

Original Article

# Analysis of Comprehensive Performance Evaluation of Chinese Listed Companies

Zhenxing Xiong<sup>1</sup>, Yong Tang<sup>2</sup>

<sup>1</sup> First.author: Hunan University of Humanities, Science and Technology, China

<sup>2</sup> Corresponding Author: Hunan University of Humanities, Science, and Technology, China

**Abstract** - This paper uses factor analysis to focus on the annual results of selecting 10 Chinese SME sample companies. From the latest year's annual financial statements issued by the Shenzhen Stock Exchange, they extracted certain significant factors and used them to express the company's comprehensive performance for the current year. A corresponding analysis of the performance of SMEs from different aspects, to understand the company's development potential in all aspects, and then to rank high and low. Give investors a good investment opinion, highlighting the development potential of different companies in different aspects so that investors have a platform for reference comparison. Compare the final conclusions with the same industry and analyze their competitive position in the same industry. Studies have shown that the strength of a company depends on the growth rate of the year-on-year growth factor, which represents the development prospects of a company. The year-on-year growth rate of revenue is high; the company has a good development prospect; on the contrary, the company's development prospects are worrying.

**Keywords** - Factor Analysis, Listed Company, Performance

## I. INTRODUCTION

The comprehensive performance evaluation of listed companies is actually an ability analysis of the operating structure and development potential of listed companies. The comparison between the listed companies and the advantages and disadvantages of their competition determines their position in the same industry.

In general, the correlation matrix obtained from the mathematical calculation of the original variables has a well-known idea of reducing the dimension in mathematics. Some related and extremely complex variables are pulled down by the dimension, and these variables are combined into a number. Fewer variables, then parsing the variables, and finally classifying his factor scores. The methods used to evaluate the comprehensive performance of listed companies include the literature collection method, data research method, and comparative research method. These methods all have some shortcomings,

such as factor expression and information repetition. In the case of minimizing data loss, the factor analysis method uses several representative factors to represent the overall data. According to the problems reflected by each factor, the factor variance contribution rate is used to express the impact on the overall data, and the utilization is solved. The lack of index weights obtained by the main viewing method. Therefore, the factor analysis method can fairly and fairly reflect the difference in the comprehensive performance of listed companies.

## II. THEORETICAL BASIS

### A. Factor Analysis

In the case of minimizing data loss, the factor analysis method uses several representative factors to represent the overall data. According to the problems reflected by each factor, the factor variance contribution rate is used to express the impact on the overall data, and the utilization is solved. The lack of index weights obtained by the main viewing method. Therefore, the factor analysis method can fairly and fairly reflect the difference in the comprehensive performance of listed companies. Factor analysis is the conversion of a large number of factors into a few principal factors to represent the impact on the population. A new linear group of factors is used to extract the load factor of the variable data in the model to represent the original variables.

### B. Research Theory of Factor Analysis

The comprehensive performance of listed companies directly affects the competitiveness of an enterprise, and thus there is a strong correlation between competitiveness factors. Factor analysis is a small number of variables to represent the relationship between a large amount of data. It can solve the problem that the process is complicated due to too many variables and the relationship between them, and the impact on the final result is incorrect. The ratio of the contribution rate of each factor extracted in the total extraction factor is weighted and summed, and the comprehensive score (F) of the financial industry competitiveness of the central provinces and China's average level is obtained. The higher the competition, the higher the competition status and the lower the



score. The weaker the competitiveness of listed companies.

**C. Factor Model**

Suppose there are random vectors that can be observed  $X = (X_1, X_2, \dots, X_p)$ ,

$Y = (Y_1, Y_2, \dots, Y_p)$  indicates that after processing X, its average is  $E(Y) = 0$ , calculate the covariance

matrix  $D(Y) = 0$ . Hypothesis  $\varepsilon = (\varepsilon_1, \varepsilon_2, \dots, \varepsilon_p)$ ,  
 $E(\varepsilon) = 0$ ,  
 not related to F

$$D(\varepsilon) = \begin{vmatrix} \partial_1^2 & & \\ & \ddots & \\ & & \partial_p^2 \end{vmatrix} = \text{diag}(\partial_1^2, \dots, \partial_p^2)$$

Suppose the random vector Y can be expressed as the following system of equations:

$$\begin{cases} Y_1 = a_{11}F_1 + a_{12}F_2 + \dots + a_{1m}F_m + \varepsilon_1 \\ Y_2 = a_{21}F_1 + a_{22}F_2 + \dots + a_{2m}F_m + \varepsilon_2 \\ \dots \\ Y_p = a_{p1}F_1 + a_{p2}F_2 + \dots + a_{pm}F_m + \varepsilon_p \end{cases}$$

Then, model 1 is called an orthogonal factor model. Expressed as a matrix:  $Y = AF + \varepsilon$

$$\text{This } A = \begin{pmatrix} a_{11} & a_{12} & \dots & a_{1m} \\ a_{21} & a_{22} & \dots & a_{2m} \\ \dots & \dots & \dots & \dots \\ a_{p1} & a_{p2} & \dots & a_{pm} \end{pmatrix}$$

is the factor load matrix that needs to be estimated.

$$a_{ij} = (i = 1, \dots, p; j = 1, \dots, m)$$

The load on the jth factor for the ith variable.

We can think  $F = (F_1, F_2, \dots, F_m), F_1, F_2, \dots, F_m$

is the main factor of Y.

$$\varepsilon = (\varepsilon_1, \varepsilon_2, \dots, \varepsilon_m)' \varepsilon_1, \varepsilon_2, \dots, \varepsilon_m$$

Is a special factor called Y. Main factor?

$$F_1, F_2, \dots, F_m$$

In general, all variables  $Y_i$  of Y can play an effective role. And  $\varepsilon_i$  only has a certain effect on  $Y_i$ . There is no correlation between all factors.

**III. EMPIRICAL ANALYSIS**

**A. Selection of samples and variable indicators**

As of July 7, 2018, relevant financial data for the most recent year was published on the financial and financial website (www.jrj.com.cn). This article uses these ten listed companies as research objects, finds their latest year's financial statements, and uses factor analysis to analyze and discuss these listed companies.

The primary task of factor analysis is to find the corresponding variables, and the variable indicators must be moderate. Too much will make this variable have a high load on the whole but can not show the significant meaning of these factors; too little will make these selected variables can not correctly reflect the relationship between the variables.

This article refers to the relevant data published on the financial website and collects several significant factors: the year-on-year growth rate of the net profit (X1), the weighted return on equity (X2), the year-on-year growth rate (X3), and the operating profit rate. (X4), inventory turnover ratio (X5), and asset-liability ratio (X6).

**B. Related Data Processing**

1) Find the eigenvalue and contribution rate of the correlation coefficient matrix.

The processed financial data is obtained by SPSS 23.0 software calculation (as shown in Table 2). It is obvious that there are three eigenvalues in the variable matrix (both over 1), which are 1.988, 1.489, and 1.015, respectively, which together represent 74.879% (cumulative contribution rate) of the standard deviation of the total performance data of 10 sample listed companies.

2) Generating factor load matrix

First, the three main factor variables, F1, F2, and F3, are correlated, and then a factor load matrix is obtained. Then start to simplify the matrix to get a new concise factor load matrix and use the orthogonal rotation method to calculate a quadratic rotation matrix with the largest variance (as shown in Table 3). This is the matrix of the first three principal factors obtained after processing. The resulting values are then classified higher, and the prominent factors are named (as shown in Table 4).

**Table 1. 2017 comprehensive performance data of 10 listed companies**

	X1	X2	X3	X4	X5	X6
Perfect World Co., Ltd	The year-on-year growth rate of attributable net profit (%)	Weighted return on equity (%)	The year-on-year growth rate of revenue (%)	Operating profit margin (%)	Inventory turnover rate (times)	Assets and liabilities (%)
Jinhe Industrial Co., Ltd.	22.18	15.63	-0.2	26.65	1.13	41.16
Hangzhou Binjiang Real Estate Group Co., Ltd.	-10.83	25.15	-7.75	25.73	8.89	31.17
S.F. Holding Co., Ltd.	13.91	2.54	-46.47	38.43	0.02	80.12
Zhejiang Satellite Petro Chemical Co., Ltd.	27.94	3.4	16.68	6.48	24.4	51.64
Tianqi Lithium Corporation	94.1	2.69	20.18	11.75	2.19	44.24
Rainbow Department Store Co., Ltd.	2.57	22.97	14.16	57.42	3.9	73.26
Shenzhen Grandland Group Co., Ltd.	5.25	4.66	-0.82	7.71	3.9	55.74
Guizhou Bailing Group Pharmaceutical Co., Ltd.	-27.62	0.75	-5.68	2.8	1.68	64.02
Iflytek Co., Ltd.	5.32	4.48	3.6	25.81	0.31	38.56
Perfect World Co., Ltd	24.26	1.25	40.11	9.29	0.95	44.76

**Table 2. Eigenvalue and contribution rate of correlation coefficient matrix**

Ingredients	Initial eigenvalue			Extract square sum loading			Rotation square sum loading		
	total	% of variance	accumulated %	total	% of variance	accumulated %	total	% of variance	accumulated %
1	1.988	33.134	33.134	1.988	33.134	33.134	1.678	27.962	27.962
2	1.489	24.824	57.959	1.489	24.824	57.959	1.550	25.829	53.790
3	1.015	16.921	74.879	1.01	16.921	74.879	1.265	21.098	74.879
4	.836	13.930	88.810						
5	.563	9.382	98.191						
6	.109	1.809	100.00						

**Table 3. Factor load matrix after rotation**

	Ingredients		
	1	2	3
Zscore (X1)	-.231	.786	-.251
Zscore (X2)	.965	-.090	.050
Zscore (X3)	-.030	.764	.264
Zscore (X4)	.678	-.287	-.541
Zscore (X5)	-.002	.001	.825
Zscore (X6)	.481	.508	.395

**Table 4. Name of each main factor**

variable	Main factor 1	Main factor 2	Main factor 3
Factor name	Year-on-year growth in	Weighted return on equity	Year-on-year growth in
High load index factor	Debt service and profitability factor	Ability per share	Growth factor

After the dimensionality reduction, the measured variables become three main factors, and the dimension is three, so it is enough to analyze his three main factors. In other words, these measured variables are actually three mutually unrelated variables.

The division of the first principal factor in the table is essentially the year-on-year growth rate of net profit attributable to debt service and profitability. That is to say, the load on the weighted return on equity and the growth factor of the growth rate of revenue per year is small. It can be ignored. The speed of development and the ability of the enterprise, the assets of the enterprise or the circulation of funds, and the results of operations, their measurement are closely related to the growth rate of net profit. The main factor 1 variance contribution rate is more significant, close to 30%, so the main factor is completely justified to explain the management status of the company or company.

The second major factor has outstanding performance in weighted return on equity. Whether the investment can be invested and whether the profit brought by the investment is expected can be measured by the indicator, but the contribution rate of the main factor 2 to the original data is 24.824%. Therefore, when determining the above problem, the indicator data can be considered.

The third main factor has a large load on the year-on-year growth rate of revenue. The pros and cons of the company's performance or business entry

and exit can be explained by this main factor3. The main factor 3 contributes 16.921% to the original data, so his degree of interpretation is not profound, and it can reflect the certain structural essence, but it cannot be detailed to the micro-element.

### C. Factor score

However, all the main factors can only represent the specific aspects of the sample company, so this paper uses the values calculated by the operations between the main factors to perform the relevant data transformation to get the final total factor score. The formula is as follows:

$$F = (0.4425F_1 + 0.3315F_2 + 0.2259F_3) / 0.7488$$

Table 5 shows the scores of the various factors and the total factor scores of the 10 samples in this paper. According to this table, we can compare 10 sample companies for correlation analysis.

**Table 5. Scores and ranking of comprehensive performance factors of listed companies in 10 listed companies**

company name	Factor score			The total score of factor
	F1	F2	F3	
S.F. Holding Co., Ltd	0.2068	0.6121	20.2745	6.5097
Jinhe Industrial Co., Ltd	0.5766	-0.0736	7.3375	2.5218
Tianqi Lithium Corporation	0.9454	0.3189	3.2387	1.6770
Rainbow Department Store Co., Ltd	0.3457	0.2957	3.3829	1.3558
Zhejiang Satellite Petro Chemical Co., Ltd	0.0906	1.0660	1.2589	0.9053
Shenzhen Grandland Group Co., Ltd	0.3963	0.0577	1.6784	0.7661
Iflytek Co., Ltd	0.2204	0.6977	0.9559	0.7275
Perfect World Co., Ltd	0.4820	0.1412	0.8500	0.6038
HANGZHOU BINJIANG REAL ESTATE GROUP CO., LTD	0.6522	0.0487	-0.0324	0.3972
Guizhou Bailing Group Pharmaceutical Co., Ltd	0.3897	0.1874	0.2668	0.3936

A

s can be seen from the above table, companies in different industries have outstanding capabilities in certain specific aspects, and investors can make different judgments from the competitive positions of different companies in their respective industries.

Based on the overall score: SF Holding Co., Ltd., Jinhe Industrial Co., Ltd., Tianqi Lithium Corporation, Rainbow Department Store Co., Ltd., their total scores exceeded 1, And the total factor score of SF Holding Co., Ltd. far exceeds 1; and Zhejiang Satellite Petro Chemical Co., Ltd., Shenzhen Grandland Group Co., Ltd., Iflytek Co., Ltd., Perfect World Co., Ltd., HANGZHOU BINJIANG REAL ESTATE GROUP CO., LTD., Guizhou Bailing Group Pharmaceutical Co., Ltd. These six companies have a total factor score of less than 1. With a total factor score of 1 as a reference, companies with more than 1 have SF Holding Co., Ltd., Jinhe Industrial Co., Ltd., Tianqi Lithium Corporation, and Rainbow Department Store Co., Ltd. The companies of 1 are Zhejiang Satellite Petro Chemical Co., Ltd., Shenzhen Grandland Group Co., Ltd., Iflytek Co., Ltd., Perfect World Co., Ltd., HANGZHOU BINJIANG REAL ESTATE GROUP CO., LTD., and Guizhou Bailing Group Pharmaceutical Co., Ltd., these companies did not perform well. In this way, we have a basic understanding of the ten sample companies.

Since the sample companies of the 10 listed companies are in various industries, there is not a reliable comparison between the selected factors, and considering the competitive position of the company in its industry is different from different aspects. A more reliable approach, in order to express the feasibility of this approach, we extracted the highest and lowest sample companies to conduct a comparative study. It should be noted that the research results obtained in this paper are only for academic discussion, and there is no bias against any selected sample companies of listed companies.

Among the selected 10 listed companies, S.F. Holding Co., Ltd. scored the highest total score of 6.5097, which is much higher than the other nine companies. This is due to the fact that the company scored high on the second and third major factors selected. The second factor expresses the company's ability per share. According to another sample company, the company's ROE is generally higher than other companies, which reflects the company's shareholder in the company has higher returns. The third major factor is to highlight the company's potential for growth. The company's factor in the year-on-year growth rate of revenue is much higher than that of other companies, indicating that the company has very strong development prospects and reliable investment tendencies.

Among the 10 companies, Guizhou Bailing Group Pharmaceutical Co., Ltd. (002424) had the lowest total factor score, only 0.3936, lower than several other companies. This is due to the lower

scores of the company's three main factors selected. It shows that the company is in a state of steady development, with little ups and downs, ups and downs, and investors are not recommended to invest.

#### IV. CONCLUSION

From the above research and analysis, it seems that in the case of minimizing data loss, the representative data is represented by several representative factors. According to the problems reflected by each factor, the influence of the factor variance contribution rate on the overall data is expressed. The problem of using the index weight obtained by the main viewing method is solved. Using the factor analysis method to compare the results of the selected sample companies, we can see the advantages and disadvantages of each company and thus determine the competitive advantage of the sample companies in many listed companies. In a listed company, different factors correspond to the company's inability to compete, and a higher factor score indicates that the company's ability in a particular aspect is more prominent, and vice versa. Investors can analyze each other's different factors in the same industry according to different factors of the company and make corresponding decisions on the development potential of various aspects of the company from different fields. In these 10 sample companies, factor analysis can be used to derive a more prominent relationship from a large number of disorganized data to find its decisive factors; you can have a company with a final score of factor analysis. Probably an overall assessment. Of course, in addition to evaluating a company based on the total factor score, we can also rank each company according to the score of a single factor and have different effects on the company according to different factors to evaluate the impact of factors on the overall performance.

#### REFERENCES

- [1] 孙荣., 商业银行基于 FTP 模式对业绩评价体系的优化[J]. 金融会计, 10 (2016) 57-64.
- [2] 王勇., 情绪劳动在商业银行业绩评价中的应用[J]. 合作经济与科技, 02 (2017) 74-75.
- [3] 申志东., 运用层次分析法构建国有企业绩效评价体系[J]. 审计研究, 2 (2013) 106-112.
- [4] 李晓梅., 灰色模糊聚类方法在科技型企业创新绩效评价的应用[J]. 数学的实践与认识, 15 (2015) 170-177.
- [5] 郭晋宇, 李恩平., 大数据背景下科技型中小企业创新能力影响研究——基于模糊综合评价法模型[J]. 数学的实践与认识, 46(10) (2016) 77-84.