Development of land rental market and its effect on household farming in rural China : an empirical study in Zhejiang Province

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February 2012

Abstract

This paper investigates the impact of land rental market development on the efficiency of labor allocation and land utilization in rural China. To test the hypothesis that the shadow wage of a rent-in household with limited off-farm opportunities will increase with the development of a land rental market for households, a statistical comparison between the shadow wage and the estimated market wage was conducted. The results showed that the shadow wage for both rent-in households and non-rent-in households was significantly lower than the market wage, but that the wage for the rent-in households was statistically higher than that for non-rent-in households in Fenghua and Deqing, the two counties surveyed in this study. In addition, the estimated marginal product of farmland for rent-in households was statistically higher than the actual land rent that those households paid, while a null hypothesis that the actual rental fee accepted by rent-out households is equivalent to the marginal product of farmland for those households was not rejected in Fenghua county where land transactions by mutual agreement were more prevalent. These results indicate that the development of the land rental market facilitates the efficiency of labor allocation and farmland utilization in rural China.

Keywords: Land Rental Market, Agricultural Production Function, Household Model
JEL classification: J22, O13, Q12, Q15

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I. Introduction

The development of a well-functioning land rental market is one of the most feasible means to increase factor allocation and raise the efficiency of land use in rural areas of developing countries (World Bank 2007, Otsuka 2007). In most of these countries, land reform is difficult to implement politically, and the purchase and sale of farmland is greatly restricted. By comparison, a land rental market is relatively easy to formulate. This is especially true in a developing country experiencing a rapid growth in the number of out migrants and off-farm workers. If the households of these migrants and off-farm workers are no longer fully utilizing their land because fewer family members are available, then land transactions from these households to more able farmers not only raises the efficiency of land use, but also accelerates the off-farm employment of rural workers.

Rapid economic growth in China has induced a huge demand for labor from rural areas. High productivity in the manufacturing sector has been achieved using cheap labor from the rural sector. The amount of migrant labor increased from the end of the 1980s, and a survey on this labor by the National Bureau of Statistics (NBS) of China (http://www.stats.gov.cn) showed that the number of rural laborers who had migrated from their registered townships for more than six months reached 153 million people in 2010, accounting for about 30 percent of total rural labor in China. In recent years a shortage of physical-labor workers from rural areas has become evident mainly in coastal areas such as Shenzhen and Guangzhou, which has pushed up the wages for these workers. This has created a debate in the recent literature of whether the Chinese economy has passed the Lewis turning point.[1]

In contrast to the burgeoning development of China's urban manufacturing sector, development of rural land utilization, notably the rental market for farmland, has lagged. At the end of 1990s, the ratio of farmland that was rented in was under 5 percent (MoA eds. (2001)). After the abolition of the rural commune system, right of farmland utilization was distributed almost equally to rural households, and the Household Responsibility System (HRS) was implemented at the beginning of the 1980s. The HRS granted households farmland utilization rights in return for meeting certain tax and grain quota obligations. Although the HRS raised the incentive for family farmers to increase the production of their own farmland, agricultural sector had begun to suffer

[1] A special issue on the Lewis turning point in China was published by the *China Economic Journal* (Vol. 3, No. 2, 2010), and the results of a symposium on this topic will be published in the *China Economic Review*.

from low productivity since the end of the 1980s (Macmillan et.al (1989), Lin (1992) and Wen (1993)). This was mainly due to the diseconomy of small-scale family farming and the dysfunction of agricultural extension services.[2]

Moreover, Chinese farmers were not eager to rent out farmland since it functioned as an important source of social security against unemployment when there were no off-farm jobs and in their old age (Dong (1996)). The reallocation of farmland by village (*xingzheng cun*) or village small-group (*cunmin xiaozi*) in the 1980s and 1990s also hindered the development of the land rental market in China. Property rights to land were not privatized but vested in villages (*xingzheng cun*) or village small-groups (*cunmin xiaozi*), and village cadres had reallocated land among households at least once and, on average, more than twice. Thus, insecure land transfer rights discouraged farmers from investing in agriculture (Carter and Yao (1998), Li, Rozelle and Brandt (1998) and Jacoby, Li and Rozelle (2002)).

However, since the late 1990s the situation in agriculture has begun to change. The Chinese government has started to implement a new agricultural policy called "agricultural industrialization" (*nongye chanye hua*). The purpose of this policy is to support economic organizations such as agribusiness enterprises, large farmers, and rural agricultural cooperatives that integrate small farmers to achieve economies of scale and to increase the quality and safety of agricultural products through agricultural contracts and extension services. Such agricultural integration has spread widely especially in the coastal areas, accompanied by progress in the land rental market (World Bank (2006), MoA eds. (2008), Miyata, Minot and Hu (2009) and Lingohr-Wolf (2011)).

This trend is confirmed by the statistical data. According to MoA (2010), the ratio of leased-in farmland to total faming area had reached 16 percent in 2009. Data from an agricultural census conducted in 2006 showed that the ratio of leased-in farmland was over 20 percent for developed coastal provinces such as Shanghai, Zhejiang, and Fujian (SC and NBS (2008)). This study investigates the effects of this growing land rental market on farm management and recent agricultural development in China.

There are many studies addressing the mechanism of the farmland lease market in China. Yao (2000) theoretically formalize the effect of the imperfect labor market on the farmland lease market using a general equilibrium model and household panel data. He showed empirically that product heterogeneity and a freer labor market promote more land leasing. Carter and Yao (2002) employ an agricultural household model to prove

[2] According to a rural household survey by the NBS, the average area of farmland held by a household in China during the 1990s was just 0.4-0.6 of a hector.

that uncertainty in land transfer rights and high transaction cost prevented efficient farmland reallocation through the rental market. Based on the model settings of Carter and Yao (2000), Deininger and Jin (2005) and Deininger and Jin (2009a) suggested that the land rental market reallocated land to lower endowment but more able households which had a bigger effect on agricultural production. Deininger, Jin and Nakarajan (2008) applied the same framework for India and concluded that the restrictions on land rental transactions negatively affect the productivity and equity of rural households.

The impacts of off-farm employment on the land rental market have also been examined. Kung (2002), using a two-stage IV regression, showed that households actively participating in off-farm employment are less likely to rent in farmland. Benjamin and Brandt (2002) examined the impact of administrative land reallocation and unevenly developed off-farm labor markets on farm efficiency. They concluded that inefficiency in labor allocation is alleviated to some extent by administrative land reallocation and development of the off-farm labor market. Kimira et al. (2011) also empirically suggest that higher off-farm wage rates increase off-farm employment opportunities inducing a more active land rental market.[3]

However, few studies have tested the efficiency of the land rental market by comparing estimated and actual rental fees. Moreover, the theoretical relationship of whether land rent-out or rent-in has an effect on the shadow wage of farmers has not been explored sufficiently. Farmland leasing tends to be conducted within personal networks of kinship and local friends, thus rental fees tend to be very low or not charged at all. This made it difficult in former studies to directly estimate allocation efficiency through a comparison between actual land fees and estimated ones.

Since 2003 the Chinese government has enforced a rural land contract law that has formalized land transfers. Land transfer centers have been set up to handle the registration of land leases, and all lenders and tenants are required to exchange land lease contracts within one year, except in the case of substitute farming.[4] Formalization of the land rental market has developed especially in the coastal areas, as off-farm employment has been more pervasive and the motivation to engage in agricultural

[3] The main objective of Kimira et al. (2011) was to test the hypothesis that the perception of tenure insecurity reduces the likelihood of renting out land. However, the estimation model in their study is not constructed to test this hypothesis directly, because a variable which indicates tenure insecurity is not included in the estimation model for rent-in or rent-out determination.

[4] The survey for this study indicated that an exchange of lease contract is unlikely in the case of a kinship transaction. In Fenghua and Deqing, the two counties surveyed, the ratio for lease contracts exchanged was 51% and 78% respectively. Deininger and Jin (2009b) found that implementation of the rural land contract law significantly increased the value of compensation for land sold; it also prevented illegal land relocation.

production decreasing. Therefore this study undertook a rural household survey in Zhejiang Province, a coastal area, in 2008 and 2011 to collect information on land lease activity.

The objective of this study is to construct a theoretical agricultural household model to test the hypothesis that the development of a land rental market and the rise in land rental transactions changes the shadow wage of the household, and to evaluate the effect through econometric estimations. The study will also conduct a statistical test between the estimated rental fee and the actual one to highlight the characteristics of China's land rental market. The remainder of this study proceeds as follows. Section II presents a household model with a land rental market and proposes a testable hypothesis. Section III conducts an econometric analysis to test the hypothesis. Section IV summarizes the results and indicates implications for agricultural land policy in developing countries.

II. Theoretical Framework

Following Yao (1999) and Yao (2000), I assume job opportunity or work time for off-farm employment (L_w) is institutionally limited, and that quantity rationing imposes a ceiling in the form of ($\overline{L_w^0} \geq L_w$). This assumption is plausible because of China's *Hukou* (household registration) system which restricts the movement of population and labor from rural to urban areas. The government has been easing these restrictions since the middle of the 1980s, but rural households cannot settle permanently in urban areas with all of their family members. Also, most migrated workers engage in physical labor such as construction, manufacturing and the restaurant sector, and they tend to go back to their home villages or retire from off-farm work on reaching around forty years of age. Thus, it is reasonable to assume that off-farm employment is rationed.

I assume a unitary household model with $U = U(y, l)$, where y is income, l is leisure, $U_y>0$, $U_l>0$, and U is strictly concave in y and l. Household income comes from three source: agriculture, off-farm work and land rental market. Households allocate their labor endowment between their own land L_A and off-farm employment L_W at an exogenous wage W. The renting of land has transaction cost TC because of the need to collect information on the rental market, to negotiate with latent lenders or borrowers, and to enforce rental contracts. Therefore, the lender's net gain from renting out one unit of land is $r - TC^{out}$, where r is the rental rate, and the tenant's net cost of renting in one unit of land is $r + TC^{in}$. I assume that transaction cost is not the same

between renting in and renting out since renting in land involves a relatively large amount of investment.

The decision of a representative rural household to rent in or rent out land can be modeled as follows:[5]

$$\text{Max} \qquad U = U(y, l) \tag{1}$$

$$\text{s. t.} \quad y = pQ(L_A, T_A) + I^{out}(r - TC^{out})T_1 - I^{in}(r + TC^{in})T_2 + wL_w \tag{2}$$

$$\overline{L} = L_A + L_w + l \tag{3}$$

$$\overline{L}_w^0 \geq L_w \tag{4}$$

$$T_A = \overline{T} + T_2 - T_1 \tag{5}$$

where p denotes the price of agricultural goods, Q denotes the production function of agriculture with inputs of T_A(operational land size) and L_A(amount of agricultural labor), $\overline{L}$ and $\overline{T}$ are labor and land endowments respectively, T_1 is the amount of rented-out land, T_2 is the amount of rent-in land. I^{out} is an indicator for renting out (1 for rent-out, 0 otherwise), I^{in} is an indicator renting in (1 for rent-in, 0 otherwise) .

This model yields the following first order condition (FOC) of L_A.

$$U_y pQ'_{L_A} - U_y w + \lambda \leq 0 \tag{6}$$

where λ is the Lagrange multiplier for the constraint on L_w. I now define shadow wage (w_s) as:

$$pQ'_{L_A} \leq w - \frac{\lambda}{U_y} \equiv w_s \tag{7}$$

This indicates that w_s is smaller than w if off-farm employment is constrained, and the marginal productivity of agricultural labor is less than wage rate. In this model, I assume that w_s is strictly positive to ensure that an interior solution of L_A and equality in equation (7) hold. Equation (7) also indicates that the shadow wage approaches the wage rate if the rationing of off-farm employment is reduced.

As Yao (2000) shows, the effect of L_A on shadow wage is deduced from the partial differential in equation (7).

[5] Yao (2000) includes wage labor for own agriculture as a variable of household income. He assumes that the level of the shadow wage of the household is less than that of agricultural labor, thus the household will not hire outside labor. For the purpose of simplifying the setting, I do not introduce agricultural wage labor.

$$\frac{\partial w_s}{\partial L_A} = \frac{\lambda}{U_y^2} U_{yy}(pQ_{L_A} - w) \geq 0 \qquad (8)$$

This is because U_{yy} is negative and $(pQ'_{L_A} - w)$ is non-positive. In order to clarify the relationship of w_s, w, and L_A, Figure 1 depicts the labor allocation of the household. The vertical axis is the wage rate or marginal product of agricultural labor, and the horizontal axis is the amount of agricultural labor. If the labor market works perfectly, the amount of labor is determined at a node of the wage rate and marginal product. In my model, the optimal amount of agricultural labor is more than that of the perfect market because of off-farm labor rationing.

(Insert Figure 1 here)

Looking next at the determinants of the decision to rent in or rent out land and the effect of land rental on the level of the shadow wage, if the land rental market is perfect, the amount of land rented in or rented out is decided only by the land rental fee. However, the renting of land comes with transaction cost as assumed in equation (2). The first order condition of land for T_1 and T_2 are shown as follows:

T_1 (rent-out; I^{out} =1 and I^{in} =0):

$$-pQ'_{T_A} + (r - TC^{out}) \leq 0, T_1 \cdot (-pQ'_{T_A} + (r - TC^{out}) = 0$$

$$\text{thus } T_1 > 0 \text{ if } pQ'_{T_A} = (r - TC^{out})$$

$$T_1 = 0 \text{ if } pQ'_{T_A} > (r - TC^{out})$$

T_2 (rent-in; I^{in} =1 and I^{out} =0):

$$pQ'_{T_A} - (r + TC^{in}) \leq 0, T_2 \cdot (pQ'_{T_A} - (r + TC^{in}) = 0$$

$$\text{thus } T_2 > 0 \text{ if } pQ'_{T_A} = (r + TC^{in})$$

$$T_2 = 0 \text{ if } pQ'_{T_A} < (r + TC^{in})$$

This indicates that the household decision to participate in the land rental market is determined by the relationship between the marginal product of land and the real rental fee. Based on the FOCs, we can divide households into three exclusive regimes as follows:

Rent-out ($T_1 > 0$): $pQ'_{T_A} \leq (r - TC^{out})$

Autarkic ($T_1 = T_2 = 0$): $(r - TC^{out}) < pQ'_{T_A} < (r + TC^{in})$ (9)

Rent-in ($T_2 > 0$): $pQ'_{T_A} \geq (r + TC^{in})$

It is clear from these equations that the number of autarkic households expands with the increase in transaction cost. Assuming these equations to be the condition of the regimes, the marginal product of land for the rent-out household must be less than the real rent. The effect of the increase in land rent-out on the level of the shadow wage is derived from the partial differential of equation (7).

$$\frac{\partial w_s}{\partial T_1} = -\left(\frac{\frac{\partial \lambda}{\partial T_1} U_y - U_{yy}\left(- pQ'_{T_A} + (r - TC^{out})\right)\lambda}{(U_y)^2} \right) = -\frac{U_{yy}\left(- pQ'_{T_A} + (r - TC^{out})\right)}{U_y}\left\{ w - \frac{\lambda}{U_y} \right\} \geq 0$$

Using the same procedure, the effect of the increase in land rent-in is obtained as follows:

$$\frac{\partial w_s}{\partial T_2} = -\left(\frac{\frac{\partial \lambda}{\partial T_2} U_y - U_{yy}\left(pQ'_{T_A} - (r + TC^{in})\right)\lambda}{(U_y)^2} \right) = -\frac{U_{yy}\left(pQ'_{T_A} - (r + TC^{in})\right)}{U_y}\left\{ w - \frac{\lambda}{U_y} \right\} \geq 0$$

These two equations imply that the more the amount of land rented in (rented out), the higher the level of the shadow wage. It needs to be remembered, however, that participation in the land rental market induces a shift in the marginal product of agricultural labor, thus the equilibriums of labor allocation and the shadow wage are shown in Figure 2. The shadow wage of the rent-in household surges from W_S to W'_S, and at the same time the marginal product of agricultural labor also shifts upward from MP_0 to MP_1. Therefore, the intersection point of the two curves changes from *A* to *B*, and the optimal amount of the shadow wage always rises compared with that at point *A*; but that of agricultural labor is uncertain since it is dependent on the degree of shift in the two curves. For the rent-out household, the optimal level of agricultural labor at point *D* always decreases compared with that at point *A*, while the degree of the optimal shadow wage is not certain. From these conjectures, I make the following hypothesis.

(Insert Figure 2 here)

Hypothesis: An increase in rent-in land will always increase the amount of the shadow wage toward approaching the off-farm wage. On the other hand, an increase in rent-out land will always decrease the quantity of agricultural labor.

III. Description of the Dataset and Estimation Strategy

(1) Sampling Design and Dataset

We conducted questionnaire surveys of rural household in two counties of Zhejiang Province, Fenghua City (a county-level city) and Deqing County, with the help of the Department of Public Management of Zhejiang University.[6] The survey in Fenghua was carried out in August 2008, and that in Deqing was done in January 2011. Fenghua City is in the southern part of the province and Deqing County is in the north. Manufacturing such as electronics, clothing and food processing is relatively developed in both counties, and both have a relatively productive agricultural sector which has been shifting from traditional grains (rice and wheat) to raising more commercialize agricultural products such as fruits (peaches, strawberries, mulberries), bamboo shoots, tea plants and the breeding for oysters and fish.

Sample households were selected using the multi-stage stratified random sampling method. First, the total size of the sample was set at 450 households in each county. Then three representative townships (*xiang*) or rural cities (*zhen*) in each county were select, in each of which three to five villages were randomly chosen. Sample households were selected in advance from the list of households registered in each village based on systematic sampling method. If a selected household was absent at the time of the survey, a substitute households, also selected beforehand, was interviewed by enumerators. Because of a disparity between the counties in the average number of people per village, we adjusted the sampling ratio for each county, selecting five villages from each township and thirty households in Fenghua, and three villages and fifty households in Deqing.[7] The total number of surveyed households was 450 in Fenghua and 442 in Deqing.

Table 1 provides the survey statistics. The average household size and the number of workers in Fenghua was less than in Deqing. The percentage of workers engaged in

[6] Financing for these household surveys came from a Grant-in-Aid for Scientific Research (GIASR) from the Ministry of Education, Culture, Sports, Science and Technology, and from the Japan Society for the Promotion of Science (JSPS) [GIASR, # 20252007].

[7] The average number of people per village in the surveyed areas was 278 for Fenghua and 517 for Deqing.

agriculture as their principal job was relatively low, standing at less than a third in both counties. A much higher percentage worked in off-farm jobs in manufacturing, commerce and the service sector. The per capita income in Fenghua was a little less than that in Deqing. The average per capita income of a rural household in Zhejiang Province was 8,265 *yuan* in 2007, which implies that the living standard of our sample households was relatively higher than that of the average Zhejiang rural household.

(Insert Table 1 here)

Looking at the farmland statistics, the average area of contracted farmland (*chengbao di*) in Fenghua was 2.64 *mu* per household, comparatively less than the 3.77 *mu* in Deqing, although the Gini coefficient for contracted farmland was relatively low and almost the same for the two counties.[8] However, there was a large gap between the two in the average size of total farmland, which included woodlands and orchards; the average was 4.93 *mu* for Fenghua compared to 8.12 *mu* for Deqing. The difference was mainly due to the area of cultivated land and woodlands; the area of cultivated land in Fenghua was almost half that of Deqing, and that of woodlands was less than a third. The average area of rent-out farmland was 0.84 *mu* in Fenghua and 1.55 *mu* in Deqing, which accounted for about 20 percent of total farmland. The average area of rent-in land was much higher in Fenghua, mainly because a few households had rented in large amounts of farmland (70-80 *mu*) from outside their villages. Excluding those households, the average area of rent-in farmland in Fenghua came to 1.46 *mu*.

A point to note was some difference between the two counties in the method of land rental. All land rentals in Fenghua were by mutual agreement. While such agreements were also prevalent in Deqing, slightly less than half of land rentals were carried out through the direct intervention of a village committee or village small-group and were called a “collective subcontract” (*fanzu daobao*). This method meant that the village committee used its administrative authority initially to collect the land-use rights from the villagers and then redistribute those rights collectively to specific rentees such as large farmers and agribusiness enterprises. According to interviews with village cadres, all of the village committees supported the development of land rentals, however it appeared that such direct intervention in land transfers was conducted more among the villages in the mountains of Deqing.

[8] 1 *mu* equals about 6.66 acres, and 15 *mu* equals 1 hectare.

(2) Characteristics of the Land Rental Market

Table 2 summarizes the patterns of rent-in/rent-out land transactions in the surveyed areas. The "✓" sign indicates the households that engaged in the renting in and/or renting out of farmland, and "X" indicates the households that did not. The ratios of autarkic households that neither rented in nor rented out were 39 percent for Fenghua and 34 percent for Deqing. The ratio of rent-out households was 34 percent for Fenghua, rather lower than the 53 percent for Deqing. The average area of total farmland for these households in Fenghua was just 1.7 *mu*, implying that most of these households rented out the whole of their farmland.[9] The percentage of rent-in households was much higher in Fenghua than in Deqing, but the average area of farmland for these households in Fenghua was smaller, especially among the households that only rented in, which averaged 9.9 *mu*, much less than the 18.7 *mu* for such households in Deqing. The ratio of the households that engaged in both renting in and renting out was about the same in both counties. The statistical results indicate that farmland concentration through rental transactions has progressed more in Deqing, but many agricultural households in both counties actively engaged in these transactions.

(Insert Table 2 here)

Basic information on land rental contracts is summarized in Table 3. For rent-out households in Deqing, the average rental fee was higher and the average period of contract much longer than in Fenghua, whether through subcontract or collective subcontract. At the same time, the ratio of rent-out households that took no rental fee was much smaller in Deqing than in Fenghua. The same characteristics were observable for renting in. The percentage of rent-in households in Deqing that did not pay a rental fee was just 8 percent, much less than the 48 percent in Fenghua. This suggests that land rental is conducted on a more regular basis in Deqing.

(Insert Table 3 here)

There were differences between the two counties in the content of rental contracts. The average size of rent-in farmland in Fenghua was much smaller, and the average rental fee was a little higher. But in both counties the average fee to rent in farmland

[9] The ratio of rent-out households that rented out all of their farmland was 65 percent in Fenghua and 16 percent in Deqing, which explains the large difference between the two counties in the average area of farmland held by rent-out households.

was lower than that to rent out. This seems to have been due partially to discounts by the village committees to facilitate land transactions. But differences in the quality of land also likely played a role in the gap between rent-out and rent-in fees.[10]

(3) Estimation Strategy[11]

To test the hypothesis examined in Section II, this section will perform a three-step estimation procedure. The first step will use a probit model to estimate the determinant of whether or not a household participates in the land rental market. As explained in equation (9), the difference between the marginal product of agriculture and the real rental fee determines the land rental regime of each household. However, the number of households that rented out part of their farmland and also maintain their own agricultural production was very limited which made it hard to obtain robust results from the production function estimations. Therefore, the households were separated into two regimes: whether farmland was rented in or not, and the determinants of renting in farmland were analyzed.[12] The probit model is then specified as:

$$\text{Prob}\,(z_h = j) = \frac{\exp(X_h\gamma_{j1} + V_j\gamma_{j2})}{\sum_{j=1,2}\exp(X_h\gamma_{j1} + V_j\gamma_{j2})} \qquad (10)$$

where z_h is an indicator variable denoting the choice for household *h* about the type of regime *j* (rent-in=1, non-rent-in=2), X_h is a vector for household attributes, *V* is a vector for village attributes representing the level of rental fee and transaction cost in the land market, and γ_{j1} and γ_{j2} are vectors of coefficients to be estimated.

In the second step, a Cobb-Douglas production function for agriculture to adjust for selection bias will be estimated for each regime. To control for the effects of the household's decision on land renting, a two-stage procedure is adopted in which a correction term $\hat{\lambda}_{hj}$ compiled from the estimation results of equation (10) is added as a regressor. The production function is then specified as follows:

$$\ln Y_{hj} = \alpha_{ij} + \beta_{1j}\ln L_{hj} + \beta_{2j}\ln T_{hj} + \beta_{3j}\ln M_{hj} + X_h c_j + \sum_k \gamma_k V_{kj} + \rho_j\hat{\lambda}_{hj} + \varepsilon_{hj} \qquad (11)$$

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[10] The survey was not organized to evaluate the quality of land, thus it did not examine directly the effect of land quality on rental fees.

[11] The estimation strategy is based on that of Carter and Yao (2002), Deininger and Jin (2005) and Kurosaki and Khan (2006).

[12] The results of the multinomial logit model for each type of regime j (rent-out=1, autarky=2, and rent-in=3) are shown in the Appendix.

where Y_{hj} is the gross output of agriculture (total output of crop, animal and fish farming), L_{hj} is the total amount of labor in agriculture, T_{hj} is the total area of farmland utilized for agricultural production, M_{hj} is the total amount of agricultural input cost (including fertilizer and pesticide purchase, irrigation, and fees to rent machinery for cultivation), X_j is a vector of household characteristics that affect agricultural productivity, V_{kj} is village dummy, and ε_{ij} is an *i.i.d* error term. Parameters to be estimated are $\alpha, \beta_1, \beta_2, \beta_3, \gamma, \rho$ and vector c.

The third step is estimating the shadow wage (W_S) which is difficult to do directly since it requires a lot of information on household attributes and strong assumptions on the form of the utility function. Thus, instead of estimating the shadow wage directly, I will calculate the marginal product of agricultural labor, which can be regarded as the lower limit of the shadow wage as shown in equation (2). The marginal product of agricultural labor is calculated using the estimated parameters in equation (14) as follows:

$$\frac{\partial \widehat{Y}_h}{\partial L_{hA}} = MPL_h \equiv \left(\frac{\partial \ln \hat{Y}}{\partial \ln L_A} \right) \times \frac{\widehat{Y}_h}{L_{hA}} = \beta_1 \times \frac{\widehat{Y}_h}{L_{hA}} \qquad (12)$$

where $\widehat{Y}_h$ is a fitted value of gross output. The same procedure is used to estimate the marginal product of land. These values will then be compared with the nonfarm market wage and the actual rental fee.

In order to compare the value of the shadow wage with that of the market wage, the Mincerian wage function for wage labor, including non-agricultural self employment, is estimated. Here W_{ih} is regressed on X_{ih} and V where W_{ih} is the wage level of individual *i* of household *h*, and X_{ih} is the human capital of the employee. To control for bias occurring from self selection of whether or not a person should engage in wage employment, a two-stage procedure is adopted in which a correction term, the so-called inverse Mill's ratio, is added as an additional regressor. The Micearian wage function is specified as:

$$\ln W_{ih} = X_{ih}\beta + \rho\hat{\lambda}_{ih} + \sum_k \gamma_k V_k + \varepsilon_{ih} \qquad (13)$$

where β is a vector of coefficients, $\hat{\lambda}_{ih}$ is the term of the inverse Mill's ratio, ρ is a coefficient, and ε_{ih} is a zero-mean error term. The fitted values of the wage function for all individuals, including those who do not engage in wage employment, are calculated, and the average of the fitted value is reckon by household. I regard this

household average as the wage rate which represents the expected wage if a person engages in wage employment. To test the hypothesis, a statistical comparison between the shadow wage and expectation wage will be conducted in the next section.

IV Estimation Results

(1) Descriptive Statistics and Result of Probit Model

The variables in vector X_h include characteristics of the household head such as age, age squared, years of education completed, China Communist Party membership dummy and health index (3=very good, 2=good, 1=not good). Also included are variables representing attributes of household production endowments such as size of contracted land, total number of workers engaged in production activities, ratio of higher education, the child dummy (0-5 years old), and the old age dummy (more than 75 years old). Since the values of the rental fee and transaction cost are determined by village attributes, I have incorporated the Gini coefficient of contracted land, total size of cultivated land, geographic conditions (plain, hilly, mountainous), and average wage of temporary agricultural work as vector *V*.

The descriptive statistics of these variables for both counties are shown in Table 4. In Fenghua, the averages for contracted land, total workers, age and health index are statistically different for rent-in and non-rent-in households. In Deqing, the averages for only two variables (total workers and old age dummy) are statistically different for such households, which mean that the basic attributes of rent-in and non-rent-in households in Deqing are more similar.

(Insert Table 4 here)

The lower half of Table 4 shows the descriptive statistics for the production function. All of the averages for the agricultural inputs and outputs of rent-in households are statistically higher than those of non-rent-in households in both counties. This indicates that rent-in households tended to conduct more commercialized agricultural production. Since the log-likelihood test that all of the elasticity for agricultural inputs is the same for rent-in and non-rent-in households is rejected at 1 percent level in both counties, the production function will be estimated by the type of land rental.

Table 5 provides the estimation results for the probit model on the decision to rent

in land. In Fenghua, the parameter of years of education is statistically negative, meaning that more educated households were less likely to rent-in farmland. The size of contracted land and the child dummy also had a negative effect on the rent-in decision. On the other hand, the total number of workers, level of the Gini coefficient and geographic features had a positive effect on the rent-in decision. These suggest that the households in Fenghua with less favorable agricultural conditions tended to rent in farmland.

(Insert Table 5 here)

Compared with Fenghua, the estimated results for Deqing were less distinct. The total number of workers and years of education completed were significant, and the signs of these variables were the same as those for Fenghua. The old age dummy had a negative effect on rent-in, indicating that households needing to care for a child were not likely to participate in the land rental market. All of the variables for village characteristics were not significant, a result suggesting that village features in Deqing were not important factors for a household's decision to rent in. This result seems related to the fact that direct intervention in land rentals by village committees was more prevalent in Deqing.

(2) Production and Wage Functions

Estimations of the production functions of rent-in and non-rent-in households are shown in Table 6. The elasticities of input variables for rent-in households are mostly significant, and that for farmland displays a high number reflecting land scarcity in Zhejiang agriculture. The elasticity of input cost for Deqing is higher, which implies that the county's rent-in farmers conduct more input-cost intensive agriculture. The sums of elasticities are 1.01 for Fenghua and 1.26 for Deqing. The coefficients of the correction term are not significant for both counties, thus the selection bias on the type of land rental is not serious for the estimated results. While the results for non-rent-in households are generally the same as those for rent-in ones, the coefficients of the correction term are not significant, that of input cost is the highest of all inputs, and the sum of elasticities for three inputs is slightly over one. However, the elasticity of labor and the parameters of household characteristics (age and education) are not significant for Fenghua.

(Insert Table 6 here)

The marginal products of agricultural labor and farmland can now be calculated based on the estimated parameters. To compare the marginal product of labor with the market wage, the wage functions are estimated with the selection term specified in equation (11). The explanatory variables included are age, age squared, education level, female dummy, and the inverse Mill's ratio. Education level has two parts: educational stage dummies (primary school, junior high school, high school and university) and years of education completed. The results of model 1, shown in Table 7, suggest that workers with a junior high school education are paid 32% and 10%, and those with a high school education are paid 45% and 24% more than non-literate workers in Fenghua and Deqing respectively. The Mincearian rates of education for Fenghua and Deqing in model 2 are 3.1% and 2.1% respectively. According to earlier studies, such as Knight, Deng and Li (2011) and Psacharopoulos and Patrinos (2002), the return on education in rural China is generally lower than that in other countries, thus the estimated results found in this study appear to be consistent with the previous literature.

(Insert Table 7 here)

The parameter of the inverse Mill's ratio is significant for Fenghua but not for Deqing, indicating that selection bias for the latter is not serious. Looking at the results of other human capital variables, the linear and quadric terms of age, a proxy for job experience, are positive and negative for both counties, implying that the wages of nonfarm jobs positively increase with experience but at a diminishing rate; and the female dummy for both counties is significantly negative, which suggests that wage rates for female workers are lower than those for male workers by about 25% for Fenghua and 35% for Deqing.

(3) Statistical Test for Labor and Land Market

I estimated the fitted value of the wage function and calculate the arithmetic average of this value in terms of a household's expected market wage as a value of off-farm work. A comparison of the marginal product of agricultural labor (a proxy for the shadow wage) with the estimated market wage was conducted using parametric (t-test for a paired and unpaired sample) and non-parametric (Wilcoxon signed-rank test) tests.

The results of the tests are summarized in Table 8. The marginal product of agricultural labor was significantly lower than the expected market wage in both the

paired t-test and Wilcoxon signed-rank test regardless of counties and the type of land rental, but the gap was much smaller for rent-in households. For rent-in households in Fenghua, the mean value for the marginal product of agricultural labor was 861 yuan, while that for the estimated market wage was 1191 yuan. The gap was much larger for non-rent-in households in Fenghua, indicating that the mean value for the marginal product of agricultural labor was only 72 yuan. The result was the same for Deqing, although the gap was less apparent than for Fenghua.

(Insert Table 8 here)

The results of the t-test showed that the marginal product of agricultural labor for rent-in households was significantly higher than that for non-rent-in households at the 1 percent level in both counties. These results support the hypothesis that the increase in rent-in land increases the amount of shadow wage toward approaching the off-farm wage.

A comparison of the marginal product of farmland with the actual rental fee was also performed and the results are shown in the lower half of Table 8. Where the survey found that the value of the actual rental fee was missing or the land was rented free of charge, those observations were excluded from the comparison test. The mean values for the marginal product of land for rent-in household was 1812 yuan for Fenghua and 865 yuan for Deqing, significantly much higher than the actual rental fees, which indicates that rent-in households obtain a large income from renting farmland for agricultural production.

For non-rent-in households, the mean values for the same two variables were much more similar. This was especially true for Fenghua where there was no statistical difference in the paired sample t-test and Wilcoxon signed-rank test, although the actual rental fee was significantly higher than the marginal product in Deqing.[13] Thus, it appears that the rental fee on rent-in farmland in Fenghua was determined so as to reflect the marginal product of farmland. While in Deqing it was determined so as to favor rent-out households to compensate for involuntary land transactions. However, it must be kept in mind that the tests were performed on a limited number of observations, since the group forming the non-rent-in households included both autarky and rent-out households. Moreover, of the households in Fenghua that rented out land, most of them

[13] The tests were conducted by dividing rent-out households into types (subcontract and collective subcontract). The results were the same for both types. This suggests that the type of renting out does not to directly affect the level of rental fee.

rented out all of their farmland; only 28 households among the rent-out households engaged in agricultural production renting out part of their farmland.

The disparity in the marginal product of land between rent-in and non-rent-in households can be interpreted by the monopsonistic (demand monopolistic) model for the land rental market involving higher transaction cost. Up to now in this study it has been assumed that rental fee r is decided exogenously, however the theoretical model in this study can be extended to allow the rental fee to be determined by the equilibrium of the land rental market. Yao (2000), Deininger and Jin (2005), and Deininger and Jin (2009a) proposed a theoretical framework to examine the equilibrium of land market clearance and the endogenous determinants of the rental fee. Their models are informative and theoretically sophisticated, but it is difficult for these models to explain why the marginal product of land for rent-in household is much higher than the actual rental fee and why the difference is so small for non-rent-in household.

For this reason I will briefly present a monopsonistic model for the land rental market to explain the characteristics of that market in Zhejiang Province. To examine the endogenous rent rate, two assumptions are added to equation (9). First, the aggregated supply curve of land rent-out is assumed to be less elastic to price in Fenghua than in Deqing. As mentioned, the size of farmland as well as the amount of gross agricultural income in Fenghua was smaller, and almost half of rent-in households did not pay rental fee. Thus, less willingness to cultivate farmland stimulates households in Fenghua to rent out farmland, and the slope of supply curve tents to be steeper.

The second assumption is that the number of latent tenants for land is strictly limited and actual tenants have monopsonistic control over the rate of rent. Although more commercialized and intensive agricultural production has the potential to earn more profit, it requires large amounts of investment to improve land conditions and purchase agricultural machinery. In addition, investment in agriculture involves relatively higher risk because of price fluctuations and weather conditions. This could be expressed in a higher level of TC^{in}, which prevents ordinary farmers from renting in farmland. As pointed out above, the percentage of households that rent in land is lower, and they rent relatively large amounts of farmland ranging from twice to three times the contracted land distributed by villages or village small-groups. Thus, ordinary farmers show little willingness to invest in more differentiated agricultural production. For the purpose of simplifying the model, the shapes of demand curves are assumed be the same in Fenghua and Deqing.

The relationship of aggregated demand and supply for farmland is depicted in Figure 3, which means that the amount of land rented in is determined by the point

where the demand curve and marginal factor cost (MFC) curve intersect. Since tenants have monopsonistic control over the rental fee reflecting their marginal revenue of farmland, the optimal amount of farmland for monopsonistic rent-in households is T^{**}, which is less than that of the non- monopsonistic market equilibrium of T^{*}. Meanwhile the level of the rental fee of rent-out households in a monopsonistic market is determined at r^{out}, which is less than that of r^{*}, so tenants are able to obtain excess revenue from rent-in farmland. But the tenants' monopsonistic control was mitigated in Deqing where the supply curve is less steep than that of Fenghua and rental fee was a little raised by administrative interventions in land transactions.

(Insert Figure 3 here)

These implications from this monopsonistic model are consistent with this study's estimated results. Thus, in order to develop further studies on land rental markets, we need to examine the bargaining power between lenders and tenants and to accumulate statistical estimations from actual situations in developing countries.

V. Conclusion

This paper investigated the impact of land rental market development on the efficiency of labor allocation and land utilization in rural China based on a household survey conducted by this study in the counties of Fenghua and Deqing in Zhejiang Province. The study constructed a simply agricultural household model and set up a hypothesis that the shadow wage of rent-in households with limited off-farm opportunities will increase with the development of the land rental market for households whose marginal product of farmland is higher than the real rental fee.

To test this hypothesis, the study first estimated a probit model of whether a household rents in farmland or not, and estimated the agricultural production functions with a sample selection term to deduce the marginal product of agricultural labor. The study then conducted a statistical comparison between the shadow wage and the estimated market wage based on the Mincerian wage function to control for sample selection bias. The results showed that the shadow wage of both rent-in and non-rent-in households was significantly lower than the market wage, but the wage of rent-in households was statistically higher than that of non-rent-in households in both Fenghua and Deqing counties. These results are consistent with the study's hypothesis.

Moreover, the estimated marginal product of farmland for rent-in households was statistically higher than the actual land rent that rent-in household paid, while a null hypothesis that the actual rental fee accepted by rent-out households is equivalent to the marginal product of farmland for those households was not rejected for Fenghua, but was for Deqing. These results indicate that rent-in households exhibit monopsonistic power to restrain the land rental fee at the opportunity cost of land use in each village, and they obtain excess profit from more commercialized agricultural production, although they face numerous risks by investing in agricultural.

The findings of this study suggest that the development of the land rental market facilitates the efficiency of labor allocation and farmland utilization in rural China, and policy supports for reducing transaction cost and risks indigenous to agriculture would be effective in weakening the monopsonistic power of tenants and improving overall economic welfare in rural areas.

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Figure 1 Agricultural Labor and Wage under an Imperfect Labor Market

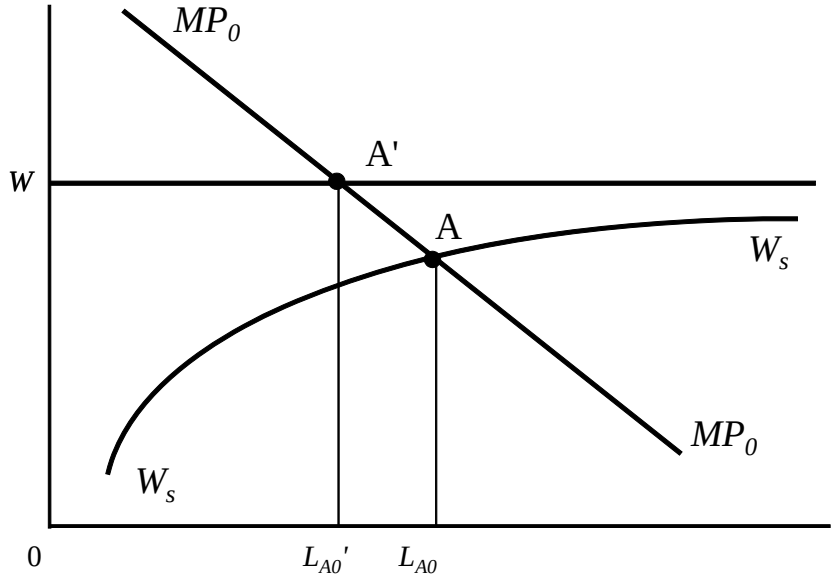


Figure 2 Effect of Land Transactions on the Shadow Wage

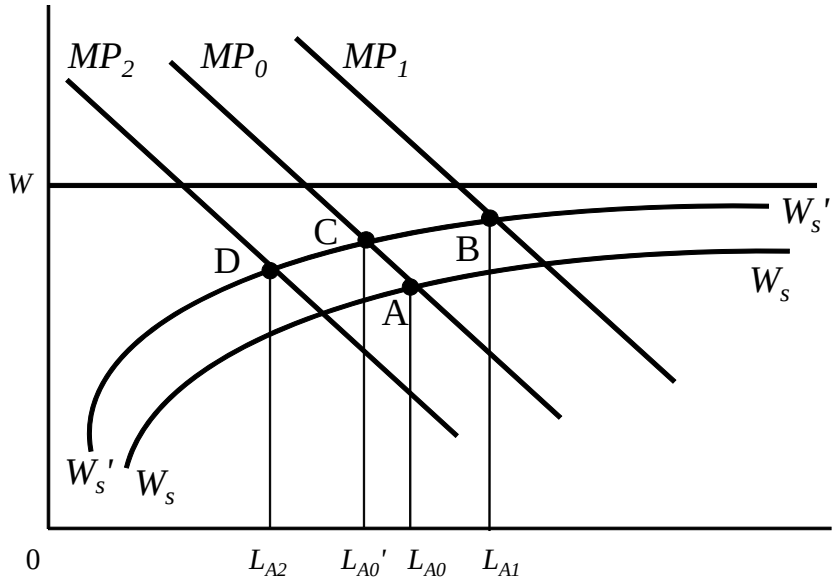
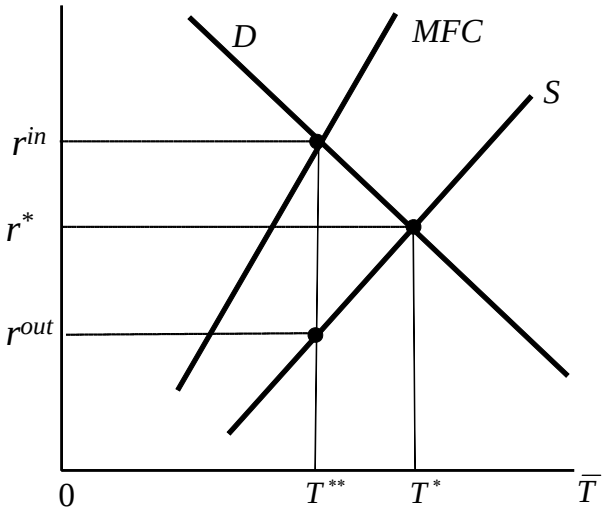


Figure 3 Monopsonistic Model for a Land Rental Market

(i) Fenghua



(ii)Deqing

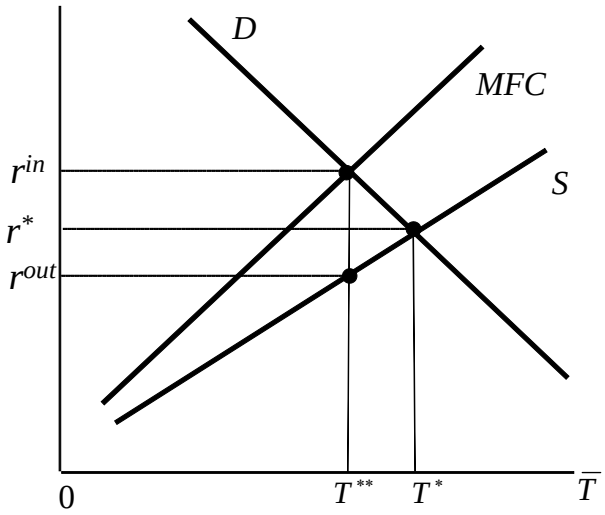


Table 1 Characteristics of Sample Households by County

	Fenghua	Deqing
Number of sample households	450	442
Household size	3.32	4.38
Amount of household labor	2.16	2.70
Employment (%)		
Agriculture	30	23
Mining	0	6
Manufacturing	35	28
Construction and Transportation	9	12
Commerce and Services	14	24
Per capita Income in 2007 prices	12,723	15,474
Size of contracted land (mu)	2.64	3.77
Gini Coefficient of contracted land	0.32	0.33
Total Farmland (mu)	4.93	8.12
Cultivated land	1.59	3.17
Paddy field	0.92	2.22
Woodlands	0.78	3.16
Orchards	0.91	0.30
Other	1.64	1.48
Gini Coefficient of total farmland	0.67	0.63
Rent-out (mu)	0.84	1.55
Collective subcontract	0.00	0.89
Rent-in (mu)	2.28	1.53

Table 2 Pattern of Land Transactions

rent-in	rent-out	Fenghua		Deqing	
		Ratio of households (%)	Average farmland (mu)	Ratio of households (%)	Average farmland (mu)
X	X	39	3.4	34	6.7
X	✓	34	1.7	53	4.5
✓	X	22	9.9	7	18.7
✓	✓	4	18.7	6	20.7
Total		100	4.9	100	7.2

(Note) 1)The sign "✓" indicates that the households conduct the renting in/renting out of farmland, and "x" indicates that the households do not.

2) Two households whose total farmland was over 100 mu were removed from the estimation.

Table 3 Basic Characteristics of Land Rental Contracts

	rent-out					rent-in			
	Land rental form	Number of households	rental fee (RMB) Average	rental fee (RMB) S. D.	Percentage of non-monerary transaction	Number of households	rental fee (RMB) Average	rental fee (RMB) S. D.	Percentage of non-monerary
Fenghua	Subcontract	127	374	0.40	27%	61	305	0.62	48%
Deqing	Subcontract	143	539	0.30	4%	45	253	0.63	8%
	Collective subcontact	100	498	0.22	0%				

Table 4 Descriptive Statistics of the Estimation Data

(1) Descriptive statistics of the Probit model

	Fenghua					Deqing				
	rent-in		non-rent-in			rent-in		non-rent-in		
	Mean	Std. Dev.	Mean	Std. Dev.		Mean	Std. Dev.	Mean	Std. Dev.	
contracted land (mu)	2.40	1.17	2.83	1.75	**	3.88	2.12	3.90	3.51	
total workers	2.35	0.93	2.10	1.05	**	3.11	0.98	2.63	1.08	***
age	52.26	8.76	55.70	10.97	***	51.27	9.24	51.40	11.32	
education (years)	6.65	2.69	7.00	2.91		6.43	3.45	6.49	3.46	
CCP dummy	0.18	0.38	0.20	0.40		0.20	0.40	0.13	0.34	
ratio of high education	0.16	0.13	0.15	0.16		0.19	0.13	0.18	0.12	
child dummy	0.09	0.29	0.15	0.36		0.23	0.43	0.20	0.40	
old age dummy	0.11	0.32	0.18	0.39		0.13	0.33	0.30	0.46	***
health index	2.60	0.64	2.41	0.75	**	2.77	0.50	2.65	0.60	
Nos	96		287			56		366		

(2) Descriptive statistics of the agricultural production function

	Fenghua					Deqing				
	rent-in		non-rent-in			rent-in		non-rent-in		
	Mean	Std. Dev.	Mean	Std. Dev.		Mean	Std. Dev.	Mean	Std. Dev.	
age	53.2	8.2	58.5	10.1	***	51.366	7.732	51.163	10.608	
education (year)	6.2	2.7	6.3	2.9		6.366	3.300	6.226	3.410	
output (RMB)	23,554	17,981	5,795	6,964	***	51,214	72,003	16,246	40,219	***
farmland (mu)	7.5	6.8	3.7	2.6	***	19	18	7	7	***
agricultural labor (months)	10.7	7.6	7.9	6.0	***	15	10	9	7	***
input (RMB)	3,553	2,899	1,380	1,634	***	19,927	33,721	5,901	19,128	***
Nos	66		107			41		190		

Notes: *** and ** indicate statistical significance of t-test at the 1% and 5% level, respectively.

Table 5 Estimation Results of Probit Model

	Fenghua	Deqing
	coefficient	coefficient
Contracted land	-0.158***	0.005
	(-2.835)	(0.219)
Number of total workers	0.184	0.222***
	(2.172)	(3.085)
Age	0.089	0.078
	(1.007)	(1.179)
Age*Age	-0.001	-0.001
	(-1.205)	(-1.240)
Years of education	-0.054*	-0.013
	(-1.736)	(-0.475)
CCP Dummy	0.011	0.436*
	(0.056)	(1.901)
Ratio of higher education	-0.342	-0.455
	(-0.615)	(-0.641)
Child Dummy 1	-0.517**	-0.003
(0-4)	(-2.092)	(-0.017)
Old age Dummy	0.038	-0.473**
	(0.135)	(-2.071)
Health index	0.132	0.221
	(1.129)	(1.486)
Land Gini	9.043***	-0.541
	(2.629)	(-0.128)
Village wage rate	-0.010	0.008
	(-1.534)	(0.817)
Cultivated land per household	-1.109	-0.272
	(-1.575)	(-0.696)
Geographic dummy (hilly)	2.316***	-0.362
	(4.298)	(-0.804)
Geographic dummy (mountainous)	2.202***	-0.476
	(3.969)	(-0.784)
Intercept	-6.792	-3.855
	(-2.481)	(-1.559)
Observations	383	422
Wald test	58.65***	29.52**
Pseudo R^2	0.181	0.089

Notes: Values of z-statistics are shown in parentheses; *** significant at 1% level, ** at 5% level, and * at 10% level.

Table 6 Estimated Results of Production Function

	Fenghu		Deqing	
	rent-in	non-rent-in	rent-in	non-rent-in
Age	0.306 *	-0.103	-0.033	-0.034
	(1.917)	(-1.549)	(-0.292)	(-0.583)
Age*Age	-0.003 **	0.001	0.000	0.000
	(-2.015)	(1.560)	(0.351)	(0.505)
Years of education	-0.060	-0.010	0.051	0.015
	(-1.561)	(-0.428)	(1.592)	(0.685)
Log of Land	0.499 ***	0.382 ***	0.477 **	0.309 **
	(4.100)	(3.027)	(2.347)	(2.162)
Log of Labor	0.275 **	0.083	0.193	0.371 ***
	(2.269)	(0.871)	(1.024)	(3.485)
Log of Agricultural Input	0.249 **	0.685 ***	0.589 ***	0.518 ***
	(2.497)	(8.874)	(4.447)	(5.935)
Selection correction	1.011	-1.639	0.381	-0.859
	(0.532)	(-0.997)	(0.157)	(-0.578)
Intercept	0.301	7.584 ***	3.953	5.365 ***
	(0.076)	(2.910)	(1.332)	(2.349)
Observations	66	107	41	190
F test	11.98***	29.71***	8.87***	16.36***
Adjusted R^2	0.762	0.761	0.747	0.522

Notes: 1) Values of t-statistics with robust stander error are reported in the parentheses; *** significant at 1% level, ** at 5% level, and * at 10% level.

2) The results of Village dummy are omitted from the table.

Table 7 Estimated Results of Wage Functions

	Fenghua		Deqing	
	Model 1	Model 2	Model 1	Model 2
Age	0.115 ***	8.408 ***	0.106 ***	0.098 ***
	(8.387)	(8.404)	(8.309)	(8.079)
Age*Age	-0.002 ***	-9.613 ***	-0.001 ***	-0.001 ***
	(-9.641)	(-9.601)	(-8.649)	(-8.444)
Primary school	0.306 **		-0.048	
	(2.409)		(-0.474)	
Junior high school	0.281 **		0.102	
	(2.127)		(0.895)	
High school	0.373 **		0.214 *	
	(2.555)		(1.721)	
University	0.718 ***		0.265 *	
	(4.063)		(1.820)	
Years of education		0.031 ***		0.021 **
		(2.972)		(2.360)
Female Dummy	-0.308 ***	-0.298 ***	-0.441 ***	-0.439 ***
	(-5.791)	(-5.585)	(-9.237)	(-9.156)
Inverse Mill's Ratio	0.272 **	0.289 **	0.230	0.225
	(2.127)	(2.237)	(1.055)	(1.072)
Intercept	5.032 ***	5.124 ***	5.461 ***	5.553 ***
	(15.04)	(15.32)	(18.17)	(18.79)
Wald χ^2	189.00***	171.12***	156.58***	149.52***
Observations	954		1124	
Censored	314		298	
Uncensored	640		826	

Notes: 1) Values of t-statistics are reported in the parentheses with *** significant at 1% level, ** at 5% level, and * at 10% level.

2) Included as regressors of 1st stage estimation are variables on age, educational level (two specifications), female dummy, marriage dummy, CCP (China Communist Party) dummy, *Hukou* dummy, Health index, household characteristics (Child dummy 1 (0-4 years old), Child dummy 2 (5-9), Old age dummy (more than 75 years old), Contracted land.

Table 8 Comparison of Marginal Product and Market Value

	Fenghua				Deqing			
	rent-in		non-rent-in		rent-in		non-rent-in	
	marginal product of labor	estimated market wage	marginal product of labor	estimated market wage	marginal product of labor	estimated market wage	marginal product of labor	estimated market wage
Sample size	63		98		40		187	
Mean	861	1,191	72	1,015	1,060	1,567	466	1,568
S. D.	1,114	437	83	520	1,853	220	465	250
paired sample t-test	-2.256**		-17.576***		-1.754*		-32.019***	
Wilcoxon signed-rank test	-4.388***		-8.591***		-3.347***		-11.698***	
t-test by rent type	7.169^{***}				4.141^{***}			
	marginal product of land	actual rental fee	marginal product of land	actual rental fee	marginal product of land	actual rental fee	marginal product of land	actual rental fee
Sample size	37		25		28		77	
Mean	1,812	323	495	372	865	249	401	544
S. D.	1,175	190	635	147	515	170	296	216
paired sample t-test	7.822***		0.955		7.149***		-3.506***	
Wilcoxon signed-rank test	5.107***		0.229		4.554***		-3.785***	
t-test by rent type	7.206^{***}				9.216^{***}			

Notes: *** significant at 1% level, ** at 5% level, and * at 10% level.

Appendix Estimated Results of Multinomial Logit Model

	Fenghua		Deqing	
	j=1 (rent-out) coefficient	j=3 (rent-in) coefficient	j=1 (rent-out) coefficient	j=3 (rent-in) coefficient
Contracted land	-0.004	-0.269 **	0.060 *	0.021
	(-0.046)	(-2.420)	(1.733)	(0.454)
Number of total workers	-0.245	0.268	0.231 *	0.489 ***
	(-1.635)	(1.620)	(1.858)	(3.457)
Age	-0.178	0.109	0.040	0.170
	(-1.392)	(0.626)	(0.601)	(1.196)
Age*Age	0.001	-0.001	0.000	-0.002
	(1.287)	(-0.870)	(-0.550)	(-1.226)
Years of education	0.042	-0.080	0.015	-0.016
	(0.725)	(-1.407)	(0.334)	(-0.313)
CCP Dummy	1.045 ***	0.537	-0.250	0.657
	(2.954)	(1.325)	(-0.579)	(1.479)
Ratio of higher education	-0.886	-1.014	0.281	-0.712
	(-0.888)	(-0.970)	(0.220)	(-0.488)
Child Dummy 1	0.428	-0.790 *	0.131	0.073
(0-4)	(1.082)	(-1.748)	(0.389)	(0.185)
Old age Dummy	-0.180	-0.033	0.164	-0.887 *
	(-0.375)	(-0.058)	(0.564)	(-1.766)
Health index	0.311	0.349	0.011	0.425
	(1.511)	(1.617)	(0.048)	(1.402)
Land Gini	0.745	16.367 **	1.234	3.490
	(0.146)	(2.355)	(0.184)	(0.404)
Village wage rate	0.009	-0.012	0.040 *	0.022
	(0.882)	(-0.955)	(1.801)	(1.127)
Cultivated land per household	3.214 ***	-0.520	-0.754	-0.578
	(2.695)	(-0.374)	(-1.021)	(-0.775)
Geographic dummy (hilly)	-2.548 ***	2.756 **	-1.857 ***	-1.609 *
	(-3.214)	(2.383)	(-3.314)	(-1.674)
Geographic dummy (mountaino	-2.252 ***	2.703 **	-0.034	-1.261
	(-2.566)	(2.281)	(-0.037)	(-0.959)
Township Dummy 1	-0.925	1.487 **	2.170 ***	0.715
	(-1.428)	(2.000)	(3.990)	(1.129)
Township Dummy 2	-1.596	3.855 ***	2.817 ***	1.952
	(-1.568)	(2.976)	(3.076)	(1.520)
Intercept	4.064	-10.139 *	-5.241	-9.161 *
	(1.030)	(-1.787)	(-1.639)	(-1.805)
Observation	383		422	
Wald test	100.05***		100.74***	
Pseudo R2	0.164		0.155	

Notes: 1) Values of z-statistics are reported in the parentheses with *** significant at 1% level, ** at 5% level, and * at 10% level.

2) Baseline of the estimation is autarky households (j=2).