

Research on Multi-factor Fundamental Stock Selection

Liyu Su^{1,†}, Yutao Wang^{2,†}, Shenhai Zhang^{3,*†}

¹ The International Department of Liaocheng NO.1 Senior High School, Liaocheng, China

² School of Business, University of Southampton, Southampton, United Kingdom

³ School of Finance, Dongbei University of Finance and Economics, Dalian, China

* Corresponding Author Email: liyuanbo_dufe.edu.cn

† These authors contributed equally.

Abstract. Although more and more people are interested in stock investment, many investors (especially retail investors) do not know enough about the stock market, resulting in serious losses in investment. In order to reduce the losses of first-time investors, this paper borrows the hot multi-factor fundamental stock selection in recent years, screens out effective factors from valuation, profitability, solvency, growth ability, operating ability and other aspects, and conducts backtesting with the help of the Ricequant platform to conduct factor screening research, and obtains a combination of returns higher than the average return of the market. The backtest period is from January 1, 2020 to January 1, 2023, with the Shanghai Shenzhen 300 INDEX as the research object. Through backtesting, this paper recommends that investors judge the future returns of stocks from different perspectives, and select multiple financial variables with low correlation as factors as much as possible, which can enhance the model information capture ability and improve stability. I hope that the analysis of the article will be useful to investors.

Keywords: Multi-factor stock picking, Investment, Investment risk.

1. Introduction

In the context of the continuous development of China's economy, more and more people are interested in the stock market. It has become a habit of investors to discuss the stock market [1]. However, most shareholders know little about the stock market. Many people only know that stocks with high returns are often accompanied by high risks. They cannot use the company's financial data to screen out stocks that meet the investment needs [2]. In addition, China's stock market tends to rise and fall in disorder, which also makes many investors do not know how to choose stocks [3]. For investors, the most important thing before deciding to invest is to have enough reference materials, and the most intuitive and easiest reference materials are the financial reports disclosed by listed companies. Therefore, in order to reduce the investment risk, it is necessary for investors to conduct a detailed analysis of the financial information, and then select potential value stocks to increase the probability of obtaining income. With the arrival of the era of big data and the continuous development of various financial theories, multi-factor stock selection has become an important investment stock selection method [4]. Multi-factor model is based on modern financial investment theories such as portfolio and capital asset pricing (CAPM) for analysis [5]. In addition, multi-factor also means judging the future returns of stocks from different perspectives, and the number of factors will be more comprehensive [6]; At the same time, the risk among factors can offset each other, which increases the stability of the model. Selecting more and more effective candidate factors will undoubtedly enhance the information capture ability of the model and improve its stability, which is one of the key factors to obtain excess returns. This paper selects effective factors from multiple aspects such as valuation, profitability, solvency, growth ability and operating ability, and carries out factor screening research through operation back-testing with the help of the Ricequant platform, and finally combines a class of factors with strong correlation to combine effective and weak correlation factors to obtain potential financial reporting factors that are beneficial to investors to improve earnings, Then we can get the portfolio with the yield higher than the average market yield, which is expected to be a reference for investors.

The component stocks of the CSI 300 index involve important industries such as banking, real estate, biology, medicine, food, etc., with high market coverage, which is usually used as the evaluation standard of investment performance [7]. This paper takes the constituent stocks of the Shanghai and Shenzhen 300 Index as the overall study and carries out the back-test based on the starting date of the back-test from January 1, 2020 to December 31, 2022. After eliminating the sample companies with stock suspension, incomplete data of financial indicators and abnormal data due to merger or reorganization, the back-test experiment is conducted with the financial indicators of other listed companies as samples.

2. Experimental Methods and Results

This paper takes the CSI 300 index of China as the overall study, and takes the back-test starting date from January 1, 2020 to January 1, 2023 as the condition. After eliminating the sample companies with stock suspension, incomplete data of financial indicators and abnormal data due to merger or reorganization, the back-test experiment is conducted with the financial indicators of other listed companies as samples.

2.1. Growth Ability Indicators

The growth ability reflects the company's ability to expand its business and its future development prospects [8]. Strong growth ability can indicate that the market demand for the company's products is large, the company's industry has a good future development prospect, and the company's business expansion ability is strong. Growth factor refers to the index reflecting the company's medium and long-term growth ability. If the growth factor of a stock exceeds that of other stocks of the same kind, it can be considered that the stock price of the company has a greater possibility of rising in the future.

Financial indicators reflecting growth capability mainly include growth rate of total operating income, growth rate of total profit, growth rate of basic earnings per share, growth rate of net assets per share, etc. After repeated back-testing, we selected four growth factors and set the corresponding numerical range to achieve the best back-testing results. The value range of stock selection factor is shown in Table 1.

Table 1. Growth ability indicators

Stock selection factors		
Growth ability indicators	Value Range (%)	
	Minimum	Maximum
Basic earnings per share (year-on-year growth rate)	5.00	10.00
Operating profit (year-on-year growth rate)	10.00	18.00
Total assets (relative growth rate at the beginning of the year)	6.50	28.00
Total operating income (year-on-year growth rate)	5.00	10.00

The back test results are shown in Table 2.

From Table 2, we can see that the strategy's back-test return is 18.13%, which is better than the benchmark return of -5.94%.

Table 2. Growth factors back test results

Test result	
test income	18.13%
test annualized income	5.94%
Benchmark income	-5.49%
Benchmark annualized income	-1.94%
Accumulated Net	1.1810
Maximum withdrawal rate of excess return	3.1244
Annual win rate	0.3333
Quarterly win rate	0.5000
Monthly win rate	0.5000
daily win rate	0.4821
alpha	0.0475
Beta	0.3006
Sharp ratio	0.2665
Sortino ratio	0.4303
Information ratio	0.3673
Annualized volatility	0.1880
maximum drawdown	26.82%
Annualized tracking error	0.2289
Annualized downward volatility	0.1165

The annual income of the strategy is shown in Figure 1:

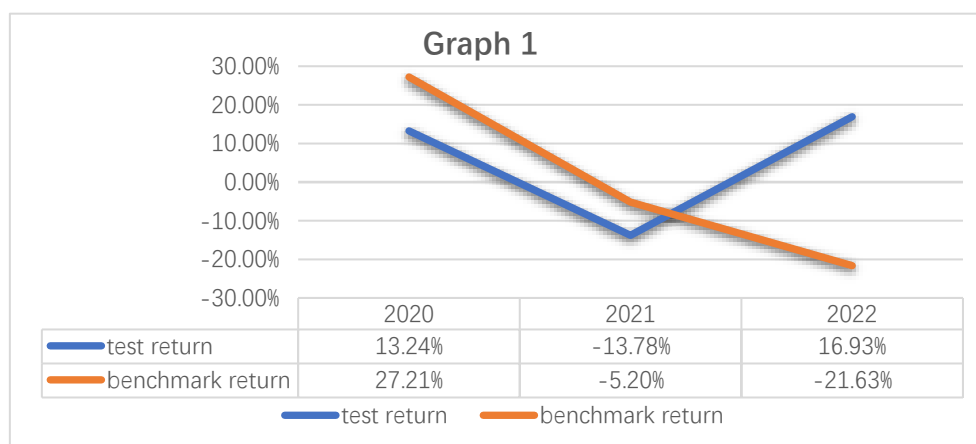


Figure 1. Backtest return on growth capacity indicators

Figure 1 shows that the benchmark returns have been decreasing year by year since 2020, which also reflects the poor performance of China's stock market in 2022. The change in backtest earnings is very different from the benchmark return, and in 2020 and 2021, the backtest yield is also declining and the yield is lower than the market average for both years, but the yield in the backtest period in 2022 is significantly higher. Therefore, the three-year average yield is better than the market average.

2.2. Solvency Variables

The index of enterprise's solvency refers to the ability of an enterprise to repay its debts [9]. The measurement of an enterprise's solvency mainly depends on whether its capital structure is reasonable and stable, and the size of its long-term profitability [10].

The solvency of an enterprise mainly depends on the proportion of assets and liabilities, especially the capital structure and the profitability of the enterprise. Long-term creditors pay special attention to long-term solvency in order to judge the safety of their claims. Its indicators include asset-liability ratio, property right ratio, contingent liability ratio, interest earned multiple, interest-bearing liability

ratio, etc. We selected three indicators of asset-liability ratio, working capital and current ratio to achieve the optimal back-test results within a specific range.

The value range of stock selection factor is shown in Table 3:

Table 3. Stock selection factors

Stock selection factors		
Solvency factors	Value range	
Asset-liability ratio	less than	40%
working capital	greater than	400,000
Current ratio	greater than	2

Relevant back test results are shown in Table 4.

Table 4. Test result

Test result	
test income	19.21%
test annualized income	6.27%
Benchmark income	-5.49%
Benchmark annualized income	-1.94%
Accumulated Net	1.1920
Maximum withdrawal rate of excess return	5.1953
Annual win rate	0.6667
Quarterly win rate	0.6667
Monthly win rate	0.5556
daily win rate	0.5110
alpha	0.0855
Beta	1.0758
Sharp ratio	0.2682
Sortino ratio	0.3646
Information ratio	0.2686
Annualized volatility	0.1880
maximum drawdown	47.41%
Annualized tracking error	0.1514
Annualized downward volatility	0.1975

The annualized rate of return is 6.27%, which is better than the benchmark return of -5.49%.

The annual income of the strategy is shown in Figure 2:

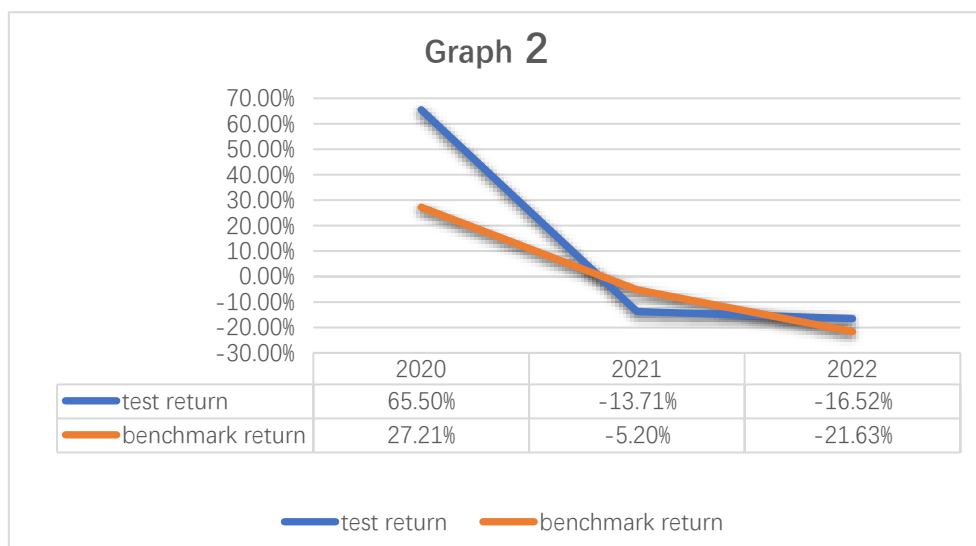


Figure 2. Backtest return on solvency capacity indicators

As can be seen from Figure 2, the backtest returns have shown a decreasing trend for three consecutive years, which is very similar to the average market returns. However, between 2020 and 2021, the backtest period yield fell significantly more than the market yield, from 65.50% to -13.71%, while the 2021 yield did not change much from 2022. Overall, backtest period yields in 2020 and 2022 were better than the market average and yields in 2021 were lower than the market average.

2.3. Operational Capacity Indicators

Operating capacity refers to the operating capacity of an enterprise, that is, the ability of an enterprise to use various assets to earn profits [11]. Broadly speaking, operational capability is the operational role that all elements of an enterprise can play; In a narrow sense, operating capacity refers to the operating efficiency of enterprise assets, which does not directly reflect the rational and effective use of human resources.

Common indicators that can reflect the operating capacity of enterprises include total asset turnover, accounts receivable turnover and inventory turnover. Generally speaking, the faster the asset turnover, the higher the liquidity, the stronger the solvency of the enterprise, and the faster the asset gains profits. However, in the actual back-test, it was found that the higher the value of all indicators, the greater the income of the enterprise. By constantly adjusting the size of the indicators, enterprises can get quite good returns when the total return on assets is between 1.5 and 2.5 and the turnover rate of accounts receivable is more than 5 times. The value range of stock selection factor is shown in the table:

Table 5. Stock selection factors

Stock selection factors		
Operating capacity factors	Value range	
	Minimum	Maximum
Total asset turnover rate	1.5	2.5
Accounts receivable turnover rate	5.0	

The test results are shown in Table 6.

Table 6. Test result

test result	
test income	35.44%
test annualized income	11.07%
Benchmark income	-5.49%
Benchmark annualized income	-1.94%
Accumulated Net	1.354
Maximum withdrawal rate of excess return	2.0715
Annual win rate	1.0000
Quarterly win rate	0.5000
Monthly win rate	0.5556
daily win rate	0.4849
alpha	0.1079
Beta	0.5044
Sharp ratio	0.4929
Sortino ratio	0.7168
Information ratio	0.6833
Annualized volatility	0.2049
maximum drawdown	28.37%
Annualized tracking error	0.2039
Annualized downward volatility	0.1409

The annual income of the strategy is shown in Figure 3:

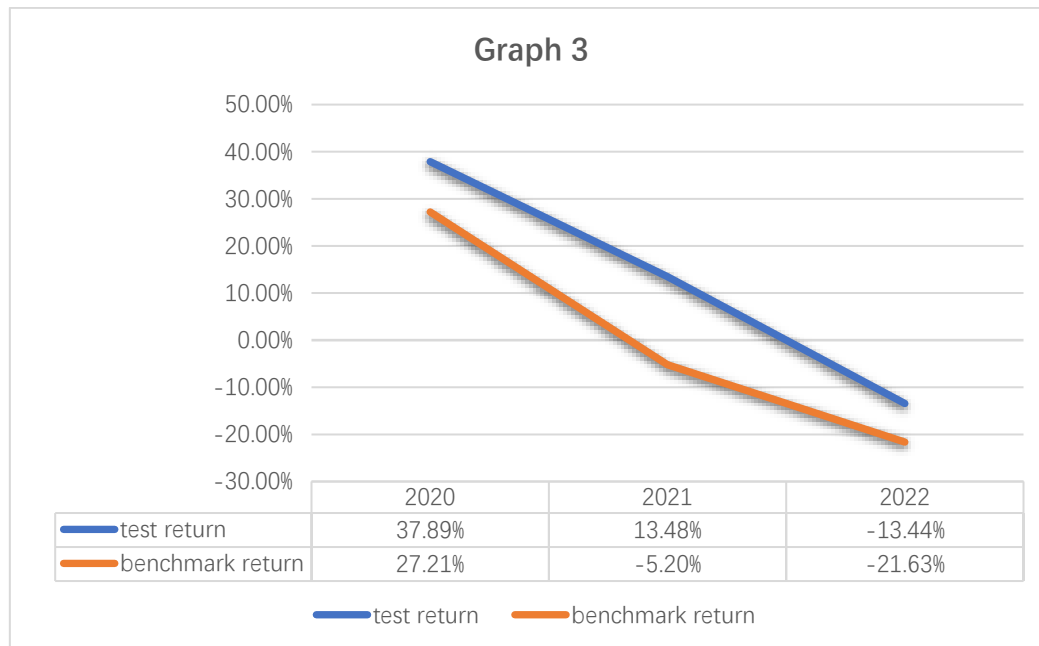


Figure 3. Backtest return on operational capacity indicators

According to Figure 3, the backtesting returns are decreasing year by year, but the returns in the three years are better than the market returns in the same period. Although the yield in 2022 is less than zero (-13.44%), it is still more than 8% higher than the market yield, allowing investors to reduce their losses.

2.4. Valuation Indicators

Valuation factors are a very important factor in the factor pool [12]. Investors can judge whether the current price of the stock is reasonable according to the valuation of the listed company and have a reasonable expectation of the company's development prospects. Valuation factors have significant differences among different industries [13]. For example, the investment value of stocks with low price-to-book ratio is large and relatively stable. For example, in manufacturing industry, banks generally have a price-to-book ratio of about 1.5. On the contrary, technology companies with large growth space, such as Pinduoduo and Meituan, have a price-to-book ratio of about 10. By changing the index and index value range, the annualized return rate of 17.71% and annualized alpha were achieved at the P/E ratio of 20 to 40, P/B ratio of 1 to 1.5, and P/B ratio of 2 to 3 α 17.36% of the back-test data. The factor range is shown in Table 7.

Table 7. Stock selection factors

Stock selection factors		
Valuation factors	Value range	
	Minimum	Maximum
P/E ratio	20.00	40.00
P/B ratio	1.00	1.50
Cash to market ratio	2.00	3.00

Specific data are shown in Table 8.

Table 8. Test result

test result	
test income	60.18%
test annualized income	17.71%
Benchmark income	-5.49%
Benchmark annualized income	-1.94%
Accumulated Net	1.602
Maximum withdrawal rate of excess return	6.8354
Annual win rate	0.6667
Quarterly win rate	0.5000
Monthly win rate	0.5000
daily win rate	0.4808
alpha	0.1736
Beta	0.4875
Sharp ratio	0.6705
Sortino ratio	1.1067
Information ratio	0.8036
Annualized volatility	0.2531
maximum drawdown	25.87%
Annualized tracking error	0.2552
Annualized downward volatility	0.1533

The annual income of the strategy is shown in Graph 4:

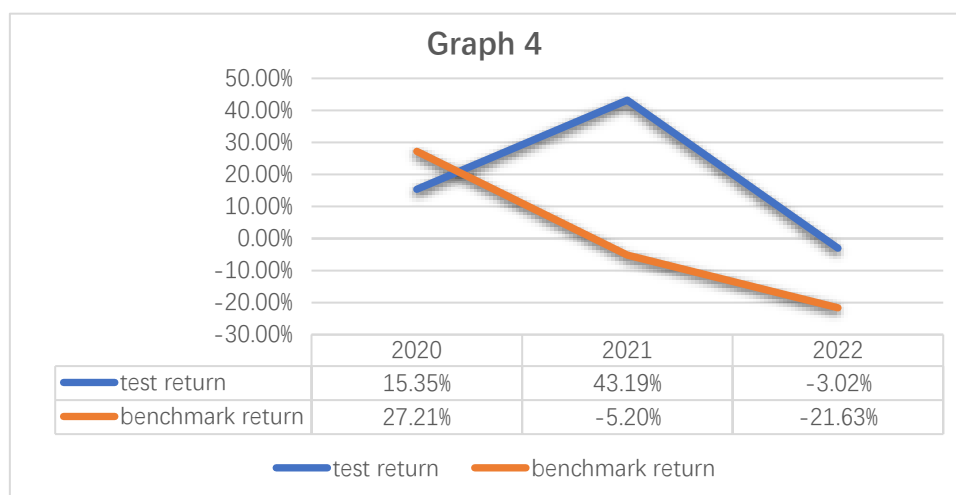


Figure 4. Backtest return on Valuation indicators

As can be seen from Figure 4, the yield of the backtesting period first rose and then fell in the past three years. In 2020, it was 15.35%, lower than the average market yield of 27.21% over the same period, but in 2021 it rose sharply to 43.19%. Although yields have fallen significantly in 2022 (-3.02%), they are still far better than benchmark earnings.

3. Conclusion

This paper uses the fundamental multi-factor stock selection strategy to experiment with financial indicators from four aspects: solvency, growth ability, operating ability and valuation, and obtains four backtest results with positive returns from 2020 to 2022. In the growth capacity indicator, the annualized return of 5.94% was obtained by valuation screening of four variables: basic earnings per share, operating profit, total assets and total operating income. In terms of solvency, this paper tests three variables: asset-liability ratio, current ratio and working capital, and finally obtains a backtest result of 6.27%. In terms of operating capacity, an annualized rate of return of 11.27% was obtained

through the study of total asset turnover and accounts receivable turnover. This article suggests that investors can optimize and adjust their investment methods through the above backtest results, and increase the reference indicators as much as possible, which will help reduce the error. However, multi-factor stock selection has certain risks and timeliness, and investors need to adjust and update according to their own experience and market conditions, which is the deficiency of multi-factor stock selection strategy. However, multi-factor stock selection is based on financial indicators, and it is meaningful to set and filter the values of correlation factors to obtain a stock portfolio with higher returns.

References

- [1] Huang Huiyu. Empirical Study on Main Financial Indicators and Stock Price Changes of Listed Companies [J]. Hebei Enterprise, 2021000 (007): 102-104.
- [2] Wang Jinbiao. On the thinking of fundamental stock selection [J]. Contemporary Economy, 2011000 (013): 132-133.
- [3] Liu Yang, Xia Siyu, Hu Sirui, Lin Siliang. Research on quantitative stock selection of GARP and timing strategy of Markov chain [J]. Finance and Economics, 2016 (05): 66-71. DOI: 10.19622/j.cnki.cn36-1005/f.2016.05.013.
- [4] Liang Xiaoying. Research on quantitative stock selection method based on multi-factor model [J]. China Market, 2021 (25): 31-32. DOI: 10.13939/j.cnki.zgsc.2021.25.031.
- [5] Wang Binyan, Lin Cong. Research on multi-factor quantitative investment model based on value mining [J]. China Economic and Trade, 2020, (24): 153-154.
- [6] McCrory, P, Meeuwisse, et al. Consensus Statement on Concussion in Sport-the 4th International Conference on Concussion in Sport Held in Zurich, November 2012 [J]. Clinical Journal of Sport Medicine, 2013.
- [7] Zhao Di. Research on multi-factor stock selection strategy based on machine learning method [J]. Economic Research Guide, 2022, (2): 106-108.
- [8] Li Ning. Analysis of financial indicators of Huaxia Happiness's solvency [J]. Cooperative Economy and Technology, 2022, (20): 145-147.
- [9] Enyi E P. Corporate Solvency Management: How Effective are Contemporary Tools? [J]. 2011.
- [10] Wang Xin. Research on corporate solvency index [J]. Li Ren: Teacher, 2016000 (006): P.270-270.
- [11] Han Xuejiao. Analysis of enterprise operating capacity based on financial indicators [J]. New Economy, 2016000 (7): 18-19.
- [12] Downing C, Stanton R, Wallace N. An Empirical Test of a Two-Factor Mortgage Valuation Model: How Much Do House Prices Matter? [J]. Research Program in Finance, Institute for Business and Economic Research, UC Berkeley, 2005.
- [13] Xu Bozhi, Liu Pengyang, Wang Zexin, Cao Junfan, Zhang Lixun. On the valuation method of stock (equity) based on the P/E ratio, P/B ratio and P/S ratio of enterprise growth [J]. China Market, 2022, (11): 8-12.