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GENERAL & APPLIED ECONOMICS | RESEARCH ARTICLE

The rural household's entrepreneurship under the land certification in China

Fang Yang^{1,2}, Wei Liu³ and Ting Wen^{4*}

Abstract: As China's economic growth slows down and the pressure of the economic downward increases gradually, the agricultural and rural economic development faces more serious challenges. Fortunately, thanks to the China's rural land certification, it guarantees the security and stability of property rights of land, and provides a huge development space for rural household's entrepreneurship, which promotes agricultural and rural economy greatly. In order to investigate the impact of the land certification on rural household's entrepreneurship in China, this paper uses China Rural Household Panel Survey data for the empirical analysis based on the panel Logit model. The results show that: (1) The land certification increases the probability of agricultural entrepreneurship by at least 25%, but it has no significant influences on non-agricultural entrepreneurship. (2) The rural land certification with boundary influences agricultural entrepreneurship more significant than that without boundary, and the land certification to household is more beneficial for agricultural rural household's entrepreneurship than that without to household. (3) The land certification mainly increases probability of agricultural entrepreneurship through the land transfer, labor allocation, and capital allocation. Moreover, the research of this study highlights the importance of standardizing rural labor market

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PUBLIC INTEREST STATEMENT

The purpose of this article is to investigate the impact of the land certification on rural household's entrepreneurship in China. This is the research that is used to highlight the importance of rural land system reform in creating conditions for the rural household's entrepreneurship. The rural institutional change can significantly promote the entrepreneurship of rural households, economic growth, and reduce poverty for the developing countries. This article provides an effective experience support for the future rural reform.

and accelerating land financial reform in creating conditions for agricultural entrepreneurship, which can provide effective data support for future rural policy-making.

Subjects: Agricultural Economics; Population & Development; Sustainable Development; Rural Development; Economics and Development

Keywords: Agricultural economics; land certification; agricultural entrepreneurship; non-agricultural entrepreneurship

1. Introduction

In developing countries, agricultural growth as a result of policy reform and technology adoption remains significant to promote the entrepreneurship of rural households, economic growth, and reduce poverty (Mesele et al., 2022). In recent decades, agriculture and rural areas have been the shortages of China's economic growth. Whether China can jump out of the middle-income trap and realize mid-term and long-term sustainable of economic growth is mainly determined by agricultural and rural economic development. As China's economic growth slows down in recent years, the economic downward pressure increases gradually and agricultural and rural economic development also face more severe challenges (Y. Zhou et al., 2020). Increasing rural household's income will be the path choice to achieve the goal of inclusive affluence. In 2020, the urbanization rate of permanent residents population in China reached 63.89%. According to a rough estimation based on a total population of 1.4 billion, China still had 500 million of rural residents. Such a large rural population not only constrains China's economic growth, but also brings a development opportunity for China's economic and social transformation. Raising the agricultural and non-agricultural income level of this group is the way to narrow the income gap between urban and rural residents, and promote inclusive affluence. Many experiences in developed countries have proved that entrepreneurship has significantly positive correlations with income (Bernhardt, 1994; Lofstrom, 2002; Mcmanus, 2000). On one hand, entrepreneurship increases income of entrepreneurs by solving their own employment problems. On the other hand, it increases income of employees by absorbing and driving employments (Suresh et al., 2009). The historical evidence of reform and opening up has demonstrated that Chinese farmers not only possess rich entrepreneurial experiences, but also have considerable potentials in entrepreneurship. Especially in the stage of promoting comprehensive rural revitalization in China, rural household's entrepreneurship become more important than entrepreneurial activities (John & Abigail, 2021), which can not only improve rural household's agricultural or non-agricultural income, but also provide a driving force for the agricultural or non-agricultural industry revitalization in rural.

The reform of China's rural land system is the main background for the study of rural household's entrepreneurship, which provides land element guarantee for rural household's agricultural entrepreneurship, or promotes rural household to transfer the land out to engage in non-agricultural entrepreneurship. Government of China (GOC) initiated a new round of rural land certification in 2013 to determine and protect land property rights clearly and effectively, increased efficiency of land resource allocation, and protected land property rights and interests of rural households. According to statistics of Ministry of Agriculture and Rural Affairs, China has confirmed the ownership of 1.5 billion mu (Appendix A1) of contracted land to 200 million of rural households and issued the certificate of the right to the rural land contracting and management rights by November 2020. The rate reached 96% (Appendix A2). Regularized property rights provide a legalization rule and procedure for the use, income and transfer of property rights through the process of issuing certificates, registration and right confirmation (Soto, 2000).

Existing studies mainly focus on urban entrepreneurial activities (Justin et al., 2018) and pay few attentions to entrepreneurial behaviors of rural residents (G. Zhou et al., 2017). Nowadays, studies on rural residents' entrepreneurship cover three levels, including individual entrepreneurship, migrant workers' entrepreneurship and rural household's entrepreneurship. Most studies focus on migrant workers' entrepreneurship since rural migrant workers are more likely to start

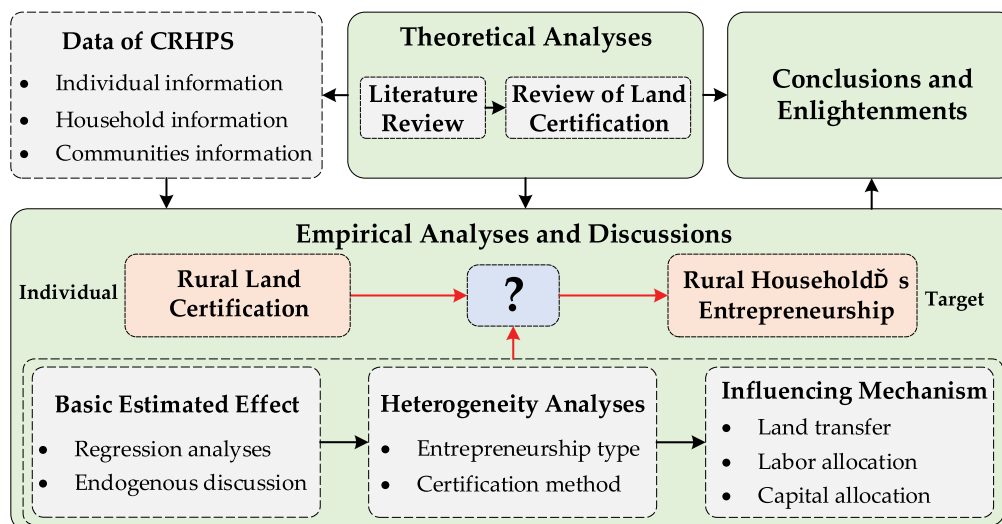
entrepreneurship. There are rare studies on the rest two types of entrepreneurship, especially the rural household's entrepreneurship. Existing studies on rural household's entrepreneurship focus on influencing factors and recognition of causality. Specifically, influencing factors include individual characteristics, family characteristics, community characteristics, socioeconomic environment and entrepreneurship supportive policies (Glaeser & Kerr, 2009; Han & Hare, 2013; He & Li, 2019). Studies on causality mainly focus on influences of social capitals (Westlund & Bolton, 2003), human capitals and material capitals (Lazear, 2005; G. Zhou et al., 2017) or economic capitals (Cai et al., 2018) on entrepreneurship.

This study investigated influences of land certification on rural household's entrepreneurship. This study reviewed previous researches on rural household's entrepreneurship and land certification. According to existing studies, Besley firstly established the theoretical model about influences of land ownership stability on investment, transfer and credit (Besley, 1993). Feder further proposed the theoretical framework which was the basis of follow-up associated studies. Chinese scholars proposed a lot of practical evidences (Feder & Nishio, 1998). Huang and Ji tested influences of land certification on long-term land investment of rural households based on the panel tracking data in 2000 and 2008 (Huang & Ji, 2012). They found that land certification increased application of organic fertilizers and promoted long-term land investment. Based on CHARLS in 2010 and 2012, Cheng et al. discussed influences of land certification on land transfer in pilot areas and they found that land certification promoted land transfer-out and increased land rents (Cheng et al., 2016). Mi et al. discussed the relationship between land certification and credit availability of rural household based on 2704 survey data in 9 provinces, China, and found that land certification has significant "De-Soto Effect" and it could improve credit availability of rural households (Mi et al., 2018). Furthermore, some scholars have discussed influences of land certification on labor flow (Xu et al., 2017; Zhang et al., 2018), income of farmers (Ningm et al., 2018) and agricultural production management (Han et al., 2018; Lin et al., 2018).

With the analyses of above analyses, this paper mainly studies the rural household's entrepreneurship in China, which focuses on the impacts of land certification on them (see the research framework in Figure 1). Three improvements are achieved in the following three aspects.

(1) The research perspective is relatively novel. This study chose entrepreneurial behaviors of rural residents as the research object, which offset shortages of studies on rural household's entrepreneurship.

Figure 1. The research framework of this paper.



(2) It involves richer and more comprehensive research contents. The new round of rural land certification has been finished. According to existing studies, land certification can create or improve element conditions of rural household's entrepreneurship to some extent. By discussing influences of land certification on rural household's entrepreneurship, this study further investigates differences between agricultural entrepreneurship and non-agricultural entrepreneurship as well as influences of different certification methods on agricultural entrepreneurship.

(3) Research data is more nationally representative and it can cover the whole process of land certification. Besides, this study uses the unbalanced panel survey data of 29 provinces in 2013, 2015 and 2017 from China Rural Household Panel Survey (CRHPS) of Zhejiang University, which reflects basic conditions of rural household's entrepreneurship in China accurately.

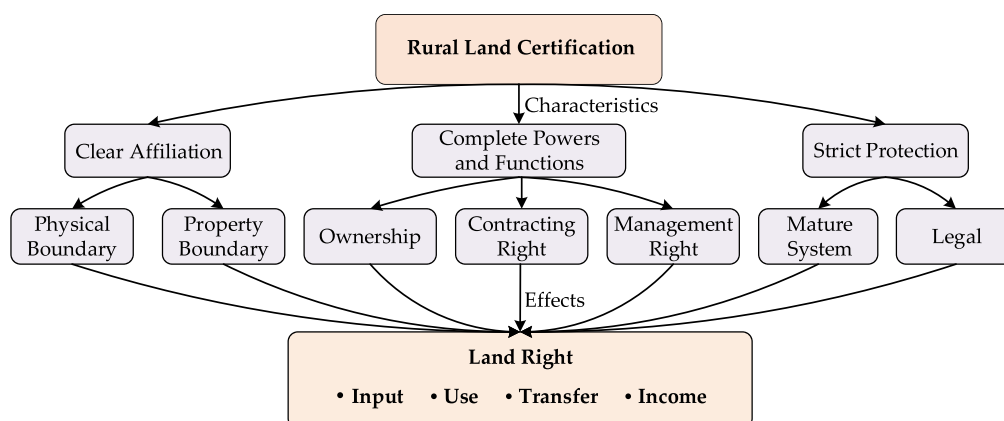
The remainder of this study proceeds as follows. Section 2 reviews the land certification of China and sorts out the relationship between land certification and land right. In Section 3, the source of research data of CRHPS and relevant variables are introduced. The important results, including estimated effects, heterogeneity analyses, and influence mechanism of land certification on rural household's entrepreneurship, is presented in Section 4, Section 5, and Section 6, respectively. Conclusions and policy enlightenments are summarized in Section 7.

2. New round of land certification: institutional traceback and theoretical analysis

2.1. Brief review on new round of land certification

Property rights have multiple economic effects, such as incentive effect, stability effect, integrity effect (Demsetz, 1967). Protection of intellectual property rights has very important influences on economic growth (S. Huang et al., 2005). For a long time, it lacks effective protections over rural land property rights. The ambiguous and instable land property rights have been restricting agricultural rural economic development in China. To address these problems, GOC initiated a new round of rural land certification to determine and protect land property rights clearly and effectively, increased efficiency of land resource allocation, and protected land property rights and interests of farmers. Moreover, GOC has finished the confirmation, registration and certification of land contractual management rights, and solved ambiguous boundary of household contracted land areas in 5 years. Recently, GOC also issued many policy documents to facilitate reform in the rural land property right system, including maintaining long-term rural land contract relation, implementing ownership, contracting right and management right of rural land, endowing management right and mortgage financing right, and so on. All of these policies aim to establish a rural land property right system which has clear affiliation, complete powers and functions, smooth transfer and strict protection.

Figure 2. The logic of a new round of rural land certification in China.



Compared with previous land certification, this round has more obvious characteristics (see Figure 2). Firstly, the affiliation is clearer. Physical boundary and property right boundary of rural land are determined clearly. Secondly, powers and functions are more complete. Based on the stable ownership, the contracting right has been consolidating continuously, while the management right has been loosening, accompanied with extension of core powers and functions of rural land, such as usage, revenues and transfer (Yu et al., 2021). Besides, it pays more attentions to the property attribute of land, and allows land assets and mortgage loan. Thirdly, the protection is stricter. It requires to establishing a unified and complete registration management system and issuing legal land property certificate comprehensively.

2.2. Influencing mechanism of land certification on rural household's entrepreneurship

Based on the actual situation of the land property right system in China, this paper defines rural household's entrepreneurship as the realization of new career choices, new management methods, and the upgrading of original production methods. Among of them, the new career choices (i.e., industrial or commercial management) belong to non-agricultural entrepreneurship (Paulson & Townsend, 2004), while the new management methods and the upgrading of original production methods in agriculture are defined as agricultural entrepreneurship of rural household. Previous study has shown that frequent adjustment of rural land lead to land fragmentation, insufficient investment, decline of soil fertility and other problems (Deininger & Jin, 2003). However, in recent years, the rapid reform of China's rural property right system and the improvement of the stability of land property rights have provided favorable conditions rural household's entrepreneurship.

Firstly, land certification promotes rural household's entrepreneurship through land transfer. For agricultural entrepreneurship, the contracting right and management right separate after land certification, which makes the transfer of management rights smoother. Rural households adopt agricultural entrepreneurship by expanding land scale through land transfer. Limited by national conditions of big population and relatively few land resources, most essential land for agricultural entrepreneurship comes from the transfer-out part. Moreover, the new round of land certification is not only beneficial for rural households to maintain the long-term stability of contract relationship, but also is conducive to protect the legitimate rights of transfer subjects. This brings positive effects on both transfer-in and transfer-out parties. Therefore, land certification might influence rural household's entrepreneurship through transfer-in intention, transfer-in behavior and transfer-in term. On one hand, land certification increases the safety of land right (Kassa, 2018), reduces the possibility of illegal occupation of agricultural land by the lessee (Yami & Snyder, 2016), and improves the power of farmers to expand the scale of land. Land expansion will provide essential sites for rural household's entrepreneurship. On the other hand, land certification also increases the stability of land right (Kassa, 2018). It means that the land contract management relationship is long-term fixation and cannot be adjusted (Cheng et al., 2016), which decreases the administrative intervention (Wang et al., 2018). Land certification strengthens confidence of farmers in protecting land property rights (Ye et al., 2018). Property rights protection and stable expectation are beneficial for agricultural entrepreneurs to expand business scale and extend long term of investment in agricultural land.

Secondly, land certification influences rural household's entrepreneurship through land allocation. Entrepreneurship is a behavior that increases element inputs. land certification may affect the allocation of labor factors from labor supply and labor demand. (1) For labor supply, land certification with certificate guarantees the land legitimate interests of rural households, so that they can no longer worry about the recycling problems after the land is transferred out. The possibility of land transfer-out is greatly improved (Cheng et al., 2016). Rural labor is more inclined to withdraw from household agricultural production (Xu et al., 2017) which will promote land transfer (Chernina et al., 2014; Janvry et al., 2015) and create more labor supply. (2) For labor demand, entrepreneurship means more labor input. According to evidences from countries like Brazil and Vietnam, rural households with land certification have significantly higher land investment compared to those without that (Alston et al., 1996; Saint-Macary et al., 2010).

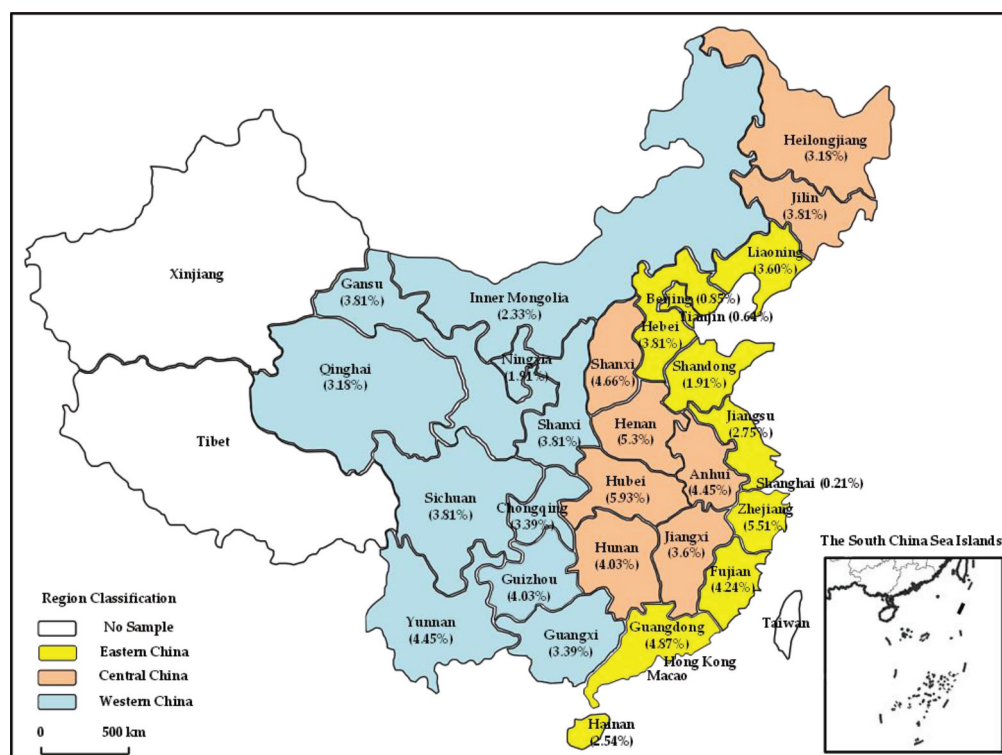
Finally, land certification also can influence rural household's entrepreneurship through capital allocation. (1) Land certification can relieve credit constraint of rural households. Since land has fixed geographic and spatial locations, increasing rent expectation and impossibility of destruction, land can be used as effective mortgage of formal credit agencies after land certification (Feder & Nishio, 1998). There's significant "De-Soto Effect" in rural land certification (Mi et al., 2018). Based on the loans with land certification, it expands the credit channels of rural households (Goldstein et al., 2014; Piza & Mauricio, 2016), relieves the financial pressure against rural household's entrepreneurship, reduce the risk of agricultural investment (Besley, 1993), and increases the possibility of entrepreneurial investment. (2) Land certification can increase the income level of rural households. Land certification strengthens the property rights and promotes free land transfer. Rural households can acquire stable incomes from land rents, which highlights the property function of land. In fact, perfecting land transaction rights in active land market can increase bargaining power and negotiation status of rural households. Due to the stable expectation of rising rent in the future and the premium effect of land certification (Hu & Luo, 2016), it is more possible to improve transaction value and property income or other potential incomes of land (Lin et al., 2018), which further increases total incomes of rural households.

3. Data source and research design

3.1. Data source

This study collected data from three rounds of CRHPS of Zhejiang University in 2013, 2015, and 2017, respectively. CRHPS reflects the economic life of rural households in China comprehensively. The research data was mainly divided into three parts: (1) Individual information, including gender, age, cultural degree, and health condition; (2) Household's information, including head of a household, family size, financial conditions, land certification, and agricultural production and management; (3) Communities' information, including population size of the village, land use of the village, village terrain, and land certification. The sampling method adopted in CRHPS combines stratified, three-stage, and scale measurement proportional key sampling. It covers 24,764 rural

Figure 3. Location of the study samples from rural households of China.



families in 29 Chinese provinces (cities and districts) and it has village-level, families in 29 Chinese provinces (cities and districts) and it has village-level, city-level, province-level, and national-level data representativeness. In order to illustrate the influence of land certification on entrepreneurship of rural households since 2013, this study selected some relevant variables, including land certification, household income and expenditure, and agricultural production and management. Through data review, the unbalanced panel data of rural household for three years were screened covering eastern, central and western China (see [Figure 3](#)).

3.2. Variable description

With reference to existing studies, this study aimed to select the following variables combining the research needs.

1. Dependent variables. This study defined entrepreneurship of rural households as the dummy variable of engaging in agricultural or non-agricultural entrepreneurship. Considering that studies which recognize entrepreneurship by income level or employment relations might have errors (Appendix A3), this research defined agricultural entrepreneurship as a household which was engaging in agricultural production and management, and the practical management area is at least three times the average of the cultivated area per household in the village (Appendix A4) (>20 mu). This is basically consistent with the definition of He Jing and Li Qinghai (He & Li, 2019): Agricultural entrepreneurship >10 mu of land transfer-in area. According to the practices of Cai Dongliang et al. (Cai et al., 2018), non-agricultural entrepreneurship was judged by the following questionnaire item: “Is your household engaging in industrial business production, and management projects, including self-employed entrepreneurs, renting, transportation, online shops, and enterprises?”

2. Core independent variables. The core independent variable in this study was land certification, which was derived from two questionnaire items: “Does your cultivated land have the certificate of land contractual management rights?” and “When was the certificate of land contractual management rights issued?” According to the considerations of the new round of land certification, this certification was limited to the land

contractual management rights issued after 2013. The land certification is very likely to gather significant “noises” for neglecting time of certification.

3. Control variables. The control variables of this study are mainly divided into individual characteristics, family characteristics, community characteristics, as well as human, economic, and social capital. (1) Population sociological variables. Regarding studies of Chen Wenchao et al. (G. Zhou et al., 2017) and Huang Kai et al. (K. Huang et al., 2020), individual characteristics were measured by gender, age, and the square of age. Family characteristics were measured by family size, and the burden ratios of children and the elderly. Village characteristics were represented by distance from the village to county and village terrain. Meanwhile, man-land relationship in the village was measured by the average cultivated land area per household in the village. (2) Capital accumulation variables. Since labor capital is vital for entrepreneurship (Lazear, 2005) and it is often measured by education and health, this study analyzed influences of labor capital on entrepreneurship of rural households through educational background and physical health condition of respondent households. Economic capital is the material basis of entrepreneurial activities. Capital shortage is often an important cause of impossible implementation or failure of entrepreneurship (Hurst & Lusardi, 2004). Moreover, household incomes per capita in the previous stage were chosen to measure economic conditions of rural households. Social capital can promote entrepreneurship significantly. In China, being a member of the Communist Party of China (CPC) is not only a political identity, but also implies the accessibility to many social and economic resources. Therefore, with references to study of He Jing and Li Qinghai (He & Li, 2019), this study measured social capital by membership of CPC in the household. (3) Spatio-temporal dummy variables. To eliminate influences of time-effect on estimation results, time dummy

variables were set according to year of survey and then controlled. Meanwhile, to avoid omission of potential locational factors, this study also introduced regional dummy variables of Eastern, Central, and Western China as control variables. Basic definitions and statistical characteristics of major variables are listed in Table 1.

3.3. Statistical description

Considering that this study focuses on influences of land certification on entrepreneurship of rural households, these are grouped simply according to whether they have finished land certification or not. It can be observed from Table 2 that: (1) The rural households with land certification present a relatively higher possibility of general, agricultural, and non-agricultural entrepreneurship compared to those without certification. This reveals that the new round of land certification has promoted entrepreneurship of rural households. (2) In addition to age and physical health, most variables are slightly related to land certification for the following two reasons. On the one hand, the measurement effect of variables associated with land certification is generally favorable. On the other hand, variables which might induce entrepreneurship differences, such as age and physical health, must be controlled. The above only presents a simple correlation. Therefore, whether land certification has promoted entrepreneurship of rural households needs further empirical testing.

3.4. Empirical strategies

Since dependent variables in this study are discrete variables, the panel Logit model has been chosen (John & Abigail, 2021; Zainul, 2020). Firstly, it can avoid heteroscedasticity generated by the linear probability model. Secondly, it can avoid the insufficiency of the linear probability model in estimating fixed effects. Thirdly, the Logit model is more sensitive when processing rare events or when the prediction probability is close to 0 or 1. Fourthly, it has great advantages in capturing entrepreneurial behaviors in villages. To assure scientific merit of model selection, all independent variables are assumed exogenous before using the panel Logit model. Normality testing is carried out on dependent variables and it is found that none of the entrepreneurship variables belonged to a normal distribution.

$$\text{Entrepreneurship}_{it} = \text{land_certificate}_{it}\beta + Z_{it}\theta + \lambda_t + U_i + \varepsilon_{it} \quad (1)$$

Where i refers to individual and t represents time. $\text{Entrepreneurship}_{it}$ implies that whether the rural household i had entrepreneurial behaviors in the stage t . $\text{land_certificate}_{it}$ reflects whether rural household i had certification of land contractual management rights in the stage t . Z is the control variables including individual, family, and community characteristics, and capital accumulation. λ refers to the time dummy variable of survey, U refers to the regional dummy variable, and ε is the random disturbance term.

4. Estimated effects of land certification on rural household's entrepreneurship

4.1. Basic regression results

Regression results of influences of land certification on entrepreneurship of rural households are reported in Table 3. For the convenient elucidation of the model, numerical values of all explainable variables are presented via mean marginal effect. Columns (1) and (2) are the estimated random and fixed effects of core-independent variables on entrepreneurship of rural households. Columns (3) and (4) are random and fixed effect models after control variables are added in. By comparison with the previous two columns, influences of land certification on entrepreneurship of rural households are of statistical significance. Moreover, differences of estimation results are very low and are maintained at approximately 13%. According to the above results, land certification perhaps increases the probability of entrepreneurship of rural households. According to model estimation results of Column (3), although statistical significance of the random effect model declines to some extent after control variables are added in, the economic significance still differs

Table 1. Definition of variables and descriptive statistics

Variables	Definitions	Mean	SD
<i>Dependent variables</i>			
Entrepreneurship	Engagement in agricultural entrepreneurship or non-agricultural entrepreneurship. (Yes = 1, No = 0)	0.1706	0.3761
Agricultural entrepreneurship	If the real management area is three times the average of cultivated land area per household in the village or higher, and the household is engaging in agriculture during the survey, the household is defined as agricultural entrepreneurship. (Yes = 1, No = 0)	0.1217	0.3269
Non-agricultural entrepreneurship	Considering whether the household is engaging in industrial business production and management projects, including self-employed entrepreneurs, renting, transportation, online shops, and enterprises? (Yes = 1, No = 0)	0.1083	0.3107
<i>Core independent variables</i>			
Rural land certification	Does your cultivated land have the certificate of land contractual management rights? (Yes = 1, No = 0)	0.4620	0.4986
<i>Individual characteristics</i>			
Gender	Male? (Yes = 1, No = 0)	0.5245	0.4994
Age	Age (years)	42.61	21.37
Square of age	Square of age	2871.87	1798.98
<i>Family characteristics</i>			
Family size	Number of people in a family (person)	4.6101	1.9128
Burden ratio of children	Proportion of children <16 years old in the family	0.1663	0.1722
Burden ratio of the elderly	Proportion of the elderly ≥70 years old in the family	0.0828	0.1917
<i>Human capital</i>			
Educational background	Proportion of people with high school education or higher in the family	0.1487	0.2068
Physical health	Proportion of unhealthy people in the family	0.3581	0.3887
<i>Economic capital</i>			

(Continued)

Table1. (Continued)

Variables	Definitions	Mean	SD
Net household income per capita	Net household income per capita of previous stage (10,000 yuan)	0.7484	11.9759
<i>Social capital</i>			
CPC member	CPC member in the family or not? (Yes = 1, No = 0)	0.1927	0.3944
<i>Village characteristics</i>			
Terrain	Terrain (1 = hills; 2 = mountains; 3 = plateau; 4 = plain)	2.3190	1.3728
Man-land relationship	Average cultivated land area per household in the village (mu)	6.6485	7.9704
Transportation convenience	Distance to county: km	24.9591	20.9872
Location	Eastern China (Yes = 1, No = 0)	0.3790	0.4851
	Central China (Yes = 1, No = 0)	0.3267	0.4690
	Western China (Yes = 1, No = 0)	0.2637	0.4407

Table 2. Statistical description of different variable groups

Variables	Confirmed	Unconfirmed	Difference
Entrepreneurship	0.1755 (0.0029)	0.1636 (0.0026)	0.0119
Agricultural entrepreneurship	0.1286 (0.0034)	0.1122 (0.0030)	0.0164
Non-agricultural entrepreneurship	0.1110 (0.0024)	0.1073 (0.0022)	0.0037
Gender	0.5257 (0.0038)	0.5254 (0.0035)	0.0003
Age	43.7871 (0.1631)	41.1062 (0.1505)	2.6809
Family size	4.5050 (0.0141)	4.6760 (0.0132)	-0.171
Burden ratio of children	0.1648 (0.0013)	0.1751 (0.1112)	-0.0103
Burden ratio of the elderly	0.0936 (0.0016)	0.0716 (0.0012)	0.022
Educational background	0.1558 (0.0016)	0.1478 (0.0015)	0.008
Physical health	0.2273 (0.0022)	0.4405 (0.0030)	-0.2132

Numbers in the brackets are SD.

slightly. In other words, land certification still increases the probability of entrepreneurship by at least 13%. Moreover, estimation results of Columns (3) and (4) also differ slightly. Given the same control variables, the statistical significance of the fixed effect model remains stable, but economic significance increases substantially. The economic significance is around 10% higher compared to estimation results of the fixed effect model without control variables in Column (2), in addition to the random effect model in Columns (1) and (3). Although the academic circle nominates the fixed effect by default in the linear panel model, the random effect might be more beneficial for the non-linear panel model, because controlling a lot of individual dummy variables (fixed effect) may

Table 3. Land certification and entrepreneurship of rural households: basic results

Variables	Entrepreneurship of Rural Households				
	(1)	(2)	(3)	(4)	(5)
Land certification	0.128*** (0.039)	0.133*** (0.043)	0.132** (0.061)	0.246*** (0.082)	0.141*** (0.052)
Gender			−0.019 (0.061)	—	−0.021 (0.054)
Age			0.022*** (0.006)	0.074* (0.042)	0.024*** (0.005)
Square of age			−0.000*** (0.000)	−0.001* (0.000)	−0.000*** (0.000)
Family size			0.148*** (0.018)	0.069** (0.034)	0.131*** (0.015)
Burden ratio of children			−0.079 (0.207)	0.277 (0.368)	−0.182 (0.185)
Burden ratio of the elderly			−0.865*** (0.206)	−0.860** (0.385)	−0.962*** (0.182)
CPC member			0.048 (0.075)	−0.372** (0.172)	0.097 (0.064)
Educational background			1.273*** (0.145)	−0.221 (0.326)	1.169*** (0.128)
Physical health			−1.025*** (0.077)	−0.241** (0.102)	−0.936*** (0.069)
Net household income per capita			0.071*** (0.009)	−0.034*** (0.011)	0.073*** (0.008)
Man-land relationship			−0.082*** (0.004)	−0.176*** (0.010)	−0.097*** (0.004)
Transportation convenience			0.003** (0.002)	—	0.005*** (0.001)
Terrain			Control	—	Control
Regional fixed effect			Control	—	Control
Time fixed effect			Control	Control	Control
Intercept term	−2.725*** (0.046)	—	−3.494*** (0.183)	—	−3.578*** (0.164)
Observations	37,182	9160	27,891	6374	34,411
Wald chi2	10.859	9.410	958.568	827.852	1280.826
Sigma_u	2.172		2.188		2.076
rho	0.589		0.593		0.567

Numbers in the brackets are standard errors. *** refers to a significance level of 1%. ** refers to a significance level of 5%, and * refers to a significance level of 10%.

cause estimation errors of coefficients. Hence, this study primarily randomly selected the effect model in the follow-up regression.

With respect to control variables, influences of age on entrepreneurship of rural households presented an inverted U-shaped pattern. Family size, education background, physical health, and per capita net income can all promote entrepreneurship of rural households. The probability of entrepreneurship of rural households is negatively correlated to the burden ratio of the elderly. The above results agree with existing research results. At the village level, villages with a tense man-land relationship possess a higher probability of entrepreneurship of rural households. Distance to county might be negatively related to entrepreneurship of rural households. Firstly, limited by

household cultivated land resources; rural households must consider increasing incomes through entrepreneurship. Secondly, there are richer cultivated land resources as proximity to the county increases, which is advantageous for agricultural entrepreneurship of rural households.

4.2. Endogenous discussion

Regarding influences of land certification on entrepreneurship of rural households, relevant control variables, such as individual, family, and community characteristics, were added in as much as possible. Furthermore, regional and time fixed effect were included in the regression model to decrease possibility of estimation errors caused by variables missing. Compared to previous studies, this research not only measured land certification via the question of “whether your cultivated land has the certificate of land contractual management rights?”, but also further recognized the new round of land certification since 2013 through the question of “when was the certificate of land contractual management rights issued?” Moreover, household-level land certification might have some endogeneity in grouped descriptive statistics as per Table 2. For this reason, variables related with the new round of land certification were recognized through village-level land certification and time of confirmation, which were used as the proxy variables of household-level land certification. Finally, land certification in China is a protection of property rights under the control of the government to a large extent. Despite some self-informed issues possibly existing (Appendix A5), it demonstrates that there is no reverse causality between entrepreneurship of rural households and land certification.

The estimated random effect when using the village-level land certification as the proxy variable of household-level land certification are shown in Column (5) of Table 3. The estimation results of village-level land certification are consistent with those of the household-level land certification in the first three columns. On the one hand, the probability for village-level land certification to improve entrepreneurship of rural households is approximately 13% considering core-independent variables. On the other hand, the average marginal effect of variables is highly consistent in term of economic and statistical significance from the perspective of control variables. According to the analysis by combining various statistical indexes of the model, the random effect model of village-level land certification (Column (5)) is even superior to that of household-level land certification (Column (3)) to some extent. To eliminate endogeneity of core-independent variables as much as possible, the village-level land certification was used instead of the household-level land certification in the proceeding models unless there is a particular instruction stating otherwise.

5. Heterogeneity analysis of influences of land certification on rural household's entrepreneurship

Existing studies have illustrated that protection of property rights is crucial to economic growth and entrepreneurship plays a very important role in economic growth. Land certification promotes entrepreneurship of rural households significantly. Does this imply that land certification can promote any type of entrepreneurship of rural households? Does it mean that different certification methods have consistent influences on entrepreneurship of rural households? To answer these two questions, heterogeneous influences of land certification on entrepreneurship of rural households from perspectives of dependent and core-independent variables, refined categories of entrepreneurship, and certification methods must be investigated.

5.1. Comparative analysis between agricultural and non-agricultural entrepreneurship

Basic regression results of agricultural and non-agricultural entrepreneurship are shown in Table 4. Columns (1) and (3) are household-level Logit random effect. Columns (2) and (4) are village-level Logit random effect (proxy variable). It was found in the comparison that gender and CPC membership have no influences on entrepreneurship of rural households. On the contrary, both agricultural and non-agricultural entrepreneurship are sensitive to age, square of age, burden ratios of children and the elderly, education background, physical health, man-land relationship, and distance from village to county. It must be noted that the burden ratio of children and

distance from village to county have completely opposite effects on agricultural and non-agricultural entrepreneurship. Land certification only influences agricultural entrepreneurship; whereas net household income per capita and family size only impact non-agricultural entrepreneurship. Specifically, land certification can influence the agricultural entrepreneurship, but it cannot affect the non-agricultural entrepreneurship. This might be explained as follows:

Firstly, land certification is connected to policy regulations of land. To guarantee national food security, the state determined the strictest red line of cultivated land protection. Secondly, it is related to basic characteristics of the non-agricultural sector.

In relation to control variables, (1) Net household income per capita and family size can influence non-agricultural entrepreneurship, but they cannot influence agricultural entrepreneurship. There

Table 4. Agricultural and non-agricultural entrepreneurship: a comparative analysis

Variables	Agricultural Entrepreneurship		Non-agricultural Entrepreneurship	
	(1)	(2)	(3)	(4)
Land certification	0.362*** (0.096)	0.260*** (0.082)	−0.022 (0.081)	0.062 (0.071)
Gender	−0.067 (0.098)	−0.103 (0.085)	−0.009 (0.085)	0.021 (0.076)
Age	0.022** (0.010)	0.027*** (0.009)	0.022*** (0.008)	0.019*** (0.007)
Square of age	−0.000*** (0.000)	−0.000*** (0.000)	−0.000*** (0.000)	−0.000*** (0.000)
Family size	0.036 (0.029)	0.005 (0.025)	0.220*** (0.024)	0.215*** (0.021)
Burden ratio of children	−0.853*** (0.334)	−1.315*** (0.297)	0.840*** (0.281)	1.042*** (0.255)
Burden ratio of the elderly	−0.280 (0.332)	−0.505* (0.289)	−1.077*** (0.311)	−1.151*** (0.280)
CPC member	−0.028 (0.123)	0.148 (0.106)	0.104 (0.098)	0.131 (0.086)
Educational background	0.714*** (0.236)	0.255 (0.204)	1.914*** (0.198)	2.045*** (0.178)
Physical health	−0.655*** (0.123)	−0.658*** (0.108)	−1.384*** (0.107)	−1.292*** (0.097)
Net household income per capita	−0.008 (0.006)	−0.004 (0.005)	0.106*** (0.011)	0.102*** (0.010)
Man-land relationship	−0.178*** (0.010)	−0.196*** (0.009)	−0.038*** (0.005)	−0.038*** (0.005)
Transportation convenience	0.029*** (0.003)	0.029*** (0.003)	−0.012*** (0.002)	−0.010*** (0.002)
Terrain	Control	Control	Control	Control
Regional fixed effect	Control	Control	Control	Control
Time fixed effect	Control	Control	Control	Control
Intercept term	−5.605*** (0.330)	−5.328*** (0.295)	−4.747*** (0.251)	−5.046*** (0.230)
Observations	19,951	25,141	27,996	34,532
Wald chi2	518.962	653.940	580.032	745.300
Sigma_u	2.937	2.911	2.883	2.856
rho	0.724	0.720	0.716	0.713

Numbers in the brackets are standard errors. *** refers to a significance level of 1%. ** refers to a significance level of 5%, and * refers to a significance level of 10%.

are widespread difficulties in supervision of agricultural production. It is also impossible to realize effective supervision of scaled agricultural production completely no matter how many family members there are. However, the non-agricultural sector shows the opposite. The independent procedures and explicit division of labor help family members to provide more effective supervision over the production management. (2) The burden ratio of children counters agricultural entrepreneurship. However, it is favorable for non-agricultural entrepreneurship. (3) Distance to county has completely different influences on agricultural and non-agricultural entrepreneurship. Specifically, distance to county promotes agricultural entrepreneurship, but it hinders non-agricultural entrepreneurship. This can be explained via the following two aspects. There is “high-cost land” surrounding counties for the small land resources and the high rent. They are inapplicable to agriculture, which has relatively low return on investment (ROI). There also exist higher demands for non-agricultural products, and opportunities surrounding counties, which provides accessibility and convenience of product marketing.

5.2. Influences of different certification methods on agricultural entrepreneurship

The new round of land certification mainly adopts four certification methods. They can be divided into land certification with no boundaries (hereinafter referred to as Method 1) and land certification with boundaries (including confirmation of shares and dividends) (hereinafter referred to as Method 2). They also can be divided into household-level land certification (hereinafter referred to as Method 3) and other land certification (including land certification to collectives or individuals) (hereinafter referred to as Method 4). Since land certification has no influences on non-agricultural entrepreneurship, its influences on entrepreneurship are predominately attributed to agricultural entrepreneurship. Therefore, this study focuses on the influences of land certification on agricultural entrepreneurship.

The regression results of agricultural entrepreneurship under the four methods are shown in Table 5. Method 1 renders better effects on agricultural entrepreneurship. A clear definition on property rights is the premise of transaction. Since Method 2 involves ambiguous property rights, the uncertainty of entrepreneurship is increased to some extent. Therefore, Method 1 has more practical significance for a clear definition of property rights. Comparatively, Method 3 possesses better effects on entrepreneurship of rural households than Method 4. This reflects that a household, a decision-making unit, has the lower cost in equity transaction. Consequently,

Table 5. Certification methods and agricultural entrepreneurship: a comparative analysis

Certification Methods	Agricultural Entrepreneurship			
	Land Certification with Boundary	Land Certification without Boundary	Land Certification to Household	Land Certification without to Household
Land certification	0.513*** (0.122)	0.419** (0.188)	0.600*** (0.124)	0.372** (0.153)
Control variable	Control	Control	Control	Control
Intercept term	-5.143*** (0.350)	-5.789*** (0.504)	-4.879*** (0.348)	-5.377*** (0.507)
Observations	16,544	8531	16,033	9046
Wald chi2	374.679	254.264	324.687	219.843
Sigma_u	2.638	3.133	2.591	2.661
rho	0.679	0.749	0.671	0.683

Numbers in the brackets are standard errors. *** refers to a significance level of 1%. ** refers to a significance level of 5%, and * refers to a significance level of 10%. To save space, only regression results of core independent variables are represented.

Table 6. Agricultural entrepreneurship under the standards of average cultivated land area of rural household and per capita net income

Recognition Standards	Agricultural Entrepreneurship			
	Mean of Cultivated Land Area	Median of Cultivated Land Area	Median of Income	Mean of Income
Land certification	0.321*** (0.117)	0.306*** (0.142)	0.124** (0.051)	0.139** (0.055)
Control variable	Control	Control	Control	Control
Intercept term	-6.878*** (0.468)	-7.137*** (0.571)	-0.617*** (0.141)	-0.837*** (0.152)
Observations	19,951	19,951	23,826	23,564
Wald chi2	351.481	299.979	1415.024	1318.413
Sigma_u	3.149	3.005	1.478	1.521
rho	0.751	0.733	0.399	0.413

Numbers in the brackets are standard errors. *** refers to a significance level of 1%. ** refers to a significance level of 5%, and * refers to a significance level of 10%. The mean of practical management area and average cultivated land area of rural household is 3.16 and the median is 1.08. The mean of per capita net income of household is 7,500 yuan and the median is 1,800 yuan. To save space, only regression results of core independent variables are represented.

Method 3 is more likely to increase negotiation cost than Method 4, and thereby inhibits enthusiasm of entrepreneurship.

5.3. Robustness discussion

This study mainly adopted two ways for robustness testing. Firstly, agricultural entrepreneurship was defined as the multiples of mean or median proportion of practical agricultural production and management area per household on average cultivated land area per household. Combined with regression results of agricultural entrepreneurship in Table 4, results in Columns 2 and 3 of Table 6 all show that land certification can promote agricultural entrepreneurship significantly no matter whether multiples of mean or median are applied. Land certification increased probability of agricultural entrepreneurship by around 30% compared to previous estimates. Secondly, agricultural entrepreneurship was defined as the multiples of absolute of mean or median per capita net income from agricultural production and management. According to results in Columns 4 and 5 in Table 6, land certification can promote agricultural entrepreneurship. In summary, regression results in this study are generally reliable.

Figure 4. Influencing mechanism of land certification on agricultural entrepreneurship of rural households.

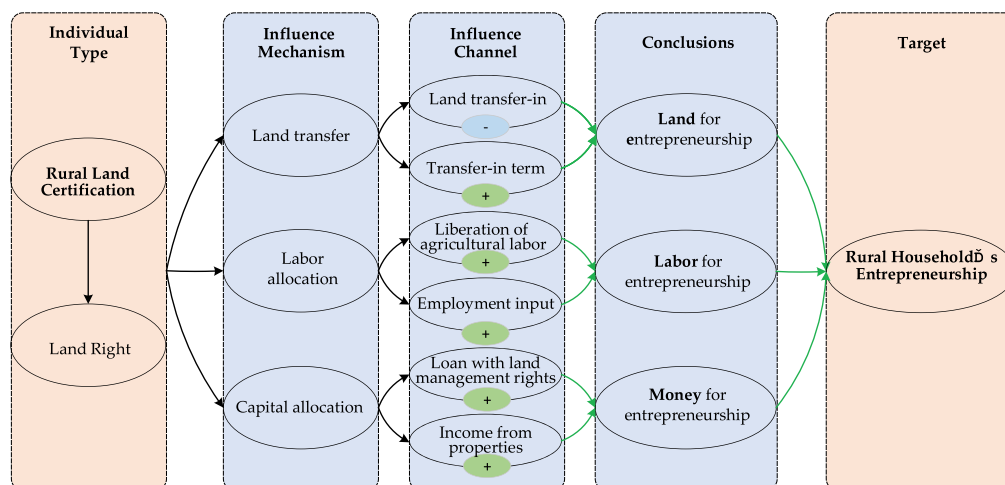


Table 7. Verification results of influence mechanism of land certification on agricultural entrepreneurship of rural households

Influence Mechanism	Influence Channel	Coefficient	Observations	Wald chi2
Land transfer effect	Land Transfer-in	-0.433*** (0.060)	22,824	382.145
	Transfer-in term	6.273*** (0.156)	1989	128.173
Allocation effect of labor force	Liberation of household agricultural labor force	0.584*** (0.075)	19,556	410.146
	Employment input	0.183*** (0.064)	23,532	32.903
Allocation effect of capital	Loan with land management rights	1.714*** (0.188)	23,532	172.427
	Income from properties	0.017*** (0.004)	23,532	98.453

Numbers in the brackets are standard errors. *** refers to a significance level of 1%. ** refers to a significance level of 5%, and * refers to a significance level of 10%. To save space, only regression results of core independent variables are represented.

6. Influencing mechanism of land certification on rural household's entrepreneurship

Based on the above analysis results, land certification can increase the probability of agricultural entrepreneurship significantly. Thus, through which pathways does the new round of land certification promote agricultural entrepreneurship? Combined with the preceding mechanism analysis and with reference to the mechanism testing method of Zhou et al. (G. Zhou et al., 2017), the influencing mechanism was evaluated thoroughly from three perspectives of land transfer effect, labor allocation effect, and capital allocation effect (Appendix A6), which is shown in Figure 4.

6.1. Land transfer effect

GOC is largely focusing on encouraging land transfer and developing appropriate-scaled management, and thereby, promoting optimal configuration of land resources. A high expectation of the new round of land certification was proposed. According to the results in Table 7, land certification cannot promote land transfer-in, but inhibits land transfer-in to some extent, which aligns with the research conclusions of Lin et al. (Lin et al., 2018). But it does not align with the research conclusions of Holden et al. that the incentive effect of property rights may improve the possibility of land transfer (Holden et al., 2009). Judging From the transfer period of the land, land certification strengthens property rights and stabilizes expectations of rural households, the new round of land certification also expands land transfer-in area and extends the land transfer-in term significantly. Thus, increasing probability of agricultural entrepreneurship accordingly.

6.2. Allocation effect of labor force

Entrepreneurship not only implies greater labor demands, it also requires adequate labor supply. Regression results of influences of land certification on allocation of labor force are listed in Table 7. In view of labor supply, land certification increases the land transfer-out ratio significantly. This implies that more rural households withdraw from agriculture and the surplus rural labor forces enter the labor market; hence increasing labor supply gradually. This is consistent with the research conclusion of Bezabih and Holden (Bezabih & Holden, 2014), which verified the non-agricultural employment promotion effect of land certification with Ethiopian data. The implementation of land certification policy promoted the flow of rural labor force from agricultural sector to non-agricultural sector. In view of labor demands, entrepreneurship implies the larger-scaled labor input and land certification increases labor inputs significantly.

6.3. Allocation effect of capital

Capital is an economic support for agricultural entrepreneurship. The new round of land certification requires issuing legal certificate of land property rights comprehensively, trains the exchange market of land property rights vigorously, increases the possibility of land becoming effective collateral for credit institutions and endows land management right with loan financing power. In addition, land certification strengthens the property attribute of agricultural land, and household can increase other potential income via other channels, such as the secondary transaction of property rights. It can be observed from Table 7 that the possibility of loan with land property and income from household properties are indeed increased significantly after land certification. It also increases property income of household.

7. Conclusions and policy enlightenments

It has been widely accepted that property protection can promote economic growth. As the fundamental thrust of economic growth, property rights have more direct influences on entrepreneurship. This study uses unbalanced panel data from CRHPS of Zhejiang University in the last three years to test influences of the new round of land certification on entrepreneurship of rural households, especially on agricultural entrepreneurship. According to the empirical analysis, land certification increases the probability of agricultural entrepreneurship by at least 25% compared with previous forecasts. After the use of the proxy variable method and series robustness tests, the conclusions are still vigorous. According to further mechanism analysis, although the new round of land certification inhibits land transfer-in to some extent, it generally increases the probability of agricultural entrepreneurship through various means, such as expanding land transfer-in area, extending land transfer-in term (land transfer effect), increasing labor supply and input (allocation effect of labor force), increasing probability of loans with land management right, household income from properties, and per capita net household income (allocation effect of capital).

Additionally, the promotion effect of land certification on entrepreneurship of rural households is mainly attributed to agricultural entrepreneurship. It has no substantial influences on non-agricultural entrepreneurship. Age, burden ratio of the elderly, education background, and physical health can promote both agricultural and non-agricultural entrepreneurship. However, other control variables influence agricultural and non-agricultural entrepreneurship differently. Family size has positive influences on non-agricultural entrepreneurship, but it has no influences on agricultural entrepreneurship. The burden ratio of children will lower the probability of agricultural entrepreneurship, but increases the probability of non-agricultural entrepreneurship. The longer distance to county is more beneficial for agricultural entrepreneurship while the shorter distance is more conducive to non-agricultural entrepreneurship. It is to be noted that influences of certification methods on agricultural entrepreneurship are also heterogeneous. Land certification with no boundaries can influence agricultural entrepreneurship more significantly than land certification with boundaries. Compared to other methods of land certification (including land certification to collectives or individuals), household-level land certification can lower the internal negotiation cost of rural households; thus, increasing probability of agricultural entrepreneurship accordingly. This demonstrates that a household is always a relatively reasonable decision-making unit in economic life.

7.1. Enlightenments

Reform of the rural land system has achieved positive effects over a short period in China. Furthermore, the new round of land certification can promote agricultural entrepreneurship significantly. Currently, GOC should fully utilize the advantages of land certification to perfect the exchange market of rural land property rights, and thereby develop various forms of moderate scale management, train new agricultural management entities, and promote agricultural and rural economic developments. In the background of rural revitalization, GOC should encourage rural land transfer, standardize rural labor market, accelerate reform financialization of rural land, and configure conditions for element improvement for agricultural entrepreneurship. It should also conduct the third round of extension pilots after the second round of contract period, aiming to form duplicable and promotable reform experiences. Furthermore, considerations should be given

to rights and interests of agricultural entrepreneurs and contracted rural households. Expectation for agricultural production and management should be stabilized. Concurrently, essential legal guarantee should be given to agricultural entrepreneurship.

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Appendix A

A1 “mu” is a Chinese unit of area, which equals to 1/15 of a hectare or 1/6 an acre.

A2 Xinhua News, Ministry of Agriculture and Rural Affairs: The certification rate for land certification reached 96%.

A3 The shortages of recognizing entrepreneurship through income level are introduced as follows: Firstly, it ignores the situation that some entrepreneurs have zero or negative income before entrepreneurship. Secondly, the group who have relatively high-income levels, such as village cadres, are included in entrepreneurs. The shortages of recognizing entrepreneurship through employment relationship are that in busy farming season, non-entrepreneurs might hire others in agricultural production and management affairs irregularly. However, CRHPS data in 2013 and 2015, respectively, are difficult to recognize whether there is long-term employment relations.

A4 Average cultivated land area per household in a village rather than the household cultivated area was used to define agricultural entrepreneurship for following reasons: 1) It is common to see land adjustment in some rural areas in China. Some household cultivated land area changes greatly, while average cultivated land area per household is generally stable. 2) Multiples of average cultivated land area per household can eliminate situations that some villages originally possess rich or rare land resources, while multiples of household cultivated land might witness situations that some households have very small or large cultivated land area, which might induce great errors. Of course, this problem might exist if recognizing entrepreneurship of rural household by transfer-in area alone.

A5 Since Document No. 1 in 2013 emphasized comprehensive land certification in 5 years. This implies that land certification is necessary no matter what the conditions of communities are. Therefore, it is easy to determine that different from previous reform pilots on land certification, it must be selected in advance. The self-informed issues can basically be ignored in this comprehensive land certification.

A6 To guarantee reliability of estimation results, control variables of mechanism testing shall remain consistent, which are gender, age, square of age, family size, burden ratios of children and the elderly, average cultivated area of rural households, distance from village to county, terrain, regional dummy variable, etc.



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