

Project II: Long-Short Portfolio Based on Factor Analysis

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1. Part 1 (3 marks)

In this project, we attempted to find out the characteristics of exposure to different financial factors in the Shenwan level 1 industry and whether the industry has more/less exposure to the market in a certain factor means that the factor has significant stock selection ability in the industry, as well as whether de-extremization, normalization, and neutralization would affect the results.

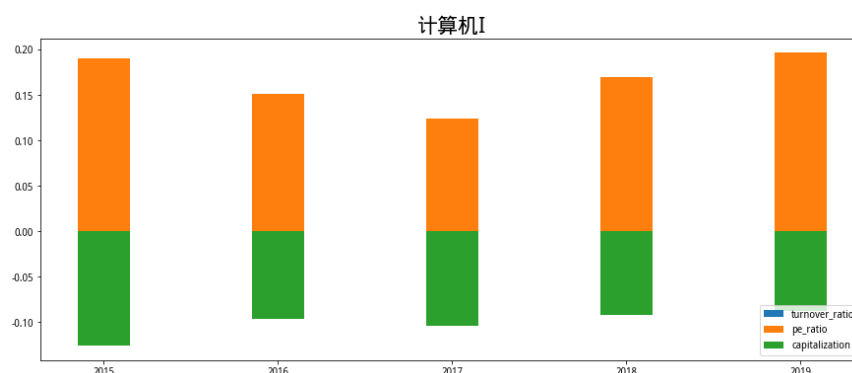
First, we selected turnover ratio, PE ratio and capitalization as our research factors. Second, we obtained the average rank of industry stocks in the market to calculate industry exposures and selected the first and last industry of each factor according to their exposures. They are computer industry, Machinery Equipment industry, Banking industry and National Defense and Military industry respectively. Third, we grouped the industries depending on the order of factor values and calculated the returns of each group. The first group and the fifth group were used to construct the long-short portfolio and NAVs are calculated as the spreads between the two groups of each industry, along with excess returns, annualized returns, annualized volatility, the Sharpe ratios, and maximum drawdowns. Fourth, we winsorised, standardised, and neutralised financial factors for stocks by their market value and by the industry they are belong to and repeated step 3 based on processed data. Finally, we compared the results in step 3 and step 4 and found that de-extremization, normalization and neutralization made the results different and decreased factor's stock selection ability. However, data process strengthened the relationship between exposure industry characteristics and factor stock selection ability.

2. Part 2 (3 Marks)

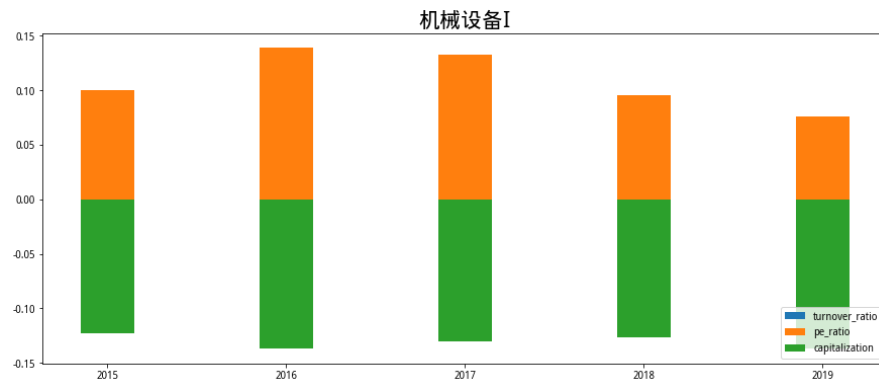
● Summary

In this part, we calculated industry exposures on different investment factors and analysed the visualised results.

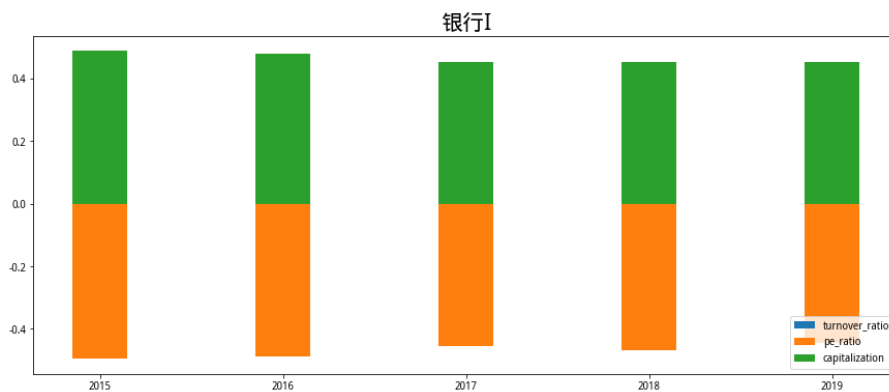
● Results



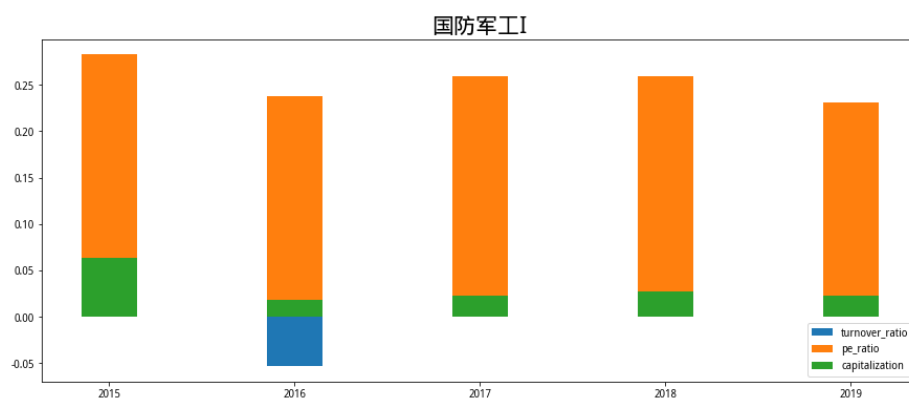
Computer industry is mostly exposed to PE ratio (about 0.17 on average) and capitalization (about -0.10 on average). However, turnover ratio seems not one of this industry's exposure factors.



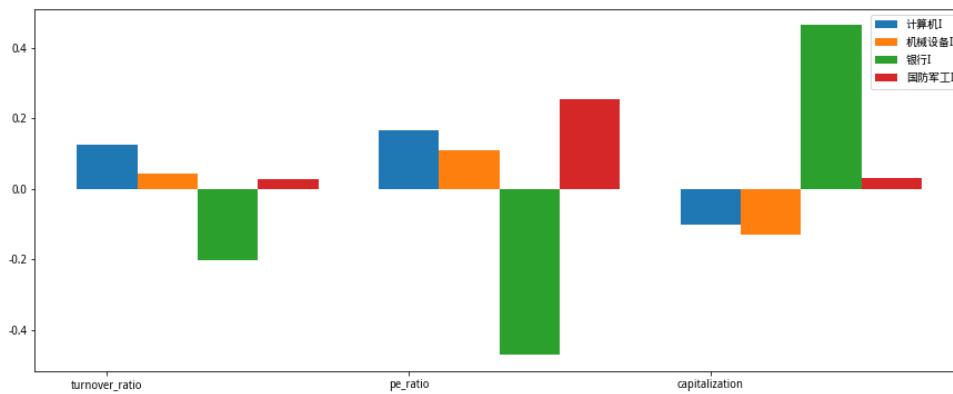
Machinery Equipment industry is quite similar to Computer industry, so we dropped this industry in the following analysis to simplify our results.



Banking industry is contrary to Computer industry in terms of the direction of factor exposure. Moreover, Banking industry is exposed more than Computer industry to PE ratio (< -0.40) and capitalization (> 0.40).



National Defense and Military industry has positive exposures on PE ratio and capitalization while merely appeared little turnover ratio exposure in 2016 (-0.05). This industry has a higher exposure to PE ratio than capitalization which is very small, no more than 0.05 on average.



Turnover ratio has the lowest exposure of the four industries among the three factors. Banking industry is mostly exposed to the three factors.

● Discussion

We found that Banking industry is characterized with high exposures in investing factors. National Defense and Military industry has the nature of low exposures except for PE ratio. Computer industry and Machinery Equipment industry have similar characteristics in terms of factor exposures.

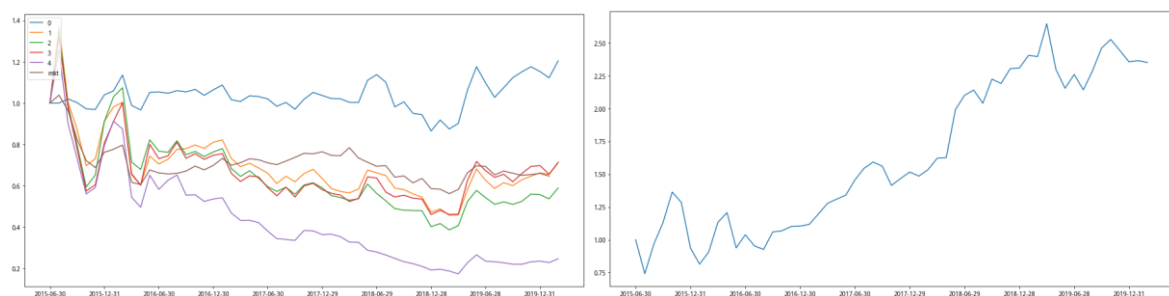
3. Part 3 (9 Marks)

● Summary

In this section, we constructed our monthly rebalanced long-short portfolios based on above factors and industries. The results demonstrate the performance of our portfolios to test the stock selection ability of each factor and the relationship between exposures and stock selection ability of each factor.

● Results

■ Computer industry (turnover ratio)



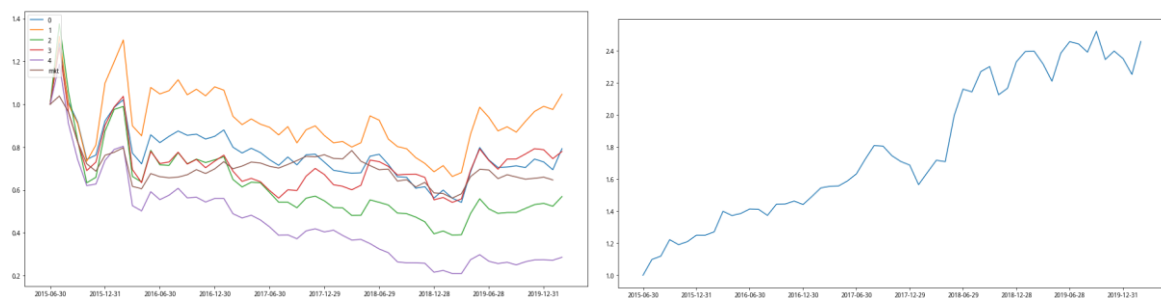
	zero	first	second	third	fourth	0-4
策略收益	0.20	-0.29	-0.41	-0.29	-0.75	1.35
策略年化收益	0.04	-0.07	-0.11	-0.07	-0.26	0.20

	zero	first	second	third	fourth	0-4
夏普比率	-0.00	-0.27	-0.33	-0.24	-0.66	0.43
最大回撤	0.24	0.67	0.71	0.65	0.86	0.40
年化波动率	0.18	0.41	0.44	0.47	0.45	0.37

Turnover ratio has a better ability to earn the spreads of the portfolio returns between high group and low group, revealing a better stock selection ability.

In addition, this long-short portfolio has a high proceed of 0.20 annualized returns and a high Sharpe ratio of 0.43. However, maximum drawdowns and volatility are also very high, nearly 0.4. This means a high return accompanied with a high risk.

Computer industry (PE ratio)

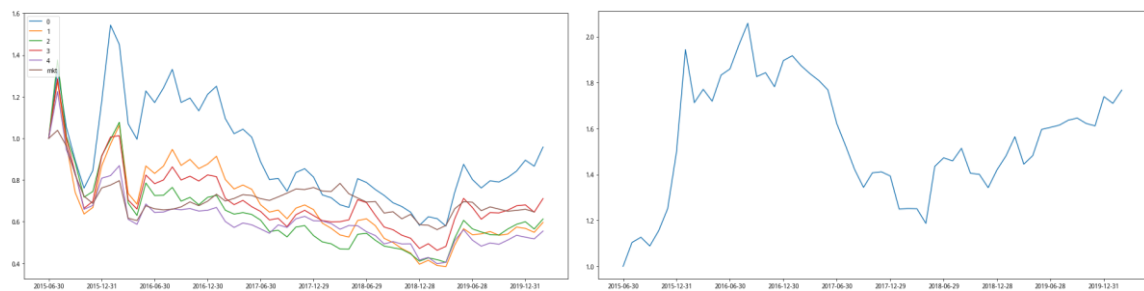


	Zero	first	second	third	fourth	0-4
策略收益	-0.21	0.05	-0.43	-0.22	-0.71	1.46
策略年化收益	-0.05	0.01	-0.11	-0.05	-0.23	0.21
夏普比率	-0.26	-0.08	-0.36	-0.24	-0.77	1.05
最大回撤	0.58	0.50	0.72	0.57	0.82	0.13
年化波动率	0.34	0.40	0.42	0.38	0.36	0.16

PE ratio is not a good stock selected factor since 0 portfolio returns are very closed to 4 portfolio returns.

However, the performance of this long-short portfolio is very astonishing. Compared with turnover ratio, this strategy brought a higher return and a lower risk because maximum drawdowns is only 0.13 and volatility is only 0.16.

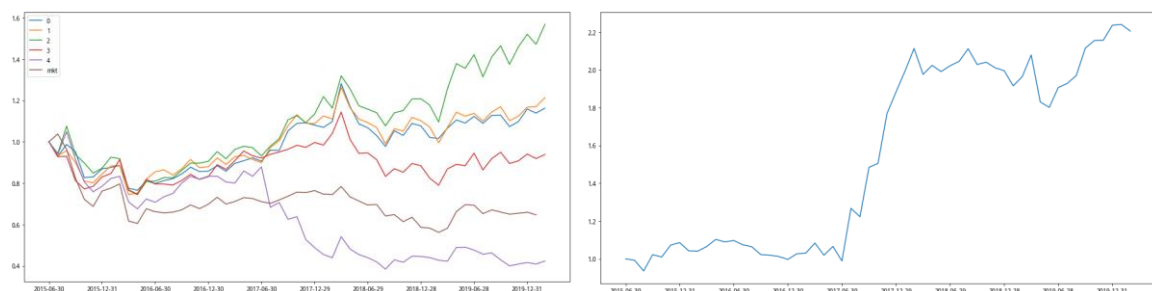
Computer industry (capitalization)



	zero	first	second	third	fourth	0-4
策略收益	-0.04	-0.40	-0.39	-0.29	-0.45	0.77
策略年化收益	-0.01	-0.10	-0.10	-0.07	-0.12	0.13
夏普比率	-0.11	-0.35	-0.34	-0.28	-0.48	0.34
最大回撤	0.63	0.70	0.71	0.64	0.68	0.42
年化波动率	0.45	0.41	0.41	0.40	0.33	0.26

Similar to PE ratio, capitalization has a bad stock selection ability in computer industry. Besides, its strategy returns is lower than PE ratio with a higher risks. So, its Sharpe ratio is lower than above strategies.

Banking (turnover ratio)

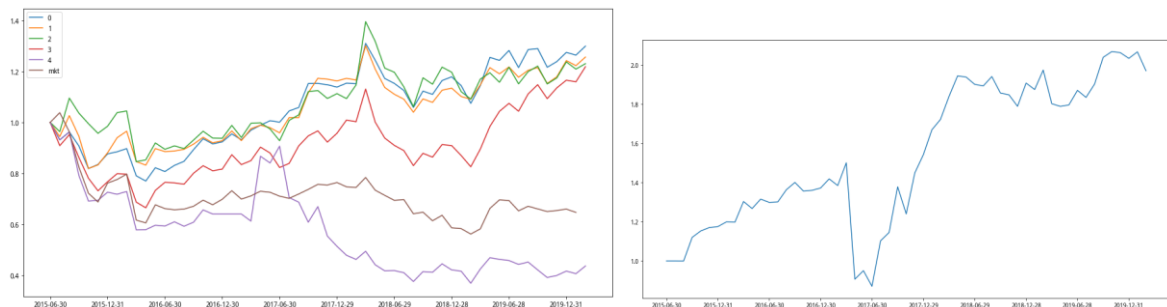


	zero	first	second	third	fourth	0-4
策略收益	0.16	0.21	0.57	-0.06	-0.58	1.21
策略年化收益	0.03	0.04	0.10	-0.01	-0.17	0.18
夏普比率	-0.04	0.01	0.28	-0.28	-0.76	0.64

	zero	first	second	third	fourth	0-4
最大回撤	0.24	0.26	0.31	0.31	0.63	0.15
年化波动率	0.18	0.19	0.22	0.19	0.27	0.22

As for Banking industry, turnover ratio has a good stock selection ability. Besides, its returns and risks revealed by annualized returns and volatility are excellent.

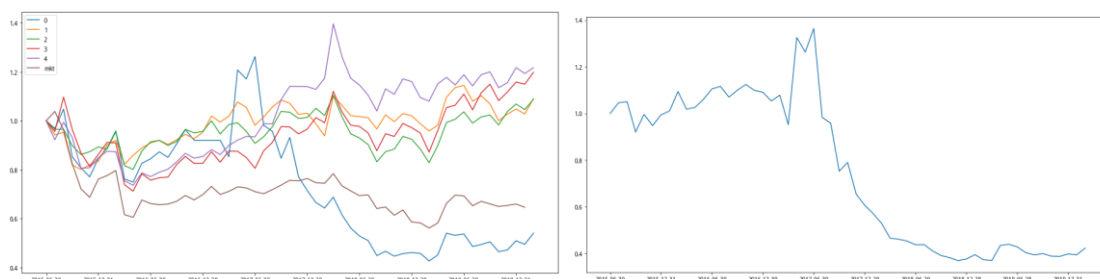
■ Banking (PE ratio)



	zero	first	second	third	fourth	0-4
策略收益	0.30	0.26	0.23	0.22	-0.56	0.97
策略年化收益	0.06	0.05	0.04	0.04	-0.16	0.15
夏普比率	0.10	0.05	0.02	0.01	-0.60	0.39
最大回撤	0.23	0.20	0.24	0.34	0.63	0.42
年化波动率	0.17	0.17	0.21	0.20	0.33	0.29

PE ratio has a significant stock selection ability since the difference between 0 portfolio returns and 4 portfolio returns are considerably huge from the figures. However, the performance of its strategy seems not very satisfying due to a 0.42 maximum drawdowns.

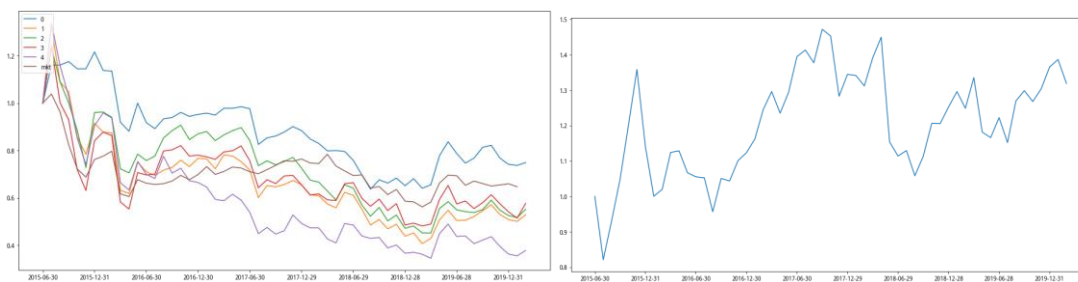
■ Banking (capitalization)



	zero	first	second	third	fourth	0-4
策略收益	-0.46	0.09	0.09	0.20	0.22	-0.58
策略年化收益	-0.12	0.02	0.02	0.04	0.04	-0.17
夏普比率	-0.47	-0.12	-0.13	-0.01	0.01	-0.65
最大回撤	0.66	0.20	0.25	0.35	0.26	0.73
年化波动率	0.35	0.18	0.17	0.22	0.19	0.32

Capitalization has a significant stock selection ability since the gap between 0 portfolio and 4 portfolio. However, we need to long low group and short high group instead of longing high group portfolio and shorting low group portfolio.

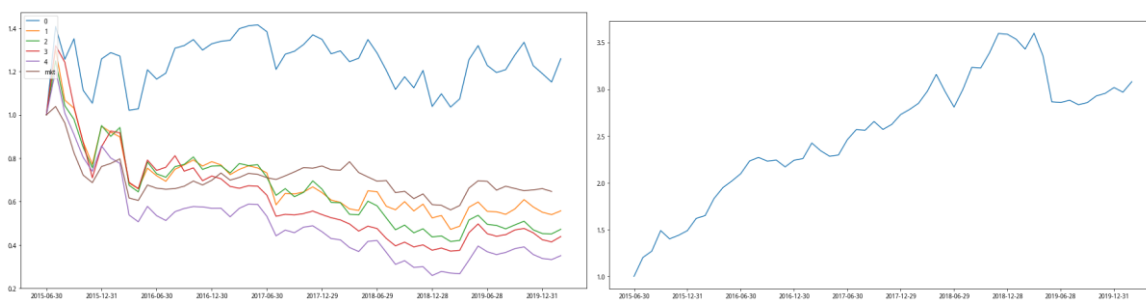
■ National Defense and Military industry (turnover ratio)



	zero	first	second	third	fourth	0-4
策略收益	-0.25	-0.47	-0.45	-0.42	-0.62	0.32
策略年化收益	-0.06	-0.13	-0.12	-0.11	-0.19	0.06
夏普比率	-0.46	-0.49	-0.49	-0.38	-0.58	0.08
最大回撤	0.48	0.69	0.63	0.61	0.74	0.30
年化波动率	0.22	0.34	0.33	0.39	0.39	0.27

Turnover ratio is not a good stock selecting factor for National Defense and Military industry since the gaps between each portfolio are very narrow. The performance of this strategy is also worse than other strategies.

■ National Defense and Military industry (PE ratio)

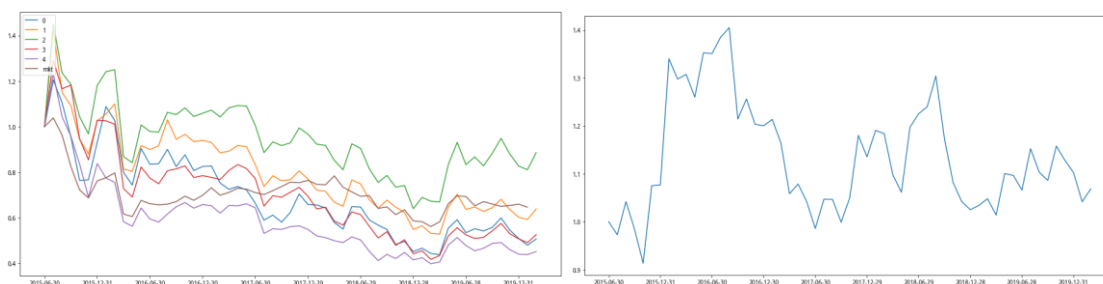


	zero	first	second	third	fourth	0-4
策略收益	0.26	-0.44	-0.53	-0.56	-0.65	2.08
策略年化收益	0.05	-0.12	-0.15	-0.16	-0.20	0.27
夏普比率	0.03	-0.48	-0.56	-0.60	-0.70	1.20
最大回撤	0.27	0.64	0.67	0.72	0.79	0.21
年化波动率	0.32	0.33	0.34	0.33	0.34	0.19

PE ratio is significant in stock selection and a promising NAV which grows from 1 to 3.0.

Meanwhile, the performance of the strategy is also excellent with a 1.2 Sharpe ratio and 0.21 maximum drawdowns.

■ National Defense and Military industry (capitalization)



	zero	first	second	third	fourth	0-4
策略收益	-0.49	-0.36	-0.11	-0.47	-0.55	0.07
策略年化收益	-0.13	-0.09	-0.03	-0.13	-0.15	0.01
夏普比率	-0.50	-0.37	-0.17	-0.50	-0.66	-0.11

	zero	first	second	third	fourth	0-4
最大回撤	0.64	0.63	0.56	0.68	0.68	0.30
年化波动率	0.35	0.36	0.38	0.33	0.30	0.23

Capitalization has a poor stock selection ability for National Defense and Military industry. Its NAV also fluctuates in a narrow range. Besides, the returns of this strategy is low burdened with high risks.

● Discussion

Exposures

	Computer	Banking	National Defense & Military
Turnover ratio	Low	Low	Low
PE ratio	High	High	High
Capitalization	High	High	Low

Stock Selection Ability

	Computer	Banking	National Defense & Military
Turnover ratio	High	High	Low
PE ratio	Low	High	High
Capitalization	Low	High	Low

Comparing the above two tables, we can see that more than half of the combinations are consistent with corresponding exposures of stock selection ability. This means industry characteristics of exposure might not have impacts on our factor stock selection ability. It is noticeable that nearly all of our strategy returns are higher than market portfolio. This means our long-short strategies created an excess return and they are effective.

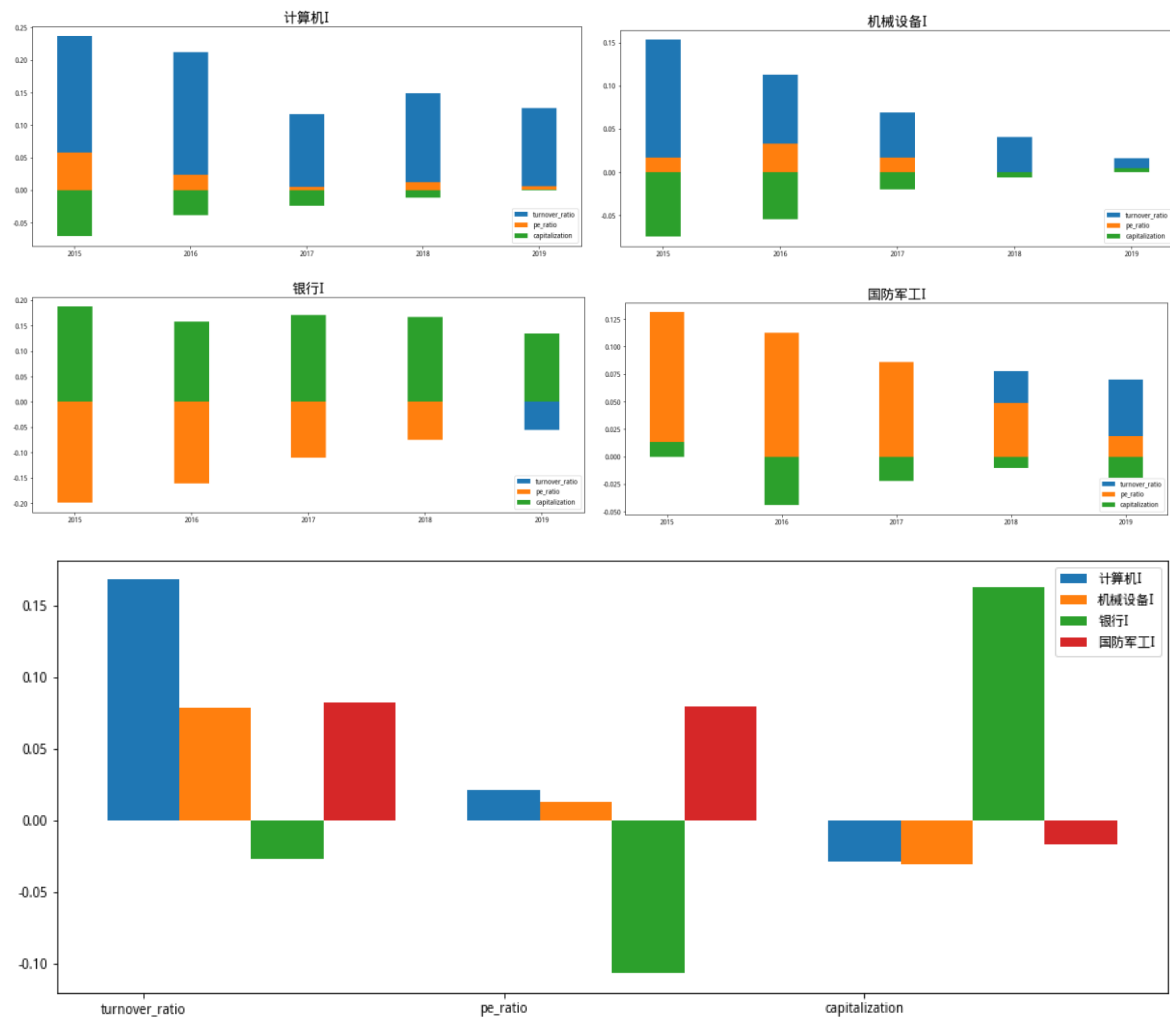
4. Part 4 (6 Marks)

● Summary

In this part, we winsorised, standardised and neutralised financial factors for stocks by their market value and by their industries and redid the analysis in part 3. Through comparing the results, we discussed whether we should use processed factors to select stocks.

● Results

● Factor exposures



From above figures, industry exposures under turnover ratio becomes extremely high of Computer and Machinery Equipment, which is quite different with former results. However, the similar characteristics of the two industries remain unchanged. The other two industries seems no great changes.

● Stock Selection ability

Stock Selection Ability

	Computer	Banking	National Defense & Military
Turnover ratio	High	Low	Middle
PE ratio	Low	Low	High
Capitalization	Low	Low	Low

The stock selection ability of each factor decreases. This means de-extremization, normalization, and neutralization would affect the results negatively.

Exposures

	Computer	Banking	National Defense & Military
Turnover ratio	High	Low	Low
PE ratio	Low	High	High
Capitalization	Low	High	Low

The consistence between exposures and stock selection ability improved after de-extremization, normalization and neutralization. This means industry characteristics would affects the stock selection ability and they are positively related.

● Discussion

We got different results before and after de-extremization, normalization, and neutralization. And concluded that exposures can affect factor's stock selection ability. Additionally, we think de-extremization, normalization and neutralization are necessary for the following reasons:

Due to the existence of outliers or different dimensions, each factor value of the stock cannot be directly calculated in the following way. Therefore, data cleaning is a very necessary process to avoid possible data errors and extreme data affecting the test results. Standardized data can be used to ensure the robustness of the resulting model. Data cleaning mainly includes two parts, processing of outliers and missing values. Since the common extremum method of 3 is based on the assumption that the sample is normally distributed, it is often found that the distribution of most factors is not normally distributed, and the thick-tailed distribution is more common. So, we applied a more robust method, Median Absolute Deviation.

To summary, if an industry is characterized with more exposure under certain factor, the stock selection ability is revealed to be higher than less exposed industries. This conclusion is based on de-extremization, normalization and neutralization of factors. Otherwise, the relation would be uncertain. Besides, factor processed results are more accurate since data cleaning avoids data errors and make the data more predictable.

Reference

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