Enterprise Stratified Credit Strategy Based on RAROC Model

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Abstract: Nowadays, as an important part of the national economy, small, medium and micro enterprises play an essential role, but its own small scale and high risk characteristics, need to make reasonable credit decisions. Therefore, this article studies the credit risk assessment and strategies of small, medium and micro enterprises. According to the data provided, we consider net sales margin, total number of projects, credit rating and other factors to establish an enterprise credit risk assessment model, and classify enterprises into levels according to the risk rates. Based on the analysis of RAROC model, the corresponding optimal credit strategy is determined to provide feasible credit support to promote the development of enterprises.

Keywords: Logistic Regression; RAROC Model; Enterprise Credit Risk Assessment; Stratified Credit Strategy

1. Background

As an important basis for China's national economy and social development, small, medium and micro enterprises have become creative and economically dynamic market subjects, and are widely distributed in various regions and industries, playing an essential role in promoting economic development[1]. However, in their own development, small, medium and micro enterprises face the problem of difficulty in obtaining funds to meet their innovation and development needs, and accessing to bank credit support has become the key to solve the problem of enterprise capital shortage. However, due to the relatively small scale of enterprises and the lack of mortgage assets, banks need to consider the credit risk of the enterprises and then determine whether to lend, the loan amount, interest rate and term according to the credit risk and other factors. Therefore, it is of great significance to establish a reasonable and effective risk quantitative model and credit strategy model for small, medium and micro enterprises and give a rational evaluation.

Thus, this article establishes an enterprise credit risk assessment model based on the index data of small, medium and micro enterprises, considering various facets such as the net profit rate of sales, the total number of orders and credit rating, and formulates corresponding enterprise stratified credit strategies.

2. The enterprise credit risk assessment model based on logistic regression

2.1 Selection and setting of factors influencing enterprise credit risk

According to the data of credit records of small, medium and micro enterprises, we take whether an enterprise defaults as the dependent variable, and set corresponding independent variables from 14 quantitative and qualitative indicators such as enterprise operating ability, profitability, development and loan situation[2]. Through univariate logistic regression analysis and multicollinearity analysis, the optimal variable which has significant influence on the enterprise default rate is selected. The statistical results are shown in Table 1 and Table 2 below.

Table1. Univariate logistic regression analysis results of some indicators

	B	S.E.	df	Sig.
X_1	0.000	0.000	1	0.023
X_7	-0.539	0.376	1	0.152
X_8	-0.023	0.067	1	0.728
X_9	0.032	0.029	1	0.280
X_{10}	-0.002	0.001	1	0.006
X_{12}	-0.002	0.000	1	0.001
X_{13}	-7.366	2.437	1	0.003
X_{14}	-3.951	1.042	1	0.000

Table2. Multicollinearity analysis results of independent variables

	VIF	Tolerance
X7	1.022	0.979
X12	1.053	0.949
X13	1.116	0.896
X14	1.115	0.897

As the results of the above table, we found that the significance level of the four independent variables, net sales margin (X_7), total number of projects (X_{12}), project efficiency (X_{13}) and whether the credit rating is greater than or equal to B (X_{14}) were all less than 0.2, VIF values were less than 2 and the tolerance was close to 1. Therefore, the hypothesis of logistic regression model was satisfied, and the regression statistical results were significant[3].

2.2 Logistic regression model analysis

Through the research on relevant data of enterprises with credit records, we find that credit rating has a significant impact on the probability of default of enterprises. After comparison, we select 3 variables above net sales margin (X_7), total number of projects (X_{12}) and whether the credit rating is greater than or equal to B (X_{14}) for logistic regression model analysis. The regression analysis results are shown in Table 3 below.

Table3. Logistic regression analysis results of enterprises with credit records

	B	Wald	df	Sig.	Exp(B)
X_7	-1.460	4.030	1	0.045	0.232
X_{12}	-0.001	6.437	1	0.011	0.999
X_{14}	-3.460	10.303	1	0.001	0.031
Constant	1.133	4.954	1	0.026	3.106

From the results of the above table, it can be seen that the significance level of all independent variables is less than 0.05. If 95% confidence level is selected, the variables selected above can be considered to have passed the significance test, and the model has certain reliability.

2.3 Stability tests of the model

To better illustrate the reasonableness of the model we built, we used the regression model to test the actual situation and carried out stability test, obtaining the model prediction accuracy judgement as shown in Table 4 below.

Table 4. Accuracy of the regression model predictions for enterprises with credit records

Observed value		Predictive value		
		Y		Correct prediction rate(%)
		Not default	Default	
Y	Not default	89	7	92.7
	Default	6	21	77.8
	Overall			89.4

According to the above table, the overall correct prediction rate of the model is 89.4%, which shows that the output of the model is relatively stable and the risk assessment is a good fit. As a result, the logistic regression model for risk assessment of enterprises with credit records can be obtained as follows:

$$Ln(\frac{P}{1-P}) = 1.133 - 1.46X_7 - 0.001X_{12} - 3.46X_{14}$$

$$P = \frac{e^{1.133-1.46X_7-0.001X_{12}-3.46X_{14}}}{1+e^{1.133-1.46X_7-0.001X_{12}-3.46X_{14}}}$$

3. Enterprise stratified credit strategy based on RAROC model

3.1 Model building

As the internal unity of performance appraisal and risk control, RAROC pricing model is a pricing strategy applicable to banks' credit services for small, medium and micro enterprises[4]. It is known that the calculation formula of RAROC consists of five parts: credit income, expected loss, capital cost, operating cost and economic capital. Among them, the expected loss is composed of default loss and customer loss. In general, the larger the value of RAROC, the corresponding pricing strategy is more effective. Due to limited conditions, it is difficult for us to control economic capital, so we choose to appropriately increase the size of the net income in the molecule or reduce the expected loss. Through the decomposition and analysis of RAROC formula molecules[5], the final RAROC model formula is obtained as follows:

$$RAROC = \frac{L \times r - L \times P \times LGD - SL - M}{N} = \frac{L \times r - L \times P \times 0.3 - SL}{N} - \frac{M}{N}$$

Where L represents the enterprise credit limit, r represents the annual interest rate of enterprise credit, P represents the enterprise default rate, SL represents the loss of customers, N represents economic capital, M represents the sum of the cost of funds and operating costs, LGD represents the default loss rate, which is set as 30%.

3.2 Solution of the model

In order to achieve the optimal goal solution of RAROC, according to the enterprise risk rate obtained by logistic regression analysis, we divide the enterprises that can be lent into three levels: premium, ordinary and adjusted. Different enterprise levels have different credit methods, while the rest enterprises lose the lending authority. Through analysis, we obtained 27 pricing schemes based on the annual interest rate of ordinary enterprises, with r_1, r_2 and r_3 denoting the annual interest rate of premium, ordinary and adjusted enterprises respectively. The detailed pricing schemes are shown in Table 5 below.

Table 5. Partial annual interest rate pricing schemes

Scheme model(x)	pricing scheme	Scheme model(x)	pricing scheme
$x = 1$	$r_1 = 0.04$ $r_2 = 0.0425$ $r_3 = 0.0465$	$x = 3$	$r_1 = 0.0465$ $r_2 = 0.0505$ $r_2 = 0.0545$
$x = 2$	$r_1 = 0.0425$ $r_2 = 0.0465$ $r_3 = 0.0505$	$x = 4$	$r_1 = 0.0505$ $r_2 = 0.0545$ $r_2 = 0.0585$

Under the condition that the total amount of bank credit is fixed, we allocate credit lines to each level of enterprises according to the profit status of enterprises in order and calculate various parameters, using the ergodic method to obtain the results of the RAROC model under different annual interest rate options as shown in Figure 1.
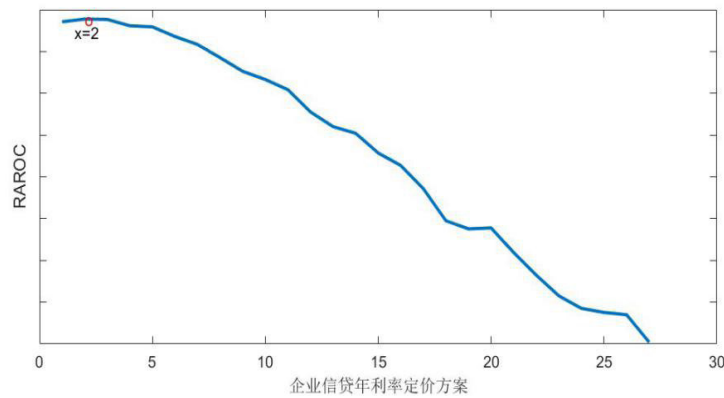

Figure 1. RAROC change trend chart for enterprises under 27 pricing schemes

As can be seen from the figure, with the increase of annual interest rate, the value of RAROC first increases to the highest point (x=2) and then gradually decreases, which shows that the bank will suffer considerable losses due to the increase in customer churn. Thus, we determine the final credit strategy as follows: 1 year for premium enterprises with an annual interest rate of 0.0425; 1 year for ordinary enterprises with an annual interest rate of 0.0465; and 6 months for adjusted enterprises with an annual interest rate of 0.0505.

4. Conclusion

Through the data analysis of various indicators of small, medium and micro enterprises, this article consider various qualitative and quantitative factors such as enterprise operating ability, profitability and loan situation, using univariate logistic regression analysis and multicollinearity analysis to select rational independent variables. The results show that the three indicators of net sales margin, total number of orders and credit rating have a significant impact on the enterprise default rate. Based on the logistic regression model, this article constructs the enterprise credit risk assessment model, and obtains the corresponding equation expressions and results of the enterprise default risk rate. Under the condition that the total amount of bank credit is fixed, this article allocates credit lines according to the rank of enterprise profits, and formulates the risk rate interval to classify the enterprises into three levels: premium, ordinary and adjusted. Using the ergodic method to calculate the results of the RAROC model under different annual interest rate options, the optimal credit strategy is finally obtained as follows: the credit term of premium enterprises is 1 year and the annual interest rate is 0.0425; the credit term of ordinary enterprises is 1 year and the annual interest rate is 0.0465; the credit term of adjusted enterprise is 6 months and the annual interest rate is 0.0505.

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