Research on Investment Value of Listed Manufacturing Companies Based on Principal Component Analysis and Cluster Analysis

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Abstract

This paper selects 30 stocks of listed manufacturing companies for research, and analyzes the investment value of listed manufacturing companies using principal component analysis and cluster analysis. The research results show that: (1) The performance of principal components in the value evaluation system of different listed companies is quite different, and the internal investment value of their companies fluctuates significantly. (2) An important factor affecting the intrinsic value of listed companies is the profitability and growth ability of listed companies. (3) The profitability and solvency of manufacturing enterprises have a great impact on the internal investment value of enterprises. (4) The operating capacity of listed companies has a cyclical impact on the investment value of enterprises during normal operation. Finally, this paper will put forward relevant suggestions to investors and provide them with certain value investment basis and reference suggestions.

Keywords

Manufacturing; Principal Component Analysis; Cluster Analysis; Investment Value.

1. Introduction

Since the reform and opening up, China's economy has been developing rapidly, especially the manufacturing industry. As of today, according to the relevant data of the United Nations Industrial Development Organization, China has had the added value of dozens of manufacturing industries in the forefront of the world. China has developed from a poor agricultural country at the beginning of the founding of the People's Republic of China to a manufacturing country with the most complete industrial system and the most complete industrial facilities in the world, Become the most important processing and manufacturing base in the world.

The rapid development of manufacturing industry in China has also made various manufacturing enterprises listed in China. However, in today's stock investment market, investors are faced with a wide range of stocks with both risks and benefits. It is particularly difficult to select manufacturing listed companies with a bright development prospect only by heart. Therefore, this paper selects 30 manufacturing listed companies for research, analyzes and processes the data using SPSS, theoretically analyzes the internal investment value, and gives investors who prefer manufacturing listed companies certain investment reference

opinions and suggestions, which will be of great significance to China's manufacturing listed companies' stock investment market.

2. Index System Construction and Data Source

Based on most relevant literature on the evaluation of listed companies, this paper selects 10 indicators from three major aspects: profitability growth (Y1), operating capacity (Y2) and asset solvency (Y3) to build the investment value index system of listed companies. See Table 1 for the indicator system.

Table 1. Indicator system

Primary index	Secondary indicator code	Secondary indicator
Profitability	X1	Return on net assets
	X2	Net profit from sales
Operating capacity	X3	Total asset turnover
	X4	Current asset turnover rate
Asset solvency	X5	Current ratio
	X6	Quick ratio
	X7	Asset-liability ratio
Profit capacity	X8	Growth rate of total profit (percentage)
	X9	Net profit growth rate (percentage)
	X10	Growth rate of earnings per share (percentage)

The data source of this paper is mainly from the manufacturing listed companies under the RESSET database.

3. Principal Component Analysis

3.1. Adaptability Test

Due to the difference of data, firstly, the statistical software SPSS23.0 is used to standardize the variables, conduct KMO test and Bartlett test, judge the partial correlation matrix between 10 variables, and analyze the size relationship between sig value and KMO value and critical value. See Table 2 for inspection results.

Table 2. KMO and Bartlett test

KMO sampling suitability quantity		0.650
Bartlett test	Approximate chi-square	480.477
	Freedom	45
	Significance	0.000

According to Table 2, the KMO value of the relevant data after processing is 0.650, which is greater than the critical value of 0.5 for principal component analysis, so principal component analysis can be used; In addition, Bartlett's sphericity test results show that its significance is 0.000, less than the critical value of 0.05, indicating that the constructed index system is suitable for principal component analysis.

Table 3. Interpretation of total variance

Principal component	Initial eigenvalue			Extract the sum of the squares of the load		
	Total	Percent Variance	Accumulate %	Total	Percent Variance	Accumulate %
1	5.745	57.453	57.453	5.745	57.453	57.453
2	2.303	23.028	80.480	2.303	23.028	80.480
3	1.167	11.665	92.145	1.167	11.665	92.145
4	.415	4.153	96.299			
5	.166	1.661	97.960			
6	.104	1.036	98.995			
7	.070	.699	99.694			
8	.019	.189	99.884			
9	.008	.084	99.968			
10	.003	.032	100.000			

3.2. Solve Principal Components

It can be seen from Table 3 that the three principal components selected successfully explained 92.145% of the total variance of the data variables, indicating that the three principal components extracted can be used to represent the information of the original 10 indicators, so the three principal components extracted can better evaluate the investment value of listed companies, and also play a role in reducing the dimension of indicators in the multi-indicator system. Finally, the three principal components, T1, T2 and T3, are extracted. According to the principal component scores of the SPSS software operation results and the principal component matrix coefficients, the theoretical coefficients of each index are calculated, and the following linear combinations are obtained.

$Y1 = 0.302ZX1 + 0.365ZX2 + 0.303ZX3 + 0.329ZX4 - 0.205ZX5 - 0.254ZX6 + 0.240ZX7 + 0.373ZX8 + 0.364ZX9 + 0.373ZX10$

$Y2 = 0.246ZX1 + 0.193ZX2 + 0.096ZX3 + 0.003ZX4 + 0.552ZX5 + 0.512ZX6 - 0.490ZX7 + 0.152ZX8 + 0.160ZX9 + 0.191ZX10$

$Y3 = 0.331ZX1 - 0.150ZX2 + 0.541ZX3 + 0.513ZX4 + 0.052ZX5 + 0.050ZX6 + 0.000ZX7 - 0.343ZX8 - 0.320ZX9 - 0.295ZX10$

3.3. Calculate the Principal Component Score and Comprehensive Score

First of all, according to the scores of each principal component calculated, the total load value and the component matrix coefficient are used for calculation, and then the investment value system of each listed company is calculated using the variance contribution rate of the data variable of each index principal component as the weight, and the comprehensive score is calculated.

Judging from the principal component factor score, Ningbo Construction Engineering Group's profitability (Y1) score is 1.98, which shows that compared with other companies, Ningbo Construction Engineering Group has a strong profitability growth ability and can bring higher income from its investment, while other companies are relatively weak here. In terms of operating capacity (Y2), Runnong Water Saving and CAMCE International scored 5.44 and 2.93 respectively, with higher scores, which are more prominent compared with other companies, indicating that the two listed companies have strong operating capacity, and the production and operation status of the two companies is good and strong. In terms of asset solvency (Y3), Yabo shares 2.58549, Ningbo Construction Engineering 1.30702 and Zhejiang Construction Investment 1.22358 scored 4.01, which is far superior to other relative industries and has a strong debt repayment ability, indicating that the company's capital turnover is good, while other listed companies' debt repayment ability is relatively weak. From the comprehensive

score, Ningbo Construction Engineering ranked first with 1.21 points, and all indicators are normal. The company's profitability and solvency are stronger than other companies. Investors can focus on investment, while the manufacturing listed company controlled by Yabo shares ranked lower with - 5.39 points, and its indicators are relatively weak. Therefore, investors are not recommended to invest.

Table 4. Principal Component Score and Comprehensive Score

Code of listed company	Y1	Y2	Y3	Y(Comprehensive score)	Comprehensive ranking
C601789	1.98224	-.36433	1.30702	1.20742	1
C603929	1.51178	.96880	.92313	1.19934	2
C002761	2.00761	-.90328	1.22358	1.08816	3
C601668	1.67574	-.31236	.96236	1.00309	4
C600970	1.51345	-.03750	.86572	.96187	5
C601390	1.63660	-.47374	.85543	.93097	6
C601618	1.44581	-.14318	.79389	.89029	7
C601186	1.47421	-.33905	.70931	.85164	8
C601117	1.25954	.18946	.60171	.83746	9
C002140	1.39202	-.26145	.52793	.80113	10
C601868	1.13237	-.20976	.29331	.63649	11
C601800	1.21639	-.56751	.15420	.58615	12
C002060	1.34282	-1.03725	-.01778	.53056	13
C601669	1.13183	-.75291	-.05168	.47086	14
C830964	-1.50187	5.43729	.37685	.43319	15
C002051	.52922	1.21022	-1.69416	.38511	16
C601611	.98509	-.70567	-.31306	.36694	17
C300649	.55924	.11400	-.06788	.33964	18
C603098	.12054	.94855	.26459	.31855	19
C002307	.96250	-1.14314	-.45894	.23621	20
C601068	.32191	-.27992	-1.05326	-.00238	21
C300008	-1.18788	2.93101	-.60878	-.07854	22
C601399	-.72949	1.60897	-1.18051	-.18631	23
C002564	.23070	-1.28284	-1.75655	-.36777	24
C002542	-.75328	.38450	-.25079	-.37349	25
C603778	-2.00995	.84303	-1.84829	-1.17625	26
C300506	-1.61624	-.42702	-2.16505	-1.27946	27
C300237	-2.55797	-1.67201	.14361	-1.83791	28
C603007	-4.28270	-3.41801	-1.12139	-3.37845	29
C002323	-9.79223	-.30489	2.58549	-5.39454	30

4. Cluster Analysis

After principal component analysis, in order to further help investors make better investment decisions, the three principal component factors Y1, Y2 and Y3 extracted from the above analysis are selected as indicators for cluster analysis of the 30 manufacturing listed companies.

Table 5. Classification of 30 listed companies

Class	Quantity	Corporate name
Class I	4	Runnong water-saving, Tianhai defense, national machinery reloading, dry landscape garden
Class II	1	Yabo Shares
Class III	25	Ningbo Construction Engineering, Yaxiang Integration, Zhejiang Construction Investment, CSCEC, Sinoma International, China Railway, China Metallurgical Corporation, China Railway Construction, China Chemical, Donghua Technology, China Energy Construction, China Communications Construction, Guangdong Hydropower, China Power Construction, China Industrial International, China Nuclear Construction, Hangzhou Gardens, Suntech, Beixin Road and Bridge, Chinalco International, Tianwo Technology, Sinochem Geotechnical, Mingjiahui, Meichen Ecology, ST Huawang

Table 6. Mean value of main factors of each category

Mean value of main factor score	Class I	Class II	Class III
Y1	-1.3572975	-5.79223	0.6088568
Y2	2.705075	-0.30489	-0.420616
Y3	-0.8151825	2.58549	0.02701
Y(Synthesize)	-0.2519775	-1.39454	0.2560968

It can be seen from the above Table 5 and Table 6 that the first category includes Runnong Water Saving, Tianhai Defense, National Machinery Heavy Equipment, and Qianjing Garden listed companies. The average profitability growth (Y1) and asset solvency (Y3) of the above manufacturing enterprises are -1.3572975 and -0.8151825, respectively. Compared with the third category, there is a large gap. The average operating capacity (Y2) is 2.705075, which is far more than other categories, indicating that these enterprises have strong operating capacity, The solvency of assets is relatively weak, while the profitability of growth is the weakest of the three categories. Its financial and operating conditions are unstable, and its development prospects are small. It is difficult to have high development in the future. Investors are advised to invest cautiously. The second category is Yabo. The average value of the manufacturing company's profitability (Y1) is - 5.79223, but the average value of its asset solvency (Y3) is 2.58549, indicating that the company's net profit rate is low, but its total asset turnover rate is high. Although the company's profitability is the weakest and the future economic development prospects are not optimistic, its asset solvency is high on the contrary, The enterprise will not be insolvent. Due to the low profitability and growth ability of enterprises, the market development potential remains to be observed, but its asset solvency is the highest. Investors are advised to pay close attention to it for a long time. The third category is Ningbo Construction Engineering, Yaxiang Integration, Zhejiang Construction Investment, CSCEC, Sinoma International, China Railway, China Metallurgical Corporation, China Railway Construction, China Chemical and other companies. These companies have low operating capacity (Y2), but compared with the other two categories, they are relatively able to operate normally, and are not relatively prominent in terms of operating capacity, However, by comparing the profitability growth ability (Y1) of these companies with the other two types of companies, we

can find that their profitability growth ability is the highest, the future development prospects are good, and the asset solvency (Y2) ability is only second to the first type of companies, which shows that these companies have strong asset utilization ability, good future prospects, and good development potential, and can be used as investors to invest.

5. Conclusion and Suggestions

Through the theoretical analysis of the comprehensive ranking of the investment value of the 30 manufacturing listed companies, it is found that: ① the performance of the principal components in the value evaluation system of different listed companies is quite different, and the fluctuation of the intrinsic value of investment is relatively obvious. ② The profitability and growth ability of listed companies have a profound impact on the intrinsic value of listed companies in the manufacturing industry, and the listed companies with the highest comprehensive ranking have great development advantages and bright prospects in terms of net sales rate and return on net assets. ③ In the three principal components extracted, it is found that the important factors affecting its internal investment value are the profitability and solvency of assets. At the same time, through SPSS analysis, it is found that enterprises with higher net sales interest rate and asset-liability ratio, current ratio and quick ratio often have higher investment value. ④ The operating capacity of listed companies has a cyclical impact on the investment value of enterprises during normal operation.

Based on the above conclusions, the following suggestions are put forward: ① When investors invest in manufacturing listed companies, they should allocate funds reasonably and diversify the corresponding risks by using the investment portfolio to reduce the investment risks. ② Investors should have a deep understanding of the company's financial statements, and pay long-term attention to the changes of the company's profit and asset solvency indicators such as the net interest rate on sales and the rate of return on net assets. ③ Manufacturing products are cyclical. Investors should consider carefully when investing in the stocks of listed companies in manufacturing industry, and make decisions after careful analysis. ④ Investors need to constantly improve their learning of relevant investment aspects, strengthen the investment concept through theoretical knowledge learning, use theoretical analysis and practical operation to apply appropriate investment decisions to avoid risks and improve returns.

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