

# **How does Land Titling Affect the Rural Credit Market? Evidence from China**

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**Abstract:** We study how the recent rural land titling experiment in some areas in China has affected the rural credit market in these areas. We find that land titling was associated with (1) increased households' effective and hidden demand for credit; (2) a higher level of access to formal credit; and (3) a high level of non-price credit rationing. The results suggest that land titling facilitated lending (access to credit). Meanwhile it also increased the extent of frustrated transactions (credit rationing) because the improvement on the supply side was not sufficiently large to accommodate the increased desire to borrow.

**Key words:** rural land titling in China, demand for credit, credit rationing, credit access, efficiency of the rural credit market

## 1. Introduction

Article 10 of the Chinese Constitution stipulates that “...land in the rural and suburban areas is owned by collectives”, but the use rights of rural land have been contracted to individual rural households under the Household Responsibility System (HRS) since the late 1970s. The Law on Land Contract in Rural Areas (农村土地承包法, adopted in 2002, “the Law” hereafter) sets out in detail the rights and obligations of the contracting parties under the HRS. In particular, the Law considers land use rights as property rights and requires that holders of land use right holders be issued land certificates (Deininger et al., 2014). However, the implementation of the Law’s requirements was slow following the promulgation of the Law and only a minority of rural households received written contracts and land certificates as provided by the Law (Zhu et al., 2006). In addition, while land use rights are regarded as property rights, the current Property Law (adopted in 2007) prohibits the use of land rights as collateral.

Against this background, the Ministry of Agriculture in China began a new round of rural land titling experiments (“land titling” hereafter) in 2011. The essential elements of land titling include: clarification of land boundaries by surveying and verification, issuance and registration of land use-right certificates, and permission to use land rights as collateral. The experiments were carried out in stages: 50 randomly selected counties participated initially and more counties joined in over time. By the end of 2015, 1988 counties (or nearly 70% of all counties) had been included. The progressing of the land titling experiments is summarized in Table 1.

[insert Table 1 here]

The purpose of this paper is to study the impact of the land titling experiments on the rural credit market in the areas where the experiments took place.

Specifically we aim to answer two questions: (1) what effects did land titling have on rural households' demand for credit? (2) what was the impact of land titling on the efficiency of the rural credit market?

To answer these questions, we compile a dataset from two surveys: the Ministry of Agriculture's 2010 annual survey within its Fixed Rural Observation-Point System (the "2010 FOPS survey") and the 2015 Special Supplementary Survey on Rural Land Reforms and Rural Financial Innovations (the "2015 Special Survey"). Our dataset includes 1938 households for 2010 and 2073 households for 2015. Slightly more than half of the households participated in the land titling experiment ("the treatment group") in or before 2015 and the rest did not ("the control group"). Applying the difference-in-differences approach to analysing the data, we find that land titling had the effect of increasing the probability of a household having effective and/or hidden demand for credit. As for the impact of land titling on the efficiency of the credit market, we find that on the one hand, land titling was associated with a higher probability of a household obtaining formal credit (credit access), which suggests that relative to the situation without land titling, the credit market was performing better in that it was serving more households. On the other hand, due to increased demand, land titling was associated with a higher probability of unmet demand at prevailing interest rates (non-price credit rationing), which suggests that the credit market was less efficient relative to the standard of meeting existing demand. Hence, it is important to be explicit about what the reference point is when we assess whether the credit market was more or less efficient following the land titling experiments.

To our knowledge, the only other study that examines the credit impact of the 2011 land titling experiments in China is Zhang et al. (2017) who investigate the effects these experiments had on rural households' access to credit and on rental market activities. This paper complements that work by exploring separately how

the land titling experiments affected the demand side and the supply side of the credit market, and by assessing whether the efficiency of the credit market improved as a result of land titling.

Apart from adding to the empirical literature on the credit effects of land titling in China, we include some conceptual distinctions which serve to deepen our understanding of the rural credit market. First, we distinguish two types of demand for credit: effective demand and hidden demand. Effective demand is the amount (or number) of loans a household actually applies for. Hidden demand is the amount (or number) of loans a household would like to have but did not apply for because of (perceived or real) risks or transaction costs (Mushinski, 1999). Land titling improves the security of land rights, which gives rural households greater incentives to invest in the land. The greater desire to invest would mean a greater demand for credit. However, not all the increase in demand for credit would be effective as some households may choose not to apply for loans. By distinguishing effective and hidden demand we can identify different barriers to credit faced by households, which would help us formulate appropriate policy responses.

Second, we clarify the concepts of credit access and of various types of credit rationing, and then apply these concepts to assess the efficiency of the credit market following the land titling experiments. In doing so, we get a richer picture about the sources of credit rationing, and also gain an appreciation that the efficiency impact of land titling on credit market may be judged from different points of reference.

The rest of the paper is organised as follows. Section 2 explains how land titling may affect credit demand, credit access and credit rationing in the context of the existing literature. Section 3 provides a brief history of China's rural land regimes. Section 4 describes the data used in our analysis and our estimation strategy. Section

5 presents the empirical results. Section 6 concludes.

## **2. The credit effects of land titling**

Before we discuss the credit effects of land titling, it is useful to clarify the measures of the credit effects we use in this paper: credit demand, credit access and credit rationing.

As noted earlier, we rely on two surveys conducted by the Ministry of Agriculture: the 2010 FOPS survey and the 2015 Supplementary survey. Both surveys follow the direct elicitation approach to obtaining information on households' borrowing needs and experiences (Mushinski, 1999; Petrick, 2005; and Boucher et al. 2009). Specifically, the households were asked whether or not they applied for loans in 2010 and 2015. Those households that applied were then asked whether their applications were approved, partially rejected or completely rejected. Those households that did not apply were asked to select the main reasons (from the list below) for not having applied for a loan.

- (1) Do not need loans
- (2) Expecting that a loan application would be rejected
- (3) Fearing the risk of default or the risk of losing collateral
- (4) Interest rate is too high
- (5) Currently having loans not yet paid off
- (6) Collateral requirement is too high
- (7) Application process is too long and complicated
- (8) Loan offers are too small in size or too short in duration
- (9) Having access to other sources of credit
- (10) Other

Based on households' responses to the survey questions, we first define different

types of credit rationing. A household was *price rationed* (or unconstrained in the credit market) if the household applied for a loan and its loan application was approved, or if household did not apply for a loan for any of the following reasons: it does not need a loan, or interest is too high, or currently having loans not yet paid off, or having access to other sources of credit, or other (i.e., reason (1), (4), (5) (9) or (10) on the list above). A household was *risk rationed* if it did not apply for a loan because it expected that its application would be rejected, or because it feared the risk of default or of losing collateral (reasons (2) or (3) on the list above). A household was *transaction rationed* if it did not apply for a loan for transaction cost reasons (reasons (6), (7) or (8) on the list above). Since households that were risk rationed or transaction rationed voluntarily withdrew from the credit market, we consider them to be constrained from the demand side. A household is *partial-quantity rationed* if it applied for a loan and the application was partially rejected; the household was total-quantity rationed if its loan application was totally rejected. The quantity rationed households were constrained from the supply side. We present the detailed classification of credit rationing in Table 2.

<insert Table 2 here>

Next we distinguish two types of credit demand. If a household applied for a loan, the household is said to have an effective demand. If a household did not apply for a loan for risk or transaction reasons (i.e., the household was risk rationed or transaction rationed), the household is regarded to have a hidden demand. We follow Mushinski (1999) and refer to the sum of effective and hidden demand as notional demand.

Finally, we define credit access. A household is considered to have access to credit if it applied for a loan and the application was accepted or partially accepted. The definitions of and the relationships between credit rationing, credit demand and

credit access are outlined in Table 3.

<insert Table 3 here>

There is a large literature that helps us understand how land titling may affect credit demand, credit access and credit rationing. At a general level, what land titling achieves is that it improves the security of land rights, and enables the use of land rights as collateral. An improvement in land rights increases farmers' willingness to undertake fixed investment, thereby increasing credit demand. Evidence of positive investment impact of increased land tenure security have been found throughout the world, including China (Jacoby et al., 2002), Thailand (Feder and Onchan, 1987), Latin America (Bandiera, 2007), Eastern Europe (Rozelle and Swinnen, 2004), and Africa (Besley, 1995). However, not all the increase in credit demand would result in higher investment. For instance, based on Paraguayan data for 1991 and 1994, Carter and Olinto (2003) find that of all farmer who had higher demand for investment, only wealthier producers were able to increase investment because they were less credit constrained than the poor. Indeed, not all the increase in credit demand would be expressed because while some households may have a desire to borrow following land titling, they may be discouraged from applying for a loan due to high risks or transaction costs (Mushinski, 1999). In this paper, we attempt to separately analyze the impact of land titling on effective (i.e., expressed) credit demand and that on hidden (i.e., not expressed) credit demand.

With regards to credit rationing, the well-known theoretical narrative is that due to information asymmetry, the credit market does not clear at the prevailing interest rates. Lenders restrict the quantity of loans provided ("quantity rationing"), which means some borrowers cannot obtain sufficient credit to fund profitable investment projects (Stiglitz and Weiss, 1981). There are different ways to mitigate the information asymmetry problem, an important one of which is to use collateral. The

provision of collateral not only signals the borrower's credit-worthiness, but also reduces the moral hazard problem. Land is traditionally seen as an ideal collateral for its immobility and stability in value. For land to be accepted as collateral, land rights need to be clearly defined and enforced. By enabling the use of land as collateral, land titling would have the effect of reducing the incidences of quantity rationing and improving households' access to credit.

There is indeed considerable empirical evidence consistent with the theoretical prediction. In an early study, Feder and Onchan (1987) find that land ownership security helped rural household obtain formal credit in Thailand. More recently, Boucher et al. (2008), Galiani and Schargrotsky (2010), Deininger and Goyal (2012), Dower and Potamites (2014), and Piza and de Moura (2016) all detect some positive effect of land security improvement on credit access in different countries. However there are also other studies showing that land titling failed to bring about any identifiable improvement in credit access (Place and Migot-Adholla, 1998; Boucher et al., 2005; and Do and Iyer, 2008). The failure may partly be explained by the fact that some farmers are unwilling to offer land as collateral due to high perceived risks. At the same time, some lenders are unwilling to accept (low-value) land as collateral for transaction cost considerations (Boucher et al., 2008, Deininger and Feder, 2009).

This paper presents empirical evidence on how China's latest land titling experiments have affected the rural credit market. Different from the existing literature, we consider not only effective demand, credit access and quantity rationing, but also hidden demand, and risk and transaction cost rationing. This gives us a richer picture about how the desires and constraints change for households, and allows us to assess the efficiency of the credit market in a more nuanced way. In particular, we use credit access to gauge the ability (likelihood) a household is able to obtain some formal credit, and use credit rationing to measure the extent to which



a household's desire to borrow is frustrated (by either self-withdrawal or quantity rationing). We show that land titling had the effect of improving credit access and of increasing credit rationing experienced by households.

### **3. A brief history of China's rural land regimes**

Shortly after the founding of the People's Republic of China in 1949, the government began its "rural land reform" which took land from landlords and redistributed it to rural households on an egalitarian basis. As a result of the reform, rural households became small private land owners (Zhu et al., 2006, Vendryes, 2010). However the ownership was short-lived. From early 1950s, the government decided to follow the Soviet economic model, and land was taken back from households and put under collective ownership. By the late 1950s, most rural land in China was collectively owned and managed. Meanwhile the government bought grain and oil-bearing crops from the farming collectives at low prices through the Unified Procurement system, leaving farmers little surplus. Farmers' work incentives were severely weakened; and agricultural production fell substantially for three years from 1959, resulting in the Great Famine of 1959-1961 (Lin and Yang, 2000).

Agricultural production continued to stagnate in the 1960s and 1970s under the collective farming regime. From the late 1970s, a small group of farmers in Anhui province secretly contracted out the collective land to individual households to farm. This practice, known as the Household Responsibility System (HRS), was hugely successful in raising output and income (Lin, 1992). After gaining the central government's formal endorsement in 1982, the HRS quickly spread across rural China, marking the beginning of a new land regime with households holding the use-right of collectively-owned land.

The use-right of a particular plot of land was conferred on a household through

a contract between the collective owning the land and the household belong to the collective. In 1984 the typical land use contract was for 15 years. By the time the first round of contracts was to expire in 1998, the term was extended to 30 years. In 2008, the government signalled its intention to further increase the term of contract by stating that land contract relationship will “remain unchanged for a very long time”(Dean and Damm-Luhr, 2010).

As the term of the land use contract has been extended over time, the scope of the use-rights has been enlarged through incremental removal of various restrictions on land use. Meanwhile a legal framework has been set up that formally establishes and protects households’ contractual land use- rights. Currently the major laws governing rural land rights in China include the Constitution (宪法, adopted in 1982 and amended in 2004), the Land Administration Law (土地管理法, adopted in 1986 and amended in 1998 and 2004), the Law on Land Contract in Rural Areas (农村土地承包法, adopted in 2002) and the Property Law (物权法, adopted in 2007).

As noted in the introduction section, while the legal framework is in place that establishes the land use rights of rural households under the Household Responsibility System, the implementation of relevant laws has been inadequate. The latest land titling experiments starting in 2011 is, in effect, an attempt by the Ministry of Agriculture to speed up the clarification, certification and registration of land use rights as required by law; and to add to the bundle of land rights the permission to use land as collateral (which is currently prohibited by law) in areas included in the experiments. Many studies have shown that China’s rural credit markets face specific challenges different from those confronting the rural credit markets in other less-developed countries. One of the most important challenges is the lack of physical collateral for rural lending, as farmland is owned by collectives and farm families are not allowed to use land as loan collateral (Unger, 2002; Li et

al., 2011; Xu et al., 2014). In the following, we present our analysis on how the recent land titling experiments have affected the rural credit market.

## **4. Data and empirical strategy**

### **4.1. Data**

The data used in our analysis come from two surveys: the Ministry of Agriculture's 2010 annual survey within its Fixed Rural Observation-Point System (the "2010 FOPS survey") and the 2015 Special Supplementary Survey on Rural Land Reforms and Rural Financial Innovations (the "2015 Special Survey").

The Ministry of Agriculture began its FOPS annual survey in 1986. The surveys follow about 23,000 rural households from 360 villages in 357 counties of 31 provinces. The 2015 Special Survey was a supplementary survey with specific questions about the 2011 land titling experiments and their impact on households' activities in the rural credit market and the land rental market. It selects within the FOPS two types of villages: (1) the "treatment villages", which are allocated in the national reform experimental zones and had participated in the land titling experiments<sup>1</sup>; and (2) the "comparison villages", which are geographically similar to the treatment villages but had not participated in the land titling experiments. The geographic distribution of the treatment and comparison villages is shown in Figure 1.

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<sup>1</sup>The reform experimental zones largely but do not completely overlap the locations of land titling experiments. Reform experiments cover a wider range of experiments than land titling. There are a small number of villages in the 2015 Special Survey's treatment groups that had not completed land titling and also a small number of villages in the comparison groups that had. When we compiled the dataset for our analysis, we made minor adjustments to ensure that all villages in our treatment groups had completed land titling, and no villages in our comparison groups had completed land titling at the time of survey.

<insertFigure 1>

The dataset we have compiled based on the 2010 FOPS annual survey and the 2015 Special Survey covers 40 villages in 36 counties of 17 provinces<sup>2</sup>. There are 1938 households in the 2010 survey and 2073 households for 2015. Table 4 reports the main characteristics of the households (mean values and standard deviations) in 2010 and 2015. Most of the household characteristics – for instance, household size, proportion of household members in the labor force, proportion of income from non-agricultural operations – were fairly stable between 2010 and 2015. However the average value of household productive asset rose significantly from 9,950 yuan to 14,410 yuan. Also the proportion of the households owning a car increased from 3% to 13%.

<insert Table 4>

Tables 5-7 report descriptive statistics on household demand for formal credit, credit rationing and credit access, respectively. From Table 5 it is clear that, over the period from 2010 to 2015, effective and hidden demand for formal credit fell for both the treatment group and the comparison group. However, the magnitudes of the fall were smaller for the treatment group. For instance, the proportion of households having an effective demand fell from 5.93% to 2.59% for the comparison group, and the corresponding fall for the treatment group was from 4.22% to 3.20%. This suggests a positive effect of treatment (i.e., land titling) on credit demand.

Table 6 shows that credit access fell from 98.31% to 84% between 2010 and

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<sup>2</sup>The 17 provinces (or autonomous regions or directly administered municipality) are: Shanxi, Liaoning, Jilin, Heilongjiang, Jiangsu, Zhejiang, Anhui, Fujian, Jiangxi, Shandong, Henan, Hubei, Guangxi, Sichuan, Guizhou, Chongqing and Ningxia.

2015 for the control group. For the treatment group, credit access also fell, but to a lesser extent from 95.56% to 88.24%, which indicates a positive effect of land titling on credit access.

Table 7 shows that the incidences of all types of credit rationing: quantity rationing (including both partial and total quantity rationing), transaction cost rationing, risk rationing fell between 2010 and 2015. However the magnitudes of the decreases were smaller for the treatment group. For instance, the extent of quantity rationing fell from 1.21% to 0.52% for the control group, and corresponding fall for the treatment group was from 1.41% to 1.13%. This suggests a positive effect of land titling on credit rationing.

<insert Tables (5-7)

## **4.2. Empirical strategy**

As explained earlier, the 2010 annual FOPS survey and the 2015 Special survey cover households in villages that had participated in the land titling experiment (the treatment group) and households in villages that are otherwise similar but had not participated in the experiment (the comparison group). We are therefore able to use the difference-in-differences approach to identify the effects of land titling on the rural credit market. The idea is to use the comparison group's outcome difference over time as the counterfactual, which is compared to the treatment group's outcome difference before and after the land titling experiment. Since the treatment group and comparison group are similar but for the treatment (after controlling for observable characteristics), the estimated difference-in-differences identifies the effect of the treatment, i.e., the effect of land titling, on the rural credit market.

Our baseline estimation equation in its general form is as follows

$$y_{it} = \alpha_0 + \alpha_1(\text{year} \times \text{title}) + \alpha_2 \text{year} + \alpha_3 \text{title} + X_{it} \beta_1 + \varepsilon_{it} \quad (1)$$

where  $y_{it}$  is the dependent variable for household  $i$  in year  $t$  (year2010 or year2015).  $\text{year}$  is a binary variable which equals to 0 for year 2000, and 1 for year 2015.  $\text{title}$  is a binary variable which equals to 1 if the household participated in the land titling experiment, and 0 otherwise.  $X_{it}$  is a set of control variables describing household characteristics, including: whether household was located in the reform experimental zone; total area of cultivated land, age of household head, years of education of household head, household size, share of working members in the household, share of non-agricultural income, value of household productive asset, car ownership, whether the household experienced consumption shocks (e.g., wedding or funeral) during current year, and distance to nearest bank.

Our estimations concern the following 5 dependent variables:

(1) Household effective demand for credit:  $y_{it} = 1$  if a household had an effective demand for credit; and 0 otherwise.

(2) Household hidden demand for credit:  $y_{it} = 1$  if a household had a hidden demand for credit; and 0 otherwise.

(3) Non-price credit rationing:  $y_{it} = 1$  if a household experienced non-price credit rationing; and 0 otherwise.

(4) Types of credit rationing:

$y_{it} = 0$  if a household was a price-rationed borrower;

$y_{it} = 1$  if a household was partially quantity rationed;

$y_{it} = 2$  if a household was totally quantity rationed;

$y_{it} = 3$  if a household was demand-side rationed (including both risk rationed

and transaction cost rationed)

$y_{it} = 4$  if a household was a price rationed non-borrower.

(5) Access to formal credit:  $y_{it} = 1$  if a household had access to formal credit; and 0 otherwise.

In equation (1), the before-and-after outcome difference for the treatment group is measured by  $\alpha_1 + \alpha_2$ , and the difference over time (between 2010 and 2015) for the comparison groups is  $\alpha_2$ . The parameter we are interested in is  $\alpha_1$ , which is the difference in outcome differences between the treatment group and the comparison group.  $\alpha_3$  is an estimate of the effects of the treatment (i.e., land titling) on the dependent variable.

For the difference-in-differences estimation to be unbiased, the assignment into the treatment group should not be endogenous. In other words, the decision over who should receive the treatment should be independent of any factor that may influence the outcome of the treatment. Zhang et al. (2017) have analysed the characteristics of the treatment group and comparison group and shown that the two groups do not differ in identifiable ways, which suggests that our analysis is unlikely to be biased by this endogeneity problem.

## 5. Empirical results

In this section we discuss our estimation results of equation (1) with different dependent variables: effective credit demand, hidden credit demand, access to formal credit, non-price credit rationing and non-price credit rationing types. Where the dependent variable is binary, the estimates are obtained from applying the probit model. When the dependent variable has values of more than two categories as is the case with credit rationing types, we use the multinomial logit model.

## 5.1. Credit demand and credit access

The effects of land titling on effective credit demand are shown in Tables 8a and 8b. We report 5 regression results from simple to the more complex: (1) estimation with no control variables; (2) adding province fixed effects; (3) excluding attrition household from the sample; (4) adding control variables; (5) adding control variables and province fixed effects. The effects of land titling on effective demand are measured by the estimated parameter ( $year \times title$ ). Our estimations reveal that land titling had a statistically significant positive effect on household effective demand for credit (significant at 5% or 10% levels depending on model specifications). However the magnitude of the effect (as measured by the marginal effect estimate) appears to be small: in estimation (4), land titling raised the probability of a household having an effective credit demand by 1.6%.

In contrast, land titling appears to have a larger impact on hidden credit demand. As reported in Tables 9a and 9b, land titling had the effect of increasing household hidden credit demand (significant at 1% level). The estimated marginal effects in the estimation with control variables (estimation (4) in Table 9b) indicate that participating in land titling experiment increased the probability of a household having a hidden demand for credit by 12.6%. These results suggest that land titling notably increased households' desire to borrow, but much of the increased desire was not expressed in the form of loan applications.

From the estimation results reported in Tables 8a and 9a, we also observe that a household was more likely to have an effective credit demand if it had a larger share of working members in household, if it had a larger share of non-agricultural income, and if it more productive assets. A household is also more likely to have an effective credit demand if it experienced a consumption shock (for instance, a wedding, or a funeral). Similarly, a household's hidden credit demand was positively correlated



with the household's share of non-agricultural income, and the value of its productive asset. However it was not related to the share of working members in the household or whether the household experienced a consumption shock. Instead it was positively associated with the household's distance to the nearest bank, which suggests that transportation cost was a reason for a household not expressing its desire to borrow by lodging an application at a bank.

The estimated effects of land titling on credit access are reported in Table 10a and Table 10b<sup>3</sup>. Consistent with our expectations, land titling had the effect of improving household credit access as shown in all 5 model specifications. However, the extent of the improvement was rather moderate. In our estimation with control variables (estimation (4) in Table 10b), land titling is found to be associated with a 1.1% increase in the probability of a household having access to formal credit (statistically significant at 5% level). The improved credit access may in part be explained by the use of land as collateral enabled by land titling. It may be also attributable to the fact that land titling had a positive impact on households' income and wealth which in turn improved their ability to obtain formal loans (Zhang et al., 2017).

## **5.2. Credit rationing**

The estimated effects of land titling on non-price credit rationing are reported in Tables 11a and 11b. All 5 estimations show that land titling had the effect of increasing a household's probability of experiencing non-price credit rationing. In the estimation with control variables (estimation (4) in Table 11b), land titling is associated with a 1.1% higher probability of facing non-price credit rationing. On the face of it, this finding is counter-intuitive or contradicting the result presented above that land titling had the effect of improving credit access. However, since we

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<sup>3</sup>Table 10a duplicates Table 5 in Zhang et al. (2017).

use credit rationing as a measure of frustrated transactions in the credit market, it is no longer obvious that land titling would have the effect of reducing rationing. This is because, as we have shown above, land titling not only facilitated lending (thus improving credit access), but also increased (effective and hidden) demand. Only when the improvement on the supply size was large enough to more than accommodate the increase in demand, would the extent of frustrated transactions fall (i.e., lower credit rationing).

To understand how land titling might have affected rationing from the supply side and that from the demand side in more detail, we estimate the effects of land titling on different credit rationing types. We run 2 sets of estimations: (1) the dependent variable is defined as having 5 categories: price rationed borrowers, partially quantity rationed, totally quantity rationed, demand side rationed, and price rationed non-borrowers; and (2) the dependent variable is defined as having 4 categories with the price rationed borrowers and non-borrowers together. The estimation results are reported in Tables 12a and 12b.

Both sets of estimations show that land titling had the effect of increasing demand side rationing (statistically significant at 1% level), and had no effect on total quantity rationing. When 5 credit rationing types were considered, land titling was associated with a 2.6% higher probability of being demand side rationed (estimation (9) in Table 12a), and 2.8% lower probability of being price rationed non-borrowers rationed (estimation (10) in Table 12a). When 4 credit rationing types were considered, land titling was associated with a 0.7% higher probability of being demand side rationed, and 1% higher probability of being partially quantity rationed. These results suggest that land titling appears to have increased demand side rationing and partial quantity rationing without having any identifiable impact on total quantity rationing. In other words, with land titling, households had a greater desire to borrow. Some of increased desire was not actioned upon as some

households chose to withdraw from the credit market, thus demand side rationing rose. Some of the increased desire turned into effective demand, but not all of the increase in effective demand was met, which manifested as increased probability of partial quantity rationing.

## **6. Conclusion**

Using data drawn from official surveys conducted by the Ministry of Agriculture of China in 2010 and 2015, we have estimated the effects of the land titling experiment which began in 2011. We have found that land titling was associated with (1) increased households' effective and hidden demand for credit; (2) a higher level of access to formal credit; and (3) a high level of non-price credit rationing. These results suggest that land titling facilitated lending which led to improved access to credit. At the same time, land titling increased the extent of frustrated transactions measured by credit rationing. This is because land titling increased households' desire to borrow. Some of increased desire was expressed, which turned into effective demand, but the improvement on the supply side was not sufficiently large to accommodate the increased effective demand resulting an increase in partially quantity rationing. Some of the increased desire to borrow was not expressed as households chose to withdraw from the credit market due to high risks or transaction costs, which means an increase in demand side rationing.

Our results highlight that land titling affects both demand and supply of credit. How well the credit market functions depends on how the forces on both sides of the market respond to the policy change. Our findings increase our knowledge about the intentions of and constraints faced by rural households and credit providers. This helps us evaluate the land titling experiment and form further policies to lessen the constraints and to deal with emerging issues. For instance, the finding that land titling increased rural households' desire to borrow can be seen as evidence of

greater confidence in land rights and improved incentive to invest. The fact that much of the increased desire to borrow was frustrated due to risk and transaction cost considerations suggests that future reforms should aim to lower risk and transaction costs.

Finally it should be noted that while we have presented evidence that land titling had statistically significant impact on credit demand, credit access and credit rationing, the economic significance as indicated by the magnitudes of the estimated marginal effects were quite moderate. This may suggest that the credit impact of land titling was indeed small in the case of the latest Chinese experiment. Or it may be related to data limitations: although the number of households surveyed (around 2000 each time) was not small, the proportion of households participating in the credit market was small. As the land titling reform is continuing in China, it is important that we follow its progress and investigate its impact further as more data come to hand.

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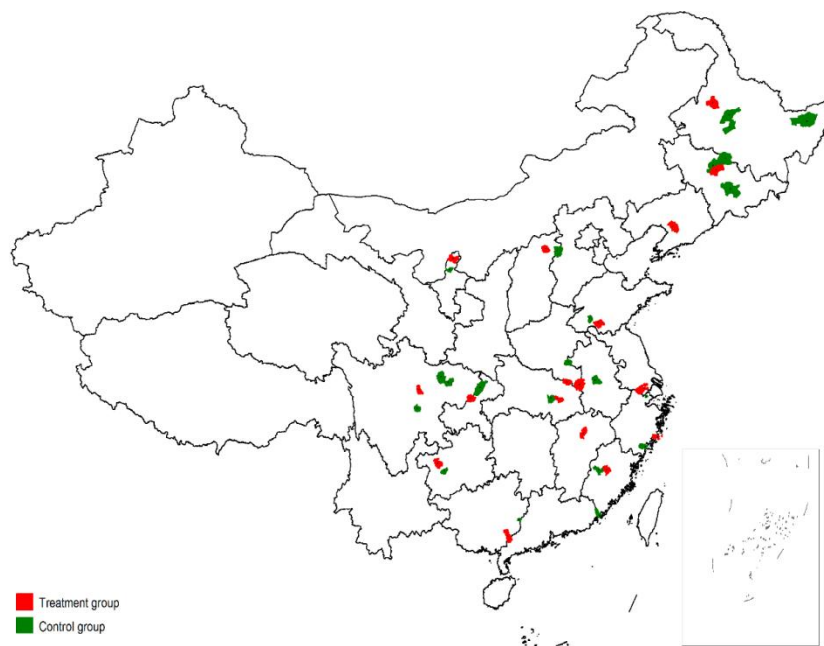
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**Figure 1. Location of Treatment and Control Groups**



**Table 1. Progress of Land Titling in China: 2010-2015**

	No. of counties participated	Proportion of participating (%)	No. of entire provinces participated	Proportion of entire provinces participated (%)	Total area of land certified (million mu)	Proportion of land titled (%)
2010	0	0	0	0	--	--
2011	50	1.75	0	0	--	--
2012	100	3.50	0	0	--	--
2013	205	7.18	0	0	--	--
2014	518	18.18	3	9.38	--	--
2015	1988	69.61	12	37.50	330	25.78

*Note:* Authors' calculation based on data from the Ministry of Agriculture of China. Only 8 villages participated in the first round of small-scale pilot reform from 2009-2010 countrywide.



**Table2. Classification of Credit Rationing**

		Unconstrained	Demand Side Constrained		Supply Side Constrained	
		De ≤ S	De ≤ S; Dh > 0		De > S; Dh ≥ 0	
		Price rationed	Risk rationed	Transaction cost rationed	Partial quantity rationed	Total quantity rationed
Applied for a loan	Application approved	✓				
	Application partially rejected				✓	
	Application totally rejected					✓
Did not apply for a loan	(1) Do not need loans	✓				
	(2) Expecting that a loan application would be rejected		✓			
	(3) Fearing the risk of default or the risk of losing collateral		✓			
	(4) Interest rate is too high	✓				
	(5) Currently having loans not yet paid off	✓				
	(6) Collateral requirement is too high			✓		
	(7) Application process is too long and complicated			✓		
	(8) Loan offers are too small in size or too short in duration			✓		
	(9) Having access to other sources of credit	✓				
	(10) Other	✓				

*Note:* For more details, see also Mushinski(1999), Petrick(2005) and Boucher et al.(2009).

**Table 3. Credit Demand, Credit Rationing and Credit Access**

		Credit Demand			Credit Rationing		Credit Access
		Notional Demand	Effective Demand	Hidden Demand	Type of Credit Constraining	Credit Rationing Code	
Applied for a loan	Applied and accepted	✓	✓	×	Price rationed borrower	1	✓
	Applied and totally rejected	✓	✓	×	Total Quantity Rationed	2	×
	Applied and partially rejected	✓	✓	×	Partial Quantity Rationed	3	✓
Did not apply for a loan	Self-rationed: fear of risk	✓	×	✓	Risk rationed	4	×
	Self-rationed: high transaction cost	✓	×	✓	Transaction-cost rationed	4	×
	Not interested/ high interest rate	×	--	--	Price rationed non borrower	5	×

**Table 4. Household Characteristics: Mean Values and Standard Deviations**

	2010 Survey		2015 Survey	
	Baseline Households	Attrition Households	Panel Households	Replacement Households
Number of households	1938	91	1847	226
Whether the village is located in reform experimental zone	0.42 (0.49)	0.37 (0.49)	0.42 (0.49)	0.50 (0.50)
Total area of cultivated land	7.75 (11.27)	8.10 (11.56)	7.51 (12.90)	4.18 (10.93)
Age of household head	50.59 (11.00)	49.84 (8.94)	55.27 (11.06)	53.79 (10.10)
Years of education of household head	6.87 (2.54)	6.64 (2.11)	6.67 (2.83)	7.04 (2.46)
Household size	3.80 (1.50)	3.67 (1.95)	3.58 (1.59)	3.32 (1.50)
Proportion of household members in the labor force	0.69 (0.26)	0.62 (0.26)	0.67 (0.29)	0.68 (0.30)

Proportion of income from non-agricultural operations	0.10 (0.26)	0.01 (0.09)	0.09 (0.25)	0.08 (0.22)
Household productive asset value ('000 yuan)	9.95 (49.18)	3.67 (15.88)	14.41 (135.14)	8.31 (30.93)
Whether the household owns a car	0.03 (0.18)	0.01 (0.10)	0.13 (0.33)	0.13 (0.34)
Whether the household experienced consumption shocks during current year	0.32 (0.47)	0.37 (0.49)	0.36 (0.48)	0.28 (0.45)
Distance to the nearest bank (km)	4.28 (3.40)	3.64 (2.56)	4.31 (3.43)	3.53 (2.70)

**Table 5. Demand for Formal Credit**

Type of demand	Control Group		Treatment Group		Total	
	2010	2015	2010	2015	2010	2015
Notional demand	211	146	121	102	332	248
	21.21%	15.10%	11.34%	9.61%	16.10%	12.23%
Effective demand	59	25	45	34	104	59
	5.93%	2.59%	4.22%	3.20%	5.04%	2.91%
Hidden demand	152	121	76	68	229	189
	15.28%	12.51%	7.12%	6.41%	11.11%	9.32%
No demand	784	821	946	959	1730	1780
	78.79%	84.90%	88.66%	90.39%	83.90%	87.77%
Total	995	967	1067	1061	2062	2028
	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%

**Table 6. Access to Formal Credit**

Access to credit (a loan application partially or totally approved)	Control Group		Treatment Group		Total	
	2010	2015	2010	2015	2010	2015
0	1	4	2	4	3	8
	1.69%	16.00%	4.44%	11.76%	2.88%	13.56%
1	58	21	43	30	101	51
	98.31%	84.00%	95.56%	88.24%	97.12%	86.44%
Total	59	25	45	34	104	59
	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%

**Table 7. Credit Rationing**

		Non-price CreditRationed	Type of Credit Rationing	Incidence of Credit Rationing			
				Control Group		Treatment Group	
				2010	2015	2010	2015
Applied for a loan	Applied and accepted	0	Price rationed borrower	47	20	30	22
				4.72%	2.07%	2.81%	2.07%
	Applied and totally or partially rejected	1	quantity rationed	12	5	15	12
				1.21%	0.52%	1.41%	1.13%
Did not apply for a loan	Self-rationed: high transaction cost	1	transaction-cost rationed	62	52	22	18
				6.23%	5.38%	2.06%	1.70%
	Self-rationed: fear of risk	1	risk rationed	90	69	54	50
				9.05%	7.14%	5.06%	4.71%
	Not interested/ High interest rate	0	Price rationed non- borrower	784	821	946	959
				78.79%	84.90%	88.66%	90.39%
Total				995	967	1067	1061
				100.00%	100.00%	100.00%	100.00%

**Table 8a. Effects of Land Titling on Effective Credit Demand**

	Difference-in- Difference Estimation, Probit				
	Dependent variable=1 if household has effective credit demand				
	No Controls	Province FE	No-attrition Households	With Controls	With Controls and Province FE
	(1)	(2)	(3)	(4)	(5)
Title×Year=2015	0.378**	0.337	0.352*	0.452**	0.396*
	(0.183)	(0.206)	(0.184)	(0.227)	(0.235)
Year=2015	-0.434***	-0.467***	-0.438***	-0.482***	-0.469***
	(0.111)	(0.133)	(0.111)	(0.156)	(0.163)
Title	-0.368***	-0.263	-0.342***	-0.037	-0.018
	(0.123)	(0.259)	(0.124)	(0.150)	(0.312)
Whether household was located in the reform experimental zone				-0.016	-0.052
				(0.131)	(0.151)
Total cultivated land area				0.024***	0.009**
				(0.004)	(0.004)
Age of household head				-0.026***	-0.026***
				(0.005)	(0.005)
Years of education of household head				-0.035	-0.044*
				(0.022)	(0.024)
Household size				-0.042	-0.048
				(0.040)	(0.042)
Share of working members in household				0.466**	0.627***
				(0.228)	(0.235)
Share of non-agricultural income				0.445**	0.557***
				(0.197)	(0.216)
Ln(value of household productive assets)				0.091**	0.071
				(0.040)	(0.049)
Whether the household owns a car				0.108	0.191
				(0.197)	(0.226)
Whether the household experience consumption shocks during current year				0.700***	0.708***
				(0.105)	(0.118)
Distance to nearest bank				0.012	0.019
				(0.014)	(0.018)
Constant	-1.556***	-2.024***	-1.553***	-1.232***	-1.252**
	(0.066)	(0.265)	(0.067)	(0.458)	(0.525)
Province fixed effects	No	Yes	No	No	Yes
Household level control variables	No	No	No	Yes	Yes

Prob>Wald chi <sup>2</sup>	0.000	0.000	0.000	0.000	0.000
Pseudo R <sup>2</sup>	0.023	0.181	0.023	0.226	0.282
Observations	3,185	2,793	3,138	3,005	2,677

*Notes:* 1. Robust standard errors are in parentheses.

2. \*, \*\*, \*\*\* indicate statistical significance at 10%, 5% and 1% levels, respectively.

**Table 8b. Effects of Land Titling on Effective Credit Demand (Marginal Effects)**

	Difference-in- Difference Estimation, Probit				
	Dependent variable=1 if household has effective credit demand				
	No Controls	Province FE	No-attrition Households	With Controls	With Controls and Province FE
	(1)	(2)	(3)	(4)	(5)
Title×Year=2015	0.027** (0.013)	0.017* (0.010)	0.026* (0.013)	0.016** (0.007)	0.012* (0.007)
Year=2015	-0.031*** (0.008)	-0.023*** (0.006)	-0.032*** (0.008)	-0.017*** (0.005)	-0.014*** (0.005)
Title	-0.026*** (0.009)	-0.013 (0.013)	-0.025*** (0.009)	-0.001 (0.005)	-0.001 (0.009)
Whether household was located in the reform experimental zone				-0.001 (0.005)	-0.002 (0.004)
Total area cultivated				0.001*** (0.000)	0.000** (0.000)
Age of household head				-0.001*** (0.000)	-0.001*** (0.000)
Years of education of household head				-0.001 (0.001)	-0.001* (0.001)
Household size				-0.001 (0.001)	-0.001 (0.001)
Share of working members in the household				0.017** (0.008)	0.019** (0.007)
Share of non-agricultural income				0.016** (0.007)	0.017** (0.007)
Ln(value of household productive assets)				0.003** (0.002)	0.002 (0.002)
Whether the household owns a car				0.004 (0.007)	0.006 (0.007)
Whether the household experience consumption shocks during current year				0.025*** (0.004)	0.021*** (0.005)
Distance to nearest bank				0.000 (0.000)	0.001 (0.001)
Province fixed effects	No	Yes	No	No	Yes
Household level control variables	No	No	No	Yes	Yes
Prob>Wald chi <sup>2</sup>	0.000	0.000	0.000	0.000	0.000
Pseudo R <sup>2</sup>	0.023	0.181	0.023	0.226	0.282

Observations	3,185	2,793	3,138	3,005	2,677
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*Notes:* 1. Marginal effects are estimated at the sample mean of regressors.

2. Robust standard errors are in parentheses.

3. \*, \*\*, \*\*\* indicate statistical significance at 10%, 5% and 1% levels, respectively.



**Table9a. Effects of Land Titling on Hidden Credit Demand**

	Difference-in- Difference Estimate, Probit				
	Dependent variable=1 if household has hidden credit demand				
	No Controls	Province FE	No-attrition Households	With Controls	With Controls and Province FE
	(1)	(2)	(3)	(4)	(5)
Title × Year=2015	0.784*** (0.123)	0.784*** (0.144)	0.736*** (0.124)	0.814*** (0.137)	0.818*** (0.158)
Year=2015	-0.491*** (0.082)	-0.531*** (0.097)	-0.481*** (0.083)	-0.428*** (0.094)	-0.513*** (0.107)
Title	-0.301*** (0.088)	-0.492*** (0.135)	-0.253*** (0.089)	-0.036 (0.102)	-0.343** (0.148)
Whether household was located in the reform experimental zone				-0.315*** (0.080)	0.105 (0.104)
Total area of cultivated land				-0.007** (0.003)	0.002 (0.005)
Age of household head				-0.010*** (0.004)	-0.007* (0.004)
Years of education of household head				-0.042*** (0.014)	-0.032* (0.017)
Household size				-0.028 (0.024)	0.039 (0.031)
Share of working members in the household				-0.070 (0.131)	-0.130 (0.159)
Share of non-agricultural income				0.404*** (0.138)	0.081 (0.171)
Ln(value of household productive assets)				0.157*** (0.023)	0.097*** (0.029)
Whether the household owns a car				-0.167 (0.153)	-0.170 (0.174)
Whether the household experience consumption shocks during current year				0.052 (0.073)	-0.008 (0.088)
Distance to nearest bank				0.106*** (0.009)	0.167*** (0.016)
Constant	-1.052*** (0.051)	-0.884*** (0.132)	-1.063*** (0.052)	-0.870*** (0.288)	-1.866*** (0.389)
Province fixed effects	No	Yes	No	No	Yes
Household level control variables	No	No	No	Yes	Yes

Prob>Wald chi <sup>2</sup>	0.000	0.000	0.000	0.000	0.000
Pseudo R <sup>2</sup>	0.022	0.143	0.021	0.148	0.247
Observations	3,185	2,480	3,138	3,005	2,372

*Notes:* 1. Robust standard errors are in parentheses.

2. \*, \*\*, \*\*\* indicate statistical significance at 10%, 5% and 1% levels, respectively.

**Table 9b. Land Titling and Hidden Credit Demand (Marginal Effects)**

	Difference-in- Difference Estimate, Probit				
	Dependent variable=1 If household has hidden credit demand				
	No Controls	Province FE	No-attrition Households	With Controls	With Controls and Province FE
	(1)	(2)	(3)	(4)	(5)
Title × Year=2015	0.142*** (0.022)	0.141*** (0.025)	0.134*** (0.022)	0.126*** (0.020)	0.125*** (0.024)
Year=2015	-0.089*** (0.015)	-0.095*** (0.017)	-0.087*** (0.015)	-0.066*** (0.014)	-0.078*** (0.015)
Title	-0.054*** (0.016)	-0.088*** (0.024)	-0.046*** (0.016)	-0.006 (0.016)	-0.053** (0.023)
Whether household was located in the reform experimental zone				-0.049*** (0.012)	0.016 (0.016)
Total area of cultivated land				-0.001** (0.000)	0.000 (0.001)
Age of household head				-0.002*** (0.001)	-0.001* (0.001)
Years of education of household head				-0.006*** (0.002)	-0.005* (0.003)
Household size				-0.004 (0.004)	0.006 (0.005)
Share of working members in the household				-0.011 (0.020)	-0.020 (0.024)
Share of non-agricultural income				0.062*** (0.021)	0.012 (0.026)
Ln(value of household productive assets)				0.024*** (0.004)	0.015*** (0.004)
Whether the household owns a car				-0.026 (0.024)	-0.026 (0.027)
Whether the household experience consumption shocks during current year				0.008 (0.011)	-0.001 (0.013)
Distance to nearest bank				0.016*** (0.001)	0.026*** (0.002)
Province fixed effects	No	Yes	No	No	Yes
Household level control variables	No	No	No	Yes	Yes
Prob>Wald chi <sup>2</sup>	0.000	0.000	0.000	0.000	0.000
Pseudo R <sup>2</sup>	0.022	0.143	0.021	0.148	0.247

Observations	3,185	2,480	3,138	3,005	2,372
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*Notes:* 1. Marginal effects are estimated at sample mean of regressors.

2. Robust standard errors are in parentheses.

3. \*, \*\*, \*\*\* indicate statistical significance at 10%, 5% and 1% levels, respectively.

**Table 10a. The Effects of Land Titling on Access to Formal Credit**

	Difference-in- Difference Estimate, Probit				
	Dependent variable=1 If household have access to formal credit				
	No Controls	Province FE	Excluding attrition Households	With Controls	With Controls and Province FE
	(1)	(2)	(3)	(4)	(5)
Title×Year=2015	0.398**	0.361*	0.352*	0.540**	0.500**
	(0.187)	(0.212)	(0.188)	(0.235)	(0.244)
Year	-0.460***	-0.520***	-0.462***	-0.528***	-0.573***
	(0.111)	(0.135)	(0.111)	(0.161)	(0.171)
Title	-0.358***	-0.289	-0.312**	-0.145	-0.200
	(0.123)	(0.210)	(0.125)	(0.157)	(0.264)
Whether household was located in the reform experimental zone				-0.049	-0.057
				(0.129)	(0.149)
Total area of cultivated land				0.021***	0.009**
				(0.004)	(0.004)
Age of household head				-0.028***	-0.025***
				(0.005)	(0.005)
Years of education of household head				-0.022	-0.028
				(0.023)	(0.025)
Household size				-0.024	-0.009
				(0.041)	(0.043)
Share of working members in the household				0.856***	1.062***
				(0.244)	(0.263)
Share of non-agricultural income				0.440**	0.502**
				(0.199)	(0.221)
Ln(value of household productive assets)				0.114***	0.089*
				(0.041)	(0.051)
Whether the household owns a car				0.101	0.264
				(0.198)	(0.231)
Whether the household experienced a consumption shock during the current year				0.710***	0.727***
				(0.105)	(0.123)
Distance to nearest bank				0.012	0.009
				(0.013)	(0.017)
Constant	-1.703***	-2.119***	-1.700***	-1.719***	-1.881***
	(0.064)	(0.274)	(0.064)	(0.437)	(0.546)
Province fixed effects	N	Y	N	N	Y
Household level control variables	N	N	N	Y	Y
Prob>Wald $\chi^2$	0.000	0.000	0.000	0.000	0.000

Pseudo R <sup>2</sup>	0.025	0.176	0.025	0.247	0.286
No. of Observations	4,011	3,130	3,920	3755	2952

*Note:* 1. Robust standard errors are in parentheses.

2. \*, \*\*, \*\*\* indicate significant at 10%, 5%, and 1% levels, respectively.

**Table 10b. Effects of Land Titling on Access to Formal Credit (Marginal Effects)**

	Difference in Differences Estimate, Probit				
	Dependent variable=1 If household have access to formal credit				
	No Controls	Province FE	Excluding attrition Households	With Controls	With Controls and Province FE
	(1)	(2)	(3)	(4)	(5)
Title×Year=2015	0.021**	0.014*	0.019*	0.011**	0.010**
	(0.010)	(0.008)	(0.010)	(0.004)	(0.005)
Year	-0.025***	-0.021***	-0.025***	-0.011***	-0.012***
	(0.006)	(0.005)	(0.006)	(0.003)	(0.003)
Title	-0.019***	-0.011	-0.017**	-0.003	-0.004
	(0.007)	(0.008)	(0.007)	(0.003)	(0.005)
Whether household was located in the reform experimental zone				-0.001	-0.001
				(0.003)	(0.003)
Total area of cultivated land				0.000***	0.000**
				(0.000)	(0.000)
Age of household head				-0.001***	-0.001***
				(0.000)	(0.000)
Years of education of household head				-0.000	-0.001
				(0.000)	(0.001)
Household size				-0.000	-0.000
				(0.001)	(0.001)
Share of working members in the household				0.017***	0.022***
				(0.005)	(0.007)
Share of non-agricultural income				0.009**	0.010**
				(0.004)	(0.005)
Ln(value of household productive assets)				0.002**	0.002
				(0.001)	(0.001)
Whether the household owns a car				0.002	0.005
				(0.004)	(0.005)
Whether the household experienced consumption shocks during the current year				0.014***	0.015***
				(0.003)	(0.004)
Distance to nearest bank				0.000	0.000
				(0.000)	(0.000)
Province fixed effects	N	Y	N	N	Y
Household level control variables	N	N	N	Y	Y
Prob>Wald $\chi^2$	0.000	0.000	0.000	0.000	0.000
Pseudo R <sup>2</sup>	0.025	0.176	0.025	0.247	0.286
No. of Observations	4,011	3,130	3,920	3755	2952

- Note:* 1. Marginal effects are estimated at sample mean of regressors.  
2. Robust standard errors in parentheses.  
3. \*, \*\*, \*\*\* indicate significant at 10%, 5%, and 1% levels, respectively.



**Table 11a. Effects of Land Titling on Non-price Credit Rationing**

	Difference-in- Difference Estimate, Probit				
	Dependent variable=1 If household was non-price credit rationed				
	No Controls	Province FE	No-attrition Households	With Controls	With Controls and Province FE
	(1)	(2)	(3)	(4)	(5)
Title × Year=2015	0.539*** (0.107)	0.558*** (0.116)	0.505*** (0.108)	0.464*** (0.118)	0.473*** (0.126)
Year=2015	-0.315*** (0.068)	-0.247*** (0.074)	-0.310*** (0.068)	-0.136* (0.076)	-0.135 (0.084)
Title	-0.401*** (0.078)	-0.827*** (0.120)	-0.367*** (0.079)	-0.279*** (0.090)	-1.032*** (0.146)
Whether household was located in the reform experimental zone				-0.096 (0.067)	0.359*** (0.085)
Total area of cultivated land				-0.015*** (0.003)	0.005 (0.004)
Age of household head				-0.011*** (0.003)	-0.009*** (0.003)
Years of education of household head				-0.051*** (0.012)	-0.033** (0.014)
Household size				-0.004 (0.021)	-0.001 (0.024)
Share of working members in the household				-0.053 (0.109)	0.039 (0.124)
Share of non-agricultural income				0.433*** (0.116)	0.181 (0.138)
Ln(value of household productive assets)				0.130*** (0.022)	0.091*** (0.026)
Whether the household owns a car				-0.108 (0.124)	-0.213 (0.132)
Whether the household experienced consumption shocks during current year				0.202*** (0.062)	0.147** (0.072)
Distance to nearest bank				0.144*** (0.009)	0.192*** (0.015)
Constant	-0.704*** (0.046)	-0.307*** (0.108)	-0.709*** (0.046)	-0.664*** (0.245)	-0.949*** (0.289)
Province fixed effects	No	Yes	No	No	Yes
Household level control variables	No	No	No	Yes	Yes

Prob>Wald chi <sup>2</sup>	0.000	0.000	0.000	0.000	0.000
Pseudo R <sup>2</sup>	0.012	0.148	0.010	0.142	0.239
Observations	3183	3183	3135	2999	2831

*Notes:* 1. Robust standard errors are in parentheses.

2. \*, \*\*, \*\*\* indicate statistical significance at 10%, 5% and 1% levels, respectively.

**Table 11b. Effects of Land Titling on Non-price Credit Rationing (Marginal Effects)**

	Difference-in- Difference Estimate, Probit				
	Dependent variable=1 If household was non-price credit rationed				
	No Controls	Province FE	No-attrition Households	With Controls	With Controls and Province FE
	(1)	(2)	(3)	(4)	(5)
Title × Year=2015	0.141*** (0.028)	0.121*** (0.025)	0.133*** (0.028)	0.111*** (0.028)	0.107*** (0.028)
Year=2015	-0.083*** (0.018)	-0.054*** (0.016)	-0.082*** (0.018)	-0.033* (0.018)	-0.030 (0.019)
Title	-0.105*** (0.020)	-0.180*** (0.026)	-0.097*** (0.021)	-0.067*** (0.022)	-0.233*** (0.034)
Whether household was located in the reform experimental zone				-0.023 (0.016)	0.081*** (0.019)
Total area of cultivated land				-0.004*** (0.001)	0.001 (0.001)
Age of household head				-0.003*** (0.001)	-0.002*** (0.001)
Years of education of household head				-0.012*** (0.003)	-0.007** (0.003)
Household size				-0.001 (0.005)	-0.000 (0.005)
Share of working members in the household				-0.013 (0.026)	0.009 (0.028)
Share of non-agricultural income				0.104*** (0.028)	0.041 (0.031)
Ln(value of household productive assets)				0.031*** (0.005)	0.021*** (0.006)
Whether the household owns a car				-0.026 (0.030)	-0.048 (0.030)
Whether the household experienced consumption shocks during current year				0.048*** (0.015)	0.033** (0.016)
Distance to nearest bank				0.035*** (0.002)	0.043*** (0.003)
Province fixed effects	No	Yes	No	No	Yes
Household level control variables	No	No	No	Yes	Yes
Prob>Wald chi <sup>2</sup>	0.000	0.000	0.000	0.000	0.000

Pseudo R <sup>2</sup>	0.012	0.148	0.010	0.142	0.239
Observations	3183	3183	3135	2999	2831

*Notes:* 1. Marginal effects are estimated at sample mean of regressors.

2. Robust standard errors are in parentheses.

3. \*, \*\*, \*\*\* indicate statistical significance at 10%, 5% and 1% levels, respectively.

**Table 12a. Effects of Land Titling on 5 Credit Rationing Types (Marginal Effects)**

	Difference-in- Difference Estimate, Multinomial Logit									
	PRB	PQR	TQR	DSR	PRNB	PRB	PQR	TQR	DSR	PRNB
	No Controls	No Controls	No Controls	No Controls	No Controls	With Controls & Province FE	With Controls & Province FE	With Controls & Province FE	With Controls & Province FE	With Controls & Province FE
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Title × Year=2015	0.000	0.002	0.000	0.059***	-0.061***	0.000	0.002	0.000	0.026***	-0.028***
	(0.001)	(0.003)	(0.000)	(0.016)	(0.016)	(0.001)	(0.004)	(0.000)	(0.007)	(0.008)
Year=2015	0.000	-0.000	0.000	-0.020**	0.020**	0.000	0.000	0.000	-0.004	0.003
	(0.001)	(0.002)	(0.000)	(0.010)	(0.010)	(0.001)	(0.002)	(0.000)	(0.005)	(0.005)
Title	0.002**	-0.015***	-0.000	-0.048***	0.061***	0.003***	-0.016***	-0.000	-0.015*	0.028***
	(0.001)	(0.003)	(0.000)	(0.017)	(0.018)	(0.001)	(0.005)	(0.000)	(0.008)	(0.010)
Whether household was located in the reform experimental zone						-0.002***	0.003	-0.000*	-0.010*	0.009
						(0.001)	(0.003)	(0.000)	(0.006)	(0.007)
Total area of cultivated land						0.000	0.000	-0.000	0.001***	-0.001***
						(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Age of household head						-0.000	-0.000	-0.000*	-0.000	0.000*
						(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Years of education of household head						-0.000	-0.001**	0.000	-0.001	0.002**
						(0.000)	(0.000)	(0.000)	(0.001)	(0.001)
Household size						0.000*	-0.001	-0.000	0.003**	-0.002
						(0.000)	(0.001)	(0.000)	(0.001)	(0.002)
Share of working members in the household						0.001	0.000	0.000**	0.005	-0.007
						(0.001)	(0.003)	(0.000)	(0.007)	(0.008)
Share of non-agricultural income						0.002**	0.010***	0.000*	0.015*	-0.028***
						(0.001)	(0.003)	(0.000)	(0.008)	(0.009)
Ln(value of household productive assets)						-0.000	0.001	-0.000	0.005***	-0.006***
						(0.000)	(0.001)	(0.000)	(0.001)	(0.002)
Whether the household owns a car						0.000	0.003	-0.000***	-0.013*	0.010
						(0.001)	(0.003)	(0.000)	(0.007)	(0.008)
Whether the household experienced consumption shocks during current year						0.001	0.003	0.000	-0.012***	0.009*
						(0.000)	(0.002)	(0.000)	(0.004)	(0.005)
Province fixed effects	N	N	N	N	N	Y	Y	Y	Y	Y
Household level control variables	N	N	N	N	N	Y	Y	Y	Y	Y
Log-Likelihood	-2091.343					-1974.206				

Pseudo R <sup>2</sup>	0.190	0.217
Total observations	3221	3116

*Notes:*

1. Marginal effects are estimated at sample mean of regressors.
2. Robust standard errors are in parentheses.
3. \*, \*\*, \*\*\* indicate statistical significance at 10%, 5% and 1% levels, respectively.
4. PRB=Price-Rationed Borrower, PQR=Partial quantity rationed, TQR=Total quantity rationed, DSR=Demand side rationed (including transaction cost rationed and risk rationed), PRNB=Price-rationed non-borrower.

**Table 12b. Effects of Land Titling on 4 Credit Rationing Types (Marginal Effects)**

	Difference-in- Difference Estimate, Multinomial Logit							
	PR	PQR	TQR	DSR	PR	PQR	TQR	DSR
	No Controls	No Controls	No Controls	No Controls	With Controls & Province FE	With Controls & Province FE	With Controls & Province FE	With Controls & Province FE
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Title×Year=2015	-0.018*** (0.005)	0.010** (0.004)	0.000 (0.000)	0.007*** (0.002)	-0.017*** (0.005)	0.010** (0.005)	0.000 (0.000)	0.007*** (0.002)
Year=2015	0.009*** (0.003)	-0.007** (0.003)	-0.000** (0.000)	-0.003** (0.001)	0.008** (0.003)	-0.007** (0.003)	-0.000** (0.000)	-0.001 (0.001)
Title	0.037*** (0.005)	-0.029*** (0.004)	0.000 (0.000)	-0.008*** (0.002)	0.041*** (0.007)	-0.034*** (0.006)	-0.000 (0.000)	-0.007*** (0.002)
Whether the village is located in reform experimental zone					-0.005 (0.004)	0.006* (0.004)	-0.000 (0.000)	-0.001 (0.001)
Total area of cultivated land					-0.000 (0.000)	0.000 (0.000)	-0.000** (0.000)	0.000* (0.000)
Age of household head					0.000* (0.000)	-0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)
Years of education of household head					0.001** (0.001)	-0.001** (0.001)	0.000 (0.000)	-0.000* (0.000)
Household size					0.001 (0.001)	-0.002* (0.001)	-0.000 (0.000)	0.001** (0.000)
Share of household members in the labor force					-0.005 (0.005)	0.002 (0.004)	0.000** (0.000)	0.003* (0.002)
Share of income from non-agricultural operations					-0.016*** (0.005)	0.012*** (0.004)	-0.000 (0.000)	0.004* (0.002)
Ln(household productive asset value)					-0.003** (0.001)	0.002 (0.001)	0.000 (0.000)	0.001*** (0.000)
Whether the household owns a car					0.002 (0.005)	0.001 (0.005)	-0.000*** (0.000)	-0.002 (0.002)
Whether the household experience consumption shocks during current year					-0.002 (0.003)	0.004 (0.003)	0.000* (0.000)	-0.003*** (0.001)
Province fixed effects	N	N	N	N	Y	Y	Y	Y
Household level control variables	N	N	N	N	Y	Y	Y	Y
Log-Likelihood	-1684.512				-1608.155			
Pseudo R <sup>2</sup>	0.170				0.192			

Total observations	3178	3073
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*Notes:*

1. Marginal effects are estimated at sample mean of regressors.
2. Robust standard errors are in parentheses.
3. \*, \*\*, \*\*\* indicate statistical significance at 10%, 5% and 1% levels, respectively.
4. PR=Price-Rationed, PQR=Partial quantity rationed, TQR=Total quantity rationed, DSR=Demand side rationed (including transaction cost rationed and risk rationed).