Factors Affecting the Development of Land Rental Markets in China – A case study for Puding County, Guizhou Province

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1. Introduction

Introduced in the late 1970s and early 1980s, the Household Responsibility System (HRS) gives rural households rights to use farmland and keep the residual income from farm activities; land remains collectively owned at the village and sub-village level, but individual households have a bundle of rights to use it and reap the benefits from the land. Compared to many studies on the land tenure system and the impact on productive efficiency and investment behavior of farm households (Carter et al., 1996; Kung and Liu, 1997; Jacoby et al., 2000; Benjamin and Brandt, 2002; Li et al., 1998), the land rental market in rural China receives much less attention in the literature.

According to traditional economic theory, when large landowners have problems to supervise hired labor, they will rent out their land. But the situation in China is different. Because agricultural land is very scarce and the land-labor ratio is very small, demand for land is huge and supply for land is very limited. In addition, rural households often experienced major institutional problems to transfer their land use right to other households until the late 1990s (Kung and Liu, 1997; Brandt et al., 2002). A village-survey undertaken in eight provinces in China showed that the percentage of rented-in cultivated land was only 0.6% in 1988 and 2.9% in 1995, respectively (Brandt et al., 2002).

The available literature on land rental market development is very limited, probably due to the small size of such markets until the end of the 1990s. In recent years, with rapid economic growth providing many off-farm employment opportunities for rural households, there has been

a rapid increase in the incidence of land rental activities in China. The development of land rental markets can enhance agricultural productivity and incomes by facilitating transfers of land to more productive farmers and facilitating the transfer of labor to the non-farm economy (Deininger and Jin, 2002; Lohmar et al., 2001; Kung, 2002; Zhang et al., 2004).

The purpose of this study is to analyze the factors affecting the development of land rental markets in one of the poorest regions within China, namely Puding County in Guizhou Province, and compare the results with those of previous studies on other regions in China. Data from 792 households in three villages are used to analyze the participation in land rental markets , using probit models of household decision making on land renting in and renting out, respectively. The main factors analyzed in these models are migration, investments in farming, health and education status of household members, and demographic and cultural factors. The insights obtained from the study can provide an important input into the design of appropriate policies to improve the functioning of land rental markets in poorer regions and thereby stimulate agricultural production and reduce rural poverty.

A problem with the survey data used in this study, and probably most survey data on land rental markets in China, is that rural households that have migrated out of the village are not included in the sample. These households still hold land use rights in the villages from which they migrated, but have generally rented their land out to other households. In order to solve this missing data problem, we use Monte Carlo simulations to examine the effects of applying binary probit models, and develop a weighted probability method to correct for missing data in the probit model for land renting out.

The remainder of the paper is organized as follows. In section 2, we discuss the problem of missing data and present a model that can be used for solving this problem. Information on the survey, model specification, and descriptive statistics for the variables used in the model are presented in section 3. Model estimation results are discussed in section 4, while section 5 draws some major conclusions.

2. Missing Observations Problem

One important type of households is missing the survey that was used for this study and in most surveys on rental market development in China, namely households that still belong to the village but have migrated to another place. Because the whole household has moved out of the village, they cannot be interviewed during the survey. Migrated household will normally rent their land out to other households in the village, and will not rent in land. These missing observations in our data set may bias our results if we do not correct for it. Similar for land renting out decision.

If we assume that the incentives to rent in land are the same for migrated households and for household that do not rent in land, and, without loss of generality, we also assume that their incentives to rent in land are smaller than those for the households that do rent in, then a binary probit model can be used to estimate the household land renting in decision.[1] We assume that probabilities of a random household belonging to the group of migrated and renting in households are $p_m=m$ and $p_{RI}=p_I$ respectively; then the probability of belonging to the not renting

[1] Alternatively, it may be assumed that the utility of renting-in land is lowest for migrated household and the utility of land renting-out is highest for migrated households. In this case, and ordered probit model should be used, and should be corrected for missing observations. The resulting approach is more complex than correction of the binary probit model.

in household group is $p_{NI}=1-p_I-m$. The probabilities of a renting in and not renting in household observed in our survey sample are equal to $p'_{RI}=\frac{p_I}{1-m}$ and $p'_{NI}=\frac{1-p_I-m}{1-m}$ respectively. If we could observe the migrated group, the "real" probabilities of renting in and not renting in are p_I and $1-p_I$ respectively. It follows that $p'_{RI}>p_I$ and $p'_{NI}<1-p_I$, in other words that we over-sampled the renting in group and under-sampled the not renting in group.

A latent (unobserved) continuous variable y_i^*, measuring the incentive (or utility) of renting in land for household i is given as: $y_i^* = x_i'\beta + \varepsilon_i$. Here, x_i is a vector of observed variables for household i related to renting in decision making, β are unknown parameters we want to estimate, and ε is a normally distributed error term with unit variance and zero mean (for normalization). We observe y_i, a discrete choice of each household i: if $y_i^*>0$, $y_i=1$ and the household will rent in land; if $y_i^*\le 0$, $y_i=0$ and the household will not rent in land. Then the probabilities of $y_i=1$ and $y_i=0$ are $\Phi(x_i'\beta)$ and $\Phi(-x_i'\beta)$ respectively. Conditional on missing migrated households, the log-likelihood of household renting in decision after correcting for the sampling problem is as follows:

$$L_{RI} = w_1 \sum_{if\ y_i=1} \log\ \Phi(x_i'\beta) + w_2 \sum_{if\ y_i=0} \log\ \Phi(-x_i'\beta)$$

Here, $w_1=\frac{p_I}{p'_{RI}}=1-m$ and $w_2=\frac{1-p_I}{p'_{NI}}=\frac{(1-p_I)(1-m)}{1-p_I-m}$, are probability weights for correcting the sampling problem of missing migrated households. Maximizing the log likelihood L_{RI} can solve this problem if we know m and p beforehand.

We can apply the same methodology to solve the problem of missing observations for the renting out decision. We assume that migrated households rent out their land. Let the

probabilities for these three types of households, not renting out, renting out, and migrated households, be equal to $1-p_O-m$, p_O and m respectively. Then, after correcting for the sampling problem, we can write the log-likelihood of the renting out decision conditional on missing migrated household as follows:

$$L_{RO} = r_1 \sum_{rent-out} \log \Phi(x_i'\beta) + r_2 \sum_{no\ rent-out} \log \Phi(-x_i'\beta)$$

Here, $r_1 = \frac{m+p_O}{p_O/(1-m)} = (1-m)\frac{m+p_O}{p_O}$, $r_2 = \frac{1-p_O-m}{(1-p_O-m)/(1-m)} = 1-m$ are probability weights for correcting the sampling problem of missing migrated households.

We expect that the bias caused by the missing data is relatively small for renting in, because the probability of migrating is quite small in our data and the probability of not renting in is large. The missing migrated group will not affect the results much, because the probability weights w_1 and w_2 are close to 1 and the weighted log-likelihood is similar to the unweighted one. But for the renting out decision, the bias is expected to be much larger, because the probabilities of renting out and migration are both small. With the migrated household group missing, the probability weight r_1 is much larger than 1, and the weighted log-likelihood will differ considerably from the unweighted one.

Our expectation is proved by Monte Carlo simulation[2]. Hence, it can be concluded that the corrected binary model should be preferred over the standard binary model for explaining household land renting out decisions when migrated households are missing from the sample.

[2] We don't present our result of Monte Carlo simulation here because of limitation of paper length, anybody who is interested in the result can ask the authors.

3. Model Specification and Data

The data we use in this study come from a stratified survey held in three villages in Chengguan town, Puding County, a traditional rural county in Guizhou Province in south-west China. The survey was conducted by Guizhou university in February 2005, and mainly concentrated on public services and poverty issues. The questionnaire contains detailed information about demography, housing, annual income (in the year 2004), annual expenditures on (food and non-food) consumption and durables, and household access to public services. The survey is a full-sample survey; all 805 farm households that were present in these three villages were interviewed. After cleaning the data and deleting observations with missing values, a final sample of 792 households could be used for our purpose.

From the survey we know that about 5% of the households migrated out of the villages and could not be interviewed. Of the 792 households in sample, 151 indicated that they rent in land. Assuming that the migrated households do not rent in land, this means that 18.1% of the households rent in land. Only 63 households in the sample rent out land. Assuming that all migrated households rent out their land to other households, this means that 12.6% of the households rent out land, there is an active land rental market in these three villages.

Table 1 Percentages of households involved in land rental market, corrected for migration

Renting in		Renting out	
Choice	% of households	Choice	% of households
Renting in	18.1%	Renting out (observed)	7.6%
Not renting in (observed)	76.9%	Migrated (missing)	5.0%
Migrated (missing)	5.0%	Total renting out	12.6%
Total not renting in	81.9%	Not renting out	87.4%

Quotas were abolished at the time of the survey. Moreover, land reallocations had never taken place in the three villages were the su rvey was held. Contrary to previous studies, we therefore cannot examine the impact of these two institutional factors on land rental market development.

Table 2 Definitions of variables used in the empirical analys es

Gender	Gender of household head: 1 ma le, 0 female
Minority	Dummy vari able for bel onging to minority: 1 yes, 0 no
Age	Age of household head
Age-sq	Age-squared of head / 100
Num	Number of member s in household
Nlabor	Number o f labor forc e members in household: members aged 16 -65
Nkid	Numbe r of children aged 6 years or less
Poverty	Dummy varia ble for po verty: 1 yes, 0 no
Saving	Logarithm of savings deposi ts in bank (in Yuan)
Nout	Number o f household members involved in off-farm empl oyment
Landp	Land per labor force member (in mu)
Landp-sq	Land per labor for ce member squared (in mu)
Wasland	Dummy varia ble for having opened up was teland: 1 yes, 0 no
Garden	Log (area of garden land + 1)
Wood	Log (area of forest land + 1)
Edu	Years of education of household head
Edu-sq	Years-squared of education of household head
Train1	Dummy varia ble for member having training for agricultural techniques: 1 yes, 0 no
Train2	Dummy varia ble for a t leas t one member having training for non -agricultural skills: 1 yes, 0 no
Dis1	Number of household members that had a disease last year
Dis2	Number of labor force members that had a disease la st year
Relation	Dummy variab le for having relatives and friends who are loc al official s: 1 yes, 0 no
Cadre	Dummy variab le for having cadre in the household: 1 yes, 0 no
Party	Dummy vari able for having communist pa rty members in the household: 1 yes, 0 no
Machine	Dummy variab le for pre sence of agricultural machinery: 1 yes, 0 no
Animal	Dummy varia ble for pr esence of dra ught animal: 1 yes, 0 no
Invest	Dummy vari able for investment in land: 1 yes, 0 no
Infrice	Dummy variab le for re ceivi ng extension ab out rice: 1 yes, 0 no
Infcorn	Dummy variab le for re ceivi ng extension about corn: 1 yes, 0 no
Infcrp	Sum of dummy variabl es for re cei ving extension about other five main crops: 0 to 5
Infani	Sum of dummy variabl es for re cei ving extension about four main lives tock and poultry types: 0 to 4

Table 2 provides the definitions of all variables in the analyses. Involvement in off-farm employment is not high; only 0.55 out of 4.23 household members are involved in off-farm activities on average. Average farm size is very small, 3.3 mu on average. For China as a whole, average farm size is almost 8 mu (NBS, 2004). The majority of the households in the sample (72.9%) have land between 1 to 5 mu. Only 15.2% of the households possess an agricultural machine, while 52% of the households have a draught animal. Almost 30% of the households belong to minority groups.

4. Results

As we explain in section 2, we used the standard binary probit model for estimating land renting in decisions, while we use a binary probit model corrected for missing observations to estimate land renting out decisions. The estimation results for land renting in and renting out are shown in Table 3.

Table 3 Results of binary probit model for land renting in decision

Variable	Renting in (no correction)			Renting out (with correction)		
Variable	Parameter	t-stat.	dF/dx	Parameter	t-stat.	dF/dx
Gender	0.990**	2.18	0.129**	-0.067	-0.25	-0.010
Minority	-0.520**	-3.70	-0.102**	-0.769**	-3.57	-0.090**
Age	0.099**	2.35	0.022**	-0.034	-1.02	-0.005
Age-sq	-0.126**	-2.82	-0.028**	0.034	1.00	0.005
Num	0.093*	1.71	0.020*	-0.268**	-3.24	-0.039**
Nlabor	-0.021	-0.26	-0.005	0.047	0.43	0.007
Nkid	-0.300**	-3.05	-0.066**	0.101	0.69	0.015
Poverty	0.066	0.34	0.015	-0.369	-1.64	-0.044
Saving	0.003	0.11	0.001	0.064**	2.64	0.009**
Nout	-0.055	-0.65	-0.012	0.341**	3.79	0.049**
Landp	-0.246**	-2.01	-0.054**	0.153	0.94	0.022
Landp-sq	0.026	1.47	0.006	-0.012	-0.48	-0.002
Wasland	-0.379**	-2.06	-0.071**	0.151	0.68	0.024

Garden	0.021	0.25	0.005	-0.201	-1.18	-0.029
Wood	-0.408*	-1.89	-0.090*	-0.024	-0.07	-0.003
Edu	0.022	0.38	0.005	-0.085	-1.41	-0.012
Edu-sq	-0.003	-0.51	-0.001	0.011**	2.14	0.002**
Train1	-0.281	-0.87	-0.053	0.090	0.29	0.014
Train2	-0.097	-0.40	-0.020	-0.034	-0.14	-0.005
Dis1	0.172	1.48	0.038	-0.037	-0.23	-0.005
Dis2	-0.214	-1.42	-0.047	0.241	1.21	0.035
Machine	0.260*	1.65	0.063*	-0.212	-0.88	-0.028
Animal	0.164	1.36	0.036	-0.133	-0.83	-0.019
Invest	0.412*	1.94	0.108*	-0.002	-0.01	0.000
Relation	0.276*	1.69	0.068*	-0.186	-0.95	-0.024
Cadre	0.066	0.22	0.015	0.398	1.33	0.073
Party	0.153	0.56	0.036	0.205	0.80	0.033
Infrice	-0.074	-0.56	-0.016	-0.456**	-2.97	-0.067**
Infcorn	0.160	0.94	0.034	-0.245	-1.43	-0.038
Infcrp	0.133**	2.34	0.029**	0.019	0.24	0.003
Infani	0.011	0.20	0.002	0.110	1.52	0.016
Constant	-3.81**	-3.60		0.539	0.62	
Log likelihood	-325.3			-239.7		
Pseudo R^2	0.157			0.199		

* is significant at 10% level, ** is significant at 5% level.

4.1 Demographic characteristics

A male household head is more likely to rent in land, but gender has no significant effect on household land renting out decision. Minority people are significantly more inactive in the land rental market as compared to majority (Han nationality) people. Traditional cultural beliefs often impede the participation of minorities in markets, including land rental markets. The age of household head does not affect land renting out decisions significantly; it has a robust inverse U-shaped pattern for land renting in decisions. This inverse U-shaped age pattern is consistent with the findings of Kung (2002). A possible explanation is that middle-aged farmers are more efficient than younger or older farmers, because they have more experience than younger farmers

and have more physical strength than older farmers.

Household with more members is more likely to rent in land, and less likely to rent out land. The number of labor force members in the household has no significant effects both on household land renting in and renting out decisions. It should be noted, however, that land per labor force member is a separate explanatory variable in the analysis. So, given this land -labor ratio, the number of laborers in a family does not have an independent effect on land renting decisions. The number of young children in a household has a significant negative effect on land renting in. With more children younger than six years old in a household, parents need more time to take care of them, and do not have enough time to work on rented land.

4.2 Household assets

Households with more savings in the bank are more likely to rent out land, while renting in land is not affected. Households are poor because of lack labor do not significant rent out more land or rent in less land. This finding is consistent with the insignificant impact of lab or force size discussed in 4 .2 above.

4.3 Off-farm employment

The number of household members havin g an off-farm job significantly affects the probability of land renting out. But off-farm employment does not change the probability of renting in significantly. This result confirms findings of previous studies that improved off -farm job opportunities increase the supply of land and is a major factor driving the development of village Land rental markets.

4.4 Land resources

As expected, households with more land per laborer are less likely to rent in land. But land availability has no significant effect on land renting out decisions. The large land scarcity in the surveyed villages, with 92% of the households having less than three mu contracted land per laborer and 97% of the households having less than five mu per laborer may explain the latter result. This result indicates that the land rental market is mainly driven by off-farm employment in areas with high land scarcity. Without off-farm job opportunities, even households with relatively large land endowments do not rent out their land, and the land rental market is absent due to lack of supply.

Other land resource variables in the models are the exploitation of waste land, and the areas of garden land and forest land available to the households. As expected, the exploitation of waste land and the availability of forest land have a significant negative effect on land renting in. Availability of garden land, however, does not have a significant effect. All three variables do not affect the renting out of land. This again confirms that off-farm employment, not land availability, may drive the development of the land rental markets in the research area.

4.5 Human capital

The education level of household head has different effects on land renting in and out. Contrary to Kung (2002) and Zhang et al. (2004), we find that education does not affect land renting in. Instead, we find that education has a significant positive effect on land renting out. A possible explanation may be that household with higher educated head earns higher income from off-farm employment, therefore has fewer incentive to earn an income from agriculture.

Training in agricultural skills or non-agricultural skills, however, does not significantly affect

land renting in or renting out decisions. We expect households with training in agricultural skills to be more efficient in farming and therefore have more incentives to rent in land, while households with training in non-agricultural skills may obtain higher earnings from off-farm employment and therefore are more likely to rent out land. A possible explanation for the insignificant results for the two training variables is that the quality of the training is not high.

The number of household and labor force members that had a disease last year has no significant effects on both renting in and renting out decisions. Because land is very scarce in the research area and labor is abundant, the occurrence of diseases probably does not significantly affect household land rental decisions.

4.6 Social capital

Higher social capital may mean better possibilities to rent in land, but it may also mean better access to relatively high-paid local off-farm jobs. Only the first variable has a significant effect on decision to rent in land. The renting out of land is not significantly affected by the social capital of households in the research area.

4.7 Agricultural assets

Households with more investment in agriculture are expected to have more incentives to rent in land. The probit model results show investments in land and machines indeed significantly affect land renting in. Investments in agricultural assets, however, do not significantly affect the decision of land renting out. This result again confirms that the supply of land is not driven by agriculture-related factors in the research area.

4.8 Access to extension

Access to extension services has mixed effects on land renting in and out. Households receiving information on other crops than rice and maize are more likely to rent in land than households that do not receive such information. And households that receive information on rice farming are less likely to rent out land than other households. Receiving information on maize and livestock does not seem to affect land rental behavior. It is not clear what causes these different responses for different types of extension services.

6 Conclusion

In this paper, we use data for three villages in one of the poorest provinces in China, Guizhou Province, to analyze the factors affecting the development of land rental markets. A major advance compared to the few available studies on land rental market development in China is the use of a weighted probabilities approach in the model for land renting out in order to correct for missing data caused by migrated households.

The main finding of the research is that the land rental market is mainly driven by off-farm employment; land-labor ratios do not play a significant role in land renting out. Without off-farm job opportunities, households are unlikely to rent out their land, and the land rental market does not work if there is no supply. This finding confirms the results of previous studies for China. The sample contains information on the number of household members involved in off-farm employment, but not on the earnings obtained from off-farm employment. We find, however, that the level of education of the household head and the size of the savings in a bank both affect land renting out positively. Both education of the household head and savings deposits are likely to be positively correlated with the earnings obtained from off-farm employment.

Another important finding is that households belonging to minority gro ups are significantly more inactive in the land rental market. The age of the household head shows an inverted U-shaped relationship with land renting in. Participation in off-farm employment is relatively low in the research area used for this stud y. Only 0.55 household members on a total household size of 4.23 have an off-farm job on average. With further increases in off-farm work, the land rental market is expected to develop further. Households belonging to minority groups, however, are unlikely to participate much. Appropriate measures taken by local governments to stimulate land rental participation by minority groups can be an important way to stimulate agricultural productivity and total household incomes of such minority groups.

Decisions on off-farm employment may be jointly taken with decisions on land renting out and land renting in. Further research in this field may therefore develop and estimate models of household decision making that reflect such joint decisions. In addition, ordered probit models that correct for missing data caused by migrated households may provide a further improvement over the correc ted binary probit model that we use in this study.

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