

Article

Why the Uncertain Term Occurs in the Farmland Lease Market: Evidence from Rural China

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Abstract: Urbanization and aging of the agricultural population lead to the insufficient supply of agricultural labor and land being idle in rural China, calling for the farmland lease market to maintain sustainable and efficient use of farmland. However, rural households tend to agree on an uncertain term for farmland leasing in/out, which leads to low efficiency and land loss in agriculture. Therefore, using the survey data collected from 2704 rural households and a logistic regression model, we examine the effects of risk faced by the rural households on the likelihood of the uncertain term for farmland leasing. Results reveal that a large share of labor with low education and high income increase the likelihood of an uncertain term for farmland leasing out activities, while a high disaster frequency, a high education of household and a high share of agricultural income increase the probability of an uncertain term for farmland leasing in activities. Additionally, leasing farmland to/from relatives or neighbors, informal contracts, low rent and the lack of pension insurance also increase the likelihood of the uncertain term for farmland leasing out/in activities. Findings suggest that more attention should be paid to education, agricultural insurance and social security system in rural areas.

Keywords: farmland lease market; risk; uncertain term; lease in; lease out

1. Introduction

China, a developing country with the world's largest population, has about 35% of its labor force in agriculture, compared to 2.5% in the United States. According to the third National Agricultural Census in 2016, agricultural operators age 55 and above were about 106 million and accounted for 34% of total agricultural operators [1]. This means that China suffers from an aging agricultural population. On the other hand, the rural migrant workers increased from about 242 million in 2010 to about 286.5 million in 2017 [2]. This migration leads to two main consequences in agriculture. One is that most of the labor force for agricultural production is women and the elderly, which may be less productive than a younger and male labor force [3]. The other is the growth of farmland being idle. For example, the survey of 5000 Chinese rural households conducted by Central China Normal University revealed that rural households that left their farmland idle accounted for 5.7% of the sample in 2010, and the average area of the farmland idle was 0.54 mu (mu is a unit used to measure the area of land, 1 mu = 0.067 hectare). In 2012, 7.54% of the sample rural households left their farmland idle (about 0.57 mu on average) [4]. All of these threaten the sustainable use of farmland resources in rural China.

To address these questions, an efficient way is farmland leasing because farmland cannot be sold in China and only rural households as members of the collective village have the original contractual right and operational right under the Household Contract Responsibility System (HCRS) [5].

In practice, what the Chinese rural households could transfer in the farmland market is only the right of farmland operation. Thus, farmland leasing holds a dominant position in the rural land market [6]. The Chinese government pays attention to proceeding with the development of the farmland lease market. For example, China's State Council and the Ministry of Agriculture jointly issued the National Plan for Sustainable Development of Agricultural (2015–2030), which emphasized that protection of cultivated land resources and promoting sustainable use of farmland comprise one of the five key tasks to promote the sustainable development of agriculture in China in the future [7]. The sustainable development of agriculture includes detailed considerations of resources, technology and environment [8] and is inextricably related to the growth of food production, efficient use of economic and intellectual resources, improvement of wealth and quality of life for rural households and balanced nature management [9]. In this way, farmland leasing contributes to the sustainable development of agriculture as it enables the redistribution of the operation right of farmland and avoids farmland being idle. Furthermore, the shift of the operation right of farmland to more capable and more professional operators may make contributions to the increase of agricultural investment, adoption of agricultural innovations and especially the sustainability of farmland use for rural households with an off-farm job.

The farmland leasing activities are unique for three reasons. First, the lease term is constrained by the biological process. Hence, the term should be at least one year or one season for agricultural production. Second, the investment in agricultural production may create a lock-in effect and long payback period, like the agricultural machinery. Finally, some investment in agriculture requires a long duration to work, such as the improvement of soil fertility [10]. Thus, the term for farmland leasing is of particular importance as a tool to measure coordination flexibility and adaptability, which allow them to be tailored to the exact conditions of their use. Previous studies believed that the long-term contract was quite important for the efficiency of the farmland lease market [11,12], because it can promote the formation of stable expectations and maintain cooperative relations between the contracting parties.

However, the Chinese rural households tend to agree on an uncertain term for farmland leasing out/in in most of rural China [12]. The farmland leasing with an uncertain term is similar to the open-ended contracts that do not have a fixed term, indicating that it may be as short as one season or as long as over ten years. The key point of an uncertain term is that it cannot create stable expectations among landowners and renters, which may lead to renters' pursuit of short-run benefits, extensification of land use and a reduction in long-term investment for agriculture. Existing literature attempted to explain this interesting phenomenon in various ways. For instance, farmland provides livelihood security, old-age security and employment security for rural households; therefore, rural households will pay more attention to the decision-making of farmland leasing and take account of the potential risk posed by farmland leasing [13]. The rural households' perception of risk will reduce the enthusiasm of their participation in long-term land leasing to some extent. Overall, the existing literature is aware of the impacts of risk on rural households' decision of farmland leasing, but still suffers from some weakness. First, previous research did not distinguish the specific content of the potential risk for farmland leasing out and leasing in. Second, the influence of factors affecting rural households' decision-making on the farmland leasing term has rarely been quantified. Third, the root of the risk has not been further explored, and the phenomenon of choosing an uncertain term for farmland leasing failed to attract attention.

In this way, this study attempts to investigate the risk that the Chinese rural households face and how it results in the uncertain term for farmland leasing. We use the survey data collected from 2704 rural households covering nine provinces in China. There are several contributions of this study. First, this study focused on the uncertain term, which frequently occurs in the farmland lease market in rural China, but is neglected by existing studies. Second, we analyze the farmland leasing activities from the term for farmland leasing, which is a key factor to measure the efficiency of farmland leasing by using the national survey data of 2704 rural households. Finally, this study considers the difference between the behaviors of farmland leasing out and leasing in; thereby, it is the first study to distinguish

the risks from farmland leasing out and in and their influences on the decision-making of their term for farmland leasing, respectively.

The paper is organized as follows. Section 2 shows the related literature. Section 3 presents the research data and descriptive statistics, while Section 4 provides the theoretical model and estimation method. The estimated results are presented in Section 5, followed by a discussion in Section 6. The last section provides conclusions and implications.

2. Literature Review

With the development of the farmland lease market, there is an increasing body of research work highlighting the risk of farmland leasing [14–16]. For example, farmland leasing may lead to further land abandonment, which may threaten food security [15] and the possibility of the moral hazard caused by the tenant [16,17]. Several studies also focused on the risk of the land lease market on agricultural efficiency [18], agricultural investment [19] and social security [20]. Although the above papers add to the knowledge regarding the risk caused by farmland leasing, few of them address the risk that the rural households face.

The relationship between the risk and contract choice has been recognized by some researchers with the assumption that risk aversion is pervasive in modern economies [21] and the incomplete contract is a general phenomenon in human society [22]. Some studies discussed the impact of risk on farmland leasing. For example, Paulson and Schnitkey [14] examined the relationship between contract type, rental rates, crop revenues and risk and found that the tenure position of a farm operation has a significant effect on risk exposure due to the price volatility. Yang et al. [23] analyzed the effect of landowners' risk and time preferences and land quality on the equilibrium terms of contracts (land-leasing contract, fixed-price contract and revenue-sharing contract) with the purpose of net benefit maximization. However, recent studies mainly considered the contract types' determination [14,16,17], and few of them especially paid close attention to the decision of the term of a farmland lease contract.

Time is a fundamental dimension of any human action [24]. The term of a contract is one of the most important factors in virtually any economic relationship, either as the duration of contractual obligations or as the advance notice time for certain unilateral actions [25]. Thereby, the contract term has a direct correspondence to the contract implementation and option [26], as well as the holdup problem [27]. In other words, a clear contract term is the key point of a contract. Early studies attempted to compare long-term contracts and short-term contracts in order to find which one is an optimal decision [28,29]. One basic consensus of previous studies is that the best form of contract is making trade-offs between the rigidity of protecting rights and the flexibility for motivating efficiency afterward for the reason that the subject can accept or refuse the terms in a contract when signing a contract [30].

Although this literature explained the parties' choice of the term of a contract, the result of the term between the false dichotomy of long-term or short-term was ignored. Additionally, there is surprisingly little work in the uncertain term of a contract, especially the influence of rural households' risk perception on their decision-making on the term of farmland leasing in or leasing out.

3. Data and Descriptive Statistics

To satisfy the objective of our study, we use the household level data from the Cultivation of Rural Land and Related Factors Market survey, which was conducted in nine provinces of China at the beginning of 2015. Thus, the collected information refers to the calendar year 2014. The survey collected measures of the characteristics of rural households' resource endowment (labor, farmland, income and assets), agricultural production, land operation and state of life, which meet the purpose of this study. By clustering analysis of six indicators related to the economy, agriculture and population, we respectively extracted nine provinces, including Guangdong, Guizhou, Henan, Jiangsu, Jiangxi, Liaoning, Ningxia District, Shanxi and Sichuan. It can be seen in Figure 1 that these provinces are evenly distributed in the east, center and west of China, so that the sample can reflect the difference of climate, economic development, geographical condition, etc., and show appropriate representativeness.



Figure 1. Provinces of China and the nine surveyed provinces.

By using the same method and combined with the administrative division of China (Figure 2) based on the National Bureau of Statistics of China, the four layers of regions were randomly selected. Then, an administrative village was chosen from each township and ten rural households randomly chosen from the village. In all, 595 villages within 69 cities of nine provinces were randomly selected. Finally, we distributed 2880 questionnaires and recycled 2838 questionnaires, of which 2704 were effective. The sample distribution is shown in Table 1. It reveals that except for Guangdong province and Jiangxi province with over 500 surveyed rural households, the number of surveyed rural households ranged from 201–239 in other provinces.

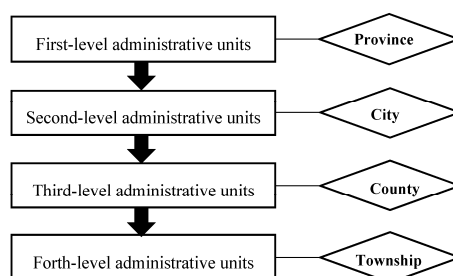


Figure 2. The administrative division of China.

Table 1. Sample distribution.

Province	City		County		Township		Village		Household	
	Freq.	Percent	Freq.	Percent	Freq.	Percent	Freq.	Percent	Freq.	Percent
Guangdong	15	21.74	15	14.29	65	17.47	112	18.82	547	20.23
Guizhou	11	15.94	27	25.71	64	17.20	100	16.81	239	8.84
Henan	5	7.24	7	6.67	24	6.45	24	4.03	230	8.51
Jiangsu	6	8.70	6	5.71	24	6.45	34	5.71	239	8.84
Jiangxi	10	14.49	15	14.29	69	18.55	132	22.18	587	21.71
Liaoning	6	8.70	10	9.52	39	10.48	53	8.91	221	8.17
Ningxia	4	5.80	7	6.67	23	6.18	41	6.89	226	8.36
Shanxi	5	7.25	6	5.71	21	5.66	28	4.72	201	7.43
Sichuan	7	10.14	12	11.43	43	11.56	71	11.93	214	7.91
Total	69	100	105	100	372	100	595	100	2704	100

Table 2 describes the distribution of the term of farmland lease contracts. There were 614 rural households that leased out their farmland and 326 rural households that leased in farmland. Table 2

shows that 225 rural households agreed on an uncertainty term for farmland leasing out, accounting for 36.64% of households that leased out farmland, while 146 rural households agreed on an uncertain term for farmland leasing in, accounting for 44.79%. These two proportions indicate that rural households have a strong preference for an uncertain term. Among the rest, more rural households would choose the term of above five years for a farmland lease-out contract (25.08%), followed by the term of 1–3 years (14.66%). This is opposite in the case of farmland leasing in as about 19% of the households that leased in farmland chose the term of 1–3 years and about 16% of the households chose the term of above five years. The proportions of rural households that chose the term of 4–5 years for farmland lease-out and lease-in contract were 12.54% and 7.98%, respectively. Over 10% of the households chose the term of one year or less than one year.

Table 2. Rural households' decision of the term of farmland lease contract.

Contract Term	Lease Out		Lease In	
	Observation	Proportion	Observation	Proportion
within 1 year	68	11.07	40	12.27
1–3 years	90	14.66	63	19.33
4–5 years	77	12.54	26	7.98
above 5 years	154	25.08	51	15.64
uncertain	225	36.64	146	44.79
total	614	100.00	326	100.00

Table 3 reports the definition and summary statistics of the variables used in our analysis. The choice of the term for farmland leasing, our variable of interest, is directly from the answer of rural households. Table 3 reveals that 36.6% of the rural households agreed on an uncertain term when leasing out their farmland, while 44.8% of the rural households agreed on an uncertain term when they leased in farmland. Among rural households that leased out their farmland, the proportion of labor with an off-farm job is about 74%, but few of them had a written contract for their off-farm job, suggesting the instability of the off-farm job for rural migrant labor. The mean of the proportion of laborers with an education of senior high school or above to total household laborers is just 24%, indicating that many rural laborers did not have high educational qualifications. This may be the main obstacle for them to find a well-paid and stable job in urban areas. Thus, the rural households that lease out the farmland need to consider the risk of unemployment.

The leasing out of farmland may cause land-use risk by the lessee, such as the change in land quality, shape or the land usage. This risk will affect their land allocation and contract choices [23]. The increase of the share of farmland leased out to total contracted (allocated by the village) farmland of rural households may also increase the risk of leasing out farmland. Especially, we asked two questions referring to the risk attitude and risk perception of rural households: (1) how much would you consider what plant and cultivation method the lessee used on your farmland; (2) how much would you consider if the lessee dug a ditch or a well on your farmland. As a result, a large proportion of rural households would not consider how the lessee manages the farmland, but they would definitely consider digging a ditch or a well on their farmland by the lessee.

As farmers tend to be risk-averse and the production risk increases with the size of farmland, they are more willing to take the risk of production into account before they decide to lease in farmland. Furthermore, the productivity and risk profile vary between different cropping systems [31]. Thus, we consider the production risk from both objective and subjective perspectives. Table 3 shows that the average number of the occurrences of agricultural disasters in the last three years was about 2.4. The proportion of rural households that planted grain was 89.9% of the total households leasing in farmland, while only 39.6% of the rural households planted a commercial crop. Otherwise, rural households' advantages in farming will reduce the risk. However, only 39.6% of the rural households leasing in farmland reported that they had farming competitiveness.

Table 3. Definitions and summary statistics of variables.

Variable	Definition	Lease Out	Lease In
		Mean (Std.Dev)	Mean (Std.Dev)
lease-out term	=1 if household leased out farmland and agreed on an uncertain term, 0 = otherwise	0.366 (0.482)	
lease-in term	=1 if household leased in farmland and agreed on an uncertain term, 0 = otherwise		0.448 (0.498)
Unemployment risk			
off-farm labor	proportion of laborers with off-farm job to total household laborers	0.740 (0.322)	
off-farm contract	the share of the off-farm job with a written contract, 0 = no non-farm work, 1 = no contract, 2 = few, 3 = many, 4 = all	1.896 (1.447)	
labor education	proportion of laborers with an education of senior high school or above to total household laborers	0.240 (0.300)	
Land use risk			
land lease-out	the share of the area of farmland leased out to total contracted farmland	0.691 (0.302)	
farm management	level of consideration of what the lessee plants and cultivation method he/she used on your farmland, 1 = would not consider, 2 = would consider, 3 = definitely consider	1.612 (0.768)	
land change	level of consideration of digging a ditch or a well on your farmland by the lessee, 1 = would not consider, 2 = would consider, 3 = definitely consider	2.308 (0.827)	
Production risk			
disaster frequency	number of the occurrences of agricultural disasters in the last three years		2.445 (1.068)
planting grain	=1 if household planted grain, 0 = otherwise		0.899 (0.302)
planting crop	=1 if household planted commercial crop, 0 = otherwise		0.506 (0.501)
competitiveness	=1 if household has farming competitiveness, 0 = otherwise		0.396 (0.490)
Market risk			
market participation	=1 if household's grain and commercial crop production are all for sale, 0 = otherwise		0.334 (0.472)
yield level	average yield of per mu of farmland compared to other households, 1 = much lower, 2 = somewhat lower, 3 = about the same, 4 = somewhat higher, 5 = much higher		2.439 (0.816)
farm-income level	average agricultural income per mu compared to other households, 1 = much lower, 2 = somewhat lower, 3 = about the same, 4 = somewhat higher, 5 = much higher		1.979 (1.015)
Contract risk			
renter	=1 if household leased out farmland to relatives or neighbors, 0 = otherwise	0.332 (0.471)	
landowner	=1 if household leased in farmland from relatives or neighbors, 0 = otherwise		0.675 (0.469)
contract type	=1 if the household leased out/in farmland through a written contract, 0 = otherwise	0.459 (0.499)	0.301 (0.459)
rental	the rent of farmland leased out/in per mu for one year (yuan, RMB)	712.011 (2450.556)	280.445 (401.312)
Household characteristics			
age	age of the respondent (years)	43.420 (15.119)	43.448 (13.268)
age square	age square of the respondent (years)	2113.528 (1392.294)	2063.209 (1136.947)
education1	=1 if the respondent had primary or lower education, 0 = otherwise (base group)	0.293 (0.456)	0.380 (0.486)
education2	=1 if the respondent had middle/junior high school education, 0 = otherwise	0.409 (0.492)	0.383 (0.487)
education3	=1 if the respondent had senior high school education, 0 = otherwise	0.163 (0.370)	0.172 (0.378)

Table 3. Cont.

Variable	Definition	Lease Out	Lease In
		Mean (Std.Dev)	Mean (Std.Dev)
education4	=1 if the respondent had above senior high school education, 0 = otherwise	0.135 (0.342)	0.064 (0.246)
occupation	=1 if the respondent engaged in full-time off-farm job, 0 = otherwise	0.282 (0.450)	0.132 (0.339)
pension insurance	=1 if the contracted owner of the farmland has pension insurance, 0 = otherwise	0.549 (0.498)	0.506 (0.501)
land area	the area of contracted (=allocated by the village) farmland (mu)	6.954 (20.909)	12.460 (46.797)
household income1	=1 if the household income was within 10 thousand yuan (RMB), 0 = otherwise (base group)	0.122 (0.328)	0.156 (0.364)
household income2	=1 if the household income was among (10, 30] (thousand yuan), 0 = otherwise	0.362 (0.481)	0.316 (0.466)
household income3	=1 if the household income was among (30, 50] (thousand yuan), 0 = otherwise	0.254 (0.436)	0.252 (0.435)
household income4	=1 if the household income was among (50, 100] (thousand yuan), 0 = otherwise	0.173 (0.378)	0.206 (0.405)
household income5	=1 if the household income was over 100 thousand yuan (RMB), 0 = otherwise	0.090 (0.286)	0.071 (0.256)
agricultural income	share of agricultural income to total household income	0.312 (0.324)	0.439(0.334)
Village characteristics			
village_mountainous	=1 if the terrain of village is mountainous, 0 = otherwise (base group)	0.239 (0.427)	0.331 (0.471)
village_hilly	=1 if the terrain of village is hilly, 0 = otherwise	0.292 (0.455)	0.347 (0.477)
village_plain	=1 if the terrain of village is plain, 0 = otherwise	0.469 (0.499)	0.322 (0.468)
village economic1	the village economic development is low, 0 = otherwise (base group)	0.160 (0.367)	0.236 (0.425)
village economic2	the village economic development is medium, 0 = otherwise	0.632 (0.483)	0.580 (0.494)
village economic3	the village economic development is high, 0 = otherwise	0.208 (0.407)	0.184 (0.388)
distance to town	distance from household dwelling to the nearest town center (km)	2.938 (0.755)	5.251 (3.913)
Observation		614	326

With the assumption that rural households that plan to lease in more farmland are more likely to maximize the profit of agricultural production, market risk is the key consideration for rural households before their decision on the term of a farmland leasing-in contract. As shown in Table 3, the share of grain and commercial crop production of rural households that was all for sale was 33.4%. Additionally, a large number of rural households stated that their average yield and the average income per mu of farmland was lower compared to other rural households within the village.

Because of the incompleteness of the land lease contract, there is an unavoidable contract risk during land leasing activities, which is closely linked to the trust between the contracting parties and the possibility of the use of third parties for legal support. Thus, we asked the rural households if they leased out farmland to or leased in farmland from relatives and neighbors to measure the relationship between the landowner and renter. Generally, there was a high level of trust relation between people, and they may adopt the relational contract [32]. However, the formal written contract and higher rent can reduce the default risk. Table 3 reports that 33.2% of rural households leased out their farmland to relatives or neighbors, while 67.5% of rural households leased in farmland from relatives or neighbors. About 46% of the rural households leased out their farmland through written contract, and about 30% of rural households leased in farmland through written contract. The average rent of farmland leasing out (about 712 yuan) was more than that of farmland leasing in (about 280 yuan).

Finally, the bottom half of Table 3 shows the characteristics of the rural households and village that we considered in this study. The average age of two groups of rural households was about 43 with a majority having primary or junior high school educational attainment. The proportion of rural households engaged in a full-time off-farm job and the proportion of households with pension insurance were both higher in the group of households leasing out farmland than the group of households leasing in farmland. However, the average area of contracted farmland was about 12 mu for households leasing in farmland, which was larger than that of households leasing out farmland (about 7 mu). About one-third of the sample households' income was in the range of 10–30 thousand yuan. On average, the share of agricultural income was higher for households leasing in farmland. Economic development and village location were significant for the development of the farmland lease market and non-farm employment opportunities [33]. About half of rural households leasing out farmland reported that they lived in plain villages with medium economic development. However, more of the households that leased in farmland lived in hilly villages, being farther away from the town center.

4. Theoretical Model and Estimation Method

Following a household model of determinants of participation in the land lease market [34], we developed a theoretical model to address the problem of a rural household's selection of the uncertain term in the farmland lease market. We assume that the rural households are risk-averse and they aim to maximize their total family utility (or welfare) U by allocating labor resource between agricultural production and non-farm activities, as well as participation in the farmland lease market during only one period. This can be obtained by solving the following optimization problem:

$$\text{Max } U\{pQ + wL_{NF} + T_{out}[(\bar{F}l - Fl_F)(r - R_{out})] - T_{in}[(Fl_F - \bar{F}l)(r + R_{in})]\} \quad (1)$$

Subject to the constraints:

$$L_F + L_{NF} \leq \bar{L} \quad (2)$$

$$Q = Q(Fl_F, L_F, k, \theta) \quad (3)$$

$$R_{out} = R_{unemp} + R_{land} + R_{contra-out} \quad (4)$$

$$R_{in} = R_{produ} + R_{market} + R_{contra-in} \quad (5)$$

where \overline{Fl} and \overline{L} denote original contracted farmland and fixed amounts of the labor of a rural household's family, respectively. In Equation (1), p is the price of farm output Q ; w refers to the exogenous wage rate for migration labor L_{NF} ; r denotes the rental rate for farmland. T_{out} and T_{in} are indicators for the term of farmland lease-out contract and the farmland lease-in contract, respectively. R_{out} refers to the potential loss from the unemployment risk R_{unemp} , land use risk R_{land} and contract risk $R_{contra-out}$ when the rural households lease out their farmland, while R_{in} refers to the potential loss from the production risk R_{produ} , market risk R_{market} and contract risk $R_{contra-in}$ when the rural households lease in farmland. The potential losses R_{out} and R_{in} are supposed to be affected by various factors, such as the contract types, length of contract term, household characteristics, the relationship between rural households and the lessees, etc. As shown in Equation (3), the output of farm production is summarized by a production function, where Fl_F , L_F , k respectively stand for farmland input, labor input, capital inputs, and θ depicts location-specific characteristics such as the local climate, irrigation facilities and soil quality in the village. Assume that the utility function U as Equation (1) and the production function Q as Equation (3) are concave, continuous and twice differentiable. Equivalently, by solving the maximization problem of Equation (1), we can derive the equations for the separating decision of the term of farmland leasing-out contract and leasing-in contract as follows:

$$T_{out} = f(\overline{Fl}, \theta, \overline{L}, L_F, L_{NF}, R_{out}, w, r) \quad (6)$$

$$T_{in} = f(\overline{Fl}, \theta, \overline{L}, L_F, L_{NF}, R_{in}, w, r) \quad (7)$$

For the sake of simplicity, we assume that w and r are consistent for all the sample rural households. θ is a random parameter determined by the village characteristics (V). The farmland variable \overline{Fl} and labor variables (\overline{L} , L_F , L_{NF}) could be represented by the household characteristics (H). Thus, we can simplify the functions related to the decision of the term of farmland leasing-out contract and leasing-in contract as follows:

$$T_{out} = f(R_{unemp}, R_{land}, R_{contra-out}, H, V) \quad (8)$$

$$T_{in} = f(R_{produ}, R_{market}, R_{contra-in}, H, V) \quad (9)$$

The purpose of this study is to estimate the effect of risk on rural households' decision of an uncertain term of a farmland lease contract. The dependent variable y is a discrete, dummy variable indicating whether the term of the land lease contract is uncertain, which takes one of two values:

$$y = \begin{cases} 1 & (\text{uncertain term}) \quad \text{with probability } p \\ 0 & (\text{certain term}) \quad \text{with probability } 1 - p \end{cases} \quad (10)$$

The usual binary logit model is able to address the problem in the case with a binary dependent variable [35], so we estimated a logit model to predict the effect of risks on the contract term. In the logit model, the bounds $0 \leq p \leq 1$ are satisfied. The logit model refers to the logistic distribution, and the probability of p_i is as follows:

$$p_i = \Pr(y = 1|x) = \Lambda(x'\beta) = \frac{e^{x'\beta}}{1 + e^{x'\beta}} \quad (11)$$

In order to better estimate the influence of variables, the marginal effects are calculated, which are equivalent to:

$$\frac{\partial p}{\partial x_j} = \Lambda(x'\beta) \{1 - \Lambda(x'\beta)\} \beta_j \quad (12)$$

5. Results

5.1. Uncertain Term of Farmland Leasing Out

Table 4 reports the variables used in the logit regression model, including coefficients, robust standard errors and marginal effects. In addition, pseudo- R^2 measures and comparisons based on classification (\hat{y} equals 1 or 0) were used to evaluate the model's fitness. By controlling the dummy variable for provinces, the likelihood ratio, pseudo- R^2 of 0.261 and the percentage of correctly specified values in this model was 76.38%, both of which mean that the logistic regression equation is relatively fit.

Table 4. Logistic regression estimates of factors affecting the decision of an uncertain term for farmland leasing out.

Variable	Estimates		Marginal Effects	
	Coefficient	Robust Standard Errors	$\partial p / \partial x$	Standard Errors
off-farm labor	−0.292	0.329	−0.047	0.052
off-farm contract	0.029	0.074	0.005	0.012
labor education	−0.711 *	0.428	−0.113 *	0.067
land lease-out	0.318	0.402	0.051	0.064
farm management	−0.373 ***	0.152	−0.059 ***	0.024
land change	0.075	0.141	0.012	0.022
renter	0.478 *	0.255	0.076 *	0.040
contract type	−1.045 ***	0.271	−0.166 ***	0.041
rental (ln)	−0.221 ***	0.046	−0.035 ***	0.007
age (ln)	−5.227	30.752	−0.832	4.895
age square (ln)	2.661	15.361	0.424	2.445
education2	−0.404	0.262	−0.064	0.042
education3	−0.128	0.390	−0.020	0.062
education4	−0.154	0.429	−0.025	0.068
occupation	0.378	0.234	0.060	0.037
pension insurance	−0.379 *	0.223	−0.060 *	0.035
land area (ln)	−0.059	0.145	−0.009	0.023
household income2	0.247	0.341	0.039	0.054
household income3	0.582	0.361	0.093	0.057
household income4	0.477	0.388	0.076	0.062
household income5	1.388 ***	0.468	0.221 ***	0.072
agricultural income	0.477	0.342	0.076	0.054
village_hilly	−0.505	0.358	−0.080	0.057
village_plain	−0.995 ***	0.367	−0.158 ***	0.058
village economic2	−0.645 **	0.316	−0.103 **	0.050
village economic3	−0.292	0.329	−0.083	0.058
distance to town	−0.040	0.032	−0.006	0.005
constant	1.275	1.561	/	/
province dummies	YES		YES	

Notes: * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$. The marginal effect ($\partial p / \partial x$) for factor levels is the discrete change from the base level. Observations = 614, Pseudo $R^2 = 0.261$, Wald χ^2 (35) = 151.78, Prob > $\chi^2 = 0.000$. Correctly classified = 76.38%.

Tuning our attention to the variables in Table 4, the variable labor education shows a significant and negative influence on the uncertain term for farmland leasing out with the marginal effect of −0.113, implying that the increase of the proportion of laborers with senior high education or above leads to a decline of the probability of an uncertain term for farmland leasing out by 11.3%. The coefficient on farm management measuring the land use risk was negative at the significance level of 0.01, which means that the rural households that tended to consider the renter plant and cultivation method he (she) used are less likely to agree on an uncertain term (about 6% less). A plausible explanation for this is that the risk of land loss caused by crop changes or management method increases the probability of a fixed term for farmland leasing out in order to take charge of the farmland well.

The regression results also present the significant effect of contract risk. Compared to other renters, rural households that leased their farmland to relatives or neighbors were more likely to agree on an uncertain term (about 8% more). However, the signing of a written contract and the increase of rent have significant and negative effects on the choice of an uncertain term for farmland leasing out as the coefficient on contract type and rent was respectively -1.045 , -0.221 at the 1% level of significance, indicating that the presence of a written contract decreased the possibility of the uncertain term by 16.6% and the increasing rent reduces the likelihood of the uncertain term by 3.5%. This is consistent with the theoretical study of contracts on contractual relationships and formal contracts [36].

As for the control variables, the coefficient on pension insurance was -0.379 and significant at the 10% level of significance, suggesting that the rural households with pension insurance are more likely to agree on a fixed term for farmland leasing out by 6%. Moreover, the coefficient on variable household income5 was 1.388 and significant at the 1% level of significance, indicating that rural households with a total income of over 100 thousand yuan have a higher likelihood of agreeing on an uncertain term (about 22% more). Among the variables of village characteristics, the variables village_plain and village economic2 had significantly negative impacts on rural households' choice of the uncertain term. This reveals that the rural households living in the plain village are less likely to agree on an uncertain term (about 16% less) compared to households living in the mountainous village. Moreover, the likelihood of the uncertain term decreased within the village of medium economic development (about 10% less). Perhaps the farmland lease markets in the plain areas and village with medium economic development (including roads, public infrastructure, income per capital) developed better, which may have promoted the adoption of formal contracts.

5.2. Uncertain Term of Farmland Leasing In

Table 5 shows the estimated results of the case of farmland leasing in. The results are reliable, and the fitting degree of this logistic regression equation is high because the pseudo- R^2 equaled 0.344 and the correctly specified value in this model was 78.83%.

Table 5 shows that disaster frequency has a significantly positive effect on the likelihood of an uncertain term, and the marginal effect was 0.062, implying that the increase of the disaster frequency increases the probability of an uncertain term for farmland leasing in by 6.2%. Other variables measuring the production risk and market risk did not have significant impacts on the likelihood of the uncertain term. This may be caused by the rural households' relatively low participation in the agricultural product market and diversify production, which reduces the risk related to agricultural production. However, the contract risk played a vital role in the term of farmland leasing in. For example, when the rural households leased in farmland from relatives or neighbors, the likelihood of uncertain term increased by 11.4%. Similar to the case of farmland leasing out, the coefficients on contract type and rent were -2.017 , -0.294 , respectively, at the 1% level of significance, and the value of marginal effects revealed that the signing of a written contract decreases the possibility of the uncertain term for farmland leasing in by about 30%, and an additional increase of rent reduces the likelihood of the uncertain term by 4.3%.

Tuning our attention to the household characteristics, findings show that the rural household's age and age square both had significant impacts on the probability of the uncertain term, but the marginal effect of age was 17.642, while the marginal effect of age square was -8.716 , suggesting that there is an "inverted-U"-shaped relationship between rural households' age and the likelihood of the uncertain term for farmland leasing in. The coefficients on education2 and education4 were significantly positive, and their marginal effects imply that rural households with a junior high school education (0.088) and over senior high school education (0.215) are more likely to agree on an uncertain term for leasing in farmland. The pension insurance also had a negative impact on the uncertain term for farmland leasing in with the marginal effect of -0.073 , suggesting that the probability of the uncertain term decreases with the presence of pension insurance. The coefficient on household income2 was negative and significant at the 10% level of significance, indicating that rural households

with income between 10 and 30 thousand yuan are about 13% less likely to agree on the uncertain term for leasing in farmland. The agricultural income has a significantly positive effect on the likelihood of the uncertain term with a marginal effect of 0.139, suggesting that the additional augment of the share of agricultural income increases the probability of the uncertain term for farmland leasing in by 13.9%.

Table 5. Logistic regression estimates of factors affecting the decision on an uncertain term for farmland leasing in.

Variable	Estimates		Marginal Effects	
	Coefficient	Robust Standard Errors	$\partial p / \partial x$	Standard Errors
disaster frequency	0.422 ***	0.155	0.062 ***	0.022
planting grain	−1.095	0.820	−0.160	0.118
planting crop	−0.323	0.625	−0.047	0.091
competitiveness	−0.033	0.343	−0.005	0.050
market				
participation	−0.103	0.348	−0.015	0.051
yield level	−0.129	0.374	−0.019	0.055
farm-income level	0.116	0.217	0.017	0.032
landowner	0.781 **	0.363	0.114 **	0.053
contract type	−2.017 ***	0.399	−0.296 ***	0.050
rental (ln)	−0.294 ***	0.066	−0.043 ***	0.008
age (ln)	120.425 **	52.422	17.642 **	7.512
age square (ln)	−59.494 **	26.161	−8.716 **	3.750
education2	0.601 *	0.362	0.088 *	0.052
education3	0.558	0.571	0.082	0.083
education4	1.470 **	0.758	0.215 **	0.109
occupation	0.363	0.452	0.053	0.066
pension insurance	−0.498 *	0.302	−0.073 *	0.044
land area (ln)	−0.015	0.168	−0.002	0.025
household income2	−0.894 *	0.477	−0.131 *	0.068
household income3	−0.558	0.475	−0.082	0.069
household income4	−0.024	0.497	−0.004	0.073
household income5	−0.029	0.722	−0.004	0.106
agricultural income	0.947 *	0.498	0.139 *	0.071
village_hilly	0.491	0.551	0.072	0.080
village_plain	0.206	0.533	0.030	0.078
village economic2	−0.601	0.434	−0.088	0.062
village economic3	−0.917	0.574	−0.134	0.082
distance to town	−0.015	0.043	−0.002	0.006
constant	−4.351	2.461	/	/
province dummies		YES		YES

Notes: * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$. Marginal effect ($\partial p / \partial x$) for factor levels is the discrete change from the base level. Observations = 326, Pseudo $R^2 = 0.344$, Wald $\chi^2(36) = 105.52$, Prob > $\chi^2 = 0.000$. Correctly classified = 78.83%.

6. Discussion

Since it is routine among research about farmer's behavior to assume that farmers are risk averse [37], rural households have naturally a preference for certainty. In addition, it is suggested that the choice of alternative options reflect the consideration of the need of the organism, the mean expected outcome of each option and the variance among the option's outcome [38]. Therefore, the determination of the term for farmland leasing is likely to be a reasonable decision with risk consideration and satisfaction of their need. It can also be observed from the results mentioned above that an uncertain term is determined by a series of factors related to potential risk.

The main driving factor for the rural household to participate in farmland leasing out is off-farm employment so that the stability of employment is directly related to the risk of unemployment. However, the human capital can reduce this risk and in turn help to reduce the likelihood of the uncertain term. Note that farmland is quite important for rural household's livelihood. Rural households that care

about renters' farm management are less likely to agree on an uncertain term, but the likelihood of an uncertain term increase among the richer rural households. This suggests that the strong dependence on farmland increases the risk expectation of farmland leasing. For rural households that leased in farmland, the main risk comes from natural disasters.

Furthermore, many rural households leased farmland to/from relatives or neighbors, indicating that much of the farmland leasing happened among smallholders. This may make it hard to realize farm improvements, soil conservation and the adoption of technology. On the other hand, it reflects that rural households prefer to choose relatives or neighbors as their partner. Perhaps this choice can avoid the risk caused by information asymmetry and moral hazard and reduce the transaction cost. However, a written contract and high rent can make up for these weaknesses and facilitate the achievement of a fixed term contract. Besides, pension insurance has a negative impact on the uncertain term, which means that social security significantly reduces the risk of rural households' risk of surviving and makes their lives more stable.

Though rural households prefer the ability to update their evaluation and plans continually [39], the uncertain term for farmland leasing is not conducive to the development of the farmland lease market in rural China in the long run. Operators who are willing to lease in farmland and have more professional knowledge, as well as agricultural management capabilities, are likely to become the dominant operators of farming in rural China in the future, and such farms are supposed to be the main sources to improve the agricultural production in rural China. Therefore, a relatively long-term and stable farmland leasing is important.

7. Conclusions

Using the data collected from 2704 rural households from nine provinces of China in 2015, we found that the proportion of rural households that agreed on an uncertain term for farmland leasing out and farmland leasing in is very high, accounting for 36.64% and 44.79% of the two groups of sampled households. Thus, this study affirmatively answered the research question, "Why is there so large a proportion of rural households that agree on an uncertain term for farmland leasing in rural China?" Our analysis distinguishes the terms farmland leasing in and leasing out and five sources of risk including unemployment risk, land use risk, production risk, market risk and contract risk. Through logistic regression, this study examined the impacts of factors related to risk on the uncertain term for farmland leasing activities. Results revealed that rural households with income over 100 thousand yuan increased the likelihood of an uncertain term for farmland leasing out by 22.1%, but the increase of the share of labor with senior high school education, the consideration of farm management and living in a plain village reduced the probability of the uncertain term for farmland leasing out. A high disaster frequency, high education of household and a high share of agricultural income increased the probability of an uncertain term for farmland leasing in activities. Additionally, leasing farmland to/from relatives or neighbors, informal contracts, low rent and the lack of pension insurance also increased the likelihood of the uncertain term for farmland leasing out/in activities.

Due to the performance of the farmland lease market plays an important role in the sustainable use of farmland, the adoption of modern agricultural technologies and commercialization of agriculture, especially in developing countries, some actions need to be taken to improve the farmland lease market. First, as a written contract can reduce many unnecessary disputes later during the land leasing term, the policymakers should propose a contract law and found an individual way to build up a formal structure of legal systems for the farmland lease market. Second, social insurance and households' human capital (education) significantly reduce the likelihood of an uncertain term; therefore, the social security system and education resources in rural China should be given sufficient attention. Third, policymakers are supposed to provide multiple-risk crop insurance programs, especially in developing countries, to mitigate the impact of natural disasters on agricultural production. Finally, the development of the intermediary organizations of the farmland lease market

should be encouraged for the purpose of reducing the risk of information asymmetry and providing land access to other capable renters instead of relatives and neighbors.

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