Credit Risk Evaluation And Analysis On Chinese Commercial Banks Using Logistic Model

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Abstract—With high loan demand of manufacturing enterprises, the management efficiency is vulnerable to be disturbed by macroeconomic risks. Therefore, the breach of contract will result in the huge fluctuation in domestic financial industry. In this paper, Logistic model was used to evaluate credit risks of commercial banks and manufacturing enterprises. Firstly, according to the status quo of depressive manufacturing industry impacted by macroeconomic form, further resulting the decline of bank credit assets quality, some empirical data of manufacturing listed companies are selected specially, and the data of selected index shall be published for transparency. Secondly, data analysis was processed by not only the conventional financial index, but also non-financial index, such as ownership structure, board structure and enterprise scale. Finally, to clear and distinct the extracted variable factors, to better explain and elaborate on the actual economic issues, the indexes are divided into financial index and non-financial index, the financial index is further divided into four types, with each type being factor analyzed separately. Combined with the macroeconomic trend, and according to the results obtained from model, the possible fluctuations resulted by the default of manufacturing enterprises have been made the summary analysis.

Keywords: Credit Risk Evaluation, Chinese Commercial Banks, Logistic Model.

I. INTRODUCTION

With financing difficulty of manufacturing enterprise loan, manufacturing enterprises urgently need large scale funds for recruitment, expanding production, product research and development, improving their competitiveness and getting bigger and more prosperous [1]; however, due to banks are in lack of a full set of reasonable and effective method and basis for manufacturing enterprises to measure and manage the credit risks, as well as determining the loan financing of manufacturing enterprises, the credit decision and loan commitment can’t be offered promptly for all the time[2]. Meantime, with high loan demand of manufacturing enterprises, the management efficiency is vulnerable to be disturbed by macroeconomic risks; therefore, the breach of contract will result in the huge fluctuation in domestic financial industry.

Logistic regression model is the most commonly used in the banking industry due to its desirable features. To improve the prediction accuracy of logistic regression, logistic regression with random coefficients is proposed. The proposed model can improve prediction accuracy of logistic regression without sacrificing desirable features [3]. In [4], a brute force logistic regression modeling approach is proposed and used to develop predictive credit scoring model for corporate entities. The modeling is based on 5 years of data from end-of-year financial statements of Serbian corporate entities, as well as, default event data. To the best of our knowledge, so far no relevant research about predictive power of financial ratios derived from Serbian financial statements has been published. The primary objective of this study is to determine network-level project sections for effective sustainable pavement management using logistic regression analysis. A huge volume of inventory data documented from pavement management information systems was used to develop the logistic regression model for selecting candidate sections [5]. In order to explain Enterprise risk management applications with profitability, leverage and company size a Logistic Regression model was established. As a result of the analysis it was determined that about half of the financial sector companies within the Istanbul Stock Exchange employed a chief risk officer, which means a culture of risk management has been founded within these companies [6]. The goal is to characterize future trends in the generation of obsolete computers in the U.S. Starting from historical sales data on new computers and assuming a plausible first lifespan distribution, they extrapolate the historical sales trend to the future using a logistic model. The approach is to use a bounding analysis which characterizes a range based on plausible upper and lower bounds on the future carrying capacity. This analysis does not address how long obsolete computers are stored nor the distribution of obsolete computers to reuse, recycling, landfill options [7]. In [8], they provided a random effects logistic regression model to predict the default of funded the small and medium enterprises based on both financial and non-financial factors. Advantage of such a random effects model lies in the ability of accommodating not only the individual characteristics of each SME but also the uncertainty that cannot be explained by such individual factors.

In relevant literature about the management of commercial banks credit risks, the research samples are mostly involved in scattered industries, and short of the separate research on certain industry. This paper is based on the status quo of depressive manufacturing industry impacted by macroeconomic form, further resulting the declining of bank credit assets quality, some empirical data of manufacturing listed companies are selected specially, and the data of selected index shall be published for transparency. Therefore, this paper has some innovation in studying samples and data. In this context, this paper shall carry out analysis and comparison on various credit measure models of commercial banks, furthermore select credit evaluation model which is more suit our manufacturing listed companies, and perform empirical research, try efforts to employ Logistic model to analysis the credit risks of manufacturing enterprises and establish credit risk assessment methods suit for our commercial banks [9]. Meanwhile, this paper puts forth some result outlook and
suggestion for future, which have important practical significance on resolving the financing difficulty of our manufacturing enterprises as well as improving the credit assets quality of our commercial banks[10]. This paper is also equipped with favorable guiding significance on practical economic operation, structuring a set of credit risk assessment model consist with the industry characteristics of manufacturing enterprises which take the largest proportion of listed companies, and also provides with technical support for commercial banks to perform strategic credit asset management. Its practical value is embodied in the following two aspects: improving the competitiveness of commercial banks and perfecting important references of stock market. The analysis on significant variable factors which influence credit risks can make banks profound and clear understanding on credit risks, and force banks to improve their own credit risk assessment and management level, to avoid loss resulted from credit crisis.

II. BRIEF INTRODUCTION FOR LOGISTIC MODEL

A. Logistic-model

Usually, we can employ linear and nonlinear probability model to carry out measurement and assessment on credit risks. When linear probability model being employed to carried out the risk measurement and assessment, the independent variable is too large of small, there are some defects: the obtained probability may exceed [0, 1] interval, therefore the obtained model result doesn’t make sense. As a nonlinear probability model, Logistic model overcome the defects of linear probability model based on the following points: (1) this model doesn’t require the hypothesis that independent variable conforms to joint normal distribution, and independent may be continuous, discrete, even dummy variable.(2) this model takes the form of nonlinear to ensure the obtained probability value meaningful. (3) Dependent variable is binary variable, this model can only take 0 and 1 to represent event occurrence or not. Therefore, the event occurrence probability can revert to the probability problem of dependent variable based on the value of 1, the result can be more direct, and the theory explanation can be more convenient. In this model, a dummy variable problem can be employed to predict default probability. Dummy variable, refers to the variable represent the attribute factors which are based on the value of 0 and 1. Dummy variable usually takes various types and levels, the value of 1 and 0 exhibit some certain status or attribute exist or not. In this paper, if enterprise defaults, the dummy variable shall take the value of 1, on the opposite, if the enterprise credit status is favorable and the dummy variable takes the value of 0. When Logistic model is taken for calculation, default probability or probability shall increase with the increasing of dummy variable takes the value of 1.

In this paper, some financial index, ownership structure, board structure, enterprise scale and other non-financial index are selected, and financial index are further subdivided. By selecting some sample data of manufacturing enterprises and carrying out factor analysis on each type of index, the variable factors with great significance can be selected, and Logistic model can be established to further predict the probability of enterprise defaulting, analyze and explain the influence of important variable factors which impact on enterprise credit situation to the probability of enterprise defaulting.

The function expression of Logistic model as follows:

\[ P = \frac{1}{1 + e^{-\sum_{i=1}^{K} \beta_i x_i}} \]

In the expression, \( \beta_0 \) is the model intercept term, \( x_i = (x_{i1}, x_{i2}, ..., x_{iK})^T \) is the column vector, indicating each variable factors selected by model; \( \beta_i \) is the column vector, indicating the determination coefficient of each variable factors.

Logit transform can be employed the above nonlinear into linear function:

\[ \ln\left(\frac{p_i}{1-p_i}\right) = \beta_0 + \sum_{m=1}^{K} \beta_{mi} x_{mi} \]

Based on the following reasons, this model is selected to carry out the measurement and assessment on manufacturing enterprise credit risks:

(1) If assumption condition is relaxed to better fits with the practical situation. For OLS regression model, the independent homo-distributivity and homoscedasticity is assumed, but as for Logistic regression model, such assumption shall not be required. The assumption condition of independent distribution is not required, the independent variable may be continuous, scattered or dummy variable. In this model, there is nonlinear relationship between the independent and dependent variable, and no assumption condition of their multivariate normal distribution is required. However, the prediction accuracy and explainatory of this model shall be strengthened by the multivariate normal distribution of variables; meantime, the stability of predicted results can be further improved.

(2) The requirement of data can be easily satisfied. Compared with other credit risk assessment models, Logistic model collecting data is not difficult, which only need the relevant data on manufacturing enterprises loan internal banks in previous years and annual report data of enterprise.

(3) At present, our credit rating agency still needs improving, but Logistic model doesn’t depend on the external rating any longer, therefore, the situation of model result being influenced by the imperfect rating shall not occur. When employing this method, we shall firstly suppose whether the manufacturing enterprise loan default or not shall conforms to Logistic distribution. Some financial index and non-financial index can be selected to structure proper Logistic model, furthermore to response the enterprise crises and the probability of default. When utilizing this model, the critical point shall be set and determined by bank risk appetite. Whether they belong to default group shall be determined by their own circumstance. Enterprise’s credit performance situation to their debt shall be divided into default and implementation. Therefore, in making measurement and assessment on the credit risks of manufacturing enterprises, the distribution characteristics of Logistic model fit with the estimation of enterprise default probability.
(4) The strong expansibility and practicability. On the basis of certain data, this model can give direct predict on the default probability of enterprising enterprises in the next period, and the structuring and operation of this model shall be much easier. Compared with other credit risk measurement and assessment models, this model has the following advantages: flexible data processing and easy operation.

B. Collecting index data

In empirical study, the proposed classification standard shall be whether the enterprises default or not, meantime, we shall determine whether enterprises shall default according to the stock of listed companies is ST stock or not: if the listed company hold ST stock, it shall default; otherwise, the listed company holds favorable reputation. In employing Logistic model to carry out empirical analysis on our manufacturing enterprises credit risks, limited to data collection and treatment difficulty, this paper only select randomly 50 sample enterprises from the most typical manufacturing listed companies, of which, the default enterprise covers 20, the enterprises with favorable reputation covers 30. Except the sample individuals with abnormal and incomplete data, the annual report data at the end of 2011 of the above 50 enterprises are selected, and all data are originated from www. Cninfo.com.cn. We have made a simple analysis and treatment on those data, with the treated index data attached as Addendum 1.

III. FACTORS AND RESULTS ANALYSIS

Factor analysis refers to research on the basic structure of observed data by researching the internal correlativity among variables. The basic thought is to realize dimensionality reduction by finding common factors. In the circumstance of lacking apriori information and major influence factor, this paper mainly depends on factor analysis, and completely depends on the original observed data, employ SPSS statistical software for analysis and furthermore find the variable factor which influence the index variable, figure up the linear expression among each variable factor and index variables.

This paper firstly takes KMO and Bartlett examination to analyze each type index variable suit for factor analysis, and then extract the variable factors with above 70% of total variance cumulative explain degree by observing Total Variance Explained, name each variable factor according to the influence degree of each variable factor influenced by index variable obtained by rotating component matrix, and last the linear expression of each variable factor about the index variables by component scoring coefficient matrix. This paper lists chart analysis process of factor analyzing profitability index variables by employing SPSS statistical software.

A. Profitability index

Profitability index reflects the company's profitability. This paper mainly expounds analysis from the following three ratios:

1) Return on net assets reflects the amount of owners’ profit for each yuan investment. This higher the ratio, usually the better. The formula is expressed as follow:

\[\text{Return on net assets} = \frac{\text{net profit}}{\text{total assets}} \times 100\%\]

2) Return on total assets is used to measure the all companies’ ability to use assets for profit, which refers the ratio of total profit and total assets. The formula is expressed as follow:

\[\text{Return on total assets} = \frac{\text{gross profit in this year}}{\text{total assets in this year}} \times 100\%\]

3) Sales net interest rate, also known as the sales net profit margin, is the ratio of net profit and sales revenue. This ratio reflects the amount of net profit brought by each yuan sales revenue, and the profitability of sales revenue. The formula is expressed as follow:

\[\text{sales net profit margin} = \frac{\text{net profit}}{\text{sales revenue}} \times 100\%\]

The above three profitability index values, the greater values show that company's profitability is stronger, and company profit level is higher. We analyze whether profitability index variables suit for factor analysis. It is known from KMO and Bartlett test results in the Table2:KOM value of 0.599,between 0.5 and 0.7, so the correlation between variables is normal ,which suits for factor analysis in Table 1; At the same time, we get the result that Bartlett test P value is 0.000, less than the significance level of 0.05. Therefore we can reject the Bartlett test null hypothesis, regard the profitability index variables suitable for factor analysis.

Table1 KOM and Bartlett Test

| Kaiser-Meyer-Olkin Measurement of sampling sufficient degree | .59 |
| Bartlett’s degree of sphericity test | Approximate chi-square | 44.429 |
| Df | 3 |
| Sig | .00 |

Table 2 is total variance explained. “Components” listed in the table corresponds to the root factor number with different characteristics. In “Initial eigenvalue” column, “total” refers to eigenvalue of correlation coefficient matrix R of raw data value; the “total” in “Extract the square and load” Column, “total” shall be the load total square corresponding to the selected factors; the “total” in “Rotate the square and load” Column, “total” shall be the load total square corresponding to the rotated factors; The three “variance %” columns are the proportion of the population variance, the “cumulate”columns are the cumulative percentage of total variance.Data in the table shows that the cumulative explain degree of the first two factors for the population variance reached 90.442%, which exceeds 70% of our required and the explain effect is better.

Table2 The Total Variance Explained
B. Extraction method by principal component analysis.

Table 3 refers to the component matrix by employing Varimax. The data in the table shows that after rotation, factor 1 is greatly influenced by the rate of return on net assets and total assets, entitled asset income factor (XI). Factor 2 is greatly influenced by sales net interest rate, entitled sales income factor (marked X2).

Table 3 Rotating component matrix

<table>
<thead>
<tr>
<th>ICA</th>
<th>component</th>
<th>1</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Return on equity</td>
<td>0.929</td>
<td>-0.011</td>
<td></td>
</tr>
<tr>
<td>Return on total assets</td>
<td>0.910</td>
<td>0.159</td>
<td></td>
</tr>
<tr>
<td>Sale Net Margin Method</td>
<td>0.74</td>
<td>0.995</td>
<td></td>
</tr>
</tbody>
</table>

C. 3.3 Extraction method: principal component analysis (pca).

Table 4 Component score coefficient matrix

<table>
<thead>
<tr>
<th>PCA</th>
<th>component</th>
<th>1</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Return on equity</td>
<td>0.563</td>
<td>-0.126</td>
<td></td>
</tr>
<tr>
<td>Return on total assets</td>
<td>0.530</td>
<td>0.048</td>
<td></td>
</tr>
<tr>
<td>Sale Net Margin Method</td>
<td>-0.078</td>
<td>0.996</td>
<td></td>
</tr>
</tbody>
</table>


D. Solvency index

Solvency index is used to measure enterprise's ability to repay debt. This paper shall expound analysis from the following four ratios:

\[
\text{current ratio} = \frac{\text{current assets}}{\text{current liabilities}} \times 100\%
\]

Enterprise short-term liquidity strengthens with the increasing of the ratio. The higher the ratio, shows that the possibility of enterprise failing to repay short-term debt, and the occurrence of financial risk is smaller; however, too high rate shows that the enterprise takes up too much liquid assets, which may weaken the profitability of enterprise capital. The suitable ratio is usually 2.

Quick ratio refers to the ratio of the part with strongest cashability in current assets and the current liabilities. The ratio deducts index factor which cannot be converted into cash immediately in the current assets such as the inventory and prepaid expenses. The formula is expressed as follow:

\[
\text{Quick ratio} = \frac{\text{monetary capital + temporary investment + bill receivable + accounts receivable in a year}}{\text{current liabilities}} \times 100\%
\]

The higher the ratio, the enterprise's future debt paying ability is more guaranteed; however, the too high ratio shows that the enterprise takes up too much monetary funds, which may make the enterprise capital profitability reduce. The suitable ratio is usually 1.

(3) Asset-liability ratio is also called financial leverage coefficient, which measures the proportion of the funds provided by creditors in the total enterprise assets, or the creditors' rights' guarantee degree subject to the enterprise total assets. The formula is expressed as follow:

\[
\text{Asset – liability ratio} = \frac{\text{the total liabilities in last year + the total liabilities this year}}{\text{the total assets in last year + the total assets this year}}
\]

The role of financial leverage has two sides: When business operation management is favorable, the positive role of financial leverage multiplies the enterprise operation profit; conversely, when business operation management is poor, not only the liquidity need of enterprise cannot rely on the existing funds for guarantee, the negative effect of leverage will further deteriorate enterprise debt paying ability. The smaller this ratio,
the enterprise long-term debt paying ability is stronger. The ratio is usually not higher than 70%.

E. Cash flow liability ratio.

Cash flow liability ratio, reflects the ratio of net operating cash flow to current liabilities in a certain period. It reflects the enterprise’s ability to repay short-term debt ability at current from the perspective of cash flow. The formula is expressed as follow:

\[
\text{Cash flow liability ratio} = \frac{\text{Annual net cash flow from operating}}{\text{The total current liabilities}}
\]

The higher the ratio, the more is the net cash flow produced by enterprise business operation activities, the stronger is the due short-term solvency ability. However, the excessive high ratio shows that the enterprise takes too much idle of current liabilities, thereby weakening the profit ability of enterprise current capital. Generally the ratio is greater than 1, which means enterprise payment of current liabilities is more reliable guaranteed. We carry out KMO and Bartlett inspection on solvency index variables, the correlation between variables is normal for factor analysis. At the same time, we extract the first two factors with more than 70% of the interpretation degree of population variance accumulation: After rotating, factor 1 is greatly influenced by quick ratio and flow ratio, entitled short-term solvency factor (X3) and X3=0.465* current +0.454* quick ratio-0.047* asset-liability ratio-0.153* Cash flow ratio; factor 2 is greatly affected by asset-liability ratio, entitled long-term solvency factor (X4) and X4 = 0.074* current -0.082*quick ratio+0.884* asset-liability ratio+0.021* Cash flow ratio.

F. Operation ability index

Operation ability index is the measurement and reflection of the enterprise in the operation and management efficiency. This paper is expounded from the following four ratios: (1) current asset turnover ratio reflects the amount of main business net income obtained by each yuan total liquid assets value at a certain period, which is an important index to evaluate enterprise asset utilization ratio. The formula is expressed as follow:

\[
\text{Current asset turnover ratio} = \frac{\text{Main business net income}}{\text{(the total current assets in this year + the total current assets in last year) / 2}}
\]

Generally the higher the ratio is, the speed of current assets turnover is faster, the utilization of current assets is better and more savings. To a certain extent, enterprise profitability shall be strengthened with the increasing of liquid assets investment; conversely, the slow speed of current assets turnover needs more cash flow up to guarantee, which may result in waste of enterprise liquidity, and the deterioration of corporate profitability.

(2) Accounts receivable turnover ratio reflects the speed ration of enterprise's accounts receivable turnover. It shows the average times of company accounts receivable converting into cash in a certain period of time. The formula is expressed as follow:

\[
\text{Accounts receivable turnover} = \frac{\text{Main business net income}}{\text{(the total amount of accounts receivable in this year + the total amount of accounts receivable in last year) / 2}}
\]

Usually, the higher the accounts receivable turnover ratio is, the better, which indicates that the rapid speed of company bill-collecting, the short average bill-collecting time limit, the less loss on bad debt, quick liquidity and the strong debt solvency.

(3) Inventory turnover ratio is used to measure a comprehensive ratio of inventory efficiency each link in the enterprise production and management. The formula is expressed as follow:

\[
\text{Inventory turnover ratio} = \frac{\text{Main business cost}}{\text{(the inventory balance in this year + the inventory balance in last year) / 2}}
\]

The ratio will be affected by any link in the asset management. Generally speaking, the higher the ratio is, the better. We carry out KMO and Bartlett test on operating capacity index variables, the correlation between variables is found weak which is suitable for factor analysis. At the same time, we extract the first two factors with the interpretation degree of population variance accumulation of more than 70%: After rotating, factor 1 is greatly influenced by quick ratio and flow ratio, entitled asset turnover factor (marked X5) and X5 = 0.442*current asset turnover+0.119*turnover of account receivable-0.177*inventory turnover ratio+0.471*total assets turnover; Factor 2 is greatly influenced by inventory turnover, entitled inventory turnover factor (marked X6) and X6 = -0.087*current asset turnover-0.213*turnover of account receivable+0.996*inventory turnover ratio-0.036*total assets turnover.

G. Development capacity index

Development capacity index is used to measure the growth and development trend of the company's business in a certain period of time. This paper is mainly expounded from the following four ratios:

(1) Total assets growth rate is used to measure the development and growth speed of enterprise overall management level. Usually the higher the ratio is, the better, which indicates the rapid growth of the enterprise total assets, and the rapid development of enterprise strength.

(2) Main business revenue growth reflects the growth and development of the company's main business revenue. The ratio reflects the future development prospect of the enterprise: If the enterprise is in growth period, the ratio value is usually higher; If the enterprise in the mature period, the rate may be low, and the continuous favorable profit-level of the enterprise mainly depends on the powerful market share it occupied; If the enterprise is in recession, the ratio may even be negative, which is usually a dangerous signal.
(3) Main business profit growth reflects the expansion situation of corporate profitability, manifesting the enterprise’s long-term profitability trend.

(4) Growth rate of earnings per share measures the growth degree of each common share profit.

We carry out KMO and Bartlett test on development capacity index variables, the correlation between variables is found normal which is suitable for factor analysis. At the same time, we extract the first two factors with the interpretation degree of population variance accumulation of more than 70%:

- Factor 1 is greatly influenced by operating profit growth and growth rate of earnings per share, named earnings growth factor (marked X7) and X7=-0.266* growth rate of total assets +0.171* increase rate of business revenue+0.510* growth rate of operating profit +0.626* EPSG; Factor 2 is greatly influenced by growth rate of total assets, named asset growth factor (marked X8) and X8=0.859* growth rate of total assets +0.312* increase rate of business revenue-0.011* growth rate of operating profit -0.242* EPSG.

H. Non-financial index

The share proportion of the first biggest shareholder is the proportion of the share amount of the first largest shareholder in the total amount of enterprise stocks. The share proportion of the top 10 shareholders is the proportion of the share amounts of the top 10 shareholders in the total amount of enterprise stocks. The board size shall take the logarithmic value of the total number of the board. The proportion of independent directors is the proportion of the number of independent directors in the total number of all board directors. The number of staff shall take the logarithmic value of the total number of employees.

We carry out KMO and Bartlett test on non-financial index variables, and the correlation between variables is found normal which is suitable for factor analysis. At the same time, we extract the first two factors with the interpretation degree of population variance accumulation of more than 70%:

- After rotating, factor 1 is greatly influenced by the board scale logarithmic and the logarithmic of the employees number; Factor 2 is greatly influenced by the proportion of independent directors and X2=0.446* the shareholding ratio of the top 10 shareholders , named shareholder shareholding ratio rotating, factor 1 is greatly influenced by the shareholding ratio of the first largest shareholder +0.447* the shareholding ratio of the top 10 shareholders - 0.073* The board of directors logarithmic and the logarithmic of the employees number; Factor 2 is greatly influenced by the board scale logarithmic and the logarithmic of the employees number, named scale factor (marked X10) and X10=0.216*the shareholding ratio of the first largest shareholder+0.116* the shareholding ratio of the top 10 shareholders +0.561* the board scale logarithmic -0.238* the proportion of independent directors +0.660* the logarithmic of the employees number.

I. Building model

This paper employs SPSS statistical software for analysis, resorts to entering method (Enter), namely all variable factors (X1 - X10) are input into the equation at one time. The model analysis results obtained by regression analysis can see Table6:

<table>
<thead>
<tr>
<th>X1</th>
<th>B</th>
<th>S.E.</th>
<th>Wald</th>
<th>df</th>
<th>Sig.</th>
<th>Exp(B)</th>
</tr>
</thead>
<tbody>
<tr>
<td>X2</td>
<td>0.339</td>
<td>0.245</td>
<td>4.135</td>
<td>1</td>
<td>0.032</td>
<td>0.713</td>
</tr>
<tr>
<td>X3</td>
<td>0.061</td>
<td>0.036</td>
<td>6.972</td>
<td>1</td>
<td>0.019</td>
<td>0.941</td>
</tr>
<tr>
<td>X4</td>
<td>1.135</td>
<td>0.883</td>
<td>7.067</td>
<td>1</td>
<td>0.018</td>
<td>0.321</td>
</tr>
<tr>
<td>X5</td>
<td>0.413</td>
<td>0.327</td>
<td>6.476</td>
<td>1</td>
<td>0.022</td>
<td>0.662</td>
</tr>
<tr>
<td>X6</td>
<td>0.742</td>
<td>0.609</td>
<td>8.087</td>
<td>1</td>
<td>0.015</td>
<td>0.476</td>
</tr>
<tr>
<td>X7</td>
<td>0.018</td>
<td>0.109</td>
<td>5.763</td>
<td>1</td>
<td>0.025</td>
<td>0.982</td>
</tr>
<tr>
<td>X8</td>
<td>1.027</td>
<td>0.903</td>
<td>8.546</td>
<td>1</td>
<td>0.011</td>
<td>0.358</td>
</tr>
<tr>
<td>X9</td>
<td>0.863</td>
<td>0.624</td>
<td>6.134</td>
<td>1</td>
<td>0.023</td>
<td>2.307</td>
</tr>
<tr>
<td>X10</td>
<td>0.535</td>
<td>0.509</td>
<td>9.087</td>
<td>1</td>
<td>0.006</td>
<td>1.707</td>
</tr>
</tbody>
</table>

IV. MODEL TESTING

A. Goodness of fit test

There are many independent variables, continuous variables, and large sampling amount of independent variable combinations, therefore Hosmer and Lemeshow test method is suitable for adoption.

It is known from Table6, Hosmer and Lemeshow statistic is 5.147, degree of freedom is 8, P = 0.858, therefore we can regard model’s imitative effect to sampling data is favorable.
B. Prediction accuracy test

This test randomly select 10 enterprises, 4 default enterprises and 6 enterprises with favorable reputation separately, from typical manufacturing listed companies, and select annual report data at the end of 2011 which are originated from www.Cninfo.com.cn. The data after being analyzed and processed shall be tested by model. If the result is closer to 1, it shall be judged to be default enterprise; otherwise, if the result is more close to 0, then it shall be judged as enterprises with good credit. The sample data after being analyzed and processed can refers to Addendum 2.

Table 7 shows that the prediction of Logistic regression model on the default of test sample. It can be seen that, in view of the manufacturing enterprise credit risk, the regression model discriminant accuracy is higher, reached 80.00% (8/10); Among them, the discriminant accuracy rate of the default enterprise is 75.00% (3/4), the discriminant accuracy rate of enterprise with favorable reputation is 83.33% (5/6). The discriminant effect of a practical problem model is well.

Table 7 Prediction Accuracy test

<table>
<thead>
<tr>
<th>Step No.</th>
<th>Chi-square</th>
<th>F</th>
<th>Sig</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>5.147</td>
<td>8</td>
<td>0.858</td>
</tr>
</tbody>
</table>

V. DISCUSSION AND CONCLUSION

Through the observation of the flow coefficient of the Logistic regression model, we can draw the following conclusions: (1) In this paper, assets benefit factor is mainly affected by two financial indexes: return on net assets and return on total assets. In this paper, the sales revenue factor is mainly influenced by the sales net interest rate – a financial index. These two factors reflect the capability of enterprise profit; the greater value shows that the strong enterprise profiting ability, the enterprise has more sufficient profits funds and assets as guarantee, and the smaller default probability.

In this paper, the short-term solvency factor is mainly affected by two financial indexes: current ratio and quick ratio. The long-term solvency factor in this paper is mainly influenced by asset-liability ratio, a financial index. These two factors are used to reflect the enterprise capital and assets to repay debt the ability before the debt due, the greater numerical value, shows that the enterprise has more sufficient short-term financing and long-term assets to repay debt, the production and business operation is more assured, and the smaller the default probability.

(3) In this paper, assets turnover factor is mainly affected by two financial indexes: current assets turnover and total assets turnover. The inventory turnover factor in this paper is mainly affected by inventory turnover -a financial index. These two factors reflect the operation efficiency of enterprise funds, assets and inventory. The larger value shows that the enterprise's funds, assets and inventory operation efficiency is good, with enough available short-term funding, long-term assets and inventory pledge to guarantee their own solvency, and the smaller default probability.

In this paper, earnings growth factor is mainly affected by two financial indexes: operating profit growth rate and earnings growth rate per share. In this paper, assets growth factor is mainly affected by the financial index- growth rate of total assets. These two factors is used to reflect the enterprise growth and the development trend, the bigger numerical value, shows the greater enterprise management, the rising trend of enterprise's profit, income and assets, and the stronger the enterprise insolvency strength, and the smaller the default probability.

In this paper, the shareholder shareholding ratio factor mainly be affected by the following two non-financial index: the shareholding ratio of the first biggest shareholder holds, and the shareholding ratio of the top 10 shareholders. This factor reflects the enterprise holdings of major shareholders, the larger value shows that the more concentrated enterprise equity, even the possibility of the single-large shareholder, thus enterprise may have poor management decision, the phenomenon of minority shareholders abusing power for personal gains, the default probability will therefore increase.

In this paper, the scale factor is mainly influenced by the following two nonfinancial indexes: board logarithmic scale and staff logarithmic scale. The factor reflects the overall size and structure of the enterprise, the bigger value mirrors the redundant personnel structure, the inflexible governance mechanism, the low enterprise management efficiency, and less market competitiveness, furthermore the increasing default probability.

Through the empirical analysis and prediction, the prediction accuracy is found low, which may have the following reasons.(1) The financial management of many manufacturing enterprises is not standard, and external audit for manufacturing enterprise is not mature, therefore its financial statements may be whitwashed, accounting information may be fabricated and in lack of authenticity.(2) Macroeconomic situation shall affect the business operation condition of manufacturing enterprises, the macroeconomic fluctuation shall dramatically improve or deteriorate manufacturing companies, referring as the lack of data stationarity reflected in the financial statements, and furthermore resulting in certain deviation on estimated results.(3) Due to the limitation of calculation amount, the selected sample in this paper is limited, and the analysis is only performed on the financial data and non-financial data analysis extracted from this paper without consideration of the
commercial bank’s credit risk management on manufacturing enterprises and other aspects, which also affect the accuracy of prediction. This paper only uses factor analysis to find out variable factor with significant impact, but multicollinearity among variables factor may exist, which may affect the prediction precision of this model. The author has taken consideration of the problem, however, in consideration of the interpretation of the number of variables of practical economic problems and explanation power, after repeated consideration, the author finally abandoned to structure the model by using stepwise regression method.

REFERENCE


