Farmland lease, high-rent threat and contract instability: evidence from China

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Abstract

Purpose – The purpose is to understand why contract instability occurs when small landowners lease their land to large landholders.

Design/methodology/approach – The authors develop a contract theoretical model to understand the stability problem in the farmland lease contract in China, where most landowners are small landholders.

Findings – Results from the doubly robust estimation method used on randomly selected interview data from 552 households in nine provinces of China indicate that contract instability can arise endogenously when large landholders sign a contract. The authors conclude that a suitable rent control regime or contract enforcement may be necessary to promote a large-scale farmland transfer in China.

Originality/value – The authors develop a contract theoretical model and apply it to the land rental market in China. Data used are original and collected from farmers located in nine provinces of China.

Keywords Contract instability, Farmland lease, High-rent threat, Large renter

Paper type Research paper

1. Introduction

Throughout the history of agricultural development, sustained increases in agricultural productivity and mechanization have been strongly associated with the release of labor from land (Allen, 2009; Collier and Dercon, 2014; McErlean and Wu, 2003). In areas with small per capita farmland holdings, mechanization and farmland transfer can help the farm economy reach economies of scale. Farmland transfer has helped to increase farm size and the formation of land cooperatives; the latter has become the fundamental feature of agricultural innovation in China. Kimura *et al.* (2011) indicate that a well-functioning tenancy market is vital to increase the scale of farm operation and farm income.

JEL Classification — D81, Q13, Q15, Q18

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Farmland transfer has been increasing in China since the inception of the Household Responsibility System in 1979 [1]. Before the implementation of the Household Responsibility System, the commune system was implemented in rural China. The collective owned the land, and the village collective organized farmers to carry out agricultural production. Agricultural products were distributed according to the number of members in a household. Due to the difficulty in supervising the labor and the lack of incentive mechanism in a commune system, farmers did not give their full effort in the production process. After the implementation of the Household Responsibility System, under the premise that the agricultural land is collectively owned, the user rights of agricultural land are contracted out from a collective to the farmers born in the village within its jurisdiction. The agricultural production autonomy of farmers has expanded, stimulating the enthusiasm of farmers for production and making rational use of land, labor and other production factors. According to the data available on farmland transactions, only 6.2% of farmers participated in farmland transfer between 1984 and 1992. By the end of 2015, the farmland transfer reached 30% of cultivated land [2]. However, despite increased efforts by the government to facilitate farmland transactions, large-scale farm operations have not become the norm in China. Based on the official Chinese statistics [3], a farm operation below 10 mu [4] (0.67 ha) accounted for 76.0% of the total operations in 1996, but increased to 85.74% in 2015; meanwhile, the number of farmers with an operation between 10 and 30 mu (0.67–2 ha) was 20.2% in 1996 but decreased to 10.3% in 2015. In a recent survey conducted in nine Chinese provinces, Luo *et al.* (2015) find no significant increase in farm size from the area with land transfer to the area without land transfer. Luo *et al.* (2015) also indicate that landowners transfer out farmland to their relatives, friends or other similar farmers living in the same village rather than large-scale farm households or leading agricultural enterprises. The farmland transfer contracts between landowners and their relatives or friends accounted for 79.2% of all contracts.

A well-functioning tenancy market implies that farmland transfer increases over the years and that the existing transfer contract is stable. Moreover, an effective tenancy market means that large landholding through contract is possible and, with proper mechanization, land productivity can be increased. These motivate us to identify the reason behind the failure to increase farm size. Our objective is to understand the farmland transfer contract situation in China. Specifically, we argue that a lack of a well-functioning contract market may be the reason for the still prevailing majority of small land size operations in China. Our study mainly contributes to the literature that delves into the analysis of the characteristics of farmland lease contracts in China, as well as to the literature that relates to contract breaks by large renters [5]. Our second contribution is that we use a doubly robust model (Bang and Robins, 2005; Tan, 2006) based on data collected from randomly selected face-to-face interviews of 1,537 households located in nine Chinese provinces. We estimate the causal effect of large renters on the contract break issue and answer the question why signing a contract with large renters will increase the incidence of contract breaks. Doubly robust estimation is a double robust and effective method of propensity score matching (PSM) models. It has the advantage of being suitable for data analysis where the number of observations in the treatment group and the control group is quite different.

The remainder of this article is organized as follows. Section 2 proposes a theory about the relationships between contract instability and the scale of operation of farmers who transfer-in farmland. Section 3 introduces the data sources and variable selections. Section 4 provides the reason for the selection of the doubly robust model. Results are presented in Section 5. We conclude the article with a discussion of the results and policy suggestions in Section 6. Supporting documents (such as background and key issues) are relegated to the appendix.

2. Theory

In our model, renters who rent land choose between a short-term and a long-term contract. Short-term contracts result in a stable farmland lease contract between landowner and renters. For large renters, given the availability of sufficient capital, they prefer a long-term contract and to operate a large size farm. They also prefer to invest in leased land to obtain the maximum profit. When contracts are broken, large renters incur an economic loss. Small landowners realize that large renters prefer a long-term contract, and they believe that large renters can earn a sufficient return. Therefore, small landowners constantly evaluate the terms of the contract and can raise rent at a later date, wielding their monopolistic power [6]. This results in the instability of the farmland lease contract.

Because contracts are unenforceable, this theory demonstrates that the contract structure resembles a hold-up problem. The landowner can extract all profit from the renter by increasing the rent. This makes long-term contracts undesirable for the renter.

2.1 Theoretical model structure

There are two agents: an owner of land (O, he) and a renter of land (R, she). Renters have two types, which are publicly known: large and small. Large renters can take advantage of having multiple contiguous plots of rented farm by investing to increase their productivity, while small renters do not have this option. The game takes place over two periods after the initial contract is set. Each player's total payoff is the sum of profits from each period.

The timing of the game, summarized in Figure 1, is as follows:

First, at date 0 (denoted t_0), a contract is written. The renter chooses a short-term or a long-term contract. If a short-term contract is chosen, the game ends.

If a long-term contract is written, at date 1 (denoted t_1), if the renter is a large renter, the renter decides an investment $I \in [0, I_{\max}]$. Investment has a profit determined by the function $\pi(I)$ where π is continuous and strictly quasiconcave over $[0, I_{\max}]$, and $\pi(0) = v$ is the value of land without investment. Additionally, suppose that $\pi(\varepsilon) > v$ for some ε. In this setting, an investment can be thought of as either equipment or land improvement or infrastructure used to efficiently utilize multiple rented land plots. Based on this investment, a large renter will earn a period 1 profit of $\pi(I) - r$ while the owner earns a period 1 profit of r. Small renters have no profitable investments, so for small renters $I = 0$.

At date 2, (denoted t_2) the owner observes the renter's profits from period 1. Based on this, the owner can choose to increase rent by $\hat{r}$, so that the new rent is $r + \hat{r}$. Because the contract is nonenforceable, at this point the renter can decide whether to break the contract or accept the change. If the contract is broken, no rent is paid to the owner and no profits are made by the renter. Additionally, the owner incurs a penalty P for causing a contract break. This penalty can be thought of either as a legal penalty or alternatively as a missed payoff stream. If the contract is accepted, the renter earns a period 2 profit of $\pi(I) - r - \hat{r}$. The owner earns a period 2 profit of $r + \hat{r}$.

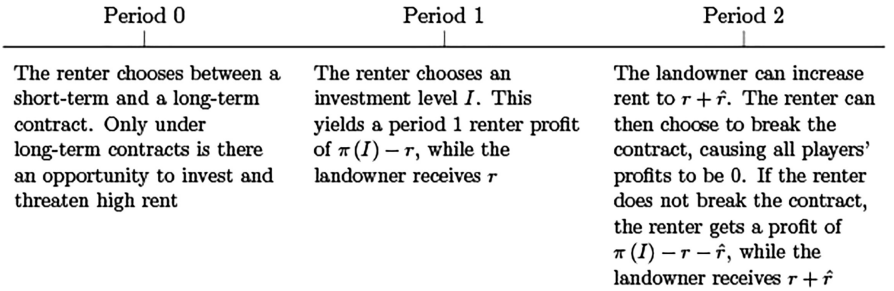

Figure 1.
Timeline of game

For a short-term contract, the total payoff to each agent is the payoff they would earn under no investment and no rent increase, but both are penalized by the cost of having to renegotiate the contract at date 2. The renter has a total payoff of $2v - 2r - S$ and the owner has a total payoff of $2r - S$ where S is the cost of renegotiating the contract between periods in a short-term contract. We assume that $v - r \geq S$ in order to ensure that there is always value from resigning a contract in a future period.

2.2 Equilibrium

The renter payoff function is given by $U_R : \{\text{small, large}\} \times C \times I \times \widehat{r}(I) \to \mathbb{R}$. The owner payoff function is given by $U_O : \{\text{small, large}\} \times C \times I \times \widehat{r}(I) \to \mathbb{R}$. We will analyze subgame perfect equilibria. Because this is a game of perfect information, we will use backward induction starting from date 2.

In t_2, the renter will accept any $\widehat{r}$ such that the payoff from accepting the change is greater than the payoff from a contract break. This means that the renter accepts if $\pi(I) - (r + \widehat{r}) \geq 0$. The owner will choose $\widehat{r} = \pi(I) - r$, extracting all profit from the renter. Any $\widehat{r} > 0$ is referred to as the high-rent threat strategy.

This means that in period 1, a large renter chooses I to maximize $\pi(I) - r$. By the intermediate value theorem, and because π is strictly quasiconcave with $\pi(\varepsilon) > v$ for some ε, π has a unique and positive maximum. Call this solution I^*.

In period 0, the renter chooses between a short-term and a long-term contract. A large renter chooses a long-term contract if $\pi(I^*) - r \geq 2v - 2r - S$. In other words, if it is possible to earn more in one period from investing than it is to earn in 2 periods with no investment, factoring in the cost of recontracting, then the renter prefers a long-term contract.

A small renter chooses a long-term contract if $v - r \geq 2v - 2r - S$. However, this implies that $v - r \leq S$, meaning there is no value to a renter for renewing the contract in the second period. Thus, a small renter always prefers a short-term contract.

It is important to realize the implications of $\widehat{r}$ being such that the renter is indifferent between accepting the contract change and rejecting it. Renters who face a decision where they are indifferent between accepting and rejecting a new rental amount and who feel slighted by an owner may choose to break these contracts. There is an extensive literature in experimental economics that shows that this behavior takes place in a variety of (ultimatum) bargaining settings (Burnham, 2007; Hennig-Schmidt *et al.*, 2008; Li *et al.*, 2018; Nowak *et al.*, 2000; Sanfey *et al.*, 2003; and many others).

This observation, along with the equilibria of the model, leads to the following predictions:

Prediction 1: Large renters (renters) are more likely to have contract breaks than small renters (renters).

Only large renters have any incentive to use long-term contracts due to the possibility of investment. This means that renters who are locked into a long-term contract face a higher possibility of a contract break because of being threatened with high rent.

Prediction 2: When the high-rent threat strategy is played, it leads to more contract breaks than when it is not played.

Our theory predicts that the high-rent threat strategy is played in a long-term contract. The vast literature on ultimatum games suggests that high-rent threats are likely to lead to contract breaks. We therefore predict that the threat of a rent increase leads to more contract breaks.

Prediction 3: Large renters (renters) are more likely to be subjected to the high-rent threat strategy than small renters (renters).

We assume throughout the theory section that high rent can only be threatened in a long-term contract, which only large renters who can take advantage of renting multiple contiguous plots of land are incentivized to opt into. In reality, owners can threaten high rent in both long-term and short-term contracts. In our theory, threatening high rent has no impact on the outcome of a short-term contract, as both parties have equal bargaining power in a negotiating process. Because long-term contracts are the only contracts where it is predicted that the high-rent threat strategy is played, we predict large renters are more likely to experience a threat of higher rent.

3. Data and variable selections

We use data collected using the questionnaire that solicited information about household characteristics, the labor market, the financial market and land transfer [7]. First, we conducted a nationally representative face-to-face interview survey of 2,880 randomly selected peasant households from 54 counties in Guangdong, Guizhou, Henan, Jiangsu, Jiangxi, Liaoning, Ningxia, Shanxi and Sichuan provinces during the Chinese Spring Festival (January) in 2015. The sampling method used is as follows: the counties in each province were clustered into three county groups according to the six indicators mentioned in endnote 9, and two counties were randomly selected in each county group (six counties in each province and 54 counties in a total of nine provinces). Second, the towns in each sampled county were ordered according to their GDP value, and four towns were randomly selected from each sampled county (ten towns were selected in each sampled county in the Guangdong and Jiangxi provinces). One representative village was randomly selected from each sample town. Finally, the households in each sample natural village were divided into five groups according to their annual income, and two households were randomly selected in each group for the questionnaire survey [8]. In total, 2704 effective questionnaires were collected. Therefore, the effective response rate was 93.39%. Among them, 614 households transferred farmland out. Removing the missing data, the final useable number of observations is 552. The survey questionnaire asked about household characteristics, the labor market, the financial market, land transfer and land lease contract (see Figure 2).

The first important variable regarding contract stability is the occurrence of contract breaks. We asked small landowners if the latest contract they signed with renters was broken. The data show that in total 9.78% of contracts were broken, whereas the remaining 90.22% of contracts were stable.

Second, as the contract instability can come from a landowner's high-rent threat strategy during the contract, the second question asked was "did you ask for an increase in rent during the contract period?" The answers were set to be "yes," "no" or "not sure." The number of landowners who responded with "yes" were 33.70%, and 14.52% of those who said "yes" had a contract break. The numbers of landowners who responded with "no" were 33.88%, and 3.74% of those who said "no" had a contract break. The remainder of the respondents provided "not sure" as their response. Among those, 11.17% had a contract break. The answer of "not sure" may mean that landowner asks for higher rent during the contract period but feels uneasy to admit it.

Third, whether the actual renter is a large renter will serve as a key explanatory variable. Farmers rented their land to "relatives," "neighbors," "local small farmers," "local big farmers," "foreign small farmers," "foreign big farmers," "leading enterprises," "cooperatives" and "village collectives." Generally speaking, landowners who are allocated farmland from the village collective have similar type of land and renting out to neighbors and relatives within the village is considered renting to small renters. Those who rent land to "local big farmers," "foreign big farmers," "leading enterprises," "cooperatives" and "village collectives" are considered to be renting to large renters. The percentage of landowners who rented their land to large renters are 48.73%. The remainder is considered as renting their land to small renters.

Figure 2.
Map of China with the study area highlighted in yellow

Taking into account that family situation, farmland conditions and contractual characteristics can also affect the duration of the transfer contract, we add "the family population structure," "the community resource," "the village's traffic and terrain conditions," "farmland status and economic situation" and "the characteristics of the contract" of the household as control variables in the model. Also, as the household sample contains observations from different provinces, province dummies are included in treatment models.

We use the family labor ratio (number of adult laborers divided by total family members), the under 16-year-old ratio (number of under 16-year-old family members divided by total family members), the over 50-year-old labor ratio (number of over 50-year-old working adults divided by total working adults), female labor ratio (number of female working adults divided by total working adults), farmer ratio (number of working adults who are farmers divided by total working adults), part-time farmer ratio (number of working adults who are part-time farmers divided by total working adults) and highly educated labor ratio (number of working adults with high school degrees divided by total working adults) as the observed variables of "the family population structure."

This paper uses the number of Communist Party members in the family, the number of village cadres in the family, the number of village cadres in the relatives, the different kinds of medical insurance channels (ag-insurance medical guarantee, business-insurance medical guarantee, children support, own savings, rental rent or government bailout) and big names in the village as the observed variables of "the community resource." In China, the majority of people in each village have the same surname, which means that their families have lived in the village for generations. As a result, if the household has a same surname as the majority of

the villagers, the variable is denoted as "big names." These variables capture the social network and social capital of a household.

This study uses the terrain of the village (plain, hills or mountain), time needed to get to the nearest town and time needed to get to the prefecture as the observed variables of "the village's traffic and terrain conditions."

This paper uses farmland area, number of farmland plots, farmland readjust, land fertility, land irrigation and family annual income as the observed variables of "farmland status and economic situation." Other observed variables representing characteristics of contract are transferred farmland area, transferred farmland quality, rent, contract type and contract term.

In addition, Kahneman *et al.* (1991) indicate that emotions and relationships can affect human behavior. This paper introduces the expectation variable "Want to rent farmland to large renters" as a control variable.

The variable definitions and descriptive statistics and provincial distribution of households are shown in Table 1.

4. Econometric model

The relationships between (1) contract breaks and renter types (with and without the control of the high-rent threat strategy), (2) contract breaks and the rent threat strategy and (3) high-rent threat strategy and renter types are estimated. The first model calculates the total influence of the renter types on the probability of contract breaks. The second model calculates the influence of the renter types on the probability of contract breaks when the control is the landowners' high-rent threat strategy. The third model calculates the effect of the high-rent threat strategy of landowners on the probability of contract breaks. And the final model calculates the effect of renter types on the landowners' high-rent threat strategy.

To estimate the causal effect of renter types on contract stability, a doubly robust estimation method is used. This study then selects matching (MATCH) estimators for estimating the effects of treatment variables on the dependent variable (Funk *et al.*, 2011), while a PSM model needs both outcome regression and propensity score methods are unbiased [9].

Rosenbaum and Rubin (1983) and the estimator for stratified samples proposed by Horvitz and Thompson (1952) provide the basic foundation to obtain matching estimators with inverse propensity-score weighting (IPW). Several authors (Robins *et al.*, 1994; Robins, 2000; Lunceford and Davidian, 2004; Glynn and Quinn, 2009; Graham *et al.*, 2012; Waernbaumand, 2012; and Kreif *et al.*, 2013) indicate that IPW delivers greater robustness and efficiency. Chernozhukov *et al.* (2016) focus on improving matching estimators' properties in settings with many covariates. They partition sample into k subsamples, then repeated and averaged k times estimators for the parameter of interest to obtain the final estimator. Athey *et al.* (2017) review the literature and propose some supplementary analyses to assess the credibility of the results. In the application, matching methods have been frequently applied in cross-sectional data in applied microeconomics. Jordà and Taylor (2016) use matching methods in macroeconomics and identify the causal effects of austerity on GDP growth using doubly robust estimators.

Each individual observation (farmers) is given a weight equal to the inverse of the probability of the treatment a farmer received conditional on baseline covariates to create two pseudo-populations of subjects that represent the expected response in the entire population under those two treatment conditions (large renter or small renter). Finally, we use the estimated parameters from the model in conjunction with each individual's actual covariate values to calculate the predicted mean response (contract breaks or not) under each exposure renter-type condition (one of which is counterfactual), the PS, for each farmer in the cohort. Therefore, the doubly robust effect estimates have a marginal rather than a conditional (on

Variable			Assignment	Mean	SD
	Contract breaks		0 = no; 1 = yes	0.098	0.297
	Farmer's behavior of asking for higher rent		1 = no; 2 = not sure; 3 = yes	1.998	0.823
Renter		Large renter transfer object	0 = no; 1 = yes	0.487	0.500
		Relatives	0 = no; 1 = yes	0.199	0.400
		Neighbors	0 = no; 1 = yes	0.101	0.302
		Local small farmers	0 = no; 1 = yes	0.179	0.384
		Local big farmers	0 = no; 1 = yes	0.170	0.376
		Foreign small farmers	0 = no; 1 = yes	0.040	0.196
		Foreign big farmers	0 = no; 1 = yes	0.177	0.382
		Leading enterprises	0 = no; 1 = yes	0.029	0.168
		Cooperatives	0 = no; 1 = yes	0.022	0.146
		Village collective	0 = no; 1 = yes	0.094	0.229
Family population structure		Family labor ratio	The actual data	0.738	0.220
		Under16-year-old ratio	The actual data	0.150	0.196
		Over 50-year-old labor ratio	The actual data	0.265	0.312
		Female labor ratio	The actual data	0.466	0.177
		Farmer ratio	The actual data	0.228	0.293
		Part-time farmer ratio	The actual data	0.266	0.351
		High educate labor ratio	The actual data	0.243	0.299
Community resource		Communist Party members	1 = no; 2 = one; 3 = more than one	1.253	0.519
		Village cadres in the family	1 = no; 2 = one; 3 = more than one	1.870	0.337
		Village cadres in the relatives	1 = no; 2 = one; 3 = more than one	1.426	0.672
		Ag-insurance medical guarantee	0 = no; 1 = yes	0.913	0.282
		Business-insurance medical guarantee	0 = no; 1 = yes	0.054	0.227
		Children support medical care	0 = no; 1 = yes	0.454	0.498
		Own savings for medical care	0 = no; 1 = yes	0.409	0.492
		Rental rent for medical care	0 = no; 1 = yes	0.047	0.212
		Government bailout medical care	0 = no; 1 = yes	0.025	0.157
		Main surname	1 = no; 2 = ordinary; 3 = yes	2.233	0.793
Village's traffic and terrain conditions		Hills	0 = no; 1 = yes	0.292	0.455
		Mountain	0 = no; 1 = yes	0.476	0.500
		Time spent to town	The actual data	0.311	0.244
		Time spent to prefecture	The actual data	0.906	0.604

Table 1.
Variable definition and descriptive statistics

(*continued*)

	Variable	Assignment	Mean	SD
Farmland status and economic situation	Farmland area	The actual data	6.183	6.467
	Number of the farmland plots	The actual data	5.330	4.712
	Farmland readjust	1 = no; 2 = small; 3 = big	1.340	0.632
	Land fertility	1 = too bad; 2 = bad; 3 = ordinary; 4 = good; 5 = so good	3.417	0.835
	Land irrigation	1 = too bad; 2 = bad; 3 = ordinary; 4 = good; 5 = so good	3.257	1.011
	Family annual income	1 = less than ¥10,000 2 = ¥10,000–30,000 3 = ¥30,000–50,000 4 = ¥50,000–100,000 5 = more than ¥100,000	2.753	1.128
Characteristics of the contract	Transfer farmland area	The actual data	5.575	42.546
	Transfer farmland quality	1 = too bad; 2 = ordinary; 3 = so good	2.284	0.618
	Rent	The actual data	702.437	2354.171
	Contract type	1 = No contract ; 2 = Oral contract ; 3 = Written contract	2.214	0.838
	Contract term	1 = irregular ; 2 = Within 1 year ; 3 = 1–3years ; 4 = 4–5years ; 5 = more than 5years	2.864	1.635
Emotion	Want to rent their lands to large renters	0 = no; 1 = yes	0.576	0.495

Province	Total number of farmers interviewed	Number of observations used in this study (those with land transfer)	Percent of observations used from each province in the final analysis
Jiangxi	587	128	23.19
Sichuan	214	45	8.15
Ningxia	226	44	7.97
Shanxi	201	33	5.98
Guangdong	547	83	15.04
Jiangsu	239	94	17.03
Henan	230	55	9.96
Guizhou	239	41	7.43
Liaoning	221	29	5.25
Total	2704	552	100

Table 1.

covariates) interpretation. It can be used to directly compare the effect estimates that a farmer would obtain from a randomized trial in which a population is randomly assigned to receive treatment (Funk *et al.*, 2010).

The Inverse probability weighting estimator regression adjustment (IPWRA) specifies outcome and treatment models together and uses the inverse of the conditional probability to

weigh the corrected regression coefficients that are from the outcome regression adjustment. IPWRA is an estimator combination of the inverse probability weighting estimator (IPW) and regression adjustment (RA). The basic principle of IPW is similar to the traditional standardization method. It uses the probability of being in a treatment group as a weighing value to calculate the mean outcome. In this procedure, each individual observation (farmers) is given a corresponding weight equal to the propensity score to the inverse of the probability of the treatment (renter types), conditional on baseline covariates to create two pseudo-populations of subjects that represent the expected response of the entire population, thus eliminating the effect of confounding factors. In this method, the weight is defined as the reciprocal of the probability of the actual grouping of the object, calculated as follows (Hernán *et al.*, 2000). We weigh observations of the large renter by $W_t = {}^1/_{P_s}$, while we weigh observations of the small renter by $W_c = {}^1/_{1-P_s}$. Here, P_s is the propensity score of the observation object.

We specify the outcome (contract breaks) model as a binary regression model (logistic regression) for the propensity score, given that the dependent variable contract break is a binary variable:

$$\widehat{m_1}(x_i) = \frac{\exp(x_i\widehat{\beta_1})}{(1+\exp(x_i\widehat{\beta_1}))} \tag{1}$$

$$\widehat{m_0}(x_i) = \frac{\exp(x_i\widehat{\beta_0})}{(1+\exp(x_i\widehat{\beta_0}))} \tag{2}$$

$$\ln_{\text{outcome}}\frac{P_i}{1-P_i} = a_1Ps_i + a_2Cr_i + a_3Tt_i + a_4Fs_i + a_5Cc_i + \varepsilon_i \tag{3}$$

Independent variables x_i in the outcome model are $\widehat{m_1}(x_i)$ (this is the treated group), $\widehat{m_0}(x_i)$ (this is the nontreated group), population structure (Ps_i), community resource (Cr_i), traffic and terrain conditions (Tt_i), farmland status and economic situation (Fs_i) and characteristics of the contract (Cc_i).

In the second step, we model the treatment variable as a function of covariates to estimate the propensity score (PS) for each farmer according to the observable data. Covariates defining the probability of a farmer signed with a large renter are population structure (Ps_i), community resources (Cr_i), traffic and terrain conditions (Tt_i), farmland status and economic situation (Fs_i) and characteristics of the contract (Cc_i).

$$\widehat{p_i}(x_i) = \frac{\exp(x_i\widehat{\delta})}{(1+\exp(x_i\widehat{\delta}))}$$

$$\ln_{\text{treatment}}\frac{P_{oi}}{1-P_{oi}} = \beta_1Ps_i + \beta_2Cr_i + \beta_3Tt_i + \beta_4Fs_i + \beta_5Cc_i + \varepsilon_i$$

In the third step, we weigh the conditional mean by using inverse probability. The PS obtained from the second step can be used to weigh the observed data. Inverse probability weights are calculated as the inverse of the conditional probability that a farmer signed with a large renter.

Denoting ${}^1/_{\widehat{p_i}(x_i)}$ is for the treated farmers who signed with a large renter, and ${}^1/_{1-\widehat{p_i}(x_i)}$ is for the untreated farmers who signed with a small renter, we then write:

$$\min_{\beta_1}\sum_{i=1}^{N} D_i(y_i - \exp(x_i\widehat{\beta_1}))/(1+\exp(x_i\widehat{\beta_1}))^2/\widehat{p}$$

$$\min_{\beta_0} \sum_{i=1}^{N} (1 - D_i)(y_i - \exp(x_i\widehat{\beta}_0))/(1 + \exp(x_i\widehat{\beta}_0))^2/(1 - \widehat{p}(x_i))$$

Finally, we have the estimated average treatment effect (ATE) on population, average treatment effect (ATET) on a treatment sample, average treatment effect on a nontreated sample (ATENT) estimated by doubly robust estimation as (Cerulli, 2015):

$$\begin{aligned}\widehat{\text{ATE}} &= E(Y_1 - Y_0|x) \\ &= 1 \Big/ N \sum_{i=1}^{N} \{[\exp(x_i\widehat{\beta}_1)/(1 + \exp(x_i\widehat{\beta}_1))] - [\exp(x_i\widehat{\beta}_0)/(1 + \exp(x_i\widehat{\beta}_0))]\}\end{aligned}$$

$$\begin{aligned}\widehat{\text{ATET}} &= E(Y_1 - Y_0|D = 1) \\ &= 1 \Big/ N_1 \sum_{i=1}^{N} D_i\{[\exp(x_i\widehat{\beta}_1)/(1 + \exp(x_i\widehat{\beta}_1))] - [\exp(x_i\widehat{\beta}_0)/(1 + \exp(x_i\widehat{\beta}_0))]\}\end{aligned}$$

$$\begin{aligned}\widehat{\text{ATENT}} &= E(Y_1 - Y_0|D = 0) \\ &= 1 \Big/ N_0 \sum_{i=1}^{N} (1 - D_i)\{[\exp(x_i\widehat{\beta}_1)/(1 + \exp(x_i\widehat{\beta}_1))] - [\exp(x_i\widehat{\beta}_0)/(1 + \exp(x_i\widehat{\beta}_0))]\}\end{aligned}$$

ATE, ATET and ATENT are the three estimations that give a mean outcome difference between treated and untreated farmers matched by PS weighting. ATET is the average treatment effect calculated within the subsample of treated units (those with $D = 1$, large renter's lease contract), while the ATENT is the average treatment effect calculated within the subsample of untreated units (those with $D = 0$, non-large-renter's lease contract) (Cerulli, 2015). In other words, according to ATET, the average small renter outcome for a farmer that signed with a large renter selected by PSM is used to express a counterfactual outcome using a large renter contract sample. According to ATENT, the average large renter outcome of a farmer that signed with a small renter selected by PSM is used to express the counterfactual outcome using a small renter contract sample. ATE uses the same matching rule on the population sample. The derived estimator will be unbiased under three conditions (Funk *et al.*, 2011):

(1) The first condition requires conditional independence. That is:

$$E(Y_1|x, D) = E(Y_1|x)$$
$$E(Y_0|x, D) = E(Y_0|x)$$

(2) The second is the common support that requires the propensity score to cover large renter's lease contract farmers and non-large-renter's lease contract farmers. This condition is shown in Figures 3 and 4 (large renter's lease contract), with all treatment and nontreatment samples on the support. Outside support farmers cannot find matches to obtain the counterfactual outcome. In our case, only a small number of observations are lost when running the first two impact evaluations.

(3) The third condition is a balancing that shows distributions of covariates are similar for large renter's lease contract farmers and non-large-renter's lease contract farmers

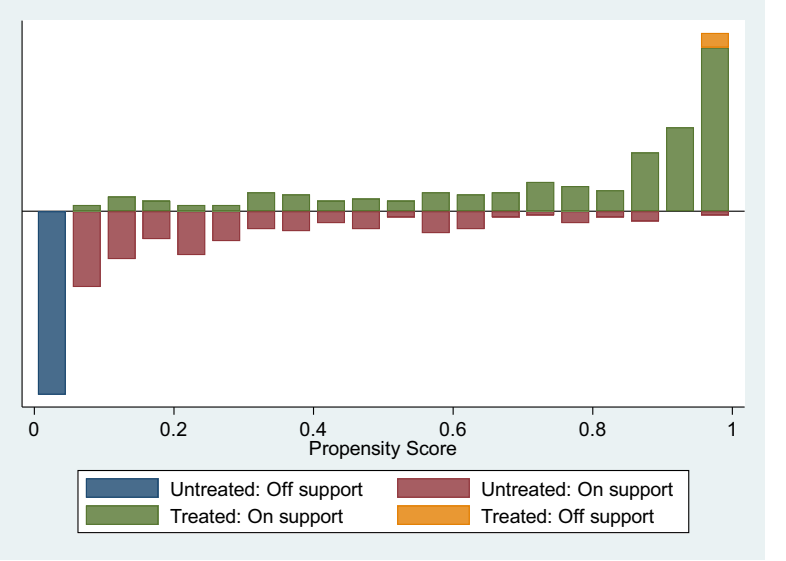

Figure 3.
Propensity score (dependent variable is contract break)

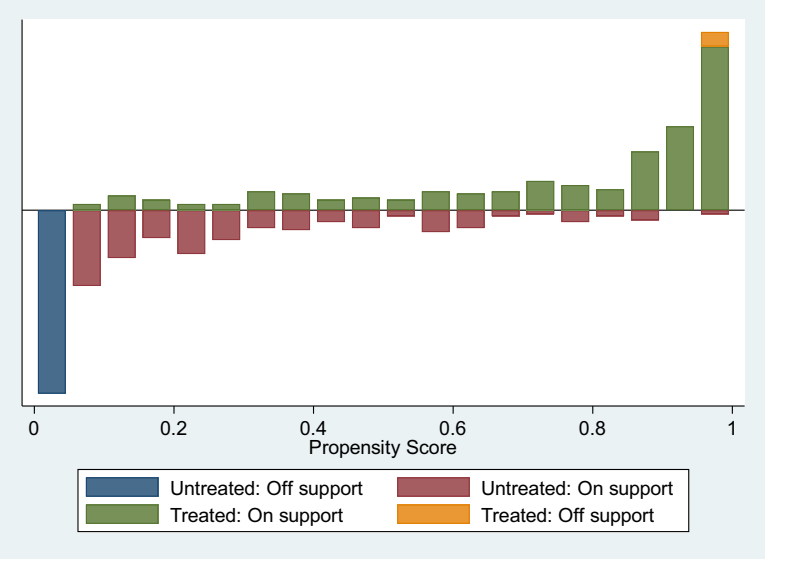

Figure 4.
Propensity score (dependent variable is high-rent threat strategy)

(Funk *et al.*, 2011). The balancing test indicates a high-quality result with standard bias below 10% and most standard bias around zero after matching, as shown in Figures 5 and 6. The *t*-test statistics show that most of the variables pass the balance test (see Tables A1 and A2). The balancing test also indicates high-quality results with MedBias, reducing to 12.8 and 13.9% respectively and the most standard bias reduced after matching.

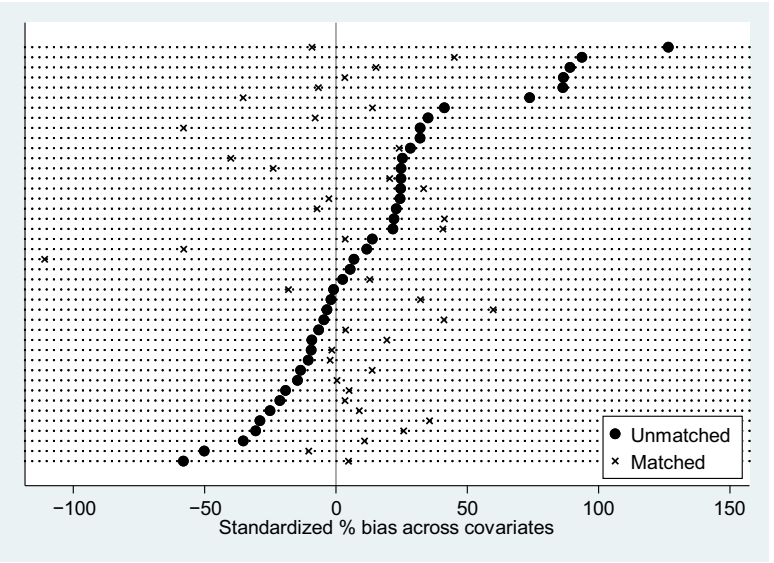

Figure 5. Standardized percentage bias across covariate associated with contract break model

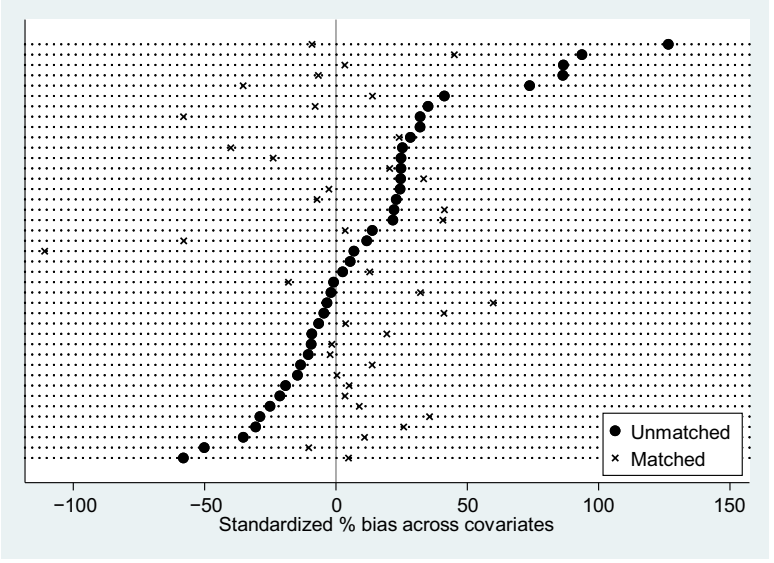

Figure 6. Standardized percentage bias across covariate associated with rent threat strategy model

5. Results

We report the results from the treatment effects of renter types on contract breaks, treatment effects of the high-rent threat strategy on contract breaks and treatment effects of renter types on landowners' rent threat strategy.

We estimate five different models using the doubly robust estimation methods as shown in Table 2. We focus on the average treatment effect using the whole sample, so we interpret ATE obtained from IPWRA (IPWRAATE). For comparison, we also show results from the

Table 2.
The impact of large renter transfer on contract break and rent threat strategy and the impact of rent threat strategy on contract break

Variable	Model 1	Model 2	Model 3	Model 4	Model 5
Contract break (without the control of rent threat strategy)					
large renter vs. small renter	0.0905** (0.0434)	0.0599 (0.0474)	0.1375*** (0.0307)	0.1331*** (0.0312)	0.1313*** (0.0226)
Average contract breaks value of small renter	0.0687*** (0.0239)	0.0888** (0.0418)	0.02286 (0.0148)	0.0288*** (0.0096)	0.0152** (0.0077)
Observations	552	552	549[a]	549	549
Contract break (with the control of rent threat strategy)					
large renter vs. small renter	0.0719* (0.0434)	0.0469 (0.0467)	0.1221*** (0.0272)	0.11802*** (0.0273)	0.1298*** (0.0231)
Average contract breaks value of small renter	0.0749*** (0.0240)	0.1017** (0.0410)	0.0261** (0.0128)	0.0305*** (0.0095)	0.0168*** (0.0081)
Observations	552	552	549	549	549
Contract break					
Not clear rent threat strategy vs. no rent threat strategy	0.1199*** (0.0373)	0.0737** (0.0292)	0.2406 (0.1933)	0.2191 (0.1386)	0.0778*** (0.0271)
Have rent threat strategy vs. no rent threat strategy	0.1210*** (0.0393)	0.1271** (0.0538)	0.1085*** (0.0373)	0.1085*** (0.0382)	0.0111** (0.0453)
Average contract breaks value of no rent threat strategy	0.0263 (0.0180)	0.0380** (0.0180)	0.0389** (0.0156)	0.0390** (0.0160)	0 0.0339** (0. 0162)
Observations	552	552	552	552	552
Rent threat strategy					
large renter vs. small renter	0.3899*** (0 0.1109)	0.3035*** (0.1229)	0.6053*** (0.2423)	0.6044*** (0.1943)	0.6464*** (0.3112)
Average rent threat strategy value of small renter	1.8502*** (0.0675)	2.0384*** (0.1147)	1.6931*** (0.2369)	1.6882*** (0.1865)	1.6994*** (0.3088)
Observations	552	552	549	549	549

Note(s): a. As treatment 0 has 3 propensity scores less than 1.00e-05, there are only 549 observations in model 3, model 4 and model 5
1. Model 1 is average treatment effect in regression adjustment (RAATE), model 2 is average treatment effect in regression adjustment using treatment sample (RAATET), model 3 is average treatment effect in augmented inverse probability weighting estimator with regression adjustment (AIPWATE), model 4 is average treatment effect in inverse probability weighting estimator with regression adjustment (IPWRAATE), model 5 is average treatment effect in inverse probability weighting estimator with regression adjustment using treatment sample (IPWRAATET)
2. The POM for each treatment level is an average of each potential outcome
3. Robust standard errors are shown in the parentheses

PSM model in Appendix Tables A3 and A4. In the PSM model, the results of Mahal Matching are similar to those of the propensity score matchings confirming the robustness of the results.

5.1 Effects of renter types on contract breaks

Results from IPWRA ATE are presented in Table 2 under the column model 4. All coefficients are significant at the 1% level. Results indicate that landowners who signed with large renters had a 13.31% more incidence of contract break than those who signed contracts with small renters. These results confirm our theoretical derivations that the contract is more likely to break when the renter types are big renters. Since relationship affects the joint decision of contract partners, landowners are more likely to rent land to/from similar farmers with similar economic status (Macours, 2014). Once landowners perceive that renters are receiving a higher return than the perceived fair amount, the stability of the contract is not likely to hold. Therefore, the renter types can affect the stability of a farmland transfer contract.

If we add the variable "landowners' high-rent threat strategy" into the model, we would be able to assess whether the influence of the transfer on the probability of contract break exists after controlling for the high-rent threat strategy. Results indicate that, compared to those who signed contracts with small renters, landowners who signed with large renters still have 11.80% more contract breaks. The result illustrates that landowners' high-rent threat strategy should be one of the reasons that the renter types affect the stability of a farmland transfer contract.

5.2 Effects of landowners' high-rent threat strategy on contract breaks

Results from IPWRA ATE are presented in Table 2 under the column model 4. Almost all important coefficients are significant at the 1% level. Results indicate that the landowners' high-rent threat strategy causes 10.85% more contract breaks. These results indicate that the contract is more likely to break when landowners have a high-rent threat strategy during the contract period. It proves that small landowners' high-rent threat strategy results in instability of the farmland lease contract.

5.3 Effects of renter types on landowners' high-rent threat strategy

Results from IPWRA ATE are presented in Table 2 under the column model 4. All coefficients are significant at the 1% level. Results indicate that landowners who signed with large renters had a 60.44% more incidence of asking for higher rent (high-rent threat strategy) in the contract duration than those who signed a contract with small renters. Small landowners believe that fixed rental contracts will induce the renter to adopt techniques of cultivation that are too risky (Ghatak and Pandey, 2000). In addition, small landowners believe tenure security has a positive effect on farm productivity (Abdulai *et al.*, 2011). Small landowners realize that large renters prefer a long-term contract and can earn sufficient returns by adopting better technologies and better enterprise choice. Therefore, small landowners constantly evaluate the terms of a contract and are likely to implement the high-rent threat strategy to the large renters by practicing their monopolistic power.

In summary, the above results reflect that: (1) signing a contract with large renters will significantly increase the incidence of contract breaks. Small landowners are more likely to have a "high-rent threat strategy" to the large renters, which will result in the contract breaks; (2) even if we control the landowners' high-rent threat strategy, the contract is still more likely to break when the renter is a large renter. Thus, the landowners' high-rent threat strategy is a partial mediation variable. It also means that the renter types will affect contract breaks, not only through the landowners' high-rent threat strategy but also through other channels, such

as the relationship of the contract parties or the difference of the parties' economic status. The results further confirmed that the high-rent threat and contract break between small landowner and large renter are especially serious.

6. Discussion and conclusions

Farmland transfer is the Chinese government's major policy tool to expand the scale of farmland operation. However, despite increased rural land transfer, large-scale farms still have not been the reality in the country. We argue that a lack of a well-functioning contract market may be the reason why there still exists a vast majority of small farms in China.

The formation of large-scale farms must rely on the farmland lease contract. Moreover, the land transaction process occurs through the land contract mechanism. Since large renters lose more from a contract break, they prefer lease contracts that are stable and long-term. However, small landowners realize that large renters prefer a long-term contract, and they believe that large renters can earn sufficient returns. Therefore, small landowners constantly evaluate the terms of the contract and are likely to implement the high-rent threat strategy against large renters by practicing their monopolistic power. We believe this is the major crux behind the instability of the farmland lease contract in China.

We estimated doubly robust models and found that: (1) signing a contract with large renters will significantly increase the incidence of contract breaks; (2) landowners' "high-rent threat strategy" will significantly increase the incidence of contract breaks; (3) landowners are more likely to implement a "high-rent threat strategy" against large renters, which leads to contract breaks; (4) even after controlling landowners' high-rent threat strategy, contracts are still more likely to be broken when the renter type is the large renter. Although our findings indicate contract break is only around 12.16% higher when the contracts were between small landowners and large renters, it will still have a great impact on the contiguity of land plots. Without contiguous land plots, large-scale farm machine uses can be at the minimum costly and at the maximum impossible.

The estimation bias caused by unobserved variables is a problem in many empirical studies. Only by adding reliable control variables and clarifying theoretically that the conditional mean value of the error term is zero, causal inference can be obtained. In our empirical study, we added control variables that are related to renter type. Taking into account that family situation, farmland conditions and contractual characteristics can also affect the duration of the transfer contract, we added "the family population structure," "the community resource," "the village's traffic and terrain conditions," "farmland status and economic situation," "the characteristics of the contract" and "renter type expectation" of the household as control variables in the model. We believe these variables capture potential missing explanatory variables in the model. Therefore, the empirical results presented in this paper are reliable.

We found that small landowners did not implement a high-rent threat strategy against small renters. This results in a stable farmland lease contract. However, contract instability arises endogenously when small landowners sign contracts with large renters. Under the fixed rent contract arrangement, small landowners cannot receive a share of the benefits resulting from increased farmland productivity *ex-post* contract signing. Since the Chinese government favors small landowners who have a monopoly in farmland property rights, small landowners will inevitably implement a high-rent strategy against large renters. Under that situation, the equilibrium mechanism of rent is undermined, and the farmland contract will give birth to instability and create a significant risk of contract breaks. It can be seen that it is necessary for the government to regulate the farmland lease rent while encouraging the transaction of agricultural land.

Study results indicate that designing an effective farmland lease contract that can avoid the opportunistic behavior of landowners and protect the spirit of the contract is the key to forming large-scale farms in China. First, allowing certain flexibility in rent adjustment with some prespecified benchmarks (such as those based on a county's average yield) can endogenize landowners' opportunistic behavior and help avoid the risk of contract instability. Second, encouraging local farmland transfer from small farmers to their neighbors and relatives to form some mid-size family farm could be another way. The outside renters lack understanding of the village, and their relational network inside the village is generally weak. When outside renters rent farmland as operators and carry out large-scale farming operations, the problem of contract instability will become more prominent.

On the contrary, when a capable/efficient farmer in the village rents village's farmland as operators, the relationship between these renters and the small farmers is strong. Under this scenario, small farmers are more likely to damage their reputation by asking for higher rent or breaking the contract. That is, the cost of opportunistic behavior by the small farmers is higher. It can be seen that renter's status of belonging to the village can alleviate the instability of contracts caused by outside renters renting the farmland. Finally, encouraging both parties in the transfer of farmland to find multidimensional cooperation and forming a dependency mechanism may be effective. When renters use their funds to invest in small farmers' farmland, it will form a fixed asset lock-in. Small farmers who have no contribution in fixed cost investment can take advantage of the situation and break the contract by unilaterally increasing the rent. When renters require small farmers to invest in complementary assets or cost-share as external owners, both parties will form a dependency mechanism. For example, through the collateral swap design and the capital return design, the two parties form a sharing of benefits, designing an explicit mechanism for the default costs of small farmers and realizing the exit of renters will bring losses to small farmers and reduce the return on investment of small farmers. Other countries have also adopted these approaches. For example, Guatemalan farmers indicate that it is less burdensome to find renters if the contracts involve interlinkage between land and labor (Macours, 2014). In the USA, highly erodible land and land that is expected to remain in farming in the future are most likely to be operated with share contracts, which include owners' interests in production and management decisions (Huffman and Fukunaga, 2008).

Notes

1. The Household Responsibility System is the most fundamental agricultural system in China adopted since 1979, which means China's agricultural lands are owned by collectives. Management and contract rights are contracted out to farmers born in the village. Farmers can transfer management rights.
2. The ratio of farmland transfer was 4.57% in 2006, 5.2% at the end of 2007 and 8.7% in 2008. In recent years, the ratio of farmland transfer has changed slowly but accelerating since 2013. At the end of 2009, it was up to 12.4%; at the end of 2013, it reached 26%. In 2015, it reached 30%.
3. 1996's data is from the National Rural Fixed Observation Point Farmer Survey data; 2015's data is from the National Rural Management Information collected by The Chinese Ministry of Agriculture (2015).
4. 1 mu = 0.0667 ha or 0.164 acre.
5. We classify renters as those who are transferring-in rural land from landowners. In China, rural land is legally owned by village collectives, which contract farmland to peasant households. During the contracting period, the peasant household has the right of possession, use and income of the contracted land and further has many rights such as leasing and transferring. In this paper, we call

the farmer who has the right to contract farmland the landowner. After the land title policy was nationally promulgated in 2013, farmers received land title, which allowed them to transfer (rent) farmland. Large renters cultivate transfer-in land, whereas a small renter may farm their own collective contracted land and transfer-in land from their neighbors.

6. As pointed out in the appendix, landowners have geographic, identity and information monopoly.
7. To ensure a nationwide representative sample, we selected six indicators – including total population, per capita GDP, total cultivated area, the proportion of cultivated land area to total land agricultural population accounting for the proportion to the total population and the proportion of agricultural output to provincial GDP. Moreover, we took into account the seven major geographical partitions (East China, South China, North China, Central China, Southwest China, Northwest China and Northeast China) in mainland China. According to the above principles, the final selected provinces were Guangdong, Guizhou, Henan, Jiangsu, Jiangxi, Liaoning, Ningxia, Shanxi and Sichuan.
8. 6 counties*7 provinces*4 towns*1 village*10 households+6 counties*2 provinces*10 towns*1 village*10 households = 2,880 households.
9. We use the STATA module the teffects psmatch command because it has one major advantage over psmatch2. It takes into account the fact that propensity scores are estimated rather than known when calculating standard errors. This often turns out to make a significant difference and sometimes in surprising ways – source: http://www.ssc.wisc.edu/sscc/pubs/stata_psmatch.htm. Since the sampling strategy was based on a stratified sampling method, clustering the standard errors at a province stratum is a useful way to calculate a more accurate standard error. However, there is no cluster option in the teffects psmatch command in STATA. We choose to use doubly robust estimation with the R package drgee. Source: https://cran.r-project.org/web/packages/drgee/drgee.pdf. We present the cluster standard error (cluster province) results from *R* Package Drgee in Appendix Table A5. The significance of the related estimation results is consistent with the teffect psmatch command in STATA.
10. Landowners are the ones who lease the land out. Renters are the ones who lease the land in.

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Table A1.
Balancing tests for beneficiaries and matched on contract break model

Variable	Sample	Mean Treated	Mean Control	% Bias	%reduct bias	*t*-test *t*	*t*-test $p > t$	V(T)/ V(C)
2.pro	Unmatched	0.1190	0.0424	28.3		3.35	0.001	
	Matched	0.1301	0.0854	16.6	41.6	1.6	0.11	
3.pro	U	0.0483	0.0707	−9.4		−1.11	0.269	
	M	0.0529	0.0366	6.9	27.2	0.87	0.384	
4.pro	U	0.1487	0.1519	−0.9		−0.11	0.915	
	M	0.1585	0.2642	−29.5	−3157.5	−2.89	0.004	
5.pro	U	0.3048	0.0424	73.7		8.73	0	
	M	0.2724	0.2683	1.1	98.5	0.1	0.919	
6.pro	U	0.1115	0.3463	−58.1		−6.79	0	
	M	0.1220	0.1220	0	100	0	1	
7.pro	U	0.1376	0.0636	24.7		2.92	0.004	
	M	0.1220	0.0285	31.3	−26.4	3.99	0	
8.pro	U	0.0409	0.1060	−25.1		−2.93	0.003	
	M	0.0447	0.0163	11	56.3	1.84	0.067	
9.pro	U	0.0372	0.0671	−13.5		−1.58	0.115	
	M	0.0407	0.0610	−9.1	32.2	−1.03	0.306	
fmaily_labor_num	U	0.7659	0.7118	24.8		2.9	0.004	0.87
	M	0.7584	0.7319	12.1	51.1	1.47	0.143	1.25
under16age_num	U	0.1312	0.1687	−19.2		−2.25	0.025	0.75*
	M	0.1352	0.1220	6.7	64.9	0.85	0.397	1.11
over50age_labor_num	U	0.3156	0.2167	32		3.77	0	1.24
	M	0.3073	0.1815	40.8	−27.2	4.66	0	1.43*
female_labor_num	U	0.4725	0.4605	6.8		0.8	0.423	0.92
	M	0.4786	0.5224	−24.8	−262.2	−2.78	0.006	0.9
farmer_num	U	0.2486	0.2080	13.8		1.62	0.105	0.99
	M	0.2473	0.2902	−14.6	−5.9	−1.63	0.103	1.06
high_edu_labor_num	U	0.2766	0.2120	21.7		2.54	0.011	1.06
	M	0.2646	0.3148	−16.9	22.2	−1.92	0.055	1.03
parttime_labor_num	U	0.2873	0.2461	11.7		1.38	0.17	1.08
	M	0.2848	0.3142	−8.4	28.4	−0.92	0.356	1.04
ccp_num	U	1.3123	1.1979	22.1		2.6	0.01	1.66*

(*continued*)

Table A1.

Variable	Sample	Mean Treated	Mean Control	% Bias	%reduct bias	*t*-test *t*	*t*-test $p > t$	V(T)/ V(C)
	M	1.3008	1.3008	0	100	0	1	1.26
vil_manager_in_family	U	1.8513	1.8869	−10.6		−1.24	0.215	1.26
	M	1.8537	1.7561	28.9	−173.9	2.75	0.006	0.68*
vil_manager_in_relative	U	1.3941	1.4558	−9.2		−1.08	0.281	0.96
	M	1.3902	1.3049	12.7	−38.2	1.46	0.144	1.13
main_surname_in_vil	U	2.2193	2.2473	−3.4		−0.4	0.687	1.04
	M	2.2520	2.0650	22.9	−567.4	2.48	0.014	0.86
aginsurance_medical_guarantee	U	0.9480	0.8799	24.4		2.85	0.004	
	M	0.9472	0.9390	2.9	88.1	0.39	0.698	
bsinsurance_medical_guarantee	U	0.0297	0.0777	−21.4		−2.5	0.013	
	M	0.0244	0.0081	7.2	66.1	1.43	0.155	
children_medical_guarantee	U	0.4498	0.4594	−1.9		−0.22	0.822	
	M	0.4390	0.2520	37.5	−1858.1	4.44	0	
ownsave_medical_guarantee	U	0.3978	0.4205	−4.6		−0.54	0.588	
	M	0.3862	0.2317	31.4	−579.7	3.75	0	
rentincome_medical_guarantee	U	0.0818	0.0141	32		3.79	0	
	M	0.0610	0.0081	25	21.9	3.24	0.001	
gov_medical_guarantee	U	0.0297	0.0212	5.4		0.64	0.524	
	M	0.0325	0.0203	7.7	−42.8	0.84	0.4	
Hills	U	0.1784	0.3993	−50.2		−5.87	0	
	M	0.1911	0.2480	−12.9	74.2	−1.53	0.128	
Mountain	U	0.6803	0.2827	86.6		10.17	0	
	M	0.6545	0.5854	15	82.6	1.58	0.115	
timespent_to_town	U	0.2752	0.3449	−29		−3.39	0.001	0.68*
	M	0.2803	0.2268	22.2	23.2	3.16	0.002	2.20*
timespent_to_county	U	0.8124	0.9945	−30.6		−3.58	0	0.51*
	M	0.8346	0.7102	20.9	31.6	3.25	0.001	2.12*
farmland_area	U	6.2672	6.1032	2.5		0.3	0.766	0.62*
	M	6.4370	5.8923	8.4	−232	0.98	0.326	0.82
piece_num_farmland	U	4.4944	6.1237	−35.3		−4.12	0	0.33*

(*continued*)

Table A1.

Variable	Sample	Mean Treated	Mean Control	% Bias	%reduct bias	*t*-test *t*	*t*-test $p > t$	V(T)/ V(C)
	M	4.5894	4.8577	−5.8	83.5	−0.99	0.324	1.61*
Readjust	U	1.4201	1.2650	24.6		2.9	0.004	1.69*
	M	1.4228	1.4350	−1.9	92.1	−0.19	0.85	0.98
Fertility	U	3.5242	3.3145	25.3		2.97	0.003	0.93
	M	3.5325	3.4512	9.8	61.2	1.06	0.288	0.9
Irrigation	U	3.3755	3.1449	22.9		2.69	0.007	0.93
	M	3.3780	3.1951	18.2	20.7	1.84	0.067	0.66*
income_family	U	2.6691	2.8339	−14.7		−1.72	0.086	0.89
	M	2.6504	3.1057	−40.5	−176.3	−4.82	0	1.14
tansfer_area	U	4.1530	6.9266	−6.6		−0.77	0.444	0.00*
	M	4.2011	3.1711	2.5	62.9	3.33	0.001	1.94*
tansfer_area_quelity	U	2.4126	2.1625	41.3		4.85	0	1.15
	M	2.3902	2.1138	45.6	−10.5	4.52	0	0.78*
Rent	U	1124.5000	301.2400	35.1		4.17	0	31.00*
	M	724.1300	722.7600	0.1	99.8	0.03	0.977	0.57*
Contract	U	2.6729	1.7774	126.5		14.84	0	0.82
	M	2.6463	2.5976	6.9	94.6	0.83	0.408	1.30*
contract_term	U	3.5762	2.1873	93.6		11.01	0	1.26
	M	3.4919	3.6829	−12.9	86.2	−1.47	0.142	1.54*
transfer_object_hope	U	0.7770	0.3852	86.4		10.12	0	
	M	0.7561	0.8252	−15.2	82.4	−1.89	0.06	
rent_threat_stagey	U	2.3420	1.6714	89.1		10.47	0	1.18
	M	2.3008	2.3293	−3.8	95.8	−0.39	0.697	0.89

** if variance ratio outside [0.85; 1.17] for U and[0.85; 1.18] for*

Sample	Ps *R*2	LR χ^2	$p > \chi^2$	Mean Bias	Med Bias	*B*	*R*	%Var
Unmatched	0.519	396.8400	0.0000	30.9	24.5	198.1*	1.28	36
Matched	0.198	135.3200	0.0000	15.4	12.8	109.9*	2.04*	44

Table A2. Balancing tests for beneficiaries and matched on rent threat strategy model

Variable	Sample	Mean				*t*-test		
		Treated	Control	%Bias	%reduct bias	*t*	$p > t$	V(T)/V(C)
2.pro	Unmatched	0.1190	0.0424	28.3		3.35	0.001	
	Matched	0.1221	0.0573	24	15.2	2.61	0.009	
3.pro	U	0.0483	0.0707	−9.4		−1.11	0.269	
	M	0.0496	0.0534	−1.6	82.9	−0.2	0.844	
4.pro	U	0.1487	0.1519	−0.9		−0.11	0.915	
	M	0.1527	0.2176	−18.1	−1899.8	−1.92	0.056	
5.pro	U	0.3048	0.0424	73.7		8.73	0	
	M	0.2939	0.4199	−35.4	52	−3.03	0.003	
6.pro	U	0.1115	0.3463	−58.1		−6.79	0	
	M	0.1145	0.0954	4.7	91.9	0.71	0.477	
7.pro	U	0.1376	0.0636	24.7		2.92	0.004	
	M	0.1336	0.0725	20.4	17.4	2.31	0.021	
8.pro	U	0.0409	0.1060	−25.1		−2.93	0.003	
	M	0.0420	0.0191	8.8	64.8	1.52	0.128	
9.pro	U	0.0372	0.0671	−13.5		−1.58	0.115	
	M	0.0382	0.0076	13.7	−1.9	2.34	0.019	
fmaily_labor_num	U	0.7659	0.7118	24.8		2.9	0.004	0.87
	M	0.7631	0.8154	−23.9	3.3	−2.79	0.006	0.92
under16age_num	U	0.1312	0.1687	−19.2		−2.25	0.025	0.75*
	M	0.1340	0.1243	5	74.1	0.55	0.583	0.68*
over50age_labor_num	U	0.3156	0.2167	32		3.77	0	1.24
	M	0.3159	0.4952	−58.1	−81.2	−5.25	0	0.54*
female_labor_num	U	0.4725	0.4605	6.8		0.8	0.423	0.92
	M	0.4730	0.6689	−110.9	−1523	−9.24	0	0.33*
farmer_num	U	0.2486	0.2080	13.8		1.62	0.105	0.99
	M	0.2458	0.2356	3.5	74.8	0.37	0.708	0.79
high_edu_labor_num	U	0.2766	0.2120	21.7		2.54	0.011	1.06
	M	0.2674	0.1462	40.7	−87.7	5.33	0	1.82*
parttime_labor_num	U	0.2873	0.2461	11.7		1.38	0.17	1.08
	M	0.2880	0.4917	−58	−395.4	−5.85	0	0.70*
ccp_num	U	1.3123	1.1979	22.1		2.6	0.01	1.66*

(*continued*)

Table A2.

Variable	Sample	Mean Treated	Control	%Bias	%reduct bias	*t*-test *t*	$p > t$	V(T)/V(C)
	M	1.3015	1.0878	41.3	−86.9	5.48	0	3.96*
vil_manager_in_family	U	1.8513	1.8869	−10.6		−1.24	0.215	1.26
	M	1.8550	1.8626	−2.3	78.6	−0.25	0.802	1.05
vil_manager_in_relative	U	1.3941	1.4558	−9.2		−1.08	0.281	0.96
	M	1.3931	1.2634	19.3	−110.1	2.36	0.019	1.28*
main_surname_in_vil	U	2.2193	2.2473	−3.4		−0.4	0.687	1.04
	M	2.2290	1.7405	59.8	−1643.6	6.77	0	0.98
aginsurance_medical_guarantee	U	0.9480	0.8799	24.4		2.85	0.004	
	M	0.9504	0.9580	−2.7	88.8	−0.42	0.677	
bsinsurance_medical_guarantee	U	0.0297	0.0777	−21.4		−2.5	0.013	
	M	0.0229	0.0153	3.4	84.1	0.64	0.524	
children_medical_guarantee	U	0.4498	0.4594	−1.9		−0.22	0.822	
	M	0.4428	0.2824	32.1	−1578.6	3.86	0	
ownsave_medical_guarantee	U	0.3978	0.4205	−4.6		−0.54	0.588	
	M	0.3970	0.1947	41.1	−790.2	5.19	0	
rentincome_medical_guarantee	U	0.0818	0.0141	32		3.79	0	
	M	0.0763	0.0076	32.5	−1.6	3.97	0	
gov_medical_guarantee	U	0.0297	0.0212	5.4		0.64	0.524	
	M	0.0305	0.0229	4.8	10.6	0.54	0.589	
Hills	U	0.1784	0.3993	−50.2		−5.87	0	
	M	0.1832	0.2290	−10.4	79.3	−1.3	0.196	
Mountain	U	0.6803	0.2827	86.6		10.17	0	
	M	0.6718	0.6565	3.3	96.2	0.37	0.712	
timespent_to_town	U	0.2752	0.3449	−29		−3.39	0.001	0.68*
	M	0.2749	0.1893	35.6	−22.8	5.54	0	2.97*
timespent_to_county	U	0.8124	0.9945	−30.6		−3.58	0	0.51*
	M	0.8194	0.6662	25.7	15.9	4.03	0	1.73*
farmland_area	U	6.2672	6.1032	2.5		0.3	0.766	0.62*
	M	6.3606	5.5344	12.8	−403.6	1.38	0.169	0.52*
piece_num_farmland	U	4.4944	6.1237	−35.3		−4.12	0	0.33*

(*continued*)

Table A2.

Variable	Sample	Mean Treated	Mean Control	%Bias	%reduct bias	*t*-test *t*	*t*-test $p > t$	V(T)/V(C)
	M	4.5305	4.0305	10.8	69.3	1.91	0.056	1.51*
Readjust	U	1.4201	1.2650	24.6		2.9	0.004	1.69*
	M	1.4160	1.2061	33.3	−35.4	3.86	0	1.78*
Fertility	U	3.5242	3.3145	25.3		2.97	0.003	0.93
	M	3.5229	3.8550	−40.1	−58.4	−4.2	0	0.68*
Irrigation	U	3.3755	3.1449	22.9		2.69	0.007	0.93
	M	3.3817	3.4542	−7.2	68.6	−0.87	0.387	1.11
income_family	U	2.6691	2.8339	−14.7		−1.72	0.086	0.89
	M	2.6489	2.6450	0.3	97.7	0.04	0.967	1.08
tansfer_area	U	4.1530	6.9266	−6.6		−0.77	0.444	0.00*
	M	4.2182	2.6891	3.6	44.9	5.51	0	2.83*
tansfer_area_quelity	U	2.4126	2.1625	41.3		4.85	0	1.15
	M	2.4084	2.3244	13.9	66.4	1.43	0.154	0.77*
Rent	U	1124.5000	301.2400	35.1		4.17	0	31.00*
	M	739.2900	926.1500	−8	77.3	−2.43	0.015	0.15*
Contract	U	2.6729	1.7774	126.5		14.84	0	0.82
	M	2.6679	2.7328	−9.2	92.8	−1.23	0.221	1.68*
contract_term	U	3.5762	2.1873	93.6		11.01	0	1.26
	M	3.5420	2.8740	45	51.9	5.12	0	1.24
transfer_object_hope	U	0.7770	0.3852	86.4		10.12	0	
	M	0.7710	0.8015	−6.7	92.2	−0.85	0.395	

** if variance ratio outside [0.85; 1.17] for U and[0.85; 1.18] for*

Sample	Ps R^2	LR χ^2	$p > \chi^2$	Mean Bias	Med Bias	*B*	*R*	%Var
Unmatched	0.478	365.9700	0.0000	29.5	24.4	179.2*	1.65	38
Matched	0.303	220.4100	0.0000	22.7	13.9	144.6*	0.96	71

Province	Model 1: Dependent variable = contract breaks Coef	Std. Err	Model 2: Dependent variable = rent threat strategy Coef	Std. Err
Ningxia	0.6892	0.7878	0.8097	0.7510
Shanxi	0.0194	0.7411	0.0527	0.7125
Guangdong	0.9080	0.6369	0.5485	0.5987
Jiangsu	1.7433	0.7323	1.8049	0.6906
Jiangxi	−0.2760**	0.6015	−0.4748***	0.5726
Henan	1.0046	0.7239	1.0728	0.6898
Guizhou	0.3043	0.8193	0.2170	0.7841
Liaoning	−0.2439	0.8094	−0.3789	0.7786
Family labor ratio	1.6624**	0.7618	1.6708**	0.7091
Under 16-year-old ratio	−0.1291	0.8038	0.0558	0.7346
Over 50-year-old labor ratio	0.3221	0.4889	0.4728	0.4728
Female labor ratio	−0.4730	0.8591	−0.6882	0.8110
Farmer ratio	1.0148*	0.5436	0.5328	0.5180
High educate labor ratio	0.4214	0.5267	0.2975	0.4959
Part-time farmer ratio	0.2379	0.4468	0.0535	0.4212
Communist Party members	0.2316	0.3107	0.3428	0.2945
Village cadres in the family	0.0055	0.4625	0.0131	0.4420
Village cadres in the relatives	−0.3902*	0.2199	−0.3970*	0.2069
Main surname	−0.1403	0.1764	−0.1404	0.1678
Ag-insurance medical guarantee	0.7653	0.5219	0.8874*	0.4988
Business-insurance medical guarantee	−1.5074**	0.7327	−1.3939**	0.6933
Children support medical care	−0.4223	0.3017	−0.3931	0.2860
Own savings for medical care	0.1677	0.3062	−0.1229	0.2850
Rental rent for medical care	0.2696	1.0077	0.6682	0.9221
Government bailout medical care	0.5417	0.9538	0.9133	0.9108
Hills	0.0099	0.4682	−0.0318	0.4526
Mountain	0.2430	0.4446	0.2602	0.4263
Time spent to town	−0.6245	0.6622	−0.4406	0.6456
Time spent to prefecture	−0.4568	0.3136	−0.6811**	0.2935
Farmland area	−0.0225	0.0208	−0.0318	0.0202
Number of the farmland plots	−0.0281	0.0397	−0.0182	0.0372
Farmland readjust	0.6155**	0.2430	0.5787**	0.2300
Land fertility	−0.3733**	0.2145	−0.2493	0.2051
Land irrigation	0.0716	0.1695	−0.0833	0.1626
Family annual income	0.0545	0.1294	0.0383	0.1238
Transfer farmland area	−0.0056	0.0069	−0.0045	0.0073
Transfer farmland quality	0.8401***	0.2692	0.7716***	0.2521
Rent	0.0004**	0.0002	0.0005***	0.0002
Contract type	1.2524***	0.2106	1.2215***	0.2005
Contract term	0.2390***	0.0956	0.2328***	0.0924
Emotion	1.1908***	0.2911	1.3622***	0.2770
High-rent strategy	1.0184***	0.1931		
Constant	−9.5304***	2.1517	−6.9073***	1.9262
	LR χ^2 (42) =	397.65***	LR χ^2 (41) =	366.72***

Table A3.
Logistic regression in PSM about the impact of large renter transfer object on contract breaks and rent threat strategy

Table A4. The impact of large renter transfer object on contract breaks and rent threat strategy (PSM)

Variable	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
Contract break							
ATT	0.1382* (0.0636)	0.1291** (0.0586)	0.1291** (0.0586)	0.1263** (0.0557)	0.1304** (0.0607)	0.1259** (0.0636)	0.0966*** (0.0300)
ATU	0.1222	0.12638	0.1264	0.1167	0.1203	0.1122	0.0839*** (0.0366)
ATE	0.1314	0.1279	0.1280	0.1222	0.1261	0.1201	0.0901*** (0.0294)
Observations	552	552	552	552	552	552	552
Rent threat strategy							
ATT	0.1145 (0.2981)	0.1688 (0.1921)	0.2166 (0.1906)	0.2581 (0.1681)	0.2768 (0.2036)	0.3531 (0.2981)	0.5390*** (0.0813)
ATU	0.4450	0.5249	0.5248	0.5628	0.5438	0.4926	0.6219*** (0.0933)
ATE	0.2538	0.3189	0.3466	0.3866	0.3894	0.4119	0.5815*** (0.0750)
Observations	552	552	552	552	552	552	552

Note(s): Model 1 is k-nearest neighbor matching ($k = 1$), Model 2 is k-nearest neighbor matching ($k = 4$), Model 3 is nearest-neighbor matching within caliper, Model 4 is nearest-neighbor matching within radius caliper, Model 5 is kernel matching, Model 6 is local linear regression matching, Model 7 is Mahal matching

Variable	Estimate		Std. Error
Contract break (without the control of rent threat strategy)			
large renter	0.1046**		0.0421
Observations		552	
Contract break (with the control of rent threat strategy)			
Large renter	0.0786*		0.0416
Observations		552	
Contract break (treatment variable is rent threat strategy)			
Rent threat strategy	0.0591***		0.0097
Observations		552	
Rent threat strategy			
Large renter	0.5278***		0.1107
Observations		552	

Note(s): the estimate is the treatment effect for each model. Std. error has been adjusted by clustering province

Table A5.
The impact of large renter transfer object on contract breaks and rent threat strategy (clustering province variable in R Package Drgee)

Appendix 2
Background and key issues
1.1 Focus on contract issues

Under the constraint of the Household Responsibility System and the fragmentation of farmland in rural China, the formation of a large-scale farm operation must rely on farmland transfer. That is, some farmers would transfer land out, while others would transfer land in. This transaction would increase the farmland operational scale. The land transaction process occurs through the land contract mechanism. The agricultural land lease contract is not only a link between both parties transferring the farmland but also a linchpin that directly affects the stable creation of a large-scale farm operation. However, according the data collected using a recent national representative survey in 2015 (Luo *et al.*, 2015), the incidence of contract breaks between small landowners and large renters (the types of large renters are diverse, including local big farmers, foreign big farmers, leading enterprises, cooperatives and village collectives) is more than 10% and in some cases even up to 35.71%. Luo *et al.* (2015) also indicate that the rate of contract breaks between small landowners and their relatives, neighbors, local small farmers and foreign small farmers is much lower than the contract break rate when leasing is between small landowners and large renters. It implies that when lessees are large renters, farmland lease contracts are more likely to be broken.

1.2 Particularity of farmland lease contract

A contract is a set of terms that reflects the responsibilities and rights of both parties (Bolton and Dewatripont, 2005). The contract features that are of most interest to both parties are the contract type (verbal contract or written contract), the period and the rent. Both parties make a "set of requirements" on the different terms of the contract when signing it. Furthermore, contracts in the field of agriculture have their particularities and complexities (Fukunaga and Huffman, 2009; Glover and Kusterer, 2016). The farmland tenancy market is not a pure factor market; it is a special market that shows kinship, geography and human relations (Macours *et al.*, 2004), especially in rural China where it has been subject to the special evolution of agricultural institutions and empowerment. Therefore, the negotiation and signing of farmland lease contracts inevitably have special market connotation. First, since the relationships with the landowner are different, the contract may be different for different statuses of lessees (Luo *et al.*, 2015; Macours *et al.*, 2004). Second, as the different terms represent different economic meanings (Cheung, 1968), both parties are likely to make contradictory claims on the same contract terms to minimize costs (Basu and Emerson, 2000). Third, there is a different relationship between the rent and the length of the contract period (Zhu and Luo, 2016).

Transaction costs play an important role in contract arrangements. Both parties involved in a farmland contract need to look for mutually agreed upon terms to achieve a dynamic equilibrium. If this

equilibrium cannot be maintained, the contract gets broken, which eventually leads to high transaction costs that fail to have a well-functioning tenancy market.

Although either party can break the contract, the large renters suffer more in the contract break if they are the lessee, which makes them less likely to break the contract. The large renters who lease farmland must pay particular attention to agricultural production profits. Also, the profit is affected by the characteristics of the farmland lease contract and the possible loss caused by a contract break. As a result, the most important way to maintain profit is to make sure the terms of the contract can be stable and minimize costs (Yoder *et al.*, 2008). Several elements can ensure a stable contract.

First, leasing and managing farmland is a continuous investment behavior, while short-term tenancy will cause asset specificity loss. The value of agricultural land depends on various forms of complementary investment on the land (Feder and Nishio, 1998). However, a strong asset specificity is observed when there is an investment of modern factors of production specific to crops or land (Williamson, 1979, 2007). Moreover, it may take several years to generate positive net returns to long-term asset-specific investments (Bergemann and Hege, 1998; Soule *et al.*, 2000). As a result, insecure property rights in land create a disincentive to invest (Anielski *et al.*, 2002; Besley, 1995), so the investment shortage is associated with shorter duration tenancies (Jacoby and Mansuri, 2008). Contrarily, if the plot-specific investment is higher, a longer contract period is required (Crocker and Masten, 1988; Joskow, 1987). Therefore, the large renters who want to increase production efficiency must make long-term investments and sign long-term land lease contracts.

Second, short-term tenancy increases the total cost of contracts over the duration as it involves the cost associated with multiple signings. Under the Household Responsibility System in China, most landowners are small renters. This means that each peasant household has only a small amount of farmland available for leasing. The lessees' desire to operate a larger farmland inevitably entails that they must deal with a large number of small landowners. At this point, the shorter-term contracts with multiple small landowners require more frequent signing, which increases transaction costs. To reduce the transaction cost, the large renters prefer a lease contract that is stable and long-term. If the contract is not consistent with their contract objectives, the large renters will face a lease dilemma.

It is likely that large renters are not the main reason associated with contract breaks. The problem may exist on the small landowner's side. To better shed light on this point, we try to understand the small landowners' contract demands and behavioral choices. This helps us to find the answer regarding contract breaks.

1.3 Contractual demands and behavior choices of the landowner

Generally speaking, small landowners [10] who do not have the comparative advantage in farmland operation choose to lease out. Small landowners may ask for a rental value for the land that may be smaller than the full productive potential of the farmland for various reasons, such as credit and labor constraints. Renters, on the other hand, consider land as a factor of production and may place rental value accordingly.

Net rental income (rent – contract signing cost) received by small landowners is affected by both rent and the cost of signing the contracts. When the cost of signing the contract increases (will be discussed below), small landowners ask for a higher rent. It can be observed that even if the contract signing cost for small landowners were to change, small landowners might receive the same net rental income by adjusting the rental value. Thus, the focus of this research is to identify the variables affecting small landowners' demand for higher rent and how such a rental requirement affects the stability of the lease contract.

1.3.1 Motivation: transaction costs and extra high-rent demand

A long-term contract means small landowners will be restricted by conditions stated in the initial rental agreement. This restriction moves small landowners to sign short-term contracts. The renters, on the other hand, desire to enter into a long-term contract to fully realize the return from the factors of production and to recuperate the land rental expenses.

From the small landowners' perspective, long-term contracts lead to a loss in flexibility. Under the Household Responsibility System, only farmers in villages can rent out farmland. Since the rural social security system is not fully developed, the land is both the source of livelihood and the social security in rural areas (Deininger and Feder, 2001). Therefore, small landowners may or may not want to lease land for a long period. It is the small landowners' perspective that the long-term contract will deprive them of

reallocating farmland resources. They perceive that the loss of flexibility caused by the long-term contract is large enough to make them choose short-term contracts (Hart and Moore, 2008).

Long-term contracts lead to the expected opportunistic behavior from large renters. The farmland has to be eventually returned to small landowners due to the farmland transfer rule in China. However, the difference in farmland quality from the initial rental signing period to the period when it is returned to the original owner is difficult to predict or assess. The real-world farmland leasing contract is incomplete, which provides institutional space for opportunistic behavior by renters (Klein, 1980). Moreover, tenure insecurity gives renters little incentive to maintain soil fertility or control erosion (Benedict, 1940; Laffont and Martimort, 2009). In this scenario, small landowners would assume that renters will carry out predatory behavior through the nonobservable and nonassessable nature of land quality. For instance, it is likely that an erosion-prone cultivation system will be employed (Saint-Macary *et al.*, 2010). If so, it may become expensive to restore the quality of deteriorated farmland. To avoid an unpredictable loss of farmland quality, the small landowners prefer to choose short-term contracts. From the perspective of small landowners, the advantages of short-term contracts are easy supervision and a reduction in renters' potential opportunistic behavior in the contract (Cheung, 1970).

To avoid the loss of flexibility and to see a reduction in monitoring cost, small landowners tend to sign short-term contracts and prefer lease contracts with as little regulation as possible (Slangen and Polman, 2008). In contrast, renters prefer to sign a long-term contract. The contract period needs to be agreed upon by both parties. Higher rent can provide an incentive to small landowners to enter into a long-term rental contract.

1.3.2 Ability: landowners' monopolistic power of the land

Small landowners' perspectives regarding the long-term contract make them ask for extra rent. This motivation can affect contract stability. Another important component affecting contract stability is the small landowners' absolute monopoly on the farmland leasing market.

Deninger and Jin (2004) claim that farmers' land tenure has never been secured in China as farmland is allocated to farmers by village collectives and farmland allocation is periodically adjusted by village cadres. More recent studies emphasize land takings by the government as a major threat to farmers' land rights (e.g. Chen and Kung, 2016). Actually, China's rural land system reform follows the path of strengthening farmers' rights and interests. During 1953–1978, collectives owned the farmland and organized villagers to operate farmland together. All agricultural production needed to be allocated proportionately by a collective to its members. During 1978–2013, although collectives still owned farmland, collectives contracted out farmland to each villager. Villagers could manage their own contracted farmland and keep production from contracted farmland. Since 2013, the Chinese government has initiated the Land Titling policy nationwide under which each farmer's rights and obligations are clearly defined. The Chinese Government considers "Property Right Certificate" as the physical carrier of farmland rights to strengthen the farmland property for farmers. After the implementation of Land Titling, the farmland will not be redistributed again because collectives need to follow the policy of protecting the stable property rights of farmers.

More importantly, even if farmers may have insecure farmland property rights when facing the government, the situation becomes completely different when they are facing the renters who transfer-in farmland. Under the background of the cadastral, legal and long-term empowerment system, the consolidation of farmers' land property rights becomes part of an inevitable trend of empowerment, which will also affect the development of the farmland market. China's farmland micro-property rights structure is so strong that farmers can easily form a "monopoly of property rights" on their own land when facing renters who transfer-in farmland.

First, there is identity monopoly. With the identity of the rural collective members, native farmers will be able to obtain the right to operate the land. As a result, farmland and the identity of the collective members are inseparable. It can be argued that the main identity of "collective members" has a strong ability to acquire land rights and can exclude others from the ownership of agricultural land rights, which means that farmers have a "property rights monopoly." Unlike the situation where farmland is obtained from market channels, theoretically speaking, no market or private means can deprive Chinese farmers of their farmland. Similarly, even if farmers ask for higher rent during the rental contract or simply break the contract, the penalties for breach of contract will never be confiscated farmland. Therefore, this empowerment scenario gives farmers the ability to disrespect the contract at low cost.

Second, there is geographical monopoly. Another result of the empowerment of China's agricultural land system is that, within the collective scope of the village, the land ownership certificate expresses the combination of the farmers' identity characteristics and the geographical characteristics of the land. A farmer who is born and resides in the village naturally receives the operating rights of the village land near his house. It means that the farmland is close to where the owner lives, and the owner has a full geographical advantage. Due to the geographical advantages, compared with farmland leaseholders, the cost of farmland occupation by farmers is lower. Therefore, during contract disputes, farmers can compete for farmland interests at low cost.

Third, there is the monopoly of information. Since the landowners have lived in the village for a long time, they have exclusive information regarding the actual quality of the land, its production potential and the external environment. So, the farmers in the village have a monopoly on the resource information regarding the land, which means that they can capture some of the "benefits" of the contract (Gang, 1994). Moreover, this kind of monopoly is consolidated with the extent of time the farmer holds the farmland. This is a typical information asymmetry problem that may occur in all contracts. Farmers with more complete information are in an advantageous position in the contract game.

These three types of "monopoly of property rights" of small landowners on their own land caused by the empowerment system in rural China have stimulated renters to tap into the potential gains in the public domain so that the landowner's rental requirements affect the profitability of the lessee (Arnott and Igarashi, 2000; Williamson, 1985). Under landowners' motive of raising rent and "monopoly of property rights," it is easy for landowners to implement the high-rent threat strategy to the renters due to the following reasons.

First, small landowner's strong interpersonal networks in the village make the behavior of large renters quickly known. Moreover, according to the theory of network density, a high-density network can promote consistency of behavior among members of the network. The high density of the small landowners' interpersonal network would promote consistency of action (McFadyen and Cannella, 2004). Small landowners may even carry out production damage or threaten to raise rent against renters.

Second, those renters who are not native to the village will face other problems. Given that renters who have not been living in the village have network disadvantage, even if small landowners behave against the contractual spirit, the small landowners will not face much emotional or reputational loss, which is important in mitigating a "hold-up" (Jacoby and Mansuri, 2008) problem.

Third, since the Chinese government is currently more focused on the protection of vulnerable landowners to stabilize the society, rather than on the enforcement of the spirit of the contract, the absence of judicial enforcement of tenancy contracts leaves renters with little interpersonal recourse or specific safeguard in the event of eviction or the landowner reneging on the contractual terms.

It is thus obvious that the seemingly "strong" renters can be very weak when dealing with the seemingly "vulnerable" small landowners. Even after the contract was signed, small landowners have the ability to increase rents within the contract duration once the rents of other landowners increase or small landowners observe renters' high return and feel that they are treated unfairly (Klein, 1996).

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