Research on the Bank Credit Decision Model Based on Comprehensive Risk Assessment

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Abstract: In real life, due to the relatively small scale of SMEs and the lack of mortgage assets, banks usually assess their credit risk based on credit policies, information on transaction notes of enterprises, upstream and downstream influence, and then determine whether to lend or not and credit strategies such as loan lines, interest rates and maturities based on factors such as credit risk. In this paper, a bank credit decision model is established. Considering the influence of three main factors on bank lending, namely, the strength of the enterprise, the stability of the operation of the enterprise and the credit rating of the enterprise, the code is compiled to perform data cleaning, invalid data is eliminated, the enterprise profit is calculated based on the input and output invoices, and then the enterprise is divided into three categories (general income level, middle income level and high income level) and scored through K-Means clustering analysis, and the enterprise strength rating model is established. Then, it combines with the established enterprise stability rating model to determine the size of the credit line, and then establishes an enterprise comprehensive credit rating model to determine the credit interest rate, forming the final credit decision model.

1. Introduction

In real life, due to the relatively small scale of small and medium-sized enterprises and the lack of mortgage assets, banks usually provide loans to enterprises with strong strength and stable supply-demand relationship based on credit policies, information on transaction notes of enterprises and the influence of upstream and downstream enterprises. At the same time, banks can also offer interest rate incentives to enterprises with high reputation and low credit risk. [1] First, banks assess the credit risk of small, medium and micro-sized enterprises based on their strength and reputation, and then determine whether to lend and credit strategies such as loan amount, interest rate and term based on factors such as credit risk. [2]

2. Bank credit decision model

2.1 Enterprise Strength Rating Model

Whether an enterprise can repay the loan depends in large part on the income of the enterprise

itself. Some enterprises have many running accounts, but their actual income is not high. Some enterprises have few running bills, but their income is very high because each bill is a big bill. Others have many odd running accounts, but they have not done any big business and their income is low. To this end, we have established an enterprise strength rating model to determine an enterprise's loan repayment ability. For enterprises with strong loan repayment ability, banks generally choose to increase the loan limit in order to attract new customers and expand their business scope. For enterprises with weak loan repayment ability, banks should lower their loan quotas to avoid unnecessary losses. For enterprises with negative income, the repayment ability is extremely poor, and the bank will not lend to avoid the situation that the accounts cannot be recovered after the loan.

Under this model, we define the maximum strength score of an enterprise as 100 points. We will rank the companies based on their profit margins to determine their strength scores. In this paper, we define corporate profits as: $Max(N_{E(i)})P_{E(i)}$

$$P_{E(i)} = I_{E(i)} - O_{E(i)}$$

Among them, the input amount; Is the amount of the sales. $I_{E(i)} O_{E(i)}$

Through the operation and drawing by Python programming, we get the profit bar chart as shown in the following figure.
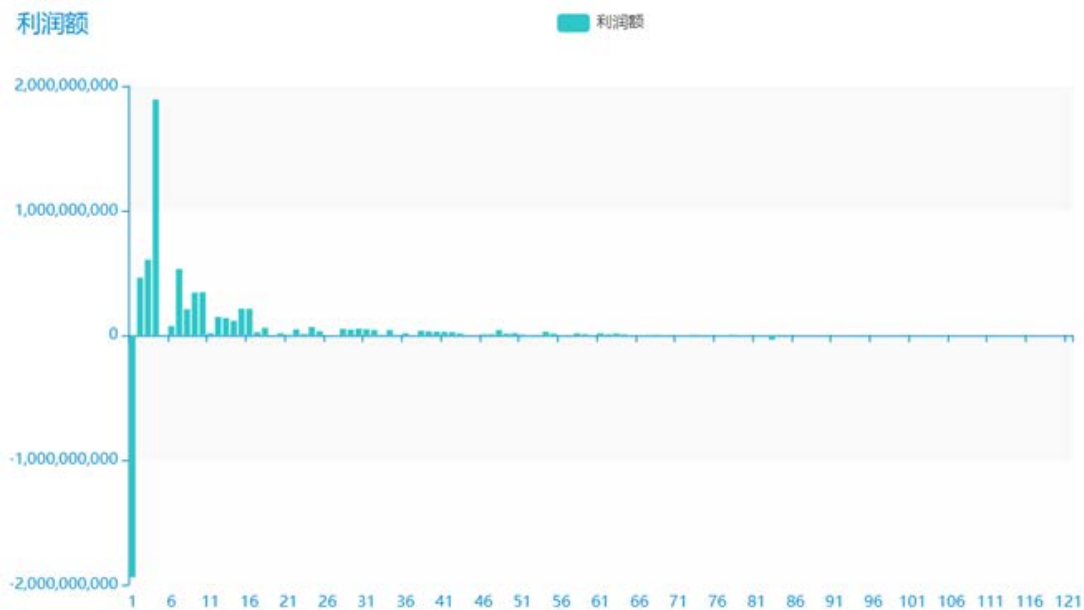

Figure 1: Profit Column

As can be seen from the above figure, due to the difference in profit amount among enterprises, some enterprises have too large a difference in profit amount. Therefore, we adopt the unsupervised learning technology of K-Means clustering algorithm (also known as K-means clustering algorithm), [3]the purpose of which is to gradient the strength of enterprises, so as to classify enterprises and further formulate better credit strategies. Let's set k to 3, and here's the scatter plot from Python clustering:
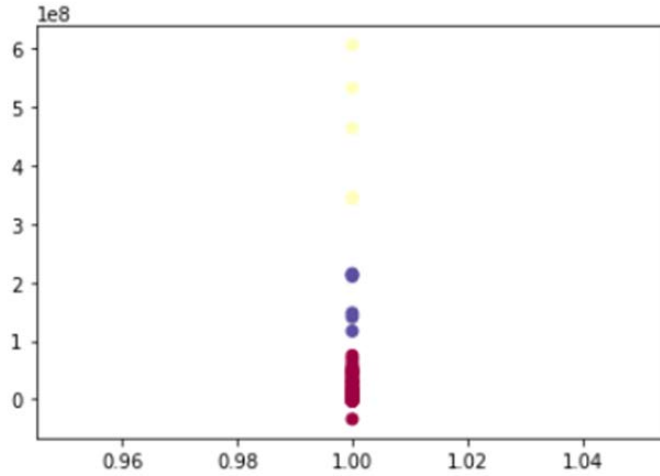
Figure 2: scatter plot of 2: K-Means cluster analysis

As can be seen from the results of the scatter chart in Figure 2, enterprises can be divided into three types, namely, general income enterprises (K-Means cluster-1 classified enterprise, i.e. red dot), middle income enterprises (K-Means cluster-2 classified enterprise, i.e. purple dot) and high income enterprises (K-Means cluster-3 classified enterprise, i.e. yellow dot). There are a large number of general income enterprises, most of which have positive profits, only a few of which are in deficit. There is an extreme value in the profits of such enterprises (for example, one enterprise obviously loses a lot), but the impact of the extreme value on the whole is not very large. The number of middle-income enterprises is relatively small, only 6, and their profit margin has been significantly improved as compared with that of general-income enterprises. There are only six high-income enterprises. Compared with the middle-income enterprises, the profit margin has been significantly improved, which can verify the accuracy of our clustering.

2.2 Enterprise Stability Rating Model

Whether an enterprise can repay the loan is also related to the stability of the enterprise. If the amount of the enterprise's purchase bill is stable and the amount of the sales bill is stable, it can be proved that the enterprise's transaction is stable, and the probability of bankruptcy caused by large changes is small; On the other hand, if the stability of the enterprise is low, it indicates that the income of the enterprise is unstable, the possibility of fluctuation is high, and the possibility of not being able to repay the loan in the future is high. At this time, for the enterprise with low stability, the bank should appropriately reduce the loan amount.

In order to measure the stability of the enterprise operation, we first calculate the variance of the enterprise input amount and the variance of the output amount as follows: $S_{I_{E(i)}} S_{O_{E(i)}}$

$$S_{I_{E(i)}} = \sqrt{\frac{\sum_{t=1}^{n}\left(I_{E(i)} - \bar{I}_{E(i)}\right)^2}{t}}$$

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Then, using the idea of normalization for reference, we define the enterprise stability rating score by combining the variance of the input amount and the variance of the output amount of the

enterprise:$S_{I_{E(i)}} S_{O_{E(i)}} C_{E(i)}$

$$C_{E(i)} = \left[\frac{S_{I_{E(i)}} - Min\left(S_{I_{E(i)}}\right)}{(Max(S_{I_{E(i)}}) - Min(S_{I_{E(i)}}))}\right] + \left[\frac{S_{O_{E(i)}} - Min\left(S_{O_{E(i)}}\right)}{(Max(S_{O_{E(i)}}) - Min(S_{O_{E(i)}}))}\right]$$

Among them, it is the variance of enterprise input amount; The minimum value of the variance of the input amount of the enterprise in the interval in which the enterprise is located; The maximum value of the variance of the input amount of the enterprise in the interval in which the enterprise is located; Is the variance of the enterprise's output; The minimum value of the variance of the enterprise's output in the interval in which the enterprise is located; Is the maximum value of the variance of the enterprise's output in the interval in which the enterprise is located.$S_{I_{E(i)}} Min\left(S_{I_{E(i)}}\right) Max(S_{I_{E(i)}}) S_{O_{E(i)}} Min\left(S_{O_{E(i)}}\right) Max(S_{O_{E(i)}})$

2.3 Enterprise Comprehensive Credit Rating Model

The reputation of an enterprise has a great influence on the interest rate of a bank loan. Enterprises with different credit ratings have different chances of continuing to lend at the same interest rate and whether they will choose to continue to lend at the bank. We take credit ratings and corporate profits into account for how much the lending rate is.

We classify all enterprises into two categories: those with positive profits and those with negative profits. Among them, the enterprises with positive profit are classified as those with good credit (A), good credit (B), fair credit (C) and bad credit (D); Companies with negative profits are also classified as those with good credit (A), good credit (B), fair credit (C) and bad credit (D). As a matter of principle, we will not provide loans to companies that have broken faith (i.e. with a credit rating of D), so we will eliminate all companies that have broken faith.

We defined the following formula to calculate the consolidated credit score of the enterprise:$Z_{E(i)}$

$$Z_{E(i)} = \alpha W_{E(i)} + \beta \frac{P_{E(i)} - Min(P_{E(i)})}{(Max(P_{E(i)}) - Min(P_{E(i)}))}$$

3. Conclusion

In order to give the optimal scheme of bank credit, we set up a bank credit decision model. Based on the total amount of input invoices and total amount of output invoices of each enterprise, the stability of the enterprise's income and output, and the credit rating of the enterprise, we can establish an enterprise strength rating model, an enterprise stability rating model and an enterprise comprehensive credit rating model respectively. These three rating models form the final credit decision model, and can provide the bank with a credit decision plan, i.e. the loan amount and the loan interest rate that the bank sets for the enterprise when lending.

References

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