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Company Bankruptcy Prediction

-Focus on Liability and Working Capital Analysis

Shiyu Zhang[1,a,*]

[1]*Law school, Southwestern University of Finance and Economics, 611130, Chengdu, China*
a. 1104655425@qq.com
**corresponding author*

Abstract: Company bankruptcy is a way of corporate restructuring, and bankruptcy prediction on various data of the enterprise in advance can avoid greater losses. The topic of this article also revolves around corporate bankruptcy predictions. This paper focuses on the screening of financial indicators related to corporate bankruptcy predictions, with a focus on the analysis of highly correlated data. In this work, SPSS is first used to screen the company's financial operation index data, and then focus on the data related to liabilities and working capital to carry out the company's bankruptcy prediction analysis, and it is concluded that these two indicators have a high impact on the company's operation and bankruptcy prediction. Its significance is that it has certain reference value for the subsequent decision-making of enterprises.

Keywords: liability, working capital, company bankruptcy prediction

1. Introduction

Predicting bankruptcy of companies has been a hot subject of focus for many economists [1]. With the development of the economy, in the past 50 years, the risk problem caused by corporate bankruptcy has become increasingly prominent, and corporate bankruptcy prediction has become an important academic research content [2]. There are also many articles on this topic, but this work pays more attention to the correlation of variables.

In this work, I rank the correlation of many data related to corporate bankruptcy from smallest to largest and select more significant variables for further analysis. Then, according to the content of the financial data represented by these variables, they are divided into six categories, and variables greater than 1 are selected for key analysis according to the display of the gravel map, and finally conclusions are drawn and recommendations are given.

2. Data Preprocessing

According to the significance test in binary logistic regression, the Table 1 is shown [3]:

Table 1: Classification table.

Classification table[a]

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Table 1: (continued).

	Actual test		Projections		
			Bankrupt?		Percent correct
			0	1	
Step 1	Bankrupt?	0	5802	797	87.9
		1	27	193	87.7
	Overall percentage				87.9

a. The cut-off value is .040

When the significance is less than 0.05, it means that the variable is significant for the dependent variable Bankruptcy, so 16 variables that meet the criteria are screened out of 96 independent variables, as shown in the Table 2:

Table 2: The remaining data after binary logistic regression screening.

ROA(C) before interest and depreciation before interest	Cash flow rate	Net Value Per Share (B)
Persistent EPS in the Last Four Seasons	Per Share Net profit before tax (Yuan ¥)	Total debt/Total net worth
Debt ratio %	Borrowing dependency	Fixed Assets Turnover
Working Capital to Total Assets	Cash/Total Assets	Cash Flow to Liability
Net Income to Total Assets	Liability to Equity	Equity to Liability
Cash Turnover Rate		

2.1. Principal Component Analysis

It can be seen in the Table 2 that even if the data is preprocessed, there are still 16 independent variables, which is not conducive to the subsequent analysis, so the data is treated by using the method of principal component analysis for dimensionality reduction.

2.1.1. Principle

After the data preprocessing operation, we get a numerical matrix of 6819 rows and 16 columns, defined as X

$$X = \begin{bmatrix} x_{11} & \cdots & x_{1p} \\ \vdots & \ddots & \vdots \\ x_{n1} & \cdots & x_{np} \end{bmatrix} \quad (1)$$

(where n=1,2... 6819; p=1,2...16)

Define a new set of variables and satisfy:

$$\begin{cases} z_1 = l_{11}x_1 + l_{12}x_2 + \ldots l_{1p}x_p \\ z_2 = l_{21}x_1 + l_{22}x_2 + \ldots l_{2p}x_p \\ \vdots \\ z_m = l_{m1}x_1 + l_{m2}x_2 + \ldots l_{mp}x_p \end{cases} \quad (2)$$

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As a result, the data of 16 dimensions is reduced to data of M dimensions.

2.1.2. Data testing

The KMO and Bartlett tests on the dataset were performed using SPSS, and the results are as Table 3:

Table 3: The KMO and Bartlett tests.

The KMO and Bartlett tests		
KMO sampling relevance measure.		.730
Bartlett sphericity test	Approximate cardinality	75111.616
	Degree of freedom	120
	Sig.	.000

When the KMO value is greater than 0.5, the data is considered to be subject component analysis, and the KMO value of the dataset is 0.730 greater than 0.5, so this data set can be used for principal component analysis.

The total variance for the data is explained in the Table 4.

Table 4: The total variance.

The total variance									
components	Initial eigenvalue			Extract the sum of squared loads			Rotational load sum of squares		
	total	Percentage variance	Cumulative %	total	Percentage variance	Cumulative %	total	Percentage variance	Cumulative %
1	4.697	29.359	29.359	4.697	29.359	29.359	4.013	25.083	25.083
2	2.407	15.041	44.400	2.407	15.041	44.400	2.009	12.556	37.639
3	1.811	11.320	55.720	1.811	11.320	55.720	1.963	12.272	49.910
4	1.360	8.501	64.221	1.360	8.501	64.221	1.621	10.134	60.044
5	1.074	6.711	70.932	1.074	6.711	70.932	1.540	9.627	69.671
6	1.055	6.596	77.528	1.055	6.596	77.528	1.257	7.857	77.528

As shown in the Table 4, the six most important components were screened, and the cumulative variance contribution rate was as high as 77.528%, which could well explain the change law of the data set.

According to the filtered components, run SPSS to obtain the rotating composition matrix as shown in the Table 5 below.

Table 5: Component matrix after rotation.

Component matrix after rotation						
	components					
	1	2	3	4	5	6
Persistent EPS in the Last Four Seasons (1)	.946					
Per Share Net profit before tax (Yuan ¥) (2)	.931					
ROA(C) before interest and depreciation before interest (3)	.878			.133		

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Table 1: (continued).

Net Income to Total Assets (4)	.829	-.110		.116		
Net Value Per Share (B) (5)	.781		.147			
Liability to Equity (6)		.973	-.135			
Borrowing dependency (7)	-.100	.970	-.117			
Equity to Liability (8)			.839	.295		
Debt ratio % (9)	-.188	.265	-.797		-.187	
Working Capital to Total Assets (10)	.200	-.105	.542		.386	.514
Cash flow rate	.221		.196	.747	.125	-.102
Total debt/Total net worth			.272	.706	-.263	
Cash Flow to Liability			-.227	.646	.503	.165
Cash Turnover Rate			-.135		-.710	.265
Cash/Total Assets	.164		.295	.134	.701	.313
Fixed Assets Turnover Frequency						-.874

As can be seen from the Table 5, the percentage variance for the first variable (Z1) after reorganization is 29.359%, including (1), (2), (3), (4) and (5) is more than 70%, this illustrates that earnings per share is an important indicator of the company's profitability, and is the net profit or net loss that ordinary shareholders can enjoy for each share they hold. For investors, earnings per share is a comprehensive concept of profitability that can be used to judge and evaluate management's operating performance. Therefore, according to the independent variables contained in Z1, it can be classified as Operational metrics of the company in relation to earnings per share.

For the second variable after the reorganization (Z2), the variance percentage is 15.041%, of which (6) and (7) both contribute more than 90%, these indicators can basically reflect the degree of a company's dependence on short-term creditors, the higher the ratio, the stronger the company's dependence on short-term funds; (10) has a negative contribution of 70%, which measures the ability of a company's current assets to be turned into cash to pay down its liabilities before short-term debt matures. Therefore, based on the independent variables contained in Z2, it can be classified as a company operating indicator related to liabilities.

For the third variable (Z3) after reorganization, the variance percentage was 11.320%, of which (8) and (10) contributed more than 50%, and (9) was negative 0.797%. Based on the independent variables contained in Z3, which can be classified as an indicator of the company's operations related to current assets.

For the restructured variables Z4, Z5, and Z6, the variance percentages are all below 10%, accounting for a relatively small proportion according to the independent variables they contain, they can be classified as company operating indicators related to accounts receivable and payable (Z4), company operating indicators related to asset turnover (Z5), and company operating indicators related to cash flow (Z6).

2.1.3. Gravel map

According to the Gravel map, the characteristic value of the first to fifth variables is greater than 1, and it is sharply reduced before the fifth. So this article will focus on the first five recombination variables. Restructuring variables 1 to 5 are mainly including the impact of liabilities and working capital on the company's bankruptcy prediction, because the capital structure refers to the composition of various funds of the enterprise and its proportional relationship. The structure of funds is at the

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heart of corporate financing decisions. In the capital structure, a certain degree of debt is conducive to reducing the cost of capital of enterprises, debt funds have financial leverage, and debt funds will increase the financial risk of enterprises. In a broad sense, working capital refers to the funds invested by an enterprise in current assets, including accounts receivable, inventory, other receivables, notes payable and so on. It can be used to measure the short-term solvency of a company or enterprise, and the larger the amount, the more prepared the company or enterprise is to pay its obligations, and the better the short-term solvency.

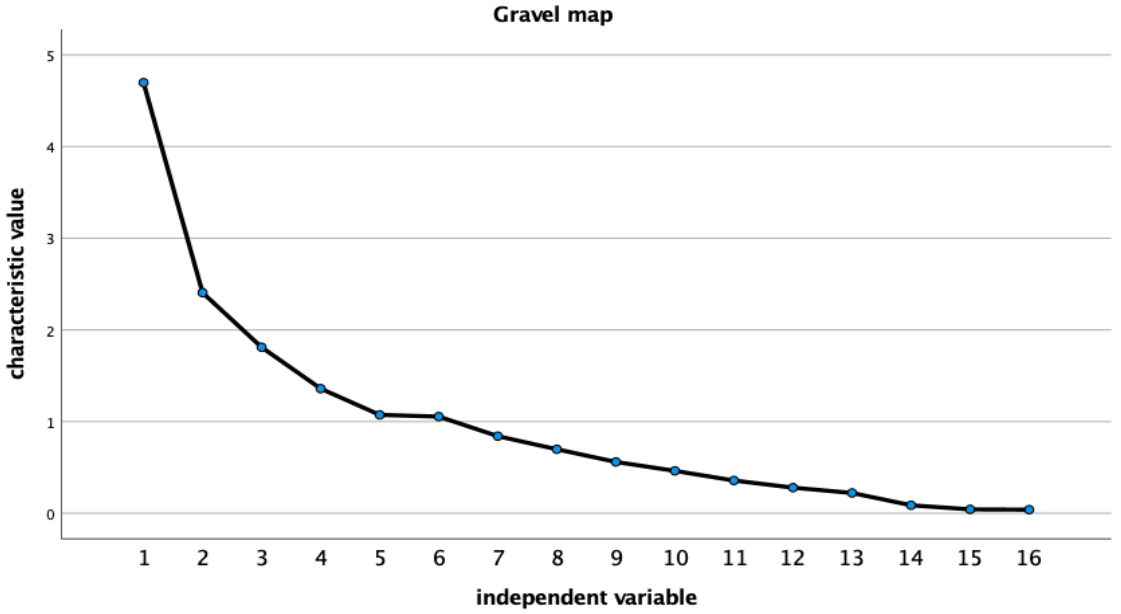

Figure 1: Gravel map.

2.2. Normality Test

Table 6: Normality test.

Normality test			
	Kolmogorov - Sminenov		
	statistics	degree of freedom	Significance
REGR factor score 1 for analysis 1	.095	6819	.000
REGR factor score 2 for analysis 1	.333	6819	.000
REGR factor score 3 for analysis 1	.103	6819	.000
REGR factor score 4 for analysis 1	.244	6819	.000
REGR factor score 5 for analysis 1	.057	6819	.000
REGR factor score 6 for analysis 1	.174	6819	.000

The normal test indicates that the recombination variables does not conform to a normal distribution, so a nonparametric independent sample test is performed, as shown in the Table 7:

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2.3. Non-parametric Test

Table 7: Non-parametric test.

	Sig.a,b	Decision
1	.000	Reject the null hypothesis.
2	.000	Reject the null hypothesis.
3	.000	Reject the null hypothesis.
4	.060	Retain the null hypothesis.
5	.391	Retain the null hypothesis.
6	.000	Reject the null hypothesis.

a. The significance level is .050.
b. Asymptotic significance is displayed.

The test shows that in the two sets of data of bankruptcy and non-bankruptcy, the reorganization data of Z1, Z2, Z3 and Z6 are different; Z4 and Z5 retain the null hypothesis, indicating that these two recombinant variables are the same in the two sets of data of bankruptcy and non-bankruptcy.

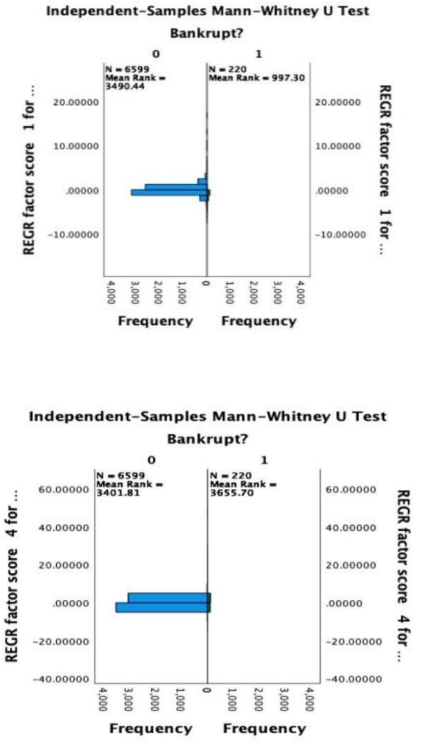

Figure 2: Recombinant variable 1 and 4.

Taking recombinant variable 1 and recombinant variable 4 as examples, recombinant variable 1 rejects the null hypothesis, so its Mean Rank is quite different (The illustration of Z2 and Z3 is the same as it is); The recombinant variable 4 retains the null hypothesis, so its Mean Rank is almost identical (The illustration of Z5 is the same as it is).

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3. Data Analysis after Screening

Combined with the above data screening, the 16 data are divided into six groups, and then, according to the display of the gravel map, take the first five recombinant variables, these five recombinant variables can be roughly divided into liabilities and working capital, therefore, this article will analyse the company's bankruptcy and the connection between these two aspects from the aspects of liabilities and working capital.

3.1. Liabilities

A well-run enterprise is by no means a completely debt-free enterprise, which requires the enterprise to have a moderate scale of debt, a reasonable debt structure, optimize the capital structure of the enterprise in the balance between the risks and benefits of debt operation, and achieve the financial goal of maximizing the value of the enterprise [4]. Debt is an important part of the company's balance sheet, there are many impacts on enterprise operation, debt management has become the main means of modern enterprise operation, research on the impact of debt on enterprise operation has many practical significance for enterprise development.

The main ways in which liabilities affect the company's operations:

Liabilities are essentially economic debts that an enterprise must repay after a certain period of time, and its repayment period or specific amount is stipulated and restricted by contracts and regulations at the time of its occurrence or establishment, and is an obligation that an enterprise must fulfill [5]. Therefore, this work will analyze the main ways in which liabilities affect business operations.

3.1.1. Influence the Company's Operations Through Financial Leverage

Financial leverage refers to the leverage effect of changes in common shareholders' equity greater than changes in operating profit due to the existence of debt. Financial leverage is the practice of enterprise debt management, and the greater the proportion of an enterprise's liabilities to the amount of assets, the greater the financial leverage. The operation of corporate liabilities will bring financial risks to enterprises, but also bring benefits. Debt interest expense is paid out of pre-tax profit, so the higher the debt ratio, the higher the after-tax distributable profit and the higher the return to shareholders.

The level of financial leverage reflects the magnitude of corporate financing risk. The greater the financial leverage, the more fixed interest expense the enterprise bears, and when the operating profit increases, the financial leverage brings shareholders a larger increase in earnings per share; However, when operating profit declines, it will also cause shareholders' earnings per share to decline even more, especially when operating profit falls to make the return on assets lower than the debt interest rate, and the negative effect of financial leverage makes earnings per share fall below the pre-debt level, and shareholders suffer huge debt losses. Therefore, studying the impact of financial leverage on a company's operations is a good way to predict whether a company is on the verge of bankruptcy.

3.1.2. The Impact of an Enterprise's Solvency on Bankruptcy Prediction

Solvency refers to the ability of an enterprise to repay its debts when due. The strength of an enterprise's solvency is one of the main criteria for judging the quality of its financial situation. The scale and liquidity of liabilities, and the proportional relationship between liabilities and owner's equity, all affect the solvency of enterprises.

From the perspective of asset-liability ratio, it indicates the proportion of creditors providing funds to total assets and the degree of protection of creditors' rights and interests by enterprise assets. For

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different industries, the best asset-liability ratio is different, some industries are higher, some are lower, so a unified data can not be used to measure whether the company's asset-liability ratio is reasonable, should be analyzed individually according to different industries. However, in general, it is the business owners who want to use debt management to obtain financial leverage benefits, so they want to maintain a high asset-liability ratio; For the safety of their own rights and interests, creditors hope that the asset-liability ratio will be lower, so that their rights and interests can be more protected. If the asset-liability ratio of the enterprise is equal to or even greater than 1, it means that the enterprise is insolvent, which will greatly affect the decision-making of creditors and even lead to the bankruptcy of the enterprise. Therefore, an appropriate gearing ratio is important for enterprises, shareholders, and creditors.

3.2. Working Capital

In recent years, market competition has been intensifying, many enterprises have difficulties in working capital scheduling, and their operations are facing many risks, a large part of which is that they cannot obtain the right amount of working capital in a timely manner. In the company's business activities, capital operation plays an important role, which directly affects the company's management ability and has a close relationship with the company's debt [6].

What working capital means to a business:

Working capital is the capital that the enterprise can use in a short period of time, and if the enterprise does not coordinate all aspects of the capital in use, there will be poor operation, resulting in unreasonable capital turnover, and even bankruptcy.

For enterprises, working capital is the most active part of the enterprise, and the continuous operation of working capital lays the foundation for the development of enterprises, so capital operation will also affect the survival and development of enterprises. The transfer of enterprise capital is not a one-time transfer, but according to the different business activities of the enterprise, it enters the product value through the value transfer in stages, and the product is turned around and waiting to be sold, and the value of the product is realized.

Enterprise working capital in this process is similar to a conveyor belt, with fixed value and the value of current assets bundled into one, transformed into a part of enterprise capital, these capital through production, sales, payment collection and other behaviors become specific funds, the original liquid assets in these capitals will also be converted into monetary funds to provide funds for the next round of production of the enterprise.

Therefore, the company's working capital is an important indicator that affects the company's decision-making and bankruptcy prediction of the company, and can help the company make correct and timely predictions in the daily operation process.

4. Conclusion

This paper selects 16 data with high correlation by filtering 6819 data and 96 variables of company bankruptcy. Then, factor analysis was used to divide these 16 variables into six categories, and the first five variables with relatively high research significance were selected for analysis through the gravel plot, and divided into two categories: liabilities and working capital according to the significance they represented. Through analysis, the advantages of debt management can help enterprises quickly finance, operate normally, and achieve corporate goals[7]. If the actual debt level of the enterprise exceeds the target debt level, it is over-indebted. This is extremely detrimental to the operation of the enterprise, which will lead to the occurrence of bankruptcy. Therefore, this article also proposes to focus on the impact of this aspect so that company managers can make timely decisions [8]. Working capital is also crucial to the survival and sustainable development of

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enterprises, involving all aspects of enterprise production activities [9]. Working capital, as the lifeblood of a company, requires great attention. This article also emphasizes its importance, and explains its important reasons with relevant data and analysis, which brings some convenience to decision-makers.

I believe that the road to corporate bankruptcy prediction is still a long way off, and this article only analyzes one aspect, but the use of methods and theoretical analysis can provide positive support for enterprises to implement bankruptcy prediction.

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