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# Does Land Certification Stimulate Farmers' Entrepreneurial Enthusiasm? Evidence from Rural China

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**Abstract:** Deepening the reform of rural land property rights and fully releasing the dividends of land policies to stimulate the vitality of rural development are important foundations for China's Poverty Alleviation and Rural Revitalization strategies. Based on the data of the China Household Finance Surveys in 2013 and 2019, this study takes the new round of land certification launched in 2013 as the starting point for exploring the impact of rural land property rights reform on farmers' entrepreneurship, using the difference-in-differences model. The results show that the implementation of the new round of land certification has significantly improved the development of agricultural entrepreneurship among farmers with certificates but has had no impact on non-agricultural entrepreneurship. The estimated results from the replacement explained variables, PSM-DID method, and placebo test verifies the robustness of the baseline results. Furthermore, it is shown that the improvement of labor allocation, land transfer, and financing and loan constraints are the main channels through which land certification affects farmers' entrepreneurship; the impact is heterogeneous at province, community, and household levels. This study not only provides new evidence for using rural land property rights reform to spearhead poverty alleviation and rural revitalization strategies but also provides beneficial reference material for the continuous optimization of land property rights certificates to boost farmers' entrepreneurship.

**Keywords:** rural land property rights reform; land certification; farmer's entrepreneurship; difference-in-differences model

## 1. Introduction

Poverty is a prominent problem that threatens the sustainable development of the worldwide economy and society. At present, there are nearly 800 million people living in extreme poverty (using a general indicator of personal income of less than USD 1.90 per day). As a solution to extreme poverty, entrepreneurship is a broad concept that is used in a number of ways by scholars [1–4]. In particular, the published research focuses on the poverty of people living at a subsistence level in developing countries and emerging economies, because poverty in developed regions is usually not so life-threatening. China's poverty alleviation strategy targets farmers engaged in agricultural production in rural areas. Farmers' behaviors in expanding the scale of agricultural production and operation, engaging in non-agricultural operations, and upgrading production methods can be regarded as entrepreneurship [5,6].

The land is the most basic means of production and the most reliable source of entrepreneurial capital for farmers. The land property rights system is the basic economic system for the operation of the Chinese rural economy. The constraints contained in it will not only affect the allocation of land resources by rural households but also affect the allocation of relevant factors due to externalities, and subsequently affect their entrepreneurial behavior. The protection of land property rights has a very important influence on the economic growth and entrepreneurial decision-making of rural households [7–13]. Different

from many countries, under the Household Contract Responsibility System (HCRS), Chinese village collectives own the land, and farmers contract farmland from these collectives to obtain land contract management rights [14]. Since the implementation of HCRS, the degree of legal protection for Chinese farmers' land property rights has been continuously strengthened. From the first round of land contracts to the second round of land contracts, the minimum period of land contracts available was fixed at 15 years to 30 years. Then, in 2009, the land registration and certification rules were gradually implemented to emphasize the long-term maintenance of land property rights, and the definition of these rights became clearer, more standardized, and more institutionalized. However, in the long term, the wide variety of reforms have not completely solved the problems of unclear, unstable rules and the lack of protection of land property rights across the country, which has become an obstacle to the development of the agricultural and rural economy in China [15–17]. Against this background, the Chinese government nationwide started a new round of land certification policies in early 2013, in order to properly address the problems of inaccurate and unclear contracted land area for rural households [18]. This policy cycle lasted for five years (i.e., until 2017) [18].

As the core measure of rural households' property rights protection, land certification has always been the focus for scholars at home and abroad. As early as 1995, some scholars established the earliest theoretical model of the impact of stability of land property rights on investment, transfer, and credit [19]. Three years later, in 1998, other scholars extended the above theoretical model by replacing the stability of land property rights with land registration and titling [20]. In recent years, with the implementation and comprehensive promotion of the pilot project affirming land certification [18], the model once again entered the academic field and attracted wide attention. Chinese scholars also provided a great deal of practical evidence in this regard. Some used the national panel tracking data in 2000 and 2008 to identify that the verification of the right to use farmland promoted rural households' long-term investment in farmland [21]; some used the data of the China Health and Retirement Longitudinal Study in 2010 and 2012 to report that land certification promoted farmland transfer and expanded the farmland transfer area [22]; others pointed out that there was a significant "de Soto effect" in the confirmation of rural land contract management rights, using 2704 pieces of survey data from nine provinces in China, which could alleviate the credit constraints of rural households [23]. Furthermore, numerous scholars have begun to explore the influence of land certification on labor mobility, rural households' income, and agricultural production [24–26]. Gladly, the related research results of rural land property rights reform have been increasingly abundant.

However, at present, few scholars pay attention to the influence of land certification on farmers' entrepreneurship. Entrepreneurship is the fundamental driving force of economic development and plays a vital role in the economic growth of a country or region [27,28]. A large quantity of empirical evidence from developed countries shows that there is a significant positive correlation between entrepreneurship and income [29–35]. On the one hand, individuals who are not in formal employment in the form of self-employed entrepreneurship can not only solve their own employment problems but also improve their income level. On the other hand, the operation of large-scale entrepreneurial projects is often accompanied by the emergence of many new jobs, which makes it possible to promote local unemployed residents' employment status and improve their income level as well [36]. Moreover, the "economic miracle" since China's reform and opening up has also shown that rural households are an important economic unit; they not only have rich entrepreneurial experience but also contain huge entrepreneurial potential. Especially driven by land reform, rural households' entrepreneurial enthusiasm can now be fully released [37].

In the context of the new round of land certification, can this reform promote farmers' entrepreneurship? What is the mechanism by which land certification affects rural households' entrepreneurship? Is there any heterogeneity in the impact on farmers' entrepreneurship? These will be the questions that this study aims to answer. In view of

this, the marginal contributions of our paper lie in the following aspects: First, since the reform and opening up of the country in 1978, China has carried out several rounds of land certification, but the existing research does not distinguish the specific time period of the new round of land certification, resulting in an estimation bias. This paper can scientifically identify the certification timing (i.e., 2013 and beyond) by using the samples that have only been processed in the new round of land certification. Second, the existing research focuses on whether farmers have entrepreneurial behavior but pay little attention to entrepreneurial scale and motivation. In order to deepen the relevant research, our research focuses on the impact of land certification on farmer's entrepreneurship by treating the entrepreneurial scale of farmers and entrepreneurship with two types of motivations as a robustness test, to try to improve the theoretical system of the existing research. Third, existing studies mainly investigate the impact of land certification on farmers' entrepreneurship on the whole, and the lack of heterogeneity analysis on the effect of land certification in different situations. In comparison, this paper further examines the heterogeneity of land certification from the three dimensions of province, community, and household.

On the one hand, our study provides Chinese evidence for testing the relationship between property rights and economic development. On the other hand, it provides a reference basis for how to promote farmers' entrepreneurship and ultimately realize rural sustainable development through land property rights reform in the context of the country's rural revitalization strategy. The rest of this research is structured as follows. Section 2 expounds upon the literature review and theoretical analysis of the related research. Section 3 introduces the data sources, variable definitions, variable descriptive analysis, and empirical strategies. The empirical results of the model are shown in Section 4, and Section 5 presents a discussion of the results. Section 6 concludes with our main findings and discusses the policy implications.

## 2. Literature Review and Theoretical Analysis

As early as the end of the last century, Besley and Ghatak pointed out that having clear rights and responsibilities and the strict protection of land property rights can affect farmers' behavior in terms of the following four aspects [19,38]:

1. Reduce the labor input for protecting land property rights and then allocate labor to achieve more efficient production departments.
2. Promote agricultural investment and then increase agricultural output.
3. Reduce the cost in the process of land transaction and then promote land transfer or transaction.
4. Make the land easy to mortgage, and then help rural households to obtain bank credit.

Among many farmers' behaviors, entrepreneurship is the core method for farmers to escape poverty and achieve prosperity. Against the background of large-scale rural labor migration to cities, labor allocation, land transfer, and financing loans have become the three main factors that affect farmers' entrepreneurial decisions [39]. In the absence of property rights protection, it is difficult for farmers to achieve entrepreneurship through the three channels of "people, land, and money". Therefore, strengthening the protection of land property rights through land certification can improve the entrepreneurial environment of farmers to a certain extent.

### 2.1. Land Certification, Labor Allocation, and Farmers' Entrepreneurship

The labor force released by land right confirmation is the direct factor by which to stimulate farmers' entrepreneurial enthusiasm [40]. Due to the lack of legal protection for farmers' land property rights, local government officials, regardless of farmers' interests, vigorously promote land adjustment projects in order to seek the rapid expansion of the regional economy for their own political ends, while village-level officials will also seek private interests to implement unreasonable land adjustment, resulting in local land fragmentation, insufficient land investment, soil fertility decline, and many other problems [41]. Usually, in order to protect their land property rights, farmers need to expend some labor

to alleviate these problems, and to identify which resources could have been invested in its more efficient aspects, such as entrepreneurship [42]. By clearly defining land property rights and issuing legally effective property rights certificates, land certification guarantees farmers' legitimate land rights and interests and liberates a large number of rural laborers who are subject to the protection of land property rights [43]. On the other hand, formal land certificates significantly enhance farmers' confidence in the protection of farmland rights. Compared with farmers without certificates, farmers with formal certificates have significantly higher investments in land [44,45]. In this case, those farmers with advantages in agricultural production absorb laborers released by the policy, increase the investment in agricultural machinery, expand the scale of agricultural production and operation, and are busy with agricultural entrepreneurship. The remaining unabsorbed laborers are occupied in self-employed non-agricultural entrepreneurship or migrant work for a living.

### 2.2. Land Certification, Land Transfer, and Farmers' Entrepreneurship

Land certification drives the development of the land transfer market and indirectly promotes farmers' entrepreneurship [46]. Theoretically, farmers with high agricultural production capacity rent the land, expand the production area, and go in for agricultural entrepreneurship, while farmers with strong non-agricultural management ability rent out the land, get rental income, and invest in non-agricultural entrepreneurship [47]. The land transfer market is an important channel by which to optimize the allocation of rural production factors and provide guarantees for farmers' entrepreneurship. Before land certification, there are three problems in the land transfer market. First of all, the land transfer market is imperfect. Secondly, the high transaction cost of land transfer may exceed the land rental income [48]. Finally, farmers fear losing their land because of contract safety and default risk [49]. The above three points lead to the unavailability of land transfer and the loss of the most important guarantee of entrepreneurship. Land property rights are the legal basis of land transfer. Land certification provides farmers with property rights certificates that can be used for land transfer and that clearly define the physical boundary of the land, which helps to reduce transaction costs, information asymmetry, and default risk, thus promoting the development of the land transfer market [50]. Therefore, land certification can solve the problem of the land transfer market, thereby stimulating farmers' entrepreneurial enthusiasm and finally enhancing rural sustainable development.

### 2.3. Land Certification, Financing Loans, and Farmers' Entrepreneurship

Expanding the financing and loaning channels via land certification is the intrinsic motivation of farmers' entrepreneurship [1]. Usually, no matter what kind of entrepreneurship farmers are undertaking, they need to be provided with the necessary financial support for expanding the scale of agricultural production and operation, engaging in non-agricultural operations, and upgrading production methods through loans [51]. Before land certification, financial institutions, for the sake of profitability and security, frequently rejected small-scale agricultural loans with high systemic risks such as unclear land property rights, and farmers could not get sufficient funding for entrepreneurship [52]. Land is naturally effective collateral for formal credit institutions because of its immobility in geographical space, rising rent expectations, and vulnerability [20]. Land certification provides farmers with land certificates that can be used for mortgages and, to a certain extent, it increases financing and loaning channels to relieve the pressure on farmers' capital, thus increasing the possibility of farmers' entrepreneurial investment [23,53].

In short, land certification improves the security and stability of land property rights, the exclusivity of usufruct, and the liberalization of transactions. Once farmland is certified, farmers will be able to draw upon sufficient labor, lease their land, and have more financing loans, thereby incentivizing rural households to devote themselves to entrepreneurship.

## 3. Materials and Methods

### *3.1. Data Sources*

The data used in this study were from the China Household Finance Survey (CHFS), carried out nationwide from 2011 to 2019 [54]. The CHFS data was sourced using the sampling method, combining stratified sampling, three-stage sampling, and probability proportional scale sampling, and follow-up visits were conducted to the sampled households every two years. Therefore, CHFS data are representative and are consistent with the data from the National Bureau of Statistics in many aspects, such as sample population age, urban and rural population structure, and gender structure [55].

Because the research purpose of our research is to investigate the impact of the new round of land certification on rural households' entrepreneurship, the paper has excluded the samples of rural households who obtained the certificate in 2013 and before, thus avoiding confusing the new round of land certification with the old one. After the above processing, this paper processed the 2013 and 2019 CHFS data into panel data, which covers 5832 valid household samples and 21,176 household members in 27 provinces, in 385 counties of China. In addition, the data in 2013 actually records the information in 2012, representing samples before the implementation of the policy, while the data in 2019 represents the samples after the completion of the policy. Due to the missing values of some variables, the actual reported effective sample size will be different in the regression analysis.

### *3.2. Variable Definitions*

Based on the results from existing studies and the objectives of our research, the following variables are propounded.

### 3.2.1. Dependent Variables

The existing mainstream literature defines agricultural entrepreneurship from two aspects: the transfer-in area in cultivated farmland and the total cost of agricultural production and operation, which means that the transfer-in area in cultivated farmland is more than 10 mu or the total cost of agricultural operation is greater than or equal to CNY 30,000 [52]. Transfer-in areas refer to those areas of land that farmers purchase in the form of trading land management rights from others, through the land transfer market. However, the sample data used in these documents have certain geographical limitations, while the sample data in the research are from all over the country. If the existing literature definition is followed, the differences between human and land resources endowments in different provinces may be ignored. Therefore, the paper distinguishes agricultural entrepreneurial households from ordinary households using the ratio of the actual cultivating farmland area to the contracted farmland area and the weighted value of the total cost of agricultural production and operation and uses the relative quantity instead of the absolute quantity to eliminate the measurement errors that may be caused by the difference in human-land resource endowments. Specifically, rural households that meet any of the following equations are regarded as agricultural entrepreneurial households:

$$\frac{area_{ij} + inarea_{ij} - outarea_{ij}}{\overline{area}} \geq \frac{\overline{area}_i + \frac{\overline{inarea}_i}{\overline{inarea}} \times 10 - \overline{outarea}_i}{\overline{area}_i} \tag{1}$$

$$acost_{ij} \geq \frac{\overline{acost}_i}{\overline{acost}} \times 30,000. \tag{2}$$

The subscript *i* above is on behalf of the province where the rural household *j* is located; *area* represents the area of contract farmland; $\overline{area}$ is the mean value of *area* across the whole sample; $\overline{area}_i$ is the mean value of *area* within the province *i*; *inarea* refers to the area of transfer-in farmland; $\overline{inarea}$ is the mean value of *inarea* across the whole sample; $\overline{inarea}_i$ is the mean value of *inarea* within the province *i*; *outarea* stands for the area of transfer-out

farmland, which means the area of the land that farmers sell in the form of trading land management rights to others through the land transfer market; $\overline{outarea}_i$ is the mean value of *outarea* within the province *i*; and *acost* is the total cost of agricultural production and operation; $\overline{acost}$ is the mean value of *acost* across the whole sample; $\overline{acost}_i$ is the mean value of *acost* within province *i*.

In this study, non-agricultural entrepreneurial households mainly refer to rural households that are occupied in industrial and commercial production and management projects. Based on the practice in the existing literature [52,56], the question in the CHFS questionnaire, "Was your family engaged in industrial and commercial projects last year?", is employed as a judge. If a respondent answers "yes", his/her household is considered to have been engaged in non-agricultural entrepreneurship, and if the answer is "no", his/her household is considered not to have done so.

### 3.2.2. Independent Variables

The core independent variables of this study are identified by two questions: "Has your family obtained the certificate of land management rights?" and "Which year was the certificate issued?" in the CHFS questionnaire and mainly investigates whether farmers have obtained the land certificate since 2013. The reason for doing so is that our study mainly examines the impact of the new round of land certification promoted by the government in 2013 on farmers' entrepreneurship. More importantly, this state-led reform, in terms of the panel data in rural areas, not only effectively avoids the reverse causality problem in econometric model inference but also reduces the endogenous problems caused by selection bias.

### 3.2.3. Control Variables

According to the relevant literature, our research mainly controls the characteristic variables of individual, household, and community, which are considered the influencing factors of land certification and farmers' entrepreneurship. Specifically, individual characteristic variables are the gender, age, square of age, education, and political status of the householder [51,57–60]. In addition, household characteristic variables mainly include the dependency ratio, household health rate, and per capita total household assets [41,42,61]. To eliminate the influence of time-varying factors at the community level, this study also controls the economic status, the number of total households, and the tenure of the current governor, which reflects the development of the economy, agriculture, and the governance of the community, respectively. The definitions and descriptions of major variables are exhibited in Table 1.

**Table 1.** Specific definitions and summary statistics of variables.

| Variables | | Definitions | Mean | SD | Min | Max |
|---|---|---|---|---|---|---|
| Dependent Variables | Agricultural Entrepreneurship | Whether engaged in agricultural entrepreneurship (0 = No, 1 = Yes) | 0.19 | 0.39 | 0 | 1 |
| | Non-Agricultural Entrepreneurship | Whether engaged in non-agricultural entrepreneurship (0 = No, 1 = Yes) | 0.15 | 0.36 | 0 | 1 |
| Independent Variables | Land Certification | Since 2013, whether the household has obtained the new round of land certificate (0 = No, 1 = Yes) | 0.28 | 0.45 | 0 | 1 |

**Table 1.** *Cont.*

| Variables | | Definitions | Mean | SD | Min | Max |
|---|---|---|---|---|---|---|
| Individual Control Variables | Gender | Gender of the householder (0 = Female, 1 = Male) | 0.87 | 0.34 | 0 | 1 |
| | Age | Age of the householder | 51.40 | 12.02 | 17 | 113 |
| | Age2 | Square of age of the householder | 2786.44 | 1256.32 | 289 | 12,769 |
| | Education | Years of education of the householder | 8.01 | 3.57 | 0 | 19 |
| | Political Status | Whether the householder is a member of the Communist Party of China or a community governor (0 = No, 1 = Yes) | 0.15 | 0.35 | 0 | 1 |
| Household Control Variables | Dependency Ratio | The dependency ratio of the elderly and children | 0.13 | 0.29 | 0 | 4 |
| | Household Health | The rate of healthy members in the household | 0.60 | 0.33 | 0 | 1 |
| | Household Asset | The logarithm of per capita total household assets | 10.91 | 1.38 | 0 | 16.12 |
| Community Control Variables | Community Economy | The range of economic development status (from low to high) | 3.26 | 1.32 | 1 | 7 |
| | Community Agriculture | The total number of households in the community | 1394.11 | 2250.42 | 7 | 41,150 |
| | Community Governance | The tenure of the current governor | 6.77 | 5.66 | 0 | 45 |

Note: Community governors refer to the staff members who are elected by all community members, hold certain positions in the Communist Party organizations and members' committees, exercise public power, manage public affairs, and enjoy certain special political and economic treatment.

*3.3. Identification Strategy*

In order to identify the impact of the new round of land certification on entrepreneurial behavior in rural households, the most direct method is to compare the differences in entrepreneurial decision-making and the scale of them before and after the promulgation of the policy. However, this difference may be affected not only by the policy but also by some general factors that change over time. The difference in differences (DID) model is used to alleviate the interference of random errors. Based on the Rubin causal model (RCM) [62,63], DID uses the control group meeting the common trend to clone the changes of the treatment group if they were not treated. More accurately, the difference in the effect between the treatment group and the control group before treatment is used to identify the sample selection bias, and, therefore, the true treatment effect of the policy is the difference between the sample selection bias and the difference of the effect between the treatment group and the control group after treatment [64,65]. As panel data is used in this study, referring to the research achievements of Nunn and Qian [66], the DID model of this research is set as follows:

$$y_{it} = \alpha + \beta \, Land\_Certification_{it} + \gamma \, X_{it} + u_i + v_t + \varepsilon_{it}. \tag{3}$$

In Equation (3), $y_{it}$ represents the dependent variables of household $i$ in year $t$, including the agricultural and non-agricultural entrepreneurial behavior, $\alpha$ is a constant term, $Land\_Certification_{it}$ is a dummy indicating whether the household $i$ has the new round of land certificate in year $t$, $X_{it}$ represents the control variables, $\gamma$ is a series of coefficients of control variables, $u_i$ is the household fixed effect, $v_t$ is the year fixed effect, $\varepsilon_{it}$ is the random disturbance term, and $\beta$ is the coefficient of interest in this study. Considering the dependent variables, including household entrepreneurial behavior, which is a binary variable, the linear probability model is used to estimate the impact of independent variables on dependent variables in the regression of Equation (3).

However, there is a probable correlation between agricultural and non-agricultural entrepreneurship for two reasons. On the one hand, farmers' capital holdings are relatively

low, and most of their personal endowments and production technologies are related to agriculture. Thus, in the initial stage of entrepreneurship, most farmers choose an agricultural context with which they are relatively familiar for entrepreneurship. When their resources have accumulated to a certain extent, non-agricultural entrepreneurship with a higher added value of products will become an option [67]. As a result, in China's rural regions, agricultural entrepreneurship is the foundation of non-agricultural entrepreneurship. On the other hand, non-agricultural entrepreneurship has a stronger wealth effect on farmers than agricultural entrepreneurship. Since Chinese farmers have a deep emotional bond with the land that nurtured them [68], non-agricultural entrepreneurs born in rural households are willing to give material assistance to unemployed members and the agricultural production of their own households, which may promote the development of agricultural entrepreneurship to a certain extent. Therefore, Chinese farmers' non-agricultural entrepreneurship is able to feed back into their own agricultural entrepreneurship. Technically, the bivariate probit model can deal with the endogeneity issue, due to the presence of a correlation between agricultural and non-agricultural entrepreneurship. According to the research model by Mohieldin and Gao [69,70], this research estimates the joint impact of the new round of land certification on agricultural and non-agricultural entrepreneurship, using the bivariate probit model, which is set as follows:

$$\begin{cases} \Pr(y_{Ait}=1)= \alpha_A + \beta_{A1}\ treated_i \times post_t + \beta_{A2}\ treated_i + \beta_{A3}\ post_t + \gamma_A\ X_{it} + \varepsilon_{Ait} \\ \Pr(y_{Nit}=1)= \alpha_N + \beta_{N1}\ treated_i \times post_t + \beta_{N2}\ treated_i + \beta_{N3}\ post_t + \gamma_N\ X_{it} + \varepsilon_{Nit} \end{cases}. \quad (4)$$

In Equation (4), $y_{Ait}$ or $y_{Nit}$ separately represent whether household $i$ is occupied in agricultural or non-agricultural entrepreneurship in year $t$, while $treated_i$ is the dummy variable of the treatment group, $treated_i = 1$ is the variable when household $i$ is the pilot household of the policy and $treated_i = 0$; otherwise, $post_t$ is the dummy variable of the experimental period, $post_t = 1$ is the variable when year $t$ follows the completion of the policy, and $post_t = 0$ represents when year $t$ is before the implementation of the policy. Because of the possible correlation above, it is assumed that the disturbances termed $\varepsilon_{Ait}$ and $\varepsilon_{Nit}$ follow the joint normal distribution, which is denoted as $\varepsilon_{Ait}$, $\varepsilon_{Nit} \sim BVN(0,\ 0,\ 1,\ 1,\ \rho)$.

## 4. Results

### 4.1. Baseline Regression

Table 2 reports the regression results of Equation (3). Columns 1–4 and 5–8 represent the comparative analyses, respectively, with the gradual addition of individual, household, and community control variables, based on the original regression of Equation (3) without any control variables. In Table 2, coefficient $\beta$ is represented by the coefficient of land certification, and coefficient $\gamma$ is reflected by the coefficients of gender to community governance. The coefficients of land certification show that land certification has a promoting effect on agricultural entrepreneurship, which is statistically significant at the 1% level and has no significant impact on non-agricultural entrepreneurship. Farmers' access to land certificates increased their ratio of engaging in agricultural entrepreneurship by about 3.6%, and furthermore, the results in columns (1)–(4) indicate that the estimates remain robust whether or not the control variables are included. These results suggest that rural land ownership can stimulate enthusiasm for agricultural entrepreneurship in rural China, but the overall change in non-agricultural entrepreneurship before and after the policy is not noteworthy. One possible reason is the existence of policy lag [71]. Another possible reason is that although the rural households' entrepreneurial enthusiasm is stimulated by policies, due to the influence of objective factors, such as the land endowment effect, information availability, credit constraints, and social trust [52], they are more willing to start businesses in the relatively familiar agricultural field.

**Table 2.** Land certification and farmers' entrepreneurship: basic results.

| Variables | Agricultural Entrepreneurship | | | | Non-Agricultural Entrepreneurship | | | |
|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| Mean of $y$ | 0.185 | 0.185 | 0.185 | 0.185 | 0.150 | 0.150 | 0.150 | 0.150 |
| Land Certification | 0.037 *** | 0.036 ** | 0.036 *** | 0.035 ** | 0.011 | 0.010 | 0.010 | 0.010 |
| | (0.014) | (0.014) | (0.014) | (0.014) | (0.010) | (0.010) | (0.009) | (0.009) |
| Gender | | 0.094 ** | 0.084 * | 0.082 * | | 0.044 | 0.030 | 0.031 |
| | | (0.045) | (0.045) | (0.045) | | (0.036) | (0.036) | (0.036) |
| Age | | 0.004 | 0.004 | 0.005 | | 0.002 | 0.001 | 0.001 |
| | | (0.006) | (0.006) | (0.006) | | (0.005) | (0.004) | (0.004) |
| Age2 | | −0.005 | −0.006 | −0.006 | | −0.004 | −0.003 | −0.003 |
| | | (0.006) | (0.005) | (0.005) | | (0.004) | (0.004) | (0.004) |
| Education | | 0.001 | 0.000 | 0.000 | | −0.000 | −0.001 | −0.001 |
| | | (0.007) | (0.007) | (0.007) | | (0.004) | (0.004) | (0.004) |
| Political Status | | 0.061 ** | 0.056 ** | 0.058 ** | | 0.028 * | 0.024 | 0.024 |
| | | (0.024) | (0.024) | (0.024) | | (0.017) | (0.017) | (0.017) |
| Dependency Ratio | | | 0.080 *** | 0.081 *** | | | 0.006 | 0.006 |
| | | | (0.028) | (0.028) | | | (0.015) | (0.015) |
| Household Health | | | 0.023 | 0.021 | | | 0.025 ** | 0.025 ** |
| | | | (0.017) | (0.017) | | | (0.011) | (0.011) |
| Household Asset | | | 0.038 *** | 0.038 *** | | | 0.032 *** | 0.032 *** |
| | | | (0.005) | (0.005) | | | (0.003) | (0.003) |
| Community Economy | | | | 0.017 | | | | −0.008 |
| | | | | (0.016) | | | | (0.012) |
| Community Agriculture | | | | 0.000 *** | | | | −0.000 |
| | | | | (0.000) | | | | (0.000) |
| Community Governance | | | | 0.001 | | | | −0.001 |
| | | | | (0.004) | | | | (0.004) |
| Year Fixed Effect | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Household Fixed Effect | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Observations | 11,664 | 11,664 | 11,664 | 11,664 | 11,664 | 11,664 | 11,664 | 11,664 |
| Adj. R-Squared | 0.329 | 0.330 | 0.339 | 0.341 | 0.553 | 0.553 | 0.560 | 0.560 |

Note: *, **, and *** represent statistical significance at the 10%, 5%, and 1% levels, respectively. Robust standard errors clustered at the household level are proposed in parentheses.

Specifically, the results in column (1) show that obtaining the new round of land certificates is associated with a higher likelihood, by 3.7 percentage points (20%), of farmers engaging in agricultural entrepreneurship, which is statistically significant at the 1% level. The regression coefficient is slightly smaller in the specification involving other control variables. As shown in column (2), the gender and political status of the householder are associated with participation in agricultural entrepreneurship. A male Communist Party member who has served as the governor is more open to the development of agricultural entrepreneurship. This result is consistent with the research of Zheng, Linyi et al. [72]. In addition, the results in column (3) show that the dependency ratio and the per capita total household assets may have a positive impact on agricultural entrepreneurship. These findings agree with the previous research results [56,73]. Besides, the results in column (4) show that the more farmers there are in the community, the greater the possibility of agricultural entrepreneurship. One possible explanation is that when there are more farmers in a community, land becomes relatively scarce, so it is more likely to be utilized for agricultural entrepreneurship.

Table 3 shows the regression results of Equation (4). The results show that $\rho$ is significant at the 1% statistical level. Therefore, there is a correlation between the disturbance terms $\varepsilon_{Ait}$ and $\varepsilon_{Nit}$, and it is necessary to use the bivariate probit model for estimation. Columns 1 and 2 report the overall impact of the policy, and columns 3 and 4 present the regression results after adding the control variables. Similarly, these results suggest that the promotion effect of the policy on agricultural entrepreneurship is more obvious and the impact on farmers' non-agricultural entrepreneurial behavior is not statistically

significant. Generally, the policy has a more significant role in promoting farmers' agricultural entrepreneurship, while its effect on non-agricultural entrepreneurship needs further observation.

**Table 3.** Land certification and farmers' entrepreneurship: bivariate probit model results.

| Variables | Farmers' Entrepreneurship | | | |
| --- | --- | --- | --- | --- |
| | Agricultural | Non-Agricultural | Agricultural | Non-Agricultural |
| | (1) | (2) | (3) | (4) |
| Land Certification | 0.182 ** | 0.055 | 0.183 ** | 0.049 |
| | (0.089) | (0.045) | (0.089) | (0.053) |
| Treated | 0.023 | −0.109 ** | 0.030 | −0.086 * |
| | (0.075) | (0.052) | (0.074) | (0.051) |
| Post | −0.522 *** | 0.061 ** | −0.503 *** | 0.034 |
| | (0.051) | (0.025) | (0.061) | (0.035) |
| Constant | −0.694 *** | −1.046 *** | −2.223 *** | −5.980 *** |
| | (0.071) | (0.035) | (0.376) | (0.396) |
| Control Variables | No | No | Yes | Yes |
| County Fixed Effect | Yes | Yes | Yes | Yes |
| Observations | 11,664 | 11,664 | 11,664 | 11,664 |
| $\rho$ | | −0.119 *** | | −0.155 *** |
| | | (0.030) | | (0.030) |
| Chi-Square | | 173.4 | | 902.3 |

Note: *, **, and *** represent statistical significance at the 10%, 5%, and 1% levels, respectively. Robust standard errors clustered at the county level are proposed in parentheses.

## 4.2. Robustness Tests

In order to further verify the positive effect of land certification on farmers' entrepreneurship, robustness tests were conducted.

### 4.2.1. Substitution of the Dependent Variables

On the one hand, this study tries to change the research approach from qualitative to quantitative and replaces entrepreneurial behavior with an entrepreneurial scale. There are many methods by which to measure the scale of entrepreneurship [74,75]. Because of the small entrepreneurial scale of rural households, their distinct family characteristics, and the common condition of self-employment, it is impossible to use quantitative financial indicators to measure their entrepreneurial scale. Therefore, by referring to the existing literature research, the scale of agricultural entrepreneurship is identified by the logarithm of the total output value of the agricultural products of households in the current year. In addition, the scale of non-agricultural entrepreneurship is reflected by the logarithm of the total assets of households participating in industrial and commercial projects in the current year.

On the other hand, this research attempts to modify the classification of entrepreneurial types. According to the motivation of entrepreneurship, entrepreneurship can be divided into necessity and opportunity entrepreneurship [73,76–80]. "Necessity entrepreneurship" mostly refers to entrepreneurship for the purpose of survival entrepreneurship supporting oneself, as a result of the absence of better or satisfactory employment options. Necessity entrepreneurs are usually engaged in simple and low-threshold entrepreneurial activities [73,77]. In this study, an entrepreneur who is engaged in agricultural production, agricultural product distribution, small rural retail, or rural roadside cafes is regarded as a necessity entrepreneur [81]. Meanwhile, opportunity entrepreneurship is a kind of proactive entrepreneurship for the sake of seizing prevailing attractive business opportunities in the pursuit of greater growth [73,77]. This research defines high commercial value-added entrepreneurial activities, such as industrial processing, information technology services, leisure and entertainment, mining, and education as opportunity entrepreneurship [81].

Table 4 presents the estimation results, based on Equation (3), after the replacement of the dependent variables. As shown in column (1), the presence of land certification increases the scale of agricultural entrepreneurship by 32.9%, which is statistically significant at the 5% level. In column (2), the estimate decreases slightly after involving the control variables, but it is still statistically significant. Consistently, the results in column (5) show that the presence of land certification is positively related to a higher possibility, by 4.2 percentage points (15.3%), of farmers engaging in necessity entrepreneurship. Again, the result is almost constant and is statistically significant after including the covariates in column (6). As shown in columns (3) and (4) and (7) and (8), the regressions to the non-agricultural entrepreneurship scale and development entrepreneurship are still not significant. These results are consistent with the basic results in Table 2, i.e., the statistical significance of the coefficient of land certification in the regression of Equation (3) has no change before and after the substitution of the dependent variables. From the above phenomena, it is not difficult to judge that the contribution of land certification to farmers' entrepreneurship in actuality comes mainly from agricultural entrepreneurship for survival purposes. In order to highlight the focus and limited goals on avoiding redundancy and the clear description, agricultural entrepreneurship will be taken as an example in the subsequent analysis.

**Table 4.** Land certification and farmers' entrepreneurship: robustness test I.

| Variables | Entrepreneurship Scale | | | | Entrepreneurship Motivation | | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| | Agricultural | | Non-Agricultural | | Necessity | | Opportunity | |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| Mean of $y$ | | | | | 0.274 | 0.274 | 0.051 | 0.051 |
| Land Certification | 0.329 ** | 0.310 ** | 0.066 | 0.061 | 0.042 *** | 0.040 *** | 0.003 | 0.003 |
| | (0.144) | (0.145) | (0.110) | (0.109) | (0.015) | (0.015) | (0.008) | (0.008) |
| Control Variables | No | Yes | No | Yes | No | Yes | No | Yes |
| Year Fixed Effect | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Household Fixed Effect | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Observations | 11,664 | 11,664 | 11,664 | 11,664 | 11,664 | 11,664 | 11,664 | 11,664 |
| Adj R-Squared | 0.425 | 0.426 | 0.555 | 0.565 | 0.340 | 0.355 | 0.250 | 0.257 |

Note: ** and *** represent statistical significance at the 5%, and 1% levels, respectively. Robust standard errors clustered at the household level are proposed in parentheses. The control variables are the same as in column (4) of Table 2, the same below.

### 4.2.2. DID Matching Estimators

As the sample size tracked from 2011 to 2019 is too sparse, it is difficult to conduct an acceptable parallel trend test in this study. DID matching estimators are an extension of traditional regression approaches and of the combination of the DID model with the propensity score matching and are helpful to avoid parametric assumptions about the relationship between the dependent variables and the covariates (i.e., $X_{it}$) [82–89]. Therefore, this paper applies the DID matching estimators to make it easier for individuals in the treatment and control groups to have the same time-trend under the given covariates. Then, we designate land certification as the processing variable. and agricultural entrepreneurship as the outcome variable. In this part of the matching process, this study applies logistic regression to calculate the propensity score, based on the nearest-neighbor matching estimator, weighting the control group according to their similarity to the treatment group, where similarity is based on $X_{it}$.

Figure 1 presents the extent of covariate imbalance between the treatment group and control group, in terms of standardized percentage differences in the DID matching estimators. As shown in Figure 1, before the matching, the standardized percentage differences of covariates are significantly different from 0, which means that the extent of covariate imbalance is stronger. In contrast, after the matching, the differences of covariates are almost equal to 0, which implies that covariates between the treatment group and control

group are balanced. These results reveal that after the matching, there is no systematic difference between the treatment and control group, thus satisfying the balance test.
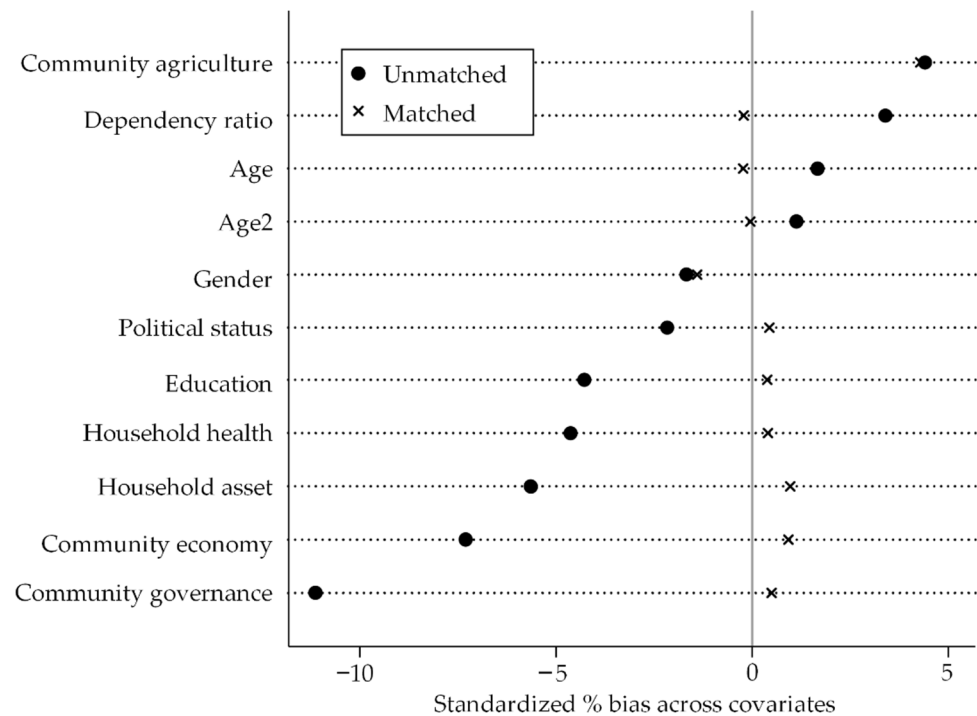


**Figure 1.** Standardization bias before and after matching.

　　Table 5 presents results using the DID matching estimators based on Equation (3), with the gradual addition of individual, household, and community control variables. We impose a strict common support condition; only those control households in the same communities as the treatment households are included in the box of latent controls. Under this condition, the restricted sample of Table 5 omits 40 households from the common support. In each column, treatment households are matched to their two nearest neighbors. As shown in column (1), the presence of the new round of land certification is associated with a high probability, by 3.8 percentage points (20.5%), of rural households participating in agricultural entrepreneurship, which is statistically significant at the 1% level. In columns (2)–(4), the estimate is smaller in the specification, including more control variables from different dimensions, which is 3.4 percentage points (18.4%) at least and is still statistically significant. These results are generally identical to those given in columns (1)–(4) of Table 2. It happens that there is a similar proof available to testify that land certification can help to promote the development of agricultural entrepreneurship and stimulate the enthusiasm of farmers for agricultural entrepreneurship.
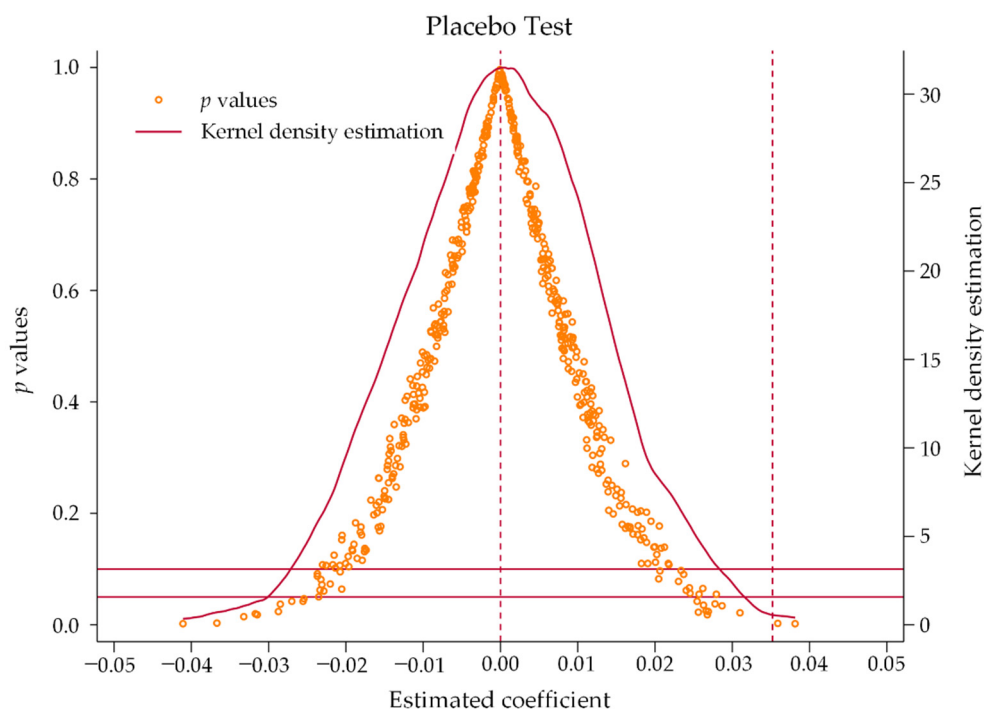
4.2.3. Placebo Test

　　In order to run a further test as to whether the above results are driven by unobservable factors at the community-household-year level, the authors conducted a placebo test by randomly assigning treated households [56]. In detail, the new treatment group is randomly selected by maintaining the same sample size as the old one from a full sample. Then, the authors carried out this random sampling 500 times and finally conducted baseline regression according to Equation (3), individually. Figure 2 displays the distribution of estimated coefficients and the related *p*-values of 500 regressions, demonstrating that the estimated coefficients of land certification are concentrated around 0. The real estimated coefficient in this paper (from column (4) of Table 2) is an obvious outlier in the placebo test. Meanwhile, the *p*-values of most of the estimated values are greater than 0.1. These results

imply that the estimation results of this paper are unlikely to be driven by unobservable factors at the community-household-year level.

**Table 5.** Land certification and farmers' entrepreneurship: robustness test II.

| Variables | Agricultural Entrepreneurship | | | |
|---|---|---|---|---|
| | **(1)** | **(2)** | **(3)** | **(4)** |
| Mean of $y$ | 0.185 | 0.185 | 0.185 | 0.185 |
| Land Certification | 0.038 *** | 0.036 *** | 0.036 *** | 0.034 ** |
| | (0.014) | (0.014) | (0.014) | (0.014) |
| Individual Control Variables | | Yes | Yes | Yes |
| Household Control Variables | | | Yes | Yes |
| Community Control Variables | | | | Yes |
| Year Fixed Effect | Yes | Yes | Yes | Yes |
| Household Fixed Effect | Yes | Yes | Yes | Yes |
| Observations | 11,624 | 11,624 | 11,624 | 11,624 |
| Adj R-Squared | 0.329 | 0.330 | 0.339 | 0.342 |

Note: ** and *** represent statistical significance at the 5%, and 1% levels, respectively. Robust standard errors clustered at the household level are proposed in parentheses.



**Figure 2.** Land certification and farmers' entrepreneurship: placebo test.

### 4.3. Endogeneity Discussion

Omitted variables, measurement errors, simultaneity, reverse causality, and sample self-selection are common endogeneity problems in research involving econometrics. In this paper, the first two problems can be alleviated by the DID model, supplemented by control variables from the various aspects, and by the replacement of dependent variables in the DID model, respectively. In terms of simultaneity, this study relieves it by adding a clustering robust standard error. Since China's new round of land certification is dominated and enforced by the government, reverse causality and selection bias are less likely. Besides this, the robustness of the benchmark results has been verified by the DID matching estimators and placebo test. Therefore, the endogeneity problem has been mitigated, to some extent.

### 4.4. Mechanism Analysis

As mentioned in Section 2, the shortage of labor force, the unavailability of land transfer, and the lack of financing and loaning channels hinder farmers' entrepreneurship. If so, can land certification relieve labor force, land, and financing constraints by issuing land certificates with legal effects and multiple economic uses to farmers, so as to encourage farmers to start businesses? This is the mechanism problem that this research aims to address. For the sake of the simplicity of the analysis, we introduce four new variables: labor employment, machinery investment, land transfer, and financing loans (see Table 6 for their definitions). The extent of the constraint of the labor force of rural households is represented by labor employment and machinery investment. The degree of the constraints on land and financing of farmers is respectively proxied by land transfer and financing loans. Then, we regard the extent of the constraints on the labor force, land, and financing as dependent variables in the regression of Equation (3), to explore the relationship between these constraints and the new round of land certification.

**Table 6.** Land certification and farmers' entrepreneurship: mechanism analysis.

| Dependent Variables | Definitions | Land Certification | Control Variables | Observations | Wald $X^2$ | F |
|---|---|---|---|---|---|---|
| Labor Employment | Whether to employ laborers due to agricultural production (0 = No, 1 = Yes) | 0.938 *** (0.135) | Yes | 11,664 | 163.53 | |
| Machinery Investment | The logarithm of value of agricultural machinery | 0.177 * (0.099) | Yes | 11,664 | | 112.59 |
| Land Transfer | Whether to transfer the land (0 = No, 1 = Yes) | 0.354 *** (0.083) | Yes | 11,664 | 119.65 | |
| Financing Loan | Whether the financing loan is restricted (0 = Yes, 1 = No) | 0.486 *** (0.159) | Yes | 11,664 | 61.67 | |

Note: * and *** represent statistical significance at the 10% and 1% levels, respectively. Robust standard errors clustered at the household level are proposed in parentheses.

Table 6 reports the estimation results regarding the impact of land certification on the degree of the constraints of the labor force, land, and financing. As shown in Table 6, the possession of the new round of land certificates is positively related to labor employment, machinery investment, land transfer, and financing loans, including other covariates, which is statistically significant. As we expected, land certification can relieve constraints on the labor force, land, and financing. In addition, the literature review and theoretical analysis in Section 2 reflect the finding that sufficient labor, a convenient land transfer market, and available financing loans stimulate farmers to engage in agricultural entrepreneurship. Consequently, these results indicate that land certification mainly promotes the development of farmers' agricultural entrepreneurship through the mitigation of constraints on the labor force, land, and loans, and finally plays a positive role in strengthening rural sustainable development.

### 4.5. Heterogeneity Analyses

Given the heterogeneity of provinces, communities, and households, the impact of land certification on farmers' agricultural entrepreneurship may be different. Therefore, it is necessary to further explore the effects of land certification under different situations.

#### 4.5.1. The Province Aspect

This section examines the influence of land certification on agricultural entrepreneurship at the province level from two dimensions: geographical regions and agricultural regions. Table 7 summarizes the results of estimating Equation (3) from the above two dimensions. As shown in column (3), the presence of land certification is significantly associated with a higher likelihood, by 11.2 percentage points (47.1%), of farmers engaging

in agricultural entrepreneurship in the west. On the contrary, the results in column (1) show that there is a negative relationship between land certification and agricultural entrepreneurship in the east. In terms of geographical regions, land certification greatly promotes agricultural entrepreneurship in the western region, slightly inhibits that in the eastern region, and has no effect on that in the central region. One possible explanation is that there is a strong regional imbalance and spatial dependence on the development of rural entrepreneurship in China [90]. Rural development in the western region lags behind, but the western region is rich in land resources and is sparsely populated, and the value of agricultural entrepreneurship is prominent. The eastern and central rural regions hold a safe lead in aspects of the non-agricultural economy, in contrast to the western region. Consequently, there are more non-agricultural employment and entrepreneurship opportunities in the eastern and central regions. In this event, agricultural entrepreneurship is not attractive to farmers in these regions, and even non-agriculture in the most economically developed eastern region may rob the resources and opportunities for agricultural entrepreneurship.

**Table 7.** Land certification and farmers' entrepreneurship: province heterogeneity.

| Variables | Farmers' Agricultural Entrepreneurship | | | | |
| --- | --- | --- | --- | --- | --- |
| | Geographical Regions | | | Agricultural Regions | |
| | East | Middle | West | Major Grain-Producing | None |
| | (1) | (2) | (3) | (4) | (5) |
| Mean of $y$ | 0.108 | 0.216 | 0.238 | 0.193 | 0.176 |
| Land Certification | −0.039 * | 0.007 | 0.112 *** | 0.002 | 0.067 *** |
| | (0.022) | (0.026) | (0.025) | (0.020) | (0.019) |
| Control Variables | Yes | Yes | Yes | Yes | Yes |
| Year Fixed Effect | Yes | Yes | Yes | Yes | Yes |
| Household Fixed Effect | Yes | Yes | Yes | Yes | Yes |
| Observations | 3996 | 4314 | 3354 | 6372 | 5292 |
| Adj. R-Squared | 0.251 | 0.368 | 0.341 | 0.350 | 0.337 |

Note: * and *** represent statistical significance at the 10%, and 1% levels, respectively. Robust standard errors clustered at the household level are proposed in parentheses. Geographically, the regions are divided according to the standards of the National Bureau of Statistics of China. The agricultural regions are divided according to the standards of the former State Administration of Grain in China.

At the same time, the results in column (5) show that the obtaining of land certificates is significantly associated with a higher probability, by 6.7 percentage points (38.1%), of the emergence of agricultural entrepreneurship in non-major grain-producing regions. In terms of agricultural regions, land certification can promote agricultural entrepreneurship in non-major grain-producing regions but has no impact on major grain-producing regions. The possible reason is that in order to ensure national food security, major grain-producing areas originally had greater support for agriculture and strong administrative constraints. As a result, the level of agricultural entrepreneurship is high, regardless of whether land certification has been implemented.

### 4.5.2. The Community Aspect

Table 8 exhibits the community heterogeneity of land certification on farmers' agricultural entrepreneurship, from the perspectives of the terrain and traffic convenience of the community. As shown in columns (1) and (2), the likelihood of participating in agricultural entrepreneurship after land certification is 6.9 percentage points (37.3%) higher among farmers living in non-plain communities, compared with those living in plain communities. From the perspective of terrain, land certification has a positive effect on agricultural entrepreneurship in non-plain communities, but it has no significant impact on plain communities. Possibly, the main reason is that compared with plain regions, the labor force, land transfer, and financing loan markets in non-plain regions are less developed.

As a result, land certification can significantly advance agricultural entrepreneurship in non-plain communities through the above three mechanisms.

**Table 8.** Land certification and farmers' entrepreneurship: community heterogeneity.

| Variables | Farmers' Agricultural Entrepreneurship | | | |
|---|---|---|---|---|
| | Terrain | | Traffic Distance | |
| | Plain | Non-Plain | ≤30 km | >30 km |
| | (1) | (2) | (3) | (4) |
| Mean of $y$ | 0.186 | 0.185 | 0.196 | 0.171 |
| Land Certification | −0.024 | 0.069 *** | 0.010 | 0.071 *** |
| | (0.023) | (0.018) | (0.019) | (0.020) |
| Control Variables | Yes | Yes | Yes | Yes |
| Year Fixed Effect | Yes | Yes | Yes | Yes |
| Household Fixed Effect | Yes | Yes | Yes | Yes |
| Observations | 5218 | 6446 | 6508 | 5156 |
| Adj R-Squared | 0.360 | 0.329 | 0.346 | 0.335 |

Note: *** represent the statistical significance at the 1% levels, respectively. Robust standard errors clustered at the household level are proposed in parentheses. The division of traffic distance is mainly based on whether the distance between the village committee and the nearest train station is greater than the mean value.

Given the availability of data, the traffic convenience of the community is proxied by the distance between the community and the nearest train station. Consistently, the results in columns (3) and (4) show that the presence of land certification is significantly associated with a higher likelihood, by 7.1 percentage points (41.5%), of choosing agricultural entrepreneurship among farmers in communities without convenient traffic links, in contrast with those living in communities with convenient traffic links. The reason for these results may be that it is more convenient for communities with good transportation links to enter the city, and farmers in these communities are more likely to be busy with non-agricultural work, which means that land certification has little impact on their agricultural entrepreneurship.

4.5.3. The Household Aspect

This paper also pays attention to the differences in the impact of land certification on the agricultural entrepreneurship of different farmers. Focusing on the status of land in rural households, this study takes land transfer in, land transfer out, and land adjustment as the grouping variables for heterogeneity analysis.

Table 9 displays the estimation results of group regression, based on Equation (3), taking land transfer in, land transfer out, and land adjustment as grouping variables. First of all, the results in columns (1) and (2) demonstrate that land certification has no effect on the agricultural entrepreneurship of transfer-in households, but it can enhance the agricultural entrepreneurship of non-transfer-in households. One possible explanation is that before land certification, the market for land transfer is not mature, and households often rent enough farmland at low cost through informal means. After the land is certified, the mature market mechanism wipes out the previous low rent price, and the transfer-in households may not invest more in agricultural entrepreneurship.

Secondly, as shown in columns (3) and (4), land certification significantly boosts the agricultural entrepreneurship of non-transfer-out households but has no significant impact on transfer-out households. The possible account is that, compared with non-transfer-out households, transfer-out households meet the conditions of renting out land that they cannot cultivate to others. Therefore, whether or not the land is certified, their agricultural entrepreneurship will not be influenced.

**Table 9.** Land certification and farmers' entrepreneurship: household heterogeneity.

| Variables | Farmers' Agricultural Entrepreneurship | | | | | |
|---|---|---|---|---|---|---|
| | Land Transfer-In | | Land Transfer-Out | | Land Adjustment | |
| | Transfer In | None | Transfer Out | None | Adjustment | None |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Mean of $y$ | 0.559 | 0.147 | 0.053 | 0.206 | 0.121 | 0.195 |
| Land Certification | 0.017 | 0.028 * | 0.033 | 0.032 ** | 0.027 | 0.036 ** |
| | (0.093) | (0.014) | (0.033) | (0.016) | (0.032) | (0.015) |
| Control Variables | Yes | Yes | Yes | Yes | Yes | Yes |
| Year Fixed Effect | Yes | Yes | Yes | Yes | Yes | Yes |
| Household Fixed Effect | Yes | Yes | Yes | Yes | Yes | Yes |
| Observations | 432 | 9924 | 636 | 9074 | 1600 | 10,064 |
| Adj R-Squared | 0.411 | 0.262 | 0.148 | 0.352 | 0.270 | 0.348 |

Note: *, ** represent the statistical significance at the 10%, 5% levels, respectively. Robust standard errors clustered at the household level are proposed in parentheses.

Thirdly, the results in columns (5) and (6) show that land certification has significantly promoted the agricultural entrepreneurship of farmers who have not experienced land adjustment; however, it has no significant impact on farmers who have experienced land adjustment. The possible explanation is that farmers who have experienced land adjustment, whether land certification has been completed or not, have no faith in the security of land tenure. Since land adjustment has been implemented before, it may continue in the future. Therefore, the security of land tenure is still uncertain.

## 5. Discussion

This paper answers the question of how the new round of land certification affects farmers' entrepreneurship and makes marginal contributions to the relevant research through scientific identification of certification time, attention to entrepreneurship scale and motivation, and three-dimensional heterogeneity analysis. Concurrently, it also provides a scientific basis for the government to guide farmers to participate in entrepreneurship and to reinforce rural sustainable development with the help of land property rights reform. This study poses the question of why the existing literature comes to completely different research conclusions on the external effects of land certification in the world (especially in developing countries) and tries to give the following responses.

First of all, whether land certification can effectively strengthen the security of farmland rights is the key to determining its influence. Only by strengthening the exclusive ability of land, reducing the cost of land protection, and improving the expectation of land stability can land certification better release the labor force bound, strengthen the availability of land transfer, and enhance the mortgage value of land, thereby generating entrepreneurial incentives for rural households. Conversely, if legal empowerment cannot be effectively implemented, owning the land certificate does not mean a higher level of stability in terms of land property rights. Not only that, if the pursuit of quantity rather than quality in the process of policy implementation is emphasized and the conflict between legal empowerment and original customary land ownership occurs, land certification poorly enhances the security of land property rights; new uncertainties and conflicts may easily emerge.

Secondly, the exertion of the effect of land certification needs some specific conditions. Land certification is only a necessary condition for agricultural entrepreneurship. The actual validity of land certification policy is affected by the development degree of the legal environment and the factor market in different countries. The reason why land certification has different effects on farmers' entrepreneurship in different countries is that some transmission mechanisms cannot function effectively, due to the lack of certain necessary conditions [91]. The specific manifestations are as follows: on the one hand, it is necessary to have an infrastructure related to the development of agriculture, such as

irrigation systems, storage equipment, power facilities, and transportation networks [92]; on the other hand, we need to develop a more perfect rural factor market. It was found that 97% of rural households' entrepreneurial capital mainly came from their own funds, which depend on the development of rural factor markets, such as the land transfer market and credit market [93].

Lastly, some of the literature ignores the potential endogenous problems caused by omitted variables, measurement errors, simultaneity, reverse causality, and sample self-selection, resulting in errors in the existing estimation results. The empirical results of this paper again show that if the estimation errors caused by endogenous problems such as covariate differences between groups and potential time trends are not relieved, the effect of the new round of land certification may be overestimated.

## 6. Conclusions and Policy Implications

This paper examines the effects of land certification on farmers' entrepreneurship behavior. Employing household survey data from CHFS, utilizing the policy shock of the new round of land certification, and applying the DID model, this study first indicates that land certification is positively and significantly related to farmers engaging in agricultural entrepreneurship. Then, replacing the dependent variables with similar variables from the other two perspectives, this paper finds that the contribution of land certification to farmers' entrepreneurship actually comes from agricultural entrepreneurship for survival purposes. Next, the focus of this research turns to agricultural entrepreneurship. Using reliable DID matching estimators, this study finds that there is a similar proof to support the claim that land certification can help promote the development of agricultural entrepreneurship. Consistently, after substitution for the dependent variables, this paper shows that land certification can relieve constraints on the labor force, land, and financing. Besides this, associating this finding with the literature review and theoretical analysis in Section 2, the results of this study imply that the incentive effect of land certification on farmers' agricultural entrepreneurship is mainly achieved by mitigating the constraints of the labor force, land, and financing. We then tested whether there is heterogeneity regarding the effect of land certification on agricultural entrepreneurship at province, community, and household levels. We find that land certification has a more obvious effect on the agricultural entrepreneurship behavior of rural households who never transfer their land or suffer land adjustment, as is the case for those living in the western non-major grain-producing regions or in non-plain communities without convenient traffic links. These findings provide a theoretical foundation for the government to rationally plan the national land property rights reform to promote farmers' entrepreneurship.

According to the mechanism analysis in Section 4.4, the mitigation of constraints on labor force, land, and financing is the intermediary channel from the emergence of land certification to a higher likelihood of occupying farmers with agricultural entrepreneurship. Therefore, this paper summarizes separately the ways of the government, financial institutions, and rural households to alleviate constraints from three dimensions: labor force, land, and financing, which encourage rural households to engage in entrepreneurship (Figure 3). More specifically, the main policy implications from the government, financial institutions, and rural households are as follows.

From the perspective of the government, the reform of the rural land property rights system should continue to be deepened. On the one hand, it is necessary to improve the rural labor market and develop the socialized service of agricultural machinery. Meanwhile, it is vital to deepen the financial reform of rural land use through the experience of mortgage loan pilot schemes, with the land property rights as collateral. Finally, the above measures will improve the factor allocation conditions for rural households' entrepreneurship. On the other hand, the demands of entrepreneurial farmers should be taken into account. The government ought to stabilize the production and operation expectations of agricultural businesses in terms of laws and policies, and provide the necessary legal guarantees for rural households' entrepreneurship.
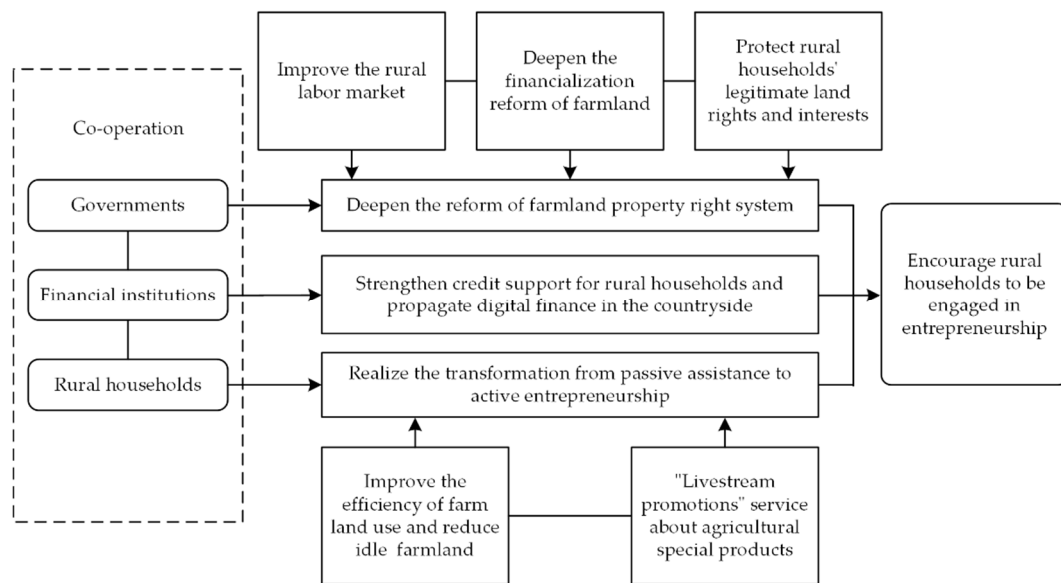
**Figure 3.** The paths to encourage rural households to engage in entrepreneurship.

From the perspective of the financial institutions, they should continue to increase credit support for rural households, propagate digital finance in the countryside, and broaden rural households' credit channels and scale. To be specific, first of all, financial institutions should focus on rural households with great entrepreneurial enthusiasm, and, after credit evaluation, increase the amount of micro-credit. Secondly, financial institutions should continue to carry out in-depth activities to create "credit users" and "credit communities". Those households and communities with good credit and active entrepreneurship ought to be offered more lending opportunities. Finally, financial institutions should propagate digital finance in the countryside. Using digital finance can alleviate rural households' credit constraints and enhance rural households' access to financial services [52].

From the perspective of rural households, they should achieve the transformation from passive assistance to active entrepreneurship under the guidance of the new rounds of land certification. On the one hand, rural households should improve the efficiency of farmland use, reduce the percentage of idle farmland, and promote the optimal redistribution of this idle farmland. On the other hand, in the post-epidemic era of COVID-19, rural households should give full play to the advantages of "zero contact" from digital finance and e-commerce, open up new non-agricultural entrepreneurial markets, and increase their output and income. For example, by means of e-commerce and short video platforms, they can provide "livestream promotion" services to promote special agricultural products in rural areas.

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