Interlinkage between Farmland Rental and Credit Markets in China

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Abstract

Capital inputs are by and large ignored in the study of farmland rental in previous literature. With the micro-data of rural household finance survey in year 2009, this paper empirically tests whether credit market promotes the development of farmland rental market in rural China. Results show that loans from banks promote the development of farmland rental market. Furthermore, farmers are more likely to use trade credit to alleviate credit constraints in the process of agricultural production and as a result, trade credit promotes the agricultural land rentals.

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Land sales and rental markets have been shown to contribute to economic growth in developing countries[1]. The development of land market promotes the reallocation of resources, leads to gains in agricultural productivity, and increases farmers' income and welfare.

China is no exception in spite of the fact that farmlands are owned collectively and that farmers are only allowed to transfer their use rights in land. Land rental has become more active since the adoption of the Household Responsibility System in 1978 and Farmland Leasing Law in 2002. An array of papers study the relationship of land rental and labor markets (Carter and Yao, 2002; Feng et al., 2010; Jin and Deininger, 2009; Yao, 2000). Nevertheless, the functioning land market is closely related to capital market yet capital inputs are by and large ignored in previous literature. Farmers in China cannot necessarily change the scale of agricultural production in the short run except through the land rental market. The development of financial market facilitates borrowing by farmers so that they may be able to increase inputs in the production process and to increase their outputs. In the meantime, capital provides a nest for agricultural production expansion and land rentals. For farmers to make a decision on whether to rent in farmland, whether they have financial constraints may be considered; for farmers who lease out their farmland, financial constraints may also apply since inadequate capital may partially contribute to the decision to rent out the land. Therefore, credit market in rural China are connected to capital market if farmers have financial constraints, whereas farmers in developing countries generally are confronted with credit constraints. This study fills the gap by investigating simultaneously credit and farmland rental markets.

[1] For example, Ethiopia, Mozambique and Nicaragua in Africa, and Vietnam, Laos and Cambodia in Asia (Benjamin and Brandt, 2002; Carter and Yao, 2002; Deininger, 2003; Deininger and Jin, 2005, 2008, 2009).

The objectives of the paper are 1) to investigate the prevalence of credit leasing in rural China; 2) to empirically test the interlinkage between land rental markets and credit markets with household survey data, and, 3) specifically to examine the use of trade credit in the land transfer transactions.

Data used are from the 2009 rural finance survey. Results show that loans from banks promote land rentals, thus establishes the interlinkage between land rental and credit markets. Furthermore, farmers use trade credit in land rental as well as informal financing to alleviate their dependence on financing from banks.

The rest of the paper is organized as following. We briefly review the literature In section 2, and formalize our testable hypotheses in section 3. In section 4, we describe the data. We discuss our results in section 5 and section 6 concludes the paper.

Literature Review

Basu (1983, p262) defines that "an interlinkage deal is one in which two or more interdependent exchanges are simultaneously agreed upon." For instance, the leasee pay rent by working for the leaser; the leaser specifies the wage contract and the lease simultaneously. Thus, rental and labor markets are interlinked. It applies similarly in the land rental market between the tenant and landlords. However, Banerji (1995) derives that the interlinked rental contract decreases the investment possibility and therefore is not optimal. Basu et al. (2000) extends the model to three parties; landlord and money lender are two players making non-cooperative decision on their contracts with a tenant. They find that interlinkage is superior if the landlord moves first and tenant has limited liability and even whether there is moral hazard. The above-mentioned research study the interlinkage theoretically. Empirically the concept of interlinkage is applied in corporate finance, trade credit for example. There exists two explanations on the use

of trade credit. Earlier explanation is that trade credit is used for the purpose of lowering transaction costs (Ferris, 1981). It is widely believed currently that it is used to financing (Burkart and Ellingsen, 2004; Ge and Qiu, 2007). Specifically, for small- and medium-sized firms, which are more likely credit constrained, tend to have higher percentage of account payables (Petersen and Rajan, 1997). What makes it worse is that financial markets are under-developed in developing countries. Firms are thus more dependent on trade credit to relieve their credit constraints (Fisman and Love, 2003; Allen et al, 2005). The land market in China similar characteristics, which we refer to as credit leasing. There are three forms of payment in land lease, namely, 1) pay the lump sum at the time of transaction; 2) pay the lump sum after harvest; 3) a combination of 1) and 2), i.e., pay partial at the time of transaction and the rest after harvest. We categorize cases 2 and 3 as credit leasing. Previous research does not take into account the use of credit leasing in the farmland rental, which we will test empirically in this paper.

An array of papers have studied the determinants of farmland rentals. For example, off-farm opportunities promote the development of land rental markets (Feng, et al, 2010), initial endowment in land affects the participation of household in the land rental market (Deininger and Jin, 2005). The effects of land transfer have also been studies. It improves the efficient allocation of arable land (Carter and Yao, 2002; Deininger, 2003) and releases labor from agricultural production and increases their non-agricultural household income (Jin and Deininger, 2009). These studies contribute to the understanding of land and labor markets; however, capital inputs, as the third input, is largely neglected. Thus, this paper focuses on the relationship of capital and land markets.

Testable Hypotheses

In this section, we formalize hypotheses to be empirically tested in the paper. First, in addition to their own land, farmers consider whether to expand or to reduce land inputs, i.e., to rent or to lease farmland. In the meantime, they may consider capital inputs, including their own funds and funds from financing. For farmers who do not have enough funds to meet current production needs, their decision to expand or reduce land inputs may be affected by their financing capacity. We therefore impose our *Hypothesis 1* as below.

Hypothesis 1. External financing has an effect on land rental transactions.

Farmers' decisions to lease land with or without credits may depend on the lessee's financial constraints. At equilibrium, the rent paid at harvest should take into account the time value. It may happen only when the lessee is faced with financial constraints. Therefore, we propose *Hypothesis 2*.

Hypothesis 2. External financing affects decision of payment scheme for land rental transactions.

Data

Data used in this paper are from a 2009 China's Rural Financial Survey conducted by the National School of Development, Peking University. It covers 1951 households in 82 villages in the provinces including Hunan, Yunnan, and Heilongjiang. It contains a household questionnaire on information of demographic information, employment, income and assets. In addition, it has detailed information on agricultural inputs and land rental. Moreover, it includes a village questionnaire on village population, infrastructure, and geographic characteristics.

As data show, an average of 57 percent farmers use credit leasing on the rented land, and an average of 65 percent on the land leased. Credit leasing grows after 1993 with the increase in the frequency of land rental.

95.3% of rural households are engaged in cropping, 2.4% in animal husbandry, and 0.8% own a commercial business. It is not observable how households allocate their capital input on agriculture if they are not farmers, therefore they are excluded from our analysis. Besides, we exclude the following samples for various reasons. 1) 6 households who rent farmland in and out in the same year; 2) 3 households who rent in only forest land; 3) 339 households not engaged in cropping; 4) 178 households that do not have information on capital inputs in farming; 5) 348 households do not have information on farmland plots and other variables. Finally, 1077 households[2] are left for our empirical analysis.

Table 1 presents the summary statistics. 41% households participate in the farmland rental market. 33% of rural households rented in the farmland to expand their agricultural production. Given that households have rented in the farmland, they rented on average 17 *mu* ($\approx$0.067 hectare), and pay for 231 yuan per *mu* a year on average, the highest rental price reaching 3,300 yuan per mu in the province of Heilongjiang. Out of the households who rent farmland in, 53% pay for the rental on credit leasing. On average, 11% households rent out farmland, and rent out only 3.7 *mu*, much smaller than that for rent in (17 *mu*). It indicates the farmland reallocation through land rental market in rural China. The average rental price is 424 yuan per *mu* a year, and 66% collect the rent at least partially after harvest.

Total capital input is 5,766 yuan on average, among which own capital is 82.6%, 4.7% from bank loans, 6.7% from informal borrowing, the rest 6% credit provided by shops selling fertilizer and seeds. A typical household has 4 members, owns 2.2 mu farmland per capita in 7

[2] 1,046 rural households are used in the rent out models. The results from rent-out land are reported in the appendix.

plots for cropping. Net income per capita in year 2007 was 4,430 yuan, compared to total own capital inputs at 4,763 yuan. It indicates that inputs on agriculture are equivalent to over one labor's income. Distance to the closest bank is 4.8km, and 25% of households are credit constrained by banks[3].

18% of households' head are party member or village cadres. Generally, the household head is 49 years old, 8% illiterate, 46% graduated from primary school, 36% from high school, and 10% high school or higher.

We use four variables to capture the village's development using the village questionnaire: off-farm job opportunity (total migration except the treated household /total population); number of banks in the village; economic development of the village (average net income per capita in year 2007). Besides, we calculate the average rental price at village level, it reaches 223 yuan per *mu* a year, similar to that at the household level (231 yuan per *mu*). It may indicate that farmland rental prices are more likely the market price in the village and that households are price takers.

Credit leasing

In this subsection, we examine credit leasing. Figure 1 shows the distribution of credit leasing from 2000 to 2008. On average, 58% rural households use credit leasing when renting in the farmlands. It gets more popularly used during 2006-2008. We then divide the households into subsamples by credit leasing and examine the characteristics of households in the subsamples. The mean difference of the two groups are reported in table 2.

It can be seen that larger rented farmland tend to be less likely on credit leasing, which may be associated with higher default risks, especially in the case of disasters. Consistent with our economic intuition, that higher the rent, the less likely for farmers to use credit leasing.

[3] This figure is calculated according to the Guirkinger(2008)'s definition of formal credit constraint.

Sources of Capital Inputs

Capital inputs mainly come from four sources: own capital, bank loans, informal borrowing, and credit, the latter referring to credit provided by shops of fertilizer and seeds. First, we test the correlation between farmland rental and capital inputs in Table 3. Columns (1) to (3) test the mean difference in the share of capital inputs between rental and non-rental households, and columns (4) to (6) report the mean difference between rent-in and rent-out households. Ratio of loans from banks is significantly higher in the renting group. It seems that higher percentage of loans are associated with higher possibility of participation in the farmland rental market. It may indicate an interlinkage between farmland rental and financial markets.

Second, we test the mean difference in capital inputs between credit leasing and non-credit leasing and report the statistics in Table 4. Columns (1) to (3) report the mean difference test within the renting-in group, and columns (4) to (6) within the renting-out group. We find that, in both rent-in and rent-out groups, the share of loans and informal borrowing are significantly higher for credit-leasing households, and the share of own capitals significant lower for credit-leasing households. It may suggest that capital constraints hinder the rural economic development.

Results

An IV probit model is estimated to examine the effect of external financing on land rental. It shows that loans from banks or Rural Credit Cooperatives (RCCs) play a key role in promoting the prosperity of the land rental market while the private financing has no significant effect. By using the Heckman two-stage sample selection model, we find a linkage between the land and credit markets. It suggests that the credit rental transactions, as a form of private financing, may

be essential to achieve the possible expansion of agricultural production, given the lack of formal financing in rural China.

Effects of Financing on Farmland Rental

We use a Probit model to estimate equation (1), and report the results in Table 5. Column (1) and (2) of Table 5 present the baseline results for capital inputs dummy and ratio. Compared to the farmers who do not get loans as capital input on agriculture, farmers who have formal loans are more likely to rent in farmland and expand their agricultural production. In the meantime, other sources of financing, including informal borrowing and credits, do not have a significant effect on the participation in the land rental markets. Besides, the larger the formal loan inputs, the higher probability of renting in the farmlands, as shown in column(2) of Table 5. The farmland segmentation positively affects the land rental, which may provide the evidence that farmland resources need to be re-allocated due to segmentation[4]. Households whose head is younger and a party member, are more likely to rent in farmlands.

However, endogeneity may potentially undermine the above results. Endogeneity may come from two sources. First, it could be that the more farmland farmers have, the higher probability they can obtain loans from banks. Second, we cannot observe the households' capital inputs if they do not have a rental record. Therefore, we apply the Hausman test and the result yields that formal loans are endogenous, but not for informal loans and credit.

Consequently, we use the distance to the closest bank, as an instrumental variable, for loans from banks. An IV Probit model is estimated with similar specifications, and results[5] are reported in column (3) and (4) of Table 5. Farmers are more likely to rent in the lands to expand their agricultural production, if they have access to the formal financial market, or get more loans

[4] Farmland segmentation is an endogenous variable adjusted by the village.
[5] First-stage results are reported in column (1) and (2) of Appendix 1.

from banks. It confirms that rural financial development will increase the farmland rental participation, and improve the reallocation of the land resources. Other factors, such as farmland segmentation, being a party member, and village economic development turn insignificant. Moreover, off-farm job opportunity does not have a significant effect on the farmland rental. It also provides evidence that omitting capital inputs or not taking into account the potential endogeneity of capital constraints may suffer from biased estimates.

We perform robustness check using average rents at village as a proxy of farmland rents at household level to re-estimate equation (1). Our major results are similar to that of table 5[6]. We also apply the same specification for households who rent farmland out and report the results in appendix 2.

To conclude, capital inputs are a key factor farmers' decision-making on whether rent in or out farmlands. Previous research that does not take it into account may be potentially biased. Our results show that the formal credit markets are interlinked with farmland rental markets.

Credit Leasing Substitute Loans from Banks

In this section, we examine the use of credit leasing if households participate in the farmland rental market. Equation (2) may also suffer from endogenous problem; given that rural households have participated in the rental market, the rents and payment scheme may be determined simultaneously. Therefore, we use the distance to the closest bank as an instrument, and report the estimation results in Table 6.

Results show that compared with households who do not have loans, households with bank loans reduce the use of credit leasing; farmers who have access to the formal financial market and obtain more loans are more likely to pay rents in cash. It may indicate that farmers use credit leasing to substitute for bank loans and to alleviate, at least partially, their capital

[6] The full set of results may be provided at request.

credit constraints. It suggests that capital and financial constraints hinder the development of farmland rental market.

However, the results of Table 6 may suffer from the self-selection problem caused by restricting the sample to be the households who rent in lands. We then apply the Heckman selection model to solve the selection problem and report the results in Table 7.

To summarize, formal financial market is interlinked with farmland rental market in rural China. We find that loans from banks promotes farmers' participation in the farmland rental market. For households who have limited access to the financial market, they use credit leasing as a substitution.

Conclusions

Land rental markets have been shown to contribute to economic growth in developing countries. The functioning land market is closely related to capital market yet capital inputs are by and large ignored in previous literature. This paper examines the interlinkage of capital and farmland rental markets in rural China.

We find that loans from banks promote households to participate in the farmland rental market, thus establishes the link between the two markets. In addition, households who have limited access to the financial market use credit leasing on farmland to alleviate their credit constraints. Therefore, development of formal financial market will increase the efficiency of reallocation of farmland through encouraging participation in farmland rental market, and credit leasing works as a substitution of formal credit in rural China.

References

Allen, F., J. Qian, and M. Qian, 2005, "Law Finance and Economic Growth in China", *Journal of Financial Economics*, 77(1):57-116.

Banerji, S., 1995, "Interlinkage,Investment and Adverse Selection", *Journal of Economic Behavior and Organization*, 28(1): 11-21.

Basu, K.,1983, "The Emergence of Isolation and Interlinkage in Rural Markets", *Oxford Economic Papers*, 35(2):262-280.

Basu,K., C. Bell, and P. Bose, 2000, "Interlinkage, Limited Liability and Strategic Interaction", *Journal of Economic Behavior and Organization* 42(2):445-62.

Benjamin, D. and L. Brandt. 2002. "Property Rights, Labor Markets, and Efficiency in a Transition Economy: The case of rural China". *Canadian Journal of Economics* 35: 689–716.

Burkart, M. and T. Ellingsen, 2004, " In-kind Finance: A Theory of Trade Credit", *American Economic Review* 94(3): 569-590.

Carter, M. R. and Y. Yao, 2002, "Local versus Global Separability in Agricultural Household Models: The Factor Price Equalization Effect of Land Transfer Rights", *American Journal of Agricultural Economics* 84(3): 702-715.

Deininger, K., 2003, "Land Markets in Developing and Transition Economies:Impact of Liberalization and Implications for Future Reform", *American Journal of Agricultural Economics* 85(5): 1217-22.

Deininger, K. and S. Jin, 2005, "The Potential of Land Rental Markets in the Process of Economic Development: Evidence from China", *Journal of Development Economics* 78(1): 241-70.

Deininger, K. and S. Jin, 2008, "Land Sales and Rental Markets in Transition: Evidence from rural Vietnam", *Oxford Bulletin of Economics and Statistics* 70(1): 67-101.

Deininger, K. and S. Jin, 2009, "Securing Property Rights In Transition: Lessons from implementation of China's rural land contracting law", *Journal of Economic Behavior & Organization* 70(1-2): 22-38.

Feng, S., N. Heerink, R. Ruben and F. Qu, 2010, "Land Rental Market, Off-farm Employment and Agriculture Production in Southeast China: A Plot-level Case Study", *China Economic Review* 21(4):598-606.

Ferris, J.S., 1981, "A Transaction Theory of the Trade Credit Use", *The Quarterly Journal of Economics* 96(2): 243-270.

Fisman,R. and I. Love, 2003, "Trade Credit, Financial Intermediary Development and Industry Growth", *Journal of Finance* 58(1): 353-74.

Ge, Y. and J. Qiu, 2007, "Financial Development, Bank Discrimination and Trade Credit," *Journal of Banking and Finance* 31(2): 513-30.

Guirkinger, C., 2008, "Understanding the Coexistence of Formal and Informal Credit Markets in Piura, Peru", *World Development* 36(8): 1436−52.

Jin, S. and K. Deininger, 2009, "Land Rental Markets in the Process of Rural Structural Transformation: Productivity and Equity Impacts from China", *Journal of Comparative Economics*, 37(4):629-46.

Khandker, S.R., 1998, "Fighting Poverty with Microcredit: Experience in Bangladesh". Oxford University Press, New York.

Kung, J.K.-S., 2002. "Off-farm Labor Markets and the Emergence of Land Rental Markets in Rural China". *Journal of Comparative Economics* 30 (2): 395–414.

Petersen, M. and R. Rajan, 1997, "Trade Credit: Theories and Evidence", *Review of Financial Studies* 10(3): 661-91.

Ray, D. 1998. Development Economics. Princeton University Press.

Yao, Y. 2000, “The Development of the Land Lease Market in Rural China.” *Land Economics* 76(2): 252-66.

Table1. Summary Statistics

Variables	Definition	Observation	Mean	Std. Dev.
Farmland rental				
Farmland rental participation	=1 if rent in or rent out, 0 otherwise	1077	0.41	0.49
Rent in	=1 if rent in, 0 otherwise	1077	0.33	0.47
Rent in areas (*mu*)	total area of rent-in land	312	16.96	24.69
Rents of leasing in (yuan/*mu*)	Rent payment of renting in	312	231.27	305.45
Credit leasing when rent in	=1 if pay (partial) rents after harvest, 0 otherwise	312	0.53	0.50
Rent out	=1 if rent out, 0 otherwise	1046	0.11	0.31
Rent out areas (*mu*)	total areas of rent-out land	105	3.65	4.39
Price of renting out (yuan/*mu*)	Rent payment of renting out	105	423.69	571.60
Credit leasing when rent out	=1 if collect (partial) rents after harvest, 0 otherwise	105	0.66	0.48
Agricultural capital inputs				
Total capital inputs (yuan)	Total capital input on agriculture	1077	5,766	11,588
Share of own capital (%)	100*Own capital/Total capital input	1077	82.55	32.31
Share of formal loan (%)	100*Formal loan/Total capital input	1077	4.71	18.40
Share of informal loan (%)	100*Informal loan/Total capital input	1077	6.70	20.93
Share of informal credit (%)	100*Informal credit/ Total capital input	1077	6.04	19.51
Characteristics of household				
Household size	Number of household members	1077	4	1.47
labor ratio	Labors/household size	1077	0.46	0.25
Per capita farmland endowment (*mu*)	Per capita farmland endowment	1077	2.21	3.65
Household's Plot	Plot of agricultural land endowment	1077	7.09	5.98
Per capita net income 2007 (yuan)	Per capita net income in year 2007(yuan)	1077	4,430	7,826
Distance to the closest bank (km)	Distance to the closest bank (km)	1077	4.84	11.53
Characteristics of Head				
party member	=1 if head is village cadre or party member, 0 otherwise	1077	0.18	0.38
Head's age	Head's age	1077	48.95	11.02
Head's illiteracy	=1 if head is illiterate, 0 otherwise	1077	0.08	0.27
Head's primary school	=1 if head finishes primary school, 0 otherwise	1077	0.46	0.50
Head's high school	=1 if head graduated from high school, 0 otherwise	1077	0.36	0.48
Head's above high school	=1 if head has high school or higher, 0 otherwise	1077	0.10	0.30
Characteristics of Village				
Village's average rent of renting in (yuan/*mu*)	Mean of rental in a village (yuan/*mu*)	312	223.17	169.58
Share of migration in village (%)	Migrated population/total village population (%)	1077	17.71	7.48
Total number of banks in village	Number of banks in a village	1077	26	8.33
Village's size	Total number of households in a village	1077	732	569
Village's per capita income in 2007	Net income per capita at village level in year 2007	1077	3,456	1,959

Table 2. The mean difference of farmland rental: credit leasing and non-credit leasing

	Credit		Non- credit		
	Mean	Std. Dev.	Mean	Std. Dev.	T-statistics
Rent in areas (*mu*)	7.10	1.21	28.04	2.32	-8.241***
Rent out areas (*mu*)	3.12	0.37	4.66	1.02	-1.723*
Price of renting in (yuan/*mu*)	152.71	16.33	319.45	30.25	-4.995***
Price of renting out (yuan/*mu*)	328.31	84.93	606.51	70.10	-2.422**

Note: * denotes significance at 10% level, ** denotes significance at 5% level, *** denotes significance at 1% level.

Table 3. The mean difference of capital inputs structure between rent in and rent out

Share of capital inputs structure %	Non-partic.	Participation	T-statistic	Participation in farmland rental		
				Rent in	Rent out	T-statistic
Share of own capital	83.78	80.80	1.488	78.26	90.55	3.256***
Share of informal credit	6.17	5.84	0.278	6.56	3.09	1.518
Share of total formal loan	3.78	6.04	1.983**	7.10	1.99	2.188**
commercial bank loan	0.05	0.43	1.435	0.54	0.00	0.722
RCCs loan	3.73	5.61	1.695*	6.56	1.99	2.049**
Share of total informal loan	6.27	7.32	0.814	8.09	4.37	1.497
borrow from relative	4.94	5.25	0.275	5.84	3.01	1.330
borrow from friends	1.20	1.89	1.231	2.03	1.36	0.545
borrow from informal finance	0.13	0.18	0.252	0.23	0.00	0.511

Note: Participation is a dummy variable defined to1 if farmers rent farmland in or out, 0 otherwise. Non-participation is a dummy variable defined to 1 if farmers do not rent farmland in or out, and 0 otherwise. Rent in is a dummy variable defined to 1 if farmers rent in farmland, and 0 otherwise. Rent out is a dummy variable defined to 1 if farmers rent out farmland, and 0 otherwise. Share of capital inputs structure =100* capital input of # source/total capital input on agriculture. Informal credit captures the credit provided by fertilizer or seeds suppliers. Total formal loan includes loan from commercial bank and rural credit cooperation(RCCs). Total informal loan includes borrowing from relatives, friends and informal financial institute. * denotes significance at 10% level, ** denotes significance at 5% level, *** denotes significance at 1% level.

Table 4. Mean difference of capital inputs structure: credit leasing versus non-credit leasing

Share of capital inputs structure %	Rent in			Rent out		
	Credit leasing	Non-credit	T-statistic	Trade credit	Non-credit	T-statistic
Share of own capital	85.79	69.47	4.552***	94.40	82.67	2.232**
Share of informal credit	6.96	5.28	0.748	3.41	3.70	0.097
Share of total formal loan	3.36	11.65	3.643***	0.00	7.56	2.473**
commercial bank loan	0.00	1.28	1.598	0.00	2.47	1.391
RCCs loan	10.37	3.36	3.240***	0.00	5.09	1.987**
Share of total informal loan	3.89	13.59	4.146***	2.18	6.07	1.184
borrow from relative	3.13	9.16	2.996***	2.18	3.52	0.445
borrow from friends	0.76	3.89	2.696***	0.00	2.55	1.807*
borrow from informal finance	0.00	0.54	1.128	—	—	—

Note: Rent in is a dummy variable defined 1 if farmers have rented in the farmland, 0 otherwise. Rent out is a dummy variable defined 1 if farmers have rented out the farmland, 0 otherwise. Share of capital inputs structure =100* capital input of # source/total capital input on agriculture. Informal credit captures the credit provided by fertilizer or seeds suppliers. Total formal loan includes loan from commercial bank and rural credit cooperation(RCCs). Total informal loan includes borrowing from relatives, friends and informal financial institute. * denotes significance at 10% level, ** denotes significance at 5% level, *** denotes significance at 1% level.

Table 5. Impacts of credit on the probability of farmland rental

	Probit		IV Probit	
	Capital input dummy	Share of capital input	Capital input dummy	Share of capital input
	(1)	(2)	(3)	(4)
Formal loan	0.512***	0.004*	0.986**	0.013*
	(0.157)	(0.002)	(0.473)	(0.008)
Informal loan	0.132	0.001	0.007	0.001
	(0.137)	(0.002)	(0.045)	(0.001)
Informal credit	0.123	0.001	0.048	0.001
	(0.137)	(0.002)	(0.033)	(0.001)
Per capita net income in 2007	-0.003	-0.010	0.007	0.005
	(0.045)	(0.045)	(0.014)	(0.014)
Per capita farmland endowment	-0.005	-0.005	-0.003	-0.004
	(0.014)	(0.014)	(0.005)	(0.006)
Plot	0.055***	0.056***	0.010	0.012**
	(0.010)	(0.010)	(0.006)	(0.006)
Household size	-0.031	-0.029	-0.007	-0.005
	(0.031)	(0.031)	(0.008)	(0.009)
Household labor ratio	0.174	0.184	-0.005	-0.011
	(0.198)	(0.198)	(0.063)	(0.076)
Head's village cadre or party member	0.222*	0.226*	0.027	0.041
	(0.119)	(0.120)	(0.047)	(0.044)
Head's age	-0.012**	-0.013**	-0.001	-0.002
	(0.005)	(0.005)	(0.003)	(0.002)
Head's primary school	0.054	0.063	-0.025	-0.010
	(0.183)	(0.183)	(0.050)	(0.053)
Head's middle school	0.125	0.118	0.031	0.042
	(0.195)	(0.195)	(0.045)	(0.050)
Head's above higher school	-0.078	-0.092	-0.003	-0.010
	(0.228)	(0.229)	(0.057)	(0.063)
Share of migration in a village	0.012	0.011	0.002	0.001
	(0.011)	(0.011)	(0.003)	(0.004)
Number of banks in village	0.063	0.063	0.015	0.023
	(0.071)	(0.071)	(0.020)	(0.020)
Village size	0.001	-0.001	0.004	0.003
	(0.003)	(0.003)	(0.002)	(0.003)
Per capita village net income in 2007	0.101**	0.102***	0.015	0.018
	(0.040)	(0.039)	(0.017)	(0.018)
County fixed effects	Yes	Yes	Yes	Yes
N	1077	1077	1077	1077
Pseudo R^2	0.139	0.133		
Wald Test chi2(1)			1.39	1.27
Prob > chi2			0.238	0.259

Note: Informal credit captures the credit provided by fertilizer or seeds suppliers. Total formal loan includes loan from commercial bank and rural credit cooperation(RCCs). Total informal loan includes borrowing from relatives, friends and informal financial institute. The distance between house and nearest formal financial institute as an instrument, the first stage results of column(3) and (4) are reported in column(1) and (2) of appendix 1, respectively. Combined the illiteracy and primary as reference do not change the results are not reported here. Robustness standard error and marginal effect coefficients are reported. * denotes significance at 10% level, ** denotes significance at 5% level, *** denotes significance at 1% level.

Table 6. Effects of external financing on farmland credit leasing

	Capital input dummy	Share of capital input
	(1)	(2)
Formal loan	-0.755*	-0.016***
	(0.422)	(0.003)
Informal loan	0.076	-0.001
	(0.066)	(0.001)
Informal credit	-0.024	-0.001
	(0.073)	(0.001)
Per capita net income in 2007	-0.007	0.010
	(0.024)	(0.023)
Per capita farmland endowment	0.017	0.013
	(0.063)	(0.076)
Plot	0.003	0.006
	(0.007)	(0.011)
Household size	0.001	0.002
	(0.003)	(0.003)
Household labor ratio	0.019	0.002
	(0.037)	(0.031)
Head′s village cadre or party member	0.074	0.059
	(0.107)	(0.109)
Head′s age	-0.002	-0.002
	(0.057)	(0.059)
Head′s primary school	-0.001	-0.002
	(0.004)	(0.003)
Head′s high school	-0.051	-0.060
	(0.107)	(0.109)
Head′s above high school	-0.066	-0.103
	(0.071)	(0.082)
Rent of renting in at village level	-0.066	-0.081
	(0.096)	(0.112)
Share of migration in a village (%)	-0.001	0.005
	(0.005)	(0.005)
Number of banks in a village	0.051	0.002
	(0.044)	(0.038)
Village size	-0.004**	-0.006***
	(0.002)	(0.002)
Per capita village net income in 2007	0.001	0.013
	(0.022)	(0.025)
County fixed effects	Yes	Yes
N	273	273
Wald Test chi2(1)	1.34	1.87
Prob > chi2	0.247	0.178

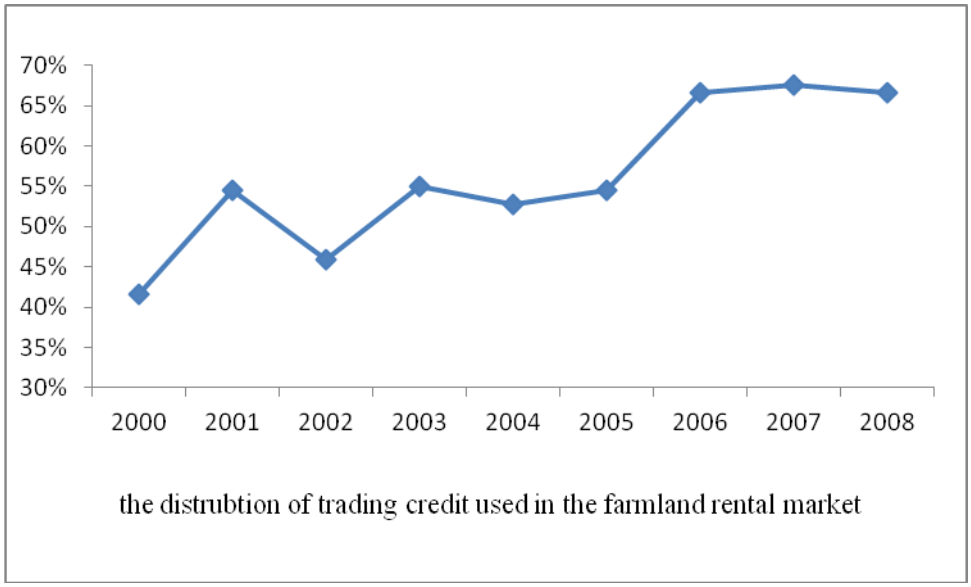
Note: Trade credit of farmland rental in defines as 1 if the payment after harvest, 0 otherwise. Informal credit captures the credit provided by fertilizer or seeds suppliers. Total formal loan includes loan from commercial bank and rural credit cooperation(RCCs). Total informal loan includes borrowing from relatives, friends and informal financial institute. The distance between house and nearest formal financial institute as an instrument. Combined the illiteracy and primary as reference do not change the results are not reported here. Robustness standard error and marginal effect coefficients are reported, 39 samples are dropped because of the collinearly. * denotes significance at 10% level, ** denotes significance at 5% level, *** denotes significance at 1% level.

Table 7. Heckman 2-step selection model

	Capital input dummy		Share of capital input	
	(1)	(2)	(3)	(4)
	Trade credit	selected	Trade credit	selected
Formal loan	-0.019	-0.933	-0.001	-0.010
	(0.063)	(1.249)	(0.001)	(0.015)
Informal loan	-0.022	-1.248	0.001	-0.013
	(0.062)	(0.890)	(0.001)	(0.013)
Informal credit	0.017	-0.602	0.001	-0.007
	(0.066)	(0.551)	(0.001)	(0.008)
Distance to the closest bank		0.303**		0.265**
		(0.123)		(0.114)
Per capita net income in 2007	0.004	-0.050	0.005	-0.048
	(0.004)	(0.048)	(0.004)	(0.049)
Per capita farmland endowment	-0.002	0.746**	-0.002	0.712**
	(0.005)	(0.360)	(0.005)	(0.358)
Plot	0.002	-0.077*	0.001	-0.070
	(0.003)	(0.045)	(0.003)	(0.044)
Household size	0.031*	0.566**	0.029*	0.526**
	(0.016)	(0.228)	(0.017)	(0.224)
Household's labor ratio	-0.001	1.328	0.005	1.351
	(0.094)	(1.112)	(0.094)	(1.117)
Head′s Leader or Communist	-0.030	-0.209	-0.026	-0.171
	(0.056)	(0.615)	(0.055)	(0.588)
Head′s age	0.002	0.064*	0.002	0.066*
	(0.002)	(0.034)	(0.002)	(0.034)
Head′s education at primary school	-0.094	-5.882***	-0.093	-5.750
	(0.089)	(0.405)	(0.089)	(0.001)
Head′s education at high school	-0.033	-5.881	-0.029	-5.715***
	(0.096)	(0.001)	(0.096)	(0.398)
Head′s education above high school	-0.015	-0.279	-0.007	-0.027
	(0.110)	(0.001)	(0.109)	(0.001)
Rent of renting in at village level	-0.027	0.016	-0.029*	-0.001
	(0.017)	(0.291)	(0.017)	(0.291)
Share of migration in a village	0.001	0.047	0.001	0.047
	(0.005)	(0.051)	(0.005)	(0.049)
Number of banks in a village	0.046	-1.573***	0.047	-1.560**
	(0.044)	(0.604)	(0.044)	(0.606)
Village size	-0.002	0.030	-0.001	0.028
	(0.001)	(0.020)	(0.001)	(0.020)
Per capita village net income in 2007	0.006	-0.293	0.005	-0.252
	(0.020)	(0.209)	(0.020)	(0.206)
County fixed effects	Yes	Yes	Yes	Yes
Lambda(mills)		-0.246		-0.232
		(0.155)		(0.162)
N(restricted 14, unrestricted 312)	326	326	326	326

Note: Trade credit of farmland rental in defined as 1 if the payment after harvest, 0 otherwise. Informal credit captures the credit provided by fertilizer or seeds suppliers. Total formal loan includes loan from commercial bank and rural credit cooperation(RCCs). Total informal loan includes borrowing from relatives, friends and informal financial institute. Combined the illiteracy and primary as reference do not change the results are not reported here. Robustness standard error and marginal effect coefficients are reported, 39 samples are dropped because of the collinearly. Un-observed trade credit variables are defined as selection. * denotes significance at 10% level, ** denotes significance at 5% level, *** denotes significance at 1% level.

Figure 1: The tendency of trading credit used in the farmlands rental market



Note: the time is the latest year when the farmers rent in the farmland

Apendix 1. Determinants of formal loan in the processing of agricultural capital inputs

	Formal loan dummy	Share of formal loan	Formal loan dummy	Share of formal loan
	(1)	(2)	(3)	(4)
Distance to the closest banks (km)	0.011**	1.210**	0.010**	1.072**
	(0.005)	(0.484)	(0.005)	(0.482)
Informal loan	0.151		0.202	
	(0.200)		(0.200)	
Informal credit	-0.397		-0.431	
	(0.280)		(0.291)	
Share of informal loan		-0.784***		-0.679**
		(0.276)		(0.272)
Share of informal credit		-1.429***		-1.449**
		(0.548)		(0.563)
Per capita net income in 2007	-0.294*	-22.591	-0.349*	-23.929*
	(0.173)	(14.428)	(0.180)	(14.372)
Per capita farmland endowment	0.018	1.410	0.013	1.050
	(0.020)	(1.748)	(0.022)	(1.866)
Plot	0.008	0.997	0.008	1.001
	(0.009)	(0.815)	(0.010)	(0.811)
Household size	0.019	0.930	0.015	0.689
	(0.050)	(4.440)	(0.051)	(4.448)
Household labor ratio	0.296	26.109	0.306	25.725
	(0.316)	(29.156)	(0.320)	(28.918)
Head′s village cadre or party member	0.214	13.817	0.217	12.835
	(0.184)	(16.296)	(0.190)	(16.373)
Head′s age	-0.019***	-1.705***	-0.022***	-1.828***
	(0.007)	(0.624)	(0.007)	(0.624)
Head′s primary school	0.710**	57.036*	0.748**	57.562**
	(0.303)	(29.324)	(0.307)	(29.001)
Head′s high school	0.234	11.824	0.241	12.193
	(0.334)	(31.498)	(0.339)	(31.150)
Head′s above high school	0.164	11.358	0.146	11.347
	(0.393)	(36.772)	(0.402)	(36.546)
Share of migration in a village	-0.012	-1.015	-0.009	-0.831
	(0.018)	(1.601)	(0.018)	(1.589)
Number of banks in a village	0.122	7.135	0.130	7.138
	(0.129)	(11.127)	(0.133)	(11.143)
Village size	-0.021***	-1.612***	-0.024***	-1.697***
	(0.004)	(0.283)	(0.004)	(0.278)
Per capita net income in a village	0.110	9.761*	0.135*	10.578*
	(0.068)	(5.861)	(0.070)	(5.909)
County fixed effects	Yes	Yes	Yes	Yes
N	1077	1077	1046	1046
Pseudo R^2	0.233	0.111	0.244	0.112

Note: Informal credit captures the credit provided by fertilizer or seeds suppliers. Total formal loan includes loan from commercial bank and rural credit cooperation(RCCs). Total informal loan includes borrowing from relatives, friends and informal financial institute. Combined the illiteracy and primary as reference do not change the results are not reported here. Robustness standard error and marginal effect coefficients are reported.
* denotes significance at 10% level, ** denotes significance at 5% level, *** denotes significance at 1% level.

Apendix 2. the probability of farmland rental out affected by credit market

	Probit		IV Probit	
	Capital input dummy	Share of capital input	Capital input dummy	Share of capital input
	(1)	(2)	(3)	(4)
Formal loan (dummy or share)	-0.482*	-0.003	-0.840	-0.009
	(0.275)	(0.004)	(0.940)	(0.010)
Informal loan (dummy or share)	-0.154	-0.001	-0.006	-0.001
	(0.214)	(0.003)	(0.052)	(0.001)
Informal credit (dummy or share)	-0.048	-0.001	-0.029	-0.001
	(0.230)	(0.003)	(0.050)	(0.001)
Household's net income per capita in year 2007(yuan)	0.004	0.005	0.001	0.001
	(0.005)	(0.005)	(0.001)	(0.001)
Household's agricultural land endowment per capita(acre)	-0.016	-0.015	-0.002	-0.001
	(0.022)	(0.021)	(0.006)	(0.006)
Plot	-0.076***	-0.078***	-0.012**	-0.013***
	(0.017)	(0.017)	(0.005)	(0.003)
Household size	-0.009	-0.008	-0.002	-0.003
	(0.040)	(0.040)	(0.008)	(0.008)
Household labor ratio	0.119	0.108	0.054	0.058
	(0.266)	(0.266)	(0.065)	(0.068)
Head′s village cadre or party member	0.034	0.034	0.021	0.013
	(0.148)	(0.148)	(0.037)	(0.031)
Head′s age	0.009	0.010	0.001	0.001
	(0.007)	(0.007)	(0.003)	(0.001)
Head′s primary school	-0.280	-0.291	-0.016	-0.031
	(0.210)	(0.209)	(0.065)	(0.047)
Head′s high school	-0.129	-0.128	-0.027	-0.033
	(0.227)	(0.226)	(0.044)	(0.045)
Head′s above high school	0.059	0.065	-0.003	0.002
	(0.275)	(0.274)	(0.057)	(0.054)
Share of migration in a village (%)	-0.021	-0.020	-0.003	-0.002
	(0.014)	(0.014)	(0.003)	(0.003)
Number of banks in a village	-0.091	-0.092	-0.018	-0.023
	(0.135)	(0.135)	(0.026)	(0.027)
Village size	0.002	0.002	-0.003	-0.002
	(0.006)	(0.006)	(0.004)	(0.003)
Per capita 2007 net income in a village	-0.017	-0.018	0.003	0.002
	(0.053)	(0.053)	(0.014)	(0.012)
County fixed effects	Yes	Yes	Yes	Yes
N	1046	1046	1046	1046
Pseudo R^2	0.156	0.152		
Wald Test chi2(1)			0.76	1.34
Prob > chi2			0.384	0.308

Note: Informal credit captures the credit provided by fertilizer or seeds suppliers. Total formal loan includes loan from commercial bank and rural credit cooperation(RCCs). Total informal loan includes borrowing from relatives, friends and informal financial institute. The distance between house and nearest formal financial institute as an instrument, the first stage results of column(3) and (4) are reported in column(3) and (4) of appendix 1, respectively. Combined the illiteracy and primary as reference do not change the results are not reported here. Robustness standard error and marginal effect coefficients are reported. * denotes significance at 10% level, ** denotes significance at 5% level, *** denotes significance at 1% level.