Plot Size, Adjacency, and Farmland Rental Contract Choice

Yueming Cao [1,2], Yunli Bai [1,3,*] and Linxiu Zhang [1,2,3]

[1] Key Laboratory of Ecosystem Network Observation and Modeling, Institute of Geographic Sciences and Natural Resources Research, Chinese Academy of Sciences, Beijing 100101, China; caoym.17b@igsnrr.ac.cn (Y.C.); linxiu.zhang@unep-iemp.org (L.Z.)

[2] University of Chinese Academy of Sciences, Beijing 100049, China

[3] UN Environment Programme-International Ecosystem Management Partnership, Beijing 100101, China

[*] Correspondence: baiyl.11b@igsnrr.ac.cn

Abstract: The purpose of this paper is to assess the impact of plot size on the components of farmland rental contracts choice and evaluate the effects of its heterogeneities on different plot characteristics in the context of China. Based on the data from a nationally representative sample of 1215 plots among 5 provinces in rural China, this paper yields robust results using regional fixed effect method and SUR model. The results show that plot size significantly affects farmland rental contract choice. The probability of renting from non-relatives, signing a written contract, and renting with a fixed term increases by 0.5%, 0.9%, and 0.6% with 1 mu increase of plot size, respectively, and the annual rent rises by RMB 3.514 per mu. The effects of plot size on contract form, contract rent, and contract term were much larger for adjacent plots, especially for the flat and eastern plots. The findings imply that the government should encourage the innovation of managing or using plots that are of small size or non-adjacent to promote the integration of farmland resources for the formalization of farmland rental contracts, especially for mountain and western areas.

1. Introduction

The fragmentation of farmland, highly related to the size and adjacency of plots, is one of the important obstacles to agricultural competitiveness [1]. It increases the number of transactions, resulting in rising negotiation and production costs and decreasing yields, revenue, profitability, and efficiency [2,3]. At plot level, moderate expansion of plot size can reduce average cost [4], and renting in adjacent plots will save time in delivering fertilizer and improve the operation level of agricultural mechanization [5]. Some studies have measured farmland fragmentation. For example, Janus et al. (2018) developed the method of calculating farmland fragmentation indicators, based on complexes of farmland belonging to the same owners, considering the phenomenon of neighborhood of plots which belong to the same owners [6]. Gonzalez et al. (2007) aggregated the influences of the size, shape, and dispersion of plots on productivity to present an evaluation approach of farmland distributions [7].

The farmland rental market plays an important role in improving farmland use efficiency and the well-being of farmers by farmland consolidation. It enhances the efficiency of agricultural productivity and facilitates economy transformation toward productive, rapid, and sustainable growth in developing countries [8]. It also increases incomes and reduces poverty for farmland-constrained smallholder farmers by enabling cultivation of more farmland and generating a greater value of output [9]. Most previous studies have mainly focused on two aspects of the farmland rental market: (i) the drivers, economic, and social consequences of farmland rent [8,10,11], and (ii) farmers' preferences in farmland rental contract choice and the effects on the welfare of smallholders [12,13].

With the development of farmland rental market, its formalization is gradually paid high attention, especially in relation to contract choice. Some studies have shown that non-relative tenants were more productive on their sharecropped plots [14,15], which implies that the formalization of farmland rental contracts is a prerequisite of improving agricultural productivity. There are many theoretical and empirical studies on the determinants of farmland rental contract choices. Theoretical studies have focused on explaining the role of risk, risk preferences, credit constraints, moral hazard, poverty, and random shocks in contract choice [16–20]. Empirical studies have found that trust, risk, and time preferences could predict the preferences for contract attributes using choice experiments [19], while moral hazard, the imperfect capital market, and proper incentives determined contract choice [21].

However, there are some gaps to narrow in empirical studies. Most previous studies have mainly focused on a certain component of contracts, such as the nature of participants (relatives or non-relatives), the form (oral or written), rent (free or charged), or duration (non-fixed or fixed) of contracts, ignoring the relationship among these components [15,22]. Although a few studies have focused on the relationship among different components of farmland rental contracts [22], they only investigated them at household level, which did not control the effects of plot characteristics. Additionally, none of these studies have analyzed the effect of heterogeneity of plot size on the farmland rental contract choice for different plot adjacency status, although it is essential to scale economy of enlarging farmland size [23,24].

Therefore, the overall goal of this study was to examine the effects of plot size on the components of farmland rental contracts choice and its heterogeneities on plot adjacency status. It contributes to the literature in the following ways. Firstly, it focuses on the formalization of farmland rental market from the aspects of plot size and position, and the essence of scaled operation of farmland, which enriches the literature. Second, it analyzes the heterogeneity of plot size on the land rental contract choice of different plot adjacency status. Third, the contract term, which indicates the stability of farmland rental market and was neglected in previous studies, is paid much attention as a component of contract choice in this study.

The remainder of the paper are as follows. Section 2 presents literature review and hypotheses. 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 an econometric model. Conclusions and implications are in Section 6.

2. Literature Review and Hypotheses

The formalization of rental contracts remained fairly underdeveloped in China [15,25,26], and some plots are rented out without fixed duration or rent [27,28]. A study described some characteristics of farmland rental contracts among 8000 households in China's nine provinces and found that less than 10% of contracts were in writing, 40% of households rented farmland from their relatives, and about 24% only of contracts were with a fixed term [15]. Another study found that 10.95% of contracts were in writing, about 46% of households rented farmland from their relatives, and 12.42% of contracts were with a fixed term, based on the data of 1200 households in six provinces of China in 2000 and 2008 [28].

The new Management Regulations on Rural Farmland Renting of Operational Rights were issued by the Ministry of Agriculture and Rural Affairs (MARA) in 2021, which requires a written contract when the rent term is more than one year, and that the contract should be recorded by the village committee. The aim of this announcement is to protect the rights of participants in farmland rental market and to improve the formalization of rental contracts and the stability of the farmland rental market. Before this, farmland renting followed the old Management Regulations on Rural Farmland Renting of Operational Rights. Both the new and old regulations are national law. The regulations'

core aim is to protect the renting rights and benefits of farmers and maintain the cultivated use of farmland. The farmers can decide the terms, rents, and area when they rent farmland.

Contract choice covers four basic components: the participants, form, rent, and term. Contracts can be used as risk management tools in agricultural sector [29], which can mitigate risk depending on the terms and conditions included in the agreement [30]. Previous studies differentiated the farmland rental contract choice between relatives and non-relatives. Some studies from Philippines, Ethiopia, Guatemala, and China suggested that trust among lessors and lessees, social capital, and farmland tenure security played an important role in the choices of contract partners [28,31–33]. Farmland titling reform decreased the probability of households renting farmland out to their relatives and friends based on the official national survey [34]. The lessees had a high probability of renting plots from relatives due to trust or social capital, but they might rent other plots from acquaintances or strangers due to limited plots of relatives [22]. Moreover, the farmland was equally allocated to households during the early contracting reform within village groups, in which most villagers were relatives. The probability of adjacent plots belonging to relatives was high for lessees.

A number of studies estimated the impacts of farmland tenure security on the choices between written and oral contacts. Insecure farmland tenure encouraged lessors to select informal contracts [34,35], and tenure security perceptions played a role in the choice of written contracts [36]. Transaction costs and risk-sharing incentives affected the choice of contract form in America, which was consistent with other studies [27,37]. Furthermore, informal farmland rental contracts are detrimental to enhanced productivity and farmland investments [38]. However, renting large sized plots means higher costs and agricultural production inputs. With the increasing scale of rented plots, they are more likely to sign written agreement to secure stability of operational rights and avoid default risk. Adjacent plots are more likely to be leased by signed written contracts as the lessees may be afraid of blurring of the farmland boundary between their own plots and rented plots.

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 risk preferences and credit constraints [16,17]. Then some studies further conducted empirical analysis and found that the availability of credit induced households to opt for fixed-rental contracts in Bangladesh [39,40]. Some studies in Ethiopia showed that poor households were more likely to choose fixed-rent contracts when experiencing random shocks or ex ante production risk was low [20]. Rental agreements have gradually shifted from crop-share to fixed-cash rent forms in America [41]. However, sharecropping contracts were nearly non-existent and fixed rent contracts dominated in China [35]. Previous studies have found that contract rent is closely related to the size and position of plots.

The choice of contract term is highly related to risk preference [42]. In order to avoid the risk of farmland being recovered, households are likely to choose a fixed term when renting plots at large scale. There is some evidence that large-scale farming operators might invest in agricultural devices with a long return period, which requires a long-term operation or fixed term for rented-in plots [22]. Adjacent plots are more likely to be leased with a fixed term because the households tend to rent in the adjacent plots to get economies of scale by signing a fixed term.

Apart from discussing the determinants of farmland rental contract choice in terms of a specific characteristic, some studies have also focused on the relationship between any two characteristics of farmland rental contracts. The relationship between the participants in farmland rental market affects the form of contracts (oral or written) [43]. The more formal the relationship between households and sources of farmland, the more formal and traceable the contracts that appears between them. Besides, some studies have paid attention to the links between rent and participants of farmland rental contracts, and found that buyer's characteristics and personal relationships affected the rent in farmland

market [44]. The households preferred to choose farmland rental contracts with short duration when the lessees were their relatives due to high trust [45]. Crop share arrangements were more likely to emerge among family relations [46], but family relations had no effect on cash rental rates.

From the perspective of households, farmland renting and large-scale farming are essentially the same, and renting more farmland means that farmers expand the scale of farming [47]. Although renting plots generally expands the total operational scale of farmland in the household, it does not mean increasing the size of each plot, which is related to the position and size of rented plots. Renting an adjacent plot promotes concentrated scaled operation of farmland, which will improve agricultural production efficiency by alleviating farmland fragmentation [48]. However, renting farmland indicates households face more operational risk. On the one hand, the households rent plots from others who want to rent out farmland, and they need to take on rent and contracting costs [48]. On the other hand, expanding the scale of farmland generally requires an increase in agricultural machinery to replace labor [49]. Consequently, it is necessary to pursue stable operational rights of rented plots for rental market participants by signing formalized farmland rental contracts with the increase of farmland size.

Therefore, there are following two groups of hypotheses:

Group 1: Hypotheses on the relationship of plot size and contract choice.

Hypothesis 1a: *The effect of plot size on the probability of contract participants is uncertain.*

Hypothesis 1b: *A contract is more likely to be signed as a written agreement with the increase of larger-scale rented plots.*

Hypothesis 1c: *Large-size rented plots are more likely to attract a higher rent per unit area.*

Hypothesis 1d: *The rented-in plots are inclined to be signed for a fixed term with the increase of size of plots.*

Group 2: Hypotheses on the effect of heterogeneity of plot size on adjacent status.

Hypothesis 2a: *With the same plot size, adjacent plots are more likely to be rented in from relatives compared with non-adjacent plots.*

Hypothesis 2b: *With the same plot size, adjacent plots are more likely to be rented with written agreements compared with non-adjacent plots.*

Hypothesis 2c: *With the same plot size, adjacent plots are more likely to be paid higher rent than non-adjacent plots.*

Hypothesis 2d: *With the same plot size, adjacent plots are more likely to be rented via a signed lease for a fixed term compared with non-adjacent plots.*

Although a few scholars have focused on the participants, form, and term of farmland rental contracts, systematic and comprehensive studies covering the four dimensions are rare, especially those covering the relationship between the size of rented farmland and farmland rental contracts. To our knowledge, there are only three studies which have touched upon this topic in China. Luo et al. (2015) found that the probability of renting out plots to relatives rose with the increase of the size of rented-out farmland by adopting logistic model based on 203 rented-out contracts from 26 provinces in 2011 [50]. Ji et al. (2017) found that the size of rented-in plots had a positive effect on rent by studying 334 plots of 8 provinces in 2013 [51]. Zou and Luo (2019) found that the size of rented-in farmland had a significant impact on the contract choice based on 326 households that rented in farmland among 9 provinces in 2015 [22].

3. Methodology

3.1. Sampling and Data Collection

The data used in this paper are from the China Rural Development Survey (CRDS) conducted by authors in 2019. The CRDS involves six waves, tracing investigations 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 as the sample provinces in the first wave of the survey in 2005. Five counties were selected in each province. Two townships were selected within each county, two villages were selected in each county, and 20 households were selected in each village. Hence, the survey covers 2000 households in 100 villages of 25 counties across five provinces (see Figure 1). For the detailed sampling procedure, see Cao et al. (2020) [52]. The surveys collected the information of farmland at household level and only collected information at plot level in 2019. Therefore, we here only use the data gathered in 2019.
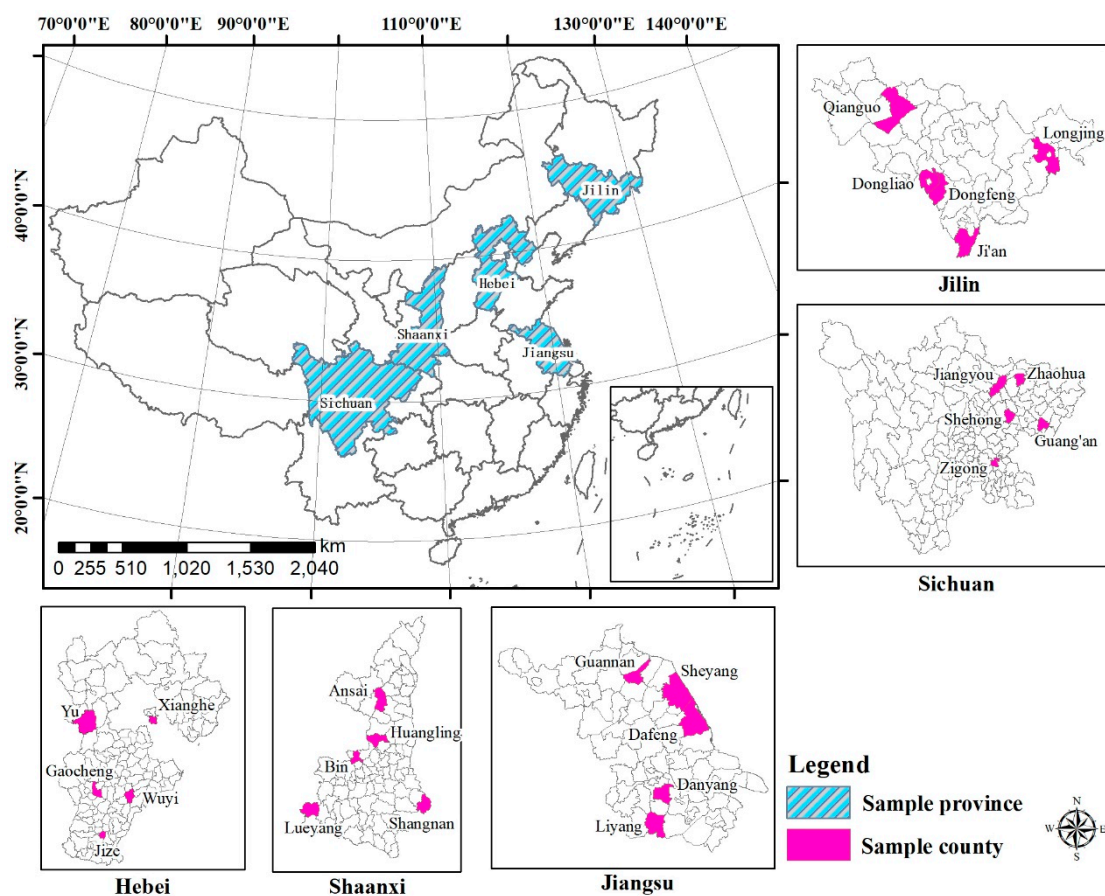
Figure 1. Map of sample province and counties' distribution. Data source: China Rural Development Survey (CRDS).

The CRDS in 2019 was conducted at the plot, household, and village levels. At plot level, we collected detailed information of farmland rental contracts, including the relationship between the lessors and lessees, contract form, rent of farmland, the duration of contract, whether or not the rented-in plot was adjacent to the plots operated by the lessees, and whether or not the subsidy of the plot belonged to lessees. There is an agriculture subsidy to encourage farming in China, including a direct subsidy, seeds subsidy, and comprehensive subsidies for agricultural supplies. In practice, the subsidy usually goes to the household renting out farmland. If the subsidy goes to lessees, the rent would rise. With this information, we acquired the variables of farmland rental contracts, such as those concerning contract participants (relatives, non-relatives), contract form

(written, oral), contract rent, and contract term (fixed duration, non-fixed duration), and the adjacency and ownership of the subsidy of any rented-in plot. We also gathered the basic characteristics of farmland plots, including size, slope, distance to the residence, and irrigation.

At household level, we collected the information on individual and household characteristics. Individual characteristics included age, general education, gender, marital status, political party, and ethnic group. We also documented the off-farm employment information of each family member, which helped us to construct the 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 village level, we collected the information of basic characteristics, including distance from village to the town, per capita income, and total area of the irrigated farmland.

For the purpose of this study, we focused on the households' rented-in plots to understand the farmland rental behaviors from the demand side. The plots might be rented in from households or organizations, such as the village committee or agricultural cooperatives: there exists a difference between the regulation of farmland contracts between households and those concerning organizations. This paper mainly analyzes the farmland contracts between households. The final sample was 1215 rented-in plots among 357 households in 5 provinces.

3.2. Variables

3.2.1. Dependent Variables

Referring to variables adopted in previous studies [22,33,35,53], we used four dependent variables to measure farmland rental contract choice, including contract participants, contract form, contract rent, and contract term. The first dependent variable is *contract participants,* which is a dummy variable to indicate the relationship between lessors and lessees (1 = the plot is rented in from relatives that relations by blood, 0 = the plot is rented in from non-relatives). The farmland rental market is mainly divided into two types according to the contract participants in rural China: relatives' market and non-relatives' market [54].

The second dependent variable is *contract form*, which equals one if the contract form is a written agreement on the plot and zero if the contract form is oral agreement. For farmland rental contract form, some studies have focused on two types of contract form, oral agreements and written agreements [55]. Written agreement is used to measure the stability of contract and considered as an efficient way to secure farmland property rights [50,54].

The third dependent variable is *contract rent*, which is measured by the annual rent per mu of each plot and indicates the value of the rented-in plot. The unit of rent is yuan in China and 1 yuan equaled USD 0.145 in 2019 when we conducted the survey. The unit of area is mu in China, and 1 mu equals 0.067 hectare. There are generally three types of farmland rent: cash, entity, and cash in grain price. We converted the latter two forms to cash.

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

3.2.2. Independent Variables

There are two key independent variables to measure the characteristics of rented-in plots: plot size and position. Considering that expanding the area of farmland does not mean the increase of average area of plot, we not only measured the plot size, but also considered the position of the plot rented in, which equaled one if the rented-in plot was adjacent to the existing plots operated by the lessees, and zero otherwise. Based on these

two key independent variables, we were able to obtain the characteristics of rented-in plots from the perspectives of size and position.

For control variables, the determinants of contract choice were divided into three categories. The first group was plot characteristics. This group of variables investigates the slope, distance to house, and irrigation of the plot. The slope and irrigation condition of plot were used to measure the quality of plot [52]. The distance to house measures the distance from the residence of farmers to the plot, which represents the convenience of household in farming the plot. This plot characteristics may affect the value and mobility of these plots in the farmland rental market [56], and further affect the contract choice. Besides, previous studies have found that the agricultural subsidy of the plots directly affected the rent [51,57], and thus we also included the ownership of subsidy of the plots.

The second group was household characteristics, including age and education level of household head, employment experience of laborers, number of plots, and agricultural equipment assets in the household. The number of plots contracted by the household was used to measure the degree of farmland fragmentation, which has been proven to affect farmland rent [58]. Plenty of studies have shown that off-farm employment was one of the key factors affecting the development of the farmland rental market [59,60]. We used the ratio of the household's labor engaged in off-farm employment to measure this effect. Agricultural equipment asset was also included to control the capacity in operating farmland among households [61]. The value of agricultural equipment is the fixed investment, which strengthens the likelihood of choosing fixed or long duration of contract for lessees [62]. The household head plays an important role in the farmland rental market and large-scale farming, which produces different decision-making on contract choice [47]. We used the age and years of schooling of the household head to control the impact of household head on the contract choice.

Finally, at village level, the distance from the village to the town was 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.

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 annual rent (yuan per mu) [a]	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 level)					
Plot size	Area of the plot rented in (mu)	4.16	8.22	0.01	75
Adjacent plot	1 = The plot rented in is adjacent to the plots operated by the lessees, 0 = otherwise	0.35	0.48	0	1
Plot characteristics					
Slope of plot	Plot slope (1 = 6–25%, 0 = otherwise)	0.24	0.43	0	1
Distance to residence	Distance from plot to household's residence (m)	738.59	805.64	0	10,000
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 lessees, 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	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
Log of agricultural equipment assets	Log (value of agricultural equipment)	1.23	2.9	−4.61	5.92
General education	Years of schooling of household head (year)	7.11	2.72	0	14
Age	Age of 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 capita income	Per capita income in village (yuan)	10,781.91	6684.05	1200	35,000

Notes: [a] 1 yuan equals USD 0.145.

3.3. Model Specification

In order to estimate the extent to which characteristics of rented-in plots affected the four components of contract choice, we adopted multivariate regression analysis. Considering the size and position of a rented-in plot is objective, there was little probability of reverse causality problems. Because we used stratified random sampling, there was little sample selection bias. We mainly paid attention to solving the endogeneity due to omitting variables.

First, we employed the regional fixed effect in the four single equations as a benchmark model to examine the basic relationship between the characteristics of rented-in plots and contract choice. Since there is a strong regional characteristic in the farmland rental market resulting from the fixed feature of plots, especially the contract rent [51,63], the contract choice is not only affected by the characteristics of rented-in plots but also is impacted by region characteristics. Therefore, we used the region fixed effect regression model at town level to eliminate the endogeneity that is caused by omitting the variables of regional characteristics, such as agricultural and economical level and so on. The model specifications were as follows:

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

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

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

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

where t represents the town and i represents plots within the town. 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} is the variable to indicate the size of the ith rented-in plot and A_{it} is the variable to indicate the adjacent status of the ith rented-in plot within the tth town. In the absence of omitted variables, β_{o2}, β_{F2}, β_{R2}, and β_{T2} are the coefficients that capture the impacts of the size of rented-in plots on contract participant, form, rent, and term, respectively. β_{o3}, β_{F3}, β_{R3}, and β_{T3} are the coefficients to measure the impacts 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 Section 3.2.2 at the tth town, respectively. β_{okit}, β_{Fkit}, β_{Rkit}, and β_{kit} are the vectors of the coefficients measuring the contribution of each variable to farmland rental contract, respectively. β_{o1}, β_{F1}, β_{R1}, and β_{T1} are the constant terms,

respectively. μ_{oit}, μ_{Fit}, μ_{Rit}, and μ_{Tit} are the error terms, which account for other factors affecting farmland rental contract in each equation, respectively. δ_t is the unobservable regional level representing the fixed factors impacting farmland rental contract at the town level, which is used to eliminate the unobservable regional characteristics, for example, productivity of plots. We let "-" indicate the mean of each variable. Following Hausman and Taylor (1981) [64], we use region fixed effect regression and eliminate δ_t by subtracting the mean over all plots of the town from Equations (5)–(8):

$$O_{it} - \overline{O_\iota} = \beta_{o2}(Z_{it} - \overline{Z_\iota}) + \beta_{o3}(A_{it} - \overline{A_\iota}) + \sum \beta_{Okit}(H_{kit} - \overline{H_{k\iota}}) + (\delta_t - \delta_t) + (\mu_{oit} - \mu_{ot}) \tag{5}$$

$$F_{it} - \overline{F_\iota} = \beta_{F2}(Z_{it} - \overline{Z_\iota}) + \beta_{F3}(A_{it} - \overline{A_\iota}) + \sum \beta_{Fkit}(H_{kit} - \overline{H_{k\iota}}) + (\delta_t - \delta_t) + (\mu_{Fit} - \mu_{Ft}) \tag{6}$$

$$R_{it} - \overline{R_\iota} = \beta_{R2}(Z_{it} - \overline{Z_\iota}) + \beta_{R3}(A_{it} - \overline{A_\iota}) + \sum \beta_{Rkit}(H_{kit} - \overline{H_{k\iota}}) + (\delta_t - \delta_t) + (\mu_{Rit} - \mu_{Rt}) \tag{7}$$

$$T_{it} - \overline{T_\iota} = \beta_{T2}(Z_{it} - \overline{Z_\iota}) + \beta_{T3}(A_{it} - \overline{A_\iota}) + \sum \beta_{Tkit}(H_{kit} - \overline{H_{k\iota}}) + (\delta_t - \delta_t) + (\mu_{Tit} - \mu_{Tt} \tag{8}$$

In Equations (5), (6), and (8), where the dependent variables are binary variables, we use aextlogit method to estimate them. Contract rent is a continuous variable, and OLS regression with region fixed effect is adopted in Equation (7). The contract participants, form, rent, and term are excluded in the single model because of significant correlation among them (see Table A1).

Second, there are relationships among the four components of farmland rental contracts. However, the single equation model may ignore these connections of error terms and lead to estimation bias. We then conducted a robustness check employing the seemingly unrelated regression (SUR) model, which is used to analyze multiple equations with correlated error terms. The SUR model yields more efficient estimation than the single equations [65]. The specification for the SUR model is:

$$\begin{cases} O_i = \beta_{O1} + \beta_{o2}Z_i + \beta_{o3}A_i + \sum \beta_{Oki}H_{ki} + \delta_t + \mu_{oi} \\ F_i = \beta_{F1} + \beta_{F2}Z_i + \beta_{F3}A_i + \sum \beta_{Fki}H_{ki} + \delta_t + \mu_{Fi} \\ R_i = \beta_{R1} + \beta_{R2}Z_i + \beta_{R3}A_i + \sum \beta_{Rki}H_{ki} + \delta_t + \mu_{Ri} \\ T_i = \beta_{T1} + \beta_{T2}Z_i + \beta_{T3}A_i + \sum \beta_{Tki}H_{ki} + \delta_t + \mu_{Ti} \end{cases} \tag{9}$$

where O_i, F_i, R_i, and T_i represent participants, form, rent, and term of contract choice for the ith plot, respectively. Z_i indicates the size of ith rented-in plot and A_i indicates the adjacent status of i th rented-in plot. In the absence of omitted variables, β_{o2}, β_{F2}, β_{R2}, and β_{T2} are the coefficients capturing the impacts of the size of rented-in plots on the contract participants, form, rent and term, respectively, and β_{o3}, β_{F3}, β_{R3}, and β_{T3} are the coefficients to measure the impacts of adjacent status of rented-in plots on the contract participants, form, rent and term, respectively. The definitions of other parameters and variables are the same as those in Equations (1)–(4).

4. Descriptive Results

4.1. Status of Farmland Rental Contract Choice

The formalization of farmland rental market is stagnating in rural China (Table 2). Rental transactions between non-relatives accounted for 59.51%, and 51.6% and 7.9% of these plots were rented in from acquaintances and strangers, respectively. The oral agreement is still the primary form of rental contract. Specifically, we found 87.57% of plots were rented in with oral agreements, which was six times the proportion of written

agreements. This was consistent with previous studies [25,66]. The average rent per mu was 189.59 yuan for all rented-in plots. 60.74% of rented-in plots were bringing in rent, and the average rent was 312.12 yuan per mu, which far exceeded that paid in 2008 [28], but was less than that paid in 2014 [63]. With regard to the contract term, 83.62% of the contracts had no fixed duration, which was 4 percentage points less than that in 2008 [28].

Table 2. The relationships between plot size and farmland contract choice.

Plot Size [a] (Mu)	Observation	Proportion (%)	Contract Participants (%)		Contract Form (%)		Contract Rent (Yuan per 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
Above 3	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: [a] 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.

4.2. Plot Size, Adjacent Status, and Contract Choice

The size of rented-in plots is related to the contract choice. In particular, about 66% of rented-in plots were within a size of 3 mu (Table 2). This indicates that the size of rented-in plots was small. The size of the plots contracted by households is not large owing to the principal of equally allocating farmland, which reflects the characteristic of farmland fragmentation in China. Similarly, existing studies found that about 45% of rented-in plots were within a size of 2 mu in Heilongjiang, Henan, Zhejiang, and Sichuan Province [51].

The proportion of plots rented in from relatives had a downward trend with the increase of plot size. Correspondingly, there was an upward trend in the proportion of plots rented in from non-relatives from 56.12% to 64.27% with the increase of the size of rented-in plots. Notably, the proportion of those renting from acquaintances increased from 1.90% to 13.02% according to our data. We found that the plots with large size were more likely to be rented in from non-relatives, which was consistent with existing findings [22]. The proportion of written agreements rose and fell with the increase of plot size. Most notably, the average rent per mu increased steadily from 69.13 to 360.04 yuan with the increase of plot size. There was an increase in the percentage of fixed-duration contracts, from 5.85% to 32.85%, with the increase of plot size.

The basic relationship between adjacent status and farmland contract choice is shown in Table 3. Only 34.9% of rented-in plots were adjacent to the plots contracted by households, which indicates that renting in adjacent plots to get contiguous farmland was not easy for households. Our data show the adjacent status of rented-in plots was highly correlated with contract choice. Specifically, if the rented-in plots were adjacent, 46.93% of them were rented in from relatives, which is much higher than figure for non-adjacent plots. 13.68% of adjacent plots were rented in with written agreements, which was higher than that of non-adjacent plots. The average rent of adjacent plots was 218.52 yuan/mu, which was higher than that of non-adjacent plots, and 17.45% of adjacent plots had a fixed rent duration, which was more than that of non-adjacent plots.

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

Plot Position	Observation	Proportion (%)	Contract Participants (%)		Contract Form (%)		Contract Rent (Yuan per 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

4.3. Plot Size and Contract Choice with Different Adjacent Status

With the same plot size, the proportion of adjacent plots rented from relatives was much higher than that of non-adjacent plots (Table 4). Meanwhile, the difference in proportions of renting from relatives between adjacent and non-adjacent plots enlarged with the increase of plot size. The proportion of adjacent plots rented with written contracts was much more than that of non-adjacent plots. For the plots less than 1 mu, the difference in the proportions of written contracts between adjacent plots and non-adjacent plots was largest, at 34.02%. For the contracted rentals, the average rent of adjacent plots was much higher than those of non-adjacent plots and the gap of rent grew with the increase of plot size. The proportion of adjacent plots with fixed-duration contracts was much higher than that of non-adjacent plots of the same size, but there was no obvious trend with the increase of plot size. For plots between 1 and 3 mu, the difference in the proportions of fixed-duration contracts between adjacent and non-adjacent plots was much the lowest, at 1.24%.

Table 4. The plot sizes with different positions and contract choices.

Plot Size [a] (Mu)	Participants-Relatives (%)			Written Form (%)			Contract Rent (Yuan per 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: [a] 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.

5. Estimation Results and Discussion

The results of region fixed effect regression in the single equation and SUR model are reported, respectively. These two types of models performed well and the results are consistent. There is contemporaneous correlation for each equation (Pr = 0.0000). Therefore, the SUR model can improve the efficiency of estimation. For brevity, we mainly present the results of SUR regression of key independent variables and some control variables. The results of region fixed effect regression are shown in Appendix A Tables A2 and A3. All models are estimated with fixed effect at township level to eliminate the regional endogeneity in Appendix A Tables A2 and A3. Z-statistics is in parentheses, and ***, **, * stands for $p < 0.01$, $p < 0.05$, $p < 0.1$, respectively in Tables 5–8 and Appendix A Tables A2 and A3. Notably, the plot subsidy was applied as a control variable only when the dependent variable was contract rent, as the ownership of subsidy of rented-in plot may impact the farmland rent.

Table 5. The impact of the characteristics of rented-in plots on contract choice, SUR estimation.

Variables	Contract Participants (1 = Relatives, 0 = Non-Relatives)	Contract form (1 = Written, 0 = Oral)	Contract Rent (Yuan per Mu)	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)
Log of agricultural equipment assets	−0.025 ***	0.009 ***	2.112	0.021 ***
	(−4.636)	(2.803)	(1.084)	(5.472)
General 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 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	1215	1215	1215	1215
R-squared	0.315	0.463	0.624	0.402

Notes: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table 6. The impact of the characteristics of rented-in plots on contract choice, SUR estimation with cross term.

Variables	Contract Participants (1 = Relatives, 0 = Non-Relatives)	Contract Form (1 = Written, 0 = Oral)	Contract Rent (Yuan per Mu)	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)
Other control variables	YES	YES	YES	YES
Observations	1215	1215	1215	1215
R-squared	0.315	0.471	0.632	0.407

Notes: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

5.1. The Determinants of Contract Choice

5.1.1. The Effect of Plot Size on Contract Choice

The results show that large plots were more likely to be rented from non-relatives, with signed written agreements, at a higher rent, and with fixed rent duration (Table 5). These findings indicate that H1a, H1b, H1c, and H1d are proven by our data. Specifically, if the plot size increased by 1 mu, the probability of renting in plots from non-relatives, signing written contracts, and with fixed rent duration increased by 0.5%, 0.9%, and 0.6%,

respectively, and the rent would increase by 3.514 yuan per mu ($p < 0.01$). The results are consistent with the study of Zou and Luo (2019) [22]. This means that households are inclined to sign formal contracts that are written contracts, pecuniary rents, and fixed-duration, and which are conducted between non-relatives when they rent in large size plots, because they need the formal contracts to secure the operational rights.

Why is it like this? First, in order to avoid the risk that lessors abruptly withdraw the plots, the lessees have a strong desire to make the farmland rental contract formal to secure benefits, and a written agreement is conductive to securing farmland operational rights [26]. Second, the lessees are more likely to pay a high rent for larger sized plots. Larger sized plots typically have lower average costs of agricultural operation [51], and can provide a wide choice of various crops for farmers [67].

5.1.2. The Effect of Adjacent Plots on Contract Choice

We also find that renting in adjacent plots increased the probability of renting from relatives. Meanwhile, the adjacency of rented-in plots had no impacts on the other components of farmland rental contacts. Specifically, the probability of renting adjacent plots from relatives was 17.3% more than that of renting non-adjacent plots ($p < 0.05$). One possible explanation is that most adjacent plots were provided by relatives, implying that trust and social capital play an important role in these transactions [68]. However, the position of rented-in plots did not seem to affect contract form, rent, and term even at the 10% level of statistics.

We think there are three reasons for this. First, lessees may pay more attention to plot size, and disregard the restrictions on the position of plots. Second, there are differences between large-scale and small-scale households when choosing the form of farmland rental contracts. Third, adjacent plots were more likely to be contracted by relatives because the farmland was equally allocated to households in the early contracting reform stage within the village group, in which most villagers were relatives.

5.1.3. The Effects of Plot, Household, and Village Characteristics on Contract Choice

The contract choice was also related to plot, household, and village characteristics. Specifically, households were more likely to rent in sloping plots or remote plots from relatives ($p < 0.05$). The results indicate that the lessees accepted these poor plots from relatives in a passive way since the relatives may engage in off-farm work and rent out their farmland to lessees with no rent. Besides, compared with plain farmland, sloping plots were more likely to be rented in with written agreement ($p < 0.05$). The distance from the rented-in plots to residences had a positive effect on the likelihood of signing written agreements and paying higher farmland rent ($p < 0.05$). The results appear to show that irrigated plots were more likely to be leased with written agreement and attracted more rent ($p < 0.01$).

Households with many plots were inclined to rent in plots from non-relatives, sign written agreement, and pay little farmland rent ($p < 0.1$). Off-farm employment had a positive impact on the probability of specifying fixed-duration contracts ($p < 0.1$). It indicates that households having a high share of off-farm laborers prefer to specify a fixed duration to secure the operational rights of farmland. We also found the households who had more agricultural equipment assets preferred to rent in plots from non-relatives, sign written contracts, and specify fixed-duration contracts ($p < 0.01$). These households have a strong demand for renting in farmland and formal farmland rental deals to obtain agricultural income and avoid potential operation risk. With the increase of years of schooling of household heads, households were more likely to rent in plots from relatives and sign written contracts. Furthermore, households were more likely to trade with relatives, sign an oral agreement, and specify a non-fixed duration with the increase of the age of household head ($p < 0.01$).

The distance from village to the town had a positive effect on the probability of renting plots from relatives and signing oral contracts ($p < 0.01$), which means households

in a village far from the town are inclined to agree informal contracts. Besides, the per capita income in a village had a positive effect on the probability of renting plots from relatives ($p < 0.01$).

5.2. Heterogeneity of Plots Size on Contract Choice

5.2.1. Adjacent Status

As the moderator variable, the adjacent status had significant impacts on contract choice with the increasing plot size (Table 6). Specifically, the interaction between plot size and adjacent status had no impacts on the probability of renting in from relatives, which means that H2a is not proven. Besides, the interaction between plot size and adjacent status significantly affected the probability of signing written contracts, paying higher farmland rent, and specifying fixed-duration contracts ($p < 0.1$), which indicates the lessees would like to sign formal contracts when renting in adjacent and large sized plots. That is, if the adjacent plot increased by 1 mu, the possibility of signing written contracts, and specifying a fixed rent duration increased by 1.1% and 0.9%, respectively, and the rent would increase by 8.02 yuan per mu ($p < 0.01$) when renting in plots. Thus, H2b, H2c, and H2d are proven. The results are consistent with the region fixed regression model, which also verifies the robustness of the estimation results.

This may be due to following reasons. First, adjacent and large sized plots easily result in farmland disputes due to blurred boundaries, so participants are more likely to sign written contracts. Second, adjacent and large sized plots may reduce field transportation costs and allow scale economies, and so lessees have a preference for adjacent and large sized plots, which increases the rent. Third, households are more likely to invest in large sized and adjacent plots [52], so they need to specify the duration of contracts to secure the return on investment.

5.2.2. Regional Difference

There are obvious differences in the population, geography, and other characteristics of different regions in China. Considering that the data used by this paper consist of information on farmland rental contract in five provinces, we further analyze the effect of heterogeneity of plot size on farmland rental contract choice among different regions. The sample was divided into two groups: western region and non-western region. The western region includes Shaanxi and Sichuan provinces, and the non-western region contains Jiangsu, Jilin, and Hebei provinces.

We first conducted a T test of the difference in contract choice between the western region and non-western region, and significant differences between the four components of contract were found (See Table A4). The results in Table 7 show that there was significant difference in the influences of plot size and adjacency status on farmland rental contract choice between these two regions. Specifically, the likelihood of paying less rent decreased with the increase of plot size and the adjacent plots were more likely to be rented from relatives in the western region. In contrast, in the non-western region, the likelihood of plots being leased with formal contracts increased with the increase of plot size and the adjacent plots were more likely to be rented via informal contracts. This means the larger size of plots had a greater effect on signing of formal contracts in the non-western region. One possible explanation is that the plots in middle and eastern regions have a higher economic value and are more desirable to households.

Table 7. The impact of the characteristics of rented-in plots on the contract choice in the western region and non-western region, seemingly unrelated regression.

Variables	Contract Participants (1 = Relatives, 0 = Non-Relatives)	Contract form (1 = Written, 0 = Oral)	Contract Rent (Yuan per Mu)	Contract Term (1 = Fixed, 0 = Non-Fixed)
western region				
Plot size	−0.005	0.003	−5.244 ***	0.004
	(−0.690)	(0.737)	(−2.630)	(1.002)
Adjacent plot	0.174 ***	−0.013	−9.028	0.034
	(3.209)	(−0.420)	(−0.655)	(1.237)
Plot size * Adjacent plot	−0.014	0.009	19.287 ***	−0.005
	(−0.532)	(0.626)	(2.885)	(−0.342)
Other control variables	YES	YES	YES	YES
Observations [a]	397	397	397	397
R-squared	0.293	0.337	0.442	0.276
non-western region				
Plot size	−0.004 *	0.007 ***	2.594 ***	0.004 ***
	(−1.920)	(6.044)	(3.284)	(2.863)
Adjacent plot	0.182 ***	−0.048 *	−27.888 *	−0.055 *
	(4.446)	(−1.909)	(−1.693)	(−1.671)
Plot size * Adjacent plot	−0.001	0.011 ***	7.957 ***	0.011 ***
	(−0.298)	(4.006)	(4.536)	(3.197)
Other control variables	YES	YES	YES	YES
Observations [a]	818	818	818	818
R-squared	0.378	0.527	0.574	0.424

Notes: *** $p < 0.01$, * $p < 0.1$; [a] Other control variables include slope of plot, distance to residence, irrigated plot, plot subsidy, no. of plots, off-farm employment, log of agricultural equipment assets, general education, age, distance to town, per capital income, town dummy.

5.2.3. Slope of Plots

Farmland quality is important in farmland rental contracts, especially in regards to output shares [69]. Therefore, this study further analyzed whether plot size and adjacent status have different effects on farmland rental contract choice with different slopes, an important indicator of farmland quality. The sample was divided into two groups: sloping plots and flat plots. The quality of flat fields is usually better than that of sloping fields.

The results are shown in Table 8. For sloping fields, the rent rose with the increase of plot size and adjacent plots were more likely to be rented from relatives and paid more rent. For flat fields, the plot size positively affected the likelihood of signing written contracts, and the adjacent plots were more likely to be rented from relatives and paid less rent. That means the larger size plots had a greater probability of being leased via formal contracts as good quality plots, because flat plots are more likely to be farmed or have high agricultural productivity efficiency [69].

Table 8. The impact of the characteristics of rented-in plots on the contract choice with sloping fields and flat fields, seemingly unrelated regression.

Variables	Contract Participants (1 = Relatives, 0 = Non-Relatives)	Contract Form (1 = Written, 0 = Oral)	Contract Rent [c] (Yuan per Mu)	Contract Term (1 = Fixed, 0 = Non-Fixed)
sloping fields				
Plot size	−0.008	0.006	7.112 ***	0.006
	(−0.993)	(1.214)	(4.254)	(1.284)
Adjacent plot	0.203 ***	−0.028	28.022 **	0.042

	(3.283)	(−0.802)	(2.310)	(1.304)
Plot size * Adjacent plot	−0.001	−0.009	−5.534 ***	−0.015 ***
	(−0.125)	(−1.551)	(−2.628)	(−2.719)
Other control variables [a]	YES	YES	YES	YES
Observations	296	296	296	296
R-squared	0.387	0.570	0.747	0.553
flat fields				
Plot size	−0.006 ***	0.007 ***	1.826 **	0.006 ***
	(−2.864)	(6.259)	(2.361)	(3.809)
Adjacent plot	0.153 ***	−0.029	−24.514 *	−0.028
	(4.177)	(−1.321)	(−1.680)	(−1.014)
Plot size * Adjacent plot	−0.001	0.015 ***	10.538 ***	0.014 ***
	(−0.181)	(5.512)	(5.684)	(3.923)
Other control variables [a]	YES	YES	YES	YES
Observations	919	919	919	919
R-squared	0.374	0.524	0.618	0.429

Notes: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$; [a] Other control variables include slope of plot, distance to residence, irrigated plot, plot subsidy, no. of plots, off-farm employment, log of agricultural equipment assets, general education, age, distance to town, per capital of income, town dummy. [c] 1 yuan equals USD 0.145.

6. Conclusions and Implications

We estimated the effects of plot size and adjacent status on farmland rental contract choice by using region fixed effect regression and the SUR model based on data covering 1215 rented-in plots among 357 households in 5 provinces. We have three main findings.

First, the plots with large size were more likely to be rented from non-relatives, be signed written contracts, have high rent, and have a fixed duration. This result suggests that the households renting in the larger plots prefer to sign formal contracts and the large size of plots is good for the formalization of farmland rental contracts, especially adjacent farmland plots.

Second, an adjacent plot increased the possibility of the plot being rented from relatives, but had no impacts on the other components of farmland rental contracts. Therefore, comparing the adjacent status of rented-in plots, plot size plays a more important role in the farmland rental contract choice.

Third, with the same size, adjacent plots were more likely to be rented with written contracts, high rent, and a fixed duration, especially for flat and eastern plots. That means the households who rent in large and adjacent plots are more likely to sign formal contracts, which guarantee the benefits of contracts participants and improve the qualitative effects of the farmland rental market.

The empirical results of this study have profound policy implications to promote the development of farmland rental market. The size and position of rented-in plots are important factors for contract choice, since plots with large size or those adjacent to contracted farmland of households could improve the formalization of farmland rental contracts and the marketization of farmland rental market. Correspondingly, smaller sized and non-adjacent plots tended to be unpopular among farmland transaction participants in farmland rental market, and were traded via informal contracts, such as oral agreements, and with non-fixed duration contracts. Therefore, the government should encourage the innovation of managing or using plots of small size or non-adjacent to promote the integration of farmland resources for the formalization of farmland rental

contracts. Meanwhile, sloping plots or plots of the western region should also be given special attention.

We acknowledge the shortcomings of this study, although it considers the relationship among four components of farmland rental contracts and captures the heterogeneities of the impact of plot size on farmland rental contract choice, which enriches the literature. The mechanisms of these effects and the relationships among farmland rental contract components should be further explored. Moreover, region fixed effect regression and SUR model that we used only partially address the endogeneity issue, but the endogeneity due to simultaneous selection between plot size and the choice of farmland rental contracts should be further uncovered. Owing to the data limitations in this survey, we only focused on the farmland rental market among households in this paper, while ignoring the role of agricultural enterprises and village committees in farmland rental market. The differences in farmland rental contracts between households and those between households and agriculture enterprises or village committees will be investigated in further studies.

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Conflicts of Interest: The authors declare no conflict of interest.

Appendix A

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

Notes: *** $p < 0.01$.

Table A2. The impact of the size of rented-in plots on contract choice with town fixed effect.

Variables	Contract Participants (1 = Relatives, 0 = Non-Relatives) Aextlogit	Contract Form (1 = Written, 0 = Oral) Aextlogit	Contract Rent [a] (Yuan per Mu) Xtreg	Contract Term (1 = Fixed, 0 = Non-Fixed) 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)
Log of agricultural equipment assets	−0.078 ***	0.140 **	2.140	0.147 ***
	(−4.067)	(2.522)	(1.070)	(4.157)
General 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 income	0.305 **	0.383	−4.618	0.384
	(2.080)	(0.840)	(−0.321)	(1.039)
Constant			251.800 *	
			(1.863)	
Observations	1188	734	1215	881
R-squared			0.050	
Number of town			48	

Notes: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. [a] 1 yuan equals USD 0.145.

Table A3. The impact of the size of rented-in plots on contract choice with town fixed effect and cross term.

Variables	Contract Participants (1 = Relatives, 0 = Non-Relatives) Aextlogit	Contract Form (1 = Written, 0 = Oral) Aextlogit	Contract Rent [a] (Yuan per Mu) Xtreg	Contract Term (1 = Fixed, 0 = Non-Fixed) 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)
Log of agricultural equipment assets	−0.079 ***	0.120 **	1.651	0.138 ***
	(−4.111)	(2.156)	(0.833)	(3.874)
General 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 income	0.297 **	0.308	−8.218	0.352
	(2.019)	(0.677)	(−0.577)	(0.955)
Constant	-	-	285.635 **	-
	-	-	(2.132)	-
Observations	1188	734	1215	881
R-squared			0.070	
Number of town			48	

Notes: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. [a] 1 yuan equals USD 0.145.

Table A4. The T test of the difference in contract choice between western region and non-western region.

Components of Contract	Western Region (1)	Non-Western Region (2)	Diff = (1)–(2)
Contract participants	0.42	0.37	0.05 *
Contract form	0.14	0.09	0.05 ***
Contract rent	264.17	35.90	228.27 ***
Contract term	0.21	0.06	0.15 ***

Notes: *** $p < 0.01$, * $p < 0.1$.

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