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Research on Practical Dilemmas and Solution Paths of Homestead Withdrawal in Traditional Agricultural Areas

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SUMMARY: *Due to the limitations of economic structure and social level development, it is difficult to carry out the work of withdrawing from homesteads in traditional agricultural areas because of the weak willingness of farmers to withdraw on a large scale. Based on the survey data of 25 townships in S County in traditional agricultural areas, this paper proposes 15 explanatory variables from four levels: personal and family characteristics, homestead characteristics, risk expectations, and expectations of security and compensation. Combined with the results of logistic regression analysis, we initially identified 13 variables that have a significant impact on farmers' willingness to withdraw from homesteads, and summarized the main dilemmas faced by the withdrawal of homesteads in traditional agricultural areas. Taking the government policy and the willingness to withdraw from homesteads as the game subjects, a two-party evolutionary game model of local government-farmers is constructed based on the interest orientation of the two. Setting up the evolutionary game simulation experiments with different influencing factors, analyzing the decision-making orientation and game stability of the game subjects, in which the government's decision not to withdraw from the farmer's decision to punish the strength or compensation for the farmer's withdrawal of the strength of the largest, are able to produce the probability of the farmer choosing not to withdraw from the strategy of the effect of converging to 0, and respectively, in the 60, 15 units of time to begin to stabilize. Accordingly, the government should design a positive incentive mechanism with rich economic compensation content and high compensation level, and a negative incentive mechanism based on economic pressure, both of which work in tandem to promote the willingness of traditional farmland residents to withdraw from homesteads.*

KEYWORDS: *homestead withdrawal; evolutionary game model; logistic regression; incentive mechanism*

1 Introduction

Traditional agricultural areas are the main grain producing areas in China, generally far from cities, mainly focusing on grain crop cultivation, small farmers are still the main body of agricultural operation, and farmers' family income mainly comes from the wage income obtained by going out to work [1, 2]. The withdrawal of traditional farmland is a major problem to be solved in the process of urbanization and modernization, as well as the process

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of economic, social and cultural change and remodeling [3]. However, the withdrawal of homesteads in traditional agricultural areas is faced with severe practical dilemmas, in addition to the lack of compensation funds for the withdrawal of homesteads, the lack of motivation for the use of homesteads after the withdrawal of homesteads, and the obstacles faced by the process of farmers' civilization, and other dilemmas, as well as psychological dilemmas [4, 5]. In practice, there are many misunderstandings in the reform of traditional agricultural areas' residence base withdrawal, such as residence base property, residence base for centralized housing, residence base for social security, residence base for housing ticket and compensation, etc., which not only makes it difficult to effectively promote the withdrawal of traditional agricultural areas' unused residence bases, but also harms the interests of farmers [6, 7]. Regarding the factors affecting the withdrawal of residential base in traditional agricultural areas, the literature [8] analyzed the factors affecting the farmers' willingness to withdraw from residential base, and through field survey and case study analysis found that the farmers have a strong willingness to land property rights, but there are differences in the implementation of the system, the area of the over-sized, multi-residential and other real problems, and their concerns mainly include the reduction of employment, the lack of social security, the low compensation standard and the decline in the standard of living, etc., and they are inclined to the allocation of residential They tend to favor the allocation of residences as a form of compensation, while focusing on public and infrastructure support. Literature [9] emphasized the importance of farmers' homestead withdrawal for intensive land use in the context of sustainable development, and based on a field survey in Dongtai, Jiangsu Province, analyzed the relationship between the migration process of farmers and their willingness to withdraw, and found that the willingness to withdraw was highest in the residential migration stage, lower in the employment transition stage, and gradually weakened in the life integration stage, presenting a non-linear characteristic. Literature [10] points out that the withdrawal of homestead is the key to community restoration, and analyzes the villagers' willingness to withdraw based on a multi-layer framework, and finds that their expectation of the future is the core influencing factor, and there is a difference between different families and regions.

In addition, based on Jilin survey data, literature [11] analyzed the vacancy rate of homesteads and farmers' willingness to quit in Northeast China, and found that the vacancy rate rises with the increase of the distance of the village from the city, and farmers who settled in the city have the highest willingness to quit, and their willingness is affected by the factors of policy awareness, perception of interests, perception of living environment and family characteristics, which are of decreasing importance in the order of their significance. Literature [12] explored the spatial characteristics of the willingness to withdraw from homesteads and the influence of risk-carrying capacity based on the data of farmers in Jiangsu Province, and found that subjective norms, behavioral attitudes and other positive effects, and the risk-carrying capacity of the double-threshold effect, which divides the region into five categories of core priority, key reforms, and so on, and provides a basis for differentiated governance. Literature [13] external environment has an important impact on the willingness of farmers to withdraw from the homestead, based on Wuhan, Suizhou 392 farmers data, examined the mechanism of its role, empirical evidence found that the number of homesteads, location and economic conditions of the withdrawal of the willingness to have a positive impact on the withdrawal of the effect of the diminishing effect of the villages with no tourism resources farmers are more inclined to withdraw. Homestead is an important property of rural families, but also the farmers' livelihood, homestead withdrawal is related to the vital interests of hundreds of millions of farmers and social stability, so it is necessary to consider the mobility of homestead, but also consider the fairness of the withdrawal results [14, 15].

Cracking the dilemma of the traditional agricultural areas of residential base withdrawal reform, need to avoid walking into the practice of misunderstanding, it needs to be based on the different stages of economic and social development, combined with the resource endowment of different regions to take different countermeasures [16, 17]. In addition, the withdrawal of homesteads needs to be supported by the process of industrialization and agricultural modernization, and it also needs to be guaranteed by the continuous improvement of education, medical care and pension system [18, 19]. In the short term, the government may need to provide some financial support to solve the problem of the withdrawal of residential land, but in the long term, it is not only conducive to promoting the process of high-quality farmers' citizenship, and is conducive to the realization of the goal of agricultural modernization, but also the realization of the common wealth of the due sense of the topic [20, 21].

As for the related research on the solution path to the dilemma of homestead withdrawal in traditional agricultural areas, the literature [22] examined the impact of family migration on the willingness to withdraw from the homestead and the preference for compensation programs, based on survey data from 11 provinces, found that the increase in the scale of migration significantly improves the willingness to withdraw, but the willingness to decline in the later stage, and the impact of the existence of regional differences, and at the same time, the migration makes the farm households more preferable to the comprehensive compensation of cash and the household towns and provides policy basis for the improvement of the This provides a policy basis for improving the property rights system and reducing the difficulty of exit. Literature [23] pointed out that resilience has become an important concept for understanding rural development, through co-citation analysis and literature review, constructed a resilience assessment system covering four dimensions of engineering, ecology, economy and society, used to evaluate the impact of the rural residential base withdrawal policy on rural resilience, and emphasized that taking into account the market to optimize the allocation of resources and appropriate government regulation is an effective path to enhance rural resilience. Literature [24] takes Qingshui County in Gansu as an example, analyzes the influence mechanism of farmers' willingness to withdraw from homesteads based on the theory of perceived value and 1,025 microdata, points out that risk perception and comprehensive satisfaction have a negative impact on the withdrawal, and divides farmers into four categories of high-risk avoidance based on the framework of “psychological perception-emotional cognition” to provide a decision-making basis for the categorization of governance. It also classifies the farmers into four categories based on the framework of “psychological perception and emotional cognition”, which provides a basis for decision-making.

Meanwhile, the literature [25] in order to alleviate the contradiction between the supply and demand of urban and rural construction land, the state guides the withdrawal of homesteads through the compensation policy, and the study found that differentiation is the key influencing factor, and analyzed the withdrawal willingness from the perspective of differentiation by taking Kuning Kui Keng Village as an example, and found that the higher the level of income differentiation, the lower the withdrawal willingness, and the health, the willingness to change the identity, and the confirmation of property rights are positively correlated with the withdrawal willingness, which emphasizes the villager's psychological characteristics, differentiation and policy characteristics jointly affect the exit decision. Literature [26] emphasized that the imbalance between the supply and demand of unused homesteads threatens food security and ecological sustainability, and analyzed the influencing factors of farmers' willingness to quit by combining the Theory of Planned Behavior with the framework of rural migration, and found that age, income, number of homesteads, and

purchase of houses in towns have significant impacts, and that the policy compensation, livelihood security, and material needs and local sentiment are the key considerations, which emphasized that the establishment of a multiagency, individualized, and comprehensive policy system should be based on the actual needs of the farmers. It is emphasized that a multi-body, personalized and comprehensive policy system should be established based on the actual needs of farmers. Literature [27] indicates that in recent years, compensated withdrawal of homesteads has become an academic hotspot, but the discussion from the perspective of farmers' rights and interests protection is still insufficient, and based on 324 judicial cases, it emphasizes that farmers' autonomy should be respected, political rights should be safeguarded, and the dual value of housing and social security of resettlement compensation should be paid attention to and the dispute settlement mechanism should be optimized in order to achieve a balance between farmers' near-term and long-term interests. Literature [28] pointed out that unused homesteads are a waste of resources and affect farmers' lives, and based on remote sensing images and participatory assessment, analyzed the supply and demand relationship of homesteads in traditional agricultural areas, and found that there is a significant difference between supply and demand and a large potential for unused homesteads, emphasizing that exit and renovation strategies should be formulated based on supply and demand, building quality and farmers' willingness to adapt to the reality of rural revitalization.

In this paper, County S was selected as the study area, and a questionnaire survey was conducted on farmers in the area to obtain relevant data on the practice of homestead withdrawal. Based on the survey, research variables are set, and correlation analysis and covariance diagnosis are used to determine the reasonableness of the structure and content of the research variables. Based on the research data, regression analysis is conducted to summarize the factor variables that have a more significant influence on farmers' willingness to withdraw from homesteads. The research hypothesis of government policy action and farmers' willingness to withdraw from homesteads is proposed and a game model is constructed, and the results of the simulation analysis of the model evolution game are combined to give a path to improve farmers' willingness to withdraw from homesteads.

2 A Study of Practical Dilemmas Based on the Willingness to Withdraw from Homesteads

2.1 Study Sample and Data Acquisition

2.1.1 Overview of the study area

In this paper, the S county region in a large agricultural province is selected for research. At the provincial level, the province has the largest total amount of rural residential land, and County S is located in a typical traditional agricultural area in the province, with a huge number of migrant workers, and the phenomenon of large-scale idle residential land generally exists. Due to the lack of geographic and economic advantages, there are not many opportunities to profit from the transfer of residential land, and thus paid withdrawal may be a better choice for farmers to realize the property function of residential land. In addition, County S is an important core area for food production, and the county has basically completed the work of confirming and certifying the rights of homesteads. The local area has the typical characteristics of a traditional farming area in the plains, with many people and little land, and only one acre or two or three minutes of land per capita, which is not conducive to the development of large-scale agricultural production, so it is still dominated by

the small-farm economy. Under the impact of the market economy in the 1990s, most of the RII generation farmers in the county went out to work and entered factories, and the differentiation of farming households was remarkable. These RII generation farmers mostly choose to go out to work and do business, in the form of either a couple at the same time to go out, working in the city for many years or even settled; or the male head of the household to go out alone, the wife at home to take care of the old and young farming. There are also some farmers who run businesses and do odd jobs in their neighborhoods, making them typical part-time workers. Individual RII-generation farmers have contracted hundreds of acres of land in their villages, employing part-time workers to grow cash crops such as three cherry peppers, and have become large agricultural households. At the same time, the economic underdevelopment and the prevalent "favoring sons over daughters" mentality during the 1990s, which led to a large number of families choosing to have sons, also contributed to the high "marriage costs" in the rural areas of this county. The "exorbitant bride prices" and the purchase of wedding houses in the county center are the true reflections of the current rural marriage market in S County.

2.1.2 Data sources

A questionnaire survey was used to collect information, and the valid data collected were used for the statistical analysis of the sample and empirical analysis of the mechanism of the impact of rural farm household division and intergenerational exploitation on the willingness of farm households to withdraw from homesteads in County S. From May to June 2023, this paper carried out a field research for a total of 25 townships within the jurisdiction of County S. On the basis of determining the survey area, a two-stage sampling method was used. A total of 362 survey samples were obtained from the field research, and 339 valid samples were obtained after screening, with an effective rate of 93.65%. In order to avoid ambiguity, the phrase “voluntary and compensated withdrawal” was emphasized when asking about the willingness to withdraw.

2.2 Statistical and regression analysis of the willingness to withdraw from the homestead of the sample

2.2.1 Statistics on study indicators and sample characteristics

Combining the existing studies and the questionnaire survey, a total of 15 explanatory variables are proposed from four levels of personal and family characteristics, homestead characteristics, risk expectations, and expectations of protection and compensation, and the variable numbers and measures are as follows:

(1) Individual and family characteristics

(v1) Gender: female=0, male=1.

(v2) Age: less than 30 years old = 1, 31-40 years old = 2, 41-50 years old = 3, 51-60 years old = 4, 61 years old and above = 5.

(v3) Education level: elementary school and below = 1, middle school = 2, high school = 3, college and above = 4.

(v4) Annual household income: Below 10,000 yuan = 1, 10,000 - 20,000 yuan = 2, 20,000 - 30,000 yuan = 3, 30,000 - 50,000 yuan =

(v5) Number of household members: 1-3 persons = 1, 4-6 persons = 2, 7 or more persons = 3.

(2) Characteristics of homestead

(v6) Size of homestead: 0-100m2=1, 101-150m2=2, 151-200m2=3, 201m2 or more=4.

(v7) Level of awareness of homestead policy: no understanding = 1, slightly

understanding = 2, very understanding = 3.

(v8)Degree of worry about the living condition status after withdrawal: no worry=0, worry=1.

(v9) Satisfaction with rural living conditions: dissatisfied=1, average=2, satisfied=3.

(3) Expectation of security

(v10) Intention to buy a house in town: no=0, yes=1.

(v11) Reasonable compensation price: unimportant=1, generally important=2, important=3, very important=4.

(v12)Expectation of urban housing security after exit: not important=1, generally important=2, important=3, very important=4.

(v13)Post-exit health and pension insurance arrangements: unimportant = 1, generally important = 2, important = 3, very important = 4.

(v14) Post-exit employment security: unimportant = 1, generally important = 2, important = 3, very important = 4.

(4) Compensation methods

(v15) Compensation methods for exiting the homestead: house for compensation payment = 1, house for house = 2, commercial pension insurance = 3, pension and medical insurance = 4.

The descriptive statistics of the variables of the study sample are shown in Table 1.

Table 1: Descriptive statistics of variables

Variable	Minimum	Maximum	Mean	SD
v1	0	1	0.552	0.605
v2	1	5	2.592	1.401
v3	1	4	2.663	1.042
v4	1	4	2.327	1.497
v5	1	3	0.866	0.379
v6	1	4	2.335	0.973
v7	1	3	1.895	0.731
v8	0	4	0.76	0.333
v9	1	3	2.106	0.53
v10	0	1	0.591	0.544
v11	1	4	2.781	1.341
v12	1	4	3.035	1.233
v13	1	4	2.564	1.338
v14	1	4	2.529	1.399
v15	1	4	2.183	1.014

The statistics of the sample characteristics in County S are shown in Table 2, which has a predominantly male population (56.64%), a predominantly 0-40 years old age group (55.45%), a relatively consistent proportion of the population in all stages of education (20.00%-30.00%), a majority of the annual household income within the range of 10,000-30,000 yuan, a majority of the number of family members within the range of 4-6 people (43.36%), 44.84% of the population have a homestead area of 151-200m2, most people (46.90%) slightly understand the content of the homestead policy, 78.76% of the people are worried about the living conditions after the withdrawal, 71.09% of the people have the intention of purchasing a house in the towns, more than 80.00% of the people think that the price of the compensation is more important, more than 90.00% of the people think that the expectation of the urban housing security given after the withdrawal is more important More than 80.00% attach importance to the arrangement of pension and medical insurance after withdrawal, more than 55.00% are more concerned about the employment security after withdrawal, and 35.69% choose the compensation method of withdrawing from

the homestead base by exchanging house for compensation money, while 52.21% choose the compensation method of withdrawing from the homestead base by exchanging house for house.

Table 2: Statistical situation of sample characteristics

Variable	Interviewee	Number of people	Proportion(%)
(v1)	0	147	43.36%
	1	192	56.64%
(v2)	1	85	25.07%
	2	103	30.38%
	3	66	19.47%
	4	49	14.45%
	5	36	10.62%
(v3)	1	103	30.38%
	2	89	26.25%
	3	79	23.30%
	4	68	20.06%
(v4)	1	53	15.63%
	2	93	27.43%
	3	116	34.22%
	4	77	22.71%
(v5)	1	106	31.27%
	2	147	43.36%
	3	86	25.37%
(v6)	1	23	6.78%
	2	101	29.79%
	3	152	44.84%
	4	63	18.58%
(v7)	1	104	30.68%
	2	159	46.90%
	3	76	22.42%
(v8)	0	72	21.24%
	1	267	78.76%
(v9)	1	63	18.58%
	2	172	50.74%
	3	104	30.68%
(v10)	0	98	28.91%
	1	241	71.09%
(v11)	1	3	0.88%
	2	42	12.39%
	3	154	45.43%
	4	140	41.30%
(v12)	1	0	0.00%
	2	27	7.96%
	3	109	32.15%
	4	203	59.88%
(v13)	1	18	5.31%
	2	49	14.45%
	3	94	27.73%
	4	178	52.51%
(v14)	1	63	18.58%
	2	85	25.07%
	3	127	37.46%
	4	64	18.88%
(v15)	1	121	35.69%
	2	177	52.21%
	3	35	10.32%
	4	6	1.77%

2.2.2 Correlation analysis of independent and dependent variables

Before the logistic binary regression analysis, in order to improve the reliability and scientificity of the results of the regression analysis, each variable is screened to eliminate irrelevant or weakly correlated variables, and then carry out the regression analysis.

With the help of correlation analysis function of SPSS software, the method of correlation analysis was selected to screen the variables. According to the characteristics of the variables, the chi-square test was selected, and the results of the independence test of the 15 variables with the dependent variable are shown in Table 3.The independent variables were tested to see whether the independent variables were independent of the dependent variable (α=0.05).

Hypothesis: H0=The willingness to withdraw from the homestead is not related to the gender of the head of the farm household.

H1=The willingness to withdraw from the homestead is related to the gender of the head of the farm household

After testing, only (v1) gender variable P-value (0.521) > 0.1000, so the original hypothesis is accepted that gender is independent of the willingness to withdraw from the homestead, and it does not show significance with the willingness to withdraw from the homestead. The other variables have a significance value of 0.000<0.100 and the original hypothesis is rejected and it is considered that their variables are related to the willingness to withdraw from the homestead.

Table 3: Cross-analysis (chi-square) results

Variable	*P*
v1	0.521
v2	0.000***
v3	0.000***
v4	0.000***
v5	0.000***
v6	0.000***
v7	0.000***
v8	0.000***
v9	0.000***
v10	0.000***
v11	0.000***
v12	0.000***
v13	0.000***
v14	0.000***
v15	0.000***

2.2.3 Diagnosis of independent variable covariance

The results of the covariance diagnosis of the 14 independent variables are shown in Figure 1, and there is no significant covariance (|r|<0.500) among the 14 independent variables, and the variable structure is well-designed and able to be tested and analyzed in the regression model.

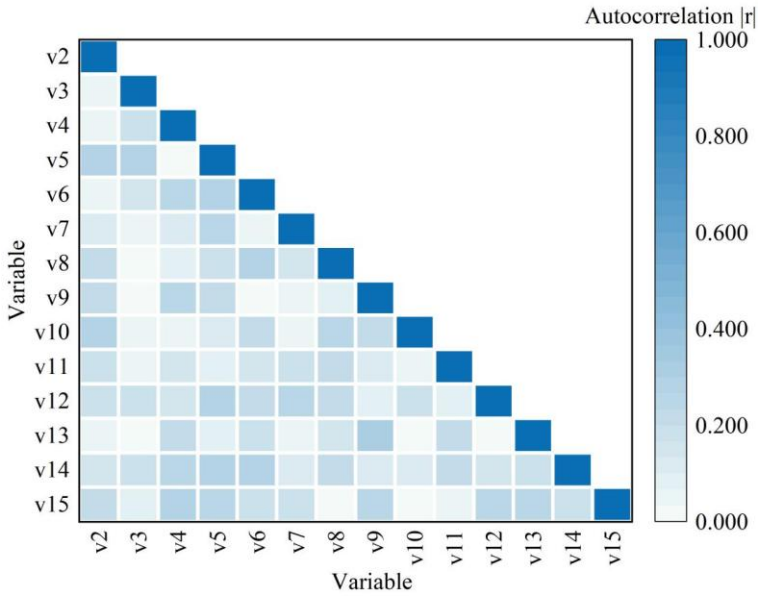

Figure 1: Diagnostic results of collinearity of independent variables

2.2.4 Regression model test and analysis

The parameter estimates of the 14 variables in the logistic regression model and their significance tests are shown in Table 4, and the factor variables that have a more significant effect on the willingness of farmers to withdraw from homesteads in County S are (v2) age (0.063), (v4) annual household income (0.074), (v5) number of family members (0.096), and (v6) area of homesteads (0.075), (v7) degree of awareness of homestead policy (0.073), (v8) degree of worry about living condition status after exit (0.000), (9) degree of satisfaction with rural living conditions (0.068), (v10) intention to buy a house in towns (0.052), (v11) reasonable price of compensation (0.000), (v12) expectation of housing security in towns after exit (0.024), (v13) Arrangement of medical and pension insurance after exit (0.049), (v14) Employment security after exit (0.093), and (v15) Compensation method for homestead exit (0.000).

Table 4: The test results of the regression model

Variable	Regression coefficient	SE	*P*
v2	-0.069	0.096	0.063
v3	0.317	0.063	0.856
v4	1.098	0.007	0.073
v5	-0.102	0.033	0.096
v6	0.215	0.072	0.075
v7	0.208	0.006	0.073
v8	0.271	0.028	0.000
v9	-0.128	0.006	0.068
v10	0.302	0.024	0.052
v11	0.347	0.052	0.000
v12	0.228	0.06	0.024
v13	0.189	0.053	0.049
v14	0.192	0.066	0.093
v15	0.194	0.007	0.000

From the analyzed data, it can be seen that the main factors considered by the research sample for the withdrawal of homesteads are the living conditions after the withdrawal, the compensation price, the housing security after the withdrawal, the arrangement of medical and pension insurance after the withdrawal, and the way of compensation for the withdrawal (P<0.050), and the requirements and expectations of farmers for the factors mentioned above differ from the level of the arrangement by the local government, which is the main difficulty that the withdrawal of homesteads from County S is facing at the present time.

3 Research on the Evolutionary Game of Farmers' Homestead Exit

3.1 Basic assumptions

Hypothesis 1: In the incentive to withdraw from the homestead, both farmers and local governments are limited rationality, and there is information asymmetry. Withdrawal of homesteads is a completely voluntary behavior of farmers, and the local government fully respects the wishes of farmers.

Hypothesis 2: The strategies that local governments can choose are to implement incentives and not to implement incentives, and the strategies that farmers can choose are to withdraw from the homestead and not to withdraw from the homestead. Notate the strategy choice space of local government as S_1, which is expressed as reasonable compensation price, medical and pension insurance arrangement for farmers after exit, employment guarantee for farmers after exit and compensation method for exiting homestead, then $S_1 = \{\text{Incentivize, or not incentivize}\}$; noting the strategy choice space of farmers as S_2, then $S_2 = \{\text{Exit, or not exit}\}$.

Hypothesis 3: The probability that the local government chooses to adopt an incentive strategy is denoted as x and the probability that it chooses not to adopt an incentive strategy is denoted as $1-x$. The probability that a farmer chooses to withdraw from the homestead is denoted as y, and the probability that he chooses not to withdraw from the homestead is denoted as $1-y$. Where, x and y are variables, the values will change as the process of the game evolves, and the range of values is $[0,1]$.

Hypothesis 4: The local government adopts an incentive strategy, and when farmers withdraw from the homesteads, the local government will sell the homesteads withdrawn by the farmers through bidding, listing, etc. The revenue gained by the local government is denoted as V_1, and the local government needs to bear the cost of compensation for the withdrawal of the farmers is denoted as C_1. C_2 is the cost of the local government to promote the incentive policy, including the cost of field research, policy research and publicity. Policy incentive intensity C_3 is the cost of economic incentives required by the local government to implement the incentive policy, such as cash incentives, pension and health insurance concessions, etc. The local government does not adopt incentive strategies, farmers choose to exit will bring some land transfer revenue for the local government, but due to the lack of cash incentives, housing subsidies and other incentives, the number of farmers will be lower than the number of incentives to exit at this time, so the local government from which the land transfer revenue should be a certain percentage of the incentives under the land transfer revenue, notated as kV_1, $0 \le k \le 1$.

Hypothesis 5: In the case of incentives, the local government's positive response to the incentives and the increase in the number of withdrawals will bring additional benefits in terms of reputation enhancement, such as increased prestige and credibility of the government, which will be denoted as V_2. On the other hand, in the case of no incentives, the exit from homesteads is ineffective, and farmers have a crisis of confidence in the government, resulting in negative impacts such as damage to the government's credibility, which is denoted as C_4. If the number of farmers withdrawing is not enough, the local government will be constrained by the shortage of construction land indicators, and the local economic development will be restricted, and the loss will be labeled as C_5.

Hypothesis 6: The local government implements incentive policies, farmers choose to withdraw from the homestead not only can get the withdrawal compensation R_1, but also can get the withdrawal incentives given by the local government R_2, but need to bear the homestead withdrawal process generated by the implicit cost of time costs, energy costs, etc. T_1, and the cost of relocation costs, the cost of renting a room and other explicit costs T_2. If they choose not to withdraw from the homestead, the current benefit that the farmers can get is zero, but the future benefit that they can get from the value-added of the homestead is recorded as R_3 and the discount rate is recorded as ε.

3.2 Construction of the game model

(1) Gain matrix

Based on the above assumptions, we can find the expression for the gains of the local government and farmers under different strategy choices. Take the local government does not implement the incentive strategy, farmers do not quit the homestead as an example, the local government at this time to obtain the land grant revenue is 0, need to bear due to the slow progress of the homestead withdrawal work brought about by the reputation of the damage and other adverse impacts C_4 and economic development constraints caused by the loss of C_5; farmers at this time to obtain the current revenue is 0, but can obtain the homestead expected future revenue as $R_3/1+\varepsilon$. The same reason can be obtained under other strategy combinations, the game of both sides of the return value.

(2) local government replication dynamic equation

Local government chooses to take the incentive strategy to obtain the expected return of U_{11} as in equation (1):

$$U_{11} = y(V_1 + V_2 - C_1 - C_2 - C_3) + (1-y)(-C_2 - C_5) \tag{1}$$

The expected return obtained by the local government choosing not to adopt the incentive strategy is U_{12} as in equation (2):

$$U_{12} = y(kV_1 - C_1 - C_4 - C_5) + (1-y)(-C_4 - C_5) \tag{2}$$

Then the average expected return received by the local government is $\bar{U}_1$ as in equation (3):

$$\bar{U}_1 = xU_{11} + (1-x)U_{12} \tag{3}$$

This leads to the equation for the replication dynamics of local government as equation (4):

$$\begin{aligned} F(x) &= \frac{dx}{dt} = x(U_{11} - \bar{U}_1) \\ &= x(1-x)\left\{y\left[V_1(1-k) + V_2 - C_3 + C_5\right] - C_2 + C_4\right\} \end{aligned} \tag{4}$$

(3) The replication dynamic equation of the farmer household

The expected return obtained by the farmer's choice of exit strategy from the homestead is U_{21} as in equation (5):

$$U_{21} = x(R_1 + R_2 - T_1 - T_2) + (1-x)(R_1 - T_1 - T_2) \tag{5}$$

The expected return obtained by the farmer's strategy of choosing not to exit the homestead is U_{22} as in equation (6):

$$U_{22} = x(R_3 / 1 + \varepsilon) + (1-x)(R_3 / 1 + \varepsilon) \tag{6}$$

Then the average expected return received by the farmer is $\bar{U}_2$ as in equation (7):

$$\bar{U}_2 = yU_{21} + (1-y)U_{22} \tag{7}$$

This leads to an equation for the replication dynamics of farmers as equation (8):

$$F(y) = \frac{dy}{dt} = y(U_{21} - \bar{U}_2) = y(1-y)\left[xR_2 + R_1 - T_1 - T_2 - (R_3 / 1 + \varepsilon)\right] \tag{8}$$

3.3 Model analysis and process evolution

3.3.1 Evolutionary equilibrium of the model

Associate equations (4) and (8) and make the two replicated dynamic equations $F(x) = 0$ and $F(y) = 0$ to form a system of replicated dynamic equations as shown in equation (9):

$$\begin{cases} F(x) = \dfrac{dx}{dt} = x(1-x)\left\{y\left[V_1(1-k) + V_2 - C_3 + C_5\right] - C_2 + C_4\right\} = 0 \\ F(y) = \dfrac{dy}{dt} = y(1-y)\left[xR_2 + R_1 - T_1 - T_2 - (R_3 / 1 + \varepsilon)\right] = 0 \end{cases} \tag{9}$$

This leads to solving for five evolutionary equilibrium points of the system, $O(0,0)$, $E(1,0)$, $F(0,1)$, $G(1,1)$, and $H(x^*, y^*)$. where $x^* = \dfrac{R_3 + (T_1 + T_2 - R_1)(1+\varepsilon)}{(1+\varepsilon)R_2}$, $y^* = \dfrac{C_2 - C_4}{(1-k)V_1 + V_2 - C_3 + C_5}$.

According to Assumption 3, it can be seen that (x, y) must be within

$Q=\{(x,y)\,|\,0\le x\le 1,0\le y\le 1\}$ in order to be practical. Combined with the five evolutionary equilibrium points that have been found, it can be seen that if we want $H(x^*,y^*)$ to have practical significance we also need to add some constraints. The specific analysis is as follows:

For $0<x^*<1$ to hold, the constraint $0<T_1+T_2-R_1+(R_3/1+\varepsilon)<R_2$ needs to be satisfied.

If we want $0<y^*<1$ to hold, we need to discuss the situation:

$0<y^*<1$ holds when the condition $0<C_2-C_4<(1-k)V_1+V_2-C_3+C_5$ is satisfied.

When the condition $(1-k)V_1+V_2-C_3+C_5<C_2-C_4<0$ is satisfied, $0<y^*<1$ holds.

3.3.2 Stability analysis of evolutionary equilibria

According to the equilibrium stability discrimination method, the local stability of the Jacobi matrix of the system is used to discriminate the stability of the evolutionary equilibrium point.

According to equations (4) and (8) the Jacobi matrix ranks of the system can be derived as in equation (10):

$$J=\begin{bmatrix}\dfrac{\partial F(x)}{\partial x} & \dfrac{\partial F(x)}{\partial y}\\ \dfrac{\partial F(y)}{\partial x} & \dfrac{\partial F(y)}{\partial y}\end{bmatrix}=\begin{bmatrix}F_1 & F_2\\ F_3 & F_4\end{bmatrix} \tag{10}$$

where F_1, F_2, F_3 and F_4 are equations (11)-(14), respectively:

$$F_1=(1-2x)\left\{y\left[V_1(1-k)+V_2-C_3+C_5\right]-C_2+C_4\right\} \tag{11}$$

$$F_2=x(1-x)\left[V_1(1-k)+V_2-C_3+C_5\right] \tag{12}$$

$$F_3=y(1-y)R_2 \tag{13}$$

$$F_4=(1-2y)\left[xR_2+R_1-T_1-T_2-(R_3/1+\varepsilon)\right] \tag{14}$$

Based on the local stability of the Jacobi matrix, it is known that when the matrix determinant $\det(J)>0$ and the trace of the matrix $tr(J)<0$, then the equilibrium can be judged as an evolutionary stable point, and at this time the combination of strategies corresponding to the two sides of the game is an evolutionary stable strategy (ESS).

3.4 Evolutionary Game Simulation Analysis

Simulation is used to analyze the dynamic effects of several key indicators in the evolutionary game process on farmers' choice of conservation strategies. Combining the content of the previous analysis with the actual situation, the following are selected: the subsidy that farmers receive from the government for withdrawing from the homestead, i.e., the compensation intensity (O), the government's penalty for farmers who do not withdraw from the homestead (P), the positive externality benefit (Q), and the government's cost of recovering the homestead (R). According to the finite rationality assumption, due to finite rationality, the

participants cannot choose the strategy that maximizes benefits at the beginning of the game. Therefore, it is assumed that the initial values of the probability that the government chooses an active strategy and the probability that the farmer chooses an exit strategy are 0.5 and 0.5, respectively. It is difficult to reach the desired equilibrium due to the changing strategies of the participants. Therefore, simulation analysis is applied in the following to explore effective measures to bring the game to an equilibrium state.

3.4.1 Effect of Penalty Strength on Game Stability

The initial strategy between the government and farmers is set to 0.5, keeping other parameter conditions unchanged, so that the government's penalty for refusing to withdraw from the excess homestead farmers P varies as 3, 5, 10. Under this condition, the changes in the probability of farmers withdrawing from the homestead over time (120 months) are shown in Fig. 2. It can be found that the probability of farmers choosing an exit strategy tends to be close to 0 when the penalty decreases, and their the degree of fluctuation of strategy change is similarly affected, showing a trend of decreasing frequency and amplitude. When the initial value of P is set to 5, the evolutionary game system fails to achieve the desired steady state. However, when the value of P is increased to 10, i.e., the government's charging of paid royalties for homesteads to uncooperative farmers is greatly increased, it emerges that the farmer's strategy stabilizes in the exit strategy after about 60 units of time, and the probability of the farmer's choosing the no-exit strategy tends to be close to 0. Therefore, the increase in the penalty for uncooperative farmers is conducive to the promotion of the decision-making of the farmer's exit from the homesteads.

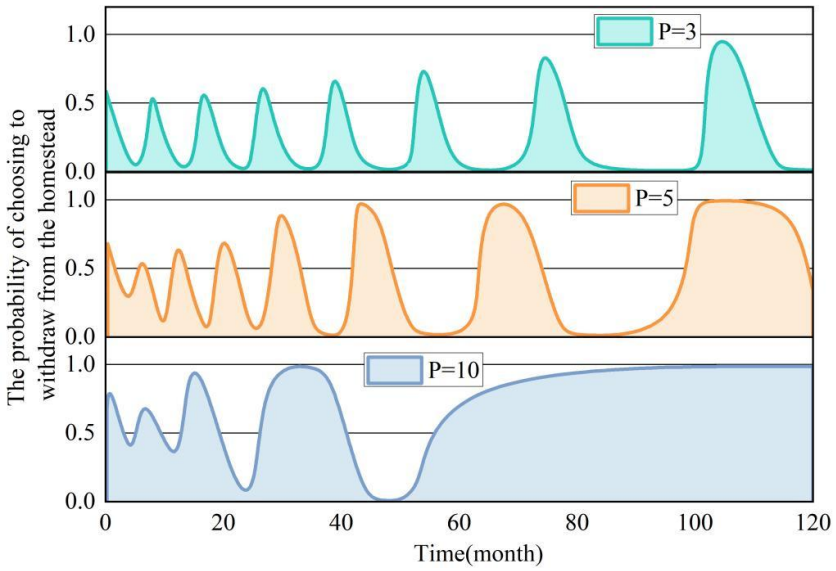

Figure 2: The changes in the probability of farmers giving up their homesteads(1)

3.4.2 Effect of compensation strength on game stability

The initial strategy between the government and farmers is set to 0.5, keeping other parameter conditions unchanged, so that the government's compensation for farmers withdrawing from the homestead O varies to 15, 30, 50. Under this condition, the changes in the probability of farmers withdrawing from the homestead over time (120 months) are shown in Fig. 3. When the degree of compensation decreases, the probability of farmers choosing the strategy of not withdrawing from the homestead increases subsequently, and the strategy the frequency of change and the amplitude of fluctuation also increase. When the degree of compensation

increases, for example, when the compensation intensity increases to 50, the strategy of non-exit behavior of farmers decreases significantly and stabilizes in the exit strategy after only 15 units of time, and the probability of exit strategy tends to be close to 1. It verifies that a reasonable compensation price, adequate medical and pension insurance and employment arrangement guarantee are effective ways to encourage farmers to exit the homestead. In this process, the government should pay attention to the control of compensation and the scientific and stability of the policy, if the compensation is high, it is obviously an uncontrollable financial burden in the long run. If the government compensation strategy changes repeatedly, it is not conducive to the realization of the effective withdrawal of farmers from the homestead.

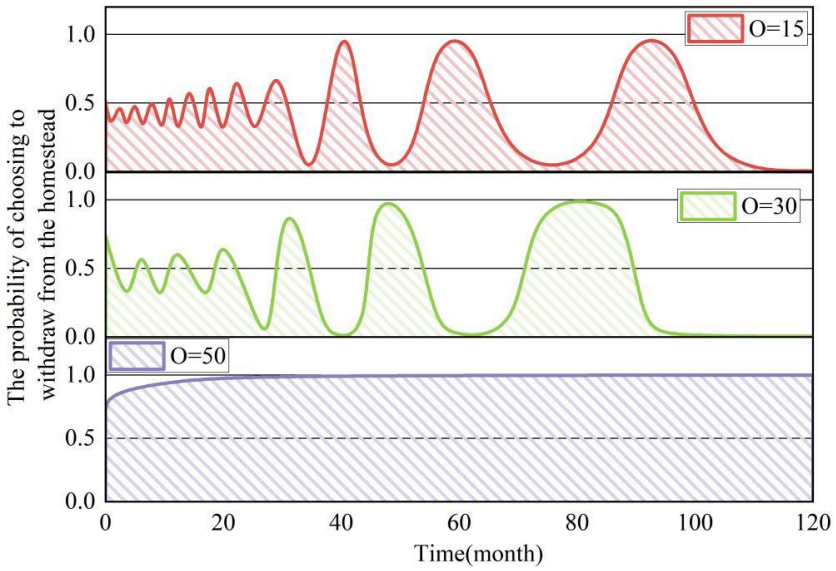

Figure 3: The changes in the probability of farmers giving up their homesteads(2)

3.4.3 Game stabilizing effects of positive externality gains

The initial strategy between the government and farmers is set to 0.5, and other parameter conditions are kept constant, so that the positive externalities Q changes to 30, 90 and 150 after farmers exit the homestead.Under this condition, the changes in the probability of farmers' exiting the homestead over time (120 months) are shown in Fig. 4.Although an increase in positive externalities expands the range of variations in the farmers' choice of exit strategy, the change in the simulation process the system cannot converge to a steady state, indicating that it is not feasible to encourage farmers to exit the homestead by changing the positive externality in a single way. Although improving the living environment can increase the willingness of farmers to exit the land to a certain extent, it is not a key factor to promote the change of farmers' strategies.

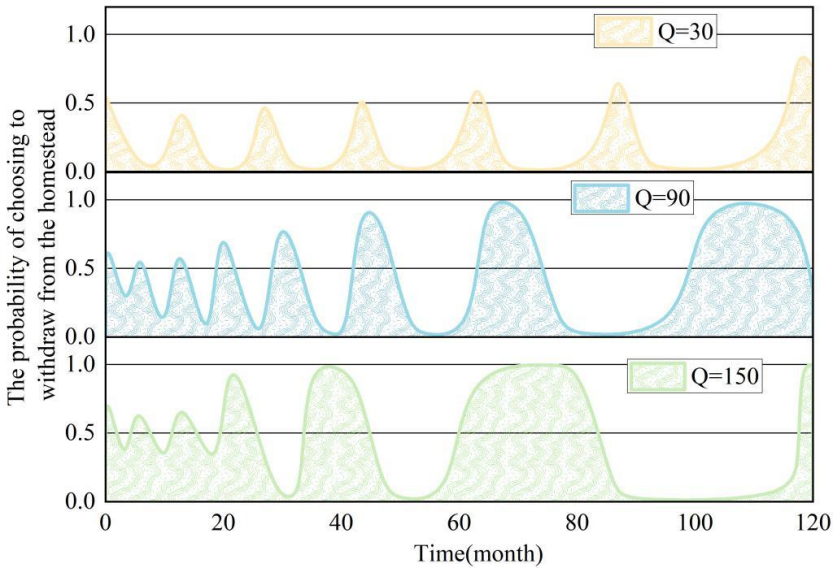

Figure 4: The changes in the probability of farmers giving up their homesteads(3)

3.4.4 The effect of the cost of government repossession of homesteads on the stability of the game

The initial strategy between the government and the farmers is set to 0.5, and other parameter conditions are kept constant, so that the government's cost of repossessing the homestead R varies as 15, 25, and 35. Under these conditions, the changes in the probability of farmers' exiting the homestead over time (120 months) are shown in Fig. 5. In the effect of the cost of the government's behavior of repossessing the homestead on the choice of its strategy, the game system is never able to converge to the desirable stable state. This is manifested in the fact that regardless of the cost of the government's resumption of homesteads, the three simulation scenarios never converge to 1 in the simulation time unit, and the overall system is in an unstable state. Therefore, the cost of the government to recover the residential land is ineffective in encouraging farmers to withdraw from the residential land.

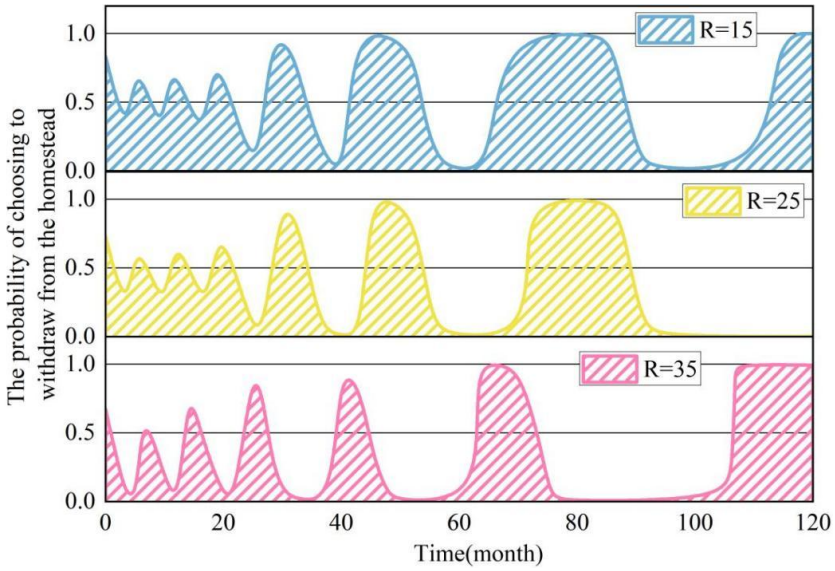

Figure 5: The changes in the probability of farmers giving up their homesteads(4)

4 Proposed Solution Paths for the Exit of Homesteads in Agricultural Areas

As can be seen from synthesizing the contents of the second and third chapters, the actual withdrawal of homesteads in traditional agricultural areas is a complex system. At the level of farmers, their willingness to withdraw from homesteads is mainly affected by the amount of compensation, compensation methods and penalties, while some elderly people are reluctant to give up their long-time homesteads due to their own local sentiment and policy awareness. At the governmental level, the effect of the withdrawal of traditional farmland is not only related to the level and quality of local urbanization development, but also closely linked to the effectiveness of the transformation and construction of traditional farmland. Therefore, the local government should be based on the background of urban-rural integration development, oriented to the interests of the residents of traditional agricultural areas, to carry out the work of homestead withdrawal. The specific measures are as follows:

(1) Positive incentive mechanism design

Positive incentives are designed to ensure that farmers can receive compensation that meets or exceeds their reasonable needs after withdrawing from homesteads, and at the same time, the compensation is within the scope of the government's financial and other levels of affordability. When designing incentive mechanisms and policies, the government should fully respect the main position of farmers in the withdrawal of homesteads, and collect and combine the interests of farmers.

In addition to giving reasonable exit compensation, the construction of reasonable housing security mechanism, social security mechanism and employment security mechanism, multi-dimensional protection and even enhance the living standards of farmers after the exit of the residential base. With rich exit compensation content and relatively high exit compensation level, to stimulate the willingness of farmers to exit the residential base.

In addition to the incentive policy-based measures to directly promote farmers to withdraw from the homestead, the government can also borrow its control function in the market mechanism, accelerate the construction process of urbanization around traditional agricultural areas, and promote the transfer of industrial focus to the secondary and tertiary industries. In the form of linking the withdrawal of residential land and urbanization construction, to attract farmers to non-agricultural industries gathered in the traditional agricultural areas to enhance the level of urbanization at the same time to guide the active choice of farmers to withdraw from the residential land.

(2) Design of reverse incentive mechanism

Different from the positive incentive mechanism, the reverse incentive mechanism is not applicable to all farmers, and is mainly oriented to the farmers who occupy or use the residence base in violation of the policy regulations. The overall design of the reverse incentive mechanism should take into account the level of socio-economic development of traditional agricultural areas and the affordability of farmers, by increasing the level of economic constraints on the possession or use of residential land, to enhance the cost of farmers to retain residential land. In addition, it can also limit the use of residential land or take measures of paid use of residential land to reduce the economic income of farmers to keep residential land. The combination of the two to form a certain, effective economic pressure, prompting farmers to take the initiative to choose to withdraw from the residential base.

5 Conclusion

This paper synthesizes the questionnaire survey and regression analysis to obtain the traditional agricultural area S county farmers, for the homestead exit after the exit of living conditions, compensation price, exit after the housing security, exit after the medical and pension insurance arrangements, exit compensation method ($P < 0.050$) more concerned. Accordingly, in the analysis of the evolutionary game model constructed by the government and the farmers' strategic actions and changes in the level of interests, when the government's punishment is changed to 10, the farmers' exit strategy is stabilized in 60 units of time and the exit strategy tends to 1. When the government's compensation is increased to 50, the farmers' exit strategy is stabilized and tends to 1 in 15 units of time.

Considering the diversified needs of farmers in traditional farming areas for compensation levels and forms, the level of government financial commitment and the background of homestead withdrawal, it is suggested that the positive incentive mechanism and the negative mechanism work together to promote the decision-making of farmers' homestead withdrawal. The positive incentive mechanism should include exit compensation, housing security, social security and employment security, etc., while the negative incentive mechanism can be achieved by means of increasing the cost of homestead holding and decreasing the income from homestead holding.

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