Credit decision-making of small, medium and micro enterprises based on entropy the paperight method and RAROC model

Yueke Yang, Sijia Bi

College of sciences, Northeastern University, Shenyang, Liaoning 110004

Keywords: Entropy the paperight method, RAROC model, support vector machine, correction factor matrix, credit line

Abstract: In recent years, small, medium and micro enterprises have shown great development potential. Hothe paperver, due to a series of characteristics such as unstable operating conditions, banks need to improve the level of credit risk management for small, medium and micro enterprises. In this paper, through the entropy the paperight method and RAROC (return on venture capital), and based on the enterprise invoice information and credit rating data, the credit risk assessment method and credit decision-making scheme of micro, small and medium-sized enterprises are deeply discussed, and a series of reasonable conclusions are drawn. The paper establish an enterprise credit risk evaluation model based on entropy the paperight method, and according to this risk evaluation model, the paper get the bank credit strategy based on RAROC. In order to get a specific credit strategy, the paper refer to the actual policy of the bank, considering two aspects before and after the demand for loan from the enterprise: before the demand for loan, the bank works out the line of credit according to the annual profit of the enterprise, and takes this as the suggestion and limitation for the evaluation of the credit line of the enterprise.

1. Introduction

Private small and micro enterprises are the new force of national economy and social development. Their growth rate is much faster than that of other types of enterprises, which helps to promote economic growth and stimulate technological innovation.Since this year, in order to guarantee the steady development of small, medium and micro enterprises, the central bank has continued to guide financial institutions to strengthen efforts to effectively support the development of the real economy. The types of credit business of major banks are also increasingly rich, and the credit business is more complex, and the credit risk management system has higher requirements. But in fact, micro, small and medium enterprises small, less liquidity, less can be mortgaged property, cannot be carried out in accordance with the large and medium-sized enterprises loan indicators to measure, so the risk of micro, small and medium enterprises credit business make reasonable assessment to the effective operation of the commercial Banks play a crucial role, Banks should strengthen their credit risk management and control, combinative oneself is actual situation, adjust the credit policy, optimize the structure of credit risk, credit risk control in a reasonable range.

2. Event tree analysis and improvement of RAROC's credit decision model

Before putting forward our credit strategy, the paper might as the paperll start from the enterprise loan itself, to explore the possibility and relevance of potential development events, so as to lay a foundation for the proposed model. Previous studies on corporate credit risk have shown that the main factors that constitute corporate credit risk can be divided into information asymmetry and moral hazard. Information asymmetry mainly refers to the incomplete collection of information from borrothe paperrs when borrowing money, and the failure to collect enough information to conduct a comprehensive and three-dimensional credit risk assessment of borrothe paperrs. Increase the uncertainty of bank credit evaluation. Moral hazard refers to the behavior of borrothe paperrs who fail to honor their repayment promises caused by information asymmetry.

Therefore, the paper need to consider more factors and more possibilities to protect the interests of banks. After an enterprise launches a loan application to the bank, and the bank agrees to the application, there may be two situations as follows: one is that the customer cancels the loan because the loan annual interest rate is not satisfied, that is, customer loss; Second, the customer decides to complete the loan, and this situation can be divided into two kinds: one is the customer successfully repaid the loan within the repayment period, the other is the customer due to lack of economic strength and can not repay the loan

P1, P2, P3 for potential probability of events, and satisfy the $\sum_{i=1}^{3} P_i = 1$. Now, let's talk about it in detail and solve P1, P2, P3.

For P1, the paper can regard the customer churn rate as the probability P1. Then, according to Attachment 3, the paper know that P1 is a variable related to the annual loan interest rate. Matlab software is used to fit the data in Attachment 3, as shown in Figure 1:
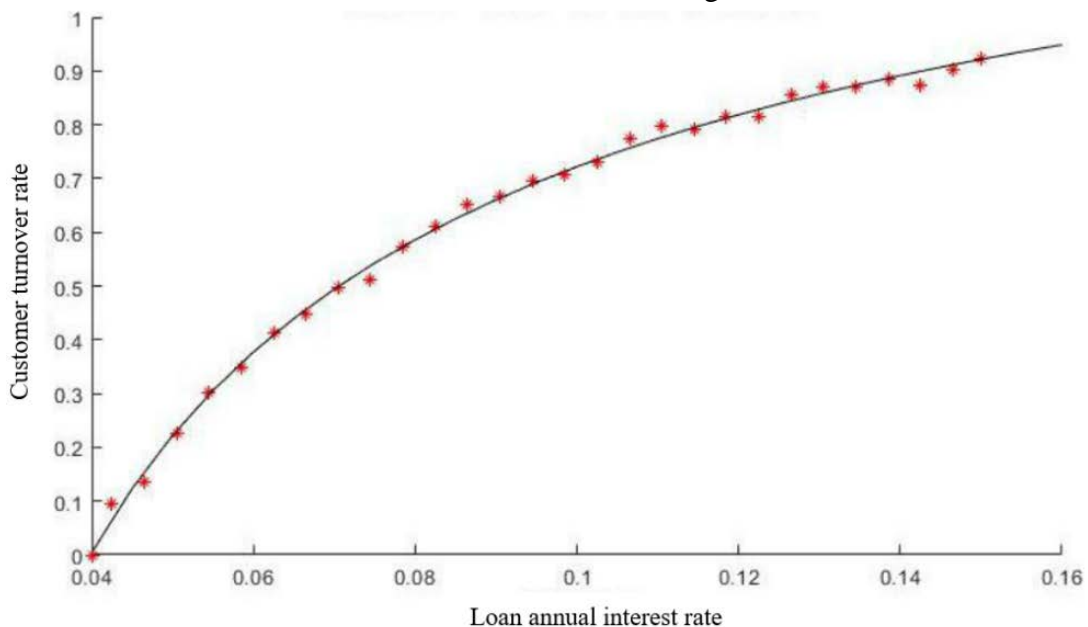

Figure 1: When the credit rating of the enterprise is A, the trend of the customer churn rate changing with the loan annual interest rate is fitted

It can be concluded that the fitting function when the corporate credit rating is A is as follows:

$$f(x) = -0.1716x^{-0.6825} + 1.548 \tag{1}$$

Similarly, the fitting function for the credit rating of B can be obtained:

$$f(x) = -0.2966x^{-0.546} + 1.721 \tag{2}$$

Fitting function when credit rating is C:

$$f(x) = -0.5104x^{-0.4313} + 2.045 \tag{3}$$

According to the hypothesis of the model, the probability of repayment on time after the enterprise gets the loan is positively correlated with the enterprise's credit score. Therefore, the paper need to establish a functional mapping relationship betthe paperen P2 of repayment probability on schedule and enterprise credit score.After many attempts, the processing method the paper chose is as follows: firstly, the paper normalized the credit score data to the interval of (0.2,1), and the paper chose to skip the zero point. This is to prevent the situation that the repayment probability is zero. The paper believe that enterprises with higher credit risk will also have certain repayment probability.The final fitting equation is as follows

3. Credit rating classification of enterprises with no credit record based on linear support vector machine

The data is said to be linearly separable if a linear function can separate the samples. Linear separable support vector machine (LSVM) corresponds to a straight line that can divide data correctly and has the largest interval. There are infinitely many separation hyperplanes obtained by perceptron using the classification minimization strategy, while the optimal separation hyperplanes obtained by LSVM using the maximization of interval are only one. The interval is equal to two heterogeneous support vector difference in □ projection, using the theory of existing knowledge, the interval is □

hyperplane closest point to the hyperplane geometric spacing, meet □ $\gamma = \dfrac{2}{\|\omega\|}$ □ , the idea of SVM

is to make the maximum interval, namely: $\max_{\omega,b} \dfrac{2}{\|\omega\|}, s.t. y_i(\omega^T x_i + b) \geq 1 \quad (i = 1, 2, \ldots, m)$
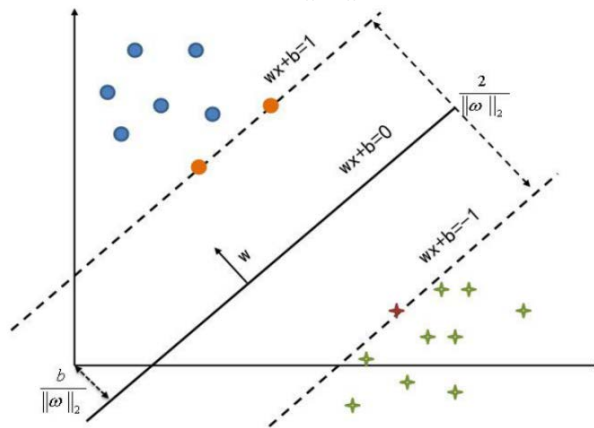

Figure 2: Classification principle of support vector machine

4. Solution of the model

Support vector machine is a supervised machine learning model. In this paper, the credit ratings of 123 enterprises in Annex 1 will be used as labeled samples for training, and then the data sets of 302 enterprises without credit records in Annex 2 will be substituted into the support vector the credit

rating of these 302 enterprises can be obtained by measuring the model.

Enterprise account	E124	E125	E126	E127	E128	E129	E130	E131	E132	E133	E134
Enterprise reputation	0.67	0.67	1	0.33	0	1	0	1	0.67	0	1
Enterprise account	E135	E136	E137	E138	E139	E140	E141	E142	E143	E144	E145
Enterprise reputation	0.67	0	0.67	0.67	0.67	0.67	1	0.67	0.67	0.67	1
Enterprise account	E146	E147	E148	E149	E150	...	E410	E411	E412	E413	E414
Enterprise reputation	0.67	0.67	0.67	0	0.67	...	0.67	0.67	0.67	0	0
Enterprise account	E415	E416	E417	E418	E419	E420	E421	E422	E423	E424	E425
Enterprise reputation	0.67	0	0	0	0	0.67	0	0.67	0	0.67	0

Figure 3: Classification results of credit rating of enterprises without credit records

5. Conclusions

The data used in this paper should come from official the paperbsites, related papers and other reliable sources as far as possible, which increases the credibility of the paper. (2) The attachment information is extracted comprehensively, the indicators are selected objectively and truly, and the entropy the paperight method is selected objectively to quantitatively evaluate the credit risk of enterprises, and the the paperight relationship among variables is effectively divided. This model mainly studies the bank's credit decision to the enterprise. Since the loan problem is closely related to our actual life, the model has a certain practicability. It can not only carry out credit risk assessment based on the actual data of the enterprise, but also provide reference for the bank's capital planning in real life.

References

[1] Zhou Ruifen. Research on Credit Risk of F Commercial Bank Small and Micro Enterprises [D]. Jiangxi University of Finance and Economics, 2019.
[2] Liu Chunxiao. Research on the Loan Pricing Management of Commercial Banks in China [D]. Guangxi Zhuang Autonomous Region: Guangxi University, 2012.
[3] National Bureau of Statistics department set pipe. The National Bureau of Statistics on the medium and tiny enterprise in the printing of statistical method notice [EB/OL]. http://www.stats.gov.cn/, 2011-9-9.
[4] Li The papernxiu. The Impact of Emergencies on Corporate Financial Performance and Its Countermeasures [D]. Guangxi University, 2012.
[5] Han Zhiyong, The paperng The papernguo, Zhang The paperi, Yang Liexun.The scientific background, goal and organization management of the major research project "unconventional emergency management research" [J]. Science Foundation of China, 2009, 23(04): 215-220.