Hindawi
Wireless Communications and Mobile Computing
Volume 2023, Article ID 9874205, 1 page
https://doi.org/10.1155/2023/9874205

*Retraction*

# Retracted: Risk Identification and Application of Farmland Management Right Mortgage Loan Based on Neural Network

**Wireless Communications and Mobile Computing**

Received 12 December 2023; Accepted 12 December 2023; Published 13 December 2023



This article has been retracted by Hindawi, as publisher, following an investigation undertaken by the publisher [1]. This investigation has uncovered evidence of systematic manipulation of the publication and peer-review process. We cannot, therefore, vouch for the reliability or integrity of this article.

Please note that this notice is intended solely to alert readers that the peer-review process of this article has been compromised.

Wiley and Hindawi regret that the usual quality checks did not identify these issues before publication and have since put additional measures in place to safeguard research integrity.

We wish to credit our Research Integrity and Research Publishing teams and anonymous and named external researchers and research integrity experts for contributing to this investigation.

The corresponding author, as the representative of all authors, has been given the opportunity to register their agreement or disagreement to this retraction. We have kept a record of any response received.

## References

[1] Q. Lan and J. Pang, "Risk Identification and Application of Farmland Management Right Mortgage Loan Based on Neural Network," *Wireless Communications and Mobile Computing*, vol. 2022, Article ID 1941360, 12 pages, 2022.

Hindawi
Wireless Communications and Mobile Computing
Volume 2022, Article ID 1941360, 12 pages
https://doi.org/10.1155/2022/1941360

*Research Article*

# Risk Identification and Application of Farmland Management Right Mortgage Loan Based on Neural Network

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Received 10 March 2022; Revised 13 April 2022; Accepted 19 April 2022; Published 4 May 2022

Academic Editor: Rashid A Saeed



There are a series of problems in China, such as low farmers' income, difficulty in financing for farmers, and relatively lag in rural financial reform. The mortgage financing of farmland management rights is one of the important ways to solve these thorny problems and promote economic development. From the perspective of farmers, combined with empirical analysis, this paper fully considers farmers' ideas, carries out risk identification and risk assessment for the mortgage loan of farmland management rights, and continuously improves the relevant risk prevention mechanism to reduce the operation risk of farmers' farmland mortgage. This paper expounds the establishment principles of the risk evaluation index system in detail, lays a theoretical foundation for the selection of indicators, determines the risk evaluation system of land management right mortgage financing from the perspective of farmers, and builds a fuzzy-level comprehensive evaluation model. Based on the practical research data, the fuzzy hierarchy (F-AHP) comprehensive evaluation method is used to conduct an empirical comprehensive evaluation on the risk of the mortgage loan of the farmland management right and analyze the evaluation results. Among the surveyed farmers in the survey area, 242 have not actually participated in the mortgage loan of farmland management rights, accounting for 94.16% of the sample farmers. However, there are only 15 farmers who actually use the farmland management right for mortgage financing, accounting for 5.84% of the sample.



## 1. Introduction

China's "agriculture, rural areas and farmers" issue is the most core issue to promote the sound and stable development of Chinese society. It is closely related to a series of major propositions such as a modernized power and the realization of the Chinese dream. That is, whether the "three rural" issues can be solved is related to whether the vital interests of thousands of farmers can be guaranteed, and it is related to China's future development. The low income of farmers, the difficulty in financing for farmers, and the lack of large-scale, long-term loan support make it difficult to meet their capital needs for production, living, and consumption, which greatly limits the solution of China's "agriculture, rural areas and farmers" problems. The new financial innovation of agricultural land mortgage financing came out. From the perspective of farmers, their financing needs are large but the assets that can be mortgaged are very limited. Rural housing asset mortgage financing is limited by national laws. The traditional agricultural industry is not feasible for mortgage loans because it does not have the characteristics of good collateral and it is difficult to measure its assets. At present, for farmers, the most convenient way is to use the mortgage of farmland management rights for financing.

The mortgage business of farmland management rights is developed under the pressure of the current situation of rural finance and the urgent needs of rural economic development. It is in line with the development of the times and provides a certain theoretical reference for the further deepening of the rural land financial reform. Secondly, it has certain theoretical significance for the innovation and development of the rural financial guarantee system. Problems such as lack of funds and financing difficulties have greatly restricted farmers' investment in the development of agricultural production. The reason lies in the lack of

reasonable collateral. The development of the farmland mortgage business has expanded the range of mortgageable objects in rural areas, solved the problem of farmers' financing, and further improved the theoretical system of farmland mortgage financing. In the development process of "Sannong" construction, the new and innovative financing method of farmland mortgage business will be fully promoted. But at this stage, the research on the theoretical system of farmland mortgage risk management, including risk guarantee mechanism and risk compensation principle, is extremely lacking. By studying the mortgage risk of farmers, the theoretical system of mortgage financing of farmland property rights can be further improved, and certain theoretical guidance can be given for the smooth development in the future.

The innovations of this paper are as follows: (1) this paper analyzes the risk factors of farmland management rights according to the factor analysis method; six risk public factors are extracted, which are self-repayment risk, agricultural land assessment risk, legal and regulatory risk, market risk, livelihood risk, and natural risk. (2) This paper analyzes the financialization and financial attributes of rural land management rights under the guidance of the theory of "separation of three rights", the theory of incompletely competitive market, and the theory of externality. This paper studies the legal guarantee, policy support, and successful practice exploration of its realization, and analyzes the particularity and weak liquidity of rural land management rights. (3) This paper analyzes the pilot situation and existing problems of the rural land management right mortgage loan and uses the mathematical model to analyze and calculate the influencing factors of the rural land management right mortgage loan business evaluation.

## 2. Related Work

Han et al. start with the current aging trend; they expounded the main concepts and the background and significance involved and introduced the above-mentioned connotations for the housing reverse mortgage loan to put forward various risk factors such as borrower risk identification framework, life expectancy, future housing value fluctuations, and loan interest, as well as correlations [1]. The Boehm and Schlottmann analysis used the Income Dynamics Panel Study (PSID) from 2009 to 2013 to model the likelihood of a mortgage modification for homeowners whose mortgages were in foreclosure, defaulted on one or more payments, or had outstanding mortgage payments. For those households who get mortgage modifications, he also estimates the likelihood that the modifications will eliminate their mortgage problems. However, the analysis did find substantial indirect evidence that many of these households were disadvantaged due to differences in socioeconomic characteristics [2]. For the third time in decades, policymakers are considering an overhaul of mortgage finance regulation. Brian's research finds that although considerable attention has been paid to how ex anteregulation affects the availability of credit and the adequacy of mortgage products offered by lenders. However, the understanding of how the legal framework governing foreclosure (a form of ex post protection for borrowers) affects mortgage lending is incomplete [3]. The Mueller and Noth study demonstrates the use of U.S. Residential Mortgage Disclosure Act (HMDA) mortgage application data to elucidate the role that banks' market power played in the likely underrepresentation of risk screening activities in the U.S. mortgage market during the precrisis period. Banks with higher market power can protect their charter value, and this effect is greater for banks with more local market information [4]. The Smith and Daniels analysis focuses on the role of risk pricing in allocating and obtaining mortgages, in particular how it contributes to cost differences across races [5]. Sheenan analyzes the contagion from the U.S. subprime mortgage-backed securities market represented by the ABX.HE index to several fixed income, equity, and volatility markets based on the seminal literature on the subject. He analyzed a "stitched" dataset constructed from the literature, as well as the ABX.HE index of two trades. The obtained principal component was then included in the VAR framework as an exogenous variable, and the sensitivity of these results was tested by taking this principal component as the eighth endogenous variable [6]. While the results suggest that the ABX index spread during the 2007-2009 crisis, the source and strength of this spread varied from index.

## 3. A Neural Network Approach to Farmland Management Rights

*3.1. Farmland Management Rights.* The complexity of the rural housing mortgage loan comes from three aspects: first, as a rural property right mortgage financing method, the rural housing mortgage loan needs to clearly define the content and ownership of the relevant property rights. Second, rural houses play a role in guaranteeing the production and life of farmers. Based on this particularity, the mortgage of rural houses requires relevant policy support from the government. Third, once there is a risk in the mortgage loan of rural houses, it will face the problem of the circulation and disposal of the collateral. Therefore, the rural houses need professional value evaluation and transaction market. The governance structure of rural housing mortgage loan risk is shown in Figure 1.

As shown in Figure 1, in the process of rural housing mortgage loans, local financial institutions are the main implementers of rural housing mortgage loans. However, the complexity of rural housing mortgage loans far exceeds the cognitive scope and cost carrying capacity of financial institutions, and financial institutions cannot independently complete rural housing mortgage transactions. To this end, financial institutions, government departments, rural communities, and other social organizations constitute a diverse governance body.

*3.2. Convolutional Neural Networks.* A typical convolutional neural network consists of a series of processes. Among them, the convolutional layer and the pooling layer are the first few stages, and the convolutional layer unit is organized in the feature map. In a feature map, each unit goes through

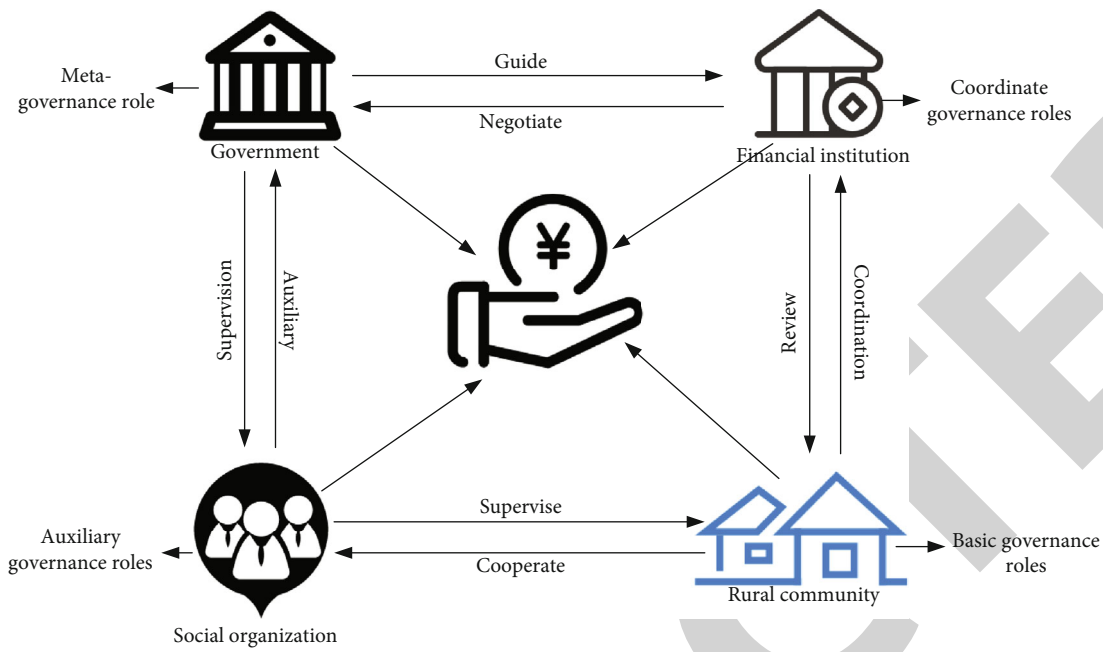



Figure 1: The governance structure of the risk of rural housing mortgage loans.

a set of weights that are connected to a local block of the previous layer's feature map, and this local weighted sum is passed to a nonlinear function (often called an activation function). The basic structure of the convolutional neural network is shown in Figure 2.

As shown in Figure 2, the role of the convolutional layer is essentially to extract local features, and then, the role of the pooling layer is to combine semantically similar features [7]. Usually, the pooling layer computes the maximum value of a local patch in the feature map, and adjacent centralized neurons read data from the patch by moving rows or columns, which is to reduce the dimensionality and invariance of the data [8].

$$O = \left(\sum\sum I(i,j)^P \times G(i,j)^{1/P}\right). \tag{1}$$

Among them, $I$ represents the input feature map, $G$ represents the Gaussian kernel, 0 represents the output feature map, and the value of $P$ is selected from 1 to $\infty$. When $P - 1$, the subsampling layer performs mean sampling, and the mean value in each subregion will be calculated as the subsampling result [9]. When $P \longrightarrow \infty$, the subsampling layer performs maximum sampling, and the maximum value in each subregion will be selected as the subsampling result. The sampling diagram is shown in Figure 3.

As shown in Figure 3, it is assumed that there are $m$ -labeled training samples $\{(x_1, y_1), (x_2, y_2), .., (x_m, y_m)\}$ in the training set, where the input features $x^{(i)} \in \mathrm{R}^{n+1}$. Because it is used for binary classification in logistic, the class label $y^{(i)} \in \{0, 1\}$ [10]. The assumed function (hypothesis function) is as follows:

$$h_\theta(x) = \frac{1}{1 + \exp\left(-\theta^T x\right)}. \tag{2}$$

The following cost function needs to be minimized by training the model parameters $\theta$.

$$J(\theta) = -\frac{1}{m}\left[\sum_{i=1}^{m} y^{(i)} \log h_\theta\left(x^{(i)}\right) + \left(1 - y^{(i)}\right) \log\left(1 - h_\theta\left(x^{(i)}\right)\right)\right]. \tag{3}$$

Given test input data $x$, a hypothesis function needs to be used to estimate the probability value $p(y = j \mid x)$ for each class of $j (j = 1, 2, \cdots, k)$. That is, when $x$ appears as an input, the probability of each classification result is appearing. It is assumed that the function needs to output a $k$-dimensional vector (each dimension component sums to 1), and each dimension component represents the probability that the input $x$ belongs to this class [11]. Assuming the function has the following form:

$$h_\theta(x_i) = \begin{bmatrix} p(y_i = 1 | x_i; \theta) \\ p(y_i = 2 | x_i; \theta) \\ \cdots \\ p(y_i = k | x_i; \theta) \end{bmatrix} = \frac{1}{\sum_{j=1}^{k} e^{\theta_j^T x_i}} \begin{bmatrix} e^{\theta_1^T x_i} \\ e^{\theta_2^T x_i} \\ \cdots \\ e^{\theta_k^T x_i} \end{bmatrix}. \tag{4}$$

Among them, $\theta$ represents the parameters of the model, and the fraction $1/\sum_{j=1}^{k} e^{\theta_j^T x_i}$ is used for the normalization

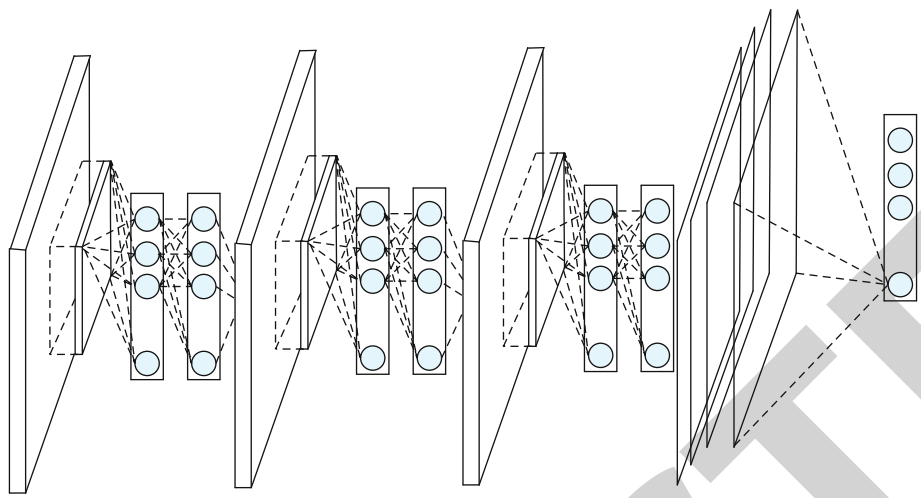


Figure 2: Basic structure of convolutional neural network.

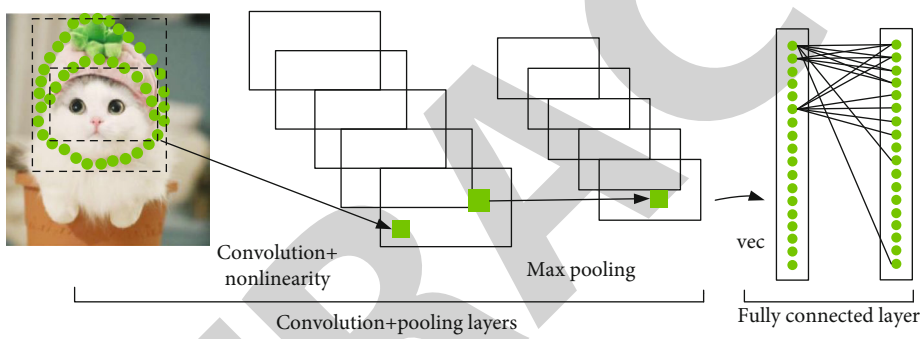



Figure 3: Schematic diagram of sampling.

operation to ensure that the sum of the elements of each dimension of the vector is 1 [12].

The cost function of the Softmax classifier is as follows:

$$J(\theta) = -\frac{1}{m}\left[\sum_{i=1}^{m}\sum_{j=1}^{k} 1\{y_i = j\} y^{(i)} \log \frac{e^{\theta_j^T x_i}}{\sum_{j=1}^{k} e^{\theta_j^T x_i}}\right]. \quad (5)$$

The logistic regression model is a binary classification model with values between 0 and 1. The model can be used to solve classification problems of nonlinear variables without requiring the sample variables to satisfy the conditions of normal distribution and equal covariance. However, the model also has premise assumptions: the data are selected from random samples, there is no multicollinearity problem between independent variables $x$, the dependent variable $Y$ is a function of $N$ independent variables $x$, and the relationship between the two is nonlinear. Logistic regression model is:

$$Y = \frac{1}{1 + e^{-x}}, \quad (6)$$

$$\hbar = c_0 + \sum_{i=1}^{m} C_i X_i. \quad (7)$$

Among them, $Y \in [0, 1]$ is the default probability of the borrowing company; $X_i (0 \le i \le p)$ is the financial indicator variable for credit risk assessment; $C_i$ is the explanatory variable coefficient, which can be obtained by regression or maximum likelihood estimation [13]. The function image of logistic is a sigmoid distribution, $Y$ is a continuous increasing function of $\hbar, \eta \in [-\infty, +\infty]$.

$$\lim_{\hbar \longrightarrow \infty} Y = \lim_{\hbar \longrightarrow \infty} \frac{1}{1 + e^{-x}} = 1, \quad (8)$$

$$\lim_{\hbar \longrightarrow \infty} Y = \lim_{\hbar \longrightarrow \infty} \frac{1}{1 + e^{-x}} = 0. \quad (9)$$

In practical applications, 0.5 is generally used as the dividing point. That is to say, if the logistic value $Y$ of the loan enterprise is close to 1, it belongs to the enterprise that has failed in operation, may face financial crisis, has a high default probability, and is judged as a company with "poor" credit.

*3.3. Training of Convolutional Neural Networks.* For convolutional neural networks, supervised methods are generally

used directly for training, while supervised methods usually use gradient-based methods. Batch stochastic gradient descent is usually used [14, 15]. The error function formula for sample $n$ is as follows:

$$J(W, b; x, y) = \frac{1}{2}\sum_{k=1}^{c}(t_k - y_k)^2 = \frac{1}{2}||t - y||^2. \quad (10)$$

The corresponding gradient calculation formula is as follows:

$$\nabla_{W^{(l)}} J(W, b; x, y) = \delta^{(l+1)}\left(a^{(l)}\right)^T, \quad (11)$$

$$\nabla_{W^{(l)}} J(W, b; x, y) = \delta^{(l+1)}. \quad (12)$$

Finally, when calculating the gradient, it is necessary to flip the convolution kernel as in the convolution operation. The calculation formula is as follows:

$$\nabla_{W_k^{(l)}} J(W, b; x, y) = \sum_{i=1}^{m}\left(a_i^{(l)}\right) * rot90\left(\delta_k^{(l+1)}, 2\right), \quad (13)$$

$$\nabla_{b_k^{(l)}} J(W, b; x, y) = \sum_{a,b}\left(\delta_k^{(l+1)}\right)_{a,b}. \quad (14)$$

In the above formula, $f^{'}(\cdot)$ is the steering function of the activation function $f(\cdot)$, $a^{(l)}$ is the activation (output value) of layer l, and $a^{(1)}$ is the input image. $a_i^{(l)} * \delta_k^{(l+1)}$ represents $k$ convolution kernels with $i$ inputs and error terms on the l layer for convolution operations [16, 17]. When using the AHP to calculate the weight of each index, two methods can be adopted: the square root method and the product method. This paper adopts the relatively simple square root method, and calculates the product $M$ of each row of factors in the judgment matrix according to the following formula.

$$M_i = \prod_{j=1}^{n} u_{ij}, i = 1, 2, \cdots, n. \quad (15)$$

Calculating the $n$th root value of the product $M_i$ according to the following formula

$$W_i = \sqrt[n]{M_i}. \quad (16)$$

The vector $W = [W_1, W_2, \cdots, W_n]^T$ is normalized according to the following formula

$$W_i = \frac{W_i}{\prod_{j=1}^{n} W_i}. \quad (17)$$

After the normalized eigenvectors, that is, the corresponding weights are obtained in the previous section, the consistency check of the judgment matrix must also be performed to ensure that the obtained judgment matrices are compatible with each other [18, 19]. The specific operations are as follows: the random consistency index CI is calculated according to the following formula:

$$\mathrm{CI} = \frac{\lambda_{\max} - n}{n - 1}, \lambda_{\max} = \frac{1}{n}\sum_{i=1}^{n}\frac{\sum_{j=1}^{n} u_{ij} W_j}{W_i}. \quad (18)$$

In formula (18), $\lambda_{\max}$ and $n$ are the maximum eigenroot and order of the judgment matrix [20, 21], respectively.

## 4. Construction of Risk Assessment Model for Farmers' Farmland Management Right Mortgage Loan

### *4.1. Establishment of the Risk Assessment Index System for the Mortgage of the Farmer's Management Right*

*4.1.1. Principles of Index Selection.* As the premise of comprehensive risk assessment of farmers' land mortgage financing risk assessment index system, indicators should be selected on the basis of certain scientific methods.

*(1) Wholeness*. Compared with the general mortgage loan business, the mortgage risk of farmland management rights is diverse and special, so the screening of risk evaluation indicators should be carried out in a wider range [22, 23]. These indicators should be able to cover the potential risk factors in all aspects of the development process of farmland mortgage and involve all subjects and links. Through the close connection with each other, the overall efficiency of the land mortgage loan risk index can be brought into play to the best state, so as to better reflect the agricultural land mortgage financing risk [24].

*(2) Testability*. To evaluate farmers' land mortgage risk, the evaluation results must be presented in the form of subjective evaluation or objective numerical value. Therefore, the selection of indicators should be based on the premise of easy acquisition and easy calculation, so as to accurately measure the risk evaluation.

*(3) Scientific*. The selection of evaluation indicators must follow the principles of objective science and should be logical, representative, efficient, reasonable, convenient, objective, and true. The most important point is to summarize the evaluation indicators, which can neither overlap nor omit.

*(4) Purposefulness*. The establishment of the evaluation index system should be aimed at reflecting the mortgage risk of the land management right. On the basis of this purpose, several typical and clear variables should be selected. The premise of a scientific and objective index system is that its establishment must be consistent with the evaluation purpose.

*(5) Combining Quantitative and Qualitative*. Comprehensive risk assessment is a process of combining subjective and objective indicators, and the purpose of establishing a risk assessment system is to make the assessment results measurable. Therefore, when selecting indicators, quantitative

calculation and qualitative analysis should be combined with each other, and relevant indicators should be selected in a comprehensive manner to ensure that the evaluation system is scientific and reasonable, and the evaluation results are accurate and true.

*4.1.2. Index Screening Method.* The selection of evaluation indicators is crucial to the accuracy and objectivity of risk assessment results. The specific selection methods of farmers' land mortgage financing risk indicators are as follows:

*(1) Literature Reading*. The farmer's land mortgage financing work is in the initial stage, so the literature on this aspect is relatively scarce. However, it is still possible to obtain the available indicators from paper materials such as newspapers and periodicals or use electronic media such as the Internet and organize and summarize them.

*(2) Expert Consultation*. On the basis of referring to a large number of indirect literature on land mortgage financing and direct literature and preinvestigation affecting farmers' agricultural land mortgage financing risks, we solicited the opinions of experts and scholars in relevant fields, communicated with them continuously, and formed the first draft of the questionnaire. And in the later period, the problem is found in a timely manner, and the supplementary modification is continuously carried out.

*(3) Field Investigation*. Field surveys were conducted on farmers in 18 villages in Yangling district, the pilot project of agricultural land mortgage financing, to understand the current situation of farmers' agricultural land mortgage implementation, and to constantly find problems and solve problems, so as to improve the risk evaluation index system of land mortgage financing, do a good job in risk prevention and control to promote its smooth development.

*4.2. Evaluation Method of Farmer's Management Right Mortgage Loan Risk.* Analytic hierarchy process (AHP) takes the network tree as the basic theory and decomposes the relationship among the complex and ambiguous variables in the research object according to the research purpose. The combination of qualitative and quantitative methods is used to divide the variables into different constituent target sets, and according to the overall research purpose, the relationship between the indicators is divided into an ordered hierarchical structure diagram. After consulting with experts and scholars, the relative importance of each indicator in the hierarchy relative to an indicator in the upper layer is clarified through pairwise comparison. Because in practice, it is difficult to weight each indicator, so experts will use fuzzy language instead and construct a paired comparison matrix on this basis. Later, some scholars proposed that the above-mentioned vague language can be quantified by the Arabic numerals "1," "3," "5," "7," and "9" and introduce the function $f(x, y)$ to show which factor is more important than $x$ and $y$. The scale meaning of the pairwise comparison matrix is shown in Table 1.

Table 1: Scale meaning table of pairwise comparison matrix.

| $f(x, y)$ | Factor $x, y$ compared |
|---|---|
| 1 | $x$ and $y$ are equally important |
| 3 | $x$ and $y$ are slightly more important |
| 5 | $x$ and $y$ are obviously important |
| 7 | $x$ is strongly important |
| 9 | $x$ and $y$ are extremely important |
| 2, 4, 6, 8 | $x$ and $y$ are between the above two adjacent judgments |

As shown in Table 1, it is a multiobjective decision analysis method. In practical analysis and research applications, AHP can be used to clarify the weight of each indicator. It has multiple advantages such as simplification of complex problems, independent division of hierarchical relationships, and ingenious combination of qualitative and quantitative, so it is widely used in economics, management, society, military, and other fields. In the factor analysis, the principal component analysis method is used to calculate the 16 risk variables of the land mortgage risk factors. The number of common factors is determined according to the eigenvalue greater than 1 and the extraction principle of the characteristic root rubble map, as shown in Table 2.

As shown in Table 2, six common factors can be extracted from the mortgage financing risk of land management right, and the cumulative contribution rate of the first six factors is 60.544%. It shows that these six factors reflect most of the information of the land mortgage financing risk assessment in the sample area. In general, the use of AHP to determine weights is first of all comprehensive, and the ambiguous relationship between variables is first decomposed. Experts compare the weights and scores and finally integrate the evaluation results obtained to obtain a scientific decision-making plan. Moreover, each index factor in each hierarchy can be quantified by calculation to affect the evaluation result, which is very clear. It can solve practical problems that are very difficult for traditional theories and is very suitable for systematic comprehensive evaluation of unstructured, multicriteria and multiobjectives. AHP, a multiobjective decision analysis method, organically combines qualitative and quantitative calculations and divides the complex overall system objectives into a hierarchical structure. By calculating and quantifying and systematizing people's judgments, it is not just pursuing advanced mathematics or one-sided emphasis on logical reasoning. Analysis results can be obtained through simple calculations, which are easier for decision makers to accept and operate. The basic steps are shown in Figure 4.

As shown in Figure 4, according to the risk identification results, a risk assessment index system for the mortgage of farmland management rights can be roughly divided into three levels. Since almost all risk factors in the index system are qualitative indicators, it is necessary to further quantify the weight judgment results of various experts and scholars before conducting a comprehensive evaluation. It can be seen that the AHP method is very suitable for the risk assessment of land mortgage financing.

Table 2: Eigenvalues, variance contribution rate, and cumulative variance contribution rate.

| Ingredients | Initial eigenvalues | | |
|---|---|---|---|
| | Total | % of variance | Accumulation% |
| 1 | 3.003 | 18.769 | 18. 769 |
| 2 | 1. 876 | 11.722 | 30.491 |
| 3 | 1. 371 | 8.568 | 39.059 |
| 4 | 1.229 | 7.681 | 46.740 |
| 5 | 1.132 | 7.077 | 53.817 |
| 6 | 1.076 | 6.727 | 60.544 |

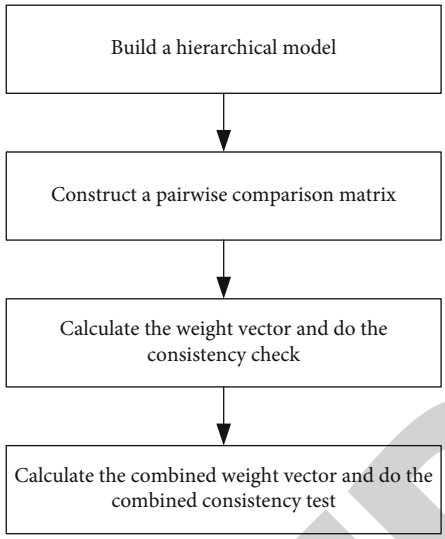



Figure 4: Flowchart of the steps of the AHP method.

### 4.3. Construction of Fuzzy Hierarchy (F-AHP) Comprehensive Evaluation Model

*4.3.1. Establishment of Risk Analysis Hierarchy Structure Model.* The risk hierarchy model is based on comparative judgment thinking, decomposes the ambiguous relationship of the evaluation object according to the evaluation purpose, regards it as a whole, and continuously integrates it as a whole. The hierarchical structure is shown in Figure 5.

As shown in Figure 5, it decomposes the complex and ambiguous problem of the research object into a number of different indicator sets, and according to the overall goal of the research, it is divided into an ordered hierarchical structure diagram according to the affiliation between them. Generally, it includes three layers: target layer, criterion layer, and factor layer.

*4.3.2. Construction of Pairwise Comparison Judgment Matrix.* Constructing the judgment matrix is one of the important steps in the comprehensive evaluation of fuzzy hierarchy. According to the evaluation purpose, establish a hierarchical structure diagram of the subordination relationship between each index and have a deep understanding of it. And consult experts to obtain the relative importance of the indicators through the pairwise comparison of fuzzy language and to score this according to the comparison matrix scale to obtain the corresponding score.

*4.3.3. Establishing a Set of Risk Fuzzy Evaluation Factors.* Taking each land mortgage loan financing risk index as a set of elements, that is, the risk fuzzy evaluation factor set, in this paper, $U$ is used to represent the main factor set of comprehensive risk assessment. If multiple risk factors of farmland management right mortgage loan are divided into $m$ categories, then $U = \{U_1, U_2, \cdots, U_m\}$ can be used to indicate that the main factor set contains m sub-factor sets. $U = \{U_{i1}, U_{i2}, \cdots, U_{im}\}$ represents each sub-factor set, where $U_{ij} = \{i = 1, 2, \cdots, m, j = 1, 2, \cdots, n\}$ represents the $j$th factor of the $i$th subfactor set. It is explained here that since the number of risk factors contained in each subfactor set may be unequal, that is, there may be different $n$ for different $i$.

*4.3.4. Establishing a Risk Fuzzy Evaluation Set.* A set of results is obtained by evaluating the risk factors of land mortgage loan financing, namely, the risk fuzzy evaluation set. In this paper, $V$ is used to represent the comprehensive risk evaluation set, which can be expressed as $V = \{V_1, V_2, \cdots, V_m\}$, where element $V_1 = \{j = 1, 2, \cdots, n\}$ represents the evaluation result of the $j$th risk factor. Based on on-the-spot investigation on the mortgage loan risk of farmland management right in the sample area, a risk fuzzy evaluation grade set can be established: $V = \{V_1, V_2, \cdots, V_5\}$ means the corresponding risk grades are "high, higher, general, lower, and low", respectively.

*4.3.5. Fuzzy Comprehensive Evaluation of Each Subfactor Set in the Risk Index System.* By arranging and analyzing the questionnaires on the risk assessment level of farmers in the sample area, we can get $U_{ij} = (1, 2 \cdots .m)$, the degree of membership of the risk assessment level $vt(t = 1, 2, 3, 4, 5)$. Among them, $r_{ijt} = N_{ijt}/N$, $N$ is the number of experts participating in the evaluation, and $N_{ijt}$ is the number of experts whose evaluation risk index $U_{ij}$ is at level $V_i$. From this, the membership matrix of the first-level fuzzy comprehensive evaluation can be obtained: $R_i(i = 1, 2, \cdots, m)$ is:

$$R_i = \begin{bmatrix} r_{i11} & \cdots & r_{i15} \\ \vdots & \ddots & \vdots \\ r_{\text{in}1} & \cdots & r_{\text{in}5} \end{bmatrix}. \tag{19}$$

Among them, $n$ represents the number included in the farmers' risk subfactor set in $U_i$. Then, the first-level modular combination evaluation result is obtained by calculation:

$$V_i = W_i R_i = (W_{i1}, W_{i2}, \cdots, W_{\text{in}}) * \begin{bmatrix} r_{\text{i}11} & \cdots & r_{i15} \\ \vdots & \ddots & \vdots \\ r_{\text{in}1} & \cdots & r_{\text{in}5} \end{bmatrix} = (V_{i1}, V_{i2,}, \cdots, V_{i5}). \tag{20}$$

Among them, $v_{it} = \sum_{i=1}^{n} W_{\text{in}} \cdot r_{ijt} (t = 1, 2, \cdots, 5)$.

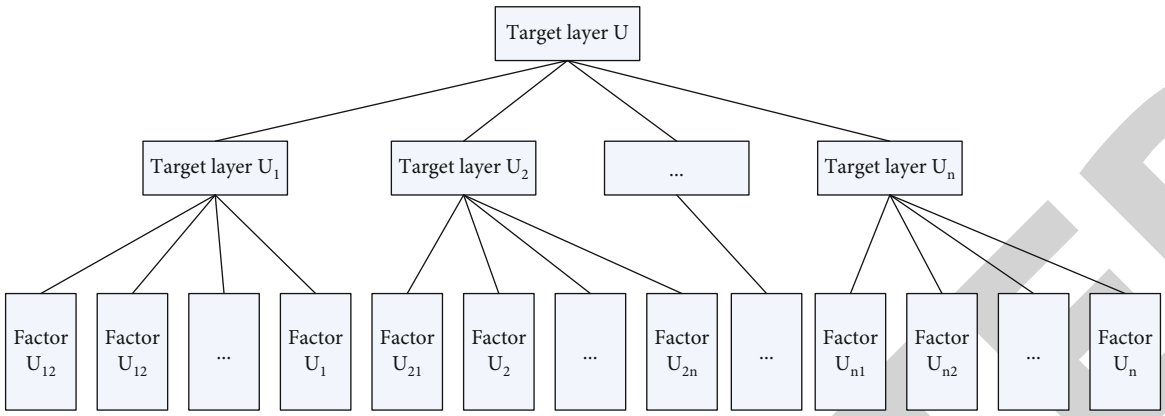



Figure 5: Hierarchical hierarchy.

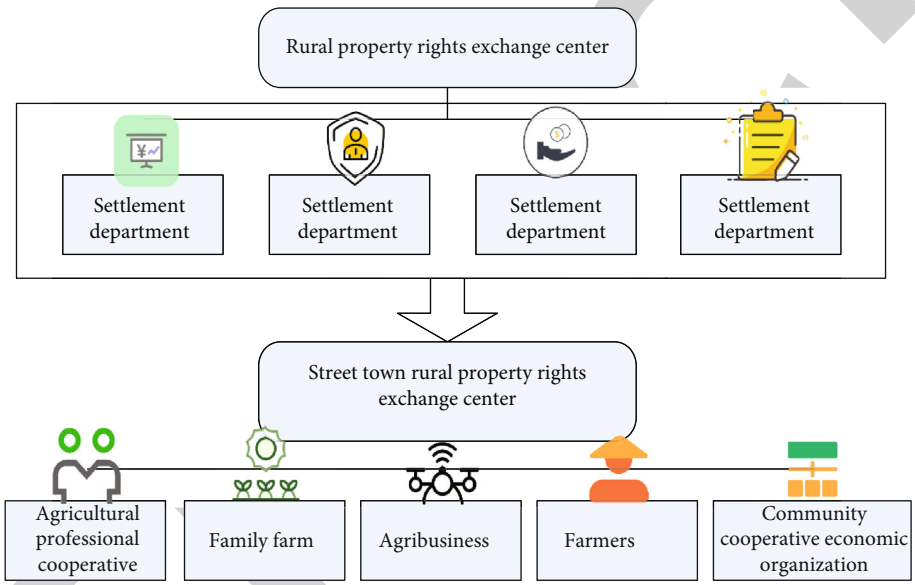



Figure 6: Schematic diagram of the structure of the agricultural transportation center.

*4.3.6. Fuzzy Comprehensive Evaluation of the Main Factor Set.* Use $U_i$ to represent each subfactor set, and use $V_i$ to represent the single-factor evaluation result for it, so that the second-level fuzzy evaluation membership matrix $R = (V_1, V_2, \cdots V_m)^T$ can be obtained. The weight of $U_i$ is $W = (w_1, w_2, \cdots w_m)$, so the second-level fuzzy comprehensive evaluation result is calculated as:

$$V = W \cdot R = (w_1, w_2, \cdots w_m) \cdot (V_1, V_2, \cdots V_m)^T = (V_1, V_2, \cdots V_5). \tag{21}$$

If $\sum_{i=1}^{5} v_t \neq 1$, then $V = (V_1, V_2, \cdots V_5)$ must be normalized again, and according to $\widetilde{v_t} = v_t / \sum_{t=1}^{5} v_t$, the fuzzy comprehensive evaluation vector $\widetilde{V} = (V_1, V_2, \cdots V_5)$ is obtained. Finally, which judgment level the researched risk results belong to is determined according to the principle of maximum membership, so as to obtain the risk level of the farmland management right mortgage loan.

## 5. Risk Identification of Farmers' Housing Property Rights Mortgage Loans

*5.1. Risk of Conflict of Laws.* The risk of conflict of laws comes from two aspects: the conflict between national-level regulations and local policies and the conflict between local policies themselves. Legal policies will lead to uncertainty about the transaction costs of various entities in the mortgage of farm houses. The restrictions on homestead mortgages in the pilot areas have been adjusted, but there are still some national-level laws that impose restrictions on the transfer of homestead property rights. In addition, the relevant laws have not revised and updated in real time the detailed rules for the transfer of the right to use the homestead and the supporting accounting and taxation systems. At the same time, the Ministry of Housing and Urban-Rural Development issued a regulation: for the transfer registration of the right to use the homestead, the transferee must be a member of the village collective economic organization; otherwise, the housing registration agency should not

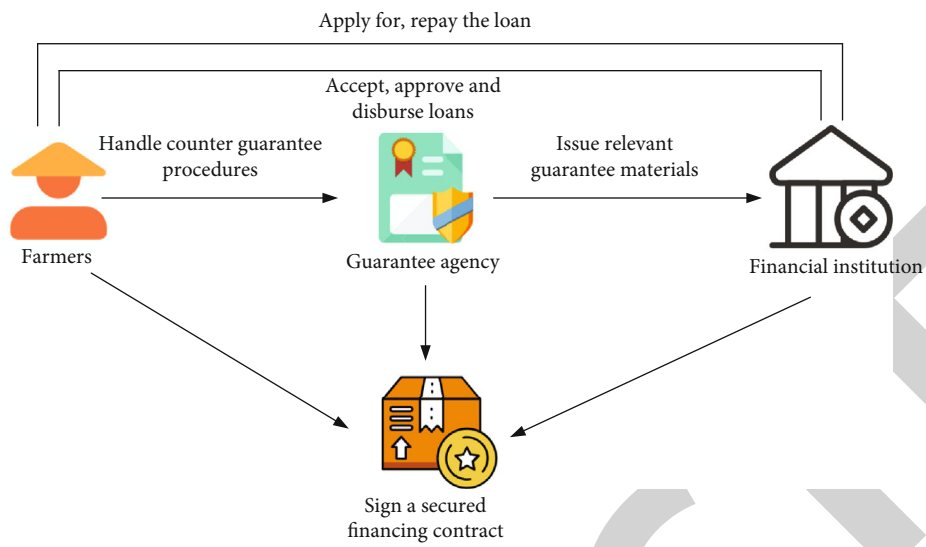
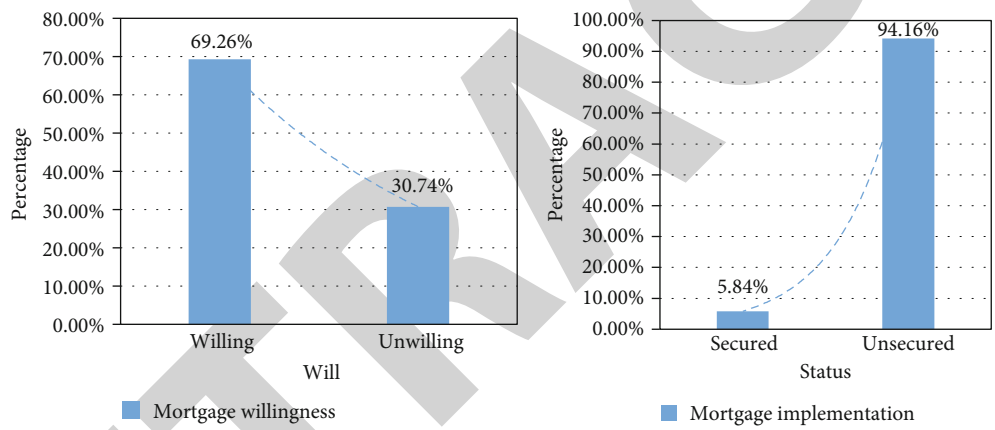



Figure 7: The basic model of rural housing mortgage loan guarantee.




(a) Mortgage loan willingness (b) Mortgage loan implementation

Figure 8: Farmers' willingness and implementation of farmland management right mortgage loan.

handle it. This undoubtedly conflicts with local policies, and legal obstacles at the national level will increase the cost of operating the government system.

Under the background of "separation of three rights" of homestead property rights, in order to broaden the transaction and circulation of rural property rights including the right to use homestead, the company operation mode of city and town (street) linkages is used at the same time. Its structure is shown in Figure 6.

It can be seen from Figure 6 that there are secondary components under the agricultural communication center. That is, the town (street) rural property rights transaction subcenter established with the help of the town (street) convenience service center and the agricultural service center, and its authority is obviously different from that of the municipal transaction center. The municipal-level trading center is responsible for the online property rights consultation in the property rights trading market and the formulation of trading rules and management measures related to various types of trading.

*5.2. Risk of Residency Security.* Rural homesteads and aboveground houses provide farmers with basic living security places. In the process of mortgage of farm houses, farmers have bounded rationality as individuals. Under the real situation of asymmetric property rights transaction information, farmers have the opportunistic tendency to obtain benefits by covering up valid information or creating false information. Opportunistic behavior means that the parties involved in the transaction implement the transaction behavior in the case of seeking the greatest benefit, and seeking the greatest benefit is to achieve the greatest utility. The objective condition for farmers to implement opportunistic behavior is that the institutional constraints are not perfect. There are not many financial institutions that can handle mortgage loans for rural houses. When farmers face fewer transaction objects, opportunistic behavior will be stimulated. The transaction fees paid by farmers in the farm house mortgage system are mainly concentrated in the ex antetransaction fees before obtaining loans. The benefit lies in the scale return of financing funds. Under opportunism, individual farmers

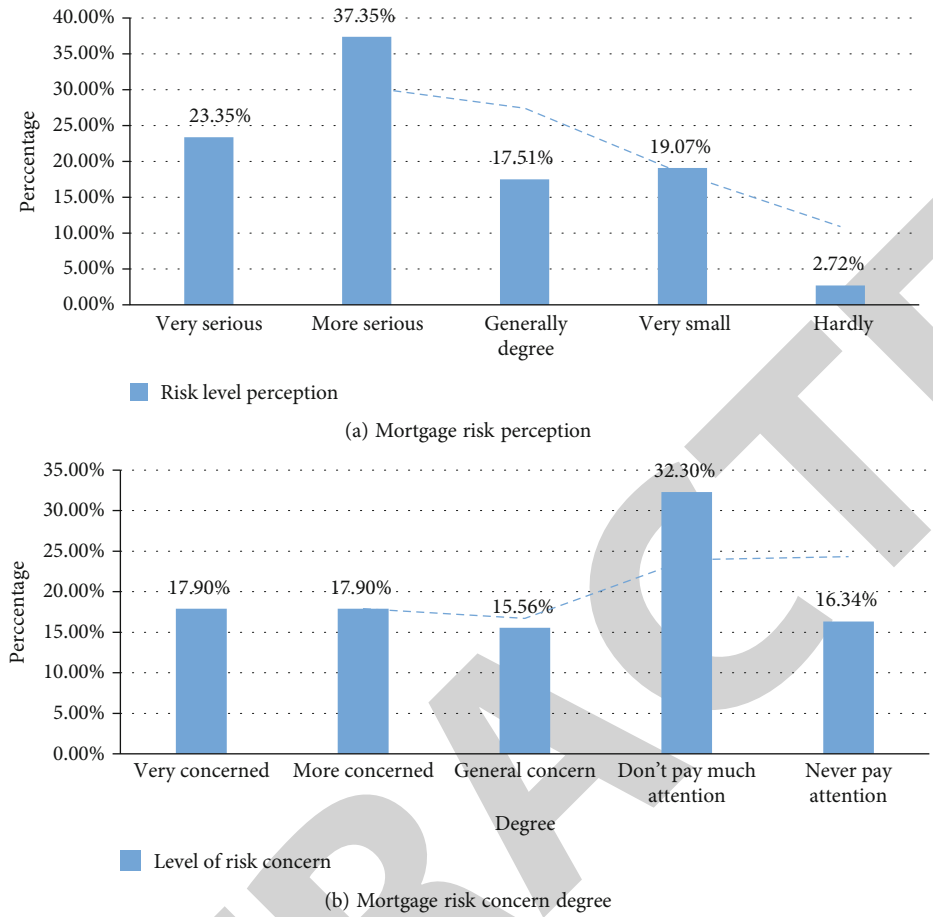



Figure 9: Farmers' cognition and attention to the risk degree of farmland management right mortgage loans.

will produce opportunistic behavior in the payment of transaction fees in advance. After the official document was issued by the state, the government took the lead and set up an agricultural guarantee company with relevant institutions to provide guarantee services for the mortgage of rural property rights, including the mortgage of rural houses, and to share the mortgage loan risk of rural houses with financial institutions. In addition, the government cooperates with the members of the village collective organization to establish a rural mutual guarantee organization and distributes the credit risk of rural housing mortgage loans through collective organization guarantees and multifamily joint insurance. However, the saving of such ex anteexpenses will make farmers ignore the issue of housing security when the house is transferred after the loan. The basic model of rural housing mortgage loan guarantee is shown in Figure 7.

As shown in Figure 7, although from the perspective of the ownership of the usufructuary right of the homestead, the farmers have the basic right to occupy and use the homestead in accordance with the law. In addition, the mortgaged farmers are required to issue a legal certificate that the farmers still have a place to live after the mortgaged house is disposed of or a third party's voluntary commitment to provide them with a place to live. However, in actual situations, farmers have obtained other residential place commitments by leasing or by means of housing from relatives and friends, and some farmers even obtained mortgage loans by opening false tripartite certificates. A third-party commitment letter alone is difficult to play a binding effect, and the borrowing farmers mostly use the loan funds for nonagricultural production and operation activities, which will increase the possibility of default. In the event of a breach of contract, the collateral will be transferred, and it is stipulated that "after the rural villagers sell or rent their houses, they will not approve the reapplication of the homestead." Therefore, the farmer will face the loss of the basic right of residence in the case of losing the homestead.

*5.3. Willingness and Implementation of Sample Farmers' Farmland Management Right Mortgage Loan.* According to farmers, the mortgage loan for farmland management rights is more suitable for loan needs with large scale of land, large loan amount, and long loan period. Under normal circumstances, farmers' capital needs generally still use the method of borrowing from relatives and friends. The willingness and implementation of farmers' farmland management rights mortgage loan are shown in Figure 8.

As shown in Figure 8, during the survey, when farmers were asked whether they were willing to participate in the mortgage of farmland management rights, 178 households expressed their willingness, accounting for 69.26% of the sampled households. However, only 79 households held

the attitude of "unwillingness," accounting for 30.74% of the sample, and more than half of the sample farmers had a strong willingness to mortgage the farmland management rights. It can be seen that farmers in the research area generally recognize this emerging rural financial financing model based on the government's leadership. Among the surveyed farmers in the survey area, 242 have not actually participated in the mortgage loan of farmland management rights, accounting for 94.16% of the sample farmers. However, there are only 15 farmers who actually use the farmland management right for mortgage financing, accounting for 5.84% of the sample, and there is a big gap between the two. This shows that the number of farmland management right mortgage loans in this pilot project is too small, and it is urgent to increase promotion efforts to actively encourage farmers with potential capital needs to use farmland management rights for mortgage loan financing.

*5.4. Overall Analysis of the Risk of Mortgage Loans for the Farmland Management Rights of the Sample Farmers.* From the survey of farmers, we learned that farmers understand the various risks faced by farmland management rights from work experience, relatives and friends, government propaganda, newspapers, radio, television, Internet, and other channels, but farmers facing risks should pay attention. Figure 9 shows farmers' awareness and concern about the risk level of farmland management right mortgage loans.

As shown in Figures 9, 60 rural households believe that the mortgage loan risk is very high, accounting for 23.35% of the sample households. There are 96 farmer households who believe that the risk of mortgage loans is high, accounting for 37.35% of the sample. The 45 sample farmers believe that the mortgage loan risk is average, which is 17.51% of the sample. There are 49 farmers thought that the risk of land mortgage was very small, accounting for 19.07% of the sample. On the other hand, only 7 farmers considered mortgage loans to be less risky, accounting for 2.72% of the total. Among the sample farmers, 17.90% are very concerned about the risks of agricultural mortgage loans, and will take the lead in finding as much information as possible. There are 17.90% of farmers said they were worried about risks, 15.56% were generally worried, and 15.56% were not very worried. There are 32.30% of farmers are mostly agricultural mortgage loans, and they know little about information, and 16.34% of farmers say they do not pay attention and do not know relevant information. Generally, farmers are less aware of risks.

## 6. Conclusions

The farmland management right loan solves the problem of land financing difficulties for rural residents to a certain extent, but at the same time, the farmland management right mortgage loan business in its infancy also faces certain potential risks, and the risk factors are diversified. This paper mainly studies the possible risks of farmers in the process of mortgage, aiming to gradually minimize the risks and realize the transformation of farmland management rights to credit resources through the active promotion and joint efforts of all parties. At present, China must continuously improve the agricultural land management right mortgage loan system and related supporting measures and must build a relatively effective risk prevention system including risk avoidance, risk reduction, and risk transfer, so as to promote rural finance forward. Through a variety of ways and means to actively enhance farmers' awareness of insurance participation, farmers' awareness of risk prevention is relatively poor. In order to increase the participation rate of agricultural insurance and reduce the losses caused by uncertain factors such as natural risks and market risks, it is necessary to enhance the awareness of farmers to participate in insurance, so that the risk mitigation function of insurance can be maximized. Factors such as market interest rates, agricultural product prices, natural risks, and the meteorological environment are always changing. If farmers do not respond in time, they will eventually increase risk losses. Therefore, a risk early warning mechanism is very necessary. There are many factors that affect the value of rural land. At present, the value evaluation of rural homestead is mostly based on the value evaluation standard of urban commercial housing. However, this standard cannot effectively evaluate the value of rural homestead, and the evaluation of homestead value under the conditions of rural land characteristics needs further research.

## Data Availability

Data sharing is not applicable to this article as no new data were created or analyzed in this study.

## Conflicts of Interest

The authors state that this article has no conflict of interest.

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