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Credit decision based on Credit risk assessment index system

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Abstract: *The loan fund allocation of banks to small and medium-sized enterprises should not only maximize the interests of banks, but also ensure that enterprises are allocated an appropriate amount of loans. First of all, carry on the data preprocessing, because the credit rating of the enterprise directly determines whether the bank lends to it or not, so as to eliminate the data of the enterprises that do not lend. Secondly, five quantitative analysis indexes, namely, total output tax, total input tax, profit, credit rating and default or not, are selected to quantitatively analyze the risk of each enterprise by establishing a fuzzy comprehensive evaluation model. In order to avoid subjectivity, the coefficient of variation method is used to calculate the index weight of each index of the fuzzy comprehensive evaluation model, and the weighted average method is used to determine the fuzzy comprehensive evaluation result. Establishment of credit risk assessment index system. Then, from the point of view of maximizing bank profits, the bank-to-enterprise credit strategy is formulated according to credit risk and credit policy, which is reflected by lending, loan line, interest rate and term. Because the exact value of the total credit of the bank is not given, when formulating the credit strategy, the credit line of each enterprise is reflected by the proportion of the enterprise credit line to the total credit line. In order to maximize bank profit, a linear optimization model of interest rate and customer turnover rate is established to fix customer loss and maximize bank interest rate.*

Keywords: *Credit risk assessment index system, Fuzzy comprehensive evaluation model, Coefficient of variation method*

1. Introduction

Small and medium-sized enterprises are an important force in the development of our national economy. At present, the development of small and medium-sized enterprises is still faced with many problems and obstacles, among which the difficulty of financing has been one of the main factors to restrain the development of small and medium-sized enterprises. In recent years, financial institutions have increased their loans to small and medium-sized enterprises [1]. In bank loans, banks first assess the credit risk of small and medium-sized enterprises, and then determine the credit strategy according to the evaluation results and other factors.

This paper makes a quantitative analysis of the credit risk of 123 enterprises with known credit rating and whether they default or not, and gives the bank's credit policy to the enterprise when the total annual credit is fixed. First of all, according to the data in Annex 1, after preprocessing the data, we select five quantitative analysis indexes, namely, total output tax, total input tax, profit, credit rating and whether or not to default. Secondly, these five indicators are used to establish the credit risk evaluation index system by using the fuzzy comprehensive evaluation model to establish the credit risk of enterprises [2]. Finally, according to the credit policy and credit risk assessment to determine whether the bank lends to the enterprise, the loan line, interest rate and term and other credit strategies when the annual total credit is fixed [3], and the credit strategy should make the bank make a bigger profit as far as possible.

2. Index selection

In practice, the bank evaluates the credit risk of the enterprise according to its strength and reputation. Therefore, the establishment of the credit risk evaluation system needs to comprehensively consider the strength and reputation of the enterprise, combined with the attachment analysis, the strength of the enterprise can be reflected by the purchasing and selling ability and the profits obtained by the enterprise, and the reputation of the enterprise can be reflected by the evaluation grade of its reputation and whether

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it is in breach of contract or not. Therefore, this paper selects the total of sales, income, profit, credit rating and whether to default as the credit risk evaluation index.

3. Model building

On the basis of the fuzzy evaluation model, the fuzzy comprehensive evaluation model is introduced to construct the credit risk evaluation index system, and the coefficient of variation method is used to calculate the index weight of each index of the fuzzy comprehensive evaluation model. The weighted average method is used to determine the fuzzy comprehensive evaluation results, that is, to determine the quantitative value of credit risk. According to the credit policy and credit risk to determine the bank's credit strategy, that is, whether to lend to their enterprises, loan lines, interest rates and terms.

Step1 builds a fuzzy comprehensive evaluation model:

1) Determine rating indicators and evaluation levels. In this paper, the evaluation index is determined as the total output items, the total income, profit, credit rating, whether or not to default five indicators, the evaluation level is the specific quantification of the indicators.

2) Constructs fuzzy comprehensive evaluation matrix.

$$R = (r_{ij})_{m*n} = \begin{bmatrix} r_{11} & \cdots & r_{1n} \\ \vdots & \ddots & \vdots \\ r_{m1} & \cdots & r_{mn} \end{bmatrix} \tag{1}$$

3) Determines the weight of each index according to the method of coefficient of variation.

a) Calculate the mean and variance of item i.

$$\overline{x_i} = \frac{1}{n}\sum_{j=1}^{n} a_{ij} \tag{2}$$

$$s_i^2 = \frac{1}{n-1}\sum_{j=1}^{1} (a_{ij} - \overline{x_i})^2 \tag{3}$$

b) Let $v_i = s_i/|\overline{x_i}|$, Normalized weight coefficient v_i,

$$w_i = v_i / \sum v_i \tag{4}$$

4) Chooses the appropriate fuzzy synthesis operator and uses the weighted average algorithm to carry out the fuzzy synthesis operation, then the quantitative value of credit risk can be obtained.

Fuzzy synthesis operator:

$$M(\cdot, +): b_j = \sum_{i=1}^{m} (a_i \cdot r_{ij}) \tag{5}$$

Step2 Credit Policy Analysis:

At present, China's loan policy is to give priority to supporting the development of energy and transportation enterprises, giving priority to the production of famous and quality products and various marketable products in the light and textile industry, actively supporting the procurement of agricultural and sideline products and expanding commodity circulation, vigorously supporting the production of products that create exchange rate for export, and supporting enterprises in the development and trial production of new products, technological renewal, technological transformation and the introduction of advanced technology. Support science and technology to serve production and commodity circulation, promote the rapid transformation of science and technology into productive forces, and support the development of collective and individual enterprises. For operating loss-making enterprises, enterprises with high product costs, poor quality and no market, and enterprises on the edge of closing or stopping,

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loans must be strictly controlled, and enterprises must be urged to seriously deal with the backlog of materials until loans are compressed and stopped.

Step3 determines the bank's credit strategy

Because whether the bank lends or not is judged according to the credit grade of the enterprise, if an enterprise decides that it will not lend, then the loan amount, interest rate and term will no longer be considered, so the enterprises considered by the bank's credit strategy are all the enterprises that lend.

Loan line: when the total loan amount is fixed but there is no exact value, the loan line is expressed as a proportion of the total amount.

Interest rate: the interest rate is determined by the benchmark interest rate plus point pricing method.

In this paper, the risk premium point is the interest rate of corporate loans when the customer turnover rate is 0.5, taking into account the profits of the bank and the customer turnover rate.

The higher the annual interest rate of bank loan is, the higher the customer turnover rate is, and the higher the customer rating is, the higher the customer turnover rate is. In order to make the bank gain more, this paper selects the customer turnover rate of 0.5 as the basic standard, and establishes the solution function about the interest rate.

Term: the term of the loan given in the title is 1 year.

4. Solution and result analysis of the model

1) Calculation of weight coefficient by coefficient of variation method

$$v1=0.507479464775053$$
$$v2=0.532499134148454$$
$$v3=7.10499446506981$$
$$v4=3.89299737417277$$
$$v5=7.10924814108396$$

After the coefficient is normalized, it can be obtained.

$$w1=0.0265040827039501$$
$$w2=0.0278107826441970$$
$$w3=0.371071883660927$$
$$w4=0.203319210989299$$
$$w5=0.371294040001627$$

2) The weighted average method is used to calculate the credit risk, and some of the results are shown in the table below.

Table 1: Credit risk

Number	Risk	Number	Risk
E1	0.381023	E11	0.779261
E2	0.694132	E12	0.756019
E3	0.703859	E13	0.746586
E4	0.498865	E14	0.761824
E5	0.762952	E15	0.745938
E6	0.733897	E16	0.746617
E7	0.694294	E17	0.759133
E8	0.729736	E18	0.754674
E9	0.72532	E19	0.756152
E10	0.736656	E20	0.763591

3) In the case of maximizing bank returns, comprehensively consider the credit policy and credit risk, determine the credit strategy for small and medium-sized enterprises, as shown in the table.

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Table 2: Problem one: credit strategy

Number	Whether to lend	Proportion of loan amount to total amount (%)	Interest rate (%)	Term (years)
E1	No	0	0	0
E2	Yes	0.009143	0.0650637	1
E3	Yes	0.009271	0.0655625	1
E4	Yes	0.006571	0.0808345	1
E5	Yes	0.010049	0.0602118	1
E6	Yes	0.009667	0.0622603	1
E7	Yes	0.009145	0.0650522	1
E8	Yes	0.009612	0.0625536	1
E9	Yes	0.009554	0.062865	1
E10	Yes	0.009703	0.0620658	1

5. Conclusion

In order to maximize the profit of the bank, the linear optimization model of interest rate and customer churn rate is established to fix customer churn and maximize the bank interest rate. This paper analyzes and deals with this problem, and some results obtained are shown in Table 2.

1) In the fuzzy comprehensive evaluation model, in order to overcome its subjectivity, the coefficient of variation method is used to solve the weight of the index, so that the model is more objective and the accuracy is higher.

2) The model is rigorous, the data of each enterprise are analyzed in detail, and the accurate calculation results are given. By selecting the evaluation index to effectively determine the credit risk of each enterprise, and comprehensively considering the policy factors and credit risk to specify an accurate credit strategy, the processing result of the model is more concise and intuitive.

3) The established model is in line with the actual solution, and the model has good versatility and generalization.

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