

Research on risk control, early warning, monitoring and decision system based on big data

Zilu Liu

College of economics and management South West University, Chongqing 400715, China

Abstract. In the process of survival and development of Internet financial enterprises, financial risk as an important influencing factor, it is of great significance to timely control and early warning it. Based on this, in order to improve the ability to resist enterprise for financial risk, based on the technology of data for the user's information, and combined with AHP analytic hierarchy process (AHP) to construct the evaluation model, construct a qualitative risk analysis system based on large data, for the Internet financial enterprises to control the financial risk early warning and decision support and help.

Keywords: AHP hierarchy analysis; Financial risk; Risk control and early warning.

1. Introduction

In today's era background, lending to financial platform of network platform for rapid development of Internet, because of information asymmetry, lack of perfect regulation system and the platform itself and inadequate management, lead to recovery, recover the blocked leading to bad loans, to borrow accounts in a mess, resulting in financial risks and, in turn, lead to the entire industry is in a state of chaos, In the lending activities, the main risk comes from users. Therefore, improving the degree of risk assessment for users and risk warning can effectively improve the ability of enterprises to resist risks.

2. Construction of risk control, early warning, monitoring and decision-making system

Of the system by big data under the background of the crawler technology on borrowing data collection, storage, by identifying risk index, and the index weight calculation to construct risk assessment model, through the model computation lending risk score, and the risks of financial loans for control and early warning, decision support information for financial platform lend.

2.1 Index Selection

Based on the investigation and analysis of relevant network platforms and related literature[1]The risk factors can be divided into two parts: the individual situation of the borrower and the situation of the loan project, with a total of 12 indicators. The specific indicators are shown in Table 1 below.

Table 1. Risk early warning indicators

Level indicators	The secondary indicators	Level 3 indicators
Personal situation of the borrower	Reimbursement ability	income
		Assets structure
		Education level
		Average monthly consumption
		The consumption structure
		Annual household income
		Repayment success rate
Loan Project Status	Credit record	Amount of outstanding payments
		Due date time limit
		Borrowing amount
		Lending rate
		Reimbursement means

2.2 Determination of indicator weights

The analytic hierarchy process (AHP) was used to build the index evaluation model, and the advantages and disadvantages of the indicators were ranked, and the standard average method was used to calculate the weight of each indicator[2].

The analytic hierarchy process is based on the selected indicators, through the establishment of hierarchical structure, the indicators are compared, the advantages and disadvantages of the indicators are arranged by the ratio of 9 quartiles, M&A

According to the above indexes, the hierarchical structure is established, and the evaluation index judgment matrix is constructed based on it. Matrix A is as follows:

$$A = \begin{bmatrix} 1 & a_{12} & \dots & a_{1n} \\ a_{21} & 1 & \dots & a_{2n} \\ \dots & \dots & 1 & \dots \\ a_{n1} & a_{n2} & \dots & a_{nn} \end{bmatrix}$$

In the matrix is the comparison result between elements and elements, where. a_{ij} a_{ji} , $j \in n$ and $a_{ij} = \frac{1}{a_{ji}}$

The hierarchical structure established according to analytic hierarchy process is shown in Table 2 below

Table 2. Overall hierarchical structure of the recursion stage

The target layer	Borrowing risk (X)	
Elements layer	Borrowing Personal situation (A1)	Loan Items (A2)

According to the content of each quasi-factor layer, the hierarchical structure is constructed, as shown in Table 3 below

Table 3. The hierarchical structure of each factor layer

The target layer	Borrowing Personal Situation (A1)		Loan Items (A2)		
Elements layer	Repayment capacity (A11)	Credit history (A12)	Amount borrowed (A10)	Borrowing rate (A11)	Repayment method (A12)
The child elements layer	Income Profile (A1)	Repayment success rate (A7)			
	Asset structure (A2)	Amount outstanding (A8)			
	Education level (A3)	Due Date Time limit (A9)			
	Average Monthly consumption (A4)			/	
	Consumption structure (A5)	/			
	Annual household income (A6)				

Taking the repayment ability in the individual situation of the borrower as an example, the judgment matrix A1 is constructed as follows:

$$A1 = \begin{bmatrix} 1 & a_{12} & \dots & a_{16} \\ a_{21} & 1 & \dots & a_{26} \\ \dots & \dots & 1 & \dots \\ a_{61} & a_{62} & \dots & a_{66} \end{bmatrix}$$

Where: is the comparison between income and asset structure; is the comparison between household annual income and asset structure. a_{12} a_{62}

Taking the situation of loan projects as an example, the judgment matrix A2 is constructed as follows:

$$A1 = \begin{bmatrix} 1 & a_{1011} & a_{1012} \\ a_{1110} & 1 & a_{1112} \\ a_{1210} & a_{1211} & a_{1212} \end{bmatrix}$$

Where is the comparison between the lending interest rate and the borrowing amount. a_{1110}

After establishing the judgment matrix, it is necessary to assign values to each element [3], the assignment rules are shown in Table 4 below.

Table 4. Importance assignment

The importance of	As important	A little important	More important	Highly important	Extremely important
The assignment	1	3	5	7	9

The importance of each element was judged by questionnaire survey. A total of 500 questionnaires were distributed, 480 were recovered, and 401 invalid questionnaires such as assignment errors were eliminated. The construction of judgment matrix was completed by assigning values. Taking repayment ability as an example, the comparison matrix of each indicator of repayment ability is shown as follows:

$$A1 = \begin{bmatrix} 1 & a_{12} & \dots & a_{16} \\ a_{21} & 1 & \dots & a_{26} \\ \dots & \dots & 1 & \dots \\ a_{61} & a_{62} & \dots & a_{66} \end{bmatrix} = \begin{bmatrix} 1 & 4 & 8 & 3 & 5 & 7 \\ 1/4 & 1 & 5 & 1/2 & 2 & 4 \\ 1/8 & 1/5 & 1 & 1/6 & 1/4 & 1/2 \\ 1/3 & 2 & 6 & 1 & 3 & 5 \\ 1/6 & 1/2 & 4 & 1/3 & 1 & 3 \\ 1/7 & 1/4 & 2 & 1/5 & 1/3 & 1 \end{bmatrix}$$

The sum of each column, and is calculated by the judgment matrix. $\sum_i a_{i1} \sum_i a_{i2} \sum_i a_{i3} \dots \sum_i a_{i4} \dots \sum_i a_{i5} \sum_i a_{i6}$ Take computation as an example, $\sum_i a_{i1}$

$$\begin{aligned} \sum_i a_{i1} &= a_{11} + a_{21} + a_{31} + a_{41} + a_{51} + a_{61} \\ &= 1 + \frac{1}{4} + \frac{1}{8} + \frac{1}{3} + \frac{1}{6} + \frac{1}{7} = \frac{1723}{840} \end{aligned}$$

Then the calculation shows that

$$\sum_i a_{i1} = \frac{1723}{840} \sum_i a_{i2} = \frac{159}{20} \sum_i a_{i3} = 26 \sum_i a_{i4} = \frac{26}{5} \sum_i a_{i5} = \frac{139}{12} \sum_i a_{i6} = \frac{41}{2}$$

The standard matrix is obtained by calculating the sum of the elements in the matrix and their relative columns, and the average value of each row in the standard matrix is calculated to obtain the weight of each factor, and the eigenvector of the repayment ability of the borrower in the risk problem and the individual situation is obtained. The standard matrix is as follows:

$$A1' = \begin{bmatrix} a'_{11} & a'_{12} & \dots & a'_{16} \\ a'_{21} & a'_{22} & \dots & a'_{26} \\ \dots & \dots & \dots & \dots \\ a'_{31} & a'_{32} & \dots & a'_{66} \end{bmatrix}$$

Where it is calculated as follows: a'_{11}

$$a'_{11} = \frac{a_{11}}{\sum_i a_{i1}}$$

The calculated weight of each factor is shown in Table 5 below.

Table 5. Overall weight information

project	Personal circumstances of the borrower	Borrowing project
The weight	0.8	0.2

Table 6. Weight Table of Borrower's personal circumstances

	project	The weight
Ability to repay (0.75)	income	0.3737
	Assets structure	0.1507
	Education Level	0.0338
	Average monthly consumption	0.2233
	The consumption structure	0.1018
	Annual household income	0.0490
	Repayment success rate	0.6232
Credit history (0.25)	Amount of outstanding payments	0.2395
	Due date time limit	0.1373

Table 7. Weight Table of loan item situation

project	Borrowing amount	Lending rate	Reimbursement means
The weight	0.6393	0.2737	0.0869

In the case of obtaining the weight of each factor, it is necessary to carry out the consistency test of the matrix, whose calculation formula is as follows:

$$CR = \frac{CI}{RI}$$

Where: is the consistency rate, is the consistency index, and is the modified value of the degree of freedom index. The modified value of the degree of freedom index is shown in Table 8.

Table 8. Revised value of freedom index

dimension	1	2	3	4	5	6	7	8	9
RI	0.00	0.00	0.57	0.95	1.17	1.24	1.32	1.42	1.47

The consistency index is calculated using the following formula:

$$CI = \frac{\lambda_{max} - n}{n - 1}$$

Where: N is the number of factors, and is the average value of the quotient of each weighting vector component and its feature vector component.

Then, the consistency of the matrix meets the standard requirements and the matrix is feasible. Then, the weight of each index can be obtained by integrating the weights as shown in Table 9 below.

Table 9. Weight table of each indicator

indicators	The weight
income	0.22422
Assets structure	0.09042
Education Level	0.02028
Average monthly consumption	0.13398
The consumption structure	0.06108
Annual household income	0.02940
Repayment success rate	0.12464
Amount of outstanding payments	0.04790
Due date time limit	0.02746
Borrowing amount	0.12786
Lending rate	0.05474
Reimbursement means	0.01738

2.3 Risk assessment method

Through the big data technology, combined with the consumer software database, such as Taobao, Jingdong and other consumer software, and docking with the credit system of the bank, the loan users of the indicators of information collection, through the database of normal lending behavior data comparison[4], to evaluate the borrower's score, denoted as, where are the above indicators. A_i And through the risk index, the risk degree is calculated, the calculation method is as follows:

$$X = \sum A_i \times a_i$$

Where: is the degree of risk, is the evaluation score of each index, the value of each index score is 10 points, a total of 12 indicators, the maximum of the total score is 120 points.

The calculated risk degree of the borrower is compared with the set standard value to provide decision support for whether the financial platform provides lending services.

Table 10. Setting value of risk degree

The degree of risk	Significant risk	Larger risk	General risk	Low risk
score	0 ~ 50	50 ~ 60	60 ~ 100	100 ~ 120

When the risk level is low, the financial risk can be limited reduced. When there is a significant risk, the lending service will be suspended. Thus, the risk control, early warning, monitoring and decision-making system is completed.

3. Conclusions and reflections

The construction of risk early warning and monitoring system can effectively resist financial risks. However, the focus of the system is to capture the user information, so the system improvement and attention points are as follows

Big data technology can ensure the acquisition of data information, so we should do a good job in the construction of the database, and constantly improve the comparison algorithm for optimization, to ensure the timeliness of information

The score of risk degree can be refined, so as to improve the assessment and control of risk.

4. Conclusion

In conclusion, through the big data technology to fetching user information, and the index information, the degree of risk weighting, lending activity three aspects form the risk early warning monitoring and decision-making system, can effectively to financial companies on the Internet to quantify financial risk, improve enterprise for financial risk resistance, thus ensure the survival and development of the enterprise.

References

- [1] Market Week,2016(5):82-84.
- [2] Xie Yani. Enterprise financial risk analysis model based on improved Analytic Hierarchy Process [J]. Computer & Digital Engineering, 222,50(4):721-725,761.
- [3] Zhu Jianping, Yang Wei. Research on credit rating of P2P online lending platform in China based on AHP [J]. Contemporary Finance Research,2019(3):5-24.]
- [4] Research on risk control of Internet finance based on big data [J]. Financial News,2022(14):154-156.