Research on Comprehensive Quality of Listed Companies Based on Principal Component Analysis

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Abstract: *The operating conditions and development prospects of listed companies are closely related to the company's financial indicators. This paper selects 10 financial indicators of 4413 listed companies in China from 2018 to 2021, constructs an index system suitable for evaluating the overall financial quality of listed Companies in China by using the principal component analysis method, explores the impact degree of each index, and draws relevant conclusions about the comprehensive quality of listed companies.*

Keywords: *Listed company, Financial indicators, Principal component analysis, Comprehensive evaluation*

1. Introduction

Over the past three decades, with the continuous development of China's stock market and listed companies, China's securities market has gradually integrated with the international securities market, and relevant national laws and regulations have been gradually improved. Therefore, the rights and interests of listed companies have been fully protected. As the world's second largest economy, China's listed companies are full of vitality, and the high-quality external environment is very favorable for the development prospects of listed companies. This paper uses the principal component analysis method to comprehensively analyze the financial indicators of 4413 listed companies in China, constructs a new evaluation system, optimizes the previous corporate financial analysis framework based on DuPont analysis, and looks for a new perspective of financial statement analysis from the driving factors of maximizing corporate value, so as to extend the Perspective of static and short-term financial index analysis to relatively dynamic long term dimension. As the benchmark of Chinese enterprises, evaluating its financial indicators and analyzing the reasons for the changes in the company's financial situation are of great practical significance to improve the comprehensive quality and operation of Chinese listed companies, and then improve the competitiveness of Chinese Listed Companies in the international market.

2. Related literature review

The theoretical research on financial quality mainly focuses on profit quality and earnings quality. Ball and brown (1968) first studied earnings quality. They proved that accounting earnings have information content. Dechow and schrand (2004) believe that high-quality earnings need to meet the following three conditions: first, to reflect the operating conditions; The second is a good prediction index of future operation; The third is to truly reflect the internal value of the company[1]. Many Chinese scholars have also conducted relevant research on financial quality. Tao Zhang, Chuanpeng Shao (2009) and Pengfei Zhang (2006) believe that the development trend of financial analysis in the future should be the comprehensive analysis of financial indicators, non-financial quality and enterprise growth. They established a comprehensive evaluation index of financial quality from five aspects: asset quality, capital structure quality, profit quality, cash flow quality and enterprise sustainable growth ability.[1]

3. Construction of comprehensive quality evaluation model of Chinese Listed Companies

3.1. Basic data collection of comprehensive quality of Chinese Listed Companies

According to the composition of China's financial indicators, this paper constructs an index evaluation system from four aspects: profitability, debt-paying ability, development ability and operation capability. Ten indicators are selected: current ratio(X_1), debt asset ratio(X_2), total asset growth rate(X_3), increase rate of main business revenue(X_4), Inventory turnover rate(X_5), Receivables turnover ratio(X_6), Return on Total Assets Ratio(X_7), Return on Assets(X_8), Return on Invested Capital(X_9) and Ratio of profits to cost and expense(X_{10}).The financial data of listed companies selected in this paper are from CSMAR database, and the data analysis and processing software adopts SPSS.[2]

3.2. Constructing principal component analysis model

Principal component analysis can eliminate the correlation between indicators, and it is relatively easy to select indicators. In this paper, the dimensionality of the data is reduced to reduce the correlation between groups to the greatest extent, then the weight is determined according to the variance contribution rate between groups, and finally the final comprehensive score F of each group is calculated[3].

4. Empirical Analysis on comprehensive quality of listed companies

4.1. Analyze the applicability of the original data

After inputting the relevant data by spss26, the KMO value is 0.714 (>0.6), and the significance index of Bartlett sphericity test is 0. It can be seen that the original data meet the requirements of principal component analysis and factor analysis can be carried out.

Table 1: KMO measure and Bartlett sphericity test result

KMO Sampling Suitability Quantity		0.714
Bartlett sphericity test	chi-squared approximation	413539.739
	degree of freedom	45
	Statistical significance	0

4.2. Extraction of principal components

As shown in Table 2, after the factor analysis processed the original data, the extraction rate of most variables was high, indicating that the overall effect of this factor extraction is ideal. Table 3 shows that four principal components can be extracted from the financial indicators of 10 listed companies adopted in this paper, and the cumulative variance of these four principal components accounts for 72.48% of the total variance, meeting the conditions for extracting principal components.

Table 2: Common factor variance communality

Evaluation indicators	initial	extract
current ratio	1	0.777
debt asset ratio	1	0.745
total asset growth rate	1	0.27
increase rate of main business revenue	1	0.854
Inventory turnover rate	1	0.152
Receivables turnover ratio	1	0.994
Return on Total Assets Ratio	1	0.894
Return on Assets (ROA)	1	0.917
Return on Invested Capital	1	0.961
Ratio of profits to cost and expense	1	0.685

Table 3: Total variance of interpretation

components	Initial eigenvalues			Extract the sum of squares of the loads		
	Total	Variance%	Accumulation%	Total	Variance%	Accumulation%
1	3.706	37.06	37.06	3.706	37.06	37.06
2	1.541	15.414	52.474	1.541	15.414	52.474
3	1	10.002	62.476	1	10.002	62.476
4	1	10.001	72.477	1	10.001	72.477
5	1	9.999	82.477			
6	0.833	8.328	90.805			
7	0.46	4.601	95.406			
8	0.415	4.146	99.552			
9	0.039	0.387	99.939			
10	0.006	0.061	100			

The rotated component matrix obtained by Caesar normalization maximum variance method is shown in Table 4:

Table 4: Composition matrix after rotation

	component1	component2	component3	component4
X1	0.049	0.88	0	0.01
X2	-0.061	-0.861	0.001	-0.002
X3	0.484	0.188	0.009	0.021
X4	0.001	-0.012	-0.068	0.921
X5	-0.002	-0.011	-0.051	-0.386
X6	0.003	-0.001	0.996	0.043
X7	0.945	0.006	-0.01	-0.007
X8	0.957	0.039	-0.009	-0.007
X9	0.978	-0.059	-0.005	-0.004
X10	0.827	0.014	0.015	0

It can be seen from table4 that the impact indicators of principal component 1 are mainlyX_9 (return on invested capital), reflecting profitability; The main impact indicators of principal component 2 areX_1(current ratio), reflecting debt-paying ability; The main impact indicators of principal component 3 areX_6(turnover rate of accounts receivable), reflecting the operating capacity; The main impact indicators of principal component 4 areX_4 (growth rate of operating revenue), reflecting development capacity.

To sum up, the significance represented by each principal component, F_1 represents profitability, F_2 represents debt-paying ability, F_3 represents operating capacity, F_4 on behalf of development capacity.

4.3. Calculate the principal component score, comprehensive score and ranking of listed companies

Because the principal component analysis method is affected by the dimension and order of magnitude of evaluation indicators, some information is lost. Therefore, the dimensionless processing of the original data by using Z-score method in SPSS not only effectively eliminates the influence of dimension and order of magnitude, but also makes the processed data contain all the information of the original data. It greatly improve the accuracy of data analysis. Based on the analysis of the data of 10 financial indicators of listed companies from 2018 to 2021, the principal component scores of each indicator are obtained, including:

$$F_1 = 0.064X_1 - 0.069X_2 + 0.259X_3 - 0.001X_4 - 0.002X_5 + 0.001X_6 + 0.489X_7 + 0.497X_8 + 0.504X_9 + 0.429X_{10}$$

$$F_2 = -0.703X_1 + 0.687X_2 - 0.118X_3 + 0.013X_5 - 0.002X_6 + 0.06X_7 + 0.035X_8 + 0.114X_9 + 0.045X_{10}$$

$$F_3 = -0.002X_1 + 0.006X_2 + 0.014X_3 + 0.194X_4 - 0.157X_5 + 0.968X_6 - 0.01X_7 - 0.009X_8 - 0.004X_9 + 0.016X_{10}$$

$$F_4 = -0.001X_1 + 0.008X_2 + 0.016X_3 + 0.903X_4 - 0.356X_5 - 0.239X_6 - 0.002X_7 - 0.002X_8 - 0.002X_9 - 0.002X_{10}$$

Then according to the variance contribution rate of each principal component in Table 3, the weight is multiplied by the score of each principal component to obtain the comprehensive score F of each listed company:

$$F = 0.371F_1 + 0.154F_2 + 0.1F_3 + 0.1F_4$$

After that, the calculation results are ranked in descending order, and the top 10 listed companies and their industries are obtained, as shown in Table 5.

Table 5: ranking of comprehensive scores of listed companies

ranking	company name	Industry name	scores	F1	F2	F3	F4
1	Feima International Supply Chain	Business service industry	57.84	147.26	22.54	-2.24	-0.43
2	Baic Bluepark New Energy Technology	Automotive Manufacturing	23.42	-0.85	0.45	41.87	194.85
3	Chongqing Road&Bridge	road transport	16.35	0.83	-0.53	214.14	-52.86
4	Fortune Trend Technology	Software and Information Technology Services Industry	6.06	18.71	-6.11	0.68	-0.03
5	Orient Gene Biotech	Pharmaceutical Manufacturing	5.62	15.95	-2.40	0.26	0.43
6	Ningbo Donly	General equipment manufacturing	5.50	13.62	3.05	-0.20	-0.04
7	Sansure Biotech	Pharmaceutical Manufacturing	4.90	14.54	-3.51	0.19	0.32
8	Intco Medical Technology	Pharmaceutical Manufacturing	4.52	12.40	-0.62	-0.01	0.12
9	Hotgen Biotech	Pharmaceutical Manufacturing	4.21	11.92	-1.35	-0.12	0.02
10	Baoli New Energy Technology	Electrical machinery and equipment manufacturing	4.08	9.89	2.87	-0.20	-0.07

5. Conclusions and policy recommendations

5.1. Conclusion

Through the empirical analysis of 4413 listed companies in China from 2018 to 2021, we can see that the problems existing in the comprehensive financial quality of Chinese listed companies are as follows:

Firstly, the debt-paying ability of Chinese listed company is generally weak. There are only 4 companies with more than 10 points, and 70% of the companies have a debt-paying ability score of less than 1 point, which means a high risk of debt default.

Secondly, the operating capacity of Chinese listed company is uneven. The highest score of operating capacity is 214, but only 6 listed companies have an operating capacity score of more than 1, so there is a great gap in operating capacity between companies. Indicators reflecting operating capacity, such as Inventory turnover rate and Receivables turnover ratio, fluctuate greatly.

Thirdly, the development prospect of China's pharmaceutical industry is good. Since 2019, the overall pharmaceutical demand has maintained a rigid growth, but policies such as the increase of macroeconomic downward pressure, the adjustment of medical insurance catalogue and volume procurement have had a great impact on the phased income and profits of the pharmaceutical manufacturing industry. In 2020, COVID-19 affected the growth of revenue of pharmaceutical manufacturers. Some enterprises have begun to actively control the cost side, and continue to strengthen innovation and R & D investment. The cash acquisition ability of enterprises in the industry continues to improve, and the leverage level is still low. Driven by the continuous increase in the market entry and use of new drug products, the global drug market is expected to grow to about US $1.55 trillion in 2023, with a CAGR of 5.1% from 2018 to 2023. In the future, with the domestic aging and consumption upgrading driving the demand market of the pharmaceutical industry, the demand for high-end products and services continues to increase. It is expected that the downstream demand of the pharmaceutical industry is expected to maintain a stable growth trend.[4]

5.2. Policy suggestion

First, improve asset quality. Enhancing the operating capacity of enterprises and improving the quality of various assets are the basis for improving the solvency of enterprises. Excessive inventories not only occupy funds, but also generally have poor liquidity, which will directly lead to the decline of solvency. Therefore, the company should strengthen inventory management and reduce WIP. In addition, we should strengthen the management of accounts receivable. When using credit sales, we should carefully compare the increased profits with the cost of accounts receivable, timely understand and pay attention to the credit situation of relevant customers, and supervise the recovery of accounts receivable. Formulate scientific and reasonable collection policies according to different customers to minimize bad debt losses.[5]

Second, scientific borrowing. The company shall make reasonable planning in advance according to the loan amount, liability period and interest rate, combine various debt raising methods with the company's capital scale, future development plan and the impact on its own asset structure, and choose the debt raising method with the lowest risk, so as to reduce the company's bad debt risk to the lowest point.

Third, strengthen the management of accounts receivable and improve the operation capacity of companies. Company decision makers should carry out aging analysis of accounts receivable and pay close attention to overdue accounts receivable. For debtors who deliberately default, enterprises should take strong measures, such as mortgaging property or recovering them through legal channels. For debtors in financial crisis, the enterprise should analyze their sustainable development ability, relax the repayment period and reduce the repayment amount for debtors with development potential, reduce the financial pressure of debtors and effectively recover part of the payment for goods[6].

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