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# A novel interpretation of farmland abandonment: evidence from the famine experience

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The growing severity of farmland abandonment in rural areas has sparked concerns about the lack of people willing to cultivate the land. This study attempts to find the endogenous factors of farmland land abandonment among Chinese farmers and to curb land degradation to stabilize food security. Based on the China Labor-force Dynamics Survey (2016–2018), this paper explores the effect of famine experience on farmland abandonment using logit and DID models. We find that famine experience does increase the probability and extent of farmland abandonment, and undergo a series of robustness tests. We also find that the famine stigma effect increases the likelihood and extent of farmland abandonment by increasing risk aversion and reducing social trust and investment in agriculture. The growth of urbanization in China worsens the effects of famine, whereas local communal production services remove the effects of famine. The overall findings of this study provide useful insights for the government to protect land quality and food security and to carefully consider the role played by communities.

## KEYWORDS

farmland abandonment, famine experience, risk aversion, trust, food security

## 1 Introduction

According to a statement made by the World Meteorological Organization, “The impacts of extreme weather and climate change are intensifying in Asia, with melting glaciers and rising sea levels set to have significant impacts on future food and water security and ecosystems” (Stephan, 2023; Zhiltsov and Murashko, 2024). The World Food Program says geopolitics and global diseases have taken a heavy toll on the food supply chain in recent years (Von Braun et al., 2023). However, farmland abandonment is on the rise in rural China. Over time, it has become a major hidden threat to the country’s ability to feed itself. According to survey data, there were four new counties (cities) with a farmland abandonment rate of more than 30% from 2001 to 2009, and 11 new counties (cities) from 2010 to 2017. Yibin City in Sichuan Province and ShuiCheng County in Liupanshui City in Guizhou Province have more than 60% farmland abandonment rates (Zhang et al., 2019). An investigation in the Shai-Osudoku District, located in the southeastern Greater Accra Region of Ghana, revealed that an average of 39.8% of the total farmland area per household is abandoned (Bavorová et al., 2023). In the Polish Carpathians, over recent decades, 13.9% of farmland has been abandoned and undergone secondary forest succession (Kolecka et al., 2017). From 2001 to 2010, Nepal witnessed a total of 9,706,000 hectares of land being abandoned, accounting for 23.9% of the country’s total arable land (Chaudhary et al., 2020). The majority of academics agree that the behavior of abandoning farmland may have a

detrimental effect on food security. As a result, the causes of land abandonment and the creation of governance systems to stop it have become popular subjects of academic study.

Existing studies have mainly classified the causes of farmland abandonment behavior of farmers into five main categories. The first category of causes is categorized as the cost of agricultural production rising faster than agricultural returns. From 2004 to 2023, the average cost of the three major grain crops increased from 395.45 yuan per mu to 1,284.92 yuan per mu, with a surge of up to 224.93%. In particular, the land cost and labor cost increased by 458.83% and 187.88% respectively. Meanwhile, the net profit decreased from 196.5 to 75.14 yuan, with a negative growth rate of 61.76%. Food production has become less profitable for farmers as a result of their rising production costs. The 2022 Migrant Worker Monitoring Survey revealed that migrant workers' average monthly income was 4,615 yuan, up 4.1% from the previous year. Because of this disparity in comparative earnings, more people may decide to leave the countryside in search of more secure and well-paying jobs in the cities, which further encourages farmers to abandon their farmland (Li and Li, 2017). The second category of reasons is categorized as increased employment opportunities and remuneration in the non-agricultural sector attracting agricultural laborers to move out of the agricultural sector. Farmland has been abandoned due to the siphoning influence of neighboring towns and the abrupt decline in agricultural output labor (Zhou et al., 2020). Farmers who choose to work outside the home are also usually reluctant to transfer their farmland for reconfiguration (Ito et al., 2016). The phenomenon stems from the instability of many migrant workers' occupations within cities, prompting them to retain farmland as a safety net against potential unemployment (Quinn and Halfacre, 2014). Nevertheless, once the right to farmland was established, individuals increasingly personalized its ownership, perceiving it as a source of anticipated income and thus favoring farmland abandonment over its transfer (Dehnert and Gunkel, 2023). The likelihood of farmers abandoning their land is high, even when they are producing on a part-time basis (Ding et al., 2022). This shows that even while farmers work outside the farm, their occupation of farmland has not considerably decreased. The third category of causes is categorized as local natural endowments. Farmers have been forced to abandon their farmland because of climate, pests, wildlife and other persecution, as well as environmental degradation and soil infertility (Hatna and Bakker, 2011). As technology advances and markets become more open, the influence of natural resources on how farmers allocate their factors of production will continue to decline (Osawa et al., 2016). The fourth category of reasons pertains to the underdeveloped state of the farmland transfer market, coupled with ongoing controversies surrounding the transfer of farmland. Village cadres tend to engage in rent-seeking behavior and violate farmers' rights and interests when it comes to farmland transfer, and they have administrative powers that are difficult to monitor (Chen, 2015). According to the survey's findings, the average income from the sale of farmland is a few hundred yuan per mu; nevertheless, farmers with low incomes run the risk of having their rights and interests as well as the quality of their property damaged. Due to this situation, many farmers now favor leaving their farms in a state of abandonment over selling their land (Deng et al., 2019). The fifth category

of reasons encompasses the inadequate development of high-standard farmland infrastructure, including water, soil, field, and road systems, which hinders the implementation of mechanization. This, coupled with poor rural infrastructure, weak grassroots organizations, irrigation and drainage challenges, a scarcity of mechanization, and land fragmentation, discourages farmers from investing in their farmland (Postek et al., 2019).

While the existing literature provides numerous insights into the causes of farmland abandonment, it is not without its limitations and shortcomings. First, agricultural production and the transfer of agricultural labor are seen as being incompatible. The period 2004–2022 was marked by rapid urbanization and the gradual transfer of agricultural labor to the urban sector, yet China achieved “19 consecutive bumper harvests” in grain production. The explanation offered by some scholars is that the reduction in the labor force will increase the use of machinery, which in turn will increase the area under cultivation (Qiu et al., 2024). This suggests that labor migration leading to farmland abandonment is not a strong enough explanation. Second, the prevailing literature commonly contends that the relatively low returns of farmland as both a productive and property factor lead farmers to make the decision of abandoning farmland. However, empirical observations reveal that farmers often subcontract their land at minimal cost or even for free to relatives and friends, leveraging the norms of rural acquaintance society to mitigate monitoring, enforcement, and transaction costs, while also ensuring the security of property rights (Hodler et al., 2020; Mutz et al., 2022). A survey report on rural land circulation in Heilongjiang Province indicates that as of October 2014, subcontracted land accounted for 69% of the total land circulation (Shao and Sun, 2015). Furthermore, according to the National Bureau of Statistics' Rural Department's survey conducted in Sichuan in 2014, among the 924 surveyed households that transferred out their land, 45.3% did so without rent, and among the 204 common farming households that took in land, only 14.2% paid rent (Song and Teng, 2014). These findings suggest that the argument that economic incentives alone are the primary factor influencing farmers' decision to abandon farmland lacks sufficient explanatory power.

Unlike the previous research, this paper proposes a new explanation for farmland abandonment by farm households. We contend that in addition to the five primary types of characteristics mentioned above, farm households' farmland abandonment behavior also takes into account previous life experiences. The imprinting theory postulates that a person's unique experience at a vulnerable time of environmental change leaves an impression that is compatible with the environment, and that this imprint continues to have an impact on a person's behavior in the future (Marquis and Tilcsik, 2013; Simsek et al., 2015). Numerous studies have supported the impression that the Chinese people's experience with the famine in 1959–1961 left on them and how it affected their future decision-making. It has been established that the early famine economy had an effect on business development (Hu et al., 2020), saving behavior (Hu et al., 2019), investment choices (Zhang K. Y. et al., 2023), insurance participation (Zheng et al., 2023), and the decision to rent farmland (Cheng et al., 2023) and use green production technology (Hu et al., 2022). Therefore, the famine that occurred in China in 1959–1961, can create an imprint in people's

minds. To elaborate, the experience of famine has a significant impact on a person's risk tolerance, ability to accumulate wealth, and degree of trust. Long-term hunger experiences shape people's conservative mindset and produce risk-averse investing preferences (Deng et al., 2020; Pan et al., 2024). Farmers who do not primarily depend on agricultural production for their income often opt to temporarily abandon their farmland due to the perceived higher risk of financial loss compared to potential gains. Consequently, they prefer to keep their farmland as a safety net for future livelihood needs, rather than actively utilizing it as a source of income. Chronic malnutrition limits the accumulation of human capital in households (Chen and Zhou, 2007). Famine experience considerably lowers literacy, health, and education levels and has repercussions on subsequent generations of the family, according to a survey of famine survivors (Güven et al., 2021). However, because the first generation parents who experienced the famine engaged in compensating human capital investment behavior, the intergenerational impacts were not passed down to the second generation (Yao and Zhang, 2023). In recent years, the cost of agricultural produce in our country has escalated rapidly, and the ultra-small-scale family farming operations have failed to adequately compensate farmers for their labor, barely sustaining their basic livelihoods. Consequently, the academic community has advocated the path of moderate-scale agricultural operations (Thindisa and Urban, 2018; Zhang X. Y. et al., 2023; Zhou et al., 2019). However, for the first generation of small families who have experienced famine, there is a dearth of accumulated human capital. Constrained by physical limitations, knowledge base, and individual capabilities, they find it challenging to embark on large-scale farming operations. In addition to affecting people's political trust, the Great Famine also had an impact on social trust (Kavakebi et al., 2023). In order to increase the effectiveness of agricultural output, both the transfer of farmland and large-scale operations seek to foster cooperation and the division of labor (Liu et al., 2019). Trust, the foundation of the cooperative economy, is essential to its growth and survival (Robbins, 2016). The perfidious behavior that emerged in the face of survival was seen by farmers who had experienced famine, and this had a significant impact on their social trust and, in turn, the achievement of the desired objectives of the rural cooperative economy (Cheung et al., 2022).

The marginal contributions of this paper are as follows: first, in terms of research perspectives, although the existing literature provides explanations for farmland abandonment, these explanations mainly focus on external factors and lack exploration of the intrinsic causes of farm households. This paper innovatively proposes that the famine experience of farmers may be the internal cause of farmland abandonment, and finds that due to the stigma of famine experience, transferring farmland does not seem to be able to solve the problem of abandonment, and the production service organization that can replace production without transforming property rights will be the direction of the problem. Second, in terms of theoretical mechanisms, we rationalize the impact of famine experience on farmland abandonment from three aspects: investment, risk attitude, and trust level, based on the stigma theory. Third, in terms of policy implications, Exploring the underlying reasons for farmland abandonment provides crucial insights for policymakers and stakeholders to develop effective strategies to prevent farmland from becoming barren, enhance

agricultural productivity, and ensure the long-term viability of rural communities.

## 2 Background and analytical framework

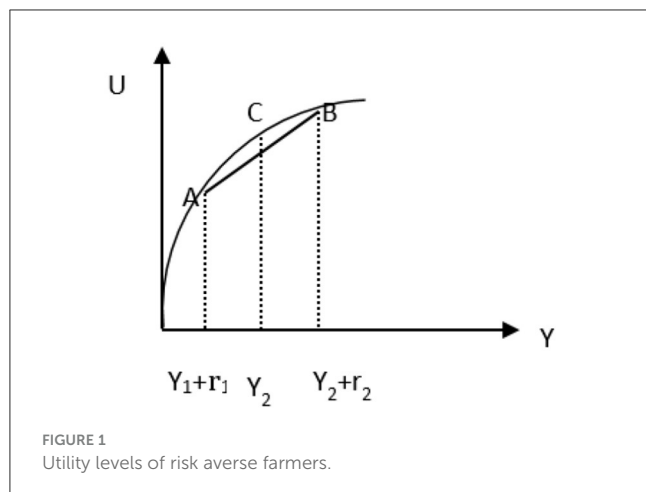
### 2.1 Background

A severe famine that lasted for 3 years, from 1959 to 1961, was caused by a confluence of "leftist" policy mistakes by the Chinese authorities, natural disasters and debt problems with the Soviet government. A system of unified purchasing and marketing was introduced in China to ensure both the survival of the urban population and the availability of raw materials for industrial use. However, the high number of requisitions and inadequate food security in rural areas led to a famine that was largely contained in rural areas and had a significant negative impact on them.

There are several measures that people usually take to cope with famine in order to survive. One was to reduce all types of expenditures. Compared to 1957, the consumption level of peasants decreased by 22.8% in 1960 and 21.4% in 1961, while the consumption level of non-peasants decreased by 26.1% in 1961 and 23.5% in 1962. The lack of food intake among famine victims led to malnutrition and physical frailty. Even after the famine had subsided, these farmers found it more arduous to undertake heavy labor compared to those who had not experienced famine. Struggling to make ends meet, they found it all but a pipe dream to continue their education. Consequently, the famine significantly reduced literacy rates and had a detrimental impact on the quality of human capital. The second involves using unethical methods, such as illegal possession, looting, and fighting, to amass more food for survival. This has increased food competition between neighbors and a crisis of trust in each other.

### 2.2 Analytical framework

We believe that famine experiences may influence farmland abandonment behavior in three ways. Firstly, there is the severe food shortage caused by famine, which has a negative impact on thyroid function (Keestra et al., 2022), diabetes (De Rooij et al., 2014), depression, and cognitive performance in children (Liu et al., 2022), as well as having a significant negative impact on the health of the labor force. The need to survive is drowning out educational chances. Our human capital accumulation has been significantly impacted by the hunger. Small-scale, family-run agricultural production in China is steadily declining, and the future trend is toward specialized and massive agricultural production. According to several research, specialized farmers outperform small farmers in terms of protecting arable land (Xu et al., 2023), increasing productivity (Li et al., 2024), and ensuring the safety of agricultural goods (Teng et al., 2022). However, the lag in human capital accumulation resulting from famine made it challenging to cultivate professional farmers. When small-scale farming became uncompetitive in the market, small farmers often resorted to abandoning their land.



Secondly, the imprint of famine has made farmers more risk averse. Numerous scholars have argued that significant trauma affects a person's risk appetite (Filipski et al., 2019; Kim and Lee, 2014; Moya, 2018; Page et al., 2014). The three-year famine experience of 1959–1961 changed the psychological characteristics of farm households, such as high risk aversion, and continued to be transmitted through intergenerational and interpersonal interactions. As shown in Figure 1, Let's assume that the farmer grows his own farmland to get income as  $Y_1$ , the planting subsidy as  $r_1$ , the farmland abandonment to work outside income as  $Y_2$ , the farmland rental income as  $r_2$ . the income from labor  $Y_2$  is greater than the income from farming  $Y_1$ . When the farmer's preference is risk averse, then the utility function is a curve as shown in the figure. The utility at point A represents the utility of a farmer who grows his own farmland, point B represents the utility of a farmer who works and rents out his farmland, and C is the utility of a farmer who works and leaves his farmland fallow. We find that the utility of point C is greater than that of points A and B. Thus, famine imprinting creates risk aversion in farmers that causes them to choose to leave their farmland fallow.

Thirdly, the pressures of famine have fueled an increase in unethical behavior, undermining people's trust levels. The famine experience of 1959–1961 exacerbated farmers' mistrust toward village cadres, and this mistrust persisted even during the subsequent period of consolidation and restoration, hindering cooperation between local farmers and the administration (Rui, 2022). The most popular solution to the issue of farmland abandonment by farmers is the creation of a market for the leasing and transfer of farmland. The Chinese government has made an effort to overhaul the agricultural system by granting village committees significant authority and independence. The village committees' intermediary function in farmland leasing was ineffective, and their regulatory utility instead decreased the likelihood of farmers leasing and increased the likelihood of farmland abandonment (Shi et al., 2018). In summary, the 3-year famine experience of 1959–1961 reduced human capital accumulation, increased risk aversion, raised the level of mistrust and thus increased the likelihood of farmers abandoning the land.

## 3 Methodology

### 3.1 Data

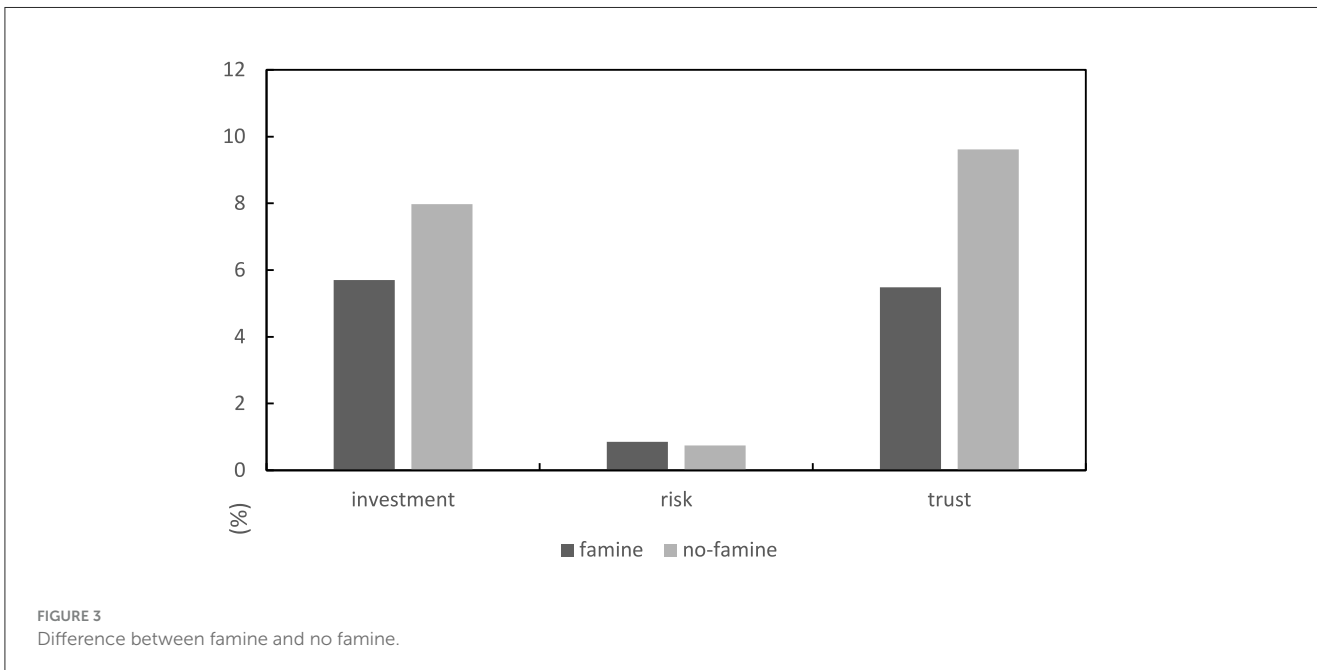
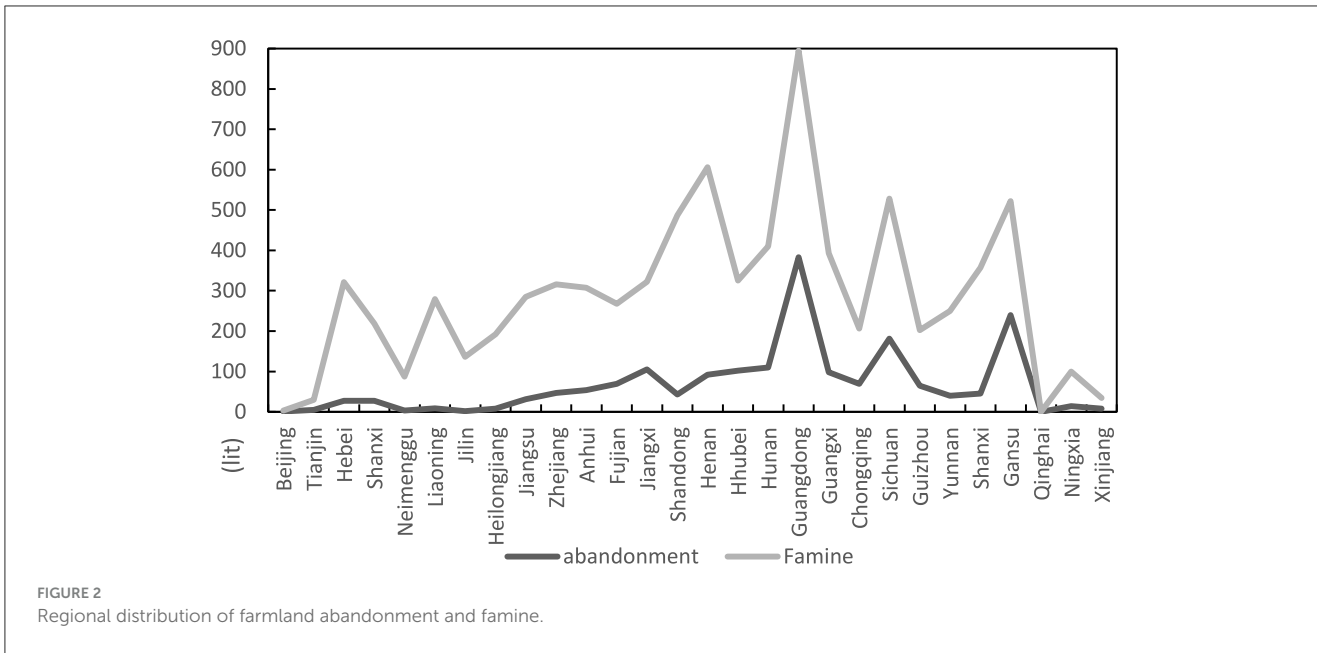
The data used in this study come from the China Labor-force Dynamics Survey (CLDS) conducted by the Center for Social Science Research at Sun Yat-sen University. The CLDS survey covers a wide range of topics, including the demographic make-up of the household where the labor force is located, the status of the household's property and income, the household's consumption habits, rural household production, and farmland, among other things. It is designed to gather information on the working-age population between the ages of 15 and 64. The survey is a large-scale tracking study covering a wide range of disciplines. The sample covers 29 provinces and cities in China, including 401 villages, 14,214 households, and 23,594 individuals. As the 1959–1961 famine was mainly concentrated in rural areas, urban samples were excluded, and survey data from 2016 and 2018 were selected to exclude missing values and outliers, for a total of 13,332 samples.

We utilize the China Labor-force Dynamics Survey (CLDS) data, selecting a sample of rural areas and removing missing values and outliers. We count as famine families with the highest average age of farmers born in <1958. We define this sample as representing abandoned households when the abandoned area is bigger than 0. We choose 28 provinces in China to observe. We use a line graph to draw the number of abandoned farm households and the number of farm households experiencing famine in the corresponding provinces. As shown in the Figure 2, we find that the provinces with more famine-experienced farm households also have more abandoned farm households, with similar distributional characteristics.

Similarly, we select this database (CLDS) and divide the sample into famine and no-famine groups. We use whether farmers are specialized in agricultural production to judge whether they make higher investments in human and material resources. We use whether farmers hold financial products to judge the risk appetite of farmers. We use whether the farmer lends money to others to judge the farmer's trust in others. The number of "yes" in each group as a percentage of each group is used for comparative analysis. As shown in the Figure 3, the proportion of farmers experiencing famine who are professionals and the amount of money lent to others are smaller than in the group that did not experience famine. Farmers' risk appetite is skewed toward risk aversion regardless of whether they have experienced famine or not, but it is slightly higher in the famine-experienced group than in the non-famine-experienced group. Accordingly, we learn that farmers who have not experienced famine have deeper human capital to invest in agricultural production, are more likely to trust others, and are somewhat less risk averse.

### 3.2 Empirical strategy

We extend the standard double difference model to a continuous DID (Ma, 2023). The Chinese famine of 1959–1961 was an entirely external shock to people, consistent with the arbitrary nature of a quasi-natural experiment. So, in order to calculate



the impact of famine experience on agricultural abandonment behavior, we employ a continuous double difference model. Farmers who have not experienced famine make up the control group in our DID model, whereas farmers who have are the treatment group. We consider that memory is absent till the age of one. Therefore, we consider those whose birth year is up to and including 1958 as having experienced the famine, and those born after 1958 as not having experienced the famine (Chen and Zhou, 2007).

$$P = F(Y_1 = 1|B_i) = \frac{1}{1 + e^{-Y_1}} \tag{1}$$

$$\ln \frac{P}{1 - P} = \alpha_0 + \alpha_1 treat_{it} * drt_s + \alpha_2 X_{it} + \delta_i + \gamma_p + \epsilon_{it} \tag{2}$$

$$Y_{2it} = \beta_0 + \beta_1 treat_{it} * drt_s + \beta_2 X_{it} + \delta_i + \gamma_p + \epsilon_{it} \tag{3}$$

where,  $Y_1 = 1$  indicates abandonment of farming behavior, and  $Y_{2it}$  denotes the area of farmland abandoned by farmer  $i$  in year  $t$ .  $P$  is the probability of abandoning the farm, and  $treat_{it}$  is a dummy variable equal to 1 for those who experienced famine, and 0 otherwise.  $drt_s$  denotes the degree of famine in each prefecture-level city.  $X_{it}$  is a series of control variables.  $\delta_i$ ,  $\gamma_p$  represent individual and provincial fixed effects, respectively.  $\epsilon_{it}$  and  $\epsilon_{it}$  are the error terms of the model.

Our parameters of interest are  $\alpha_1$ ,  $\beta_1$ . Those capture the effect of famine experience on farmers' farmland abandonment behavior. Our Empirical strategy is based on the assumption that in the



absence of treatment, the difference between famine-experienced and non-famine-experienced farm households is constant over time. We validate this assumption by conducting a parallel time test later in the paper.

### 3.3 Variables

The study selected two key dependent variables: the occurrence of farmland abandonment by rural households and the extent of such abandonment, as measured by the area of abandoned land (Movahedi et al., 2021). These two variables respectively capture whether a farmer engages in farmland abandonment and the degree to which abandonment takes place. Utilizing the China Labor-force Dynamics Survey (CLDS) database, we operationalized the concept of farmland abandonment by considering a zero value for the abandoned area as indicative of no abandonment, whereas any non-zero value was deemed as evidence of abandonment, with the magnitude of this area directly reflecting the extent of abandonment (Zhang et al., 2014).

The independent variables selected for this study are “experience of famine \* severity of famine.” A rural household is considered to have experienced famine if the oldest member of the family has personally witnessed famine conditions; otherwise, it is deemed to have had no such experience. We calculated the average number of household members born in the 3 years preceding the famine (1956–1958) and the 3 years following it (1962–1964), at the prefecture-level city unit, which represents the normal-year household births (denoted as  $P_{normal}$ ). Subsequently, we determined the number of household births during the famine years (1959–1961), designated as  $P_{famine}$ . Finally, the severity of famine for each prefecture-level city was calculated using the following formula:  $djh = \frac{P_{normal} - P_{famine}}{P_{normal}}$ . This metric, *djh*, captures the relative reduction in household births during the famine period compared to the pre- and post-famine normal years, thereby serving as a proxy for the severity of famine experienced at the local level (Zheng et al., 2023).

In this study, we selected a series of control variables based on family characteristics, farmland status, environmental quality, farm income, and subjective wellbeing. (1) The number of female family members, their health, education, and marital status are considered to have a direct impact on agricultural production activities. We measure the number of women in the household by the ratio of the number of female household members to the total number of members, the health status of the household by the number of “very healthy” and “relatively healthy” household members. The proportion of members with bachelor’s degree or above measures the education level of the household, and the proportion of members who are not married measures the marital status of the household (Ma et al., 2022; Plazinic and Jovic, 2014). (2) Relevant studies have proved that the size of the contracted land owned by a household affects the production decision. We use the total area of cultivated land owned by the farm household situation to measure the farmland situation (Weber and Key, 2014). (3) This study takes into account the impact of the local living environment and the agricultural production environment on the agricultural production choices of the farm household, and chooses the air,

water, and soil pollution situation to reflect the local environmental quality (Wei et al., 2021). (4) If the agricultural income accounts for a larger share of the total household income, the farm household is more inclined to persist in agricultural production, and conversely, it may choose to desert the agriculture. This study uses household income from agriculture, forestry, livestock and fisheries as a control variable to ensure that the impact of agricultural income on agricultural production decisions can be accurately analyzed (Rippo and Cerroni, 2023). (5) The degree of internal conflict in the household and the level of cohesion may affect the willingness of family members to gather, which in turn affects agricultural production decisions. This study measures the subjective wellbeing of farmers by the number of family gatherings (Lehto et al., 2012). The specific variable statistics table is as follows Table 1.

## 4 Results

### 4.1 Main results

We explore the effect of famine experience on abandonment behavior through Equation 1 of Table 2 and the effect of famine experience on abandonment scale through Equation 2 of Table 2. Columns (1) and (3) of Table 2 present the results of the logit regressions with and without the control variables, respectively. From the results, the coefficient of our key variable of interest, *djh\*treat*, is significantly positive at the 1% level, indicating that famine experience significantly increases the probability of farm abandonment behavior. Columns (2) and (4) of Table 2 present the results of the DID regressions with and without the inclusion of control variables and controlling for individual fixed effects and provincial fixed effects, respectively. These fixed effects capture unobserved differences for each individual and each province. From the results, the coefficients on *djh\*treat* are all significantly positive at the 10% level, and famine experience and high famine levels increase the area of cropland abandoned by farmers. Therefore, famine experience increases the probability of farmers choosing farmland abandonment and the degree of farmland abandonment is tested.

Regarding the control variables, we find that the larger the area of arable land owned by a farm household, the less likely it is that the farmland will be abandoned, and the smaller the area of farmland abandoned. The higher the household’s income from farming and the more the household’s livelihood depends on agricultural income, the less likely it is that the farmland will be abandoned, and the smaller the extent of farmland abandonment. Because of the special agricultural production situation in China, where family production is the main unit, the harmonious atmosphere of the family is negatively correlated with farmland abandonment.

### 4.2 The common trends assumption

The important assumption of the double-difference model is that the difference in abandonment is fixed over time in the absence of famine. We use an event study approach to examine trends in the presence and absence of famine. We show the regression event of *djh\*treat* with farmland abandonment area for the sample

TABLE 1 Variable descriptions and summary statistics.

Variables	Variable definition		Mean	Std	Min	Max
y <sub>1</sub>	Whether or not the farmland is abandoned	Yes = 1, No = 0.	0.14	0.35	0	1
y <sub>2</sub>	Farmland abandonment (mu)		0.48	3.15	0	200
year_birth	Year of birth of the oldest family member		1,954.70	13.66	1,900	2,001
djh	Level of famine	(P_normal-p_famine)/p_normal	0.40	0.44	-5	1
x <sub>1</sub>	Female	Number of female members/household members	0.43	0.18	0	1
x <sub>2</sub>	Unmarried	Number of members not married/household members	0.25	0.19	0	1
x <sub>3</sub>	Education	Percentage of household members with a bachelor's degree or higher	0.17	0.47	0	1
x <sub>4</sub>	Healthiness	Number of "very healthy" and "relatively healthy" family members (persons)	2.97	2.22	0	17
x <sub>5</sub>	Land	Area of cultivated land owned by the household (mu)	1,156.67	10,654.12	0.01	100,000
x <sub>6</sub>	Incomes	Household income from agriculture, forestry and fisheries (yuan)	11,896.79	30,521.78	-100,000	1,000,000
x <sub>7</sub>	Air	Air pollution levels, in order 1, 2, 3, 4	3.24	0.80	1	4
x <sub>8</sub>	Water	Degree of water pollution, in order 1, 2, 3, 4	3.16	0.86	1	4
x <sub>9</sub>	Soil	Degree of soil contamination, in order 1, 2, 3, 4	3.36	0.72	1	4
x <sub>10</sub>	Harmony	Number of family meals in a year (times)	646.25	7,916.84	0	901
Mechanism variables	Investment	Whether or not the household is specialized in agriculture, No = 1, Yes = 2	1.10	0.30	1	2
Mechanism variables	Risk	Whether financial products are held, No = 1, Yes = 2	1.01	0.09	1	2
Mechanism variables	Trust	Whether or not to lend money to someone, No = 1, Yes = 2	1.07	0.26	1	2
Moderator variable	Work	Number of people working outside the home (persons)	0.89	1.27	0	14
Moderator variable	Services	Types of socialized services provided by the community (types)	2.41	1.87	0	7

born in 1950–1964 (the year of birth of the largest member of the household). Since there is no memory of infancy, we assume that the birth year of the largest member of the household before 1959 implies that the famine was experienced, otherwise it was not experienced. We find from Figure 4 that the coefficient of the interaction term is significantly  $>0$  for being born before 1959, and the significant coefficient decreases over time, with the coefficient decreasing close to 0 in 1964. This suggests that a farmer being born before the year of the famine (experiencing the famine experience) significantly increases the extent of farmland abandonment, and that farmers who did not experience the famine have a non-significant effect on farmland abandonment. The event

study method verifies the parallel trend hypothesis and main results are more credible.

### 4.3 Placebo test

Considering whether farm abandonment can be influenced by other policies or random factors, we must conduct a placebo test. We randomly select 5,000 samples from the sample, repeat it 500 times, and plot the distribution and *P*-value of the estimated coefficients of the 500 interaction terms as shown in Figure 5. The vertical dashed line is the true estimate of the DID model (0.395),

TABLE 2 Results of the benchmark regression.

Variables	(1)	(2)	(3)	(4)
	$Y_1$	$Y_2$	$Y_1$	$Y_2$
Djh*treat	0.421*** (6.23)	0.395* (1.73)	0.451*** (6.89)	0.128* (1.83)
Land	-0.141*** (-3.15)	-0.011 (-0.45)		
Females	-0.007 (-0.05)	0.210 (0.57)		
Unmarried	0.694*** (5.15)	-0.107 (-0.42)		
Education	0.084 (1.59)	-0.578 (-1.40)		
Healthiness	-0.014 (-1.16)	0.126 (1.45)		
Air	0.171*** (3.91)	0.656 (1.26)		
Water	-0.107*** (-2.73)	-0.403** (-2.10)		
Soil	0.072 (1.55)	-0.126 (-0.65)		
Harmony	-0.010 (-0.36)	-0.014 (-1.01)		
Incomes	-0.578*** (-9.82)	-0.063** (-2.31)		
Constant	-2.606*** (-16.21)	-0.345 (-0.44)	-1.944*** (-60.83)	0.448*** (25.37)
Individual fixed effect		Yes		Yes
Province fixed effects		Yes		Yes

\*\*\*, \*\* and \* denote 1%, 5% and 10% significance levels, respectively.

and the horizontal dashed line is the 10% significance level. The more distant the estimated coefficients of the randomly selected samples are from the true coefficients, and the more the estimated *P*-values are >10%, the more this suggests that the test results of the original guidance activity are not random. As seen in the figure, the estimated coefficients are distant from the true coefficients, and most of the estimated *P*-values are not significant. Therefore, the Main results are not obtained by chance.

### 4.4 Robustness checks

The two largest existing strands of literature on the causes of farmland abandonment are the off-farm transfer of labor and low returns to agricultural production. We also recognize these points, however, we propose another endogenous factor affecting farmland

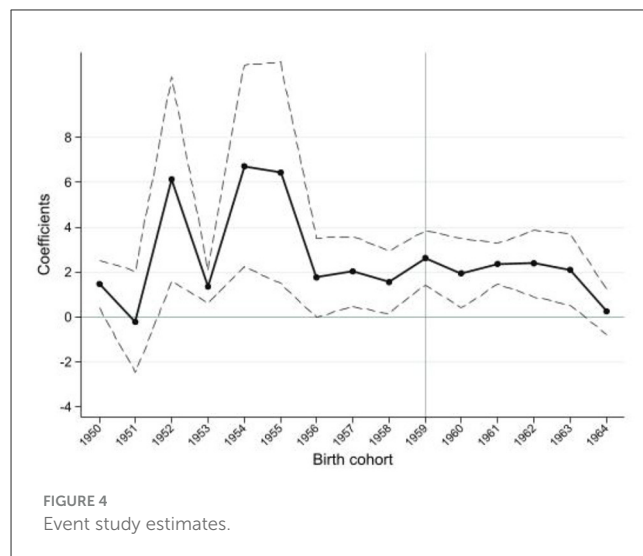


FIGURE 4 Event study estimates.

abandonment by farmers, namely the imprint effect of famine experience. These have been analyzed and modeled theoretically as above. To make the cause of famine experience more pure, we exclude the causes of labor shortages and unprofitable agricultural production. First, households with a residual household size of 6 and above are fully labor-ready for agricultural production, so we remove samples with a residual household size (total household size - number of people working outside the home) of 1-5 people and run the same regression. From the results in Table 3, the coefficient of djh\*treat is significantly positive, indicating that even if households are not short of labor, famine experience still increases the probability of farmland abandonment and the degree of farmland abandonment for farm households. Second, we select the sample with farm business income higher than 1,500 yuan and then run the regression. From the results in Table 3, the coefficient of djh\*treat is significantly positive, indicating that famine experience still significantly increases the probability of farmland abandonment and the extent of farmland abandonment even when farm income can at least be a guarantee of livelihood.

### 4.5 Mechanisms

In this section, we further identify potential mechanisms by which famine experiences increase the probability and extent of farmland abandonment among farm households. In this paper, we explore three mechanisms: risk aversion, social trust, and investment in agriculture. These are often examined as important influences on agricultural production decisions made by farm households (Amanullah et al., 2019; Buck and Alwang, 2011; Hadera and Tadesse, 2023; Tian et al., 2021; Yanuarti et al., 2019). We conduct benchmark regressions with risk averse sentiment, social trust, and agricultural investment as dependent variables, respectively, to verify that famine affects farmers' abandonment behavior by influencing their risk averse sentiment, social trust, and agricultural investment and thus their abandonment behavior.

The first mechanism is risk aversion. The experience of famine leaves a deep imprint on people's minds and makes farmers more



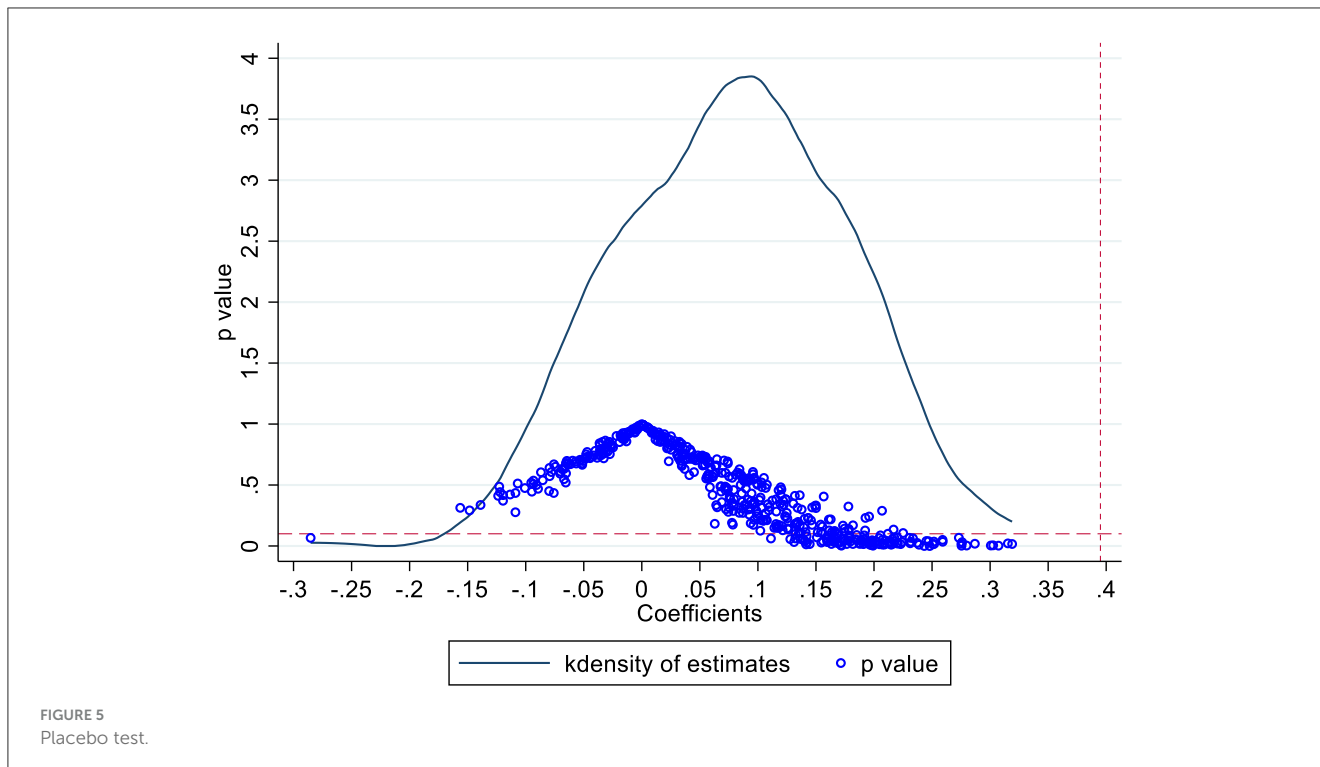


TABLE 3 Results of the robustness test.

Variables	(1)	(2)	(3)	(4)
	y <sub>1</sub>	y <sub>2</sub>	y <sub>1</sub>	y <sub>2</sub>
Djh*treat	0.291** (2.33)	1.929* (1.73)	0.622*** (5.54)	0.623** (2.53)
Control variable	Control	Control	Control	Control
Constant	-2.104*** (-6.84)	-3.274 (-1.05)	-3.148*** (-11.60)	15.305*** (9.52)
Individual fixed effect		Yes		Yes
Province fixed effects		Yes		Yes

\*\*\*, \*\* and \* denote 1%, 5% and 10% significance levels, respectively.

risk-averse. With other sources of income as their main source of income, farmers who continue to farm will face the risk of operating at a loss due to a variety of factors, such as weather, markets, and disasters, and they will face the risk of disputes over farmland and damage to property rights if they turn over their farmland to people who make a living from it. Therefore, in a risk averse mood, farmers often choose to leave their farmland fallow. The results are shown in Table 4(1), where the estimated coefficient of djh\*treat is significantly positive, indicating that famine experience does increase risk aversion among farmers.

The second mechanism is social trust. In the context of famine, people experienced first-hand violations of moralism in the competition for scarce subsistence resources, which deepened

TABLE 4 Results of the mechanism test.

Variables	(1)	(2)	(3)
	Risk	Trust	Investment
Djh*treat	0.394* (2.01)	-0.218*** (-2.86)	-0.427* (-1.80)
Control variable	Control	Control	Control
Constant	101.053*** (165.13)	10.616*** (77.86)	10.477*** (18.76)

\*\*\* and \* denote 1% and 10% significance levels, respectively.

their distrust of political authorities, communities, and external capital. Consequently, in the absence of the presence of a trusted operator, farmers tend to abandon their farmland. The results are shown in Table 4(2), where the estimated coefficient of djh\*treat is significantly negative, suggesting that the experience of famine indeed reduces the trust of farm households.

The third mechanism is investment in agriculture. We know common sense: the more people invest in something, the less likely they are to abandon it, and the more they invest, the more they expect a return. If farmers invest more in agricultural production, the more likely they are to become agricultural specialists and have a comparative advantage in agricultural production, and the probability of choosing to abandon their farms decreases. However, numerous studies have shown the far-reaching damage to the fitness and bodies of individuals who have experienced famine. Not only that, the education level of the experiencers and even that of their offspring is severely limited, which prevents them from learning and recognizing new things. Thus, famine not only

severely destroys the quality of human capital but also hinders the accumulation of raw capital by the farmers, resulting in their inability and lack of eyesight to invest in agriculture. The results are shown in Table 4(3), the estimated coefficient of  $djh^*treat$  is significantly negative, indicating that famine experience reduces agricultural investment by farm households.

## 4.6 Removing the imprint of the famine experience

According to the “growth poles” idea, cities are the growth engines that propel the development of the neighboring rural areas since they have more population, economic, cultural, and health-care resources than rural areas. The reality is that as China has become more urbanized, the growth poles provided by the city have drawn farmers to the cities to work. As more and more family members go to work in the cities, the lack of labor for agricultural production, coupled with the fact that the experience of famine creates high risk aversion, low trust and low investment attitudes among farmers, will further increase the likelihood of abandoning farmland. To test this idea, we divide the sample into households that work outside the home and those that do not, and conduct a benchmark regression. The results are shown in Table 5(1) and (2), where the coefficients estimated by  $djh^*trea$  for the “Leave” group are larger than those for the “Not leave” group.

The lingering shadow of historical famines has constrained farmers’ household capital accumulation and human capital development, making it difficult for them to transform into professional farmers through self-investment. Consequently, many farmers are inclined to choose migrant work as a more stable and higher-income livelihood option. Furthermore, land is regarded as a symbol of farmers’ personal identity and sentiment, endowed with a profound endowment effect. This emotional connection fosters a deep sense of attachment and protection among farmers toward their land, leading them to resist relinquishing control over their farmland. Memories of famine have exacerbated farmers’ risk aversion and distrust toward external entities taking over farmland management. Therefore, in the context of farmers’ migration for work, they prefer to retain direct management rights over their farmland rather than transferring it to village collectives or unfamiliar capital entities, ensuring the safety and stability of this “lifeblood.”

Although the rate of urbanization in China is not going to reverse, we can still discover strategies to remove the imprint associated with famine. Agricultural producers are viewed as several agricultural sectors or farmers who specialize in specific agricultural activities in the agricultural production process, according to the principle of division of labor in agriculture. In order to increase the effectiveness and quality of agricultural output, the division of labor in this industry places a strong emphasis on collaboration, specialization, and resource optimization. Communities that will offer unified production chain services are gradually forming in rural China. The community takes over the production process, while the farmer retains the right to administer the farmland. Farmers can operate and cultivate in this fashion without having to worry about land disputes

brought on by the transfer of farmland. We conduct the same benchmark regression by dividing the sample into community-provided service group and no service group to prove whether the community-provided production service corrects the imprint effect of famine. The results are shown in Table 5(3) and (4), the estimated coefficients of  $djh^*trea$  in the service provision group are smaller than those in the no service provision group, therefore, the community provision of production services mitigates the impact of famine or the legacy of famine.

## 5 Discussion

This study explores the importance of famine experience on farmland abandonment based on the quasi-natural experiment of famine using DID model regression. First, we focus on the effect of the interaction terms of “famine experience” and “famine degree” on farmland abandonment, and pass the parallel trend test and placebo test. The results suggest that famine experiences do increase the probability and extent of farmland abandonment. This is different from Li and Li (2017), who argue that poor returns from farming lead to farmland abandonment. It is also different from the conclusion of Zhou et al. (2020) and others who argued that the influx of farm households into urban labor led to farmland abandonment. These studies on farmland abandonment focus on external factors and have not yet explored the real internal causes. If the genuine reasons are indeed the low profitability of farming or farmers migrating to urban areas for employment, farmers could easily sublet their farmland to others and collect rent, instead of allowing it to fall into a state of abandonment and uncultivation. Our study found that it was the experience of the famine that led farmers to choose to abandon their farmland, fearing the loss of land titles. In order to prove that farmland abandonment is not determined by labor scarcity and low business income, we choose a sample with sufficient surplus household labor and a sample with high farm income to conduct the same benchmark regression, and obtain the same results as in the benchmark regression. This again demonstrates the robustness of the effect of famine experience on farmland abandonment.

Second, we choose risk aversion, social trust, and agricultural investment as mechanism variables for mechanism testing. The results show that famine experiences increase farmers’ risk aversion and reduce trust and investment in agriculture. Many studies have confirmed that the famine experienced by the Chinese in 1959–1961 had an impact on decisions such as investment choices and renting farmland (Zhang K. Y. et al., 2023; Cheng et al., 2023).

Finally, we segregated the samples into two subsets: those who migrated for work and those who remained in their localities, conducting separate regression analyses. The results indicate that farmers experiencing famine are more likely to choose to abandon their farmland and leave it uncultivated as they migrate to urban areas. This phenomenon stems from the precariousness of many migrant workers’ careers in the city, which leads them to retain farmland as a safety net against potential unemployment (Quinn and Halfacre, 2014). They are more likely to abandon their farmland rather than leave it to be farmed by others (Dehnert and Gunkel, 2023). Our study attempts to find a direction of resolution. We divided the sample according to whether or not the community

TABLE 5 Modified outcome.

Variables	(1)		(2)		(3)		(4)	
	Leave		No leave		No service		Service	
	Y <sub>1</sub>	Y <sub>2</sub>	Y <sub>1</sub>	Y <sub>2</sub>	Y <sub>1</sub>	Y <sub>2</sub>	Y <sub>1</sub>	Y <sub>2</sub>
Djh*treat	0.560** (2.33)	0.170*** (2.94)	0.236** (2.52)	0.006 (0.05)	0.779*** (2.76)	0.218* (1.74)	0.435*** (5.83)	0.087 (0.95)
Control variable	Control	Control	Control	Control	Control	Control	Control	Control
Constant	-2.820 (-0.30)	0.390*** (3.43)	-2.582*** (-11.61)	0.493 (1.00)	-2.990*** (-4.35)	0.120 (0.41)	-2.428*** (-13.10)	0.485 (1.66)
Individual fixed effect		Yes		Yes				
Province fixed effects		Yes		Yes				
Health status fixed effect					Yes	Yes	Yes	Yes

\*\*\*, \*\* and \* denote 1%, 5% and 10% significance levels, respectively.

provided production services and analyzed each subset in a separate regression. The results show that access to productive services in the community reduces farmland abandonment behavior. Our endeavor aims to not only establish famine experience as an underlying cause of farmland abandonment but also to delve deeper into potential avenues for alleviating this phenomenon.

## 6 Conclusions

Based on the China Labor-force Dynamics Survey (2016–2018), this paper explores the effect of famine experience on farmland abandonment using logit and DID models. The main conclusions are as follows. (1) Famine experience does significantly increase farmland abandonment behavior. (2) Farmers experiencing famine are more risk-averse, less trusting and less likely to invest in agriculture. (3) Farmers who have experienced the famine increase the extent of farmland abandonment because of migrant labor. However, the effect of famine experience on farmland abandonment is significantly reduced if the community provides production services.

The contractual rights to farmland are vested in farmers, which leads to fragmentation of farmland and diseconomies of scale in agriculture, making it exceptionally challenging to address abandonment. Famine experiences have made farmers deeply risk-averse, distrustful of external capital, and lacking in capital accumulation, hindering large-scale agricultural production. High information asymmetry, monitoring costs, and default risks in dealings with enterprises put farmers at a disadvantage, making it hard for them to defend their rights in conflicts. Fear of risks and lack of confidence make farmers hesitant to entrust their land to external enterprises. Therefore, we propose that communities provide outsourcing services for the agricultural production chain. Under this model, farmers still retain the right to manage their farmland, but outsource the production process to specialized community organizations, thereby significantly reducing transaction costs and risks. However, the lack of market dynamism of service organizations that undertake agricultural production, most of which rely heavily on policy support, is not a sustainable strategy in the long run. The crucial questions to

be addressed in future research include: How can the primary providers of production services bolster their internal vitality? And how can the intensity of policy support be accurately measured? These inquiries represent potential avenues for further exploration.

## Data availability statement

The datasets presented in this article are not readily available because the data used is from Chinese research and can only be used after application, I have no right to share it. Requests to access the datasets should be directed at: <https://isg.sysu.edu.cn/node/353>.

## Author contributions

LG: Conceptualization, Data curation, Investigation, Methodology, Software, Writing – original draft, Writing – review & editing. YZ: Conceptualization, Funding acquisition, Supervision, Visualization, Writing – review & editing.

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## Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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