

Land Rental Markets Participation and Its impact on Fixed Investment and Household Welfare: Evidence from China Apple Production Sites

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Abstract: To identify the determinants of affecting farmers' land rental decision and quantify the effect from renting in land on households' investment and economy welfare, original data from two specialized apple production sites of China are applied. By analyzing the access of land, labor, credit and insurance markets together, results indicate that economy of scale, efficient credit and insurance supply, laborsaving cultivation technology adoption and the motivation of reducing land fragmentation are the main forces to encourage households renting in land. Fixed investment improves with farm scales expanding and more access to credit and insurance. Renting in land from market will produce obvious welfare gains, including household agricultural income, total income and family expenditure.

Key words: land rental, investment, welfare, apple production sites, China.

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1. Introduction

For a long time, it is widely believed among policy makers and economists that markets to exchange rights to land temporarily or permanently are capable of providing a low-cost but efficient mean to effect transactions that would bring land to its most productive use in developing countries (Deininger and Feder, 2001). In order to promote the agricultural production scale efficiency, land registration and certification are adopted to secure the land use rights and to raise farmland rental intensity in Asia, especially in Vietnam and China. However, previous ideas also meet challenges from the empirical evidences that both land sales market and tenancy markets are neither efficient in the use and allocation of land nor conducive to social equity (Otsuka, 2007). Therefore, how land rental market participation affect smallholders' equity, efficiency and welfare are ambiguous, and new empirical evidences are required.

Generally, there are three primary channels in which land rental markets may impact on smallholders (Chamberlin and Richer-Gilber, 2016). First, equity gains resulted from reallocation function of land across households endowed with various assets occurs in a way that land and non-land factor ratios towards equilibrium. Second, efficiency gains caused by net land transfers from less productive to more productive farmers. The final gains are farmers' welfare occurring through rental markets by facilitating more access for smallholders as the primary productive asset in their production system. Besides these, welfare related with better household incomes might be derived from improved equity and efficiency results from land rental markets.

Therefore, present land policy of China is attempted for the twin objectives of improving scale efficiency and productive efficiency of specialization, but little work has been done on land markets in agricultural specialization regions. For instance, apple production sites including Bohai Rim and Loess Plateau in China together represent a highly specialized agricultural planting belt, which are also the two largest apple-producing areas in the world. In the micro view, apple plays a pivotal role in poverty reduction and households' income equilibrating. However, the household level effects of land rental participation have not yet been empirically explored in this setting. Our purpose is to meet this gap. Furthermore, the existing empirical analysis in China mainly focuses on grain producing case, and little attention has been paid to the function and role of high added value crop, where land access may be more competitive. Summarily, there is no empirical studies that have systematically investigated how land markets in highly specialized cash crop producing area function, and have neither measured the impacts from land rental market participation on farmers' investment, efficiency and welfare.

Against this background, this article uses nationally representative household-level cross section data from east, middle and west China to make two main contributions to the literature about land rental markets in Asia countries. First, with factor imperfection market in mind, we analyze the impact of labor, credit and insurance market access on land market participation together. Due to high transaction costs, the acute markets for nonland factors of production are imperfect, which are inconclusive from previous studies (Ghebru and Holden, 2008). We add to these studies by assessing the role of factor market access in dictating the likelihood and intensity of participation on demand sides. Second, we measure welfare gains from land rental market on a broader range than previous studies by considering household expenditure, family total income, off-farm income and agricultural income. This might be helpful for us to understand how renting in land may benefit smallholders welfare structure all sidedly.

The paper is structured as follows: Section 2 reviews how insecure property rights, imperfect labor and credit markets and missing social security system limit land rental market redistribution function as well as the economic effect of land markets. Section 3 presents data sources and provides descriptive statistical evidence on the land rental market development within specialized apple production sites. Section 4 illustrates a conceptual framework and relative empirical strategy. Section 5 discusses empirical results by estimating the determinants of land rental market participation, quantifying the factors affecting households fixed investments and assessing the economic

effect from land tenure behavior on households' welfare. Section 5 concludes with policy implications.

2. China Land Rental Markets

Previous theory suggests that the reason why China land rental markets function not vary well at least including three approaches: insecure property rights, imperfect labor and credit markets and missing social security system. There are a growing number of literatures stressing how insecure property rights reduce farmer's willingness to participate in land rental market, discourage land relative investment and prevent migration. The general results imply that well-defined and well-protected land property rights have stimulated an active land rental market, which may have long term profound implications for the development of private land rights and fertility behavior (Kung, 2006). Besides farmland, tenure insecurity also reduces migration in forest areas, which has implications for the conservation of recently replanted region (Mullan et al., 2010). Against this background, institutions that either lower transaction costs or secure property rights are found to be crucial in explaining cross-regional variations in rental-market development (Zhang et al., 2004). Chinese central government also issued a trial of policy to strengthen farmers' use rights and lease rights, so the nature of China's cultivated land rental contracts has become more formal and lengthened the period of time that the tenant is able to cultivate the rented-in plots increasingly (Huang, 2011).

The literature examines the effect that non-market form of land allocation, combined with uneven labor market development, has on efficiency in the agricultural sector (Benjamin and Brandt, 2002). In other words, the emergence of off-farm employment has significant and positive impacts on stimulating household to rent out cultivated land (Huang et al., 2012). At the same time, a number of factors, including credit rationing and the scope to use land as collateral to overcome informational imperfections that are inherent to credit markets, may increase the purchase price of land over and above the present value of agricultural profits (Deininger, 2003). Furthermore, controlling for levels of other fixed resources, a household's access of credit does affect either the amount of land leased or tenurial status (Carter and Yao, 2002). Unfortunately, pervasive rationing in the highly regulated formal credit market existing in rural China leads poor credit access are not effective in activating land rental market and promoting agricultural investments (Jia et al., 2010).

Researchers ascribe rural labor temporary migration to lack of social security for migrants (Tao and Xu, 2007). They believe that rural land tenure insecurity due to frequent land reallocation and abusive land requisition due to lack of functioning land markets are all major policy challenges that China is facing in its yet-to-be finished economic transition. In this process, specific institutional frameworks would need to be in place to avoid the potentially excessive dependence on urban welfare provisioning and inequity in allocating the released land in villages. Specifically, as village land ownership remains collective and as land use rights can be periodically reallocated, individual out-migration can result in deprivation of those rights. Moreover, the intensity of this insecurity varies according to the village-level management of land and the contractual status of land plots (Rupelle et al., 2009). Therefore, someone insists that without coordinated reforms in household registration system which can help hundreds of millions of Chinese rural migrant workers to permanently settle in cities and release their farmland to those who stay in the countryside, dilemma of "to redistribute or not" cannot be resolved effectively (Wang et al., 2011).

Having clarified the limitation of land market functioning, we turn to the economic effect of land rental market development. There is a growing body of empirical literature focuses on the equity and efficiency impacts of China land markets. Thereinto, production efficiency gain from land rental market participation has been a consensus among believers. In detail, the empirical case from rice farmer suggests that households who rented in land achieved higher technical efficiency than households that did not rent land. Meanwhile, rice production on rented plots was technically as efficient as on contracted plots (Feng, 2008). The logic behind this is that by

transferring land from less able and more affluent households who joined the non-farm sector to poorer ones with ample family labor, land markets are critical not only for non-agricultural growth but, by allowing more effective use of potentially idle land can contribute to significant productivity gains (Deininger and Jin, 2009). Therefore, although the emergence of land markets has been fairly recent, in the past decade they have begun to develop fairly quickly, with beneficial effects in terms of allocative efficiency and equity (Rozelle et al., 2005).

Finally, land rental market causes equity or disparity effect is still inconsistent among researchers, because there is empirical evidence suggests rural households who acquired land through markets significantly increased their farm income, thus, land rental markets gave rise to a new venue of income generation and increased inequality in farm income. Widening disparities in land rights and farm income, however, did not constitute a further retreat from equality, but instead had compensatory effects on overall inequality, as land markets brought up families who would have fallen at the lower end of income distribution in the absence of such markets (Zhang, 2008). Deininger and Jin (2005), and others hold opposite idea with this.

In summary, the transfer of land rights from those who move to nonfarm sectors, or migrating households, to those who continue farming, or remaining farm households, is critically important for successful industrialization, specialization and the structural transformation of the agriculture sector in China (Kimura et al., 2011). However, rental markets are not well qualified within areas of highly specialized cash crop production.

3. Land tenure in apple production sites

This section illustrates the sampling methodology applied to obtain reasonably representative information on land rental markets development and its economic effect within specialization regions. We also report the nature of complementary information on general economic indicators from household surveys. Descriptive statistics indicate that rented-in land increases households' per capita total income.

3.1 Sampling method and basic characteristics

The current study involved a field survey that was conducted by China Agriculture Research System (CARS) during the 2013/14. This survey was purposefully conducted in Coastal (Shandong Province), Centre (Henan Province), and West (Shaanxi and Gansu Province) of China. A supplemental questionnaire administered to specialized households with agricultural income contribution over half to total income. Especially, Apple production in the sample area remains the important source of income overall. The field survey involved in land transactions elicits information on contractual details, current occupation and income levels by the respondent.

A multi-stage sampling procedure was used to select counties, sub-divisions and farm households. The first stage was the deliberate selection of 122 counties in 4 northern provinces, namely Shandong, Henan, Shaanxi, and Gansu (see Figure 1). To ensure all apple producers have the same probability of choosing in the sample, the Probability Proportional to Size sampling method was used. Overall, 12 counties were randomly selected in the seven provinces and 1079 samples were selected for interview. Via face-to-face questionnaire interview, detailed information on land transaction and production are collected in 2014.

Characteristics of the sample households are described in Table 1. With 81 percent, it is obvious that sample farm households still rely heavily on apple production as the main source of income. Compared with autarky farmers, the samples that rented-in lands obtain higher per capita total income and agricultural income. This may imply that land rental market development play a role in poverty reduction and income equilibrating. Little differences are observed between the autarky group and land rented-in group on most land relative investment except hired labor size inputted. With 36.74 workdays, average hired labor input per unit area of rented-in farmers is about two times above autarky growers. Someone suggests that in order to operate labor-intensive farms well, hired labor must be employed at the farming season but the high monitoring cost of hired labors may offset the efficiency increased by land expanding. However, such judgment will not immediately appear in sample sites

because most farms are far more reaching the optimal scale and if factor market functioning effectively, they will reallocate land, labor and machine so as to wipe out the inefficiency associated with labor allocation.



Figure 1. *Geographic location of sample sites*

Table 1 also demonstrates that small-scale farms make up a major part of the production organization even though renting in land slightly increases the land endowment size per capita. Furthermore, the average farm size of most apple planters is less than one hectare. According to Hayami's (2009) approach, commercial crops like sugarcane and pineapple production in Asia have grown faster under the peasant mode of production than under the plantation system. Such observations point to small farms' higher production efficiency relative to large farms, even in the production of commercial crops. In the apple specialized production sites, high comparative profits stimulate farmers with tiny and fragmented farmland to pursuing scale efficiency via land markets. Average scale per plot in household level of households rented in land is higher than autarky households significantly, from which we may also infer that "anti land fragment" is another driving force to rent in land.

Table 1. *Basic characteristics of sample*

	Autarky		Rented-in		Total	
	Mean	SD	Mean	SD	Mean	SD
Inputs						
New machinery investments per unit area (Y 1000)	1.94	1.81	1.85	1.90	1.88	1.98
Fertilizer per unit area (Y 1000)	1.59	1.59	1.53	1.36	1.59	1.59
Manure per unit area (Y 1000)	0.54	0.48	0.55	0.54	0.47	.58
Other variable capital input per unit area (Y 1000)	0.90	0.76	1.00	1.40	0.98	1.31
Hired labor input per unit area (Workday)	18.48	29.76	36.73	54.04	23.94	45.21
Income distribution						
Per capita total income (Y1000)	16.81	14.63	20.72	17.96	17.48	15.34
of which from apple production (percent)	80.44	27.73	83.73	25.75	81.06	27.39
of which from non-farm employment(percent)	15.28	26.22	11.87	23.52	14.64	25.77
of which from other(percent)	4.83	14.02	4.36	13.04	4.73	13.83
General characteristics						
Whether family members participate non-farm work (percent)	34.04	-	30.72	-	33.36	-

Output value per unit area (Y1000)	10.05	7.69		9.95	6.94	7.69
Financed scale via credit activity (Y 1000)	22.87	106.04	35.38	124.07	25.10	109.42
Farmland size per capita (mu)	2.44	2.15	3.29	3.28	9.16	7.40
Irrigable (percent)	62.14	-	65.10	-	63.13	-
Average scale per plot in household level (mu)	3.95	4.75	5.04	8.38	4.14	5.61
Household population scale	4.34	1.57	4.46	1.64	4.37	1.59
Agricultural labor size	2.12	0.95	2.14	0.76	2.13	0.92
Apple sale price (Y/kg)	4.62	2.08	5.46	5.16	4.76	2.96
Household Head age	50.48	9.55	48.47	7.88	50.43	9.31
Household head education level(1=literacy; 2=primary; 3=junior middle; 4=senior middle; 5=bachelor)	2.89	0.88	2.85	0.75	2.89	0.85

3.2 General characteristics of land rental market in apple production sites

Table 2 illustrates that there is a gap between incidence rate of land rented-in and rented-out, which means that attracted by high comparative gains, apple producers have strong desire to rent in land for apple production rather than rent out. Land transactions within apple production sites are endowed with characteristics of geographical relation, most trade happens within community among relatives, friends or neighbors. The reason for this is mostly asymmetry information drives high transaction costs in land market, then a rational choice for farmers is to overcome land transaction costs via social network.

Apple is a long-term perennial cash crop that bears in 3-5 years after planting and can be harvested for 5–20 consecutive years, so most land lease length are consistent with apple's life cycle. Also, it's widely accepted that the longer lease term, the higher tenure security. Therefore, long-term land relative investment and high productivity are encouraged because their lease contract length assures the security of lease tenure for tenants. Land tenure contract within sample farmers mainly include gift and fixed rent, and share contract is not observed. To transfer land as a gift mostly happened within relatives and other close social networks. Furthermore, share contract is rarely found in modern economy because it often triggers high monitoring costs and enforcement costs. With 84 percent, the land contract in written form takes majority may also imply that land rental contracts become increasingly formal.

Table 2. *Characteristics of apple growers' land rental market participation*

	Total (N=1079)		Shandong (N=359)		Gansu (N=271)		Shaanxi (N=358)		Henan (N=91)	
	Freq	Percent	Freq	Percent	Freq	Percent	Freq	Percent	Freq	Percent
Autarky	851	78.87	299	83.29	189	69.74	299	83.52	64	71.11
Land markets participants	228	21.13	60	16.71	82	30.26	59	16.48	27	30.00
of which rented in	190	17.61	52	14.48	58	21.50	56	15.64	24	26.67
of which rented out	25	2.32	6	1.67	13	4.80	3	0.84	3	3.33
of which rented in and out	13	1.20	2	0.56	11	4.06	0	0.00	0	0.00
Scope of land rented										
Within villagers' group	148	64.91	38	63.33	53	64.63	32	54.24	25	92.59
Within village	43	18.86	16	26.67	5	6.10	20	33.90	2	7.41
Within town	26	11.40	6	10.00	15	18.29	5	8.47	0	0.00
Without town	8	3.51	0	0.00	6	7.32	2	3.39	0	0.00
Others	3	1.32	0	0.00	3	3.66	0	0.00	0	0.00

Land rental partner is										
Relatives	47	20.61	17	28.33	9	10.98	12	20.34	9	33.33
Acquaintance	33	14.47	8	13.33	18	21.95	5	8.47	2	7.41
General farmers	85	37.28	13	21.67	40	48.78	22	37.29	10	37.04
Enterprises	6	2.63	1	1.67	5	6.10	0	0.00	0	0.00
Village Collectives	57	25.00	21	35.00	10	12.20	20	33.90	6	22.22
Land rental behavior is organized by										
Farmers themselves	189	82.89	50	83.33	65	79.27	50	84.75	24	88.89
Local government	38	16.67	9	15.00	17	20.73	9	15.25	3	11.11
Rural organization	1	0.44	1	1.67	0	0.00	0	0.00	0	0.00
Land contract forms										
Oral	73	32.02	20	33.33	28	34.15	9	15.25	16	59.26
Written	154	67.54	40	66.67	53	64.63	50	84.75	11	40.74
Others	1	0.44	0	0.00	1	1.22	0	0.00	0	0.00
Land contract										
Gift	17	7.46	4	6.67	7	8.54	5	8.47	1	3.70
Fixed rent	211	92.56	56	93.33	75	91.46	54	91.53	26	96.30
Land contractual duration										
<5 years	28	12.28	7	11.67	5	6.10	14	23.73	2	7.41
5-20 years	129	56.58	25	41.67	60	73.17	29	49.15	15	55.56
>20 years	71	31.14	28	46.67	17	20.73	16	27.12	10	37.04
Crops planted before renting in										
Grain	74	38.95	19	36.54	19	32.76	21	35.59	4	16.67
Apple	122	44.21	31	59.62	39	67.24	33	55.93	19	79.17
Greenhouse	3	1.58	2	3.85	0	0.00	1	1.69	0	0.00
Others	29	15.26	8	15.38	0	0.00	4	6.78	4	16.67
Crops planted after renting in										
Grain	13	6.84	1	1.92	8	13.79	4	6.78	0	0.00
Apple	177	93.16	51	98.08	50	86.21	52	88.14	24	100.00

4. Conceptual framework and empirical strategy

Based on Chamberlin and Ricker-Hilbert (2016) approach, we assume a household maximizes utility via redistributing land in order to reduce the gap between a households' effective and expected land size. Specifically, famers' desired land size is usually determined by productive assets, credit and insurance market access (Deininger and Feder, 2001), labor endowment (Deninger and Jin, 2009), and other heterogeneous characters. Therefore, the land rental market participation decision can be written into:

$$R_i = L^*(K, C, A, H, V) + lL + m \quad (1)$$

where $i = 1, 2$. R_1 and R_2 represent the discrete decision of whether participate the land market and the amount of land rented in. When $R_1 = 1$ the household rents in land and R_2 can be observed. Effective land endowment before renting in is indicated by L , and L^* represents the expected optimal land scale. In our research, pre-rental farm size is defined as the amount of land that a household has use rights and lease rights. Generally, rich land

endowments mean land scarcity does not constrain agricultural production. Against such condition, household has less motivation to participate land rental market. Therefore, we may predict that the coefficient on L will be negative.

Credit access that the household has is denoted by C . To small and fragmented landholder in land-scarce economy, access to credit has two implications: loans from any source are helpful to change low levels of fixed capital and improve poor infrastructural development. On the one hand, credit market imperfections that increase the shadow price of credit for small producers would reduce small farmers' competitiveness in the land market, possibly outweighing the supervision cost advantage they enjoy. Household should be expected to use the land rental market to equilibrate the costs per unit land (Kochar, 1997). Therefore, it might be predicted that credit access may have positive effect on farmers' land rental market participation, particular on the land size of renting in.

Scale economy is another driver force of farmer' land market participation because the presence or absence of economies of scale would systematically affect the shadow price of land for different farm-size classes. Possible economies of scale could arise from the presence of indivisible factors of production or cost elements leading to an initial range of farm size where the average cost of production declines with farm size. Specifically, optimal farm sizes tend not to exceed the scale, at which family labor is fully occupied and costs of inseparable fixed productive assets are well shared. To achieve the economies of scale associated with land relative factors, production of these crops is generally organized on a scale that corresponds to the optimum scale of farmers' productive assets and agricultural labor endowments, which are indicated by K and H separately. Other household endowment factors like labor education, age of household head and geography location are denoted by V , and u is the error term.

The linear expression of equation (1) might be written into:

$$R_i = z_0 + z_1K + z_2C + z_3H + z_4V + z_5L + \eta \quad (2)$$

where R_1 and R_2 represent the discrete decision of whether participate the land market and the amount of land rented in, η is the error term.. Both Probit model and Tobit model will be applied to estimate the determinants of farmers' land market participation. It should be noted here that significances of \hat{z}_2 and \hat{z}_5 have important policy implications and equity and efficiency meaning. If \hat{z}_2 is significant different from zero and positive, it implies that credit access plays an important role in explaining the poor contribution of land rental markets in specialized agricultural production areas, and rural credit reform will be desirable to active land rental markets. Significant and Estimated value of z_5 is used to test the hypothesis that does the land rental markets redistribute the land from rich labor endowment households labor-scarce households.

Our final procedure is to illustrate how land market participations affect households' land relative investments and farm productivity. Investment indicators include fixed productive assets investment, fertilizer and manure investment and hired labor inputs, and farm productivity is demonstrated by value of apple output per unit area. Based empirical model as follows:

$$Y_j = d_0 + d_{1i}R_i + Gd_3 + Z \quad (3)$$

where d is coefficients to be estimated and variable vector, and G indicates other variables determine farmers; productive investments and farm productivity. Consider that households' land transfer decision is endogenous with some specific characteristics like capability, fixed assets and so on, we must deal with the endogenous bias properly. According to Wooldridge's (2010) approach, Instrumental Variable Method (IV) will be efficient to overcome this concern. Specifically, equation (2) might be regarded as a reduced form of the endogenous variable. IV model is expressed as follows:

$$Y_j = b_0 + b_{1i}R_{IVi} + Gb_3 + t \quad (5)$$

where R_{IVi} is the instrumental variable of R_i , β is the relative coefficients to be estimated and ϵ is the error term.

5. Empirical results

5.1 Determinants of land renting in

Table 4 presents the results for households when we evaluate the determinants of whether rented in by Probit model and area rented in using by Tobit Model respectively. We find that having more effective cultivated land before renting in has a negative effect on the rented in land at 1% significant level. This may indicate that land rental market in specialized apple production sites increases the amount of land available to the land-scarce. It should be noted here that in the presence with scale economies, liberalization of land rental markets might lead to large-scale land concentration, thereby prohibiting poor households access to land. This finding is consistent with the previous literature such as Jin and Deininger (2009), Deininger and Jin (2005), in which they define the effect of transferring resources from relatively land-rich to land-poor households as the equity effect of land rental markets.

We also find that inseparable productive assets value play a positive role in land rental decisions, as households with a higher value of machine are significantly more likely to rent in land. This finding implies that to share the fixed costs of machinery investment motives household to expand scale via renting in land. In another aspect, extended scale require further machinery investments to substitute scarce labor. In most countries, it is the staircase effect occurred between land scale and fixed investments drivers farm scale to expand.

Another finding of interest is that both agricultural labor endowment and nonfarm employment do not affect either the amount of land rented in or discrete decision choice. This result differs from most research results on Africa, such as Lunduka et al., (2010) for Malawi, Chamberlin and Jacob (2016) for Malawi and Zambia, Jin and Jayne (2013) for Kenya. In contrast to us, they find that labor endowment is another pivotal factor that is important for households to be able to get into the land market. Specifically, Households with richer labor endowment are more likely to rent in land. The reason for the differences might be that family labors within sample sites are highly substituted by laborsaving machines investment, dwarfing cultivation technology adoption and hired labors from rural labor market. In other words, less family labor does not constrain agricultural production because hired labor market outside family and fixed investments can be used to equilibrate labor inputs. This, in turn, implies a relatively low valuation of family labors and suggests that family labor endowments will not form absolute complete advantage of perennial cash crop production.

The positive and significant coefficients on access to credit and insurance indicate that households with more capital may be able to rent more land intensify land use by using higher levels of purchased inputs such as machine, labor and fertilizer. This suggests that land, credit and insurance have to be analyzed together. Improvements in rural credit will simultaneously stimulate land rental development.

We also find that “anti land fragmentation” is another driving force for households land decision. For a long time, the generally observed positive relationship between plot size and output for major crops in China suggests that fragmentation involved a significant cost (Nguyen et al., 1996). In order to overcome the inefficiency caused by fragmentation, transfer land via land rental market will an efficient choice. Therefore, households with small plot size are more like to rent in land.

Table 4. *Determinants of land renting in*

Probit Model		Tobit Model	
Coefficient	p value	Coefficient	p value

Effective cultivated land before renting in (mu)	-0.0266*** (-3.04)	0.002	-0.8577*** (-5.54)	0.000
Value of productive assets (Y 1000)	0.0130*** (2.92)	0.004	0.4553*** (6.6)	0.000
Household agricultural labor size	0.0200 (0.38)	0.705	0.1684 (0.18)	0.860
Financing scale via credit (Y 1000)	0.0003 (0.81)	0.416	0.0259*** (4.91)	0.000
Access to agricultural insurance (=1)	-0.0028 (-0.02)	0.982	4.1181** (2.19)	0.029
Access to agricultural irrigation (=1)	0.0720 (0.58)	0.559	-0.7208 (-0.36)	0.720
Amount of cultivated land plot	0.0357*** (3.07)	0.002	0.3811*** (2.81)	0.005
Adopt labor saving technology (=1)	1.5224** (2.14)	0.032	18.8721** (2.14)	0.033
Apple sale price before land renting in	0.0945*** (2.77)	0.006	0.9886** (2.41)	0.016
Household members participate in nonfarm employment (=1)	-0.0667 (-0.63)	0.526	-1.3569 (-0.79)	0.427
Age of household head	-0.0134** (-2.49)	0.013	-0.2412*** (-2.69)	0.007
Education level of household head	-0.0880 (-1.49)	0.136	-0.7479 (-0.78)	0.436
Locates in Shaanxi Province (=1)	-0.5031*** (-2.75)	0.006	-4.1335 (-1.38)	0.169
Locates in Gansu Province (=1)	-0.5222 (-2.66)	0.008	-7.3486** (-2.24)	0.025
Locates in Shandong Province (=1)	-0.8752*** (-4.8)	0.000	-11.9563*** (-3.98)	0.000
Constant	0.1679 (0.39)	0.698	1.0606 (0.15)	0.880

Note: numbers shown in parenthesis are z value. ***p<0.01** p<0.05* p<0.10.

5.2 Impacts of land tenure on agricultural investments

Fixed investment is measured by an aggregate cost of all of a household' type of productive fixed investments within 2 years before investigating. These systems of aggregation allow fixed investment to be treated as a continuous variable, with consequently richer options for empirical analysis. To check the robustness of correcting endogeneity, table 5 demonstrates the OLS and IV regressions for the factors affecting the fixed investments. Results indicate that households with greater land endowments, larger land rented in have a significant effect on household's fixed investments. The significance of farm size may be due to either supply or demand effects: On the supply side, greater farmer size leads to higher income or capital flow; On the demand side, in the sense that farm size necessitates or perhaps affords the opportunity for greater investments. Expanded farm scale via renting in land requires more investments to substitute relatively scare labor and other factors.

Another substantively interesting result is the significant and positive effect of credit access on fixed investments. This implies that the estimates of an investment equation suggest that access to credit has a statistically significant role in determining investment behavior of farmers. What we can learn from this is that Credit requirements of the farming sector have increased rapidly over the past few decades resulting from the rise in use of mechanization and hike in their prices. In return, more access to credit will be helpful for households to break up the development trap and to smooth intertemporal investment and consumption.

The significance of crop insurance mainly due to it reduces expected income shock from various natural risks. In detail, crop insurance scheme may be launched to provide cover to farmers against losses from drought, pest attacks, hailstorm, thunderstorm, heavy rains, and other natural hazards on payment of small premium in addition to credit markup (Smith and Glauber, 2012). Based on the above-mentioned empirical evidence, we have reason to believe that differential access to credit plays an important role in explaining observed differences in fixed input use in developing country. As a result, it derives an important policy implication issue that rural development and investment increase must originate with agricultural credit and insurance reform.

Table 5. *Determinants of fixed investments*

	OLS		IV	
	Coefficient	p value	Coefficient	p value
Land scale rented in (mu)	0.3753*** (8.92)	0.000	4.9119*** (8.85)	0.000
Land scale owned (mu)	0.1570*** (3.74)	0.000	0.6817*** (4.28)	0.000
Household agricultural labor size	0.4974* (1.67)	0.096	0.3737 (0.36)	0.720
Financing scale via credit (Y 1000)	0.0013 (0.50)	0.617	0.0900*** (6.45)	0.000
Access to agricultural insurance (=1)	0.7582 (1.09)	0.276	4.9637** (1.97)	0.049
Access to agricultural irrigation (=1)	-1.1216 (-1.55)	0.120	-0.1817 (-0.07)	0.943
Amount of cultivated land plot	0.0914 (1.53)	0.125	0.0409 (0.2)	0.844
Apple sale price before land renting in	-0.0003 (0.00)	0.999	-1.0262 (-1.52)	0.130
Household members participate in nonfarm employment (=1)	-0.6131 (-1.01)	0.311	1.7501 (0.82)	0.411
Age of household head	-0.1195*** (-3.89)	0.000	0.0559 (0.51)	0.609
Education level of household head	0.2391 (0.72)	0.474	0.2202 (0.19)	0.850
Locates in Shaanxi Province (=1)	0.1550 (0.13)	0.893	-1.1597 (-0.29)	0.773
Locates in Gansu Province (=1)	2.8881** (2.40)	0.017	4.7879 (1.14)	0.256
Locates in Shandong Province (=1)	0.2183	0.846	7.4623* (1.14)	0.063

	(0.19)		(1.86)	
Constant	12.3879***	0.000	-4.6674	0.606
	(4.90)		(-0.52)	

Note: Numbers shown in parenthesis are z value. ***p<0.01** p<0.05* p<0.10.

5.3 Impacts of land tenure on farm productivity and income

The previous statistical evidence suggests a positive correlational relationship between renting in land and households welfare. However, to identify whether the correlation is causal or noncausal relationship definitely requires further analysis by quantifying the directions and magnitude of these effects with micro surveyed data. Tables 6a-6d demonstrate the effect of renting in land on households' apple production income, off-farm employment income, total income and expenditure respectively. Overall, empirical results by comparing estimate values of OLS approach and IV approach may suggest that endogeneity of land decision might cause welfare gains from rental market participation are underestimated. Table 6a suggests that unconstrained access to land rental market on the tenant side would have significantly improved household agricultural income in the area. An additional mu rented in offers an extra 2440 Yuan RMB on average. This indicates that land renting is highly relative to agricultural revenue.

Table 6a. Regression estimates of factors affecting value of apple production

	OLS		IV	
	Coefficient	p value	Coefficient	p value
Value of productive assets (Y 1000)	0.5945*** (3.80)	0.000	0.2339 (1.14)	0.256
Land scale rented in	0.7392*** (3.43)	0.001	2.4407*** (3.51)	0.000
Land scale owned	-0.1195 (-0.54)	0.591	0.2076 (0.82)	0.412
Household agricultural labor size	4.4941*** (2.86)	0.004	4.5350*** (2.79)	0.005
Access to agricultural insurance (=1)	3.6389 (1.00)	0.319	1.8705 (0.48)	0.635
Access to agricultural irrigation (=1)	10.5063*** (2.75)	0.006	10.5306*** (2.68)	0.007
Locates in Shaanxi Province (=1)	1.7260 (0.30)	0.768	-1.3751 (-0.23)	0.822
Locates in Gansu Province (=1)	14.6794** (2.36)	0.019	13.7299** (2.11)	0.035
Locates in Shandong Province (=1)	16.7883*** (3.00)	0.003	16.8599*** (2.85)	0.004
Constant	16.8580** (2.37)	0.018	17.9667** (2.44)	0.015

Note: Numbers shown in parenthesis are z value. ***p<0.01** p<0.05* p<0.10.

From table 6b we can see that there is a substitute relationship between land rented in and off-farm employment income. Given the high comparative profit of apple production, devoting more land to apple planting

will increase the shadow price of off-farm work. Therefore, high intensity of renting in land has significant and negative effect on households' off-farm income.

Table 6b. *Regression estimates of factors affecting off-farm income*

	OLS		IV	
	Coefficient	p value	Coefficient	p value
Value of productive assets (Y 1000)	-0.0327 (-0.43)	0.664	0.1323 (1.33)	0.183
Land scale rented in	-0.1629 (-1.57)	0.117	-0.9947*** (-2.96)	0.003
Land scale owned	0.3921*** (3.67)	0.000	0.2653** (2.17)	0.030
Household agricultural labor size	-2.0771*** (-2.74)	0.006	-2.0439*** (-2.60)	0.009
Access to agricultural insurance (=1)	0.6477 (0.37)	0.713	1.6752 (0.88)	0.378
Access to agricultural irrigation (=1)	-0.5929 (-0.32)	0.747	-0.8135 (-0.43)	0.668
Locates in Shaanxi Province (=1)	3.4909 (1.24)	0.214	3.9798 (1.35)	0.177
Locates in Gansu Province (=1)	-5.4036* (-1.80)	0.072	-5.9040* (-1.88)	0.060
Locates in Shandong Province (=1)	-8.2286*** (-3.05)	0.002	-9.5611*** (-3.35)	0.001
Constant	16.5556*** (4.84)	0.000	17.2109*** (4.85)	0.000

Note: Numbers shown in parenthesis are z value. ***p<0.01 ** p<0.05* p<0.10.

We see from table 6c and 6d that renting in land has a strong positive association with the total family income and expenditure. This indicates that greater land size might lead to more cash flow, which will relieve farmers' cash constrain and active their consumption willingness. Taken together, tables 6a-6d provide strong evidence that renting in land from market will produce obvious welfare gains on average. Besides this, it also implies land rented in will substitute rather than compensate off-farm employment.

Table 6c. *Regression estimates of factors affecting total household income*

	OLS		IV	
	Coefficient	p value	Coefficient	p value
Value of productive assets (Y 1000)	0.5812*** (2.78)	0.006	0.5912** (1.89)	0.059
Land scale rented in	2.8089*** (9.72)	0.000	8.6994*** (8.26)	0.000
Land scale owned	0.8435*** (2.84)	0.005	1.8724*** (4.88)	0.000
Household agricultural labor size	1.7521	0.406	1.8058	0.465

	(0.83)		(0.73)	
Access to agricultural insurance (=1)	4.4594	0.362	-4.7574	0.426
	(0.91)		(-0.80)	
Access to agricultural irrigation (=1)	14.9023***	0.004	15.3868***	0.010
	(2.92)		(2.58)	
Locates in Shaanxi Province (=1)	9.6018	0.219	3.3393	0.719
	(1.23)		(0.36)	
Locates in Gansu Province (=1)	13.1751	0.115	13.7435	0.164
	(1.58)		(1.39)	
Locates in Shandong Province (=1)	16.0709**	0.033	20.4425**	0.023
	(2.14)		(2.27)	
Constant	31.2474***	0.001	30.1978***	0.007
	(3.28)		(2.70)	

Note: Numbers shown in parenthesis are z value. ***p<0.01 ** p<0.05* p<0.10.

Table 6d. *Regression estimates of factors affecting total household expenditure*

	OLS		IV	
	Coefficient	p value	Coefficient	p value
Value of productive assets (Y 1000)	0.0921	0.526	-0.6565***	0.002
	(0.63)		(-3.09)	
Land scale rented in	0.6300***	0.002	4.2194***	0.000
	(3.16)		(5.90)	
Land scale owned	0.3060	0.140	0.9030***	0.001
	(1.48)		(3.45)	
Household agricultural labor size	1.7481	0.231	1.8737	0.265
	(1.20)		(1.12)	
Access to agricultural insurance (=1)	6.8174**	0.046	1.3582	0.739
	(2.00)		(0.33)	
Access to agricultural irrigation (=1)	-1.7947	0.613	-2.2361	0.583
	(-0.51)		(-0.55)	
Locates in Shaanxi Province (=1)	7.7095	0.158	4.6405	0.464
	(1.41)		(0.73)	
Locates in Gansu Province (=1)	20.4048***	0.000	22.4347***	0.001
	(3.50)		(3.33)	
Locates in Shandong Province (=1)	1.3426	0.798	5.9159	0.334
	(0.26)		(0.97)	
Constant	28.8685***	0.000	27.3485***	0.000
	(4.37)		(3.60)	

Note: Numbers shown in parenthesis are z value. ***p<0.01 ** p<0.05* p<0.10.

6. Conclusions and policy implications

The research purposes of this paper are to identify the determinants of affecting apple growers' decision of renting in land and how much to rent in and to quantify the effect of renting in land on households welfare. The relative

data are collected within specialized apple production sites in northern China not only because the apple industry is important to northern China's rural economy, contributing to income increase and equals four-tenth of the world's total but also because little attention has been paid to the function and role of high added value crop, where land rental market might be more competitive. Our empirical results allow to draw main conclusions as follows.

First, we find that family owned land scale, inseparable productive assets, access to credit and insurance and land fragmentation have significant effect on households' land market participation. Interestingly, in contrast with the common results on Africa, our research suggests that both agricultural labor endowment and nonfarm employment do not affect either the amount of land rented in or discrete decision choice. The reason for the differences might be that family labors within sample sites are highly substituted by laborsaving machines investment, dwarfing cultivation technology adoption and hired labors from rural labor market. From a policy perspective, policy lessons can be drawn from them is that: on the one hand, land redistribution direction is from households with higher land endowments to the samples with less land endowments. Therefore, whether liberalization of land rental markets would lead to large-scale land concentration, thereby prohibiting the poor group having access to land should be drawn attention; On the other hand, the land, credit and insurance have to be analyzed together. Improvements in rural credit will simultaneously stimulate land rental development.

Our second finding of interest is that households with greater land endowments, larger land rented in have a positive and significant effect on household's fixed investments. Both efficient supply of credit and insurance are helpful to encourage larger investments. Therefore, various accesses to credit and agricultural insurance contribute to explaining observed differences in fixed input use in developing country. As a result, it derives an important policy implication issue that rural development and investment increase must originate with agricultural credit and insurance reform.

Finally, renting in land from market will produce obvious welfare gains, like household agricultural income, total household income and family expenditure. In other words, it is clear from our empirical results that there is high potential of land rental markets to improve agricultural productivity and augment the welfare of smallholders. In the area of policy, how to remove remaining land transaction obstacles and to improve functioning of land rental market is worth more policy makers' efforts.

The most important policy recommendations from our study may include that: first, land rental market should be activated and encouraged given the obvious welfare gains from renting in land. Specific policy efforts might be made to promote efficient credit and agricultural insurance supply and measures to strengthen farmers' land use rights. Besides this, due to the inner link between inseparable productive assets and land market participation, policies that promote farmers' relative fixed investments could stimulate rental market development as well.

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