Portfolio Analysis of Multi-Factor Stock Selection Model Based on Investor Sentiment

Yifan Wang[1,a,*], Minghan Qiu[2,b], Ziyu Zhu[3,c], Chenxi Yang[4,d]

[1]*School of Finance, Jilin University of Finance and Economics, Changchun, China*
[2]*Kunshan Kuncheng Chinese School, Suzhou, China*
[3]*LiCheng No.2 School, Jinan, China*
[4]*Shandong Experimental Middle School University Town Campus, Jinan, China*
a. 1427397870@qq.com, b. 2597130169@qq.com, c. 1779952239@qq.com, d. 1719588044@qq.com
*corresponding author

Abstract: Since 1990, China's securities market has been gradually improved. Domestic and foreign scholars have proposed many theoretically perfect investment models, but not many of them have been applied in practice because the market cannot satisfy the strict assumption conditions of the models. Foreign quantitative investment models are not necessarily effective in the Chinese market. Based on this, this paper takes the portfolio theory as a guide, uses the scoring method to construct a multi-factor stock selection model, and selects the relevant factors in combination with the characteristics of the Chinese market. Through empirical analyses, the validity of the multi-factor stock selection model with equal weight allocation in China's market is verified. In addition, this paper innovatively constructs an investor sentiment factor, combines the sentiment timing with the multi-factor stock selection model, optimises the timing on the basis of the multi-factor stock selection model, and proposes an investment strategy to obtain excess returns stably.

Keywords: multi-factor stock selection model, Investor sentiment, Investment portfolio

1. Introduction

China's securities market has gradually improved since 1990, and scholars have proposed many theoretically perfect investment models. Foreign quantitative investment models are not necessarily effective in the Chinese market. To obtain sustainable returns in the A-share market, it is necessary to explore localised investment models that meet the A-share market [1]. In this paper, we will screen out effective factors from many underlying factors, construct a multi-factor stock selection model that meets the characteristics of the Chinese A-share market, and carry out empirical research and optimisation in order to explore investment portfolios that can achieve excess returns [2].

2.   The Construction of a Multi-factor Stock Selection Model

2.1.   Data Selection

The CSI 300 index is an index representing the overall performance of China's A-share market, with seven years of data from 2015 to 2022 as the sample interval. The constituent companies of the index are large in scale and have good liquidity, and the total market value covers 3/4 of the A-share market, which has A good market representation. In this paper, the constituent stocks of CSI 300 index are selected as the sample stock pool, and the financial data and transaction data of the sample stocks during this period are mainly selected, and the data comes from the WIND database [3].

2.2.   Selection of Candidate Factors

This paper selects 12 indicators, including valuation factor, profitability factor, asset structure factor, technical factor and consensus expectation factor. 1. Valuation factors include price-to-earnings ratio, price-to-book ratio and price-to-cash ratio. 2. Profitability factors include ROE, ROA, EPS and main revenue growth rate. 3. Asset structure factors include asset-liability ratio and accounts receivable turnover ratio. 4. Technical factors include monthly turnover rate and monthly volume. 5. Consensus factors include consensus expected earnings per share and consensus expected net profit growth rate.

2.3.   Validity Test of Candidate Factors

In this paper, the candidate factors are analysed and tested using the sorting method, in which the sample stocks in the stock pool are sorted in descending order according to the size of the factor values. They are divided into five groups of 60 stocks each. The monthly average return of each group of stocks is calculated and the excess return of the high-quartile portfolio over the low-quartile portfolio is derived. Examine whether there is a correlation between the monthly average return of a portfolio and the ranking of that portfolio's factor, and calculate the variance of the correlation coefficient. Finally, using the monthly returns of the CSI 300 as a benchmark for comparison, stocks with low P/E ratios and low P/B ratios have a high probability of outperforming the index, the profitability category factors have a positive correlation with the return on portfolio assets, among the technical factors, both turnover and turnover rate beat the market with a high probability, and with respect to consensus expectations, the excess returns of consensus expected EPS and consensus expected net income growth rates are high. Still, the volatility of the correlation coefficients of the consensus is expected. The correlation coefficient of EPS is more volatile, so the consistent expected net profit growth rate is chosen as a candidate factor [4]. The factors tested for validity are: price-earnings ratio, price-to-book ratio, return on equity ROE, earnings per share EPS, one-month turnover ratio, and consensus expected net profit growth rate.

2.4.   Correlation Test of Alternative Factors

The purpose of correlation test is to determine whether there is a high degree of similarity between factors by using a correlation coefficient, to eliminate the factors with strong correlation and reduce the redundant factors in the model. For details, see Table 1:

Table 1: Correlation test results of alternative factors

Correlation factor	Price-earnings ratio	Marketability ratio	Return on equity(ROE)	Earnings per share(EPS)	- Monthly turnover rate	Consensus expected net profit growth
Price-earnings ratio	1.0000					
Marketability ratio	-0.3981	1.0000				

Table 1: (continued).

Return on equity(ROE)	-0.2426	0.1802	1.0000			
Earnings per share(EPS)	-0.2271	0.2580	0.3851	1.0000		
- Monthly turnover rate	0.1895	0.1547	0.1089	0.1720	1.0000	
Consensus expected net profit growth rate	-0.1573	0.1963	0.3471	0.2366	0.1695	1.0000

The threshold value of correlation is 0.5, and the absolute value of the correlation coefficient of most factors is below 0.5, indicating that the effective factors selected are relatively independent without redundant factors, so there is no need to eliminate them.

2.5. Factor Many Stock Selection Models

Based on the multiple factors to choose a model constructing portfolio, adopt a comprehensive scoring model for factors such as weight and sorted. The scoring method is relatively stable and not affected by extreme values, and the equal weight allocation avoids the unreasonable allocation of factor weights by subjective experience, making the empirical results objective and reliable [5]. The stock pool is 300 sample stocks in the CSI 300 index, which are ranked according to six effective factors, with the positive factor in descending order and the reverse factor in ascending order. The comprehensive scoring model is as follows:

$$D_i = \left(\frac{1}{j}\right)\sum_{j=1}^{j=i} Z_{i,j}$$

According to the ranking score of each stock on each factor, the comprehensive score is calculated, and then several stocks are selected from high to low according to the ranking to construct a portfolio, and the investment period is stipulated.

2.6. Effect of Multiple Factor Stock Selection Model Based on Investor Sentiment Analysis

The multi-factor stock selection model based on emotional factors, according to the six effective factors such as weight sorting get five portfolio. During 2016 to 2022, as the absolute value greater than 1 month following the month in which risky, respectively, in May 2015, 2015, 3, 4, 6, 7, 8, 9 month and September 1, 2021. In these high risk period, advised to keep looking, don't jump into the market. The empirical results show that the highest quartile portfolios have lower returns during these high-risk periods, which verifies the practicability of the model.

Table 2: Statistics of returns of each portfolio

	Highest quantile	Based on the highest score	The csi 300 samples
Maximum monthly excess	17.31%	17.31%	0.00%
Month minimum excess	-16.28%	-13.54%	0.00%
Proportion of months with	66.15%	74.26%	62.37%
Cumulative return rate	241.18%	305.61%	182.97%
Average monthly return	1.83%	2.36%	0.91%

As shown in Table 2, compared to the CSI 300 sample stocks, the average monthly returns of both strategies returns are more than twice the market performance. The overall performance of the portfolio based on the multi-factor stock selection model is higher than the market, with 66.15% of positive return months, 241.18% of cumulative return class, and an average monthly return of 1.83%; while the performance of the strategy with the multi-factor model optimised according to investor sentiment is more stable, with a minimum monthly excess return of -13.54%, which avoids the high-risk investment period, and better avoids the market sentiment due to The unoptimised strategy has a minimum monthly excess return of -16.28%. After avoiding investment in the nine high-risk months during the test period, it is clear that the optimised portfolio has a higher and more stable return, with a cumulative return class of 305.61%

The above results show that the multi-factor model construction of investment portfolio based on the actual stock market in China can bring excess returns, when considering the market investor sentiment, according to the investor sentiment factor to consider the timing of avoiding high-risk investment period, can bring higher and more stable returns. That is, the optimisation of the multi-factor stock selection model in this paper is effective, and it is recommended to consider the impact of investor sentiment for timing when investing based on the multi-factor stock selection portfolio construction [5].

3. Based on Investor Sentiment Factor to Choose a Portfolio Analysis of the Model

3.1. Portfolio Scale

The size of the portfolio cannot be increased without limit, and as the number of stocks increases, the speed of unsystematic risk diversification becomes slower while the cost increases, offsetting the benefits of risk diversification. Therefore, it is necessary to balance transaction costs and diversify risk to achieve the optimal size. Simulation experiments in this paper for 20 stocks portfolio size, because this article USES for the CSI 300 Constituents, as well as overall less, in order to spread the risk.

3.2. Portfolio Cycle

Portfolio of cycle length each has advantages and disadvantages. Long-term investments in warehouses have low frequency but may miss a good opportunity and high cost; Short-term investments are better able to capture market opportunities and get excess returns, but the high frequency will increase transaction costs in the storehouse. Factor in building a more stock selection model and considering investor sentiment factor, empirical research usually USES the monthly data, so the investment cycle should not be less than a month. If the cycle is longer than a month, data updates will not be timely and market opportunities will be missed[6]. Therefore, this paper considers that in the investment experiment in 2023, the investment period is set as one month, and the position swap adjustment is carried out at the end of each month.

3.3. Multi-factor Stock Selection Strategy Investment Experiment based on Investor Sentiment

Based on the multi-factor stock selection model and the six effective factors of A-share market efficiency test, the following scoring formula for stock selection model can be constructed:

$$D = \frac{1}{6}D_{i,ROE} + \frac{1}{6}D_{i,EPS} + \frac{1}{6}D_{i,PE} + \frac{1}{6}D_{i,PB} + \frac{1}{6}D_{i,ZHSL} + \frac{1}{6}D_{i,EGR}$$

Comprehensive scoring methodology, 20 eligible stocks are selected at the beginning of each month to construct a portfolio and performance is assessed at the end of the month. Timing investment

strategy based on investor sentiment optimisation, avoiding high-risk investments and choosing to sell based on the sentiment factor, can lead to higher and more stable returns. Based on the Wind2022 data, the investor sentiment factor formula is constructed, resulting in the y-value chart of the investor sentiment factor for each month in 2022.

Table 3: Emotional factors for each month in 2023

Month	January	February	March	April	May	June	July	August	September	October	November	December
Factor of y	0.46	0.79	1.04	0.13	-0.21	0.56	0.82	0.32	0.35	1.11	0.76	0.78

Calculation results in table 3 show that the absolute value of the investor sentiment factor in March and October 2022 is greater than 1. According to the momentum principle [7], the market sentiment in March and October is too high, and the investment risk in the following April and November may be too high. Therefore, the stock selection experiment in this paper will choose to avoid investment in April and November 2022 to avoid the risk. In summary, according to the multi-factor stock selection model based on investor sentiment optimisation obtained above, the monthly investment portfolio is constructed for the period of 2022, with the benchmark indicator being the CSI 300 yield, and the positions are re-adjusted at the beginning of the next month according to the new ranking of the factor indicators at the end of each month, and at the same time the sentiment factor is considered to determine whether to continue to hold the position in the next month at the same time, and so on, and the returns are recorded until the end of 2022. The actual returns for each month compared to the CSI 300 are shown in the following chart.

Table 4: Comparison of actual monthly returns with CSI 300 in 2022

	The combined factor 1	Based on the investor sentiment	Shenzhen 3 w 3 index combination	Portfolios 1-3 Excess returns	Combination of 2-3 excess returns
January	0.0182	0.0182	0.0235	-0.0054	-0.0054
February	0.0232	0.0232	0.0191	0.0041	0.0041
March	0.0078	0.0078	0.0009	0.0069	0.0069
April	-0.0012	0.0000	-0.0047	0.0036	0.0047
May	0.0224	0.0224	0.0154	0.0070	0.0070
June	0.0403	0.0403	0.0498	-0.0096	-0.0096
July	0.0240	0.0240	0.0194	0.0046	0.0046
August	0.0256	0.025S	0.0225	0.0031	0.0031
September	0.0143	0.0143	0.0038	0.0110	0.0110
October	0.0379	0.0379	0.0444	-0.0065	-0.0065
November	-0.0015	0.0000	-0.0002	-0.0013	0.0002
December	0.0075	0.0075	0.0062	0.0013	0.0013
Monthly average yield of 2017	0.0102	0.0185	0.0167	0.0016	0.0018

According to table 4 above, the return rate of multi-factor portfolio 1 is better than that of CSI 300 most of the time. In 2017, the 12-month average return rate is 1.82%, and the frequency of beating the market was up to 8 times in a year, indicating that the overall performance of the portfolio is good and stable. Therefore, based on factors to choose a model to build portfolios are effective, better earnings performance relative to the market. Optimized portfolio 2 takes into account investor sentiment factors to avoid high-risk months, and the monthly average return rate increases to 1.85%, and the excess return rate reaches 0.18%. The overall performance is more stable, which improves the overall return of the portfolio. Therefore, the multi-factor model based on China's market is

effective in selecting appropriate factors to construct an investment portfolio, and the performance of the multi-factor model is more stable after considering the emotional timing, which provides a new perspective for the construction of a quantitative investment portfolio.

4. Conclusion

The multi-factor stock selection model takes the constituent stocks of CSI 300 as samples, uses the historical data from 2015 to 2022, and finally determines six effective factors through test and correlation analysis. Using the scoring method to establish a multi-factor stock selection model to provide a simple and effective rational investment strategy. The investor sentiment factor is added to the model optimization, and the historical data verifies the effectiveness of the multi-factor stock selection model based on investor sentiment. The results of the 2022 simulated investment experiment show that the portfolio return of the multi-factor stock selection model is better than the market performance, and the multi-factor stock selection strategy based on investor sentiment is better, showing the applicability and effectiveness in China's market.

References

[1] Ni X M, Zheng T T, Zhao H M, et al. Research on Asset Pricing based on Best Quality Return Factor [J/OL]. Chinese Journal of Management Science:1-12[2023-08-25].

[2] WangXi, WuFei, HuangDeJin.et al. A time-varying multi-factor model of A-share market [J]. Journal of Southwest University (Social Sciences Edition), 2012,48(06):137-152.

[3] Han Guowen。Corporate carbon emissions and stock returns: green incentive or carbon risk premium [J]. Research of Financial Economics,2021,36(04):78-93.

[4] Jiang Meihong. Based on the three factor model Fama - French Shanghai 50 stocks analysis [J]. The marketing world, 2021 (18): 98-100.

[5] OuYang HongBing, Yu JingQiong. Based on the factor model of the influence of the liquidity of asset pricing research [J]. Journal of finance development research, 2020 (7): 13-22.

[6] Zhao, L. & Wang, H. Research on multi-factor stock Selection strategy based on Report Information Reconstruction [J]. Journal of Xinxiang University,2020,37(05):14-21.

[7] Wang Jiayu. Research on trend factors of A-share market [J]. China Prices,2019(08):54-57.