



How risk perception and loss aversion affect farmers' willingness to withdraw from rural homesteads: Mediating role of policy identity

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ABSTRACT

Government-guided withdrawal from rural homesteads is a sustainable solution to the problem of vacant rural residential land. Nonetheless, few studies have considered the influence of risk perception and loss aversion on farmers' decisions to withdraw from rural homesteads, and even fewer have investigated the role of policy identity. Using fieldwork-collected primary data and a lottery-choice experiment from a reform pilot area of southwestern China, this study aimed to provide a new focus for risk perception and loss aversion in farmers' intention to withdraw from rural homesteads through policy identity. According to our findings, only 45.30 % are willing to withdraw from their homesteads. Farmers typically perceive two to three categories of risks among residence risk, livelihood risk, security risk, and policy risk. Only 29.28 % of respondents report a low level of loss aversion, with the remainder reporting a moderate or high level. More than half demonstrate a high level of policy identity. Most notably, after dealing with endogeneity, risk perception has a negative impact on farmers' intention to withdraw from rural homesteads, whereas loss aversion has a positive impact. Policy identity has a positive influence on farmers' intention, partially mediating the negative path of risk perception and entirely mediating the positive path of loss aversion. Robust concluding remarks advocate for the improvement of farmers' policy identity based on heterogeneous characteristics of risk perception and loss aversion, as well as a more individualized consideration of land withdrawal options.

1. Introduction

Rural land is a scarce resource and an important productive material [1]. Land assets have a stabilizing effect on the development of a region [2]. However, inefficient rural homestead utilization has resulted in a significant waste of rural land. China has undergone tremendous urbanization and industrialization since the economic reforms and opening in 1978, leading many farmers to commute to cities for work and even residence [3]. Between 1978 and 2021, China's urban population expanded from 17.92 % to 64.72 % [4]. Nonetheless, many rural homesteads for farmers are preserved, and even some families own multiple rural homesteads due to

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inheritance from their forefathers and other causes. Concurrently, a lot of rural homesteads confront vacancies. The vacancy rate of rural residential land has increased from 10%–15%–20% in China [5]. Moreover, the dual land system that incorporates distinct urban and rural registration systems has also frequently been cited as a hindrance to sustainable and efficient rural land use [6]. To address the challenges associated with idle rural homesteads, China's central government officially announced the policy reform of withdrawal from rural homesteads (WRH), selecting some cities and districts as pilot areas. However, farmers' voluntary and being compensated of withdrawal from residential land still needs to be further advanced [7].

As for factors influencing farmers' willingness to accept WRH, current research has concentrated more on features of households' resource endowments. Socioeconomic characteristics (e.g., age, education, farming type, income and living conditions), job considerations, the price of urban houses, economic compensation, and property rights status are more likely to be considered [8,9]. However, psychological elements are also emerging as key influencers on the withdrawal of farmers from homesteads, even though the current attention is centered exclusively on emotional attachment, psychological resilience and cognition [10–12]. Some scholars even believe that psychological factors are more significant to individual behaviour than demographic influences [13]. Therefore, while following the antecedent study in examining the influence of socioeconomic status on farmers' willingness to withdraw from homesteads, it is vital to add more psychological dimensions to the relevant exploration.

Differentiated initiatives suited to individual heterogeneity perception and preference are being required to increase farmers' incentives to participate in the withdrawal of residential land [10,11]. Undeniably, it is a risky choice for farmers to withdraw from rural homesteads. Risk perception, as has frequently been proven, can influence human behavioral intentions and decisions [14]. Slovic [15] defined risk perception as the process by which people rely on their intuition to judge and assess the risk of the unknown. In reality, farmers have their own distinct risk perceptions of specific WRH-targeted events. Overall, these are the four main risks farmers may face because of the WRH, related residence risk, livelihood risk, security risk, and policy risk [16–18]. Hence, the role of risk perception on farmers' withdrawal homestead behavior cannot be ignored.

On the other hand, risk preference is a key antecedent to individuals' perceived decisions and risky decisions [19]. According to Tanaka et al. [20], risk preference contains two dimensions: risk aversion and loss aversion. Several studies have explored the effect of risk preference on farmers' willingness to withdraw from homesteads, but they have continued to focus more on risk aversion while ignoring loss aversion [11,21]. However, loss aversion was found to have a greater impact on individual decisions than risk aversion [22]. When faced with the same degree of gains and losses, the behavioral decision-maker will be more sensitive to losses. Accordingly, the story of the impact of loss aversion on farmers' willingness to withdraw from homesteads needs to be supplemented urgently. Further, the influence mechanisms of risk perception and loss aversion on farmers' behavior are even less researched. In a nutshell, the impact of risk perception and loss aversion and how they affect farmers' willingness to withdraw from their homesteads should be investigated.

WRH is essentially the outcome of government policy aimed at steering a better balance of rural–urban land transition [23]. From the case study of Israel, the policy certainly could influence land use on the rural–urban fringe [24]. To be honest, policy influences land use and urbanization enormously in developing countries, and China, a highly centralized social system, is no exception [7]. In addition, policy identity, representing the degree of individual recognition of the policy, is viewed as a prerequisite and condition for practice during the implementation process of public policy [25,26]. Some studies have stressed the role of public support or participation on policy and governance directions in acquisition and land use decisions [27,28]. Therefore, there is an urgent need to boost farmers' willingness for WRH and further deepen the reform of the land system based on individual policy identity. Meanwhile, Tang et al. [29] considered the risks experienced by farmers in the process of withdrawing from homesteads to be related to farmers' trust in administrators and policies. However, the relationship between loss aversion and policy identity in the process of withdrawing from homesteads has not been explored. Hence, the role of farmer's policy identity in the potential impact of risk perception on farmers' willingness to withdraw from the homestead should be evaluated, and the role of policy identity in the influence of loss aversion on farmers' willingness is waiting to be investigated.

We attempt to compensate for the lack of previous research in the pilot area for rural residential land reform in southwestern China. We pose the following inquiries: Will farmers agree to practice WRH? In terms of risk perception and loss aversion, how would farmers respond to WRH? Does policy identity influence farmers' willingness, and what role does it play in the mechanisms by which risk perception and loss aversion influence this willingness? The responses to these questions will not only help us better understand farmers' various willingness for WRH, but will also provide some hints for policy reforms that solve inefficient rural residential land use and enhance rural–urban land transition.

Our study contributes to the growing literature on rural residential land policy evolution in China and other developing areas. First, we conduct fieldwork and a lottery-choice experiment to examine farmers' risk perception and loss aversion as well as determine their effects on farmers' willingness for WRH. Therefore, a new insight into the relationship between loss aversion and farmers' willingness to withdraw from homesteads would be provided. Second, we highlight the effects of policy identity on WRH and emphasize the utility of policy identity in the mechanism of risk perception and loss aversion effects on farmers' willingness to adopt WRH. It overcomes the restrictions of earlier studies that disregarded the paths of risk perception and loss aversion on farmers' willingness for WRH. Third, in order to complete a comprehensive study, we apply an interdisciplinary perspective of psychology and economics to identify key factors influencing their willingness for WRH. The IV-Probit techniques are utilized to address the endogeneity issues, and they yield more trustworthy and intriguing findings.

2. Theoretical background and hypotheses

The foundation of this study focuses on the condition that farmers' rural homestead withdrawal decisions are based on the

principles of being voluntary and compensated [10]. Most importantly, our study holds the opinion that farmers' willingness for WRH was affected by farmers' differentiation, and the differing psychological aspects deserve to be explored. Additionally, this study also presented the case that farmers' policy identity and willingness for WRH differ depending on the preference traits of the farmers [30]. Consequently, once farmers' policy identity is formed, psychological aspects such as risk perception and loss aversion will also impact them.

Taken as a whole, WRH is a risky investment for farmers because giving up their rural residential land could disrupt the current peaceful state. Overall, these are four main risks farmers may face because of the WRH, regarding residence risk, livelihood risk, security risk, and policy risk. Some farmers may have only one homestead in the countryside; thus, they may want to return to the countryside occasionally or when they are elderly. Depending on the function of homesteads, they may face a certain level of residential risk. Furthermore, WRH behaviour could be a significant external shock to farmers' livelihood systems, and if farmers are unable to adapt to new ways of accessing and switching resources, they may encounter challenges in the future [31]. In addition, homesteads also perform an important security function, providing a degree of safe shelter to farmers and the possible accompanying security of tenure [32]. There could also be policy risks here, and policy changes might affect farmers' interests [33]. Notably, planned behaviour theory suggests that cognition is required for behavioral decision-making [34]. In general, farmers who perceive a higher risk are less likely to take the risky alternative. It is noteworthy that the government's role of trust in the voluntary homestead withdrawal policy has been found to be interwoven with farmers' risk perceptions [29]. Hence, the greater the perceived risk, the more likely people are to disagree with the WRH policy and practice WRH. Based on these findings, the following hypotheses were proposed in this study.

H1. Farmers with high perceived risk are unwilling to follow WRH.

H2. Farmers' risk perception can weaken their sense of policy identity.

When tradeoffs are involved, individual preferences influence personal choice, leading to variation in observed behaviour [21]. According to behavioral economists, subject preferences have a significant influence on their behavioral decisions and are heterogeneous [35]. The preference that should receive more attention in experimental psychology and economics is loss aversion. Loss aversion was first introduced in the context of prospect theory by Kahneman and Tversky [36]. Meanwhile, several studies in recent years have revealed that loss aversion does not play the same role in human behavioral decisions as risk aversion [37]. Specifically, individuals demonstrate risk aversion in the gain domain and risk seeking in the loss domain. According to Liu et al. [10], villagers' withdrawal from rural homesteads is accompanied by the endowment effect, which is based on the exchange and valuation paradigm. Further loss aversion is a key dimension of the endowment effect through the bias of utility perception [38]. On the one hand, WRH is a risky option for farmers. They might demonstrate risk seeking to choose WRH on the basis that they lose their original living situation, their house, and so on. On the other hand, WRH is also an option for farmers to seek government policy compensation and welfare. Based on the exchange paradigm, they might also opt to trust government and policy for fear of not receiving the potential benefits that WRH might bring. Therefore, this study assumes that if farmers have a high level of loss aversion, they are also likely to be more willing to adopt WRH because of their reluctance to lose policy content as a loss. This leads to the following hypotheses.

H3. Farmers with a high level of loss aversion are willing to follow WRH.

H4. Farmers' loss aversion can enhance their sense of policy identity.

Policy identity has emerged as a vital aspect in ensuring that reform proceeds smoothly, especially those involving public participation in land-use policies [12]. The choice of identity is considered as the most crucial economic decision an individual ever makes [39]. There are various dimensions to the formation and evolution of policy identity [30]. Both cognitive and emotional support are key components in the process of developing an individual's policy identity [40]. Simultaneously, farmers' trust in the identity subject is an important foundation for the development of policy identity [41]. Furthermore, interests are always central to farmers' value judgment and emotional identity [6]. In terms of policy identity promotion, the more farmers recognize and embrace the policy, the more likely they are to have the intention and behave in accordance with the policy [42]. Therefore, we proposed the following hypothesis.

H5. Farmers with a high level of policy identity are willing to follow WRH.

Therefore, based on the above literature review and hypotheses, the following conceptual framework is proposed in our study, as portrayed in Fig. 1.

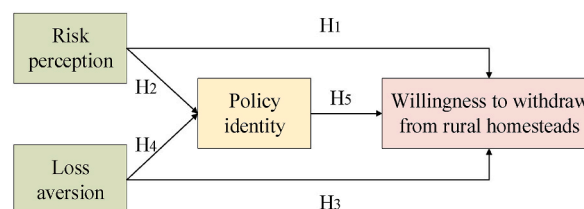


Fig. 1. Theoretical framework.

3. Methodology

3.1. Study area

This study chose Dazu District of Chongqing Municipality as the study area, as displayed in Fig. 2. Chongqing Municipality is located in southwestern China and has a rural population of 50.43 % [43]. Chongqing implemented the famous "land ticket" policy in 2008 to merge urban and rural land resources. Overall, every form of withdrawal from the homestead introduced by the government is based on the principles of farmers being voluntary and compensated. In general, the government compensates farmers based on the actual area, and the residential base reclamation standard is USD \$1124.80/hectare. Further, prior research indicated that WRH policy implementation increased rural resilience by 61 % in Chongqing, which had the lowest level among Guangzhou and Wuxi, with diverse economic development, land market development, and government regulation being the main contributors [44]. Furthermore, Li et al. [3] discovered that farmers in Chongqing received the least increase in welfare after rural residential land circulation when compared to more-developed regions, even though the welfare gap between rural and urban areas narrowed. Therefore, the WRH situation in Chongqing should be closely monitored.

Dazu District is situated in the western portion of Chongqing, and there were 556 thousand farmers, accounting for 51.93 % of the region's population in 2022. Dazu has 1436 square kilometers of land resources, and the land occupied per capita is 0.0042 ha, which is substantially lower than the national level of 0.5673 ha [4]. This indicates that Dazu District is a district with a large population and a small amount of land, as well as insufficient reserve resources. Specifically, the arable land in the district is 59330 ha with good soil quality, 99 % of which is rice soil and purple soil [45]. Most notably, Dazu District was one of the initial batches of 15 reform pilot areas for the residential land system in 2015, and it remained a pilot area for another year in 2017. It was Chongqing's lone pilot area before 2020 and was redesignated as a pilot area in September 2020. Therefore, this article selects the long-term pilot Dazu as the study area to examine its performance and make its experience available for national replication.

3.2. Survey and sampling

The study conducted an original survey in Dazu District in 2017. To verify the validity and representativeness of the survey data, a stratified and random sampling technique was adopted. Townships were first classified based on their population size and geographic location. Zhongao Township and Sanqu Township were chosen as representative areas. Three villages from each township were picked at random, with the likelihood of selection related to the pilot development and village population. Thus, the villages of Mingyue, Sanqiao, and Shuanxi in Zhongao Township and Shuixing, Banqiao, and Changping in Sanqu Township were selected. The number of household registrations determined the number of survey respondents in each village. Furthermore, Beijing Normal University in China reviewed and approved the study protocol. Prior to doing the survey, participants were required to sign an informed consent form. Anonymity and confidentiality for participants were guaranteed.

Face-to-face interviews with voluntary respondents were conducted by a survey team comprised of graduate students and village officials, and their responses were recorded in a paper-format questionnaire. At the same time, they were asked to complete a loss

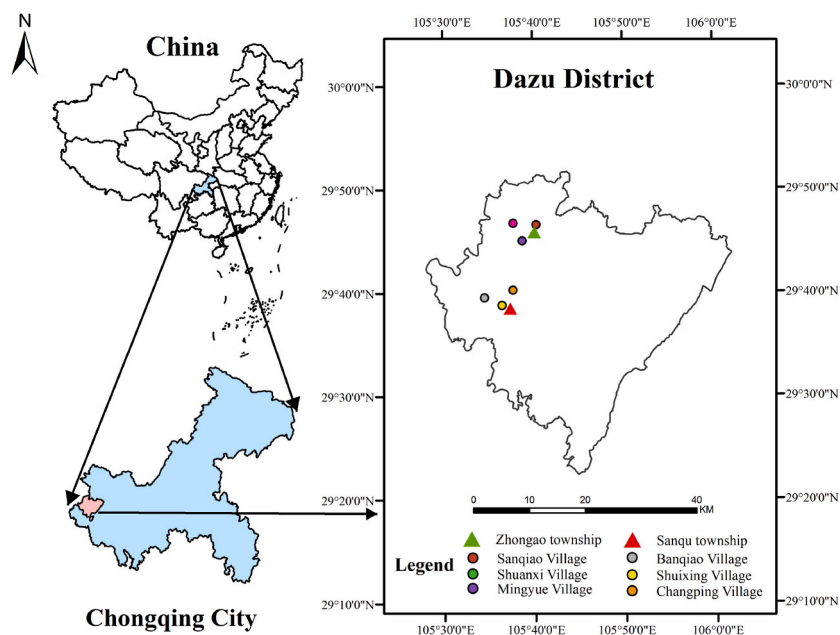


Fig. 2. Study area and location of survey sites.

aversion behavioral experiment. To compensate for respondents' time and efforts, each respondent received approximately USD \$2 in compensation for questionnaire answers and real experimental earnings after the investigation. Finally, after removing the questionnaires with numerous missing and inconsistent data, this sampling approach yielded a sample size of 240 farmers to be properly surveyed, and a total of 231 completed the questionnaire. Only 218 farmers completed both the questionnaire survey and the experiment. Therefore, the study obtained a final efficiency rate of 90.83 %. According to Sarmah and Hazarika [46], the required sample size was calculated to be 204 based on the number of agricultural populations in Dazu District, assuming a 95 % confidence level with 7 % precision. Hence, the sample size of our study was valid.

3.3. Survey design

3.3.1. Questionnaire design and variable description

The survey was conducted in July 2017, while the pre-investigation and pre-experimentation were carried out in June 2017. The loss-aversion experiment began immediately after the questionnaire. In reference to the preliminary inquiry, the formal questionnaire was constructed based on expert opinions and team discussions; thus, the questionnaire had adequate reliability and validity. It was finally separated into four portions. The first section dealt with farmers' willingness to participate in WRH. Members of the research team asked the farmers if they were willing to respond to government policy by withdrawing from their homesteads. Because the homestead withdrawal policy has been implemented on a pilot basis in the study area, this article was going to interview farmers about their future intention in a real-world scenario. Of course, their reasons for being willing to withdraw from their homesteads, as well as their reasons for not intending to withdraw, were documented.

The second component addressed risk perception. Respondents were asked to answer what risks they thought they would face if they supported the policy of voluntary withdrawal from their homesteads. These risks are primarily associated with the risks of residence, livelihood, security, and policy. Finally, the extent to which farmers perceive these four risks was used to assess risk perception. The value of this indicator ranged from 0 to 4, with 0 indicating that farmers did not perceive any kind of risk and 4 indicating that farmers perceived all risks. In addition, their preferred risk-averse strategies would be called into question.

The third section concentrated on farmers' identities toward the policy of withdrawing from residential land. This relates to several dimensions, such as farmers' support for the land withdrawal policy, the reasonableness and realizability of the compensation amount, and their trust in government departments in implementing the policy. The principal component analysis (PCA) was utilized to integrate the policy identity's numerous dimensions. The calculated Kaiser–Meyer–Olkin (KMO) and Cronbach's alpha values were used to estimate the validity of the analysis and to measure the reasonableness of the question item design.

Finally, the fourth component focused on farmers' socio-demographic information. According to Wang et al., Shi et al., and Hong et al. [47–49], this study mainly controlled these variables, such as gender, age, education, household income, population, home location, land, and current living situation.

Table 2 displays the meanings and values of all variables. All variables were also subjected to multi-collinearity testing. The results demonstrate that the average variance inflation factor (VIF) value was 1.31, which is much less than 10, indicating that our models are viable.

3.3.2. Lottery-choice experiment of measuring loss aversion

After completing the questionnaire, farmers would be instructed to complete the lottery-choice experiment to elicit loss aversion. We assessed loss aversion by refining and replicating the previous classic lottery-choice experiment conducted by Holt and Laury, Brick et al., and Liu et al. [50–52]. The experiment consisted of two series of 15 choices from the paired lotteries, with corresponding payouts shown in Table 1. Farmers would be asked to choose between Option 1 and Option 2. From choices 1 to 8, there was only one taken in Option 1, and the monetary value decreased from 200 to 150, 120, 100, 80, 60, 40, 20, with a certainty probability of 100 %. In Option

Table 1
The lottery-choice decisions measuring loss aversion.

Choice	Option 1				Option 2			
	Tokens (1)	Probability (1)	Tokens (2)	Probability (2)	Tokens (1)	Probability (1)	Tokens (2)	Probability (2)
1	200	100 %	—	—	200	50 %	0	50 %
2	150	100 %	—	—	200	50 %	0	50 %
3	120	100 %	—	—	200	50 %	0	50 %
4	100	100 %	—	—	200	50 %	0	50 %
5	80	100 %	—	—	200	50 %	0	50 %
6	60	100 %	—	—	200	50 %	0	50 %
7	40	50 %	—	—	200	50 %	0	50 %
8	20	50 %	—	—	200	50 %	0	50 %
9	60	50 %	−35	50 %	75	50 %	−65	50 %
10	55	50 %	−35	50 %	75	50 %	−65	50 %
11	50	50 %	−35	50 %	75	50 %	−65	50 %
12	45	50 %	−35	50 %	75	50 %	−65	50 %
13	40	50 %	−35	50 %	75	50 %	−50	50 %
14	40	50 %	−35	50 %	75	50 %	−45	50 %
15	35	50 %	−35	50 %	75	50 %	−40	50 %

Table 2
Variable definitions and summary statistics.

Variable name	Variable definition	Mean	Std. Dev
Dependent variable			
Willingness to withdraw from rural homesteads	Being willing to withdraw from rural homesteads (Yes = 1, no = 0)	0.453	0.499
Independent variable			
Risk perception	Risk anticipation regarding residence risk, livelihood risk, security risk, and policy risk with a scale from 0-no risks to 4-all four risks	2.226	0.943
Loss aversion	Loss aversion coefficient	2.686	2.698
Mediator variable			
Policy identity	An index extracted via factor analysis	0	0.910
Policy support	Supporting the homestead withdrawal policy (Yes = 1, no = 0)	0.594	0.492
Government trust	Thinking the government's current and future actions regarding homestead withdrawal will not harm everyone's interests (Yes = 1, no = 0)	0.778	0.417
Compensation reasonability	Thinking the compensation proceeds from the returned land can be reasonable (Yes = 1, no = 0)	0.567	0.497
Compensation realization	Thinking the compensation proceeds from the returned land can be realized (Yes = 1, no = 0)	0.618	0.487
Control variable			
Gender	Male = 1, female = 0	0.560	0.497
Age	Age of the respondents	57.047	12.722
Education	No formal education = 1, Primary school = 2, Junior high school = 3, High school and technical secondary school = 4, College and junior college = 5	2.214	1.018
Labor	Number of laborers in the household	3.154	1.509
Income	Household income (USD/month)	682.018	569.870
Big_name	Big name in the village (Yes = 1, no = 0)	0.543	0.499
Market_distance	Distance of the family from the market (km)	5.862	1.960
Village_infrastructure	Complete infrastructure in the village (Yes = 1, no = 0)	0.573	0.496
Village_environment	Residential environment in the village (scale ranging from 1-strongly dislike to 5-strongly like)	3.363	0.884

2, there were two types of gains: 200 and 0, both with a 50 % chance of occurring in the case of eight choices. As the difficulty of the task increased, Option 2 was more likely to result in a higher payout than Option 1, and there was a chance that it would not be paid. Then, for choices 9 to 15, Option 1 and Option 2 both corresponded to a 50 % chance of winning and a 50 % chance of losing. Option 2 always had a higher gain than Option 1, but it also had a higher potential loss with the same task. Option 1's gain value decreased from 60 to 55, 50, 45, 40, and 35 in that order, but the loss value was always -35; Option 2's gain value was always 75, but the loss value increased from -65 to -50, -45, and -40. In fact, Option 1 had a higher expected reward than Option 2 in choice 9. As the task progressed, Option 2 became more appealing than Option 1. At choice 12, Option 1 and Option 2 had the same expected benefit, and Option 2 had a higher expected benefit than Option 1.

To calculate loss aversion in our investigation, we used the R statistical package software. This essay accepts the assumption of Constantly Relative Risk Averse (CRRA). According to the prospect theory and prior work by Tanaka et al. [20] and Liu et al. [52], the utility function (1) can be expressed as:

$$U(x) = \frac{x^{1-\sigma}}{1-\sigma} \text{ if } x \geq 0 \text{ and } U(x) = -\lambda \times \frac{(-x)^{1-\sigma}}{1-\sigma} \text{ if } x < 0 \tag{1}$$

where x denotes the payoff amount, σ is risk aversion coefficient, and λ is loss aversion coefficient.

3.4. Data analysis

To gather and analyze survey data, this study employed the STATA 17 statistical package software. Generally, farmers' willingness to withdraw from residential land was measured on a binary scale (yes/no). Therefore, the binary probit regression model was chosen to examine the effects of risk perception and loss aversion on farmers' intention to withdraw from rural homesteads. According to Liu et al. [10], the simplified equation (2) was as follows:

$$Y_i = \ln\left(\frac{p_i}{1-p_i}\right) = \beta_0 + \beta_1 x_{1i} + \beta_2 x_{2i} + \beta_3 x_{3i} + \beta_n \text{Control}_{ni} + \varepsilon_i \tag{2}$$

where Y_i is the choice of the i th farmer's intention to withdraw from rural homesteads, which equals 1 if an individual chooses the option and 0 otherwise. The vector x_{1i} represented the i th farmer's risk perception, and x_{2i} was his or her loss aversion. The vector x_{3i} also denoted i th farmer's policy identity, and Control_i represented his or her characteristics that did not vary by choice (e.g., demographic controls). The coefficients β_n were the parameter estimates, and β_0 was the constant term. The random error term ε_i was assumed to follow the standard normal distribution.

For the mediating effects test, our study employed the stepwise regression method proposed by Baron et al. [53]. When the dependent variable was the mediating variable of policy identity, OLS model regressions were used to estimate parameters. Except for this, the coefficients were estimated using the Probit model when farmers' willingness to withdraw from the homestead was the dependent variable. In terms of an additional robustness test, this study used the Karlson-Holm-Breen (KHB) method proposed by

Breen et al. [54] for analyzing mediating effects in nonlinear probability models. As a result, the KHB methods were used to conduct the tests for re-examining the empirical results.

In addition, one of the study's primary explanatory factors, loss aversion, was generated independently by the field experiment, simply reflecting the psychological condition of farmers experiencing losses. The IV-Probit approach is primarily used in this work to address the skewed estimation findings caused by risk perception. Since both risk perception and farmers' willingness to withdraw from homesteads are subjective variables, which may be endogenously determined due to the presence of random measurement errors. Therefore, referring to Luo et al. [55] and Arora et al. [56], the adequacy of contact with villages was selected as the instrumental variable of the models in our study. The instrumental variable was defined as whether the respondent interacted with half of the people in the village on a regular basis. More communication with villagers would be effectively associated with the risk perceptions of the interviewed farmers because it is related to the risk perceptions of others through social network interactions. However, it is not directly correlated theoretically with respondents' willingness to withdraw from the homestead. As a result, this variable is consistent with the correlation and exogeneity assumptions of instrumental variables in the theoretical analysis.

4. Results

4.1. Demographic traits of the sample

Table 3 displays descriptive information about the sample's socioeconomic characteristics. Approximately 55.98 % of the respondents were male, with an average age of 57. The education level of most farmers was primary school, accounting for 42.31 %, followed by no formal education and junior high school, which comprised 25.21 % and 21.79 %, respectively. The overall average household size of the sampled respondents was approximately 5 people. The average amount of household farmland was 0.20 ha, while the ages of rural homesteads ranged between 33 and 34. In addition, the respondents' monthly household income was USD \$285.85.

4.2. Farmers' intention to withdraw from rural homesteads

Our survey results demonstrate that only 106 farmers (accounting for 45.30 %) were willing to withdraw from rural homesteads. In addition, the respondents were asked to indicate why they would be willing to withdraw from rural homesteads, as displayed in Fig. 3. The results show that 68.87 % of the respondents would be willing to follow the policy of WRH due to the village collective's advocacy and efforts. Half of farmers believed that WRH would help them receive more social insurance and other welfare policies. Approximately 28.30 % had purchased or planned to purchase a home in town, and the same proportion of farmers believed they could receive financial assistance. Only a small fraction of the respondents believed the homestead had been left unused for a long time and insisted that their behaviour would result in a more reasonable use of the land.

Moreover, farmers had some reasons for not being willing to withdraw from rural homesteads (see Fig. 4). Approximately 57.03 % of respondents thought the compensation for WRH would not be cost-effective. Almost half of the farmers were concerned about their capacity to adapt to their new lifestyle. Approximately 46.09 % were concerned about rising living costs, whereas 42.19 % were convinced that the homestead would provide them with security. Of course, 39.06 % were unaware of the policy, and 27.34 % were apprehensive that the subsidies would not be implemented. Approximately 18.75 % stated that their feelings regarding homesteads make them hesitant to leave, and only 8.59 % thought land values would rise.

Regarding the risk-averse strategy of homestead withdrawal, 47.64 % of farmers thought they could move to a townhouse, while 52.79 % thought they could rely on their offspring. Approximately 31.33 % would be willing to purchase commercial properties in town, and 30.47 % would be willing to apply for subsidized housing in towns. Only 29.18 % desired to replace their homesteads with new ones.

4.3. Effects of risk perception and loss aversion on farmers' intention to withdraw from rural homesteads

Farmers' risk perceptions and loss aversion as the key psychological variables were the determinants to be explored in our study. The respondents were questioned about their risk anticipation. In fact, 84.19 %, 64.96 %, 56.41 %, and 17.09 % of the respondents,

Table 3
Descriptive statistics of survey sample.

Demographic variables	Description	Mean	Std. Dev
Gender	Male = 1, female = 0	0.56	0.50
Age	Age of the respondents	57.05	12.72
Education	No formal education = 1, Primary school = 2, Junior high school = 3, High school and technical secondary school = 4, College and junior college = 5	2.21	1.02
Household size	Household population registered	5.22	2.05
Farm area	Arable land area (hectare)	0.20	0.13
Homestead age	Building age of oldest homestead	33.80	25.71
Income	Household income (USD/month)	682.02	569.87

Reasons for farmer being willing to withdraw from rural homesteads

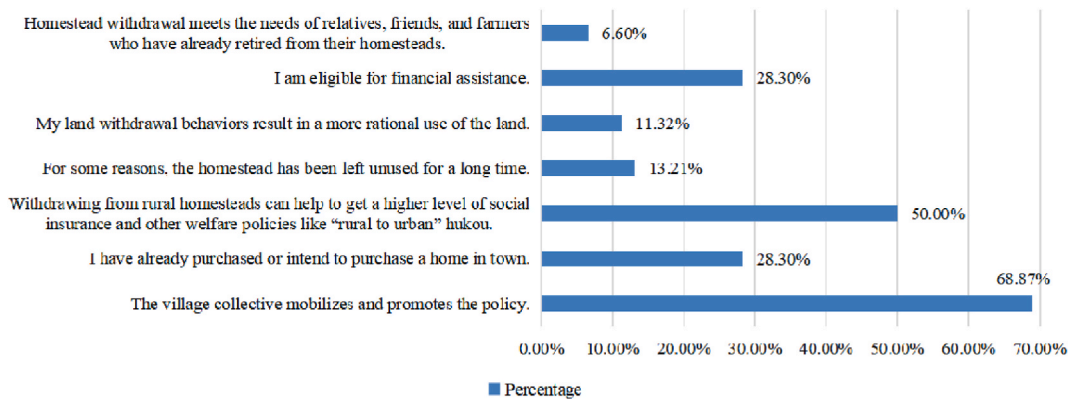


Fig. 3. Reasons for farmer being willing to withdraw from rural homesteads (sample = 106).

Reasons for farmer not being willing to withdraw from rural homesteads

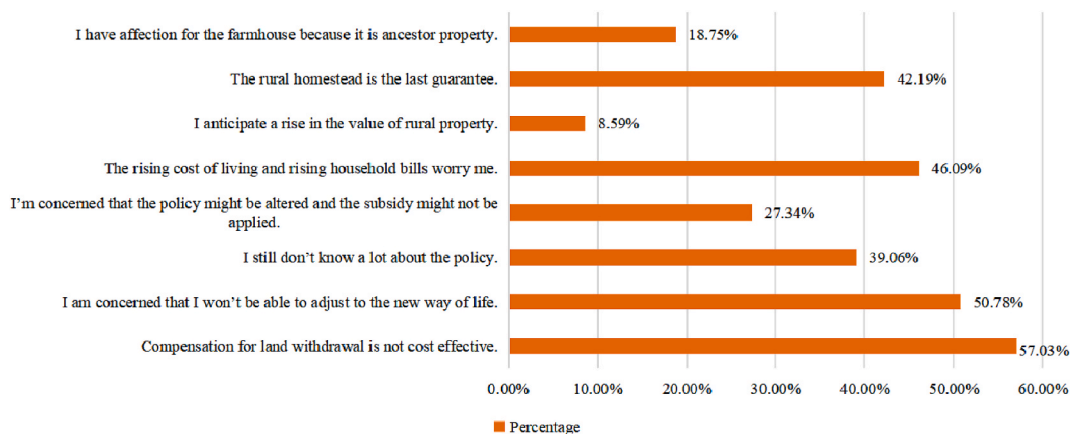


Fig. 4. Reasons for farmer not being willing to withdraw from rural homesteads (sample = 128).

respectively, thought they would face residence risk, livelihood risk, security risk, and policy risk. In total, approximately 4.27 % did not perceive any of the risks, while 6.84 % of the farmers perceived all four risks of withdrawing from their homesteads. While approximately 15.81 % perceived only one risk, 39.74 % and 33.33 % of the farmers perceived two and three types of risks. Furthermore, the mean value of loss aversion was 2.686, with a standard deviation of 2.698. Only 30.63 % of respondents reported a moderate level of loss aversion, 29.28 % reported a low level, and 40.09 % reported a high level.

Table 4 displays the effects of farmers' risk perception and loss aversion on their willingness to withdraw from rural homesteads. Models (1) and (3) represented the original models, while Models (2) and (4) showed the revised results with the addition of instrumental variables. The Wald endogeneity test values of Model (2) and Model (4) were 4.28 and 5.30, respectively, which were significant at the 5 % level, indicating that the original models had serious endogeneity problems and that the instrumental variable method was appropriate.

Meanwhile, weak instrumental variable tests were conducted in this study. As shown in Table 5, the regression coefficients of first-stage instrumental variables in Models (2) and (4) were -0.454 and -0.336, respectively, which were significant at 1 % and 5 % levels. This illustrated the correlation between instrumental variables and risk perceptions, and suggested that adequate information and social network relationships could diminish farmers' risky expectations about land withdrawal. The AR test values were 6.57 and 7.05, which were significant at the 1 % significant level, and the Wald test values were 4.52 and 3.33, which were significant at the 5 % significant level. These results suggested that there was no weak instrumental variable concern. As a result, for this investigation, the benchmark regression models for analysis were Models (2) and (4).

Most importantly, risk perception had a negative influence on farmers' intention, while the loss version had a positive effect on their willingness. Therefore, H1 and H3 were not denied. However, according to the level of significance of the coefficients, farmers'

Table 4
Estimations of risk perceptions and loss aversion on willingness of withdrawing from rural homesteads.

Variable	Willingness to withdraw from rural homesteads			
	Model (1) Probit	Model (2) IV-Probit	Model (3) Probit	Model (4) IV-Probit
Risk perception	−0.264***(0.095)	−1.200**(0.564)	−0.296***(0.106)	−1.892**(0.967)
Loss aversion	0.062*(0.034)	0.103**(0.046)	0.055*(0.031)	0.124*(0.068)
Gender			0.195(0.216)	−0.242(0.423)
Age			0.018*(0.010)	0.024*(0.017)
Education			0.146(0.119)	0.105(0.175)
Labor			0.119*(0.065)	0.309*(0.159)
Income			0.015(0.020)	0.020(0.034)
Big_name			−0.592*(0.354)	−0.680*(0.413)
Market_distance			0.080*** (0.027)	0.082*** (0.030)
Village_infrastructure			−0.031(0.220)	−0.024(0.326)
Village_environment			−0.232***(0.790)	−0.376***(0.197)
Constant	0.332(0.231)	2.290*(1.190)	−0.588(0.790)	3.338(2.802)
Log pseudo likelihood	−145.346		−132.607	
Wald chi ²	10.06***	6.19**	32.04***	18.21***
Pseudo R ²	0.035		0.127	
# of observations	218	218	216	216
Wald test of exogeneity		4.28**		5.30**

Note: Standard errors are in parentheses; *p < 0.1, **p < 0.05, ***p < 0.01.

Table 5
Weak instrument robust tests and confidence sets for IV-probit.

Tests	Model (2)	Model (4)	Model (8)
Coefficient of instrumental variables in first-stage regression	−0.454*** (0.151)	−0.336** (0.159)	−0.309** (0.153)
AR	6.57***	7.05***	5.27**
Wald	4.52**	3.33**	2.60**

Note: Standard errors are in parentheses; *p < 0.1, **p < 0.05, ***p < 0.01.

risk perception played a more important role in their willingness to withdraw from the homesteads than loss aversion. In terms of control variables, interviewees who were older and had more labor in the household were more likely to follow the policy. Similarly, respondents who had large surnames and who were satisfied with the village environment were also less likely to withdraw from residential land. Furthermore, respondents whose homesteads were further from the market were more likely to be interested in withdrawing from rural homesteads.

4.4. Mediating effects of policy identity on farmers' intention to withdraw from rural homesteads

In terms of policy identity, approximately 59.40 % of the respondents supported the withdrawal of the residential land reform policy. Regarding farmers' existing or expected perceptions of the government's behaviour in terms of homestead withdrawal, 77.78 % believed that the government would be benevolent and act in the public interest. Approximately 56.65 % of the farmers viewed the current compensation proceeds for land withdrawal as reasonable. Approximately 61.80 % felt the compensation proceeds from the returned land would be realized. PCA was employed to deintegrate information from the four variables to synthesize a new

Table 6
Key results of the mediator model.

Variable	Policy identity	Willingness to withdraw from rural homesteads		
	Model (5) OLS	Model (6) Probit	Model (7) Probit	Model (8) IV-Probit
Risk perception	−0.235***(0.062)	—	−0.219***(0.111)	−1.852*(1.079)
Loss aversion	0.068***(0.019)	—	0.025(0.039)	0.123(0.088)
Policy identity	—	0.696***(0.108)	0.651***(0.113)	0.269****(0.319)
Constant	−0.129***(0.488)	−1.206*(0.724)	−0.579(0.836)	3.091(2.849)
Control variable	Yes	Yes	Yes	Yes
Root MSE/Log pseudo likelihood	0.860	−127.026	−115.735	
F/Wald chi ²	5.20***	60.39***	67.66***	31.72***
R ² /Pseudo R ²	0.152	0.203	0.222	
# of observations	215	231	215	215
Wald test of exogeneity				4.24**

Note: Standard errors are in parentheses; *p < 0.1, **p < 0.05, ***p < 0.01.

comprehensive indicator for policy identity. The method can help reduce potential multicollinearity caused by the simultaneous introduction of the four individual variables while also maximizing the information collected. The test value of KMO validity for policy identity was 0.736, and the Cronbach's alpha was 0.838, indicating that the variables are appropriate for the integration analysis.

According to the stepwise regression method, our study introduced the variable of policy identity in the empirical model, as shown in Table 6. As shown in model (5), risk perception had a negative impact on policy identity, whereas loss aversion had a positive impact. That is, farmers' policy identities were significantly affected by risk perception and loss aversion. Thus, H2 and H4 were not rejected. Model (6) demonstrated that respondents' policy identity influenced their willingness to withdraw from rural homesteads. H5 was also not rejected. Model (7) presented the results of the factors determining respondents' withdrawal from the homestead presented by Probit after adding the mediating variables. Model (8) demonstrated the comparable estimation results of IV-Probit incorporating instrumental variables. The Wald endogeneity test value of model (8) was 4.24 with a significant level of 5 %, showing that model (7) did have an endogeneity problem. From Table 5, the regression coefficient of the first-stage instrumental variable in model (8) was -0.309 , which was significant at the 5 % significant level. From Table 5, the AR test value was 5.27 and Wald test value was 2.60, which were all significant at the 5 % significant level, indicating that there was no weak instrumental variable problem. When comparing model (7) to model (3) and model (8) to model (4), we noticed that the absolute values of the risk perception and loss aversion coefficients were reduced. The coefficient of loss aversion became insignificant, confirming the existence of a full mediation effect. Therefore, the coefficient of risk perception supported the existence of a partial mediating impact, while the coefficient of loss aversion indicated the existence of a full mediating effect.

Additionally, the KHB test also revealed the existence of mediating effects for the sample. For the mediating path of policy identity for risk perception, the mediating effect was -0.222 , with a significant value of 0.001, a direct effect of -0.290 , which was significant at the 10 % level, and a total effect of -0.512 , which was significant at the 1 % statistical level. Moreover, concerning the mediating path of policy identity for loss aversion, the mediating effect was 0.064, which was significant at the 5 % level; the direct effect was 0.025, which was not significant; and the total effect was 0.089, which was significant at the 10 % statistical level. The results of these tests imply that policy identity partially mediated the mechanistic effects of risk perception and entirely mediated the loss aversion on farmers' willingness to adopt WRH. This is consistent with the findings of the stepwise regression mediation test discussed above.

5. Discussion

Less than half of the farmers in the study area were willing to follow the WRH, suggesting that differentiated policy incentives are needed in the future. Most individuals would prefer to rely on relatives, friends, and children if the residential land was retired. Almost one-third will choose to utilize the compensation to purchase city housing and live in subsidized housing. Subsidized urban dwelling that is environmentally sound and geographically accessible could be a breakthrough in attaining the efficient land use of "one rural homestead" for rural residents [57,58]. Furthermore, some residents wanted their homesteads to be replaced with new residences under the government's construction. Additionally, supporting insurance and social benefits should also catch up in a timely manner [3]. Farmers' main concerns were the costs and benefits of adhering to the WRH, emphasizing that compensation and resettlement programs should be more appropriate to farmer realities [59]. Farmers' local feelings (*Xiangtu emotion*) and fear of unfamiliar surroundings should also be improved through pro-familiar environment enhancement in new settlements [10].

Worse still, the greatest risk perceived by farmers is residence risk, followed by livelihood risk, security risk, and policy risk. More than half of the people considered there were residence risk, livelihood risk, and security risk for their behaviors in the WRH. In total, approximately 73.07 % of the farmers perceived two or three types of risks, and 6.84 % of the farmers perceived all four risks of withdrawing from the homestead. The study's findings are consistent with earlier research, reflecting farmers' concerns about withdrawal risks [21]. In reality, many urban migrants expect to return to the countryside to retire when they do not work in the city or reach retirement age. They are still anxious about the stability of urban jobs, thus rural land can serve as a last-resort security and livelihood strategy [60]. Our data also suggest that risk perception had a negative impact on farmers' WRH, implying that higher risk anticipation may discourage farmers' willingness to withdraw from their rural homesteads. This is consistent with the majority of studies that have demonstrated that risk perception prevents people from taking risks [61]. This indicates that homestead withdrawal is truly a risky option for farmers, which enriches the literature on the relationship between risk perception and land usage [62,63].

Moreover, the mean value of the loss aversion parameter was 2.69, which is extremely close to the findings of 2.63 by Tanaka et al. [20], showing that individuals value losses more than equivalent gains [64]. Hence, under risk contexts, it has considerable practical and theoretical value to study loss aversion in relation to farmers' willingness to withdraw from homesteads. Further, in our study, loss aversion was found to have a positive effect on farmers' WRH. First of all, it's presumably because farmers were more concerned about losses and thus exhibited ultimate risk-seeking. Their loss-aversion may make them more willing to withdraw from their homesteads. Then, it is also feasible that farmers are afraid of facing losses under alternative selection risks. That is, if they do not withdraw from their homesteads, they may not obtain government compensation or benefits such as insurance. Previous research has also shown that loss aversion may allow people to exhibit risk-seeking in actual decision-making [37]. In addition, Lamorgese and Pellegrio [65] linked loss aversion with housing appraisal and believed that loss aversion was considered a driver of downward price rigidity in real estate markets, although Greenaway-McGrevy and Sorensen [66] found that loss aversion significantly inflated transaction prices. Consequently, this study is also considered a meaningful exploration of the connection between loss aversion and farmers' willingness to withdraw from homesteads.

In addition, the advocacy and work of village leaders were determined to be the most essential contributors to the generation of willingness. Less than one in five farmers perceived a policy risk, which is consistent with the high levels of government trust and policy identity in our study. Farmers, on the other hand, are not well versed in land regulations and land-return policies. Farmers'

strong level of trust in government officials and village collectives consequently positively influences policy identity. Farmers' trust in politicians and policymakers may stem from previous favorable experiences [64,67]. Most crucially, farmers' policy identities were discovered to boost their propensity to adopt WRH. This is in accordance with the findings of Cai et al. and Zhao et al. [21,68]. Interestingly, our study also found that policy identity partially mediates the negative path of risk perception and totally mediates the positive path of loss aversion. This is presumably linked to the fact that risk perception diminishes farmers' identification with the policy. However, loss aversion enhances farmers' identification owing to not wanting to lose the benefits of the policy. These findings illustrate the tremendous role of risk perceptions and preferences in policy identity [69]. Indeed, each person's policy identity is distinct. Simultaneously, each person's policy identity develops during policy execution and is constantly transformed as knowledge, capability, policy rationality, interest expectations, and institutional norms change [12]. Therefore, a targeted policy program and suitable implementation process are the ultimate ways to promote the rising willingness of WRH [70].

Our findings also reveal that individuals with a different sociodemographic status lead a different willingness to withdraw from homesteads. The farmer who was older, was more willing to withdraw from the homestead. This may be because elderly people do less agricultural work and are consequently less dependent on the land and would prefer to receive some compensation or move to a town for their old age [16]. Our findings are also consistent with those of Wang and Kang [71], who also found that households with more laborers were more likely to adopt this policy. The more young laborers there are, the more likely families are to work and live in the city. At the same time, if the respondent had a big surname, the possibilities of his reluctance to withdraw from the homestead increased. This may be related to the fact that the farmer has stronger social network ties and more kinship dependence in the village. Conversely, farmers who lived further away from the market were more willing to withdraw from the homestead, perhaps because of the current inconvenience of living there [72]. In line with earlier studies by Liang et al. [73], the current state of settlement in villages, such as the environmental situation, is also an essential factor determining the willingness of farmers.

6. Conclusions and policy implications

This study investigates how risk perception and loss aversion influence farmers' intention to withdraw from rural homesteads through policy identity. Our findings indicate that only 45.30 % are willing to withdraw from rural homesteads. Approximately 39.74 % and 33.33 % of the farmers perceived two and three types of risks associated with withdrawing from rural homesteads, respectively. Only 29.28 % of respondents reported a low level of loss aversion, while 30.63 % and 40.09 % demonstrated moderate and high levels, respectively. More than half of respondents express a high level of policy identity, indicating strong support for the policy, trust in the government, and a belief that compensation is reasonable and attainable. The empirical results suggest that risk perception and loss aversion have significant effects on residents' willingness. Farmers who perceive greater expected risks are less likely to withdraw from their homesteads, whereas farmers who are loss-averse are more willing to implement the policy. Further, the farmers' intention is positively affected by the policy identity. The most noteworthy finding is that policy identity partially mediates the negative path of risk perception on farmers' intentions to withdraw from homesteads while fully mediating the positive path of loss aversion on these intentions. In addition, farmers' sociodemographic characteristics, such as age, gender, labor and residence status are also important factors influencing farmers' willingness to withdraw from rural homesteads.

The outcomes of this study have substantial policy implications for supporting farmers' voluntary withdrawal of rural residential land with compensation. First, given that adequate information and social networks can mitigate farmers' risk perception, the government should ease farmers' risk concerns about withdrawing from rural residential land through more active advocacy and positive messaging. Additional risk mitigation measures, such as providing subsidized housing, boosting income sources, upgrading the new living environment for speedier familiarization, defining suitable supplemental standards, and promoting social welfare benefits, should be strengthened. Second, considering that loss-averse farmers are more inclined to seek risk and are willing to leave their homesteads, tailored implementation programs should be developed based on individual loss preference characteristics to better implement this voluntary withdrawal policy of farmers from homesteads. Third, increasing farmers' sense of policy identity is required to care about their level of risk perception and loss aversion. To gain greater trust, policymakers must do what they say in the implementation of specific programs, behave properly, and fairly regard farmers' interests in the ordinary course. Finally, to further raise farmers' enthusiasm, their diverse socio-demographic features and endowments should be considered. More household-specific surveys and targeted land withdrawal initiatives should be available to farmers.

Although our study did provide some results, there are still certain limitations that will be looked at in subsequent research. First, this study explores a small sampling study of a western Chinese region, and the survey data were gathered in 2017. Despite the study area's high practical value as the long-term process of pilot region and small sampling is widely employed in previous research, more evidence should be evaluated in the wider context of China in the future. Second, our calculations on loss aversion are based on prospect theory and the utility function of the predecessor. However, there are hints that loss aversion differs in more flexible models, where curvature is determined independently in the gain and loss domains [74]. Consequently, it is conceivable to employ Cumulative Prospect Theory to allow for varied weighting functions for gain and loss in future studies. Third, the focus of the study is on the effect of loss aversion level on the willingness of farmers, which has gotten less attention in prior studies. Also, in order to prevent probable interactions between risk perception and risk aversion, as well as loss aversion and risk aversion, risk aversion is not incorporated into our investigation. Hence, the impact of risk aversion on farmers' willingness to withdraw from rural homesteads, especially for rural households in developing countries, is worthy of greater public attention in future studies. Finally, this study only concentrates on and controls a few variables that may affect the willingness of farmers to withdraw from homesteads. While risk perception and policy cognition strongly explain the motivation for farmers' behavioral intentions, loss aversion affords only a partly motivated explanation. Indeed, more determinants of farmers' willingness to withdraw from homesteads, such as geographical elements, social development

considerations, and more psychological and socioeconomic characteristics for farmers, should be researched in the future.

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Additional information

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Data availability statement

The data that has been used is confidential. Data generated and utilized for analyses of results presented in this manuscript are available from the corresponding author on reasonable requests.

CRediT authorship contribution statement

Rui He: Conceptualization, Formal analysis, Funding acquisition, Investigation, Methodology, Project administration, Software, Visualization, Writing - original draft, Writing - review & editing. **Yuhang Dai:** Formal analysis, Investigation, Software, Writing - original draft. **Guiyan Sun:** Data curation, Investigation, Methodology, Software, Visualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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