Performance Evaluation of Listed Enterprises in China's Cotton Textile Industry Based on Combination Evaluation

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Abstract. In order to objectively evaluate the business performance of China's cotton textile industry, this research uses factor analysis and projection pursuit comprehensive evaluation method to conduct a single method for empirical analysis. The results show that these methods pass the consistency test of Kendall coefficient, and then the combined method of comprehensive fuzzy Borda is used to fuse the results of the above single evaluation methods. The Spearman test results show that the combined evaluation results are more reasonable than the single evaluation results. Ultimately, the research results indicate that neither approach can independently evaluate this phenomenon. The fuzzy Borda method can combine these methods, so that the advantages of the single evaluation method can complement each other which effectively make up for the shortcomings of the single evaluation method. By this way,we can obtain more comprehensive and credible evaluation results, and acquire more scientific and reasonable evaluation results, So this combination evaluation method provides an ideas and method for enterprise performance evaluation.

Keywords: Cotton textile industry · listed companies · factor analysis · entropy weight method analysis · projection pursuit comprehensive evaluation method · fuzzy Borda

1 Introduction

Back in 1985, A.T. Keamey emphasized that if financial performance measurement were applied to a business, its overall productivity would increase. Objective and fair evaluation of financial performance not only provides investors with a basis for adjusting the content and intensity of investment and strengthening the quality of investment decision, but also forms a series of practical company incentive and restriction mechanisms for enterprises, so that they can recognize their own problems and strictly enforce them, to steer the cotton textile industry in a healthy and sustainable direction.

By clarifying the theoretical basis, evaluation system and method of evaluating financial performance in conjunction with the outstanding industry characteristics and development status of the industry, this research develops an index system for evaluating

N. Akhtar et al. (Eds.): PMIS 2023, AHIS 8, pp. 24–31, 2023.
https://doi.org/10.2991/978-94-6463-200-2_4

financial performance suitable for listed companies in the cotton textile industry. The purpose of evaluating the operating performance of listed enterprises in China's cotton textile industry is to highlight the advantages and disadvantages of the enterprise through the evaluation and provide a reference basis for enterprise managers' decision-making, which will help improve the management level of enterprises and enhance the competitive advantage and capital of the industry in market competition.

2 Literature Review

2.1 Financial Performance Literature

Research n enterprise performance has a long history, especially after the introduction of the "State-owned Capital Performance Evaluation System" (2002), jointly promulgated by the Ministry of Finance and the Economic and Trade Commission of China, various industries have conducted extensive research [1–3]. The performance of the cotton textile industry is also under increasing scrutiny. Su Xiaomei used a combination of qualitative and empirical analysis to analyze the achievements and existing problems of the textile industry in terms of enterprise performance by studying the main product performance of the textile industry and other indicators [4]. Li Jingwen mainly put forward that under the background of asset restructuring, the textile industry can improve its performance, and proposed a new performance index evaluation system -the " growth rate of profit surplus" - and proved that this system is more suitable for the textile industry [5]. Revealing the Root Cause first analyzes the development environment of listed textile enterprises based on the macroeconomic and competitive landscape, and then uses empirical analysis to comprehensively evaluate the performance of 41 listed textile enterprises across the country, using cluster analysis and complex correlation analysis. The coefficient method and principal component analysis method were used for the analysis [6]. Zhang Min used the method EVA, to study the enterprise performance of the listed company X in the textile industry [7]. Qi Xiangjun studied the performance of listed companies to predict the development trend in the garment industry [8]. From the research point of view, there are those in the textile industry and those in the garment industry. As for the research methods, given that there are many indicators and most of them are factor analysis, there are also many other useful attempts for comprehensive evaluation.

2.2 Combined Evaluation Method

A single evaluation method has its own shortcomings, and its evaluation results may sometimes be too one-sided. The combined evaluation method can combine the two methods so that the advantages of each evaluation method complement each other, effectively compensate for the shortcomings of each evaluation method, and achieve a more comprehensive evaluation. The combination of the two methods leads to credible assessment results, improves the scientificity of assessment results, and provides new ideas and methods for comprehensive assessment. The general idea is to use the degree of compatibility and the degree of difference to compare the evaluation effects of different methods, and on this basis, the Kendall coordination coefficient method is used to test

the consistency of evaluation results. After this test, the fuzzy Borda method is used to evaluate the valuation objects. Finally, Spearman correlation coefficient is used to analyze the influence of each index on the evaluation results. In recent years, many domestic scholars in China have made useful attempts to combine valuation models. Some have studied the rational selection of weights in depth [9, 10], while others have combined multiple models based on a single comprehensive evaluation method [11, 12]. There has even been some literature on the performance of listed cotton textile companies [13–16]. The present research selects cotton textile industry dominated by cotton as the analysis object and abandons the single comprehensive evaluation method and applies the combined evaluation method in the research method, hoping to obtain more reasonable evaluation results.

3 Empirical Analysis of a Single Evaluation Method of Performance of Listed Companies

3.1 Selection of Sample and Data Sources

In selecting the sample, according to the "Guidelines for Industry Classification of Listed Companies (Revised in 2012)" issued by China Securities Regulatory Commission, In selecting the sample, according to the "Guidelines for Industry Classification of Listed Companies (Revised in 2012)" issued by China Securities Regulatory Commission.

In order to avoid the influence of some special abnormal samples on the research results of this research and to ensure the objectivity and accuracy of the sample data, this research has reviewed the listed companies of cotton textile industry in my country. In selecting the samples, the following conditions are not considered. First, ST listed companies with abnormal performance; second, listed companies with incomplete financial index data; third, companies with a relatively short listing period; there are 23 cases in the sample data that contain extreme values, which easily affect the evaluation results. For horizontal comparison, this article selects various financial data for the end of 2020 to calculate the corresponding indicators. Most of the data are from the Brick Agricultural Database, and refer to the following platforms: CSMAR economical and Financial Research Database, Wind Database, etc.

Based on the State-owned Capital Performance Evaluation System (2002), jointly issued by the Ministry of Finance, the Economic and Trade Commission and other four ministries, this research refers to a large body of existing literature on the four aspects of profitability, solvency, operational capability and development capability. In combination with expert opinions, a system for evaluating the financial performance of listed companies was developed (see Table 1).

3.2 Empirical Analysis Based on Factor Analysis

First, we examine whether the data are suitable for factor analysis. The KMO value calculated by SPSS 22.0 is 0.694, which is greater than 0.6, which meets the requirements for factor analysis, which means that the data can be used for factor analytical study. And the data passed Bartlett's spherical test ($p = 0.00 < 0.05$), which means the research data is suitable for factor analysis.

Table 1. Operational Performance Evaluation System of Cotton Textile Listed Companies

Profitability	Return on Assets	X1
	ROE	X2
	Operating profit margin	X3
solvency	Current ratio	X4
	Quick ratio	X5
	Asset-liability ratio	X6
	Cash ratio	X7
Operating capacity	Growth rate of total assets	X8
	Current Assets Turnover Ratio	X9
	Inventory turnover ratio	X10
development ability	Growth rate of total assets	X11
	Operating income growth rate	X12

A total of 4 factors were extracted from factor analysis, and the eigenvalues were greater than 1. The variance explanation rates of these four factors after rotation were 32.555%, 26.540%, 11.951% and 11.363%, respectively, and the cumulative variance explanation rate after rotation was 82.410%. The data in this study were rotated using the maximum variance rotation (Varimax) method to find the correspondence between the factors and the study items. The above table shows the information extraction of the factors for the study items and the corresponding relationship between the factors and the study items. It can be seen that the values of the common degree for all the study items are higher than 0.4, which means that there is a strong correlation between the study items and the factors, so these factors can effectively extract information. After making sure that the extracted factors can extract most of the information from the study items, then we can analyze the corresponding relationship between factors and research items (Table 2).

The comprehensive evaluation results based on factor analysis are shown in Table 3.

Table 2. Variance Explained Rate Table for Factor Analysis

Component	Initial Eigenvalues			Extraction Sums of Squared			Rotation Sums of Squared		
	Total	Variance%	Cumulative%	Total	Variance%	Cumulative%	Total	Variance%	Cumulative%
x1	4.56	38.04	38.04	4.56	38.04	38.04	26.54	32.56	32.56
x2	2.94	24.54	62.57	2.94	24.54	62.57	3.18	26.54	59.1
x3	1.36	11.31	73.88	1.36	11.31	73.88	1.43	11.95	71.05
x4	1.02	8.53	82.41	1.02	8.53	82.41	1.36	11.36	82.41
x5	0.76	6.36	88.77	–	–	–	–	–	–

(*continued*)

Table 2. (*continued*)

Component	Initial Eigenvalues			Extraction Sums of Squared			Rotation Sums of Squared		
	Total	Variance%	Cumulative%	Total	Variance%	Cumulative%	Total	Variance%	Cumulative%
x6	0.57	4.76	93.53	–	–	–	–	–	–
x7	0.36	2.96	96.49	–	–	–	–	–	–
x8	0.21	1.76	98.25	–	–	–	–	–	–
x9	0.11	0.88	99.13	–	–	–	–	–	–
x10	0.07	0.62	99.75	–	–	–	–	–	–
x11	0.03	0.24	99.99	–	–	–	–	–	–
x12	0	0.01	100	–	–	–	–	–	–

3.3 Empirical Analysis Based on the Comprehensive Evaluation Method of Projection Pursuit

This evaluation method is calculated using DPS software, the input parameter for local density is 0.100, the standard deviation of the projection value is 1.7113, the local density is 13.4283, and the objective function Q(a) is 22.9793. The variables are, in order: return on assets, net interest on sales, return on equity, current ratio, quick ratio, cash ratio, asset-liability ratio, turnover rate of receivables (times), turnover rate of inventories (times), total turnover rate of assets (times), growth rate of main income; the projection direction is (0.214732, 0.499003, 0.49021, 0.384806, 0.080617, 0.366382, 0.023635, 0.039437, 0.257158, 0.007519, 0.008247), and the evaluation results are shown in Table 3.

Table 3. Performance evaluation of listed companies in cotton textile industry

stock market code	factor analysis	Projection Pursuit Comprehensive Evaluation Method	Combined evaluation ranking
600398	11	9	8
601339	17	18	18
002154	6	7	9
600400	9	14	11
600448	18	13	13
002042	21	21	20
000850	14	10	12
600220	16	19	21
600630	22	22	22

(*continued*)

Table 3. (*continued*)

stock market code	factor analysis	Projection Pursuit Comprehensive Evaluation Method	Combined evaluation ranking
000726	10	11	10
002269	23	23	23
002029	12	16	15
002563	8	8	6
002193	16	20	19
600201	3	4	3
000813	1	1	1
002003	5	6	5
002015	4	5	4
000158	15	17	14
600359	19	12	16
600540	20	15	17
600177	7	3	7
000982	2	2	2

4 Evaluation Process of the Combined Model

4.1 Model Checking Based on Kendall Test

Through the test of Kendall coordination coefficient, it can be found that the coordination coefficient between factor analysis and PPC is 0.760, $P = 0.000 < 0.001$, the null hypothesis is rejected, and the evaluation results of these three methods are considered consistent. When the results of the above three evaluation methods are consistent, combined evaluation can be used.

4.2 Combination Evaluation Method Based on Fuzzy Borda

By examining the consistency of the results of these individual evaluation methods, it can be seen that although there are some differences, the results of these evaluation methods are very consistent. In order to eliminate the differences, this research uses the fuzzy Borda method to combine the results of a single evaluation method [12–14] and finally obtain a more scientific and reasonable evaluation result.

4.3 Model Testing Based on Spearman Test

The test values of the Spearman correlation coefficient for the individual scores and the combined scores were 0.9 and the highest value was 0.939, with all values passing the 1%

significance test. The correlation coefficient between the single assessment method and the combined assessment method is highest in the factor analysis with 0.939, followed by the projection method with 0.893. Obviously, the effect of the combined assessment is better.

5 Summary

In this study, the operating performance of listed companies in China's cotton textile industry is investigated; 23 listed companies are selected and an index evaluation system with 12 indicators is constructed. Considering that a single evaluation method has certain shortcomings, it is comprehensively evaluated by a combined evaluation method, and a suitable method is selected for the combination method, which has passed the consistency test to obtain a comprehensive evaluation result.

The factor analysis method uses 82.41% based on effective dimensionality reduction. From the perspective of Spearman coefficient, the results of factor analysis and projection tracking method are closer to each other, which is closely related to the similarity of their modeling basis. Finally, by using the fuzzy Borda method, these methods can be combined to balance each other's deficiencies, and the final evaluation result is more scientific and reasonable.

Acknowledgments. Thanks are due to key scientific research projects of colleges and universities in Henan Province (17A413007) for support provided.

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