**Farmland Lease, High-Rent Threat, and Contract Instability: Evidence from China**

ABSTRACT

We develop a “two-stage contract” theoretical model to understand the stability problem in the farmland lease contract in China, where most landowners are small landholders. When these small landowners lease their land to large landholders, the former adopt a high-rent-threaten strategy that can result in contract instability. Results from doubly-robust estimation method used on randomly selected interview data from 1,537 households in nine provinces of China indicate that contract instability can arise endogenously when large landholders sign a contract. We conclude that a suitable rent control regime or contract enforcement may be necessary to promote a large-scale farmland transfer in China.

*Key words：*Contract Instability; Farmland Lease; High-Rent Threat; Large Landholder

*JEL Classifications:*D81, Q13, Q15, Q18

**Running Head:** Contract instability in farmland lease in China

# 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 economy of scale. Farmland transfer has helped to increase farm size and the formation of land cooperatives; the latter have 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.

Farmland transfer has been increasing in China since the inception of the Household Responsibility System in 1979.2 Before the implementation of the Household Responsibility System, the commune system was implemented in rural China. The land was owned by the collective, 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 fully use their 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 the collective to farmers born in the village. The agricultural production autonomy of farmers has been expanded, stimulating the enthusiasm of farmers for production, and making rational use of land, labor, and other production factor. According to the data available on farmland transactions, only 6.2% farmers participated in farmland transfer between 1984 and 1992. By the end of 2015, the farmland transfer had reached to 30% of cultivated land.3 However, despite increased effort by the government to facilitate farmland transactions, large-scale farm operations have not been the norm in China. Based on the official Chinese statistics4, a farm operation below 10 mu5 (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 10-30 mu (0.67-2 ha) was 20.2% in 1996 but decreased to 10.3% in 2015. In a recent survey conducted in nine provinces of China, 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. also indicate that landowners6 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 does not only imply farmland transfer increases over the years but also it means 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 lack of 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 break by large landholders[[1]](#footnote-1). We use a doubly-robust model (Bang and Robins 2005; Tan 2006) to estimate the causal effect of large landholder on contract break issue, and answer the question why signing a contract with large landholders will increase the incidence of contract breaks.

*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, and 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 2015), the incidence of contract breaks between small landowners and large landholders (the types of large landholders are diverse, including local big farmers, foreign big farmers, leading enterprises, cooperatives, and village collectives) are more than 10% and in some cases even up to 35.71%. Luo (2015) also indicates 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 landholders. It implies that when lessees are large landholders, farmland lease contracts are more likely to be broken.

The information presented in the preceding paragraph reflects the reality of China’s large-scale farm operation contract difficulties. One particular incidence of a contract breakage well known in China happened in Qiaocheng County, Anhui Province.7In fact, from 2008 to 2013, 95% of the more than 900 large landholders in Qiaocheng County have ended up breaking their contracts.

## *1.2 Particularity of farmland lease contract*

A contract is “a set of terms” that reflects the responsibilities and rights of both parties (Appleman et al. 2016), and 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 land-owner 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 cost plays 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, and eventually lead to high transaction costs that fails to have a well-functioning tenancy market

Although either party can break the contract, the large landholders suffer more in the contract break if they are the lessee, which makes them less likely to break the contract. The large landholders 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 set to stable and minimize the costs. 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 2007, Williamson 1979). 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 landholders 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 land-owners are small landholders. 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 land-owners. At this point, the shorter-term contracts with multiple small land-owners require more frequent signing, which increases transaction costs. To reduce the transaction cost, the large landholders prefer a lease contract that is stable and long term. If the contract is not consistent with their contract objectives, the large landholders will face a lease dilemma.

It is likely that large landholders 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 land-owners' contract demands and behavioral choices. This helps us to find the answer regarding the contract break.

## *1.3 Contractual demands and behavior choices of the land-owner: high-rent threat and the risk of contract breaks*

Generally speaking, small landowners[[2]](#footnote-2) 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. Landholders, 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: flexibility loss cost, supervision cost, and 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 landholders, 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 landholders. 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 landholders will carry out predatory behavior through the non-observable and non-assessable 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 landholders’ 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. In contrast, large landholders 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.

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### *1.3.2 Ability: a high-rent-threaten strategy based on the monopolistic power of the land*

Small landowners’ perspectives regarding the long-term contract make them ask for higher 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 (2009) 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 agriculture 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 Tilting policy 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 landholders 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 landholders 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.”

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.

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.

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 landholders to tap 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 the motive of raising rent and the “monopoly of property rights”, it is easy for landowners to use the identity monopoly, geographical monopoly, and the monopoly of information to implement the high-rent-threaten strategy to the large landholders due to the following reasons.

First, small landowner's strong interpersonal networks in the village make the behavior of large landholders 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 large landholders.

Second, those large landholders who are not native to the village will face other problems. Given that large landholders who haven’t 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 large landholders 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” large landholders 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 large landholders’ high return and feel that they are treated unfairly (Klein 1996).

# 2. Theory

In our model, landholders choose between a short-term or a long-term contract. Short term contracts result in a stable farmland lease contract between landowner and landholders. For large landholders, 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 benefit. When contracts are broken, large landholders incur an economic loss. Small landowners realize that large landholders prefer a long-term contract, and they believe that large landholders 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. This results in the instability of the farmland lease contract.

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

We believe that behavioral economics plays a part in how agents act. The set of equilibria changes drastically when either guilt aversion or reciprocity is considered. The owner increasing rent mid-contract and breaking that agreement is a scenario that triggers guilt-aversion from the landowner (Charness & Dufwenberg 2006). We will show that if the landowner is sufficiently guilt averse, there is an equilibrium where the landowner does not play the high-rent-threaten strategy. However, there still always exists an equilibrium in which rent is raised at a later date.

## *2.1 Model structure*

There are two agents: an owner of land (O, he) and a holder of land (H, she).

The timing of the game is as follows:

First, at date 0 (denoted ) a contract is written. The holder 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 ), the holder decides an investment . Investment has a profit determined by the function where is continuous and strictly quasiconcave over , and is the value of land without investment. Additionally, suppose that for some . Based on this investment, the holder will earn a period 1 utility while the owner earns a period 1 utility of

At date 2, (denoted ) the owner observes the holder's profits. Based on this, the owner can choose to increase rent by , so that the new rent is . Because the contract is nonenforceable, at this point the holder 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 holder. Additionally, the owner incurs a penalty 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 holder earns a period 2 profit of The owner earns

For a short-term contract, the total utility to each agent is the utility they would earn under no investment and no rent increase, but both are penalized by a cost of having to renegotiate the contract at date 2. The holder has total utility and the owner has total utility where S is the cost of renegotiating the contract between periods in a short-term contract.

We will analyze subgame perfect equilibria. Because this is a game of perfect information, we will use backwards induction starting from date 2.

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## *2.2 Equilibrium under guilt aversion*

Suppose that only the owner is impacted by guilt aversion along the lines of Charness & Dufwenberg (2006) and Battigalli & Dufwenberg (2007). Without contract enforcement, the owner, who is local and who deals with small scale farming is likely to be influenced with community-based factors such as guilt, while the holder is operating on a larger scale and is unlikely to be influenced by guilt.

With guilt aversion, we assume that at date 2 the owner is impacted by guilt aversion. This is because a change in rent deviates from the written contract. Sensitivity to guilt aversion, is measured by a parameter . The payoff to the owner in period 2 is then , where is the owner's second order belief about what the holder believes the owner will set as . The literature on guilt in contracting suggests that the act of breaking the agreement is what causes guilt (Charness & Dufwenberg 2006), so guilt aversion will only occur in equilibria in which Thus, in such equilibria . Otherwise, .

The holder utility function , where is the set of strategy profiles . The owner utility function , where is the set of beliefs of the owner.

There are two potential equilibria in this game: One in which and one in which We will investigate that equilibrium first.

## *2.21*

Note that in this equilibrium, guilt aversion does not play a role. Thus, in , the holder will accept any . The owner will choose , extracting all profit from the holder.

This means that in period 1, the holder chooses to maximize . By the intermediate value theorem, and because is strictly quasiconcave with for some , has a unique maximum. Call this solution .

In period 0, the holder chooses between a short-term and a long-term contract. The holder chooses a long-term contract if . 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 holder prefers a long-term contract.

It is worth noting that is such that the holder is indifferent between accepting the contract change or rejecting it. Holders who feel slighted by an owner may choose to break these contracts, similar to behavior that takes place in ultimatum games (Sanfey et. al. 2003, Burnham 2007, Nowak et. al. 2000 and many others).

## *2.22*

In an equilibrium where , the holder will always accept because they always make a profit. The most profitable deviation occurs when . For the owner to have an incentive to make ,

Solving for shows that this inequality holds if

Given that **,** in the owner maximizes . This yields the same level of investment as was present in the equilibrium where **.**

In period 0, the holder chooses a long-term contract if . Because this inequality always holds and thus a long-term contract is always preferable.

We believe that guilt aversion prevents landowners from threatening landholders with high rent in some cases. However even with guilt aversion there is another equilibrium in which all profit is extracted from the landholder. This behavior would not be possible if contracts were enforceable. In the case that the landholders are afraid of having rent extracted and investment is not highly profitable relative to not investing, short-term contracts are likely to be selected. These contracts do not allow for investment, meaning this equilibrium is not Pareto optimal.

# 3. Data and variable selections

We conducted nationally representative face-to-face interview surveys of 2880 peasant households from 54 counties in Guangdong, Guizhou, Henan, Jiangsu, Jiangxi, Liaoning, Ningxia, Shanxi, and Sichuan provinces , 2500 peasant households in Jiangxi province, and 1800 peasant households in Guangdong province between January 2015 and February 2016.9 In total, 7180 peasant households were interviewed, and 6877 questionnaires were collected. The effective rate of questionnaires response rate was 95.78%. Among them, 1611 households transferred farmland out. Removing the missing data, the final usable number of observations is 1537. Survey questionnaire asked information about household characteristics, the labor market, the financial market, land transfer, and land lease contract.

*[Figure 2 should be here]*

The first important variable regarding contract stability is the occurrence of contract breaks. We ask small landowners if the latest contract they signed with landholders were broken. The data show that in total 5.79% of contracts were broken, whereas the remaining 94.21% of contracts were stable.

Second, as the contract instability can come from a landowner’s high-rent-threaten strategy during the contract, the second question asked was “did you ask for higher rent during the contract period?” The answers are set to be “yes,” “no,” or “not sure.” The number of landowners who responded with “yes” were 29.41%, and 10.24% of those who said "yes" had a contract break. The numbers of landowners who responded with “no” were 44.96%, and 2.22% of those who said "no" had a contract break. The remainder of the respondents provided “not sure” as their response. Among those, 8.84% had a contract break. The answer of “not sure” may means that landowner asks for higher rent during the contract period but feel uneasy to admit it.

Third, whether the actual landholder is a large landholder 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 landholders. Those who rent land to “local big farmers,” “foreign big farmers,” “leading enterprises,” “cooperatives,” and “village collectives” are considered to be renting to large landholders. The percentage of landowners who rented their land to large landholders are 40.4%. The remainder are considered as renting their land to small landholders.

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 years 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."

We use 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, we call it "big names". These variables capture the social network and social capital of a household.

We use 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.”

We use 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.”

We use transfer farmland area, transfer farmland quality, rent, contract type, and contract term as the observed variables of the characteristics of the contract.

In addition, Kahneman et al. (1991) indicate that emotions and relationships can affect human behavior. We introduced the emotional variable “Want to rent farmland to large landholders” as a control variable.

The variable definitions and descriptive statistics are shown in Table 2.

# 4. Econometric model

We estimate the relationship between contract breaks and landholder types (with and without the control of the high-rent-threaten strategy), the relationship between contract breaks and the rent-threaten-strategy, and the relationship between the high-rent-threaten strategy and landholder types. The first model calculates the total influence of the landholder types on the probability of contract breaks. The second model calculates the influence of the landholder types on the probability of contract breaks when the control is the landowners’ high-rent-threaten strategy. The third model calculates the effect of the high-rent-threaten strategy of landowners on the probability of contract breaks. And the final model calculates the effect of landholder types on the landowners’ high-rent-threaten strategy.

We use a doubly-robust estimation method to estimate the causal effect of landholder types on contract stability. We select Matching (MATCH) estimators for estimating the effects of treatment variables on the dependent variable (Funk et al. 2011), while a propensity score matching (PSM) model needs both outcome regression, and propensity score methods are unbiased.10

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 1999, Lunceford and Davidian 2004, Glynn and Quinn 2010, Graham 2012, Waernbaumand 2012, and Kreif et al. 2013) indicate that IPW deliver 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 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 & 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 landholder or small landholder). Finally, we could 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 landholder types 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 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).

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 (landholder 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 landholder by, while we weigh observations of the small landholder by . Here, 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:

 (1)

 (2)

 (3)

Independent variables in the outcome model are (this is the treated group), (this is the non-treated group), population structure (), community resource (), traffic and terrain conditions (), farmland status and economic situation (), and characteristics of the contract ().

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 landholder are population structure (), community resources (), traffic and terrain conditions (), farmland status and economic situation (), and characteristics of the contract ().

In the third step, we weigh the conditional mean by using inverse probability. The propensity score (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 landholder.

Denoting is for the treated farmers who signed with a large landholder and is for the untreated farmers who signed with a small landholder, we then write:

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

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 , large landholder’s lease contract), while the ATENT is the average treatment effect calculated within the subsample of untreated units (those with, non-large landholder’s lease contract) (Cerulli 2015). In other words, according to ATET, the average small landholder outcome for a farmer that signed with a large landholder selected by PSM is used to express a counterfactual outcome using a large landholder contract sample. According to ATENT the average large landholder outcome of a farmer that signed with a small landholder selected by PSM is used to express the counterfactual outcome using a small landholder 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):

i. The first condition requires conditional independence. That is:

E

E

ii. The second is the common support that requires the propensity score to cover large landholder’s lease contract farmers and non-large landholder’s lease contract farmers. This condition is shown in Figures 3 and 4 (large landholder’s lease contract), with all treatment and non-treatment 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.

iii. The third condition is a balancing that shows distributions of covariates are similar for large landholder’s lease contract farmers and non-large landholder’s lease contract farmers (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. T-test statistics show that most of the variables pass the balance test (see *Appendix A1* and *Appendix A2).* The balancing test also indicates high quality results with MedBias, reducing to 4.9% and 6.8% respectively and the most standard bias reduced after matching.

# 5. Results

We report the results from the treatment effects of landholder types on contract breaks, treatment effects of the high-rent-threaten strategy on contract breaks, and treatment effects of landholder types on landowners’ rent-threaten strategy.

We estimate five different models using the doubly-robust estimation methods as shown in Table 3. We focus on average treatment effect using the whole sample, so we interpret ATE obtained from IPWRA (IPWRAATE). For the purpose of comparison, we also estimate the PSM model in Appendix Table A3. In the PSM model, the results of Mahal Matching are similar to those of the propensity score matchings confirming the robustness of the results. We present the results from PSM in Appendix Table 3A.

*5.1 Effects of landholder types on contract breaks*

Results from IPWRA ATE are presented in Table 3 under the column model4. All coefficients are significant at the 5% or 1% level. Results indicate that landowners who signed with large landholders had 5.08% more incidence of contract break than those who signed contracts with small landholders. These results confirm our theoretical derivations that the contract is more likely to break when the landholder types are local big farmers, leading enterprises, cooperatives, and village collectives. 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 landholders are receiving a higher return than the perceived fair amount, the stability of the contract is not likely to hold. Therefore, the landholder types can affect the stability of a farmland transfer contract.

If we add the variable “landowners’ high-rent-threaten strategy” into the model, we would be able to assess whether the influence of the transfer object on the probability of contract break exists after controlling for the high-rent-threaten strategy. Results indicate that, compared to those who signed contracts with small landholders, landowners who signed with large landholders still have 4.06% more contract breaks. The result illustrates that landowners’ high-rent-threaten strategy should be one of the reasons that the landholder types affect the stability of a farmland transfer contract.

*5.2 Effects of landowners’ high-rent-threaten strategy on contract breaks*

We can only report the RAATE, RAATET, and IPWRAATET results because variables associated with the landowners’ high-rent-threaten is a categorical variable. For consistency, we focus on the average treatment effect using the whole sample. Results indicate that the landowners’ not clear high-rent-threaten strategy causes 4.49% more contract breaks on ATERA, and the landowners’ high-rent-threaten strategy causes 6.50% more contract breaks. These results indicate that the contract is more likely to break when landowners have a high-rent-threaten strategy during the contract period. It proves that small landowners’ high-rent-threaten strategy results in instability of the farmland lease contract.

*5.3 Effects of landholder types on landowners’ high-rent-threaten strategy*

Results from IPWRA are presented. All coefficients are significant at the 1% level. Results indicate that landowners who signed with large landholders had 67.12% more incidence of asking for higher rent (high-rent-threaten strategy) in the contract duration than those who signed a contract with small landholders. Small landowners believe that fixed rental contracts will induce the landholder to adopt techniques of cultivation that are too risky from the point of view of the landowner (Ghatak and Pandey 2000). In addition, small landowners believe the tenure security has a positive effect on farm productivity (Abdulai et al. 2011). Small landowners realize that large landholders prefer a long-term contract and can earn sufficient return 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-threaten strategy to the large landholders by practicing their monopolistic power.

In summary, the above results reflect that: (i) signing a contract with large landholders will significantly increase the incidence of contract breaks. Small landowners are more likely to have a “high-rent-threaten strategy” to the large landholders, which will result in the contract breaks; (ii) even if we control the landowners’ high-rent-threaten strategy, the contract is still more likely to break when the landholder is a large landholder. Thus, the landowners' high-rent-threaten strategy is a partial mediation variable. It also means that the landholder types will affect contract breaks, not only through the landowners' high-rent-threaten 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 landholder is 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 for the still prevailing 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 landholders lose more from a contract break, they prefer lease contracts that are stable and long-term. However, small landowners realize that large landholders prefer a long-term contract, and they believe that large landholders can earn sufficient return. Therefore, small landowners constantly evaluate the terms of the contract and are likely to implement the high-rent-threaten strategy against large landholders 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: (i) signing a contract with large landholders will significantly increase the incidence of contract breaks; (ii) landowners’ “high-rent-threaten strategy” will significantly increase the incidence of contract breaks; (iii) landowners are more likely to implement a “high-rent-threaten strategy” against large landholders, which leads to contract breaks; (iv) even after controlling landowners’ high-rent-threaten strategy, contracts are still more likely to be broken when the landholder types is the large landholder. Although our findings indicate contract break is only 3.4-6.9% higher when the contracts were between landowners and large landholders, it still will have great impact on contiguity of land plots. Without contiguous land plots, large scale farm machine uses can be at the minimum costly and at the maximum impossible.

We found that small landowners did not implement a high-rent-threat strategy against small landholders. This results in a stable farmland lease contract. However, contract instability arises endogenously when small landowners sign contracts with large landholders. 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 landholders. At this point, 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. Allowing certain flexibility in rent adjustment with some pre-specified benchmarks (such as those based on a county’s average yield) can endogenize landowners’ opportunistic behavior and help avoid the risk of contract instability.

**Endnotes:**

2 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.

3 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%.

4 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).

5 1 mu = 0.0667 ha or 0.164 acre.

6 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, transferring and so on. In this paper, we call the farmer who has the right to contract farmland as the landowner.

7 The Chinese government used this county as a case study to promote land contracts and land transfer. Source: http://www.sohu.com/a/202180499\_182291.

8 To simplify the “two-stage contract” theoretical model, there are only two discreet time periods, a short-term period (t1) and a long-term period (t2).However, the period of a contract should be a continuous value, so it should be rationalized as a continuous variable in mathematical analysis.

9 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.

10 We use stata module the teffects psmatch command because it has one very important 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 signification difference and sometimes in surprising ways. Source: http://www.ssc.wisc.edu/sscc/pubs/stata\_psmatch.htm.

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**Table 2. Variable definition and descriptive statistics**

|  |  |  |  |
| --- | --- | --- | --- |
| Variable | Assignment | Mean | SD |
| Contract breaks | 0 = no; 1 = yes | 0.058 | 0.234 |
| Farmer’s behavior of asking for higher rent | 1=no; 2= not sure; 3=yes | 1.845 | 0.848 |
| Landholder | Large landholder transfer object | 0 = no; 1 = yes | 0.404 | 0.490 |
| Relatives | 0 = no; 1 = yes | 0.254 | 0.436 |
| Neighbors | 0 = no; 1 = yes | 0.113 | 0.318 |
| Local small farmers  | 0 = no; 1 = yes | 0.227 | 0.424 |
| Local big farmers | 0 = no; 1 = yes | 0.130 | 0.348 |
| Foreign small farmers | 0 = no; 1 = yes | 0.044 | 0.204 |
| Foreign big farmers | 0 = no; 1 = yes | 0.120 | 0.325 |
| Leading enterprises | 0 = no; 1 = yes | 0.059 | 0.236 |
| Cooperatives | 0 = no; 1 = yes | 0.024 | 0.153 |
| Village collective | 0 = no; 1 = yes | 0.087 | 0.281 |
| Family population structure | Family labor ratio | The actual data | 0.678 | 0.235 |
| Under16 years old ratio | The actual data | 0.174 | 0.194 |
| Over50 years old labor ratio | The actual data | 0.268 | 0.314 |
| Female labor ratio | The actual data | 0.442 | 0.196 |
| Farmer ratio | The actual data | 0.220 | 0. 291 |
| Part time farmer ratio  | The actual data | 0.188 | 0.306 |
| High educate labor ratio | The actual data | 0.230 | 0.306 |
| Community resource | Communist Party Members | 1=no; 2= one; 3=more than one | 1.242 | 0.504 |
| Village cadres in the family | 1=no; 2= one; 3=more than one | 1.874 | 0.335 |
| Village cadres in the relatives | 1=no; 2= one; 3=more than one | 1.366 | 0.639 |
| Ag-insurance medical guarantee | 0 = no; 1 = yes | 0.896 | 0.305 |
| Business-insurance medical guarantee | 0 = no; 1 = yes | 0.049 | 0.217 |
| Children support medical care | 0 = no; 1 = yes | 0.445 | 0.497 |
| Own savings for medical care | 0 = no; 1 = yes | 0.358 | 0.480 |
| Rental rent for medical care | 0 = no; 1 = yes | 0.034 | 0.183 |
| Government bailout medical care | 0 = no; 1 = yes | 0.024 | 0.153 |
| Main surname | 0 = no; 1 = yes | 2.381 | 0.793 |
| Village’s traffic and terrain conditions | Hills | 0 = no; 1 = yes | 0.535 | 0.499 |
| Mountain | 0 = no; 1 = yes | 0.327 | 0.469 |
| Time spent to town | The actual data | 0.268 | 0.216 |
| Time spent to prefecture | The actual data | 0.763 | 0.524 |
| Farmland status and economic situation | Farmland area | The actual data | 5.827 | 21.36 |
| Number of the farmland plots | The actual data | 5.523 | 4.767 |
| Farmland readjust | 1=no; 2= small; 3=big | 1.385 | 0.724 |
| Land fertility | 1=too bad; 2=bad; 3=ordinary; 4=good; 5=so good  | 3.365 | 0.800 |
| Land irrigation | 1=too bad; 2=bad; 3=ordinary; 4=good; 5=so good | 3.302 | 0.940 |
| 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 | 2.906 | 1.159 |
| Characteristics of the contract | Transfer farmland area | The actual data | 5.694 | 40.03 |
| Transfer farmland quality | 1=too bad; 2=bad; 3=ordinary; 4=good; 5=so good | 1.957 | 0.672 |
| Rent | The actual data | 566.21 | 1793.905 |
| Contract type | 1=No contract；2= Oral contract；3= Written contract | 2.007 | 0.888 |
| Contract term | 1= irregular；2=Within 1 year；3=1-3years；4=4-5years；5=more than 5years | 2.630 | 1.638 |
| Emotion | Want to rent their lands to large landholders. | 0 = no; 1 = yes | 0.643 | 0.479 |

**Table 3. The impact of large landholder transfer on contract break and rent-threaten strategy, and the impact of rent-threaten strategy on contract break**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Variable | Model 1 | Model 2 | Model 3 | Model 4 | Model 5 |
| **Contract break (without the control of Rent-threaten strategy)** |
| large landholder vs. small landholder  | .0681 \*\*\*(.0177) | .0452 \*\*\*(.0172) | .0461(.0380) | .0508\*\*(.0263) | .0637\*\*\*(.0141) |
| Average contract breaks value of small landholder | .0400 \*\*\*(.0078) | .0494\*\*\*(.0125) | .0325 \*\*\*(.006) | .0325\*\*\*(0061) | .0309\*\*\*(.0083) |
| Observations | 1,507 | 1,507 | 1,507 | 1,507 | 1,507 |
| **Contract break (with the control of Rent-threaten strategy)** |
| large landholder vs. small landholder  | .0565 \*\*\*(.0180) | .0340\*(.0180) | .0379\*\*(.0191) | .0406\*\*\*(.0169) | .0525\*\*\*(.0174) |
| Average contract breaks value of small landholder | .0445 \*\*\*(.0085) | .0607\*\*\*(.0136) | .0370 \*\*\*(.0077) | .0370\*\*\*(.0077) | .0422\*\*\*(.0133) |
| Observations | 1,507 | 1,507 | 1,507 | 1,507 | 1,507 |
| **Contract break** |
| Not clear rent-threaten strategy vs. no rent-threaten strategy | .0449\*\*\*(.0160) | .0482\*\*\*(.0169) |  |  | .0433\*\*\*(.0191) |
| Have rent-threaten strategy vs. no rent-threaten strategy | .0650\*\*\*(.0180) | .0977\*\*\*(.0244) |  |  | .0758\*\*\*(.0251) |
| Average contract breaks value of no rent-threaten strategy | .0278 \*\*\*(.0074) | .0345\*\*\*(.0101) |  |  | .0393\*\*\*(.0140) |
| Observations | 1507 | 1507 |  |  | 1507 |
| **Rent-threaten strategy** |
| large landholder vs. small landholder  | .4657\*\*\*(.0572) | .3730\*\*\*(.0637) | .7409\*\*\*(.2632) | .6712\*\*\*(.1581) | .3723\*\*\*(.0787) |
| Average rent-threaten strategy value of small landholder | 1.6853 \*\*\*(.0327) | 1.8165\*\*\*(.0548) | 1.6799\*\*\*(.0368) | 1.6821\*\*\*(.0370) | 1.8172\*\*\*(.0718) |
| Observations | 1,507 | 1,507 | 1,507 | 1,507 | 1,507 |

Note: 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.



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



**Figure 3. Propensity score (independent variable is landholder types)**



**Figure 4. Propensity score (independent variable is high-rent-threaten strategy)**



**Figure 5. Standardized percentage bias across covariate associated with large landholder transfer object**

3

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**Figure 6. Standardized percentage bias across covariate associated with rent-threaten strategy**

**APPENDIX**

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

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Variable | Sample | Mean |  | %reductbias | t-test | V(T)/ |
| Treated | Control | %bias | t | p>t | V(C) |
| Province | Unmatched | 6.2353 | 6.1665 | 4.3 |  | 0.80 | 0.423 | 0.74\* |
| Matched | 6.1361 | 6.167 | -1.9 | 55.2 | -0.31 | 0.753 | 0.75\* |
|  |  |  |  |  |  |  |  |  |
| prefecture | U | 59.546 | 63.445 | -9.2 |  | -1.74 | 0.082 | 0.92 |
| M | 60.154 | 57.143 | 7.1 | 22.8 | 1.20 | 0.230 | 1.09 |
|  |  |  |  |  |  |  |  |  |
| Family labor ratio | U | .69425 | .66694 | 11.6 |  | 2.22 | 0.027 | 1.13 |
| M | .69028 | .70431 | -5.9 | 48.6 | -1.02 | 0.306 | 1.20\* |
|  |  |  |  |  |  |  |  |  |
| Under16 years old ratio | U | .17062 | .17744 | -3.5 |  | -0.67 | 0.503 | 0.96 |
| M | .16597 | .18524 | -192.2 |  | -1.66 | 0.096 | 0.89 |
|  |  |  |  |  |  |  |  |  |
| Over50 years old labor ratio | U | .30032 | .24226 | 18.4 |  | 3.54 | 0.000 | 1.22\* |
| M | .29098 | .3065 | -4.9 | 73.3 | -0.79 | 0.430 | 1.03 |
|  |  |  |  |  |  |  |  |  |
| Female labor ratio | U | .44823 | .43699 | 5.7 |  | 1.09 | 0.276 | 1.03 |
| M | .44819 | .4578 | -4.9 | 14.5 | -0.83 | 0.406 | 1.12 |
|  |  |  |  |  |  |  |  |  |
| Farmer ratio | U | .22507 | .21757 | 2.6 |  | 0.49 | 0.624 | 1.02 |
| M | .22833 | .25689 | -291.1 |  | -1.56 | 0.120 | 0.92 |
|  |  |  |  |  |  |  |  |  |
| High educate labor ratio | U | .23684 | .22081 | 5.2 |  | 1.00 | 0.316 | 1.07 |
| M | .22982 | .19122 | 12.6 | -140.7 | 2.21 | 0.027 | 1.22\* |
|  |  |  |  |  |  |  |  |  |
| Part time farmer ratio | U | .22262 | .16788 | 17.6 |  | 3.41 | 0.001 | 1.29\* |
| M | .21299 | .22962 | -5.4 | 69.6 | -0.85 | 0.393 | 0.96 |
|  |  |  |  |  |  |  |  |  |
| Communist Party Members | U | 1.2794 | 1.2179 | 12.1 |  | 2.32 | 0.020 | 1.20\* |
| M | 1.2759 | 1.225 | 10.0 | 17.4 | 1.64 | 0.102 | 1.09 |
|  |  |  |  |  |  |  |  |  |
| Village cadres in the family | U | 1.8693 | 1.876 | -2 |  | -0.38 | 0.705 | 1.01 |
| M | 1.8639 | 1.8348 | 8.6 | -333.6 | 1.35 | 0.178 | 0.85 |
|  |  |  |  |  |  |  |  |  |
| Village cadres in the relatives | U | 1.317 | 1.3966 | -12.6 |  | -2.38 | 0.017 | 0.86 |
| M | 1.3358 | 1.3593 | -3.7 | 70.4 | -0.61 | 0.542 | 0.9 |
|  |  |  |  |  |  |  |  |  |
| Main surname | U | 2.3513 | 2.4045 | -6.7 |  | -1.28 | 0.202 | 1.01 |
| M | 2.3829 | 2.3031 | 10.1 | -50.2 | 1.63 | 0.103 | 0.85 |
|  |  |  |  |  |  |  |  |  |
| Ag-insurance medical guarantee | U | .9281 | .87598 | 17.6 |  | 3.28 | 0.001 | . |
| M | .92015 | .92922 | -3.1 | 82.6 | -0.57 | 0.569 | . |
|  |  |  |  |  |  |  |  |  |
| Business-insurance medical guarantee | U | .03268 | .06034 | -13.2 |  | -2.44 | 0.015 | . |
| M | .0363 | .03267 | 1.7 | 86.9 | 0.33 | 0.742 | . |
|  |  |  |  |  |  |  |  |  |
| Children support medical care | U | .40196 | .47039 | -13.8 |  | -2.63 | 0.009 | . |
| M | .39927 | .40835 | -1.8 | 86.7 | -0.31 | 0.759 | . |
|  |  |  |  |  |  |  |  |  |
| Own savings for medical care | U | .3268 | .37207 | -9.5 |  | -1.81 | 0.071 | . |
| M | .32305 | .27949 | 9.1 | 3.8 | 1.58 | 0.115 | . |
|  |  |  |  |  |  |  |  |  |
| Rental rent for medical care | U | .05392 | .01899 | 18.7 |  | 3.73 | 0.000 | . |
| M | .02359 | .03448 | -5.8 | 68.8 | -1.08 | 0.282 | . |
|  |  |  |  |  |  |  |  |  |
| Government bailout medical care | U | .02614 | .02346 | 1.7 |  | 0.33 | 0.741 | . |
| M | .02722 | .03085 | -37.7 |  | -0.36 | 0.720 | . |
|  |  |  |  |  |  |  |  |  |
| Hills | U | .5049 | .56536 | -12.1 |  | -2.32 | 0.021 | . |
| M | .50817 | .50998 | -0.4 | 97.0 | -0.06 | 0.952 | . |
|  |  |  |  |  |  |  |  |  |
| Mountain | U | .40523 | .26034 | 31.1 |  | 5.99 | 0.000 | . |
| M | .39383 | .38838 | 1.2 | 96.2 | 0.19 | 0.853 | . |
|  |  |  |  |  |  |  |  |  |
| Time spent to town | U | .23975 | .28724 | -22.5 |  | -4.21 | 0.000 | 0.68\* |
| M | .24668 | .25426 | -3.6 | 84.0 | -0.67 | 0.503 | 1.21\* |
|  |  |  |  |  |  |  |  |  |
| Time spent to prefecture | U | .72739 | .78698 | -11.6 |  | -2.17 | 0.030 | 0.69\* |
| M | .74753 | .75641 | -1.7 | 85.1 | -0.31 | 0.759 | 0.93 |
|  |  |  |  |  |  |  |  |  |
| Farmland area | U | 6.5879 | 5.263 | 5.7 |  | 1.18 | 0.238 | 15.02\* |
| M | 6.8443 | 6.522 | 1.4 | 75.7 | 0.21 | 0.836 | 6.10\* |
|  |  |  |  |  |  |  |  |  |
| Number of the farmland plots | U | 4.9085 | 6.0179 | -24.2 |  | -4.44 | 0.000 | 0.42\* |
| M | 5.0309 | 5.1252 | -2.1 | 91.5 | -0.41 | 0.679 | 0.86 |
|  |  |  |  |  |  |  |  |  |
| Farmland readjust | U | 1.3971 | 1.3844 | 1.7 |  | 0.33 | 0.739 | 1.04 |
| M | 1.4192 | 1.3557 | 8.7 | -400.1 | 1.49 | 0.137 | 1.28\* |
|  |  |  |  |  |  |  |  |  |
| Land fertility | U | 3.415 | 3.324 | 11.4 |  | 2.17 | 0.030 | 0.94 |
| M | 3.4319 | 3.4664 | -4.3 | 62.1 | -0.77 | 0.442 | 1.16 |
|  |  |  |  |  |  |  |  |  |
| Land irrigation | U | 3.3252 | 3.2827 | 4.5 |  | 0.86 | 0.389 | 0.99 |
| M | 3.3412 | 3.392 | -25 |  | -0.89 | 0.374 | 0.95 |
|  |  |  |  |  |  |  |  |  |
| Family annual income | U | 2.7876 | 2.981 | -16.9 |  | -3.20 | 0.001 | 0.91 |
| M | 2.8294 | 2.9256 | -8.4 | 50.3 | -1.35 | 0.179 | 0.82\* |
|  |  |  |  |  |  |  |  |  |
| Transfer farmland area | U | 5.5992 | 5.8391 | -0.6 |  | -0.11 | 0.910 | 0.60\* |
| M | 5.8172 | 10.537 | -1878.9 |  | -1.20 | 0.229 | 0.18\* |
|  |  |  |  |  |  |  |  |  |
| Transfer farmland quality | U | 2.0458 | 1.9061 | 20.6 |  | 3.99 | 0.000 | 1.34\* |
| M | 2.0091 | 1.9837 | 3.8 | 81.8 | 0.61 | 0.541 | 1.19\* |
|  |  |  |  |  |  |  |  |  |
| Rent | U | 823.01 | 382.09 | 23.5 |  | 4.69 | 0.000 | 2.71\* |
| M | 707.42 | 590.17 | 6.3 | 73.4 | 1.37 | 0.170 | 1.41\* |
|  |  |  |  |  |  |  |  |  |
| Contract type | U | 2.5866 | 1.6067 | 131.6 |  | 25.07 | 0.000 | 0.98 |
| M | 2.5426 | 2.5445 | -0.2 | 99.8 | -0.04 | 0.966 | 1.33\* |
|  |  |  |  |  |  |  |  |  |
| Contract term | U | 3.4902 | 2.0458 | 96.6 |  | 18.68 | 0.000 | 1.35\* |
| M | 3.3394 | 3.2849 | 3.6 | 96.2 | 0.58 | 0.563 | 1.14 |
| \* if variance ratio outside [0.85; 1.17] for U and[0.85; 1.18] for |
| Sample | Ps R2 | LR chi2 | p>chi2  | MeanBias | MedBias | B | R | %Var |
| Unmatched | 0.314 | 639.20 | 0.000 | 17.7 | 11.8 | 155.1\* | 1.08 | 46 |
| Matched | 0.028 | 42.59 | 0.148 | 5.3 | 4.9 | 39.5\* | 0.93 | 42 |
| \* if B>25%, R outside [0.5; 2] |

**Appendix Table A2. Balancing tests for beneficiaries and matched on rent-threaten strategy**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Variable | Sample | Mean |  | %reductbias | t-test | V(T)/ |
| Treated | Control | %bias | t | p>t | V(C) |
| Province | Unmatched | 6.2353 | 6.1665 | 4.3 |  | 0.80 | 0.423 | 0.74\* |
| Matched | 6.1829 | 6.1794 | 0.2 | 94.9 | 0.04 | 0.968 | 1.06 |
|  |  |  |  |  |  |  |  |  |
| prefecture | U | 59.546 | 63.445 | -9.2 |  | -1.74 | 0.082 | 0.92 |
| M | 58.899 | 63.235 | -21.4 |  | -1.74 | 0.081 | 1.01 |
|  |  |  |  |  |  |  |  |  |
| Family labor ratio | U | .69425 | .66694 | 11.6 |  | 2.22 | 0.027 | 1.13 |
| M | .68659 | .6952 | -3.6 | 68.5 | -0.65 | 0.516 | 1.25\* |
|  |  |  |  |  |  |  |  |  |
| Under16 years old ratio | U | .17062 | .17744 | -3.5 |  | -0.67 | 0.503 | 0.96 |
| M | .17365 | .20984 | -448.9 |  | -3.00 | 0.003 | 0.76\* |
|  |  |  |  |  |  |  |  |  |
| Over50 years old labor ratio | U | .30032 | .24226 | 18.4 |  | 3.54 | 0.000 | 1.22\* |
| M | .29218 | .32734 | -11.1 | 39.4 | -1.85 | 0.064 | 1.11 |
|  |  |  |  |  |  |  |  |  |
| Female labor ratio | U | .44823 | .43699 | 5.7 |  | 1.09 | 0.276 | 1.03 |
| M | .44884 | .41963 | 14.8 | -159.9 | 2.51 | 0.012 | 1.02 |
|  |  |  |  |  |  |  |  |  |
| Farmer ratio | U | .22507 | .21757 | 2.6 |  | 0.49 | 0.624 | 1.02 |
| M | .22798 | .26559 | -414.9 |  | -2.07 | 0.039 | 0.87 |
|  |  |  |  |  |  |  |  |  |
| High educate labor ratio | U | .23684 | .22081 | 5.2 |  | 1.00 | 0.316 | 1.07 |
| M | .22311 | .22656 | -1.1 | 78.5 | -0.20 | 0.842 | 1.12 |
|  |  |  |  |  |  |  |  |  |
| Part time farmer ratio | U | .22262 | .16788 | 17.6 |  | 3.41 | 0.001 | 1.29\* |
| M | .21564 | .18944 | 8.4 | 52.1 | 1.44 | 0.151 | 1.20\* |
|  |  |  |  |  |  |  |  |  |
| Communist Party Members | U | 1.2794 | 1.2179 | 12.1 |  | 2.32 | 0.020 | 1.20\* |
| M | 1.2683 | 1.3084 | -7.9 | 34.9 | -1.35 | 0.177 | 1.12 |
|  |  |  |  |  |  |  |  |  |
| Village cadres in the family | U | 1.8693 | 1.876 | -2 |  | -0.38 | 0.705 | 1.01 |
| M | 1.8693 | 1.7526 | 34.6 | -1643.0 | 5.10 | 0.000 | 0.61\* |
|  |  |  |  |  |  |  |  |  |
| Village cadres in the relatives | U | 1.317 | 1.3966 | -12.6 |  | -2.38 | 0.017 | 0.86 |
| M | 1.3223 | 1.3746 | -8.3 | 34.4 | -1.42 | 0.155 | 0.94 |
|  |  |  |  |  |  |  |  |  |
| Main surname | U | 2.3513 | 2.4045 | -6.7 |  | -1.28 | 0.202 | 1.01 |
| M | 2.3798 | 2.3885 | -1.1 | 83.6 | -0.19 | 0.850 | 1 |
|  |  |  |  |  |  |  |  |  |
| Ag-insurance medical guarantee | U | .9281 | .87598 | 17.6 |  | 3.28 | 0.001 | . |
| M | .92683 | .88153 | 15.3 | 13.1 | 2.61 | 0.009 | . |
|  |  |  |  |  |  |  |  |  |
| Business-insurance medical guarantee | U | .03268 | .06034 | -13.2 |  | -2.44 | 0.015 | . |
| M | .02962 | .0453 | -7.5 | 43.3 | -1.40 | 0.162 | . |
|  |  |  |  |  |  |  |  |  |
| Children support medical care | U | .40196 | .47039 | -13.8 |  | -2.63 | 0.009 | . |
| M | .39024 | .36237 | 5.6 | 59.3 | 0.97 | 0.330 | . |
|  |  |  |  |  |  |  |  |  |
| Own savings for medical care | U | .3268 | .37207 | -9.5 |  | -1.81 | 0.071 | . |
| M | .31533 | .35192 | -7.7 | 19.2 | -1.31 | 0.189 | . |
|  |  |  |  |  |  |  |  |  |
| Rental rent for medical care | U | .05392 | .01899 | 18.7 |  | 3.73 | 0.000 | . |
| M | .02439 | .02787 | -1.9 | 90.0 | -0.37 | 0.712 | . |
|  |  |  |  |  |  |  |  |  |
| Government bailout medical care | U | .02614 | .02346 | 1.7 |  | 0.33 | 0.741 | . |
| M | .02613 | .04878 | -759.6 |  | -2.02 | 0.043 | . |
|  |  |  |  |  |  |  |  |  |
| Hills | U | .5049 | .56536 | -12.1 |  | -2.32 | 0.021 | . |
| M | .52091 | .45819 | 12.6 | -3.7 | 2.13 | 0.034 | . |
|  |  |  |  |  |  |  |  |  |
| Mountain | U | .40523 | .26034 | 31.1 |  | 5.99 | 0.000 | . |
| M | .38328 | .44251 | -12.7 | 59.1 | -2.04 | 0.042 | . |
|  |  |  |  |  |  |  |  |  |
| Time spent to town | U | .23975 | .28724 | -22.5 |  | -4.21 | 0.000 | 0.68\* |
| M | .24059 | .23528 | 2.5 | 88.8 | 0.43 | 0.667 | 0.71\* |
|  |  |  |  |  |  |  |  |  |
| Time spent to prefecture | U | .72739 | .78698 | -11.6 |  | -2.17 | 0.030 | 0.69\* |
| M | .72887 | .70669 | 4.3 | 62.8 | 0.85 | 0.397 | 1.26\* |
|  |  |  |  |  |  |  |  |  |
| Farmland area | U | 6.5879 | 5.263 | 5.7 |  | 1.18 | 0.238 | 15.02\* |
| M | 6.6511 | 7.3492 | -3.0 | 47.3 | -0.46 | 0.648 | 4.41\* |
|  |  |  |  |  |  |  |  |  |
| Number of the farmland plots | U | 4.9085 | 6.0179 | -24.2 |  | -4.44 | 0.000 | 0.42\* |
| M | 4.9739 | 5.6777 | -15.3 | 36.6 | -2.77 | 0.006 | 0.53\* |
|  |  |  |  |  |  |  |  |  |
| Farmland readjust | U | 1.3971 | 1.3844 | 1.7 |  | 0.33 | 0.739 | 1.04 |
| M | 1.4024 | 1.3676 | 4.8 | -174.3 | 0.81 | 0.420 | 1.05 |
|  |  |  |  |  |  |  |  |  |
| Land fertility | U | 3.415 | 3.324 | 11.4 |  | 2.17 | 0.030 | 0.94 |
| M | 3.4094 | 3.4129 | -0.4 | 96.2 | -0.08 | 0.937 | 1.09 |
|  |  |  |  |  |  |  |  |  |
| Land irrigation | U | 3.3252 | 3.2827 | 4.5 |  | 0.86 | 0.389 | 0.99 |
| M | 3.3171 | 3.3118 | 0.6 | 87.7 | 0.09 | 0.927 | 0.84\* |
|  |  |  |  |  |  |  |  |  |
| Family annual income | U | 2.7876 | 2.981 | -16.9 |  | -3.20 | 0.001 | 0.91 |
| M | 2.8206 | 2.8606 | -3.5 | 79.3 | -0.60 | 0.550 | 0.92 |
|  |  |  |  |  |  |  |  |  |
| Transfer farmland area | U | 5.5992 | 5.8391 | -0.6 |  | -0.11 | 0.910 | 0.60\* |
| M | 5.6737 | 3.9893 | 4.3 | -602.0 | 1.12 | 0.262 | 21.06\* |
|  |  |  |  |  |  |  |  |  |
| Transfer farmland quality | U | 2.0458 | 1.9061 | 20.6 |  | 3.99 | 0.000 | 1.34\* |
| M | 2.0105 | 1.9895 | 3.1 | 85.0 | 0.50 | 0.619 | 1.03 |
|  |  |  |  |  |  |  |  |  |
| Rent | U | 823.01 | 382.09 | 23.5 |  | 4.69 | 0.000 | 2.71\* |
| M | 625.51 | 823.09 | -10.5 | 55.2 | -1.90 | 0.057 | 0.06\* |
|  |  |  |  |  |  |  |  |  |
| Contract type | U | 2.5866 | 1.6067 | 131.6 |  | 25.07 | 0.000 | 0.98 |
| M | 2.5645 | 2.5557 | 1.2 | 99.1 | 0.20 | 0.841 | 1.11 |
|  |  |  |  |  |  |  |  |  |
| Contract term | U | 3.4902 | 2.0458 | 96.6 |  | 18.68 | 0.000 | 1.35\* |
| M | 3.4024 | 3.493 | -6.1 | 93.7 | -1.00 0.317 | 1.23\* |  |
| \* if variance ratio outside [0.85; 1.17] for U and[0.85; 1.18] for |
| Sample | Ps R2 | LR chi2 | p>chi2  | MeanBias | MedBias | B | R | %Var |
| Unmatched | 0.314 | 639.20 | 0.000 | 17.7 | 11.8 | 155.1\* | 1.08 | 46 |
| Matched | 0.062 | 98.19 | 0.00 | 8.0 | 6.8 | 56.2\* | 0.86 | 46 |
| \* if B>25%, R outside [0.5; 2] |

**Appendix Table A3. The impact of large landholder transfer object on contract breaks (PSM)**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Variable | Model 1 | Model 2 | Model 3 | Model 4 | Model 5 | Model 6 | Model 7 |
| **Contract break** |
| ATT | .0563\*\*\*(.0211) | .0575\*\*\*(.0196) | .0575\*\*\*(.0196) | .0520\*\*\*(.0183) | .0524\*\*\*(.0184) | .0538\*\*\*(.0211) | .0588\*\*\*(.0135) |
| ATU | .0399 | .0544 | .0544 | .0668 | .0602 | .0448 | .0304\*\*\*(.0120) |
| ATE | .0461 | .0556 | .0556 | .0611 | .0572 | .0488 | .0420\*\*\*(.0113) |
| Observations | 1429 | 1429 | 1429 | 1429 | 1429 | 1429 | 1507 |
| **Rent-threaten strategy** |
| ATT | .4790\*\*\*(.0901 ) | .4713\*\*\*(.0703) | .4713\*\*\*(.0703) | .4367\*\*\*(.0648) | .4401\*\*\*(.0651) | .4423\*\*\*(.0901) | .4979\*\*\*(.0632) |
| ATU | .5184 | .5210 | .5210 | .5490 | .5487 | .5282 | .5916\*\*\*(.0708) |
| ATE | .5031 | .5016 | .5016 | .5052 | .5062 | .4946 | .5536\*\*\*(.0560) |
| Observations | 1,469 | 1,469 | 1,469 | 1,469 | 1,469 | 1,469 | 1505 |

*Notes:* 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.

1. We classify landholders as those who are transferring-in land from landowners. Landholders could be small or large but landowners are generally small in size. [↑](#footnote-ref-1)
2. Landowners are the ones who lease the land-out. Landholders are the ones who lease the land-in. [↑](#footnote-ref-2)