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INSTITUTE OF DEVELOPING ECONOMIES

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IDE DISCUSSION PAPER No. 543

Is Prohibiting Land Reallocation Enough to Promote Development of Farmland Rental Markets in China?

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November 2015

Abstract
Prohibiting land reallocation improves tenure security, but it remains unclear whether this sufficiently facilitates the development of farmland rental markets in China. To fill this gap, we investigate how farmland rental activities are influenced by full-scale land reallocation (FSLR) and partial land reallocation (PLR), which differ in scale and imposition. Employing the instrumental-variables and the difference-in-differences approaches, we find that PLR substitutes relation-specific contracting in the markets, while FSLR complements arms-length contracting. The different impacts are attributable to the difference in imposition rather than scale. These findings suggest the need for further reforms.

Keywords: farmland reallocation, farmland rental market, rural China
JEL classification: O12, Q12, Q15

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1. Introduction

The relation between plan and market has been a long-standing concern for formerly centrally planned economies. This is particularly true for land markets in China, in which common land rights have been retained even after significant transitions toward a market-oriented economy. While land rental markets in China have historically been limited, their importance has steadily increased since the mid-1990s, following the growth of off-farm labor markets. Accordingly, the Chinese government has increasingly restricted administrative land reallocation (e.g., the Rural Land Contract Law in 2002) in order to develop land rental markets without privatizing land rights. However, while it is well known that restricting land reallocation heightens tenure security and thus land-specific investments (Bai et al. 2014; Deininger and Jin 2003; Jacoby et al. 2000; Li et al. 1998; Prosterman et al. 1996), it is still unclear whether such restrictions actually facilitate the development of land rental markets (Figure 1). Although some studies find that administrative land reallocation and land rental market are substitutes (Kiumra et al. 2011; Brandt et al. 2004), others find that they might be complements (Kung 2002; Yao 2000).

To better clarify the impact of restricting land reallocation on land rental markets, this paper investigates in more detail the relation between administrative land reallocation and land rental market transactions by distinguishing between two modes of land reallocation: full-scale land reallocation (FSLR) and partial land reallocation (PLR). FSLR affects every farm household and the plots previously assigned to them by the village community, regardless of demographic change, and PLR is based primarily on familial demographic change. Although the two modes are rarely distinguished in previous studies, recent evidence shows that FLSR and PLR have opposite associations with land rental market transactions (Che 2014). Such counterintuitive opposite associations cannot be explained by the substitute or complement hypotheses[1]. It remains unclear whether these associations are causal, and if so, why they have opposite impacts on land rental market transactions.

[1]Given the substitute relation, FSLR (i.e., reallocating more land) should reduce land rental market transactions more than PLR does. In contrast, given the complementary relation, FSLR should increase land rental market transactions more than PLR does.

This paper attempts to fill this gap by providing an estimate of the impacts of FSLR and PLR on land rental market transactions employing instrumental-variable (IV) and difference-in-differences (DID) approaches. It also investigates in more detail the mechanism behind their impacts. The paper first identifies the impacts of two modes of land reallocation (FSLR and PLR) on farmland rental market transactions by applying the IV approach over a unique set of farm survey data that allows us to differentiate FSLR from PLR. The results show that while PLR and the rental market are substitutes, FSLR and the rental market are not; FSLR has an apparently positive or insignificant impact on rental market transactions. The findings suggest that the inconsistent previous findings may be attributable to conducting estimations without distinguishing between the different modes of land reallocation.

Moreover, these counterintuitive findings lead us to a second question: why do FSLR and PLR have opposite impacts on land rental market transactions? To understand this, we focus on two key aspects—scale and imposition—that distinguish between FSLR and PLR. While scale is conventionally used to distinguish between FSLR and PLR, we additionally examine the imposed nature of some cases of FSLR as compared with that of others, which are largely conducted on a voluntary basis.[2] To identify the impact of imposed FSLR on farmland rental market transactions, we apply a DID approach over two-period panel data that distinguishes between imposed and voluntary land reallocation during 1995–1999. The results clarify that the observed difference between the impacts of FSLR and PLR is attributable to the imposed nature of FSLR rather than to the larger scale of FSLR. Our results also suggest that households affected by an imposed FSLR might have been forced to contract with those on an arms-length basis, whereas voluntary land reallocation mostly affects relation-specific contracting in the rental markets.

Lastly, we explore why imposed FSLR may increase land rental market transactions. We first develop a conceptual framework in which reallocation and the rental markets are connected through inefficiency in farmland allocation within a village.

[2] During 1995–1999, township authorities instructed some villages to reallocate land from scratch (i.e., full scale), due to a policy promulgating villages to extend household farming for another 30 years upon the expiry of their initial 15-year lease (e.g., taking effect in 1997 if de-collectivization occurred in 1982).

To empirically verify the framework, we construct a measure of inefficiency in farmland allocation within a village, following the approach proposed by Ravallion and Walle (2006). The results demonstrate that imposed FSRL creates the greatest inefficiencies in farmland allocation, and correcting for such inefficiencies results in an increase in farmland rental market transactions. In contrast, voluntary land reallocation (including voluntary FSLR and PLR) has either an insignificant effect or a beneficial effect of better matching the demand for land by a household's farm labor, where the result is a lower level of farmland rental market transactions.

Our findings shed important light on China's recent land policy reforms aiming at facilitating the development of land rental markets by strictly prohibiting FSLR while sanctioning PLR.[3] First, our findings suggest that land rental market transactions are much less sensitive to the scale of land reallocation, as compared to land-specific investments. Thus, while prohibiting FSLR improves tenure security and land-specific investments, it may not facilitate the development of land rental markets. Second, given that PLR and rental markets are substitutes, prohibiting PLR might actually stimulate more farmland rental market transactions. However, in rental markets, land reallocation largely influences relation-specific contracting rather than arms-length contracting. Because arms-length contracting is a better proxy for the development of land rental markets, it appears that the Chinese government needs further reforms to land rights toward the direction of increased private ownership.

The rest of the paper is organized as follows: Section 2 lays out our data and descriptive analysis of the relation between land reallocation and farmland rental market participation in China. Section 3 examines the causal effects of FSLR and PLR on farmland rental market transactions. Section 4 further investigates whether the observed difference between the effects of FSLR and PLR is attributable to differences in scale or imposition. Section 5 explores why imposed FSLR may increase farmland rental market transactions. Section 6 concludes with a discussion of China's land policy in terms of developing farmland rental markets.

[3] PLR is still widely conducted in China, though recently less frequently (Wang et al. 2011; Kong and Unger 2013). For example, the 2006 China General Social Survey shows that about 10% of sampled households have experienced PLR even after 2003.

2. Administrative Land Reallocations and Farmland Rental Markets in China

2.1 Data

To describe the background and conduct the empirical analysis, we use data from a 2003 survey organized by the Development Research Center (DRC), a powerful research and policy arm under China's State Council. The sample comprised 98 villages in 48 townships in 12 counties in 6 provinces (Anhui, Fujian, Heilongjiang, Hunan, Sichuan, and Zhejiang). About 20 farm households were selected randomly from each village's roster for the household survey.

This survey collected information on the history of land reallocation since de-collectivization (around 1978–2002), namely the type of reallocation (full-scale versus partial), the number of times and the specific years in which a village reallocated land, and the reasons for implementing the most recent FSLR. The survey also recorded farmland and household sizes before and after the latest administrative land reallocation (either FSLR or PLR). In addition, the survey enumerated a number of variables pertaining to farmland rental behavior of the surveyed households, including whether they participated in the demand or supply side in the farmland rental market, the extent to which they have done so, and with whom they contracted. Moreover, given that rental market transactions are intimately linked to the development of the off-farm labor market, households were also asked to provide detailed information on their involvement in the labor market. Finally, the survey enumerated many variables at both the household and village levels, ranging from socioeconomic to production characteristics.

Our analytical sample contains 2,028 household observations from 96 villages. Seventy-five households were dropped from the original sample. Specifically, two villages (24 households) were dropped because they did not report key characteristics, and 51 households were dropped because they did not report key household characteristics for our analysis. We found no systematic pattern of missing information among the households.

2.2 Descriptive Analysis

Administrative land reallocation in China can be classified into two modes by scale: PLR, and FSLR. PLR takes place in response to changes in household demand for

farming land following demographic changes (due to births, deaths, and marriages), and it is common that a negatively affected household in PLR is obligated to transfer only one of its several plots to another household. In FSLR, households not only fail to be exempted from the reallocation even though they are not affected by demographic changes, but also are unable to retain any of the plots they currently cultivate.

First, we describe the distribution of FSLR and PLR across villages and households. At the village level, 28 villages conducted only FSLR, 24 villages conducted only PLR, and 45 villages conducted both FSLR and PLR. However, at the household level, the majority of households participated in only one mode of land reallocation: 51.8% participated in only FSLR and 25.8% participated in only PLR. Additionally, 14.4% of households have never been affected by land reallocation over the period from de-collectivization until 2002, which is possible because even when a village conducted a land reallocation, some households within the village might not have been affected by the reallocation. In our sample, only 8.0% of households were affected by both FSLR and PLR. These facts may indicate that the mode of land reallocation is endogenously selected, depending on village and household characteristics (e.g., village topographies).

Second, we describe the relation between the frequency of land reallocation and the proportion of households participating in the farmland rental market. Table 1 shows that whereas only 7.6% of those who had experienced PLR four times or more had rented land, 25.4% of those who had experienced FSLR with comparable frequency did so. Our conjecture is further strengthened by the finding that households that have never reallocated land do not significantly differ in farmland rental activity (12.2% in panel 1 versus 16.6% in panel 2). This descriptive evidence supports our conjecture that FSLR and PLR have different impacts on land rental market transactions.

In contrast, the supply side of the farmland rental market shows virtually no difference between those who frequently engaged in FSLR (12%) versus PLR (9.1%) insofar as rent-out decisions are concerned. This may be because, as previous studies found, rent-out activities are dominantly determined by off-farm labor opportunities (Kimura et al. 2011; Deininger and Jin 2009; Zhang et al. 2004). In fact, our empirical analysis also found that land reallocation has insignificant effects on land rent-out activities, though the results will be suppressed for simplification. Moreover, we have

concerns about the data quality for land rent-out activities. Compared with the data for rent-in land, the data for rent-out land may be less trustworthy because the people who rent out their land tend not to stay in the village and thus were not interviewed in the survey. Therefore, the following sections focus on the demand side of the farmland rental market.

Lastly, we describe the relation between the mode of land reallocation and the contractual parties in the land rental market. Table 2 summarizes the contractual parties from whom households rent farmland (the first panel) and how the land contract is certified (the second panel) across the household groups that participated in different modes of land reallocation. Overall, we find no systematic difference across the household groups, and there are two important patterns for all the groups. First, the majority of land transactions occurred within a village (that is, the first four parties account for 92.6%). Among all households who are renters of farmland, 37.8% of them rent land from relatives within their villages, 29.1% rent land from non-relatives within their villages, 17.9% of them rent land from village leaders, and 7.8% of them rent land mediated by a village committee or village cadres. Second, more than 76% of land contracts are certified only verbally without any written certificate. Only 15% of land contracts are certified by a written certificate in the rental markets.

3. Effects of FSLR and PLR on Farmland Rental Market Transactions

To empirically test our conjectures, we estimate the causal impacts of FSRL and PLR on land rental market transactions by employing the IV approach.

3.1 Identification Strategy

We start from the following basic model:

$$LandRental_h = \mathrm{G}\left(\beta_0 + \beta_{nflr}\, nflr_h + \beta_{nplr}\, nplr_h + \boldsymbol{\beta}_{\boldsymbol{X}}'\boldsymbol{X} + \mu_h + \mu_v + \varepsilon\right),$$

(1) where $LandRental_h$ is the extent of farmland rental market transactions, $nflr_h$ and $nplr_h$ are the respectively frequencies of FSLR and PLR that household *h* has experienced since de-collectivization, $\boldsymbol{X}$ is a vector of other household and village characteristics, μ_h and μ_v represent unobserved factors that may influence farmland rental market transactions at both the household and village levels, and ε is the error term. $LandRental_h$ is represented by two distinct variables, (i) an indicator of

participating in the land rental market ($rent_h$) and (ii) the size of farmland transferred in the rental market (a_h). Our key analytical interests are the partial effects of $nflr_h$ and $nplr_h$(β_{nflr} and β_{nplr}), which represent the total effects of FSLR and PLR on farmland rental market transactions, respectively. The vector $\boldsymbol{X}$ includes the control variables for three aspects that may affect farmland rental market transactions: (i) households' agricultural ability, (ii) off-farm employment and income opportunities, and (iii) costs arising from undertaking farmland rental transactions.[4]

Similarly, to examine the effect of land reallocation on the choice of contractual parties in the land rental market, we replace the dependent variable in Equation (1) with the farmland rental market transactions contracted with each of three contractual parties: relatives (rel), village leaders (vl), and other non-relatives (nrel). Then, we examine the effects of FSLR and PLR on the choice of contractual parties by specifying the following equation:

$$LandRental_h^p = \mathrm{G}(\pi_0^p + \pi_{nflr}^p\, nflr_h + \pi_{nplr}^p\, nplr_h + \boldsymbol{\pi}_{\boldsymbol{X}}^{\boldsymbol{p}\prime}\boldsymbol{X} + \mu_h + \mu_v + \varepsilon), \quad (2)$$

where $LandRenta_h^p$ is the extent of farmland rental transactions contracted with party p (= rel, vl, or nrel). The explanatory variables are the same as those in Equation (1).

As a benchmark, we employ a probit model when $rent_h$ is used in Equation (1) and a Tobit model when land size is used in Equations (1) and (2).[5] However, there are good reasons to suspect that unobserved factors may be correlated with the explanatory

[4] We include ln(per capita household income), the share of agricultural income in overall income, household size, the proportion of household members in the workforce, the share of female household members, the share of household members who have received agricultural training, the characteristics of the household head (education level, age, whether an official), per capita arable farm size, ln(the value of agricultural assets), the share of off-farm workers in a household, the share of household members who have received non-agricultural training, ln(the value of non-agricultural assets), distance to the nearest prefecture, the share of households participating in the farmland rental market at the village level, and ln(agricultural tax).

[5] a_h is left-censored at zero. In our sample, 85% of households have not rented in any land, and 90% have not rented out any land.

variables. First, the choice of the modes and frequency of land reallocation may be affected by unobserved village characteristics such as topography. Also, within the control variables $\boldsymbol{X}$, off-farm labor participation may be connected to farmland rental activity through the unobserved nature of transaction costs for participating in the farmland rental market. Thus, we instrument the potential endogeneity of *nflr*, *nplr*, and off-farm labor participation. We employ the IV approach combined with the province-level fixed effects to control for household- and village-level unobserved factors (the so-called IVFE model).[6]

We now describe our excluded instruments. Suppose there are *n* villages within a county. We construct an instrument for village *v* by taking the average of a village characteristic over all of the surveyed villages within the same county except for village *v* itself (an average over (n – 1) villages). We obtain four excluded instruments by applying this (n – 1) strategy to four village characteristics: the average number of plots farmed per household (village topography), the average number of crops cultivated (cropping patterns), the share of off-farm workers, and the average income level of off-farm workers. We expect that these four factors will be closely related beyond village boundaries and thus correlated with village *v*'s land reallocation and off-farm labor market activity. In contrast, we expect that these (n – 1) averages are not directly correlated with farmland rental market transactions within village *v*, because farmland rentals are often restricted within village boundaries. Although these assumptions cannot be tested directly, descriptive statistics support the assumptions. For example, in our sample, only 2.7% of the rent-in households rented in land from outside their villages, while 35.8% of off-farm workers work outside their villages.

[6] First, because all of our excluded instruments in the IV estimation are village-level variables, we are unable to incorporate village-level fixed effects into the IV estimation. Second, we employ province-fixed effects instead of province dummies due to high correlations between province dummies and other explanatory variables (the variance inflation factors (VIF) of the six province dummies ranges from 2.21 to 11.66, compared to the average VIF of 2.03), province-level fixed effects approach (the VIFs of the de-meaned variables now range from 1.05 to 2.31, compared to the average VIF of 1.32).

3.2 Estimation Results

Table 3 summarizes the results from identifying Equations (1) and (2). The first panel presents the effects of land reallocation on the probability of participating in the farmland rental market, the second panel presents the effects on the size of farmland transferred in the rental market (*mu*), and the third panel presents the effects on the choice of contractual parties. Standard errors in basic models are clustered by village and thus allow for intra-village correlations.

Before presenting the main results, it is worth discussing the empirical examination for the validity of excluded instruments in our IVFE models. First-stage estimations for IVFE models are summarized in Appendix A. The excluded instruments are jointly significant at the 5% level in all of the first-stage regressions. Also, the signs of the coefficients on the excluded instruments follow our expectations.[7] In addition, the over-identification tests fail to reject the null hypothesis in almost all of the models (with p-values ranging from 0.27 to 0.75). An exception is the IVFE model, which estimates the area of the land rented out (the p-value is 0.02). The Hausman test rejects a null hypothesis that the FE and IVFE coefficient estimates are identical. Although the results do not guarantee the validity of our instruments, they do not rule out the possibility that the IV models may reduce the potential endogeneity bias.

The results from the probit and Tobit models show that both the probability of renting in land and the size of land rented in are positively associated with the frequency of FSLR and negatively associated with the frequency of PLR (Table 3, column 1). The corresponding IVFE models show that the negative effect of PLR on the probability and the land size remain unchanged even after we control for potential unobserved factors and reverse causality (column 3). For example, with each additional PLR, the

[7] The (n – 1) average of the number of crops within a village increases the frequency of PLR; a village is more likely to choose PLR if the village's cropping patterns are more complex. The (n – 1) average of the number of plots per household (an average farming scale) decreases the frequency of PLR and increases the frequency of FSLR. This is consistent with expectations, because an average farming scale tends to be larger in flat areas than in mountainous areas, and topographies are simpler in flat areas. Lastly, both the (n – 1) averages of off-farm income and share of off-farm workers within a village increase the share of off-farm workers within a household.

probability of renting in land decreases by 26.4% and the size of land rented in decreases by 3.4 *mu*. In the third panel, Tobit models show that an additional FSLR increases the rent-in land size contracted with relatives by 0.27 *mu* and that contracted with non-relatives by 0.18 *mu*, while an additional PLR decreases the rent-in land size contracted with relatives by 0.24 *mu*. However, these effects become statistically insignificant once we employ IVFE models. Lastly, using the total number of land reallocations without distinguishing between FSLR and PLR like in previous studies (TLR models), we find no significant effects of land reallocation. This indicates the importance of distinguishing between different modes of land reallocation.

In summary, we find that FSLR and PLR have opposite impacts on land rental market transactions. However, the opposite impacts cannot be explained by the scale difference, although the magnitude of the impact may differ by the scale of land reallocation. Thus, to better understand the finding, the following section examines the role of another confounding factor that distinguishes between PLR and some FSLR.

4. Why FSLR and PLR Have Opposite Impacts on Land Rental Market Transactions

In this section, we examine whether the observed difference between the effects of FSLR and PLR is really attributable to the different scales of land reallocation by examining other confounding factors.

4.1 Imposed FSLR during 1995–1999

We are particularly concerned about the fact that the incidents of some FSLR were imposed rather randomly during 1995–1999,[8] while the modes of land reallocation were

[8] This was because of a new policy in 1998 mandating local governments to stop reallocating land on a full-scale basis. Local (township and above) authorities that intended to follow this new mandate thus instructed villages under their jurisdiction to reallocate land from scratch one last time, because the first contractual period (of 15 years) was supposed to end between 1995–1999, depending on when de-collectivization occurred (typically 1979–1984). During that period, more than half of the villages that conducted FSLR reported that doing so was imposed by higher authorities.

voluntarily selected by villagers during normal periods. Thus, we conjecture that the positive impact of FSLR might be attributable to the imposed nature of some FSLR.

To investigate this possibility, we estimate the causal impact of imposed FSLR on farmland rental market transactions by employing a DID approach. We exploit the fact that some FSLR were exogenously imposed by the higher authorities during 1995–1999. To examine the exogenous imposition, Table 4 compares mean village characteristics between villages that experienced imposed FSLR and those that experienced only voluntary land reallocation. In addition to nominal means (upper panel), it also presents means after controlling for province effects (lower panel).[9] Table 4 shows that while the nominal means of village size and share of off-farm workers are significantly different between the groups, all the mean differences become insignificant once we control for the province effects (column 3). In other words, within a same province, the villages that experienced imposed FSLR are not systematically different from the other villages. This indicates that the nominal mean differences are dominantly explained by the province effects rather than the mode of land reallocation. It is also worth noting that each province contains at least one village that experienced imposed FSLR and one that experienced only voluntary land reallocation.

Moreover, Table 5 compares mean household characteristics across households affected by imposed FSLR, only voluntary land reallocation (only voluntary LR), and no land reallocation (No LR) after de-collectivization. Table 5 tests the differences between No LR and imposed FSLR households (column 4) and the differences between No LR and only voluntary LR households (column 5). For simplification, we suppressed nominal means. Comparing No LR and imposed FSLR households, differences in all household characteristics except for LR experiences and farmland

[9] Imposed FSLR were implemented unequally across provinces because agricultural provinces like Anhui and Heilongjiang were more eager to impose FSLR to consolidate household farming than were less agricultural provinces like Zhejiang. Thus, differences in nominal means can be due to provincial differences rather than the modes of land reallocation. To demonstrate this possibility, we present the means when controlling for province effects, regressing each variable on province dummies, and computing residuals. The residuals are used to compute the means in which province effects are partially corrected.

rental activity become insignificant once we control for province effects (column 4). In contrast, the means of the share of off-farm workers and arable land size per capita are significantly different between No LR and only voluntary LR households, even after controlling for province effects (column 5). These results support our expectation that the voluntary LR regime considered household conditions such as land size and off-farm workforces, but such conditions were considered much less under the imposed FSLR regime.

4.2 Identification Strategy

We apply the DID approach over household-level two-period panel data. The panel data are constructed using information about farmland sizes, land rental market transactions, and household sizes before the most recent land reallocation and in 2002 (or in 1995 and 2002 for No-LR households). The timing of the most recent land reallocation varies by village, and the longer the period after the most recent land reallocation is, the closer the dynamic process converges to a long-run equilibrium. Thus, our model controls for the length of the period between 2002 and the most recent land reallocation (or 1995 for No-LR households). To make the three groups more comparable, as implied in Tables 4 and 5 we also include province dummies to control for regional variations in farmland rental market transactions. Because FSLR was imposed in or after 1995, we focus on those households that were affected by either FSLR or PLR only in or after 1995.

To examine how imposed FSLR influences farmland rental market transactions, we compare between households affected by imposed FSLR and those never affected by land reallocation (LR) by excluding households affected only by voluntary LR.

$$RentalArea_h = \mathrm{G}(\alpha_0 + \alpha_{iflr}\, iflr_h + \alpha_{after}\, After_h + \alpha_{cross} iflr_h \cdot After_h + \alpha_{period}\, period_h + \sum \alpha_{prov} D_{prov} + \tau) \quad (3)$$

Here, $RentalArea_h$ is the size of farmland transferred in the rental market, $iflr_h$ is an indicator that equals 1 if household *h* is affected by imposed FSLR and 0 if never affected by LR, $After_h$ is an indicator that equals to 1 if the outcome is observed in 2002 and 0 if observed before the imposed FSLR (or in 1995 for No-LR households), $iflr_h \cdot After_h$ is the interaction term between $iflr_h$ and $After_h$, $period_h$ is the length of the period between the imposed FSLR and 2002 for household *h*, and D_{prov} is a dummy variable equal to 1 if the household lived in province *prov*. The coefficient of

interest is α_{cross}, which should be positive if our conjecture is supported. Also, comparing α_{cross} with the corresponding IV estimate for the impact of FSLR (β_{nflr}), we can clarify the role of the imposed nature compared to the full-scale nature.

Similarly, we also examine how imposed FSLR influences farmland rental activities in a different manner from voluntary FSLR, conditional on participation in the land rental market (excluding households never affected by LR).

$$RentalArea_h = \mathrm{G}(\theta_0 + \theta_{iflr2}\, iflr2_h + \theta_{after}\, After_h + \theta_{cross} iflr2_h \cdot After_h + \theta_{period}\, period_h + \sum \theta_{prov} D_{prov} + \tau) \quad (4)$$

Here, $iflr2_h$ is an indicator that equals 1 if a household *h* is affected by imposed FSLR and 0 if affected only by voluntary LR. The coefficient of interest is θ_{cross}, which should be positive if our conjecture is supported.

Lastly, similar to Equation (2), we examine the effects of imposed FSLR on the choice of contractual parties in the rental market by specifying the following equation:

$$RentalArea_h^p = \mathrm{G}(\alpha_0^p + \alpha_{iflr}^p\, iflr_h + \alpha_{after}^p\, After_h + \alpha_{cross}^p iflr_h \cdot After_h + \alpha_{period}^p\, period_v + \tau^p). \quad (5)$$

Here, $RentalArea_h^p$ is the size of land contracted with party *p* (= rel, vl, or nrel).

4.3 Estimation Results

Overall, our estimation results indicate that the positive impact of FSLR observed in section 3 is mostly explained by the imposed nature of FSLR rather than the full-scale nature. Table 6 summarizes the results from the DID approach by identifying Equations (3) and (4) (columns 1 and 3). The coefficient estimate on the interaction term (iFSLR*After) indicates that being affected by imposed FSLR leads renter households to rent more land compared to being affected by no LR or only voluntary LR (column 1). These results are robust even after we add the vector of other control variables ***X*** to Equations (3) and (4) (columns 2 and 4), although the control variables are available only in 2002 and fixed at the 2002 values in two periods. For example, households affected by imposed FSLR rented in 1.49–1.76 *mu* more land than households never affected by land reallocation, and rented in 1.55 *mu* more land than households affected only by voluntary land reallocation (columns 1 and 2).

Table 6 also presents estimates for the impact on the choice of contractual parties by identifying Equation (5). It shows that imposed FSLR influences the choice of contractual parties differently from voluntary ones. Households affected by imposed FSLR rented in 0.77 *mu* more land from relatives and 0.54 *mu* more land from non-relatives, compared to households affected by no land reallocation. Similarly, households affected by imposed FSLR rented in 0.60 *mu* more land from relatives and 0.47 *mu* more land from non-relatives, compared to households affected only by voluntary land reallocation.

Moreover, we specify Equation (1) for two sub-samples, one that has never experienced imposed FSLR and one without households who have experienced only voluntary FSLR. The results are summarized in the last panel of Table 6. We find that the frequency of FSLR has an insignificant impact on land rent-in activity (0.005) among those households that have never experienced imposed FSLR (columns 1 and 2), whereas the effect is three times larger and statistically significant (0.014) among those households that have experienced imposed FSLR (columns 3 and 4). These findings provide additional evidence that the positive impact of FSLR is attributable to the imposed nature of FSLR rather than the full-scale nature.

5. Why Imposed FSLR Increases Land Rental Market Transactions

5.1 Conceptual Framework

To understand why imposed FSLR increased land rental market transactions, we seek clues from the fact that imposed FSLR tended not to consider household conditions compared to voluntary land reallocation. This fact leads us to conjecture that imposed FSLR are more likely to create more substantial inefficiencies in farmland allocation across households than do voluntary ones. The larger inefficiencies may in turn create a larger scope for readjusting inefficiencies through the land rental market, which increases farmland rental activity. In contrast, we conjecture that voluntary land reallocation may decrease inefficiencies and thus decrease the scope of land transfers through the land rental market.

To describe our conjecture more formally, we construct a conceptual framework that illustrates how land reallocation affects farmland rental market transactions. We write a measure of the extent of farmland rental market transactions for household *h*,

$LandRental_h$, as a function of a measure of the extent of inefficiencies in farmland allocation ($\tau_h = \tau(L_h^*, L_h^A)$), which is a mismatch between a desirable land size (L_h^*) and an allocated land size (L_h^A), and the vector of other factors that affect farmland rental activities such as transaction costs, X_h:

$$LandRental_h = f_h(\tau(L_h^*, L_h^A), X_h). \quad (6)$$

We expect that households with a larger extent of inefficiencies involve larger land transactions through the farmland rental market ($\frac{\partial f_h(.)}{\partial \tau_h(.)} > 0$). Now consider the impact of an administrative land reallocation on farmland rental activity. Totally differentiating Equation (1), this impact approximately equals

$$\Delta LandRental_h|_{LR} = \frac{\partial f_h(.)}{\partial \tau_h(.)} \Delta\tau(L_h^*, L_h^A)|_{LR} + \frac{\partial f_h(.)}{\partial X_h} \Delta X_h|_{LR}, \quad (7)$$

where $\Delta\tau(L_h^*, L_h^A)|_{LR}$ and $\Delta X_h|_{LR}$ are changes in $\tau(L_h^*, L_h^A)$ and X_h induced by land reallocation (LR), respectively. Fixing other factors X_h constant, the sign of changes in the extent of farmland rental market transactions depends on the sign of the effect of land reallocation on the extent of inefficiencies, that is, $sign(\Delta LandRental_h|_{LR}) = sign(\Delta\tau(L_h^* - L_h^A)|_{LR})$ if $\Delta X_h|_{LR} = 0$.

Thus, once we control for $\Delta X_h|_{LR}$, $\Delta\tau(L_h^*, L_h^A)|_{LR}$ will be responsible for the fact that different modes of land reallocation have different effects on farmland rental market transactions. For instance, from the above descriptive evidence, we may reasonably expect that the effect of imposed FSLR (ILR) is positive while the effect of voluntary land reallocation (VLR) is non-positive, that is, $\Delta\tau(L_h^* - L_h^A)|_{ILR} > 0 \geq \Delta\tau(L_h^* - L_h^A)|_{VLR}$. This possibility explains why imposed FSLR and voluntary land reallocation may have different or even opposite impacts on farmland rental market transactions.

5.2 Identification Strategy

To examine our conceptual framework, we construct $\hat{\tau}$ as a proxy for the extent of inefficiencies in farmland allocation within a village after a land reallocation ($\tau(L_h^*, L_h^A)$). We estimate the effect of land reallocation on $\hat{\tau}$, and the effect of $\hat{\tau}$ on farmland rental activities. To obtain $\hat{\tau}$, we follow the approach proposed by Ravallion and Walle (2006). Based on the derivation presented in Appendix B, we use the functional form $\hat{\tau}(\hat{L}_h^*, L_h^A) = ln(\hat{L}_h^*) - ln(L_h^A)$ as a measure of the extent of inefficiencies in land

allocation within a village. This measure can be interpreted as a proportional land deficit for household h. Because our survey did not collect consumption data before the most recent land reallocation, we construct $\hat{\tau}$ only for 2002 and thus could not apply the DID approach. We therefore employ the IV approach.

We first estimate the effect of FSLR and PLR on $\hat{\tau}$ as follows:

$$\hat{\tau} = \mathrm{G}(\gamma_0 + \gamma_{nflr}\, nflr_h + \gamma_{nplr}\, nplr_h + \boldsymbol{\gamma_X}'\boldsymbol{X} + \mu_h + \mu_v + \varepsilon) \quad (8)$$

The coefficients of interest are γ_{nflr} and γ_{nplr}. If our conjecture is supported, γ_{nflr} should be positive and γ_{nplr} should be negative.

Second, we estimate the effect of $\hat{\tau}$ on farmland rental market transactions as follows:

$$LandRental_h = \mathrm{G}(\omega_0 + \omega_\tau\, \hat{\tau} + \boldsymbol{\omega_X}'\boldsymbol{X} + \mu_h + \mu_v + \varepsilon) \quad (9)$$

The coefficient of interest is ω_τ. We expect that ω_τ should be positive for the extent of rent-in activity.

5.3 Estimation Results

Table 7 presents the results from estimating Equations (8) and (9). Because we cannot employ a DID approach due to data limitations, we examine the effect of imposed FSLR by dividing the households into two subsamples, households affected by imposed FSLR and those never affected by imposed FSLR. We excluded households that have never been affected by imposed FSLR in the with-imposed-FSLR sample. Similarly, we excluded those households affected by imposed FSLR in the without-imposed-FSLR sample.

Summary statistics for the predicted extent of the inefficiencies ($\ln(\widehat{L^*}/L^A)$) are presented at the top of Table 7. The measure is based on data from 2002. Because land tenure cannot be transferred without land reallocation in China, the allocated land size in 2002 is the land size allocated in the most recent land reallocation (L_h^A). Thus, we can interpret the measure as the remaining proportional mismatch between desirable and allocated land sizes after the most recent land reallocation as of 2002. We found that the proportional land deficit is significantly negative among households that have never been affected by land reallocation, and positive among households affected by land reallocation.

The second panel in Table 7 presents the effects of land reallocation on the proportional land deficit. The IVFE estimates show that an additional PLR reduces the proportional land deficit by 73.2%, while FSLR has an insignificant influence. Once we exclude those households that have never been affected by imposed FSLR, the effect of FSLR increased from 0.142 to 0.351 in the IVFE models, although the estimates are still statistically insignificant. In contrast, once we exclude those households affected by imposed FSLR, the magnitude of the effect of FSLR becomes smaller (–0.071 in the IVFE model). The insignificant effect of FSLR even among households that experienced imposed FSLR may be because the model still mixes the effect of imposed FSLR with that of past voluntary FSLR. Thus, we may expect a more significant effect if we were able to extract only the effect of imposed FSLR, although doing so is not feasible given our data.

The third panel in Table 7 presents the effect of the proportional land deficit on the likelihood of participating in the farmland rental market and the size of land transferred in the farmland rental market (the so-called rental land size). The IVFE models show that a 1% increase in the proportional land deficit increases the probability of renting in land by 0.31% and increases the rent-in land size by 1.13%. The Tobit estimates also demonstrate that the proportional land deficit has a significantly positive effect on the rent-in land.

These results, particularly the IVFE results, are consistent with our conceptual framework. To describe the overall consistency between the results in Tables 3 and 7, for now we set aside statistical significance and focus on the values of the IVFE estimates. Then, the effect of an additional PLR on the rent-in land size through its effect on the proportional land deficit is –1.47 (= –0.732 × 2.01), which is 43% of the overall effect of PLR in Table 4 (–3.42). The effect of an additional FSLR on the rent-in land size through its effect on the land deficit is 0.285 (= 0.142 × 2.01), which is the 20% of the overall effect of FSLR in Table 4 (1.43). Similarly, the effect of an additional PLR on the rent-out land size through its effect on the land deficit is 0.351 (= –0.732 × –0.480), which is the 90% of the overall effect of PLR in Table 4 (0.388). Although these simple calculations are admittedly rough, they may still imply that our conceptual framework explains the effect of PLR better than does the effect of FSLR.

5.4 Policy Discussions

In summary, our results demonstrate that land rental market transactions are not sensitive to the scale of land reallocation. Imposed FSLR apparently increases land rental market transactions because the imposed nature of FSLR increases inefficiencies in farmland allocation within a village, which is readjusted in the rental markets. Thus, increased land rental market transactions are unnecessary and will not represent the true development of land rental markets. Moreover, land reallocation mostly affects relation-specific contracting rather than arms-length contracting in the rental markets. As arms-length contracting is a better proxy for the development of farmland rental markets, it appears that prohibiting land reallocation is insufficient for facilitating the development of land rental markets.

A more effective strategy may be to arrange better land certification for land rental market participation. In our 2002 sample, more than 70% of land contracts are certified only verbally (Table 2). We also found that the proportion of households participating in the land rental market tends to be higher within villages that arrange written certificates for land rental market participation than in other villages. For example, in villages that have issued written certificates, 20.9% of households are renters of farmland (6.1% are arms-length contracting) and 20.7% rent out their farmland (10.4% are arms-length contracting). In contrast, in those villages that have never used written certificates, 14.8% of households are renters of farmland (4.8% are arms-length contracting) and 13.3% of them rent out their farmland (3.3% are arms-length contracting). Although our available data does not allow us to clarify the causal impact of issuing the written certificate on land rental market participation, the descriptive findings lend support to the potential of such land certification.

6. Conclusions

To facilitate the development of farmland rental markets without privatizing land property rights, the Chinese government has decided to restrict administrative land reallocation. For example, it strictly prohibited FSLR by expanding the land tenure contract to 30 years in 2002 (Rural Land Contract Law), and to even an unspecified long term in 2008 (at the third plenary meeting of the 17th Party Congress). However, while previous findings support that the reforms improved land tenure security and thus

overall land-specific investments, it is still unclear whether they actually facilitate the development of land rental markets. Particularly, it is concerning that some previous studies observed a complementary relation between administrative land reallocation and land rental markets.

This paper clarifies that the complementary relation is observed because the imposed nature of FSLR causes increasing inefficiencies in farmland allocation, which are readjusted in the rental markets. On the other hand, land rental market transactions are insensitive to the scale of land reallocation, and PLR tends to substitute for land rental markets. Also, land reallocation mostly affects relation-specific contracting rather than arms-length contracting in rental markets. Thus, prohibiting FSLR (or even both modes of land reallocation) may not be adequate to facilitate the development of land rental markets, which are better proxied by arms-length contracting. To further develop the land rental market, it appears that the Chinese government needs further reforms in land property rights toward the direction of greater private ownership, such as better land certification on land rental market participation.

Appendix A: First-stage Estimation Results for IVEF Models

Dependent Variable	# of FSLR experienced	# of PLR experienced	Share of Off-Farm Workers
(n – 1) ave of number of crops per vill	-0.028	0.302***	0.014
(n – 1) ave of number of plots per hh	0.216***	-0.123***	0.000
(n – 1) ave of off-farm inc per vill	0.129	-0.107	0.026*
(n – 1) ave of share of off-farm workers per vill	0.469	0.040	0.135*
F-statistics	*8.24*	*2.28*	*40.60*
Number of Observations	2,026	2,026	2,026

Note: All regressions include the full set of control variables **X** in Equation (5).

Appendix B: Measuring Inefficiencies in Farmland Allocation after an Administrative Land Reallocation

This appendix briefly describes how we obtain the measure of $\tau(L_h^*, L_h^A)$ in subsection 4.2. More details are available on pages 928–932 in Ravallion and Walle (2006). We start by obtaining a measure of L_h^*, the consumption-efficient land allocation to each household. Suppose a household holding L_h of land is allowed to consume C(L_h, $\boldsymbol{H_h}$) where $\boldsymbol{H_h}$ is a vector of household characteristics, and C(L_h, $\boldsymbol{H_h}$) takes the form

$$lnC_h = a + b\ lnL_h + \boldsymbol{c'H_h} + \epsilon_h,$$

where *a*, *b*, and *c* are parameters and ϵ_h is an error. L_h^* is defined as the land size allocated to household *h* within a given village to maximize the village's aggregate current consumption. Then, L_h^* can be expressed as a function of $\boldsymbol{H_h}$ and the market rental price of land (λ).[10] Given data on $\boldsymbol{H_h}$ and λ and the estimates of *a*, *b*, *c*, and ϵ_h, we may calculate the consumption-efficient land allocation to each household (L_h^*) for 0 < b < 1 as

$$L_h^* = exp\left\{\left[\ln\left(\frac{b}{\lambda}\right) + \boldsymbol{c'H_h} + \epsilon_h\right]/(1-b)\right\}.$$

Suppose the latest administrative land reallocation gives L_h^A of land to household *h*. Then, the extent of mismatch between L_h^* and L_h^A is assumed to have the functional form $\tau(L_h^*, L_h^A) = \varphi(L_h^*) - \varphi(L_h^A)$, where $\varphi(L) = (L^\eta - 1)/\eta$ and $\eta \in [0, 1]$. Also, the extent of observed land rental market transactions is denoted by $\rho(L_h^R, L_h^A) = \varphi(L_h^R) - \varphi(L_h^A)$, where L_h^R is the total size of land farming in 2002. To choose a value of η we regressed $\rho(L_h^R, L_h^A)$ on $\tau(L_h^*, L_h^A)$ across the entire data set for alternative values of η at 0.1 intervals over the [0, 1] interval. The best fit was obtained at η = 0 (as Ravallion and Walle also found). Thus, we use the functional form $\tau(L_h^*, L_h^A) = ln(L_h^*) - ln(L_h^A)$ as a measure of the extent of inefficiencies in land allocation. More specifically, due to the logarithmic form of $\varphi(L)$, our measure represents a proportional mismatch between L_h^* and L_h^A.

[10] We use the village average of non-zero rents for λ because rents are often set at zero in a land rental between relatives. For both $\boldsymbol{H_h}$ and λ, we used data from 2002, which is the only available consumption and land rent data in our survey.

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Table 1. Associations between the Number of FSLR and PLR Experienced and Farmland Rental Market Participation

		Observation number	Proportion of households renting in land	Proportion of households renting out land
Number of FSLR experienced by households	0	823	12.2%	8.6%
	1	545	13.8%	9.5%
	2	216	10.6%	10.2%
	3	187	19.3%	13.9%
	4 or more	284	25.4%	12.0%
Number of PLR experienced by households	0	1,359	16.6%	10.0%
	1	371	13.2%	8.9%
	2	152	11.8%	10.5%
	3	107	8.4%	13.1%
	4 or more	66	7.6%	9.1%
Total Number of LR experienced by households	0	294	13.9%	6.8%
	1	745	13.4%	9.4%
	2	345	12.2%	8.1%
	3	304	14.5%	14.1%
	4 or more	367	21.5%	12.0%

Note: LR = land reallocation, FSLR = full-scale land reallocation, and PLR = partial land reallocation.

Table 2. Contractual Parties and Certificate in the Farmland Rental Markets in China

	All		Only FSLR		Only PLR		No LR	
	# of HH	Prop	# of HH	Prop	# of HH	Prop	# of HH	Prop
Contractual Parties								
Relatives within a village	112	37.8%	73	40.1%	21	37.5%	13	35.1%
Non-relatives within a village	86	29.1%	56	30.8%	15	26.8%	7	18.9%
Village leaders	53	17.9%	25	13.7%	14	25.0%	12	32.4%
Mediated by village committee / village cadres	23	7.8%	15	8.2%	2	3.6%	4	10.8%
Relatives outside a village	1	0.3%	0	0.0%	1	1.8%	0	0.0%
Non-relatives outside a village	7	2.4%	4	2.2%	2	3.6%	0	0.0%
Others	14	4.7%	9	5.0%	1	1.8%	1	2.7%
Total HH number	296		182		53		37	
Type of certificate								
Verbal promise	206	76.0%	130	79.3%	40	75.5%	24	70.6%
Written certificate	41	15.1%	23	14.0%	10	18.9%	5	14.7%
Others	24	8.9%	11	6.7%	3	5.7%	5	14.7%
Total HH number	271		164		53		34	

Note: # = number, HH = household, and Prop = proportion. Some households did not report the type of certificate.

Table 3. Partial Effects of FSLR and PLR on Farmland Rental Market Transactions

		Probit	FE	IVFE
	Column #	(1)	(2)	(3)
Rental Market Participation				
Dependent Variable = Rent in land (1 = Yes, 0 = No)				
Basic Model	# of FSLR experienced	0.020***	0.023**	0.009
	# of PLR experienced	-0.018***	-0.009	-0.264*
TLR Models	total # of LR experienced	0.001	-0.002	0.007
		Tobit	FE	IVFE
Rent-in Land Size				
Dependent Variable = Rent-in land size (*mu*)				
Basic Models	# of FSLR experienced	0.288*	0.349*	1.430
	# of PLR experienced	-0.284*	0.004	-3.419*
TLR Models	total # of LR experienced	0.021	0.076	1.389
		Tobit	FE	IVFE
Contractual Parties				
Dependent variable = Rent-in land size (mu) contracted with				
Relatives	# of FSLR experienced	0.270***	0.111*	0.732
	# of PLR experienced	-0.241*	-0.042	-0.908
Non-Relatives	# of FSLR experienced	0.176*	0.035	-0.260
	# of PLR experienced	-0.031	-0.016	-1.227
Village Leaders	# of FSLR experienced	-0.014	-0.004	0.036
	# of PLR experienced	-0.020	0.002	-0.062
Number of Observations		2,026	2,026	2,026

Note: (i) All regressions include the full set of control variables **X** in Equation (5). (ii) FE = the province-level fixed effects model; IVFE = the province-level fixed effects model with instrumental variables. (iii) Partial effects at means are reported for probit and Tobit models. (iv) ***, **, and * indicate statistical significance at the 1%, 5%, and 10% level, respectively.

Table 4. Mean Village Characteristics by the Experience of Land Reallocation

Column #	(1) Only voluntary LR	(2) Imposed FSLR	(3) Difference (1) – (2)	*(SE)*
# of villages (n = 96)	58	38		
Nominal Means				
Village size (total # of HH)	403.28	552.21	-148.93***	*(49.91)*
Distance to a prefectural city (km)	24.29	21.09	3.20	*(3.34)*
Average number of crop types farmed per household	2.62	2.58	0.04	*(0.31)*
Number of crops types cultivated within a village	1.55	1.51	0.0357	*(0.21)*
Share of off-farm workers	0.28	0.22	0.06***	*(0.02)*
Province dummies:				
Hunan	0.21	0.11	0.10	*(0.08)*
Zhejiang	0.28	0.03	0.25***	*(0.08)*
Fujian	0.10	0.24	-0.13*	*(0.08)*
Sichuan	0.26	0.03	0.23***	*(0.07)*
Anhui	0.03	0.37	-0.33***	*(0.07)*
Heilongjiang	0.12	0.24	-0.12	*(0.08)*
Means after controlling for province effects				
Village size (total # of HH)	-15.45	23.58	-39.04	*(40.15)*
Distance to a prefectural city (km)	0.74	-1.13	1.87	*(3.17)*
Average number of crop types farmed per household	-0.10	0.19	-0.30	*(0.20)*
Number of crops types cultivated within a village	-0.04	0.07	-0.11	*(0.10)*
Share of off-farm workers	0.00	0.00	0.01	*(0.01)*

Note: (i) LR = land reallocation, FSLR = full-scale land reallocation, HH = household. (ii) *** = 1% level, ** = 5% level, and * = 10% level.

Table 5. Mean Household Characteristics by the Experience of Land Reallocation after Controlling for Province Effects

Means after controlling for province effects								
	Column #	(1)	(2)	(3)	(4)		(5)	
		No LR	Imposed FSLR	only voluntary LR	Difference (1) – (2)	*(SE)*	Difference (1) – (3)	*(SE)*
# of households		292	775	959				
Household demographics	Household size	-0.071	0.005	0.005	-0.075	*(0.089)*	-0.076	*(0.088)*
	Share of working age 16-60	0.009	-0.009	0.002	0.018	*(0.017)*	0.006	*(0.016)*
	Share of off-farm laborers	-0.011	-0.009	0.013	-0.002	*(0.014)*	-0.024	*(0.015)*
Household head Characteristics	HH head age	-0.181	0.388	-0.467	-0.569	*(0.748)*	0.286	*(0.749)*
	HH head high education	0.013	-0.002	-0.002	0.015	*(0.013)*	0.015	*(0.013)*
	HH head mid education	0.014	-0.024	0.018	0.038	*(0.034)*	-0.004	*(0.033)*
	HH head low education	-0.027	0.026	-0.015	-0.053	*(0.034)*	-0.012	*(0.032)*
	HH head cadre	0.013	0.005	-0.009	0.008	*(0.028)*	0.022	*(0.028)*
Economic Status	Total income per capita (yuan)	-197.80	-75.57	214.85	-122.22	*(417.81)*	-412.65	*(487.52)*
	Arable land per capita (mu)	0.056	0.142	-0.142	-0.086	*(0.154)*	0.198**	*(0.084)*
	Average agri tax in 2001-2	9.248	-2.799	-1.425	12.046	*(8.778)*	10.672	*(8.484)*
LR experiences	Total # of LR	-1.472	0.042	0.345	-1.514***	*(0.066)*	-1.817***	*(0.083)*
	# of FSLR	-0.649	0.210	-0.003	-0.859***	*(0.059)*	-0.646***	*(0.081)*
	# of PLR	-0.896	-0.164	0.367	-0.732***	*(0.046)*	-1.263***	*(0.102)*
Land rental activity	Rent in land (1=yes, 0=otherwise)	-0.009	0.022	-0.013	-0.031	*(0.025)*	0.004	*(0.023)*
	Rent out land (1=yes, 0=otherwise)	-0.044	-0.002	0.017	-0.042**	*(0.017)*	-0.061**	*(0.021)*

Note: (i) LR = land reallocation, FSLR = full-scale land reallocation, PLR = partial land reallocation, # = number, HH = household, and agri = agricultural. (ii) *** = 1% level, ** = 5% level, and * = 10% level.

Table 6. Difference-in-Differences Estimates of the Partial Effects of Imposed FSLR on Land Rental Market Transactions

	Compared to No Land Reallocation		Compared to Voluntary Land Reallocation	
Column #	(1)	(2)	(3)	(4)
Rental Land Size				
Dependent variable = Rent-in land size (mu)				
Imposed FSLR indicator (iFSLR)	0.108	-0.628	0.173*	-0.350**
After the imposed FSLR (After)	0.672	0.398	0.615***	0.615***
iFSLR*After	1.488**	1.762***	1.545***	1.545***
Province dummies and period	YES	YES	YES	YES
Other control variables	NO	YES	NO	YES
F-statistic (p-value)	*5.94 (0.0)*	*3.01 (0.0)*	*8.92 (0.0)*	*3.85 (0.0)*
Contractual Parties				
Dependent variable = Rent-in land size (mu) contracted with				
Relatives				
Imposed FSLR indicator (iFSLR)	0.098	0.109	0.002	-0.071
After the imposed FSLR (After)	0.088	0.029	0.192***	0.192***
iFSLR*After	0.706***	0.765***	0.603***	0.603***
Province dummies and period	YES	YES	YES	YES
Other control variables	NO	YES	NO	YES
Non-Relatives				
Imposed FSLR indicator (iFSLR)	-0.020	-0.144	0.016	-0.047
After the imposed FSLR (After)	0.051	0.082	0.147***	0.147***
iFSLR*After	0.570**	0.539**	0.474***	0.474***
Province dummies and period	YES	YES	YES	YES
Other control variables	NO	YES	NO	YES
Village Leaders				
Imposed FSLR indicator (iFSLR)	0.025	0.070	0.017	0.025
After the imposed FSLR (After)	0.033	0.023	0.058***	0.058***
iFSLR*After	-0.001	0.009	-0.026	-0.026
Province dummies and period	YES	YES	YES	YES
Other control variables	NO	YES	NO	YES
Number of Observations	2,234	2,234	3,320	3,320
Robustness Checks	Without Imposed FSLR		Without Only Voluntary FSLR	
Dependent Variable = Rent in land (1 = Yes, 0 = No)	Probit	FE	Probit	FE
# of FSLR experienced	0.005	0.005	0.014***	0.015
# of PLR experienced	-0.018***	-0.012	-0.019	-0.017
Number of Observations	863	863	1,005	1,005

Note: (i) Other control variables are the control variables **X** in Equation (5). (ii) ***, **, and * indicate statistical significance at 1% level, 5% level, and 10% level, respectively.

Table 7. Partial Effects and Consequences of Inefficiency in Land Allocation (Proportional Land Deficit)

Summary statistics for proportional land deficit ($\ln(\widehat{L^*}/L^A)$)	No LR (1)	Only voluntary LR (2)	Imposed FSLR (3)	Difference (1) - (2)	Difference (1) - (3)
	-0.306	0.098	0.040	-0.405***	-0.346***

Effects of land reallocations on the proportional land deficit	All Sample (n = 1964)		With Imposed FSLR (n = 1,071)	Without Imposed FSLR (n = 1,179)
	FE	IVFE	IVFE	IVFE
Dependent variable = Ln(proportional land deficit) i.e., $\ln(\widehat{L^*}/L^A)$				
# of FSLR experienced	0.045**	0.142	0.351	-0.071
# of PLR experienced	0.047***	-0.732**	-0.632	-0.262*

Effects of proportional land deficit on land rental market transactions	Rent In (n = 1,964)		
	Probit	FE	IVFE
Dependent variable = Indicator of Land Rental Activity (1 = Yes, 0 = No)			
Ln(proportional land deficit)	0.011	0.009	0.310**
	Tobit	FE	IVFE^
Dependent variable = ln(Size of land transferred in the land rental market + 0.01)			
Ln(proportional land deficit)	-	0.075**	1.133*

Note: (i) All regressions include the full set of control variables **X** in Equations (8) and (9). (ii) FE = the village-level fixed effects model; IVFE = the province-level fixed effects model with instrumental variables. (iii) Partial effects at means are reported for Tobit models. (iv) ^ indicates that the over-identification test is rejected at the 10% level. (v) ***, **, and * indicate statistical significance at 1% level, 5% level, and 10% level, respectively.

Figure 1: Conceptual Overview of the Effect of Prohibiting Land Reallocation on the Development of Farmland Rental Markets