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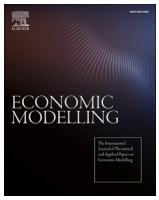

Can land transfer relax credit constraints? Evidence from China☆

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ABSTRACT

Although many studies have examined what drives credit constraints and their negative impact, evidence on the mechanism of relaxing credit constraints is scarce. This paper explores effective solutions to help households improve their access to credit. Using the China Family Panel Studies data from 2018, we employ an endogenous switching probit model to examine whether and to what extent land transfer can ease credit constraints. We find that households that transfer their land in or out are, respectively, 31.4% or 21.4% less credit constrained than those that do not. Participation in land transfers can improve borrowers' financial situations through income increases and pledging assets as collateral, alleviating both formal and informal credit constraints. Our results suggest that any government initiatives to promote the efficiency of land transfer to ease credit constraints can help boost economic growth in China.

1. Introduction

Traditional financial institutions are reluctant to lend to poor and low-income households due to a lack of collateral and opacity information (Menkhoff et al., 2012). Although such households can borrow credit from banks through group lending schemes and are jointly liable for their debts (Karlan, 2007), obtaining formal credit in the underdeveloped rural areas of China is challenging. The existing literature extensively discusses the determinants of credit constraints (CC), suggesting that several household demographic factors, including age, education, household size, and income, significantly determine the likelihood of obtaining credit access (Ali et al., 2014; Chandio and Jiang, 2018). Small-scale farmers with low income and education face more CC. Furthermore, some loan-related factors, such as required collateral, high-interest rate, delay in loan disbursement, or complicated loan procedure and documentation, can reduce accessibility to formal credit (Chandio et al., 2017; Chandio and Jiang, 2018).

Previous studies have demonstrated the impact of CC on agricultural investments (Ali et al., 2014), productivity (Guirkinger and Boucher, 2008; Hu et al., 2021), household income (Dong et al., 2012; Zhang et al., 2018; Li et al., 2019; Peng et al., 2020), labor productivity (Zhang et al., 2021), consumption expenditure (Li et al., 2016; Zhao et al., 2014) and entrepreneurship (Cai et al., 2018; Weng et al., 2020). The results show that credit constrained rural households may be unable to purchase the required agricultural inputs, resulting in decreased production, income, and consumption. Thus, alleviating CC can improve agricultural production investments and welfare for rural farmers. As rural farmlands are often exclusive and valuable resources for rural households, the question is still open to debate regarding how rural households can take advantage of their farmlands to improve their credit access. The mechanism of relaxing the CC by leveraging land rental markets and relevant evidence is scarce; therefore, this paper aims to provide insights into this question.

The growing literature suggests that through the development of the farmland rental market, land transfers could advance the efficiency of farmland allocation and production (Carter and Olinto, 2003; Ali et al., 2014), potentially improving rural households' access to credit. On the one hand, households might transfer farmland to increase production efficiency, taking advantage of economies of scale and increasing their farming income. On the other hand, households with low land efficiency can transfer their farmlands out to engage in nonfarm activities rather than cultivate the farmland themselves; thus, they can earn

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nonagricultural income (Stampini and Davis, 2009; Zhang et al., 2018). Thus, the income effects of land transfer activities can increase their repayments and decrease the default risk of households, reducing the likelihood of being credit constrained.

In light of the benefits of land transfer for rural households, governments in different countries have put substantial efforts into developing farmland rental markets (Li et al., 2020; Varga, 2020). Chandio and Jiang (2018) suggest that farming households with land ownership are less likely to suffer CC as farmland ownership status can be considered collateral to obtain formal credit. In particular, farmers with larger landholdings have easier access to credit as their loans are more collateralized and secured. Unlike in other countries where farmland is privately owned, most rural land in China is owned by village collectives, so rural households are likely to be credit constrained due to a lack of collateral. Therefore, the Chinese government has clarified property rights by separating operational land rights from contractual rights and ownership, so the transfer of farmland operational rights has been legalized since 2014 (Wang and Zhang, 2017). Furthermore, the Chinese government has allowed operational land rights to be pledged as physical collateral to obtain formal credit since 2016. Such actions tend to reduce banks' credit risk as they can sell the collateral to cover their losses if the borrowers fail to repay loans, increasing the accessibility to formal sources of credit.

This paper examines whether and to what extent land transfer can reduce the CC of Chinese households using survey data from the China Family Panel Studies (CFPS) 2018. We employ an endogenous switching probit (ESP) model to address endogeneity concerns. Our results show that land transfer in and out can significantly alleviate CC by 31.4% and 21.4%, respectively. To assess the impact of land transfers on different types of CC. We classify the CC into formal and informal ones. Our results suggest that participation in land transfer activities significantly decreases the probability of being formal and informal credit constrained. Moreover, the impacts of transferring on formal and informal financial constraints are more profound than the impacts of transferring out. Households involved in land transfers have a lower likelihood of being credit constrained than those that transfer the farmland out (1.6% lower for formal CC (FCC) and 8.7% lower for informal CC (ICC)).

This paper's contribution is threefold. First, our paper contributes to the existing literature on the determinants of CC. Consistent with Ali et al. (2014) and Chandio and Jiang (2018), our results confirm that household characteristics, such as education, gender, and household income, determine the likelihood of being credit constrained. More importantly, our research provides evidence of a significantly negative relationship between land transfer activities and CC. To the best of our knowledge, this is the first paper that investigates the interlink between CC and land transfer in the context of rural land reform in China. Second, our research extends the literature on the impact of land transfer by studying its impact on the financial wellbeing of Chinese households. The results suggest that households involved in land transfer activities are less likely to suffer CC, indicating that participation in land transfers is an efficient approach to improving credit access. Third, the extant literature mainly addresses FCC (Chandio and Jiang, 2018; Stampini and Davis, 2009). Unlike previous studies, we consider both FCC and ICC in our paper, as households tend to seek informal lending due to a lack of access to adequate formal credit. Moreover, previous studies focus on alleviating formal credit by removing supply-side restrictions on potential borrowers' credit access. Our research tends to provide solutions to ease CC by improving the financial situations of the borrowers' side. Our results suggest that land transfer activities allow households to increase on- and off-farm income and offer assets as collateral, alleviating both forms of CC to meet their financial needs.

Our research has substantial policy implications. First, the existing literature shows that inadequate access to credit adversely impacts households' welfare (Zhao et al., 2014; Li et al., 2016, 2019), so government policies have an essential role in facilitating agricultural lending. Operational rights of rural farmland are separated from contracting rights and permitted to be transferred since the rural land reform, facilitating a new channel to access formal credit, addresses the imperfections of the agricultural credit market. Second, the Chinese government could take remedial measures (e.g., reducing transaction costs and eliminating supply-side constraints in the land rental market) to promote the efficiency of land transfer to improve Chinese households' access to credit. Third, as poor households cannot escape poverty because they are credit constrained, land transfers could help households with rural farmlands get out of rural poverty in many developing regions (Varga, 2020). Specifically, land transfers could help credit-constrained households to improve agricultural productivity and increase participation in nonagricultural activities to increase aggregate income. This arrangement could improve access to credit to reduce rural poverty, boosting the welfare of rural households and stimulating economic growth in the rural areas of China.

The remainder of the paper is structured as follows. Section 2 outlines our hypotheses, and Section 3 describes data collection and definitions of variables used in our empirical analysis. Section 4 presents our main results, and Section 5 concludes.

2. Analytical framework and hypothesis development

The existing literature has extensively discussed the factors influencing CC. In most cases, households are credit-constrained due to low-income levels and a lack of collateral (Boucher et al., 2009; Ali et al., 2014; Chandio and Jiang, 2018); however, few studies have articulated the mechanisms of how land transfer can relax CC. Land transfer activities can alleviate CC through income or collateral mechanisms.

Fig. 1 illustrates the analytical framework of these two mechanisms in the relationship between land transfer and CC. First, the income mechanism applies to both land transfers in and out. Land transfers can improve land use efficiency and reduce the cost of agricultural production, which subsequently improves farm income (Zhang et al., 2018; Fei et al., 2021), while land transfer out enables households to obtain not only stable rental income but additional sources of income from off-farm work (Zhang et al., 2018; Peng et al., 2020). Thus, increasing household income could reduce the probability of Chinese households being credit constrained from formal and informal lending as default risk, and costs are much lower (Martey et al., 2019). Second, transfer in activities improve access to formal credit through a collateral mechanism as it enables Chinese households to pledge operation rights as collateral.

Outward land transfers can help rural farmers develop and expand nonfarm employment, obtaining multiple sources of nonfarming income. Rural farmers tend to reduce the scale of agricultural production by transferring out farmlands to allocate more time to off-farm activities. Farm households may invest in nonfarm business opportunities to become entrepreneurs (Nagler and Naudé, 2017). Alternatively, they can quit agricultural production to free up the agricultural labor force and then immigrate to cities where they can find stable employment (Che, 2016; Su et al., 2018). They can obtain stable rental income from transferring out farmlands and additional sources of income from off-farm work (Zhang et al., 2018; Peng et al., 2020). Households with different nonagricultural incomes from transferring farmlands out are likely to increase their probabilities of repayment and can thus more easily obtain credit from formal and informal lending channels. Therefore, we hypothesize that land transfer out can relax the CC of Chinese households due to increased household income from off-farm work.

H1. Households that transfer farmlands out are less likely to be credit-constrained than those that do not.

Inward land transfers enable farming households to expand their agricultural production scale, increasing their agricultural income and welfare. Qiu et al. (2020) show that participation in farmland transfer in can increase agricultural productivity due to economies of scale. Similarly, Fei et al. (2021) suggest that the land transfer in can significantly improve land use efficiency, increasing the production outputs of unit

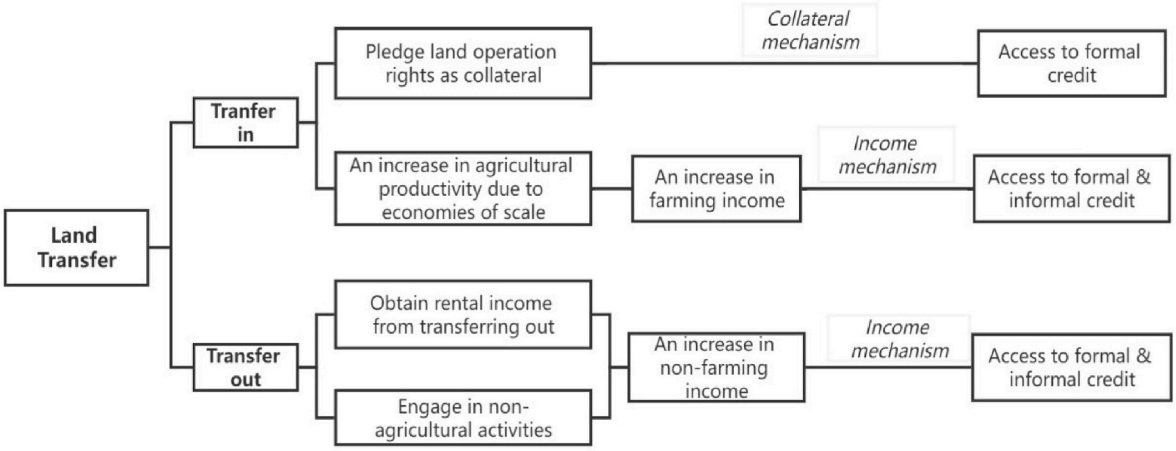

Fig. 1. The collateral and income effects of land transfers on access to formal/informal credit.

land as the farmlands are transferred to high-productive households (Chamberlin and Ricker-Gilbert, 2016; Nilsson, 2019). The efficient allocation of farm inputs and the adaption of modern agricultural technologies on a larger production scale facilitates Chinese farmers to reduce the cost of agricultural production, which subsequently improves their farm income (Zhang et al., 2018). Households with high-income levels are less likely to be under CC as default risk and costs are much lower (Martey et al., 2019). Therefore, we hypothesize that inward land transfer can relax Chinese households' CC due to the positive income effects of increased agricultural production scale and efficiency.

H2. Households involved in inward land transfers are less likely to be under CC than those not involved.

From the above discussion, land transfer in can reduce the probability of Chinese households being credit constrained through income mechanisms. Furthermore, the new "three rights separation system" has separated operational rights from their ownership and contractual rights since the Chinese rural land reform in 2014. Farm households can pledge land operation rights as collateral to obtain credit from financial institutions after transferring the farmlands in, which can address the issues of lacking collateral. However, they do not own the farmlands, which can improve formal credit accessibility through the collateral mechanism. Therefore, we hypothesize that land transfer has a greater impact on CC as it can alleviate them through collateral and income mechanisms.

H3. Households transferring farmlands in are more likely to have access to credit than those participating in land transfer out.

3. Data collection and variable definitions

3.1. Data collection

This paper's data are from the 2018 CFPS, collected by the Institute of Social Science Survey of Peking University. The CFPS is a longitudinal survey of Chinese communities, families, and households across 25 provinces. It collects detailed information on Chinese households' characteristics, land transfer activities, and access to credit. After deleting observations with missing information, we obtain the data from 11,472 households for our empirical analysis. Table 1 shows the sample matrix of CC and land transfer activities. Our sample comprises 5604 rural households (48.85%) and 5868 urban households (51.15%).[1] Only 842 (627 rural and 215 urban) and 1477 households (824 rural and 653 urban) choose to transfer farmlands in and out, respectively. Of these, 577 (428 rural and 149 urban) and 1160 (666 rural and 494 urban) households involved with land transfer activities obtained credit, whereas the remaining households are credit constrained. Among those that transfer in farmlands, 54 households (39 rural and 15 urban) are credit rationed by banks, and 231 households (174 rural and 57 urban) failed to borrow money from their relatives and friends.[2] Additionally, 317 (158 rural and 159 urban) out of 1477 households that transfer out farmlands do not have access to credit. 59 households (35 rural and 24 urban) are restricted from formal credit, and 277 households (134 rural and 143 urban) cannot access credit from informal channels. In contrast, 2148 (1044 rural and 1104 urban) and 2096 (1085 rural and 1011 urban) households not involved in transfer in and out are credit constrained, respectively. We also find that rural households are more likely to be credit constrained, particularly those that do not participate in land transfer. Access to finance from banks and credit cooperatives is out of reach for 213 rural vs. 166 urban households who choose not to transfer in and for 217 rural vs. 157 urban households who choose not to

Table 1
Credit constraints and land transfer.

			Land Transfer In		Land Transfer Out	
			No	Yes	No	Yes
CC	No	Rural	3933	428	3695	666
		Urban	4549	149	4204	494
	Yes	Rural	1044	199	1085	158
		Urban	1104	66	1011	159
FCC	No	Rural	4764	588	4563	789
		Urban	5487	200	5058	629
	Yes	Rural	213	39	217	35
		Urban	166	15	157	24
ICC	No	Rural	4086	453	3849	690
		Urban	4657	158	4305	510
	Yes	Rural	891	174	931	134
		Urban	996	57	910	143
	Total		10,630	842	9995	1477

Note: CC: Credit constraints; FCC: Formal CC; ICC: Informal CC.

[1] The rural–urban (town) classification of CFPS is based on the geographical locations of households. Thus, rural households in urban areas may have been allocated farmlands and are willing to transfer them in/out. Table 1 confirms that urban and rural households participate in land transfer activities.

[2] In our sample, some households face both FCC and ICC. The results are unchanged after we exclude them from our sample.

transfer out. Table 1 indicates that land transfer can somewhat relax CC faced by Chinese households, as most households participating in land transfer activities have access to credit. Moreover, households that transfer in farmlands are less likely to be credit constrained as only 12.33% of them are credit constrained, compared to 15.12% of those that transferred farmlands out.

3.2. Variable definitions

To conduct our research, we need to employ appropriate proxies to measure CC and land transfer activities. CFPS has a set of questions designed to measure the difficulty of credit accessibility and different CC. We define households as under CC if they tried obtaining credit to purchase a house or for business operations but were rejected. To ensure that we measure the CC more accurately, we consider two measurements of both formal and informal constraints since borrowing from friends and relatives is one of the dominant alternative lending channels for Chinese rural households (Turvey and Kong, 2010). Households also answered who rejected them when they tried to obtain credit. Households are considered formally credit constrained if they applied for bank loans and were rejected. If households were rejected by their friends or relatives, then they are informally credit constrained. The land transfer is measured as a binary variable. The households were asked whether they had transferred farmlands in/out in the last 12 months, no matter whether they had paid or received rent. Following the existing literature on the determinants of land transfer, we include age, gender, marriage status, education, household size, house value, other houses, financial products, nonagricultural income, and regional dummies as control variables (Ali et al., 2014; Su et al., 2018; Li et al., 2019; Jiang et al., 2019; Rahman, 2010; Peng et al., 2020). Table 2 shows the definitions and summary statistics of variables used in the empirical analysis.

4. Methodology

Land transfer variables are potentially endogenous as households themselves choose whether to transfer farmlands in or out; thus, both observable factors (e.g., age, gender, education, and house value) and unobservable factors (e.g., motivations, social and psychological well-being of farmers) may affect households' decisions of participation in land transfer activities (Ali et al., 2014; Su et al., 2018; Li et al., 2019). The above self-selection biases, endogeneity, and unobserved heterogeneity associated with land transfer activities can produce biased estimation results. Therefore, we employ an ESP model to assess the impact of land transfers on CC, as it can analyze the differences in access to credit between households involved in land transfer and those that are not, addressing the selection bias resulting from both observed and unobserved heterogeneity. ESP is a two-step estimation approach comprising an outcome function that describes the behavior of an agent with two binary outcomes and a selection function T_i that determines the regimes that the agent faces; it can estimate two outcome equations, one for land transfer and one for no land transfer (Lokshin and Sajaia, 2011; Li et al., 2020).

In the first stage, we model the determinants of households' decisions on land transfer. T^*_{0i} represents the utility that households obtain without land transfer and T^*_{1i} represents the utility that households obtain from land transfers. Let T^*_i be the difference in expected benefits between land transfer and no land transfer. We assume that households are rational and only choose to transfer the farmland in/out if the expected benefits of transferring in/out farmland are greater than not transferring in/out—that is $T^*_i = T^*_{1i} - T^*_{0i} = \gamma Z_i + u_i > 0$—otherwise they do not choose to transfer farmland in/out. Since T^*_i is unobserved, it can be expressed as a function of the observed household-level characteristics, denoted as Z_i, in a latent model as follows:

$$T_i = 1 \quad if\ \gamma Z_i + u_i > 0$$

Table 2
Variable definitions and descriptive statistics.

Variables	Description	Mean	Std. Dev.	Min	Max
CC	1 if households need the credit but do not have access to it, otherwise 0	0.209	0.406	0	1
FCC	1 if households applied for bank loans but were rejected, otherwise 0	0.036	0.186	0	1
ICC	1 if households borrow from their relatives and friends but were rejected, otherwise 0	0.184	0.388	0	1
Land Transfer In	1 if households transfer the farmland in, otherwise 0	0.072	0.259	0	1
Land Transfer Out	1 if households transfer the farmland out, otherwise 0	0.128	0.334	0	1
Age	Age of the household head in years	50.187	15.076	18	93
Gender	1 if the household head is male, otherwise 0	0.524	0.499	0	1
Education	The number of years in the school	7.752	4.906	0	23
Marital Status	1 if the household head got married, otherwise 0	0.821	0.383	0	1
House Value	The value of the house in 100,000 CNY	51.858	115.121	0.01	5000
Another House	1 if households have another house, otherwise 0	0.195	0.396	0	1
Financial Products	1 if households have financial products	0.059	0.235	0	1
Household Size	Number of people in a household	3.575	1.910	1	21
Nonagricultural Income	Income earned from nonfarm activities in 1000 CNY	81.56	188.84	0	9158.80
Eastern Region	1 if households live in eastern China, otherwise 0	0.235	0.424	0	1
Central Region	1 if households live in central China, otherwise 0	0.279	0.449	0	1
Western Region	1 if households live in western China, otherwise 0	0.146	0.353	0	1
Expenditure on Eating Out	Monthly expenditure on eating out in 1000 CNY	0.279	0.573	0	10

Note: CC: Credit constraints; FCC: Formal CC; ICC: Informal CC.

$$T_i = 0 \quad if\ \gamma Z_i + u_i \leq 0$$

T_i is a binary variable that equals 1 for the households who transfer farmland in/out; otherwise, it is 0. Z_i is a vector of explanatory variables (e.g., age, gender, education, household size, marriage status, house value, other houses, nonfarm income, and financial products) which impact the decisions of land transfer. γ is a vector of parameters, and u_i is an error term with zero mean and normal distribution.

In the second stage of the EPS model, we estimate two regimes explaining whether the household experienced CC based on the results of the selection function. More specifically, they are represented as follows:

$$regime1: y_{1i}^{*} = \beta_1 X_{1i} + \varepsilon_{1i} \quad y_{1i} = I\left(y_{1i}^{*} > 0\right)$$

$$regime\ 2: y_{0i}^{*} = \beta_0 X_{0i} + \varepsilon_{0i} \quad y_{0i} = I\left(y_{0i}^{*} > 0\right)$$

The observed variable y_i is defined as

$$y_i = y_{1i} \quad if\ T_i = 1$$

$$y_i = y_{0i} \quad if\ T_i = 0$$

where y_{1i}^{*} and y_{0i}^{*} are latent variables representing the likelihood of households being credit constrained. Neither y_{1i}^{*} and y_{0i}^{*} can be observed directly; they are measured as the observed binary variables y_{1i} and y_{0i}, respectively. y_{1i} takes the value 1 if households face CC; otherwise, it is 0. X_{1i} and X_{0i} are vectors of exogenous variables (e.g., age, gender, education, marital status, household size, house value, other houses, nonfarm income, and financial products) which tend to affect the propensity of being credit constrained; β_1 and β_0 are the vector of parameters, and ε_{1i} and ε_{0i} are error terms.

According to Lokshin and Sajaia (2011), the effect of the treatment is

$$TT(x) = Pr(y_1 = 1 | T = 1, X = x) - Pr(y_0 = 0 | T = 1, X = x)$$

$$TT(x) = \frac{\Phi_2(X_1\beta_1, Z\gamma, \rho_1) - \Phi_2(X_0\beta_0, Z\gamma, \rho_0)}{F(z\gamma)}$$

where F is the cumulative function of the univariate normal distribution. $Pr(y_1 = 1 | T = 1, X = x)$ refers to the likelihood of being credit constrained if households transfer the farmland in/out in an observed context. $Pr(y_0 = 1 | T = 1, X = x)$ refers to the probability of being credit constrained if households do not choose to transfer farmland in/out in a counterfactual context.

The average treatment effect on the treated (ATT), the mean effect of the treatment (land transfer out/in) on those who experience CC is

$$ATT = \frac{1}{N_T} \sum_{i=1}^{N_T} TT(x_i)$$

For model identification, the EPS model requires that at least one instrument variable (IV) be included in estimating the first stage equation. In this paper, the expenditure on eating out is selected as the IV. Households with higher eating-out expenditures tend to rely less on "subsistence" agriculture and might have turned from smallholders to commercial farmers or even agricultural entrepreneurs (Varga, 2020). That is, they are less likely to engage in land transfer; hence, we expect the expenditure on eating out to negatively affect households' decisions to land transfer, but it is not necessarily related to CC.

To test the instrument validity and reliability of the IV, we regress constraints variables (CC, FCC, and ICC) on the IV associated with control variables, respectively. The Probit estimates reported in Appendix Table A1 show that the coefficients of the instrument are insignificant even at the 10% level in the credit constraint specifications. Meanwhile, the under-identification test on the IV is conducted in the land transfer specifications. The results of Chi-square tests in Tables 3–5 are statistically significant and negative, as expected, indicating that the null hypothesis that the instrumental variable is weak is rejected. Therefore, expenditure on eating out can serve as a valid IV in the ESP model.

5. Empirical results

The second and fifth columns of Tables 3–5 present the results showing the determinants of land transfer in/out, respectively. The third and fourth columns of Tables 3–5 show the estimates of variables affecting the probability of being credit constrained for households with and without transfer in, respectively. The sixth and seventh columns of 3–5 demonstrate the factors affecting households' access to credit with and without transfer out, respectively. The estimates for the ATT, showing the impact of land transfers on CC, are presented in Table 6.

Table 3
ESP estimates of land transfer and credit constraints.

Variables	Land Transfer Out	Whether Experienced CC		Land Transfer In	Whether Experienced CC	
		Transfer Out	No Transfer Out		Transfer In	No Transfer In
House Value (10,000 CNY)	−0.001***	−0.000	−0.001***	−0.003***	−0.005***	−0.001***
	(0.000)	(0.001)	(0.000)	(0.001)	(0.002)	(0.000)
Other House	0.163***	−0.074	0.055*	0.096**	−0.013	−0.003
	(0.037)	(0.215)	(0.032)	(0.047)	(0.127)	(0.034)
Financial Products	−0.293***	0.329	−0.314***	−0.233*	0.152	−0.204***
	(0.081)	(0.383)	(0.061)	(0.131)	(0.410)	(0.065)
Household Size	−0.005	0.028	0.031***	0.069***	0.024	0.062***
	(0.009)	(0.023)	(0.007)	(0.010)	(0.038)	(0.007)
Nonfarm Income (CNY)	−0.002	−0.009	−0.018*	−0.046***	−0.077**	−0.037***
	(0.013)	(0.035)	(0.011)	(0.015)	(0.035)	(0.011)
Age	0.007***	−0.020***	−0.007***	−0.008***	−0.023***	−0.015***
	(0.001)	(0.005)	(0.001)	(0.002)	(0.005)	(0.001)
Gender	0.010	0.112	0.041	0.196***	0.111	0.116***
	(0.030)	(0.085)	(0.025)	(0.038)	(0.111)	(0.026)
Education	−0.018***	−0.003	−0.015***	−0.031***	0.008	−0.017***
	(0.004)	(0.027)	(0.003)	(0.005)	(0.022)	(0.003)
Marriage status	−0.029	0.078	0.011	0.408***	0.411**	0.154***
	(0.041)	(0.107)	(0.035)	(0.063)	(0.207)	(0.038)
IV: Expenditure on Eating Out	−0.052*			−0.238***		
	(0.029)			(0.055)		
Constant	−1.295***	0.363	−0.033	−1.007***	0.105	0.121
	(0.152)	(2.776)	(0.128)	(0.192)	(1.104)	(0.137)
Region Dummies	Yes	Yes	Yes	Yes	Yes	Yes
$Chi^2(1)$ Test for IV	3.28*			18.67***		
Observations	11472			11472		

Notes: Robust standard errors in parentheses. *, **, and *** indicate significance levels at 10%, 5%, and 1%, respectively. CC: Credit constraints.

Table 4
ESP estimates of land transfer and formal credit constraints.

Variables	Land Transfer Out	Whether Experienced FCC		Land Transfer In	Whether Experienced FCC	
		Transfer Out	No Transfer Out		Transfer In	No Transfer In
House Value (10000 CNY)	−0.000**	−0.000	−0.000	−0.003***	0.002	−0.000
	(0.000)	(0.001)	(0.000)	(0.001)	(0.004)	(0.000)
Other House	0.160***	0.233**	0.073	0.092*	−0.185	0.085
	(0.038)	(0.112)	(0.071)	(0.048)	(0.222)	(0.058)
Financial Products	−0.329***	−0.545	−0.035	−0.214	0.635	−0.031
	(0.082)	(0.334)	(0.163)	(0.133)	(0.531)	(0.110)
Household Size	−0.007	0.014	0.034**	0.065***	0.010	0.053***
	(0.009)	(0.029)	(0.017)	(0.010)	(0.067)	(0.014)
Nonfarm Income (CNY)	0.008	−0.055	−0.004	−0.045***	−0.045	−0.023
	(0.013)	(0.043)	(0.020)	(0.016)	(0.072)	(0.024)
Age	0.005***	−0.007*	−0.008	−0.009***	−0.011	−0.012***
	(0.001)	(0.004)	(0.005)	(0.002)	(0.010)	(0.002)
Gender	0.003	0.067	0.190***	0.193***	0.323	0.207***
	(0.031)	(0.098)	(0.070)	(0.038)	(0.218)	(0.048)
Education	−0.018***	0.014	−0.003	−0.028***	0.048	−0.004
	(0.004)	(0.014)	(0.009)	(0.005)	(0.033)	(0.008)
Marriage Status	−0.060	−0.065	0.050	0.405***	0.520	0.110
	(0.043)	(0.133)	(0.079)	(0.065)	(0.495)	(0.085)
IV: Expenditure on Eating Out	−0.097***			−0.265***		
	(0.034)			(0.058)		
Constant	−1.273***	−1.954***	−1.588***	−0.946***	−2.182	−1.425***
	(0.157)	(0.529)	(0.449)	(0.192)	(1.610)	(0.352)
Region Dummies	Yes	Yes	Yes	Yes	Yes	Yes
$Chi^2(1)$ Test for IV	8.14***			20.74***		
Observations	11472			11472		

Notes: Robust standard errors in parentheses. *, **, and *** indicate significance levels at 10%, 5%, and 1%, respectively. FCC: Formal credit constraint.

Table 5
ESP estimates of land transfer and informal credit constraints.

Variables	Land transfer out	Whether Experienced ICC		Land transfer in	Whether Experienced ICC	
		Transfer Out	No Transfer Out		Transfer In	No Transfer In
House Value (10000 CNY)	−0.001***	−0.000	−0.001***	−0.003***	−0.006***	−0.001***
	(0.000)	(0.001)	(0.000)	(0.001)	(0.002)	(0.000)
Other House	0.162***	−0.093	0.051	0.096**	−0.009	−0.015
	(0.038)	(0.228)	(0.032)	(0.047)	(0.124)	(0.034)
Financial Products	−0.308***	0.392	−0.332***	−0.256**	−0.198	−0.207***
	(0.080)	(0.402)	(0.062)	(0.129)	(0.377)	(0.067)
Household Size	−0.004	0.025	0.025***	0.070***	0.015	0.059***
	(0.009)	(0.024)	(0.007)	(0.010)	(0.038)	(0.007)
Nonfarm Income (CNY)	−0.001	0.005	−0.015	−0.046***	−0.063*	−0.035***
	(0.013)	(0.035)	(0.011)	(0.016)	(0.036)	(0.012)
Age	0.007***	−0.018***	−0.006***	−0.008***	−0.022***	−0.014***
	(0.001)	(0.005)	(0.001)	(0.002)	(0.005)	(0.001)
Gender	0.006	0.058	0.010	0.195***	0.068	0.083***
	(0.030)	(0.082)	(0.025)	(0.037)	(0.113)	(0.027)
Education	−0.018***	−0.008	−0.016***	−0.031***	−0.002	−0.019***
	(0.004)	(0.032)	(0.003)	(0.005)	(0.019)	(0.003)
Marriage status	−0.037	0.081	−0.001	0.408***	0.392**	0.150***
	(0.041)	(0.111)	(0.036)	(0.063)	(0.198)	(0.039)
IV: Expenditure on Eating out	−0.048*			−0.235***		
	(0.028)			(0.054)		
Constant	−1.300***	0.243	−0.112	−1.014***	−0.004	0.049
	(0.155)	(3.131)	(0.130)	(0.193)	(1.013)	(0.139)
Region Dummies	Yes	Yes	Yes	Yes	Yes	Yes
$Chi^2(1)$ test for IV	2.96*			19.01***		
Observations	11472			11472		

Notes: Robust standard errors in parentheses. *, **, and *** indicate significance levels at 10%, 5%, and 1%, respectively. ICC: Informal credit constraints.

5.1. Determinants of land transfer in/out

The second and fifth columns of Tables 3–5 show factors affecting Chinese households' land transfer decisions. We find a negative and statistically significant relationship between education and land transfer in/out, suggesting that poorly educated households are willing to participate in land transfer activities. The negative coefficients of house value and financial products variables indicate that wealthier households are less likely to participate in land transfer activities (Ali et al., 2014). Our findings indicate that the household heads' age has a heterogenous impact on the decisions of transfer in or out, which is consistent with (Zou et al., 2018), who suggest that younger household farmers are more likely to rent in the farmland as they have better health conditions and more incentives to expand production capacity. However, older people have more incentives to transfer their farmland out rather than cultivate it independently. The relationship between gender

Table 6
Treatment effects (ATT) of Land Transfer on Credit Constraints.

	CC			FCC			ICC		
	Obs	ATT	*t*-test	Obs	ATT	*t*-test	Obs	ATT	*t*-test
Transfer Out	1477	0.214	2.538**	1477	0.200	2.657***	1477	0.187	2.720***
Transfer In	842	0.314	2.891***	842	0.216	2.076**	842	0.274	2.764***

Note: *** indicates a significance level of 1%. ** indicates a significance level of 5%. * indicates a significance level of 10%. ATT: Average treatment effect on the treated; CC: Credit constraints; FCC: Formal CC; ICC: Informal CC.

and land transfer is significant and positive, indicating that male household heads may be more incentivized to transfer in farmland. Moreover, household size is a significant driver of households' decision to transfer in farmland. As agricultural production is more labor incentive in some developing countries, households with more workforce tend to transfer in farmland to increase their agricultural productivity by taking advantage of economies of scale.

In contrast, small households cannot cultivate their farmland due to labor shortages and are willing to rent the farmland out (Jiang et al., 2020). Marriage status tends to have a differential impact on households' decisions to transfer land. We find that married households have greater incentive to expand agricultural production scale by transferring in farmland but are unwilling to transfer out farmland. This finding is consistent with the finding that large household size increases the probability of transferring in farmland. Participation in nonfarm activities negatively correlates with land transfers, suggesting less incentive for households to rent farmland if they earn increased nonagricultural income. A possible explanation could be that they are willing to move to the city where they have more stable employment (Su et al., 2018; Peng et al., 2020). Finally, our results suggest that eating-out expenditures negatively affect the households' land transfer decision, implying that households who spend more are less likely to be involved in land transfer activities.

5.2. Determinant of credit constraints

As expected, households' age negatively correlates with the likelihood of being constrained. Our results are consistent with the findings of Chandio and Jiang (2018), who suggest that younger farmers are more likely to have inadequate access to credit as they usually have less savings than older households. We find that households with higher house values are less likely to face CC as they can use their houses as collateral or guarantees to obtain credit. Moreover, we can conclude that it is much easier for these households to access credit from formal and informal lending channels, although, based on the results in Tables 4 and 5 (columns 4 and 7), they are not involved in land transfer activities' however, households with more than one house are more likely to be credit rationed by banks. Increased debts from the purchase of another house might explain this. We find positive effects of household size on CC for households that choose not to participate in land transfers, which indicates that larger family size decreases the probability of obtaining credit. This result can be explained by the fact that they cannot use more labor force to increase farm production and engage in nonfarm business to increase their repayment ability by obtaining on- and off-farm income. Consistent with Li et al. (2020), the coefficients of the education variable are negative and significant, implying that households with better education have easier access to credit. Based on the results of Tables 3–5 (columns 6 and 7), households with more nonagricultural income appear to be more likely to have access to credit no matter whether they have rented their farmland in or out, as evidenced by a negative relationship between the nonfarm income variable and different measurements of CC. Family size has a significant and negative impact on access to credit. Compared with households with inward land transfers, larger households without transferring in farmland are more likely to be credit rationed, as seen in columns 6 and 7 of Tables 5 and 6 The coefficients of the financial product variable are significantly negative, implying that households with more financial assets tend to have an easier time obtaining credit. Our results are consistent with Martey et al. (2019), who suggest that wealthier households are less likely to suffer from CC.

5.3. Treatment effect of land transfer in/out on credit constraints

Results reported in Table 6 show the impact of land transfer in/out on the expected probability of being credit constrained. Based on the estimates of the first column of Table 6, we find that land transfers in and out reduce the likelihood of being credit constrained. In particular, households involved in land transfer in/out are 31.4% and 21.4% less likely to be rejected when obtaining credit, respectively. One possible explanation could be that land transfer allows households to generate different main sources of income growth. Transferring out allows them to engage in off-farm employment to improve nonfarm income, whereas transferring in enables them to improve their farm income by increasing production scale and efficiency (Peng et al., 2020). Thus, the income effects derived from land transfer activities help households to obtain credit from financial institutions and informal lending channels (e.g., relatives and friends). Moreover, we find the results remain significant after CC are classified into two types, formal and informal. More importantly, the impact of transfer in on the alleviation of CC exceeds that of transfer out. The ATT estimates show that households involved in land transfers in can be 1.6% less credit constrained by banks and 8.7% less constrained by relatives and friends than those that choose to transfer farmland out. In addition to the income effects of land transfer, transferring in enables households to apply for formal sources of credit, which the operational rights of the farmlands can collateralize. As the collateral can reduce the fractions of asymmetric information, financial institutions are willing to lend money out if the loans are secured by the collateral (Berger et al., 2011).

5.4. Robustness test

To verify the reliability of our results, we also estimate the treatment effects of participation in land transfer on access to credit using the propensity score matching (PSM) approach. We match households that engage in land transfer activities (the treatment group) with those that do not (the control group) based on similar characteristics. Table 7 presents the estimations of ATT effects. PSM estimates are consistent with our main findings that land transfer activities significantly and negatively affect the probability of being credit constrained; however, the magnitudes of ATT effects estimated in the PSM approach are relatively smaller than those obtained from the ESP models. More specifically, the results indicate that land transfer in and out decreases the probability of being constrained by 8.2% and 4.4%, respectively. This result can be explained by the fact that ESP can address both observed and unobserved selection bias while PSM only deals with the observed one.

To further test our hypotheses, we exclude urban households from our sample as whether the land transfer would help rural households ease the CC is of particular concern. Among 5604 rural households, 627 have transferred farmlands in, whereas 829 have transferred farmlands out. Consistent with our main findings, the ATT estimations shown in Table 8 indicate that land transfer activities positively impact the

Table 7
Treatment effects (ATT) of Land Transfer on Credit Constraints.

	CC			FCC			ICC		
	Obs	ATT	z-test	Obs	ATT	z-test	Obs	ATT	z-test
Transfer Out	1477	0.044	2.950***	1477	0.019	3.120***	1477	0.040	2.770***
Transfer In	842	0.082	3.750***	842	0.033	3.090***	842	0.082	3.850***

Note: *** indicates a significance level of 1%. ** indicates a significance level of 5%. * indicates a significance level of 10%. ATT: Average treatment effect on the treated; CC: Credit constraints; FCC: Formal CC; ICC: Informal CC.

Table 8
Treatment effects (ATT) of Land Transfer on Credit Constraints for Rural Households.

	CC			FCC			ICC		
	Obs	ATT	*t*-test	Obs	ATT	*t*-test	Obs	ATT	*t*-test
Transfer Out	829	0.193	1.966**	829	0.102	2.079**	829	0.200	2.089**
Transfer In	627	0.214	2.342**	627	0.241	2.088**	627	0.271	2.730***

Note: *** indicates a significance level of 1%. ** indicates a significance level of 5%. * indicates a significance level of 10%. ATT: Average treatment effect on the treated; CC: Credit constraints; FCC: Formal CC; ICC: Informal CC.

accessibility of agricultural credit for rural households. More importantly, we find that the effect of inward land transfers on easing FCC is more profound than outward land transfers. The results show that rural households that transfer in farmlands are 14% less likely to be rejected by financial institutions than those that transfer out.

6. Conclusion

This paper examines the impact of land transfers on CC using data from the CFPS collected by Peking University. Due to selection bias and endogeneity problems, we employ an endogenous switching regression model to eliminate these issues. Our findings show that being involved in land transfer activities can significantly relax the CC of Chinese households. Transferring in and out significantly decreases the likelihood of being credit constrained by 31.4% and 21.4%, respectively. We also classify CC into FCC and ICC and further investigate whether participation in land transfers can improve access to credit from both formal and informal channels. Our ATT estimations imply that both forms of CC can be alleviated regardless of transferring in or out. Moreover, we find that households that transfer in farmlands have a lower likelihood of being credit constrained than those that transfer out. In particular, land transfers in can increase accessibility to formal credit for rural households.

Our research reveals many important policy implications. This study highlights the importance of facilitating land transfer in alleviating CC. The Chinese government can continuously improve the public policy system of land transfer by developing corresponding land policies and regulations and promptly addressing political barriers to effective farmland transfer. In addition, our results suggest that the government would need to make greater efforts to develop the land rental market, reduce transaction fractions of land transfers, and consequently boost formal and informal lending. This can help rural households meet their credit needs to finance the purchase of agricultural inputs and boost consumption and investments, reducing rural poverty and income inequality in China. One limitation of our research is that we cannot examine the impact of predetermined land transfer decisions of households on their subsequent access to credit as follow-up household data in the 2020 CFPS survey is not available to be collected to support the analysis. We believe it would be interesting to study the persistent effects of land transfers on access to credit in future research.

Declaration of competing interest

The authors have no conflicts of interest to disclose.

Data availability

Data will be made available on request.

Appendix

Table A1
Probit model estimates for the validity of the instrumental variable.

	(1)	(2)	(3)
	CC)	FCC	IICC
House Value (10000 CNY)	−0.001***	−0.000	−0.001***
	(0.000)	(0.000)	(0.000)
Other House	−0.028	0.052	−0.044
	(0.035)	(0.058)	(0.036)
Financial Products	−0.169**	0.020	−0.181***
	(0.066)	(0.106)	(0.069)
Household Size	0.047***	0.041***	0.042***
	(0.008)	(0.013)	(0.008)
Nonfarm Income (CNY)	−0.025**	−0.015	−0.020
	(0.012)	(0.021)	(0.013)
Age	−0.015***	−0.011***	−0.014***
	(0.001)	(0.002)	(0.001)
Gender	0.072***	0.198***	0.025
	(0.028)	(0.047)	(0.028)

(*continued on next page*)

Table A1 (*continued*)

	(1)	(2)	(3)
	CC)	FCC	IICC
Education	−0.007**	0.007	−0.009**
	(0.003)	(0.006)	(0.004)
Marriage Status	0.085**	0.069	0.069*
	(0.039)	(0.068)	(0.040)
IV: Eating Out	0.009	0.031	0.009
	(0.026)	(0.039)	(0.027)
Constant	−0.093	−1.756***	−0.184
	(0.143)	(0.242)	(0.147)
Region Dummies	Y	Y	Y
N	11472	11472	11472
LR chi^2	445.48***	257.97***	319.5***

Note: CC: Credit constraints; FCC: Formal CC; ICC: Informal CC.

Table A2
Measures of the extent of balancing of the variables between the treatment group and control group in PSM

Panel A: Land Transfer Out					
Variable (matched)	Mean: Treated	Mean: Control	%bias	*t*-test	p-value
House Value (10000 CNY)	38.01	43.71	−4.9	−1.13	0.26
Other House	0.22	0.24	−4.1	−1.09	0.275
Financial Products	0.03	0.03	−0.3	−0.11	0.91
Household Size	3.61	3.50	5.7	1.59	0.111
Nonfarm Income (CNY)	10.42	10.43	0	−0.01	0.99
Age	53.32	53.25	0.5	0.13	0.898
Gender	0.54	0.54	−1.1	−0.29	0.769
Education	6.72	6.78	−1.5	−0.4	0.686
Marriage Status	0.83	0.82	2.7	0.72	0.472
region_centeral	0.27	0.27	−1.4	−0.37	0.71
region_west	0.30	0.28	3.6	0.97	0.331
region_northeast	0.15	0.17	−3.5	−0.95	0.341
Sample	Ps R^2	LR chi^2	p-value	Mean Bias	Med Bias
Unmatched	0.019	172.64	0.000	9.8	6.7
Matched	0.002	6.9	0.864	2.4	2.1
Panel B: Land Transfer In					
Variable (matched)	Mean: Treated	Mean: Control	%bias	*t*-test	p-value
House Value (10000 CNY)	22.00	21.84	0.2	0.11	0.914
Other House	0.19	0.19	0.6	0.12	0.901
Financial Products	0.01	0.01	1.2	0.45	0.653
Household Size	4.28	4.22	3.2	0.64	0.525
Nonfarm Income (CNY)	10.28	10.24	3	0.6	0.546
Age	50.04	50.82	−5.8	−1.27	0.205
Gender	0.60	0.59	2.2	0.45	0.655
Education	6.22	5.95	5.8	1.24	0.216
Marriage Status	0.93	0.93	−1.5	−0.39	0.698
region_centeral	0.25	0.26	−1.4	−0.28	0.780
region_west	0.39	0.38	2.8	0.55	0.582
region_northeast	0.13	0.12	3.4	0.73	0.466
Sample	Ps R^2	LR chi^2	p-value	Mean Bias	Med Bias
Unmatched	0.069	417.94	0	21.1	24.7
Matched	0.002	4.39	0.975	2.6	2.5

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