Research on the Investment Value of Growth Enterprise Market Stocks in China

Songhan Xia*

The Hong Kong University of Science and Technology, Hong Kong, China

*Corresponding author: sxiaaa@connect.ust.hk

Abstract. To study the value investment of stocks, this paper randomly selects 30 stocks from China's Growth Enterprise stock market. Based on financial statement data disclosed by listed companies, firstly select relevant sixteen indicators that can reflect the companies' financial status from four aspects of solvency, risk status, operating condition, and profitability. Then construct the stock value investment index system by using the factor analysis of the principal component method. Extract four factors and calculate the factor scores of 30 listed companies. Finally, according to the results of factor analysis, using the k-means cluster analysis method, the stocks of 30 listed companies are divided into three categories: ordinary stocks, risk stocks, and potential stocks. The results show that the mediocre stocks in the GEM make up the majority, and there are fewer high-yield, high-risk and potential stocks. Provide investment advice based on the characteristics of investors to help investors reduce investment risks and maximize returns.

Keywords: principal component analysis; factor analysis; k-means clustering.

1. Introduction

Today, the stock market plays an essential role in economic development, and the trading of my country's stock market is becoming more and more mature. The concept of value investing is deeply rooted in people’s hearts, and more and more people are starting to invest in stocks. To maximize returns and avoid risks, investors will collect relevant information on the stocks they invest in from various channels to form their judgments. Stock trends are affected by multiple factors, not only the operating conditions and financial indicators of listed companies but also macroeconomic conditions, political factors, emergencies, investor expectations, industry prospects, and other factors.

On October 30, 2009, the Chinese Growth Enterprise Market was successfully listed on the Shenzhen Stock Exchange. The arrival of the Growth Enterprises Market has attracted the attention of a large number of investors, and some investors have shifted from the primary market to the Growth Enterprises Market. However, compared with traditional stocks, the investment risk of the Growth Enterprises Market is high. Investors need to pay more attention to the information disclosure of relevant companies and conduct rational investment analysis. However, individual investors often only rely on personal perceptual analysis or the financial reports of listed companies to invest in stocks. This investment method generally depends on personal experience and preferences, with a certain degree of subjectivity, leading to different investors. There are different results, and the results are inevitably biased. Therefore, it is necessary to quantitatively analyze the disclosed information of listed companies to obtain an objective investment index evaluation system.

In 2021, China's GDP will be 114.4 trillion yuan, with a growth rate of 8.1%, leading other countries to the global economy. However, due to the late start of China's securities market, the stock market ranks relatively backward in the global securities market, and investors lack rational judgment on stock value investment. This article is based on this background to analyze the value investment of my country's 2022 ChiNext stocks. And hope to provide an objective and rational reference for stock investors.

From the initial establishment of 28 companies, as of September 16, 2022, more than 1,000 companies have been successfully listed on the Growth Enterprise Market, with a turnover of 147.03 billion yuan. The rapid development of the ChiNext market has provided substantial financing opportunities and development opportunities for domestic small and medium-sized companies, especially computer application service companies with high growth, high risk, high income, and high innovation. The gradual improvement of the multi-level capital market system has broadened the investment channels of individual investors, and the stocks of GEM computer application service companies are gradually gaining the favor of individual investors due to their high growth and high returns. Therefore, Sun and Meng (2017) used a fuzzy analytic hierarchy process to construct computer application services for GEM. A model for evaluating the value of the stock investment in business companies [1].

Feng uses factor analysis to explore the value of China's listed banks [2]. Tang uses factor analysis and k-means clustering to analyze the value investment of industrial ST stocks [3]. Like Feng, Huang also adopts factor analysis to examine the banking industry stocks [4]. Gu and others used factor analysis and clustering to analyze the stocks of the Science and Technology Innovation Board [5].

In addition to the above-mentioned typical statistical methods, there are also a group of scholars who have adopted more in-depth methods. Song, Liang, and Li construct a decision-making framework for robust stock value investment based on the ordering mechanism [7]. Chen uses AHP to determine indicator weights and uses StkTool to advise investors on stock selection [8]. Li, Gong, and Hui also use support vector machines to train a stock-picking model [9].

In the traditional method, most scholars start from the financial indicators in the financial reports of listed companies and adopt some very complex mathematical models to analyze the future risk and value investment of stocks. However, this method does not consider other relevant factors that are relatively one-sided, and the research results are not intuitive to ordinary stock investors. Inspired by the research of the above scholars, this paper adopts multiple relevant indicators for analysis. It uses various methods such as factor analysis to quantify the investment value, and the evaluation is more objective for investors to refer to.

2. Methodology

The data in this article comes from eastmoney.com, 30 stocks on the Growth Enterprise Market are randomly selected, and seven stock market indicators and nine company financial indicators are used for data analysis. Among them, the stock market indicators involve the opening price, closing price, high price, low price, trading volume, turnover rate, and amplitude. Due to frequent fluctuations in stock market data, this article selects the data on September 16, 2022, for analysis [10]. The company's financial indicators involve ROE, gross profit margin, net interest rate, asset-liability ratio, and other indicators that reflect the company and its operating conditions. The data comes from the second quarter 2022 financial report.

Table 1. Stock market quotes

	Open	Close	High	Low	Volume	Turnover rate	Amplitude
Min.	4.91	4.97	4.95	4.78	3384	0.72%	1.6%
1st Qu.	9.39	9.42	9.82	9.25	22457	1.30%	2.95%
Median	15.82	15.89	16.70	15.80	35727	2.35%	3.95%
Mean	20.92	20.98	21.67	20.54	78469	4.49%	4.82%
3rd Qu.	23.05	23.11	23.13	22.48	95947	4.69%	5.36%
Max.	84.23	84.05	85.56	83.17	390983	38.9%	15.98%

It can be seen from table 1 that the stock price fluctuates from around 4 to 86, and the lowest turnover rate is 0.72%, and the highest turnover rate is only 38.9%, which indicates that the company shares are not very liquid.

Since the names of the financial status indicators of the relevant companies are too long, they are abbreviated for convenience in the following figures. Table 2 shows the abbreviated term and detailed description.

Table 2. Explanation table of company financial indicators

Full Name	Acronym	Description
Return on Equity	ROE	Net Income/ Average shareholders' equity
Gross Profit Margin	GP	(Net Sales- Cost of goods sold)/ Net Sales
Net Interest Margin	NIM	Net Interest/ Net Sales
Current Ratio	CR	Current assets/Current liabilities
Quick Ratio	QR	Quick assets/Current liabilities
Debt Asset ratio	DAR	Total Debt/Total Assets
Year-on-year growth rate of total operating income	YoYG	(Current operating income- Operating income in the last year)/ Operating income in the last year
Year-on-year growth rate of attributable net profit	YoYP	(Net profit for the current year- Net profit for the last year)/ Net profit for the last year
Inventory turnover	IT	Cost of goods sold/Average Value of Inventory

Table 3. Company Financial Indicators Table

	ROE(%)	GP(%)	NIM(%)	CR	QR	DAR(%)	YoYG(%)	YoYP(%)	IT
Min.	-9.25	-18.7	-79.5	0.94	0.55	7.99	-63.86	-239.89	0.31
1st Qu.	0.36	20.95	1.08	1.70	1.22	25.62	-10.98	-56.28	0.79
Median	2.77	28.01	5.64	2.39	1.92	36.09	6.83	14.74	2.10
Mean	2.04	31.39	3.62	3.43	3.00	35.65	5.99	59.56	50.1
3rd Qu.	3.93	40.73	11.95	3.12	2.83	48.53	21.44	54.82	3.30
Max.	11.81	82.55	43.76	14.27	14.21	68.13	71.69	2205.32	1364

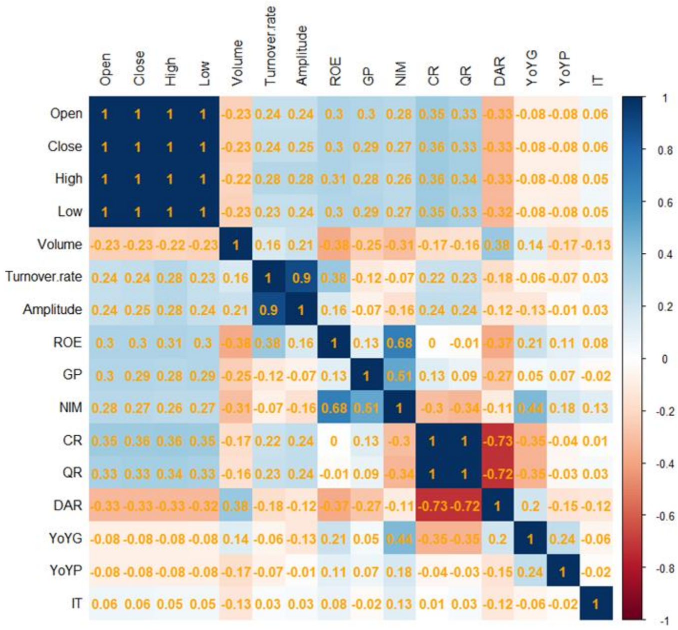

Fig. 1 Indicator correlation coefficient heatmap

However, analyzing sixteen variables may be a little tricky. It is much more convenient if multiple related variables can be merged into one variable. As shown in Figure 1 that many indicators are highly correlated. The principal component analysis method in factor analysis helps a lot with that. For the subsequent cluster analysis, this paper tries to apply factor analysis to reduce the dimensionality of the data [11].

3. Results and Discussion

3.1 Factor Analysis

Before factor analysis, this article does KMO test and Bartlett's test on the standardized data. Most KMO test coefficients are larger than 0.5, and the p-value of the Bartlett test is far less than 0.05. This shows that the multivariate correlation is relatively significant and has overlapping information. It is suitable for using factor analysis to reduce the dimension.

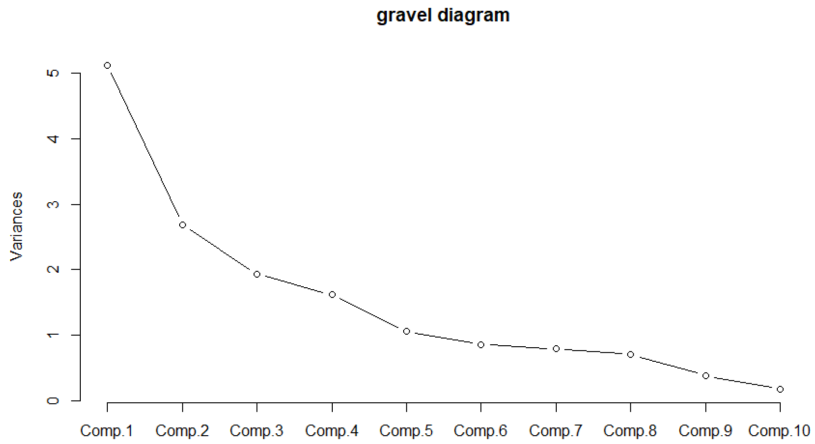

Fig. 2 Gravel diagram of 10 components

Then this article uses the eigenvalue to draw the gravel diagram. There are five components with eigenvalues greater than 1, so this paper uses the maximum likelihood method for factor rotation and retains five factors.

Table 4. The variance contribution rate of the five selected factors

	Factor1	Factor2	Factor3	Factor4	Factor5
Eigenvalue	4.292	2.941	2.234	2.123	1.259
Vars.Prop(%)	26.83	18.38	13.96	13.27	7.87
Vars.Cum(%)	26.83	45.21	59.17	72.44	80.31

In table 4, the first five factors can explain 80.31% of the variance, and the remaining five do not contribute much to explaining the whole variance. Therefore, the selection results obtained from the gravel diagram are reasonable.

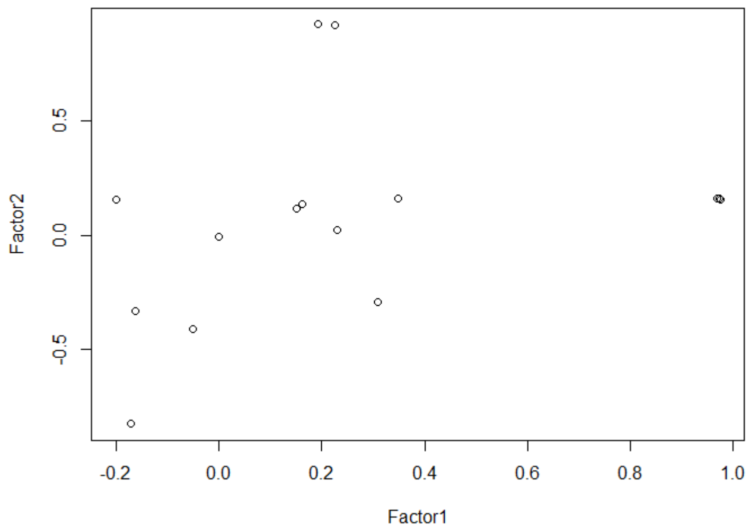

Fig. 3 Scatter plot of variables over the first two factors

Figure 3 shows the loadings of 16 variables on the first two factors. The new coordinates of the first four variables are very close, so the rightmost point in the figure is the overlap of the four points.

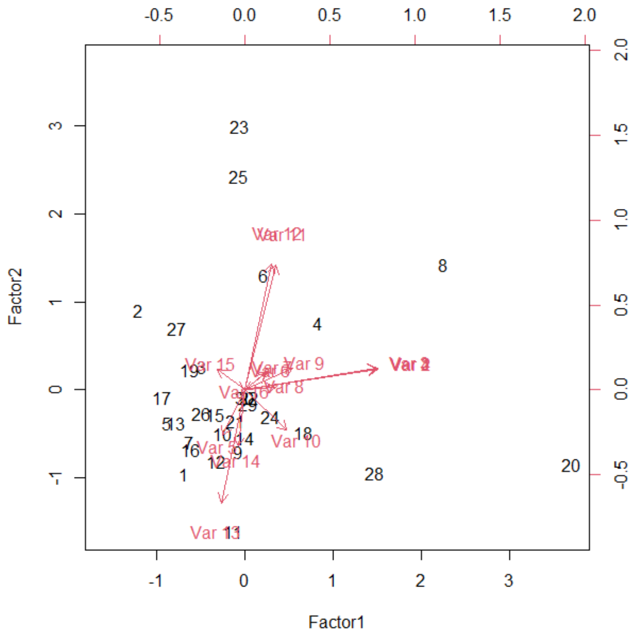

Fig. 4 Factor scores for each stock

This article finds that factor 1 and factor 2 have large loadings on several variables from figure 4. Similarly, through the factor loading matrix, this paper attempts to make a realistic interpretation of each factor and rename the factors.

Table 5. Rotated factor loadings matrix

	F1	F2	F3	F4	F5
Open	0.975	0.156	0.056	0.084	0.050
Close	0.974	0.158	0.054	0.091	0.052
High	0.970	0.162	0.052	0.129	0.040
Low	0.975	0.155	0.054	0.083	0.038
Volume	-0.164	-0.333	-0.367	0.344	-0.468
Turnover rate	0.150	0.118	0.048	0.948	0.051
Amplitude	0.161	0.136	-0.052	0.907	-0.040
ROE	0.229	0.022	0.690	0.310	0.391
GP	0.348	0.161	0.429	-0.309	-0.060
NIM	0.308	-0.292	0.786	-0.137	0.259
CR	0.224	0.922	-0.137	0.106	-0.064
QR	0.192	0.924	-0.156	0.123	-0.049
DAR	-0.173	-0.829	-0.299	-0.049	-0.190
YoYG	-0.051	-0.414	0.574	0.028	-0.265
YoYP	-0.201	0.156	0.580	-0.028	-0.208
IT	0.000	-0.005	-0.076	0.044	0.806

Factor 1 has large positive loadings on “Open”, “Close”, “High”, and “Low”, so it can be called the price factor. The significant value of factor 1 means that this stock has a high price.

Factor 2 has large positive loadings on “CR” and “QR”, and a large negative loading on “DAR”. If factor 2 is big, this stock has a high current ratio, a high quick ratio, and a low debt-asset ratio. Therefore, factor 2 can be called the short-term solvency factor. The larger the value of factor 2, the stronger the short-term solvency of the company.

Factor 3 has large positive loadings on “ROE”, “NIM”, “YoYG”, and “YoYP”. If factor 3 is big, it means that this stock’s return on equity is high, and the company's profit margin and revenue growth rate are both high. Therefore, factor 3 can be called a profitability factor. If the value of the profitability factor is tremendous, the company has strong profitability and can bring high returns to investors.

Factor 4 has a large positive loading on “Amplitude” and “Turnover rate” , and medium negative loadings on “GP”. A high value of factor 4 means that the stock price fluctuates wildly, and the company's profitability is poor. Therefore factor 4 can be called a high-risk factor. The larger the value of this factor, the greater the risk of investing in that stock.

Factor 5 has a large positive loading on the “Inventory turnover”, and a medium negative loading on the “Volume”. A large value of factor 5 means that investors' transactions are very active, and the company has strong profitability. Therefore, this paper refers to factor 5 as the operating condition factor. The larger the factor 5, the better the business performance.

For further analysis, this paper conducts cluster analysis on these 30 stocks based on the new five factors.

$$F1 \approx 0.975Open + 0.974Close + 0.97High + 0.975Low \tag{1}$$

$$F2 \approx 0.922CR + 0.924QR - 0.829DAR \tag{2}$$

$$F3 \approx 0.69ROE + 0.786NIM + 0.574YoYG + 0.580YoYP \tag{3}$$

$$F4 \approx 0.948Turnover\ rate + 0.907Amplitude - 0.309GP \tag{4}$$

$$F5 \approx -0.468Volume + 0.806IT \tag{5}$$

3.2 Cluster Analysis

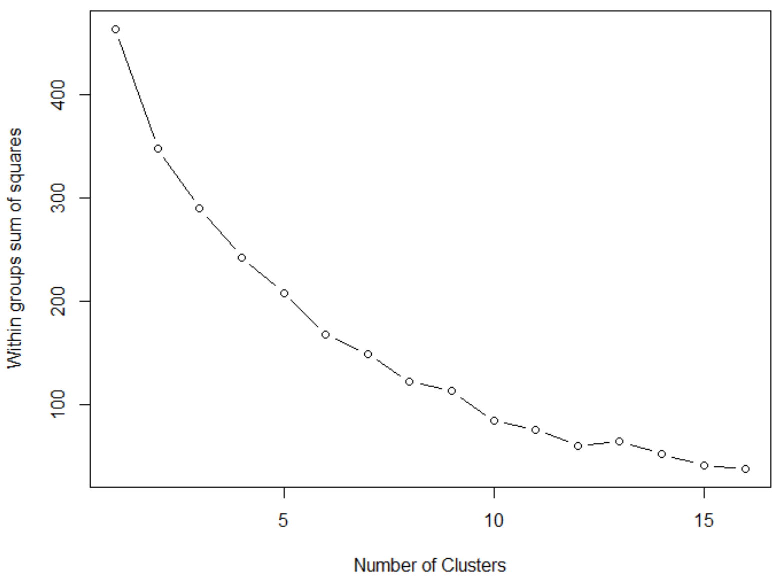

Fig. 5 The within-group sum of squares for different numbers of clusters

To determine the number of clusters, this article calculates the within-group sum of squares for different numbers of clusters. It can be seen from figure 5 that the gravel figure starts to flatten from about 5 clusters. For further confirmation, this article needs the help of average silhouette width.

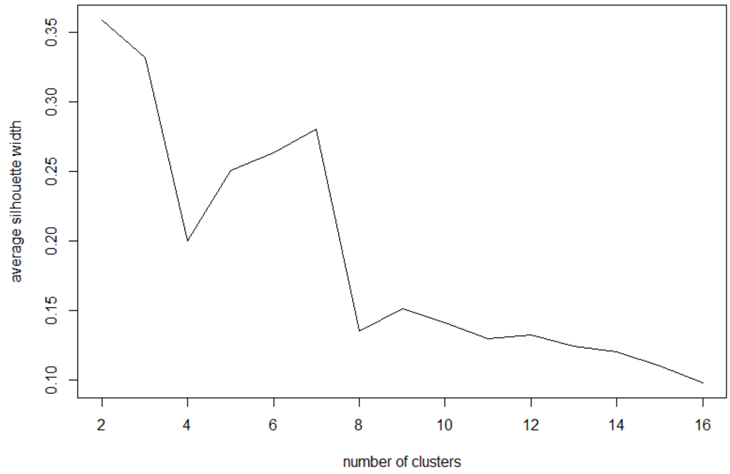

Fig. 6 Average silhouette width of different numbers of clusters

As can be seen from figure 6, the average silhouette width hits the max point when the number of clusters equals two. However, only two categories are too small for the analysis, so this article chooses the second largest point. Therefore, this paper divides stocks into three categories by factor scores.

By using the k-means cluster, this article finds three factors score centers. According to Table 6, stocks in cluster 1 are cheap, low risk, have no terrible operating conditions, and are classified as normal and stable stocks. Stocks in cluster 2 are expensive, risky, have bad operating conditions, and are classified as risky stocks. Stocks in cluster 3 have high prices, strong solvency, and good profitability, so certain risks are classified as potential stocks.

Table 6. Factors score centers on three types of stocks

	Price	Solvency	Profitability	High-Risk	Operating Condition
1	-0.34	-0.34	-0.04	-0.15	-0.12
2	0.36	-0.29	0.41	2.30	2.33
3	1.15	1.34	0.02	-0.21	-0.32

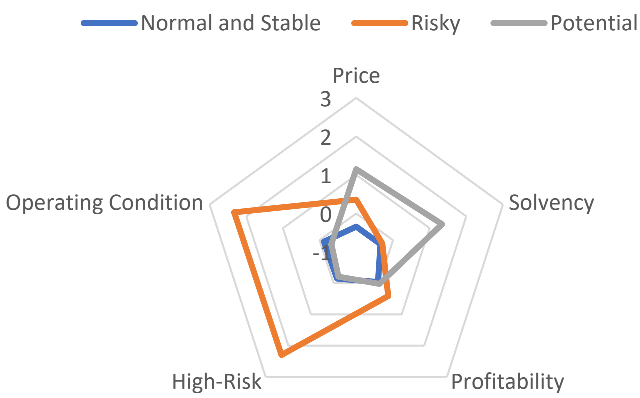

Fig. 7 Radar chart of three types of stock in factor scores

It can be seen intuitively from the radar chart that Risky stocks have a considerable value in the High-Risk dimension, and High-Quality stocks have moderate values in all five dimensions.

Although the profitability factor of High-Quality stocks is not so competitive, their price factor is low, and it's stable. In contrast to the potential category, it is significantly higher than the first category in 5 factors, and its price is pretty high.

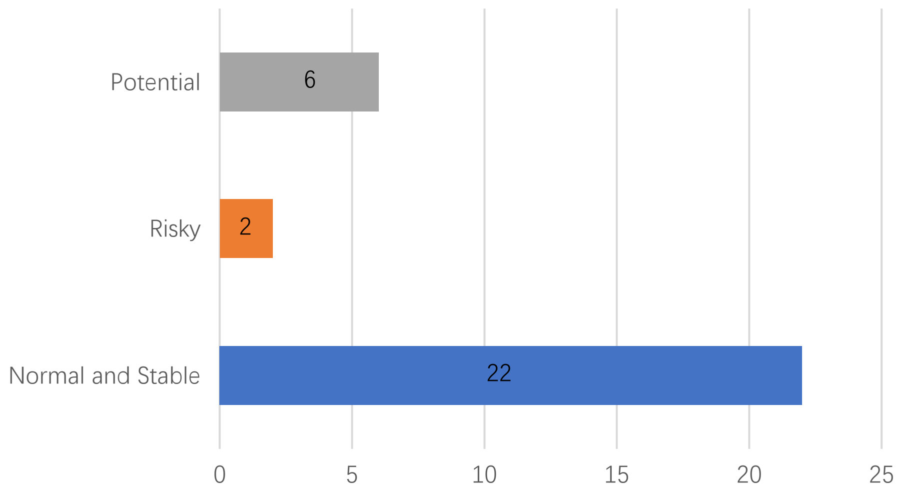

Fig. 8 Count of clustering results

After using the k-means cluster, this article counts the specific number of three types of stocks. It can be seen from figure 8 that among the whole 30 stocks, 22 stocks are normal and stable stocks, two stocks are risky, and six stocks are in the potential cluster.

Because the sample size is too small, the number of the first two types of stocks is a little small compared to the third type. The six companies in the potential stocks category involve medicine, lenses, chemicals, biology, and semiconductors. Only one stock is about the tourism industry. All of them are promising industries in the future with the high stock price. A stock with the highest closing price reached 84.05 yuan, and the lowest one also had 22.65 yuan. In addition, ROE is between -3% and 89.5%, and the net profit margin is mostly between 6% and 44%, which is outstanding in terms of sales profit.

Among the two risky stocks in cluster two, the most prominent features are low risk and reasonable operating conditions. As seen from the above, the risk factor mainly focuses on the turnover rate, while the operating condition factor mainly focuses on the inventory turnover. Both are pretty much high in the original data. This also shows that the investment indicators established in this paper are relatively accurate.

In the normal and stable cluster, all the values of the five factors are at a relatively low level. Among the 22 stocks in cluster three, they have low prices, and low risk, the solvency and profitability are not strong, and the company's operating conditions are also average. Although the number of samples in this article is relatively small, this may be the general situation of stocks in the ChiNext market. Not all companies have development potential, and most of them are mediocre.

4. Conclusion

Based on the factor and cluster analysis results, this paper puts forward the following suggestions for investors with different risk preferences. For investors who prefer risk, this article recommends stocks in the risky cluster. A high return often accompanies high risk. This article recommends investing in stocks in the potential cluster for investors with sufficient funds. Although the stock in the underlying class is expensive, the company has strong solvency and solid profit margins. There may be better developed in the future.

References

[1] Sun Sijia, Meng Qingjun. Research on the Value of Stock Investment in Computer Application Service Industry on the Growth Enterprise Market. Economic Research Guide,2017 (16):75-79.

[2] Feng Chongyang. A Statistical Analysis on the Value of Stock Investment in China's Listed Banks. Capital University of Economics and Business,2014.

[3] Tang Jiaqin. Research on investment value evaluation and investment strategy of industrial ST stocks. Nanchang University,2012.

[4] Huang Hong. Research on the value of the stock investment in my country's banking industry based on factor analysis. Modern Business,2022(03): 86-88. DOI:10.14097/j.cnki.5392/2022.03.026.

[5] Gu Baotong, Zhu Jiaming, Huang Tianli. Research on the stock investment value of science and technology innovation board based on factor analysis and cluster analysis. Journal of Jilin Agricultural Science and Technology University,2020,29(03):44-49.

[6] Liu Xiaodan. Is the value investment strategy effective? -Based on the data analysis of Shanghai and Shenzhen A-share stock market. Communication of Finance and Accounting,2019(05): 8-10.DOI: 10.16144/j.cnki.issn1002-8072.2019.05.002.

[7] Song Peng, Liang Jiye, Li Changhong. Robust stock value investment decision based on ordering mechanism-A research framework. Journal of Beijing Institute of Technology (Social Science Edition),2016,18(03):75-83. DOI:10.15918/j.jbitss1009-3370.2016.0310.

[8] Chen Yuanhong. Research and Application of AHP Method in Stock Value Investment. Guangdong Business College, 2013.

[9] Li Yunfei, Gong Dongsheng, Hui Xiaofeng. Research on PCA-SVM stock selection model based on value investment. Journal of Xi'an Polytechnic University,2009,23(03):125-131.

[10] Wang Chunyan, Ouyang Lingnan. Feasibility Analysis of Value Investing in Chinese Stock Market. Finance & Economics,2004(01):32-36.

[11] Yao Hui, Wu Tingting. An Empirical Study on Value Investment Strategies Considering Fundamentals and Valuation Indicators-Experience Data from China's Shanghai and Shenzhen A-Share Markets from 2000 to 2013. Review of Investment Studies,2014,33(11):123-138.