Research on Financial Performance Evaluation of Logistics Enterprises based on Factor Analysis

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Abstract. Financial performance uses objective data reflect the enterprises' existing operation capacity and predictable future development expectations, and it is an important sign whether enterprise strategy can contribute to financial performance. Based on this, this paper adopts the factor analysis model, takes 21 domestic listed logistics enterprises as the research objects, and focuses on the analysis and evaluation from four aspects: profitability, solvency, operation ability and growth ability, and carries out comparative study on various indexes of state-owned logistics enterprises and private logistics enterprises. The results show that the comprehensive financial performance of state-owned logistics enterprises is higher than that of private logistics enterprises overall, it reflects the overall situation when state-owned logistics enterprises have better financial benefits under the current domestic economic environment.

Keywords: Factor Analysis; Financial Performance; Logistics Enterprises; Profitability.

1. Introduction

The logistics industry is considered as the artery and basic industry of national economic development, and its development degree has become one of the important symbols to measure a country's modernization degree and comprehensive national power. At present, with the proposal of the domestic and international dual circulation pattern and the construction of the supply-side reform, the domestic logistics industry once again spurt strong development vitality, but after the brutal development model in the early stage, today the domestic logistics industry has shifted from a high-speed growth stage to a slower-growing high-quality development stage. Reducing costs and increasing efficiency has become the important development goal of the logistics industry at present, moreover, market competition and financing pressure have also posed more severe challenges to domestic logistics enterprise at present. In 2006, the State-owned Assets Supervision and Administration Commission (SASAC) clearly pointed out in the "Guidance on Promoting the Adjustment of State-owned Capital and the Reorganization of State-owned Enterprises" that it would further promote the concentration of state-owned capital in important industries and key areas related to national security and the lifeblood of the national economy, and that by 2010, the enterprises for which SASAC performs the role of capital contributor would be adjusted and reorganized to 80 to 100. This provides an opportunity for state-owned third-party logistics enterprises to achieve leapfrog development through the reorganization of state-owned capital and the merger and reorganization of target enterprises in line with the development strategy of the enterprises themselves, and also establishes the industry characteristics of China's traditional logistics industry of "the state advancing and the people retreating, the state strong and the people weak". With the continuous transformation of the economic landscape and the changing needs of logistics, the characteristics of private enterprises with fast decision-making efficiency and flexible operation have shown better adaptability in the current economic context of urgent transformation. The State Council of the Central Committee of the Communist Party of China and the "Implementation Opinions on Supporting Private Enterprises to Accelerate Reform and Development and Transformation and Upgrading" issued on 22 December 2019 points out that private enterprises are encouraged to transform, upgrade and optimize their restructuring. Encourage private enterprises to focus on their main business according to local conditions to accelerate the transformation and upgrading. Optimize the market environment for mergers and acquisitions, support private enterprises to do better and stronger, and cultivate more world class enterprises with global competitiveness. Private logistics enterprises have been given stronger opportunities for development in the current economic context, but the emergence of the

new crown epidemic has brought full challenges to the development of private logistics enterprises at present. Therefore, this paper hopes to use the financial performance of twenty-one listed logistics enterprises, which are more representative of the domestic market today, for comparative analysis, in order to get an objective reflection of the current situation of domestic logistics enterprises.

2. Literature Review

The current research methods on the financial performance of enterprises in China have become increasingly mature, Wang Qiaoxia (2018) used factor analysis to make an analytical study on the financial performance of listed commercial banks in China [1]; Geng Jingjing and Liu Li (2019) used DEA model and factor analysis to evaluate the financial performance of core enterprises in the commercial system [2]; Huang Hong (2022) based on factor analysis to make a more detailed investigation on the financial performance of China's banking industry stock investment value in more detail [3]; Li Tian (2022) used factor analysis to make a more objective evaluation of the financial performance of Founder Motors [4]. Jiang Hongning (2004) first analyzed the financial performance of China's third-party listed logistics enterprises [5]; Hou Xiangding (2021) made a corresponding analysis and evaluation of the financial performance of China's A-share listed logistics enterprises [6]; Chen Zhenlei (2021) used factor analysis in the context of the "One Belt, One Road" initiative Chen (2021) conducted an empirical study on the business environment of logistics enterprises [7]. As can be seen, there are precedents of using logistics enterprises as a case study for financial performance analysis, but the number of studies on the financial performance of logistics enterprises is relatively small, and most of the samples are not large enough to form a comprehensive dialectical theoretical view. Therefore, this paper takes logistics enterprises as the research object and uses factor analysis to analyze twelve financial indexes of twenty-one listed logistics enterprises in China in order to enrich the existing research results. At the same time, in view of the current changes in the domestic logistics industry, this paper also makes a comparative analysis of state-owned logistics enterprises and private logistics enterprises, and draws conclusions and recommendations based on the results.

3. Empirical Analysis

Table 1. Financial performance evaluation index system of listed commercial banks in China

four aspects	specific index	index code	four aspects	specific index	code
solvency	asset-liability ratio	F_1	growth ability	net profit growth rate	F_8
	current ratio	F_2		operation profit growth rate	F_9
	equity ratio	F_3			
	quick ratio	F_4			
operatiom capacity	current assets turnover rate	F_5	profitability	earnings per share	F_{10}
	current assets turnover rate	F_6		profit rate to net worth	F_{11}
	shareholders' rights turnover rate	F_7		increase rate of operating income	F_{12}

On the basis of constructing the financial performance evaluation index system of listed logistics companies in China, this paper takes twenty-one listed logistics companies in China as samples, and the initial data comes from the publicly disclosed 2020 annual financial data of each company included in the WIND database and Guotaian database, and after processing and calculating as well as testing for error-free, the empirical evidence of the twelve financial performance evaluation

indexes actually used in this paper is obtained The data are complete and there is no problem of missing data.

3.1 Feasibility Tests

In the research process, it is often difficult to avoid overlap between the information contained in each other due to the presence of many study variables and the existence of strong correlations between them, resulting in a complex distribution pattern of samples in a high-dimensional space that can be difficult to analyze effectively. Factor analysis is a multivariate statistical analysis method capable of dealing with complex relationships. It allows multiple variables to be grouped into a small number of new composite factors that are weakly correlated with each other according to their correlations, and rationalizes the key information common to the variables based on integrating as much as possible the information reflected in all the raw data, and reduces the dimensionality and simplifies the structure of the variables. Factor analysis can be classified according to the numerical attributes of the independent variables themselves, and then the correlation between indexes can be further analyzed by means of correlation analysis, and those with a high degree of correlation can be combined and screened out of irrelevant and important indexes, thus reducing the difficulty of analysis, and improving the efficiency and logic of analysis.

Factor analysis is a statistical technique that focuses on extracting common factors from groups of variables, and the empirical data selected need to have a certain degree of correlation. The KMO statistic is calculated as follows, where r and β are the correlation coefficient and partial correlation coefficient respectively.

$$KMO = \frac{\sum\sum_{i\neq j} r_{ij}^2}{\sum\sum_{i\neq j} r_{ij}^2 + \sum\sum_{i\neq j} \beta_{ij}^2} \quad (1)$$

This paper used the statistical software SPSS 23.0 to analyses and process the data, and the calculated results are shown in Table 2. It was calculated that KMO = 0.610 (greater than 0.5), while Sig = 0.00 (less than 0.01), it shows that the data selected were suitable for factor analysis.

Table 2. KMO and Bartlett's test

KMO sampling appropriateness number		0.610
Bartlett's Test of Sphericity	approximate chi-square	143.967
	degrees of freedom	66
	significance	0.000

3.2 Extraction of Principal Factors and Rotation of Component Matrix

As shown in Table 3, the rotated eigenvalues of the first four principal factors of the twelve financial indexes selected in this paper were 3.622, 2.619, 2.190 and 1.067, all of which exceeded 1, indicating that four principal factors could be extracted, and the cumulative contribution rate was 79.155%, indicating that the four principal factors could reflect 79.155% of the information of the original data.

As in practice most of the extracted factors are correlated with multiple variables making interpretation of the initial factors more difficult, they were further transformed using an orthogonal rotation with maximum variance to obtain more scientific analysis of the data. The rotated component matrices obtained using the software are shown in Table 4.

Table 3. Total variance interpretation

component	initial eigenvalue			rotated square and loading		
	total	percentage of variance cumulative	accumulation%	total	percentage of variance cumulative	accumulation%
1	3.622	30.186	30.186	3.098	25.814	25.814
2	2.619	21.826	52.012	2.330	19.415	45.228
3	2.190	18.248	70.260	2.055	17.128	62.356
4	1.067	8.895	79.155	2.016	16.798	79.155
5	0.997	8.312	87.467			
6	0.521	4.345	91.812			
7	0.331	2.755	94.567			
8	0.250	2.085	96.652			
9	0.165	1.372	98.024			
10	0.092	0.770	98.793			
11	0.079	0.661	99.454			
12	0.065	0.546	100.000			

Table 4. Rotated component matrix

		component			
		1	2	3	4
F_1	asset-liability ratio	0.956	0.071	-0.122	-0.045
F_2	current ratio	-0.648	0.044	-0.383	0.323
F_3	equity ratio	0.950	-0.024	-0.133	-0.023
F_4	quick ratio	-0.667	0.015	-0.399	0.362
F_5	fixed asset turnover rate	0.055	0.814	-0.214	0.276
F_6	current asset turnover rate	-0.298	0.835	0.284	-0.083
F_7	shareholders' equity turnover rate	0.150	0.923	-0.082	0.091
F_8	net profit growth rate	-0.004	-0.068	0.916	0.194
F_9	operation profit growth rate	-0.001	0.017	0.762	0.413
F_{10}	earnings per share	-0.283	0.014	0.272	0.729
F_{11}	profit rate to net worth	-0.410	0.094	0.092	0.702
F_{12}	operation income growth rate	0.231	0.312	0.287	00.674

From the analysis of Table 4, the first main factor (absolute value perspective) has a greater impact on the four indexes of gearing ratio, current ratio, quick ratio and equity ratio, which can be summarized as solvency factor; the second main factor (absolute value perspective) has a greater

impact on the three indexes of fixed assets turnover ratio, shareholders' equity turnover ratio and current assets turnover ratio, which can be summarized as operating capacity factor; the third main factor (absolute value perspective) has a greater impact on the two indexes of net profit growth rate and operating profit growth rate, which can be summarized as growth capacity factor; the fourth main factor (absolute value perspective) has a greater impact on the three indexes of earnings per share, net asset margin and operating income growth rate, which can be summarized as growth capacity factor. The third main factor (absolute value perspective) has a greater influence on the two indexes of net profit growth rate and operating profit growth rate, which can be summarized as the growth capability factor; the fourth main factor (absolute value perspective) has a greater influence on the three indexes of earnings per share, net asset margin and operating income growth rate, which can be summarized as the profitability factor.

Table 5. Factor score coefficient matrix

		component score coefficient matrix			
		1	2	3	4
F_1	asset-liability ratio	-0.787	0.458	0.105	0.309
F_2	current ratio	0.642	-0.377	0.274	0.209
F_3	equity ratio	-0.795	0.399	0.045	0.358
F_4	quick ratio	0.669	-0.398	0.259	0.250
F_5	fixed asset turnover rate	0.266	0.524	0.660	0.079
F_6	current asset turnover rate	0.436	0.472	0.395	-0.553
F_7	shareholders' equity turnover rate	-0.137	0.638	0.668	-0.127
F_8	net profit growth rate	0.228	0.468	-0.729	-0.281
F_9	operation profit growth rate	0.340	0.524	-0.598	-0.067
F_{10}	earnings per share	0.658	0.251	-0.293	0.320
F_{11}	profit rate to net worth	0.738	0.139	-0.101	0.323
F_{12}	operation income growth rate	0.293	0.685	-0.111	0.345

3.3 Calculation of Principal Factor Scores and Composite Performance Scores

As shown in Table 5, the factor scores of all factors can be calculated based on the component score coefficients and the corresponding values of the variables relative to each factor, and the performance scores of twenty-one major state-owned and private listed logistics enterprises in China in 2020 can be calculated by multiplying the weight of the percentage of variance of each factor to the total cumulative percentage selected. Let variables S_1, S_2, S_3 and S_4 denote the score criteria for each of the four main factors, and variable Score denotes the total score for the overall performance of the enterprise, then.

$$S_1=-0.787F_1+0.642F_2-0.795F_3+0.669F_4+0.266F_5+0.436F_6-0.137F_7+0.228F_8+ 0.340F_9+0.658F_{10}+ 0.738F_{11}+0.293F_{12} \quad (2)$$

$$S_2=0.458F_1-0.377F_2+0.399F_3-0.398F_4+ 0.524F_5 +0.472F_6+ 0.638F_7 +0.468F_8 +0.524F_9 +0.251F_{10} +0.139F_{11}+0.685F_{12} \quad (3)$$

Table 6. Ranking of main factors and financial performance scores of major listed logistics enterprises in China in 2020

company name	S_1	S_2	S_3	S_4	Score	ranking
Xiamen Xiangyu Co., Ltd.	0.793	3.421	-0.301	0.301	1.10	1
COSCO Shipping Development Co., Ltd.	2.58	-0.904	-0.158	0.882	0.77	2
COSCO Shipping Technology Co., Ltd.	0.981	-0.431	0.402	1.195	0.55	3
COSCO SHIPPING Energy Transportation Co., Ltd.	-0.140	-0.589	3.135	-0.145	0.46	4
COSCO SHIPPING Holdings Co., Ltd.	0.840	-0.242	-0.006	0.458	0.31	5
China International Marine Containers (Group) Co., Ltd.	0.457	-0.754	0.762	0.702	0.28	6
SF Holding Co., Ltd.	-0.204	0.013	0.256	1.285	0.26	7
Debon Logistics Co., Ltd.	-0.334	0.882	1.100	-0.442	0.25	8
China Railway Materials Co., Ltd.	0.544	0.948	-1.193	0.304	0.22	9
China Reserve Development Co., Ltd.	-0.700	0.979	1.350	-0.579	0.18	10
Shenzhen Today International Logistics Technology Co., Ltd.	0.150	-0.775	-0.613	1.085	-0.04	11
Hong Kong China Travel International Logistics Co., Ltd.	-1.134	0.499	-0.534	1.345	-0.08	12
SINOTRANS Limited	-0.346	0.079	-0.155	-0.263	-0.18	13
Jiangsu Xinning Modern Logistics Co., Ltd.	1.508	-0.318	-0.300	-2.741	-0.23	14
YTO Express Co., Ltd.	-0.903	0.199	0.446	-0.560	-0.27	15
Jiangsu Feiliks International Logistics Co., Ltd.	-0.089	0.203	-1.177	-0.525	-0.35	16
COSCO Shipping Special Transportation Co., Ltd.	-0.032	-0.429	-0.073	-1.481	-0.45	17
Beijing Changjiu Logistics Co., Ltd.	-0.553	-0.674	-0.574	-0.349	-0.54	18
Guangzhou Jiacheng International Logistics Co., Ltd.	-1.596	-0.956	-0.492	0.701	-0.71	19
Jiangsu Wanlin Modern Logistics Co., Ltd.	-0.270	-1.043	-1.155	-0.747	-0.75	20
China Railway Tielong Container Logistics Co., Ltd.	-1.554	-0.108	-0.724	-0.426	-0.78	21

$$S_3=0.105F_1+0.274F_2+0.045F_3+0.259F_4+0.660F_5+0.395F_6+0.668F_7-0.729F_8-0.598F_9-0.293F_{10}-0.101F_{11}-0.111F_{12} \quad (4)$$

$$S_4=0.309F_1+0.209F_2+0.358F_3+0.250F_4+0.079F_5-0.553F_6-0.127F_7-0.281F_8-0.067F_9+0.320F_{10}+0.323F_{11}+0.345F_{12} \quad (5)$$

From Table 3, the percentages of variance of each factor after rotation are 25.814%, 19.415%, 17.128% and 16.79% respectively, while the cumulative percentage of variance of the four factors is 79.155%. The total performance score of the enterprise can be calculated by summing up the contribution of each factor to the overall performance score of the enterprise, which is expressed as follows

$$Score=(30.186\%*S_1+21.826\%*S_2+18.248\%*S_3+8.895\%*S_4)/79.155\% \quad (6)$$

Then, the comprehensive performance scores of all logistics enterprises are calculated separately according to the above (6) formula to obtain the score results in Table 6 below, with the score results retained to three decimal places.

4. Conclusion

From the financial performance calculation results and their rankings in Table 6, it can be seen that the top six listed logistics enterprises in terms of overall financial performance are Xiamen Xiangyu Company Limited, COSCO Shipping Development Company Limited, COSCO Shipping Technology Company Limited, COSCO Shipping Energy Transportation Company Limited and COSCO Shipping Holdings Company Limited with overall performance scores of 1.1, 0.77, 0.55, 0.46, 0.31 and 0.28 respectively. The bottom six listed logistics companies were China Railway Tielong Container Logistics Co Ltd, Jiangsu Wanlin Modern Logistics Co Ltd, Guangzhou Jiacheng International Logistics Co Ltd, Beijing Changlong Logistics Co Ltd, COSCO Shipping Special Transportation Co Ltd and Jiangsu Feilida International Logistics Co Ltd. The overall financial performance scores were -0.35, -0.45, -0.54, -0.71, -0.75 and -0.78 respectively. 10 of the companies had positive overall performance scores and 11 had negative overall performance scores, which shows that among the top 6 listed logistics companies, all of them are state-owned logistics companies except Xiamen Xiangyu Co. Ltd. and COSCO Shipping Special Transportation Co., Ltd. Among the listed logistics enterprises ranked in the bottom 6, all of them are private logistics enterprises, except for China Railway Tielong Container Logistics Co.

1. Debt-servicing capacity analysis

The current ratio and quick ratio of COSCO Shipping Development Company Limited, Jiangsu Xinning Modern Logistics Company Limited and COSCO Shipping Technology Company Limited, the top 3 companies in the F1 solvency factor, are all in a reasonable range, indicating that they have certain short-term solvency to cope with unexpected risks, while the equity ratio and gearing ratio are both at a low level, indicating that they are exposed to debt The three enterprises with the lowest F1 score, Guangzhou Jiacheng International Logistics Co. The risk is high.

2. Operating Capacity Analysis

The current asset turnover ratio and shareholders' equity turnover ratio of Xiamen Xiangyu Company Limited, China Storage Development Company Limited and China Railway Materials Company Limited, the top three companies in the F2 operating capacity factor, far exceed those of other companies in the same industry, indicating that the companies have a strong asset flow structure and shareholders' profitability. Ltd. and COSCO Shipping Development Co., Ltd. have fixed asset turnover, current asset turnover and shareholders' equity turnover ratios that are far below the average level, and their operating profitability and capital attractiveness are poor.

3. Growth capacity analysis

The F3 growth capability factor reflects the possible future asset growth rate and scale development capability of enterprises. Among the three enterprises with the top F3 factor scores, the net profit growth rate and operating profit growth rate of COSCO Shipping Energy Transportation Company Limited, China Storage Development Company Limited and Deppon Logistics Company Limited are all at a high level. There is a large fault gap between the net profit growth rate and operating profit growth rate of the top two state-owned logistics enterprises and the third-ranked Deppon Logistics Company Limited, reflecting the trend that the growth rate of state-owned logistics enterprises far exceeds that of private logistics enterprises under the current domestic economic environment. Among the bottom three companies, the two indexes of Jiangsu Feilida International Logistics Company Limited and Jiangsu Wanlin Modern Logistics Company Limited were -63.7842, -92.4166 and -44.8106, -48.4963 respectively, both of which were in a state of negative growth far below the industry average, resulting in lower scores for this item. The two indexes of China Railway Materials Co., Ltd. were -7.329 and -10.0489, which were in a negative growth trend, but their

negative growth trend was significantly lower than that of Jiangsu Feilida International Logistics Co. and Jiangsu Wanlin Modern Logistics Co.

4. Profitability analysis

The F4 profitability silver reflects an enterprise's ability to gain profit and capital appreciation. The three enterprises with the top F4 factor scores, SF Holdings Co., Ltd. have higher contribution to the earnings per share factor score, indicating that the enterprise has stronger profitability per share and higher quality of earnings. COSCO Shipping Technology Company Limited and HITC China International Logistics Company Limited had a higher positive contribution from their operating income growth rate and net asset margin to their scores, indicating a stronger overall asset profitability and higher overall profitability.

References

[1] Wang Qiaoxia. Research on the Evaluation of Financial Performance of Listed Commercial Banks in China--An Empirical Analysis Based on Financial Data of 25 Listed Commercial Banks [J]. Friends of Accounting,2018(10):64-67.

[2] Geng Jingjing, Liu Li. Financial Performance Evaluation of Core Enterprises in Business Ecosystem [J]. Modernization of Management,2019,39(03):67-69.

[3] Huang Hong. Exploration of the Investment Value of China's Banking Industry Stocks Based on Factor Analysis [J]. Modern Business,2022(03):86-88.

[4] Li Tian. Evaluation of the Financial Performance of Founder Electric Based on Factor Analysis[J]. China-Arab Science and Technology Forum (Chinese-English),2022(01):86-89.

[5] Jiang Hongning. Performance Evaluation of Third-Party Logistics Enterprises[D]. Shanghai Maritime University, 2004.

[6] Hou Xiangding. Evaluation of Financial Performance of A-Share Listed Logistics Supply Chain Enterprises--Based on Factor Analysis[J]. Journal of Shanxi University of Finance and Economics, 2021, 43 (S2):53-57.

[7] Chen Suilei. An Empirical Study on the Evaluation of Business Environment of Logistics Enterprises Based on Factor Analysis under the Background of "The Belt and Road" Initiative[J]. Logistics Technology, 2021,40(11):54-58+93.