

Volume, Price and Fundamental Factors

Zehua Cheng

8/9/2023

Intro

This report presents a comprehensive backtesting analysis of various investment factors and strategies, with a particular focus on integrating findings from two research reports. Our analysis spans multiple dimensions: from fundamental factors to industry rotation strategies, examining both individual and composite factors' effectiveness in the Chinese market.

The study is structured around four main components. First, we establish a robust backtesting framework where it splits the investable market into 5 groups, and backtest the long/short performances according to the generated signals to ensure reliable evaluation of our strategies. Second, we replicate and analyze industry-specific factors, examining both volume and price indicators alongside industry rotation approaches. Third, we investigate industry allocation through the lens of quantitated fundamental research models while reproducing fundamental factors. Finally, we explore the effectiveness of compound factors derived from combining insights across two research reports.

Our preliminary findings suggest that certain fundamental indicators - specifically sales-to-profit ratio, equity multiplier, and cost of equity - demonstrate superior predictive power in backtesting. We also observe that while composite factors generally show more stable excess returns and smaller maximum drawdowns compared to individual factors, their performance has shown some decline since 2021, particularly in fundamental composite factors' rankIC.

This research aims to provide insights into factor investing in the Chinese market while evaluating the practical effectiveness of combining multiple factor approaches. The findings have important implications for portfolio management and factor investing strategies in the Chinese equity market.

Table of Contents

1. *Backtesting Framework structure*
2. *Replication of industry effective volume and price factors and industry rotation strategies*
3. *Looking at the direction of industry allocation through the residual income model and reproduction of fundamental factors*
4. *Compound factor based on two research reports*
5. *Conclusion*

1 公司介绍

1.

Backtesting Framework Structure

Backtesting Function: back_test_v2(factor_df, sec_name_df, trd_dt, start_dt, end_dt, assign = False, rate = 0.002, freq_str = 5, num_grps_int=5, delay_int = 1, show_plots = True, show_table = True)

factor_df: Imported/or generated factor dataframe with columns TrdDt, Industry 1, Industry 2, etc.

sec_name_df: Imported stock code-industry code mapping, used to find/compare stocks and industries

trd_dt : EOD stock trading data, including IdxCd, TrdDt, PreClIdx, OpnIdx, HlIdx, LIdx, ClsIdx, nShrTrd, nValTrd, etc.

start_dt/assign[0]: Backtest start datetime

end_dt/assign[-1]: Backtest end datetime

assign (Optional) : Specified position adjustment date. If not specified, position will be automatically adjusted according to the frequency of trading. If specified backtest start and end dates, the assigned dates will take priority.

rate (Optional) : Transaction rate, default is 0.002 fixed rate.

freq_str (Optional) : Position rebalance frequency, default to 5 days

num_grps_int (Optional) : number of groups/quantiles for ranking, default to 5

delay_int (Optional) : The number of days delayed to obtain the signal to avoid look ahead, default to 1

show_plots (Optional) : Whether to display the result plots including absolute returns, relative returns, etc.

Replication of industry effective volume and price factors and industry rotation strategies

1 Momentum

1.1 Simple momentum

1.2 Second-order momentum

1.3 Momentum spread

2 Trading Volatility

2.1 Transaction amount vol

2.2 Transaction volume vol

3 Turnover

3.1 Turnover rate

4 Long-short

4.1 Total amount of Long-short

4.2 Long-Short Difference

5 Volume-price Divergence

5.1 Volume-price Covariance

5.2 correlation Coefficient

5.3 First-order Coefficient Difference

6 Magnitude Factors

7 Composite factor

Factors that outperformed were labeled as red

Momentum

2.1.1 Simple momentum factor cannot effectively predict industry trends

2.1.2 Second-order momentum

Momentum is the first-order function of price. We subtract the past momentum from the latest momentum to get the difference between momentum, that is, the second-order momentum of price. It can be understood as the improvement of the simple momentum. We have performed an exponentially weighted moving average of the second-order momentum in some past period, and the factor is calculated as:

$$\text{Factor} = \text{EWMA} \left(\frac{\text{Close}_t - \text{mean}(\text{Close}_{t-\text{window}1:t})}{\text{mean}(\text{Close}_{t-\text{window}1:t})} \right) - \text{delay} \left(\frac{\text{Close}_t - \text{mean}(\text{Close}_{t-\text{window}1:t})}{\text{mean}(\text{Close}_{t-\text{window}1:t})}, \text{window}_2 \right), \text{window}$$

Where:

window_1 :简单动量的窗口期

window_2 :两个简单动量之间的窗口期

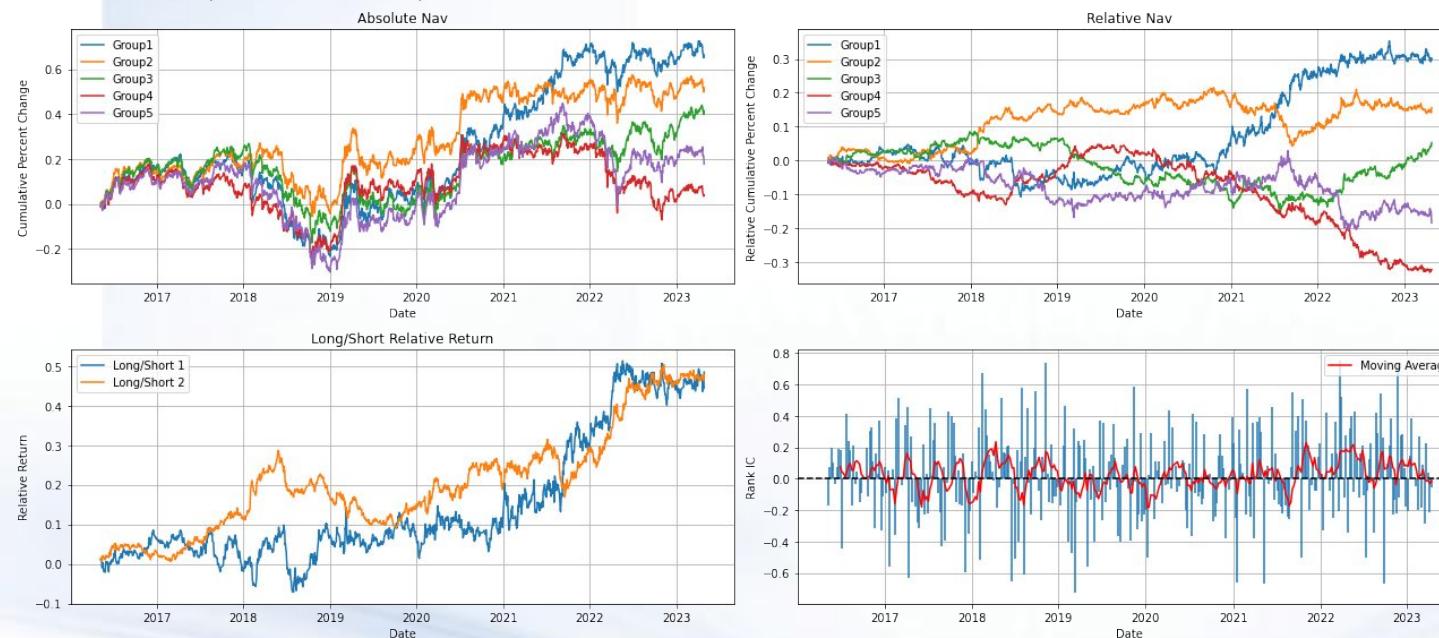
window :对二阶动量计算指数加权移动平均的窗口期

window for the simple momentum

window between the 2 simple momentum

window for EWMA

Take $\text{window}1 = 10$, $\text{window}2 = 20$, $\text{window} = 5$, and the backtest results:



Freq	Long Excess	Long Sharpe	Long Calmar	L/S Returns	L/S Sharpe	L/S Calmar	Long WR	L/S WR	rankIC	Short WR	Long TO	Short TO
0	5	4.53%	0.14	0.3	6.85%	0.62	0.46	-6.5%	-15.05%	2.36%	50.56%	51.45%

Rolling Rebalancing frequency backtest results

5 day rebalance frequency

	Start Date	Freq	多头超额	多头Sharpe	多头Calmar	多空收益	多空Sharpe	多空Calmar	多头扣费	多空扣费	rankIC	多头胜率	空头胜率	多头换手	空头换手
0	4-Day Priv	5	6.36%	0.42	0.74	10.59%	0.76	1.24	-4.76%	-11.36%	1.9%	51.81%	51.45%	110.32%	107.44%
1	3-Day Priv	5	6.43%	0.85	0.54	11.04%	0.85	0.94	-4.65%	-11.0%	1.43%	51.34%	51.69%	109.92%	108.73%
2	2-Day Priv	5	1.83%	-0.09	0.16	5.7%	0.32	0.47	-9.4%	-16.49%	2.57%	49.26%	50.27%	111.41%	108.73%
3	1-Day Priv	5	6.27%	0.35	0.56	12.49%	0.95	1.11	-4.62%	-9.26%	1.47%	50.45%	51.99%	108.04%	107.74%
4	Origin	5	4.53%	0.14	0.30	6.85%	0.62	0.46	-6.5%	-15.05%	2.36%	50.56%	51.45%	109.42%	107.84%
5	1-Day After	5	5.83%	0.34	0.67	9.97%	0.67	1.14	-5.28%	-11.94%	1.7%	51.69%	51.34%	110.22%	107.14%
6	2-Day After	5	6.2%	0.80	0.51	10.73%	0.79	0.90	-4.88%	-11.29%	1.25%	51.22%	51.69%	109.92%	108.53%
7	3-Day After	5	1.4%	-0.15	0.12	5.08%	0.23	0.40	-9.85%	-17.15%	2.35%	49.14%	50.21%	111.61%	108.93%
8	4-Day After	5	6.39%	0.35	0.56	12.55%	0.94	1.10	-4.52%	-9.23%	1.32%	50.5%	51.99%	108.23%	107.84%

20 day rebalance frequency

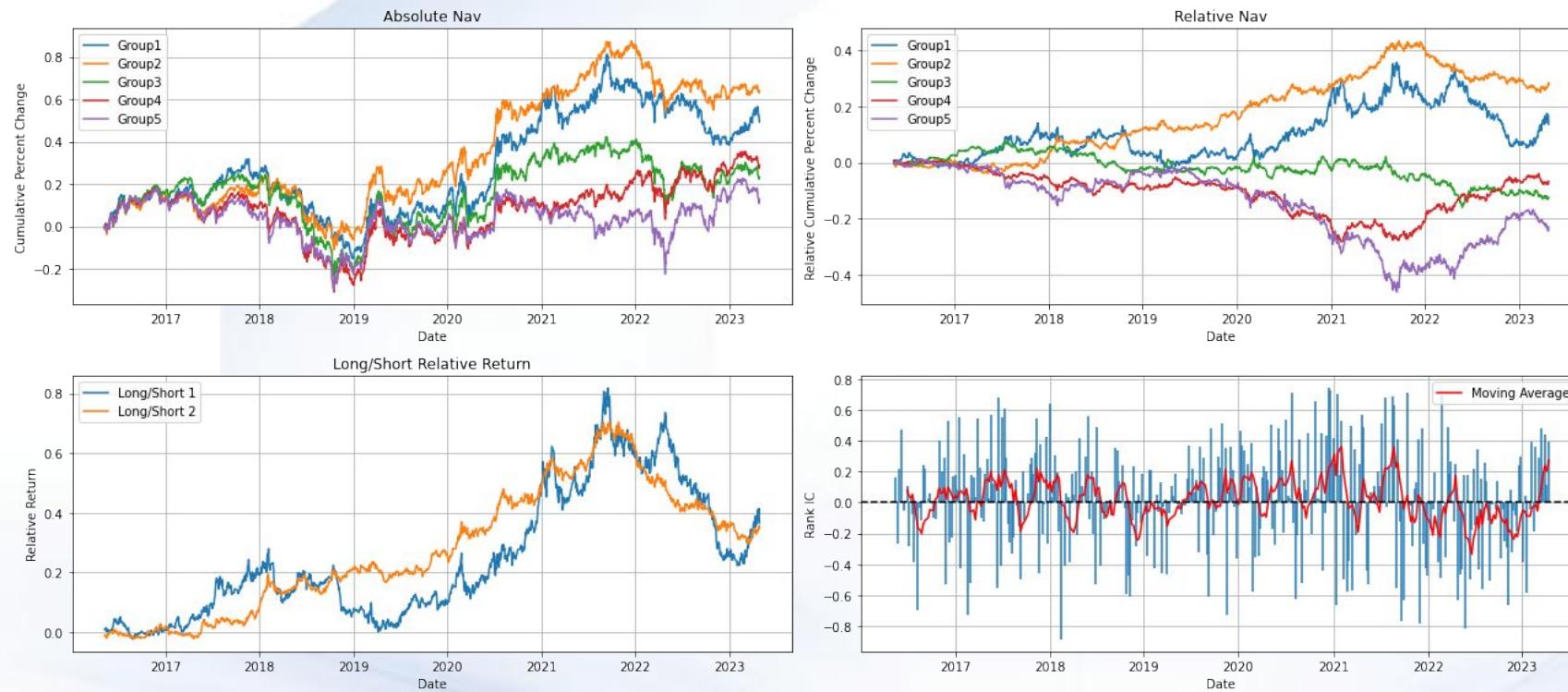
24	13-Day Priv	20	2.04%	0.04	0.08	6.23%	0.44	0.23	-2.56%	-3.05%	7.81%	49.1%	50.9%	182.52%	185.37%
25	12-Day Priv	20	5.12%	0.32	0.35	9.21%	0.66	0.63	0.49%	-0.09%	6.69%	50.36%	51.02%	183.74%	185.37%
26	11-Day Priv	20	6.73%	0.37	0.37	12.9%	0.86	0.71	2.15%	3.7%	3.88%	50.48%	51.45%	181.71%	183.33%
27	10-Day Priv	20	4.13%	0.15	0.13	8.82%	0.43	0.30	-0.53%	-0.46%	2.25%	50.3%	49.52%	184.96%	183.33%
28	9-Day Priv	20	3.31%	-0.08	0.11	4.76%	-0.05	0.17	-1.38%	-4.58%	1.32%	49.94%	49.76%	186.18%	184.55%
29	8-Day Priv	20	-0.71%	-0.41	-0.01	0.62%	-0.27	0.04	-5.33%	-8.67%	2.54%	50.08%	50.54%	183.33%	184.96%
30	7-Day Priv	20	1.05%	-0.04	0.09	5.28%	0.34	0.32	-3.5%	-3.93%	4.96%	49.52%	52.05%	180.49%	184.96%
31	6-Day Priv	20	0.29%	-0.00	0.04	4.59%	0.45	0.27	-4.24%	-4.57%	4.98%	48.86%	51.75%	180.08%	183.33%
32	5-Day Priv	20	1.43%	0.23	0.08	4.32%	0.41	0.23	-3.12%	-4.94%	3.89%	50.06%	52.41%	180.49%	186.99%
33	4-Day Priv	20	-0.26%	-0.08	-0.00	2.31%	0.20	0.11	-4.85%	-6.95%	3.42%	50.42%	51.75%	182.11%	185.37%
34	3-Day Priv	20	1.66%	0.09	0.09	2.83%	0.12	0.15	-2.93%	-6.43%	0.26%	51.39%	51.93%	182.11%	185.37%
35	2-Day Priv	20	1.01%	-0.12	0.07	-1.64%	-0.40	-0.09	-3.56%	-10.95%	2.69%	50.06%	49.28%	181.3%	188.21%
36	1-Day Priv	20	5.54%	0.52	0.50	6.81%	0.45	0.61	0.93%	-2.49%	5.07%	51.2%	51.02%	182.93%	185.77%
37	Origin	20	6.28%	0.74	0.49	9.24%	0.89	0.75	1.64%	-0.1%	5.57%	50.42%	52.59%	184.15%	186.59%
38	1-Day After	20	3.69%	0.16	0.20	8.61%	0.49	0.47	-0.92%	-0.7%	5.24%	48.67%	52.05%	182.93%	186.59%
39	2-Day After	20	3.59%	0.50	0.17	9.34%	0.81	0.44	-1.0%	0.13%	5.76%	49.04%	52.65%	182.11%	183.33%
40	3-Day After	20	2.43%	0.24	0.09	5.25%	0.44	0.20	-2.21%	-4.08%	5.95%	50.6%	50.96%	184.15%	186.18%
41	4-Day After	20	4.1%	0.31	0.18	9.28%	0.69	0.40	-0.5%	0.04%	7.08%	50.3%	51.33%	182.52%	184.15%
42	5-Day After	20	4.14%	0.26	0.22	8.57%	0.58	0.43	-0.48%	-0.69%	8.64%	49.7%	50.54%	183.33%	184.15%
43	6-Day After	20	5.26%	0.35	0.30	10.37%	0.86	0.56	0.59%	1.02%	7.49%	50.18%	51.99%	185.37%	185.77%
44	7-Day After	20	2.3%	0.09	0.09	6.93%	0.52	0.26	-2.31%	-2.36%	8.13%	49.34%	51.14%	182.93%	185.37%
45	8-Day After	20	5.74%	0.42	0.41	10.38%	0.80	0.73	1.1%	1.07%	7.37%	50.54%	51.39%	184.15%	185.37%
46	9-Day After	20	7.43%	0.42	0.39	14.27%	0.95	0.76	2.84%	5.06%	4.42%	50.54%	51.75%	182.11%	183.33%
47	10-Day After	20	4.98%	0.27	0.16	9.82%	0.52	0.34	0.31%	0.54%	2.51%	50.36%	49.76%	184.96%	183.33%
48	11-Day After	20	3.97%	0.05	0.15	5.56%	0.07	0.22	-0.73%	-3.79%	1.05%	49.94%	50.0%	186.18%	184.55%
49	12-Day After	20	-0.07%	-0.42	-0.01	1.03%	-0.31	0.03	-4.68%	-8.24%	2.18%	50.0%	50.42%	182.93%	184.96%
50	13-Day After	20	1.52%	-0.12	0.06	5.44%	0.23	0.27	-3.02%	-3.76%	4.51%	49.34%	51.93%	180.08%	184.96%

2.1.3 Momentum Spread

The higher the long-term momentum, the better the momentum sustainability, while the higher the short-term momentum usually represents a more crowded track. The spread is the long-term momentum minus short-term momentum. It can be understood as taking out the short-term crowded sectors from the long-term sustainable sectors.

$$\text{Factor} = \frac{\text{Close}_t - \text{Close}_{t-\text{window}1}}{\text{Close}_{t-\text{window}1}} - \frac{\text{Close}_t - \text{Close}_{t-\text{window}2}}{\text{Close}_{t-\text{window}2}}, \text{ where: } \begin{array}{l} \text{window}_1 : \text{长期动量的窗口期} \\ \text{window}_2 : \text{短期动量的窗口期} \end{array}$$

Take window1 = 180, window2 = 10



Window for long-term momentum
Window for short-term momentum

Freq	Long Excess	Long Sharpe	Long Calmar	L/S Returns	L/S Sharpe	L/S Calmar	Long WR	L/S WR	rankIC	Short WR	Long TO	Short TO
0	5	2.59%	0.54	0.07	6.02%	1.4	0.18	0.21%	1.42%	2.1%	51.51%	55.37%

2.1.3 Momentum Spread

Rolling Rebalancing frequency backtest results

5 day rebalance frequency

	Start Date	Freq	多头超额	多头 Sharpe	多头 Calmar	多空收益	多空 Sharpe	多空 Calmar	多头扣费	多空扣费	rankIC	多头胜率	空头胜率	多头换手	空头换手
0	4-Day Priv	5	2.81%	0.51	0.09	6.01%	1.13	0.18	0.37%	1.35%	2.8%	51.28%	55.49%	24.21%	22.02%
1	3-Day Priv	5	3.46%	0.43	0.12	5.5%	1.08	0.19	0.98%	0.78%	2.96%	51.28%	54.84%	24.6%	22.22%
2	2-Day Priv	5	2.22%	0.63	0.07	5.55%	1.38	0.17	-0.22%	0.86%	2.79%	51.87%	55.31%	24.21%	22.32%
3	1-Day Priv	5	2.58%	0.73	0.08	5.92%	1.44	0.18	0.16%	1.3%	2.1%	51.34%	55.25%	24.01%	21.83%
4	Origin	5	2.59%	0.54	0.07	6.02%	1.40	0.18	0.21%	1.42%	2.1%	51.51%	55.37%	23.61%	22.02%
5	1-Day After	5	2.84%	0.50	0.09	6.09%	1.12	0.18	0.41%	1.43%	2.77%	51.28%	55.49%	24.11%	22.12%
6	2-Day After	5	3.81%	0.41	0.12	5.98%	1.07	0.19	1.34%	1.26%	2.95%	51.22%	54.84%	24.5%	22.32%
7	3-Day After	5	2.46%	0.58	0.07	6.1%	1.34	0.17	0.03%	1.41%	2.77%	51.87%	55.25%	24.11%	22.42%
8	4-Day After	5	2.56%	0.68	0.07	5.97%	1.39	0.17	0.14%	1.35%	2.04%	51.34%	55.19%	24.01%	21.83%

20 day rebalance frequency

24	13-Day Priv	20	2.77%	0.51	0.09	5.6%	0.90	0.19	1.25%	2.53%	4.91%	51.39%	54.82%	60.16%	61.38%
25	12-Day Priv	20	2.94%	0.68	0.09	6.11%	1.05	0.19	1.35%	2.99%	4.7%	51.75%	55.42%	63.01%	60.57%
26	11-Day Priv	20	3.32%	0.67	0.08	5.86%	0.95	0.14	1.79%	2.81%	4.28%	51.51%	54.28%	60.98%	60.16%
27	10-Day Priv	20	4.33%	0.69	0.12	7.13%	0.92	0.19	2.78%	4.1%	3.95%	51.69%	53.73%	61.38%	58.54%
28	9-Day Priv	20	4.7%	0.60	0.12	7.63%	0.81	0.19	3.14%	4.61%	2.76%	52.17%	54.28%	62.2%	57.72%
29	8-Day Priv	20	3.34%	0.41	0.07	5.97%	0.63	0.14	1.75%	2.98%	3.08%	51.75%	54.22%	63.01%	55.69%
30	7-Day Priv	20	3.64%	0.49	0.10	6.43%	0.65	0.18	2.07%	3.41%	2.4%	51.81%	54.7%	62.2%	57.72%
31	6-Day Priv	20	2.84%	0.43	0.06	5.68%	0.69	0.12	1.27%	2.66%	1.28%	51.75%	54.88%	62.2%	57.72%
32	5-Day Priv	20	3.03%	0.39	0.07	5.85%	0.70	0.15	1.46%	2.83%	1.06%	51.89%	54.76%	62.2%	57.32%
33	4-Day Priv	20	2.19%	0.30	0.05	4.54%	0.66	0.11	0.6%	1.48%	2.36%	52.05%	54.7%	63.01%	58.54%
34	3-Day Priv	20	2.76%	0.42	0.05	4.34%	0.61	0.09	1.16%	1.26%	2.54%	51.63%	54.58%	63.41%	58.94%
35	2-Day Priv	20	1.87%	0.43	0.03	3.28%	0.58	0.06	0.34%	0.26%	1.75%	52.17%	53.98%	60.98%	58.94%
36	1-Day Priv	20	2.37%	0.39	0.03	3.54%	0.58	0.05	0.89%	0.55%	1.62%	51.63%	53.8%	58.54%	60.16%
37	Origin	20	2.14%	0.32	0.04	3.09%	0.51	0.06	0.66%	0.1%	3.34%	51.33%	54.7%	58.54%	60.16%
38	1-Day After	20	3.05%	0.40	0.07	5.24%	0.66	0.12	1.59%	2.27%	3.71%	52.05%	55.42%	57.72%	60.16%
39	2-Day After	20	5.5%	0.70	0.17	7.97%	0.90	0.24	4.1%	5.06%	3.9%	52.41%	55.24%	55.69%	59.76%
40	3-Day After	20	5.53%	0.72	0.16	9.17%	1.03	0.27	4.1%	6.21%	3.79%	52.23%	55.06%	56.91%	60.57%
41	4-Day After	20	5.7%	0.57	0.17	9.28%	0.89	0.28	4.24%	6.29%	2.84%	51.51%	55.0%	57.72%	60.98%
42	5-Day After	20	3.32%	0.54	0.08	6.71%	0.82	0.18	1.78%	3.66%	3.03%	51.2%	54.88%	60.98%	60.16%
43	6-Day After	20	3.35%	0.47	0.10	6.83%	0.80	0.21	1.84%	3.78%	4.25%	50.72%	54.16%	60.16%	60.98%
44	7-Day After	20	3.14%	0.54	0.11	6.12%	0.92	0.21	1.63%	3.05%	5.06%	51.39%	54.76%	60.16%	61.79%
45	8-Day After	20	3.4%	0.70	0.10	6.69%	1.08	0.21	1.82%	3.58%	5.01%	51.75%	55.48%	63.01%	60.57%
46	9-Day After	20	3.65%	0.70	0.10	6.23%	0.99	0.17	2.12%	3.19%	4.86%	51.57%	54.4%	60.57%	60.16%
47	10-Day After	20	4.84%	0.72	0.14	7.8%	0.95	0.22	3.3%	4.79%	4.48%	51.75%	53.86%	60.98%	58.54%
48	11-Day After	20	5.08%	0.70	0.15	8.14%	0.92	0.24	3.52%	5.1%	3.3%	52.29%	54.52%	62.2%	58.54%
49	12-Day After	20	3.78%	0.49	0.10	6.62%	0.73	0.18	2.2%	3.61%	3.61%	51.81%	54.46%	63.01%	56.5%
50	13-Day After	20	4.14%	0.58	0.13	7.44%	0.79	0.24	2.58%	4.4%	2.82%	51.99%	54.88%	62.2%	58.54%

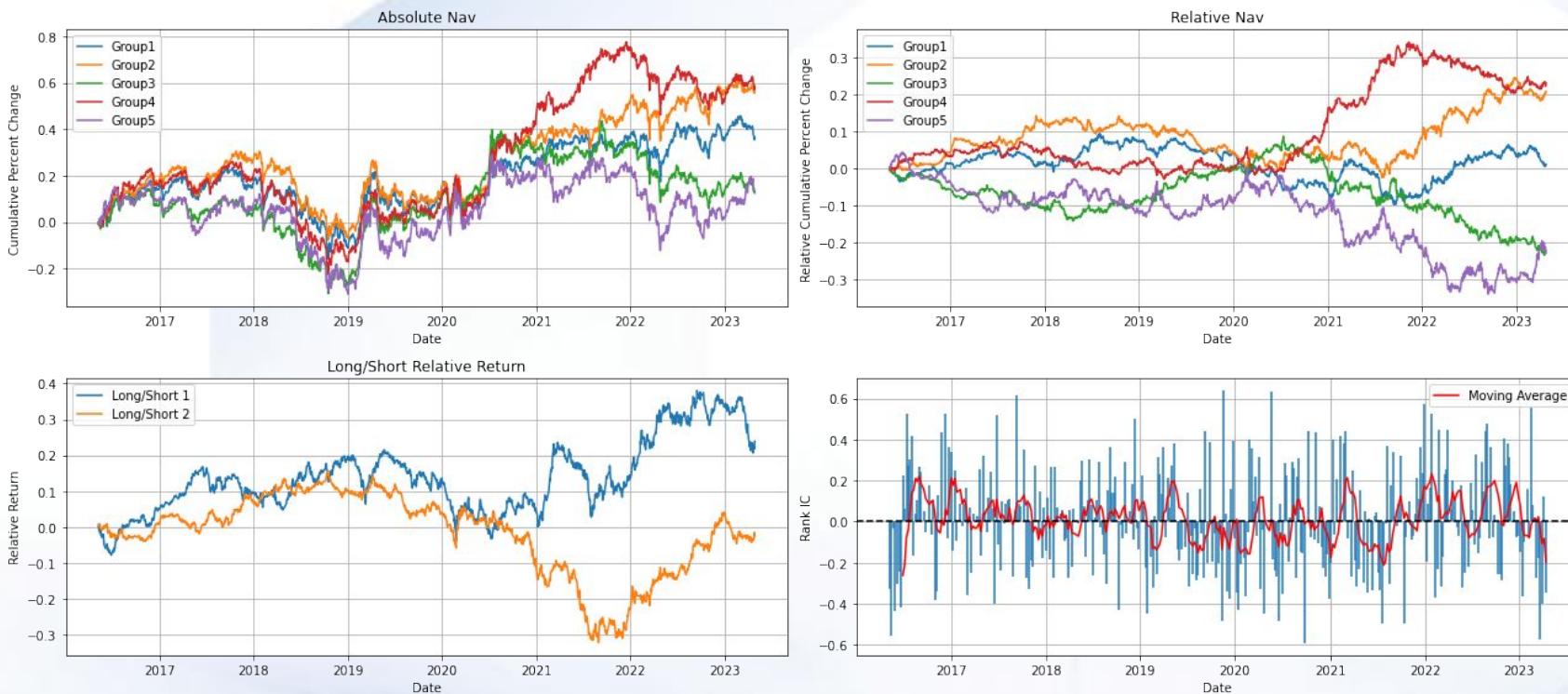
Trading Volatility

2.2.1 Trading Amount Vol

We use the standard deviation of transaction amount in some past period to measure the stability of industry transactions, and take the opposite number. The group with the minimum volatility has the maximum factor value, and vice versa.

$$\text{Factor} = -\text{STD}(Amount)$$

Take window1 = 20:



Freq	Long Excess	Long_Sharpe	Long_Calmar	L/S Returns	L/S_Sharpe	L/S_Calmar	Long WR	L/S WR	rankIC	Short WR	Long TO	Short TO		
0	5	0.08%	-0.49	0.01	2.91%	0.25	0.17	-3.03%	-3.61%	0.79%	48.55%	51.22%	30.85%	33.83%

2.2.1 Trading amount vol

Rolling Rebalancing frequency backtest results

5 day rebalance frequency

	Start Date	Freq	多头超额	多头 Sharpe	多头 Calmar	多空收益	多空 Sharpe	多空 Calmar	多头扣费	多空扣费	rankIC	多头胜率	空头胜率	多头换手	空头换手
0	4-Day Priv	5	0.26%	-0.71	0.02	3.42%	0.02	0.16	-2.74%	-2.9%	0.71%	48.49%	50.5%	29.76%	32.94%
1	3-Day Priv	5	0.58%	0.06	0.03	3.85%	0.40	0.19	-2.56%	-2.61%	0.49%	48.84%	50.92%	31.15%	32.94%
2	2-Day Priv	5	-0.93%	-0.82	-0.04	1.49%	-0.12	0.07	-4.09%	-4.97%	-0.07%	48.37%	51.1%	31.35%	32.74%
3	1-Day Priv	5	-1.0%	-0.85	-0.04	1.57%	0.10	0.06	-4.12%	-4.82%	0.71%	48.84%	51.1%	30.95%	32.44%
4	Origin	5	0.08%	-0.49	0.01	2.91%	0.25	0.17	-3.03%	-3.61%	0.79%	48.55%	51.22%	30.85%	33.83%
5	1-Day After	5	0.13%	-0.78	0.01	3.38%	-0.01	0.15	-2.88%	-2.96%	0.65%	48.31%	50.39%	29.86%	33.04%
6	2-Day After	5	0.43%	0.01	0.03	3.44%	0.38	0.18	-2.72%	-3.04%	0.48%	48.72%	50.8%	31.25%	33.04%
7	3-Day After	5	-1.02%	-0.84	-0.04	1.32%	-0.12	0.07	-4.17%	-5.13%	-0.07%	48.31%	51.04%	31.25%	32.74%
8	4-Day After	5	-0.98%	-0.85	-0.04	1.92%	0.15	0.08	-4.08%	-4.44%	0.8%	48.78%	51.1%	30.75%	32.34%

20 day rebalance frequency

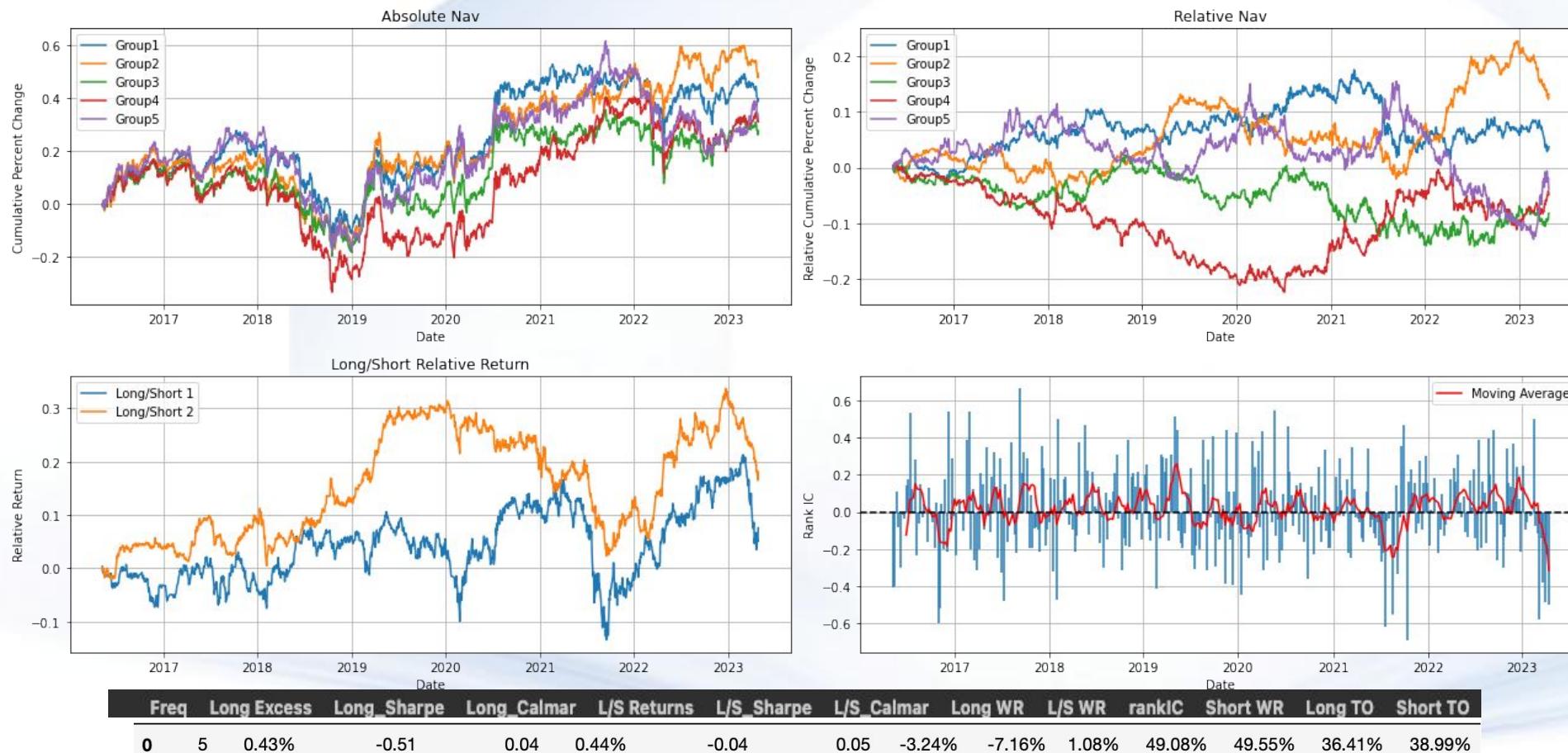
24	13-Day Priv	20	0.47%	-0.17	0.02	6.85%	0.56	0.31	-1.05%	3.54%	1.4%	48.55%	52.35%	60.16%	71.14%
25	12-Day Priv	20	0.43%	-0.22	0.03	5.38%	0.31	0.27	-1.03%	2.21%	1.44%	48.31%	51.63%	58.13%	67.89%
26	11-Day Priv	20	0.76%	-0.20	0.04	5.2%	0.34	0.25	-0.76%	2.01%	0.89%	48.49%	52.53%	60.57%	65.85%
27	10-Day Priv	20	0.57%	-0.09	0.03	4.46%	0.37	0.20	-0.98%	1.13%	1.64%	48.61%	53.13%	61.38%	70.73%
28	9-Day Priv	20	0.3%	-0.11	0.03	2.95%	0.15	0.18	-1.21%	-0.21%	2.99%	48.55%	51.33%	59.76%	65.45%
29	8-Day Priv	20	-0.29%	-0.17	0.00	3.17%	0.40	0.19	-1.81%	0.02%	1.55%	48.55%	52.17%	60.16%	64.63%
30	7-Day Priv	20	-1.4%	-0.34	-0.04	0.68%	0.14	0.07	-2.92%	-2.63%	1.87%	47.83%	51.57%	60.16%	71.14%
31	6-Day Priv	20	-1.03%	-0.20	-0.03	0.2%	0.04	0.06	-2.7%	-3.19%	3.28%	48.31%	50.84%	66.26%	68.29%
32	5-Day Priv	20	-1.06%	-0.21	-0.02	1.7%	0.18	0.08	-2.68%	-1.68%	2.75%	48.61%	50.54%	64.63%	69.51%
33	4-Day Priv	20	-2.09%	-0.46	-0.05	2.06%	0.13	0.09	-3.7%	-1.19%	2.04%	47.77%	50.72%	64.23%	64.63%
34	3-Day Priv	20	-1.95%	-0.35	-0.04	1.21%	0.13	0.08	-3.51%	-2.02%	2.0%	48.61%	50.96%	62.2%	65.85%
35	2-Day Priv	20	-2.8%	-0.59	-0.07	-0.49%	-0.06	0.04	-4.37%	-3.73%	1.29%	47.77%	50.42%	62.2%	66.67%
36	1-Day Priv	20	-2.09%	-0.53	-0.06	0.35%	-0.10	0.08	-3.63%	-2.99%	1.35%	47.65%	50.66%	61.38%	71.14%
37	Origin	20	-1.41%	-0.31	-0.03	1.31%	0.05	0.11	-2.97%	-2.03%	1.13%	47.77%	49.82%	61.79%	70.73%
38	1-Day After	20	-1.25%	-0.33	-0.03	0.69%	-0.02	0.08	-2.78%	-2.59%	1.42%	47.23%	50.24%	60.57%	69.92%
39	2-Day After	20	-1.22%	-0.29	-0.03	1.32%	0.00	0.10	-2.81%	-1.99%	1.85%	47.53%	50.24%	63.01%	68.29%
40	3-Day After	20	-0.32%	-0.19	-0.00	1.0%	-0.01	0.10	-1.89%	-2.23%	1.3%	48.31%	49.94%	62.6%	65.85%
41	4-Day After	20	0.19%	-0.04	0.03	1.87%	0.37	0.19	-1.36%	-1.35%	3.51%	48.31%	50.24%	61.38%	66.26%
42	5-Day After	20	0.06%	-0.13	0.02	4.08%	0.56	0.26	-1.44%	0.84%	2.19%	48.31%	51.08%	59.35%	69.51%
43	6-Day After	20	-0.18%	-0.21	0.01	3.41%	0.46	0.22	-1.71%	0.13%	2.24%	48.49%	51.33%	60.57%	69.51%
44	7-Day After	20	0.21%	-0.14	0.03	6.35%	0.62	0.33	-1.29%	3.05%	1.75%	48.73%	52.47%	59.35%	71.54%
45	8-Day After	20	0.29%	-0.20	0.03	4.86%	0.37	0.29	-1.14%	1.71%	1.8%	48.43%	51.81%	56.91%	68.29%
46	9-Day After	20	0.49%	-0.14	0.04	4.61%	0.45	0.28	-1.01%	1.43%	1.23%	48.73%	52.83%	59.76%	66.26%
47	10-Day After	20	0.1%	-0.07	0.03	3.21%	0.44	0.20	-1.43%	-0.12%	2.0%	48.8%	53.37%	60.98%	71.14%
48	11-Day After	20	-0.07%	-0.18	0.02	2.41%	0.13	0.16	-1.57%	-0.74%	3.16%	48.49%	51.39%	59.35%	65.45%
49	12-Day After	20	-0.61%	-0.26	-0.01	2.67%	0.33	0.15	-2.11%	-0.48%	1.81%	48.43%	52.05%	59.76%	65.04%
50	13-Day After	20	-1.77%	-0.46	-0.06	0.38%	0.06	0.04	-3.27%	-2.91%	1.92%	47.65%	51.51%	59.76%	70.73%

2.2.2 Trading Volume Vol

Volume vol, that is, the opposite number of the standard deviation of trading volume in the past period of time. Similarly, the group with minimum volatility is the group with maximum factor value, and vice versa. This factor represents longing sectors with stable market sentiment.

$$\text{Factor} = -\text{STD}(Volume)$$

Take window1 = 20:



2.2.2 Trading Volume Vol

Rolling Rebalancing frequency backtest results

5 day rebalance frequency

	Start Date	Freq	多头超额	多头 Sharpe	多头 Calmar	多空收益	多空 Sharpe	多空 Calmar	多头扣费	多空扣费	rankIC	多头胜率	空头胜率	多头换手	空头换手
0	4-Day Priv	5	1.32%	0.09	0.09	2.07%	0.30	0.14	-2.39%	-5.61%	0.9%	48.72%	49.38%	36.81%	39.38%
1	3-Day Priv	5	0.39%	-0.06	0.03	0.73%	0.32	0.05	-3.33%	-6.96%	1.02%	49.02%	49.08%	36.9%	39.38%
2	2-Day Priv	5	0.92%	-0.26	0.06	1.22%	0.06	0.09	-2.78%	-6.51%	0.15%	49.32%	49.73%	36.71%	39.98%
3	1-Day Priv	5	-0.88%	-0.36	-0.05	-1.84%	-0.37	-0.11	-4.62%	-9.56%	1.34%	49.26%	49.32%	37.1%	39.49%
4	Origin	5	0.43%	-0.51	0.04	0.44%	-0.04	0.05	-3.24%	-7.16%	1.08%	49.08%	49.55%	36.41%	38.99%
5	1-Day After	5	1.34%	0.03	0.08	2.21%	0.26	0.11	-2.37%	-5.47%	0.77%	48.55%	49.32%	36.81%	39.38%
6	2-Day After	5	0.24%	-0.11	0.01	0.49%	0.28	0.03	-3.47%	-7.19%	0.93%	48.96%	49.02%	36.81%	39.38%
7	3-Day After	5	0.77%	-0.30	0.05	1.04%	0.03	0.07	-2.91%	-6.66%	0.11%	49.26%	49.73%	36.51%	39.88%
8	4-Day After	5	-0.87%	-0.35	-0.05	-1.67%	-0.33	-0.09	-4.61%	-9.38%	1.41%	49.26%	49.38%	37.1%	39.38%

20 day rebalance frequency

24	13-Day Priv	20	1.77%	0.09	0.12	3.13%	0.36	0.23	0.12%	-0.59%	1.0%	49.16%	50.12%	65.45%	82.11%
25	12-Day Priv	20	1.25%	-0.02	0.10	2.12%	0.25	0.19	-0.37%	-1.56%	1.06%	49.58%	50.3%	64.23%	81.71%
26	11-Day Priv	20	0.82%	-0.03	0.05	0.15%	-0.04	0.04	-0.87%	-3.57%	0.35%	49.7%	50.6%	67.07%	80.49%
27	10-Day Priv	20	1.06%	0.01	0.07	1.22%	0.10	0.11	-0.64%	-2.51%	0.85%	48.43%	50.78%	67.48%	80.89%
28	9-Day Priv	20	1.32%	0.08	0.08	2.15%	0.20	0.16	-0.38%	-1.75%	1.99%	48.73%	50.84%	67.48%	87.4%
29	8-Day Priv	20	1.26%	0.14	0.07	2.05%	0.36	0.15	-0.4%	-1.74%	1.25%	48.55%	51.45%	65.85%	84.55%
30	7-Day Priv	20	1.82%	0.31	0.13	2.64%	0.37	0.23	0.11%	-1.29%	0.98%	48.86%	50.96%	67.89%	87.8%
31	6-Day Priv	20	-0.74%	-0.11	-0.01	0.4%	0.08	0.07	-2.48%	-3.43%	3.47%	49.46%	51.02%	68.7%	83.33%
32	5-Day Priv	20	0.2%	0.15	0.02	2.38%	0.35	0.18	-1.53%	-1.43%	2.94%	48.86%	51.69%	68.7%	82.52%
33	4-Day Priv	20	0.18%	0.15	0.02	2.27%	0.33	0.18	-1.58%	-1.56%	1.81%	48.31%	51.69%	69.92%	82.11%
34	3-Day Priv	20	0.63%	0.23	0.04	1.57%	0.39	0.15	-1.08%	-2.14%	3.0%	48.61%	51.14%	67.89%	79.67%
35	2-Day Priv	20	1.47%	0.50	0.10	1.13%	0.46	0.16	-0.26%	-2.61%	2.14%	50.36%	51.02%	68.7%	79.67%
36	1-Day Priv	20	1.71%	0.38	0.13	1.08%	0.36	0.19	-0.08%	-2.76%	2.49%	50.18%	49.88%	71.14%	81.3%
37	Origin	20	2.39%	0.69	0.16	3.12%	0.71	0.28	0.69%	-0.68%	2.25%	50.66%	50.24%	67.48%	83.33%
38	1-Day After	20	0.79%	0.30	0.06	0.03%	0.34	0.08	-0.94%	-3.76%	2.63%	50.18%	49.82%	68.7%	81.71%
39	2-Day After	20	1.62%	0.42	0.12	0.75%	0.36	0.12	-0.09%	-3.02%	2.68%	50.72%	49.16%	67.89%	81.71%
40	3-Day After	20	3.32%	0.67	0.28	3.31%	0.68	0.35	1.57%	-0.46%	1.72%	51.45%	50.36%	69.51%	80.08%
41	4-Day After	20	1.89%	0.35	0.15	0.45%	0.35	0.13	0.13%	-3.31%	3.23%	50.3%	49.22%	69.92%	79.27%
42	5-Day After	20	1.19%	0.15	0.09	1.44%	0.36	0.18	-0.44%	-2.26%	2.2%	49.82%	49.82%	65.04%	81.71%
43	6-Day After	20	0.78%	-0.09	0.08	-0.12%	0.17	0.09	-0.89%	-3.87%	1.44%	48.49%	49.58%	66.26%	82.52%
44	7-Day After	20	1.23%	0.04	0.11	1.93%	0.30	0.19	-0.41%	-1.79%	1.04%	48.98%	50.0%	65.04%	82.52%
45	8-Day After	20	0.76%	-0.08	0.08	1.1%	0.18	0.15	-0.84%	-2.56%	0.96%	49.28%	50.06%	63.41%	81.71%
46	9-Day After	20	0.21%	-0.05	0.04	-1.21%	-0.09	0.02	-1.45%	-4.88%	0.34%	49.46%	50.42%	65.85%	80.08%
47	10-Day After	20	0.43%	-0.06	0.05	-0.68%	-0.01	0.06	-1.27%	-4.39%	0.87%	48.37%	50.48%	67.07%	80.49%
48	11-Day After	20	0.86%	-0.00	0.06	0.93%	0.05	0.10	-0.83%	-2.96%	2.12%	48.61%	50.42%	67.07%	86.99%
49	12-Day After	20	0.8%	0.05	0.06	0.99%	0.22	0.10	-0.85%	-2.77%	1.28%	48.43%	51.08%	65.45%	84.15%
50	13-Day After	20	1.51%	0.20	0.10	1.69%	0.20	0.15	-0.19%	-2.22%	0.87%	48.61%	50.66%	67.48%	87.4%

Turnover Factors

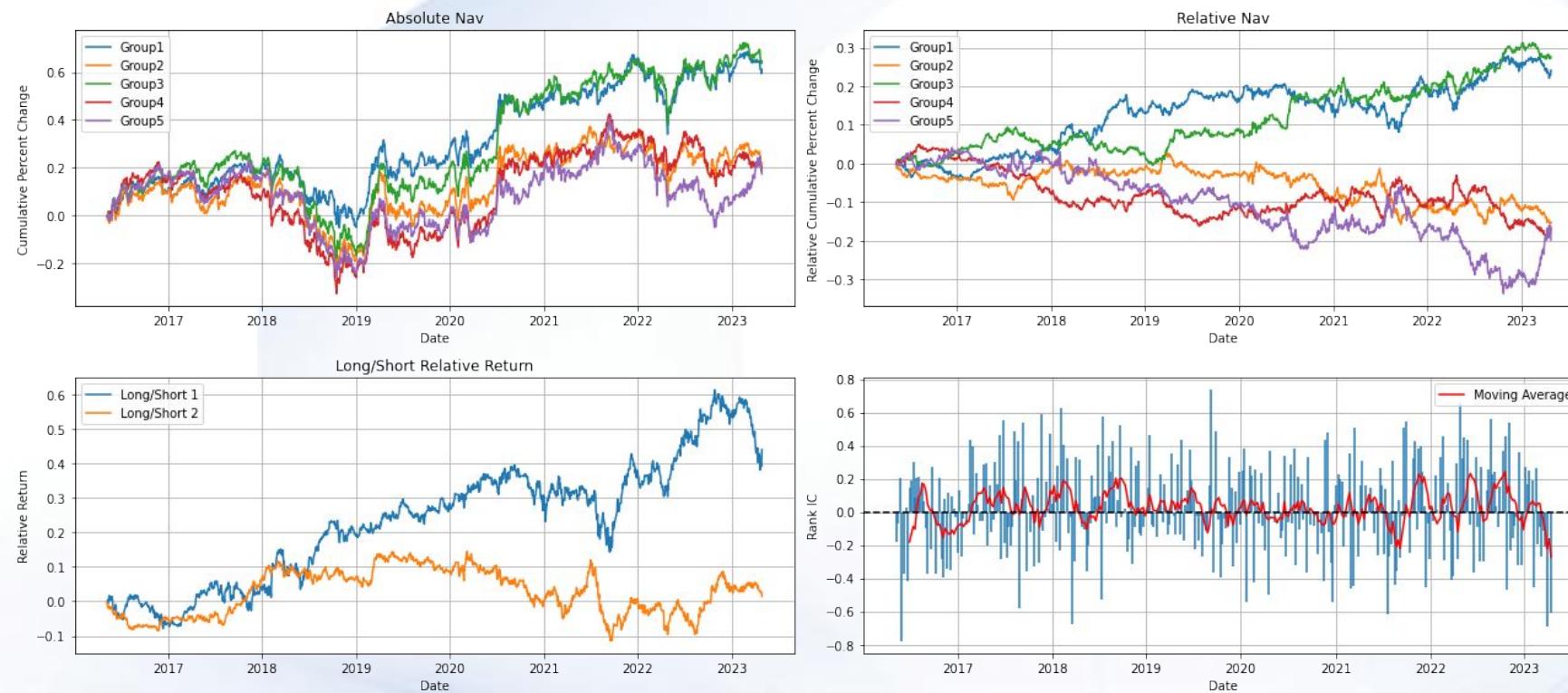
2.3.1 Turnover Rate

We divide the average long-term turnover rate by the average short-term turnover rate. Larger the factor values means a more consistent market consensus, and vice versa.

$$\text{Factor} = \frac{\text{Mean}(\text{turnover}_{t-\text{window}1:t})}{\text{Mean}(\text{turnover}_{t-\text{window}2:t})}, \text{window}_1 > \text{window}_2 \quad \text{Where: } \begin{array}{l} \text{window}_1 : \text{长期动量的窗口期} \\ \text{window}_2 : \text{短期动量的窗口期} \end{array}$$

Window1: long-term window
Window2: short-term window

Take $\text{window}1 = 120$, $\text{window}2 = 10$:



Freq	Long Excess	Long Sharpe	Long Calmar	L/S Returns	L/S Sharpe	L/S Calmar	Long WR	L/S WR	rankIC	Short WR	Long TO	Short TO		
0	5	3.29%	0.41	0.29	5.71%	0.8	0.51	-2.52%	-5.63%	2.14%	51.1%	50.62%	57.64%	54.86%

2. 3. 1 Turnover Rate

Rolling Rebalancing frequency backtest results

5 day rebalance frequency

	Start Date	Freq	多头超额	多头 Sharpe	多头 Calmar	多空收益	多空 Sharpe	多空 Calmar	多头扣费	多空扣费	rankIC	多头胜率	空头胜率	多头换手	空头换手
0	4-Day Priv	5	3.5%	0.48	0.27	5.99%	0.73	0.46	-2.29%	-5.34%	1.52%	50.62%	50.15%	57.44%	54.96%
1	3-Day Priv	5	1.33%	-0.08	0.08	5.75%	0.77	0.32	-4.29%	-5.53%	2.38%	49.32%	50.92%	55.75%	56.15%
2	2-Day Priv	5	2.2%	0.01	0.12	5.98%	0.88	0.29	-3.42%	-5.2%	1.64%	48.25%	51.34%	55.75%	55.16%
3	1-Day Priv	5	3.69%	0.48	0.32	6.82%	1.08	0.56	-1.9%	-4.37%	2.45%	49.38%	51.16%	55.46%	55.56%
4	Origin	5	3.29%	0.41	0.29	5.71%	0.80	0.51	-2.52%	-5.63%	2.14%	51.1%	50.62%	57.84%	54.86%
5	1-Day After	5	3.11%	0.43	0.25	5.58%	0.70	0.44	-2.68%	-5.74%	1.4%	50.5%	50.27%	57.44%	54.86%
6	2-Day After	5	1.08%	-0.16	0.06	5.2%	0.74	0.30	-4.54%	-6.06%	2.28%	49.14%	51.04%	55.75%	55.95%
7	3-Day After	5	2.17%	-0.06	0.10	5.75%	0.86	0.28	-3.44%	-5.4%	1.56%	48.07%	51.45%	55.65%	54.96%
8	4-Day After	5	3.75%	0.46	0.31	6.86%	1.11	0.58	-1.84%	-4.31%	2.55%	49.2%	51.22%	55.46%	55.36%

20 day rebalance frequency

24	13-Day Priv	20	2.52%	0.28	0.16	6.26%	0.70	0.44	-0.53%	0.17%	2.05%	49.46%	51.99%	120.73%	120.73%
25	12-Day Priv	20	2.37%	0.25	0.22	4.44%	0.62	0.48	-0.61%	-1.48%	3.2%	49.58%	51.27%	118.29%	116.67%
26	11-Day Priv	20	1.62%	0.15	0.10	3.51%	0.44	0.25	-1.29%	-2.35%	2.75%	49.16%	50.24%	115.45%	117.07%
27	10-Day Priv	20	2.42%	0.26	0.16	2.41%	0.34	0.23	-0.53%	-3.47%	2.28%	49.76%	49.88%	117.07%	116.26%
28	9-Day Priv	20	1.34%	0.13	0.08	0.9%	0.29	0.13	-1.72%	-5.12%	4.3%	48.43%	50.36%	121.14%	117.89%
29	8-Day Priv	20	1.45%	0.17	0.08	3.26%	0.47	0.23	-1.61%	-2.76%	4.65%	47.95%	51.27%	121.54%	117.48%
30	7-Day Priv	20	4.61%	0.53	0.45	4.91%	0.55	0.62	1.52%	-1.11%	4.11%	48.86%	50.24%	122.76%	115.85%
31	6-Day Priv	20	4.13%	0.35	0.36	7.55%	0.66	0.75	1.08%	1.54%	6.12%	49.22%	51.75%	121.14%	117.48%
32	5-Day Priv	20	3.95%	0.37	0.46	8.31%	0.82	1.06	0.98%	2.28%	6.48%	50.0%	52.11%	117.89%	121.14%
33	4-Day Priv	20	6.05%	0.67	0.73	10.69%	0.98	1.37	3.11%	4.68%	4.59%	50.78%	51.33%	116.67%	121.95%
34	3-Day Priv	20	3.95%	0.35	0.48	8.19%	0.65	1.03	1.1%	2.28%	3.56%	48.73%	51.14%	113.01%	121.54%
35	2-Day Priv	20	2.21%	0.09	0.21	6.4%	0.39	0.63	-0.63%	0.47%	3.47%	47.65%	50.48%	112.6%	122.76%
36	1-Day Priv	20	3.77%	0.19	0.28	7.19%	0.39	0.58	0.93%	1.26%	5.3%	47.95%	50.9%	112.6%	122.76%
37	Origin	20	2.82%	0.21	0.20	8.12%	0.60	0.60	-0.05%	2.2%	3.71%	48.98%	51.27%	114.23%	120.73%
38	1-Day After	20	3.0%	0.22	0.20	7.0%	0.48	0.52	0.14%	1.05%	4.57%	48.61%	51.08%	113.41%	122.76%
39	2-Day After	20	5.07%	0.40	0.45	10.24%	0.73	0.96	2.14%	4.19%	5.21%	50.96%	50.48%	116.26%	123.98%
40	3-Day After	20	4.72%	0.27	0.42	9.87%	0.74	0.92	1.71%	3.77%	4.5%	48.8%	50.96%	119.51%	122.76%
41	4-Day After	20	4.94%	0.74	0.59	8.95%	1.10	1.14	1.87%	2.83%	4.6%	49.7%	51.99%	121.95%	120.73%
42	5-Day After	20	2.54%	0.36	0.28	7.46%	0.88	0.83	-0.49%	1.32%	2.93%	50.12%	52.59%	120.33%	123.58%
43	6-Day After	20	2.66%	0.42	0.28	5.57%	0.64	0.62	-0.49%	-0.6%	2.51%	50.0%	51.45%	125.2%	119.92%
44	7-Day After	20	1.82%	0.21	0.13	4.55%	0.56	0.33	-1.25%	-1.55%	1.64%	49.52%	51.51%	121.95%	119.92%
45	8-Day After	20	1.8%	0.21	0.19	2.98%	0.49	0.34	-1.22%	-2.95%	2.59%	49.64%	50.9%	119.51%	115.85%
46	9-Day After	20	1.1%	0.13	0.09	2.19%	0.34	0.18	-1.84%	-3.71%	2.27%	49.28%	50.06%	116.67%	117.48%
47	10-Day After	20	1.47%	0.21	0.14	0.25%	0.21	0.13	-1.52%	-5.66%	2.07%	49.88%	49.58%	118.29%	116.26%
48	11-Day After	20	0.58%	0.08	0.06	-0.74%	0.11	0.03	-2.5%	-6.79%	3.88%	48.37%	50.0%	122.36%	117.89%
49	12-Day After	20	0.75%	0.14	0.07	1.65%	0.32	0.15	-2.34%	-4.4%	4.37%	48.07%	50.78%	122.36%	117.48%
50	13-Day After	20	3.86%	0.48	0.43	3.61%	0.40	0.45	0.75%	-2.42%	3.76%	48.92%	49.82%	123.58%	115.85%

Long-Short Factors

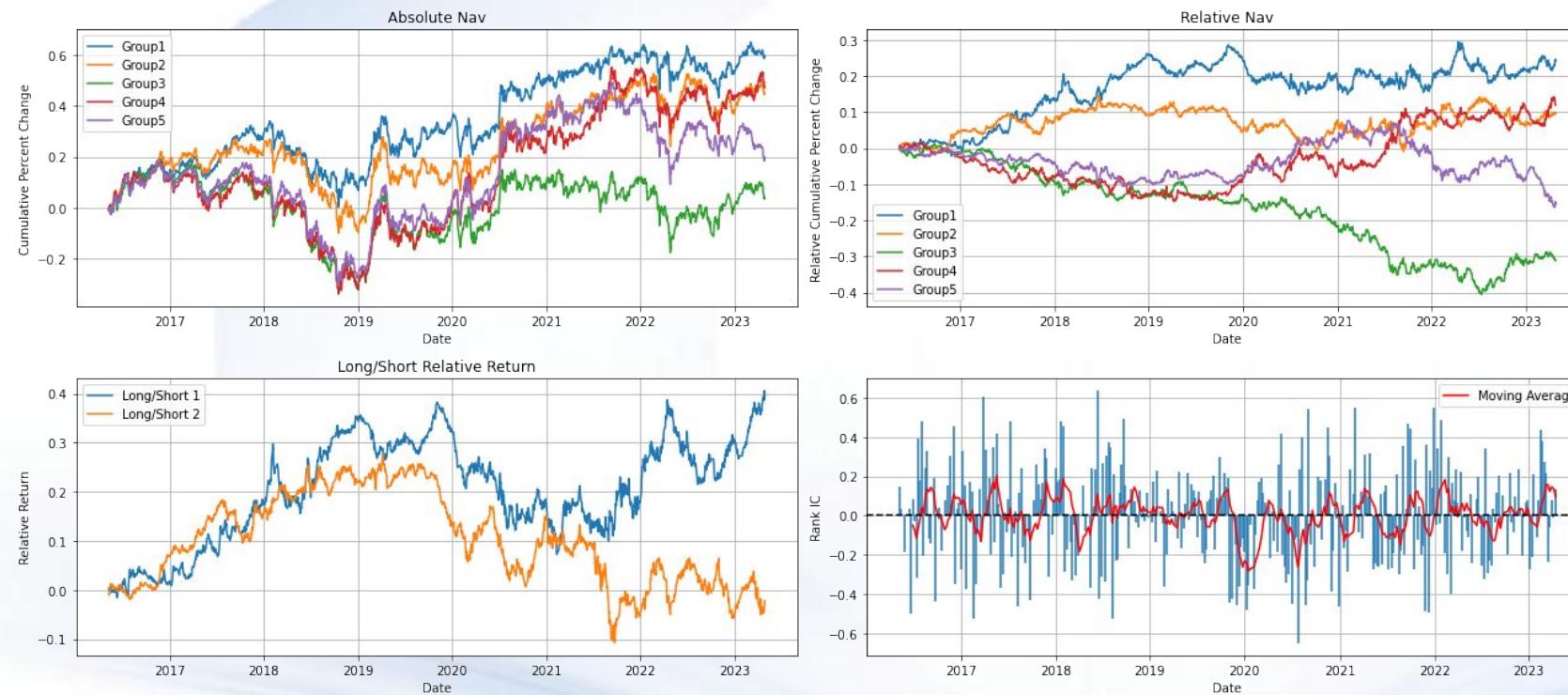
2. 4. 1 Total Amount of Long-Short

We calculate the daily balance of long-short strength over some past period, that is, the ratio of long strength to short strength, and sum it. The larger this value, the stronger the long strength compared to the short strength during this period, and vice versa. Here we take the negative of the factor value, that is, we long the sectors which in the past had more short strength, that we are essentially betting on the reversal or convergence.

$$\text{Factor} = - \sum_{i=t-\text{window}}^{i=t} \frac{\text{Close}_i - \text{Low}_i}{\text{High}_i - \text{Close}_i}$$

Where: *window* :过去一段时间每日多空力量对比窗口期

Take window = 60:



Freq	Long Excess	Long Sharpe	Long Calmar	L/S Returns	L/S Sharpe	L/S Calmar	Long WR	L/S WR	rankIC	Short WR	Long TO	Short TO
0	5	3.18%	-0.11	0.22	5.57%	0.4	0.39	0.1%	-0.12%	0.16%	48.66%	50.98%

2. 4. 1 Total Amount of Long-Short

Rolling Rebalancing frequency backtest results

5 day rebalance frequency

	Start Date	Freq	多头超额	多头 Sharpe	多头 Calmar	多空收益	多空 Sharpe	多空 Calmar	多头扣费	多空扣费	rankIC	多头胜率	空头胜率	多头换手	空头换手
0	4-Day Priv	5	3.9%	-0.35	0.28	4.72%	-0.11	0.34	0.56%	-1.29%	1.21%	49.32%	50.45%	33.13%	26.49%
1	3-Day Priv	5	4.01%	-0.07	0.28	5.79%	0.19	0.39	0.77%	-0.01%	0.06%	49.5%	50.09%	32.14%	25.4%
2	2-Day Priv	5	3.5%	0.06	0.20	4.79%	0.23	0.26	0.41%	-0.8%	-0.13%	49.32%	49.67%	30.65%	24.8%
3	1-Day Priv	5	3.83%	0.23	0.28	5.32%	0.40	0.39	0.71%	-0.34%	-0.29%	49.02%	50.21%	30.95%	25.2%
4	Origin	5	3.18%	-0.11	0.22	5.57%	0.40	0.39	0.1%	-0.12%	0.16%	48.66%	50.98%	30.56%	25.89%
5	1-Day After	5	4.13%	-0.36	0.28	5.16%	-0.12	0.34	0.83%	-0.77%	1.22%	49.26%	50.33%	32.74%	26.09%
6	2-Day After	5	4.07%	-0.05	0.28	6.17%	0.28	0.43	0.88%	0.46%	0.17%	49.5%	50.21%	31.65%	25.0%
7	3-Day After	5	3.78%	0.10	0.21	5.21%	0.29	0.29	0.74%	-0.28%	-0.01%	49.44%	49.73%	30.16%	24.31%
8	4-Day After	5	4.15%	0.28	0.30	5.47%	0.46	0.42	1.07%	-0.09%	-0.21%	49.2%	50.27%	30.56%	24.6%

20 day rebalance frequency

24	13-Day Priv	20	4.25%	0.50	0.28	5.47%	0.55	0.35	2.54%	2.14%	1.92%	49.76%	51.27%	67.89%	64.23%
25	12-Day Priv	20	3.05%	0.40	0.21	4.16%	0.41	0.28	1.34%	0.83%	1.37%	49.52%	50.84%	67.89%	64.23%
26	11-Day Priv	20	2.88%	0.36	0.21	3.95%	0.36	0.24	1.16%	0.56%	1.32%	49.22%	50.54%	68.29%	66.26%
27	10-Day Priv	20	3.67%	0.56	0.25	5.46%	0.45	0.32	1.89%	2.04%	0.71%	49.94%	51.14%	70.73%	64.63%
28	9-Day Priv	20	3.24%	0.52	0.20	4.82%	0.44	0.25	1.44%	1.36%	2.18%	50.06%	50.3%	71.54%	65.85%
29	8-Day Priv	20	3.39%	0.53	0.20	5.86%	0.55	0.29	1.66%	2.49%	0.69%	50.06%	50.72%	68.7%	65.04%
30	7-Day Priv	20	2.55%	0.52	0.12	3.34%	0.36	0.13	0.83%	0.02%	0.4%	49.46%	49.28%	68.29%	63.82%
31	6-Day Priv	20	3.14%	0.51	0.17	5.34%	0.52	0.25	1.41%	2.07%	-1.19%	49.04%	50.96%	68.7%	60.98%
32	5-Day Priv	20	2.36%	0.36	0.14	3.6%	0.26	0.18	0.59%	0.29%	0.92%	49.22%	49.7%	70.33%	61.38%
33	4-Day Priv	20	4.19%	0.73	0.29	4.12%	0.40	0.26	2.39%	0.81%	0.56%	49.82%	50.48%	71.54%	59.76%
34	3-Day Priv	20	4.15%	0.72	0.28	3.91%	0.34	0.23	2.39%	0.68%	0.73%	50.12%	49.64%	69.92%	58.13%
35	2-Day Priv	20	4.08%	0.74	0.26	5.24%	0.58	0.28	2.35%	2.01%	1.07%	50.24%	50.36%	68.7%	59.76%
36	1-Day Priv	20	1.33%	0.41	0.10	3.18%	0.41	0.16	-0.47%	-0.12%	0.65%	49.16%	50.72%	71.14%	59.76%
37	Origin	20	0.91%	0.28	0.06	1.97%	0.31	0.08	-0.83%	-1.33%	1.68%	48.13%	50.72%	69.11%	61.79%
38	1-Day After	20	2.28%	0.49	0.15	2.86%	0.36	0.15	0.49%	-0.51%	1.69%	48.86%	50.72%	71.14%	62.6%
39	2-Day After	20	3.65%	0.55	0.24	4.12%	0.46	0.24	1.89%	0.71%	0.56%	48.61%	50.72%	69.92%	65.45%
40	3-Day After	20	2.11%	0.35	0.15	2.73%	0.34	0.17	0.4%	-0.62%	0.43%	48.37%	50.48%	67.89%	65.04%
41	4-Day After	20	3.64%	0.45	0.27	3.41%	0.36	0.22	1.89%	0.01%	2.27%	48.98%	50.36%	69.51%	65.45%
42	5-Day After	20	4.3%	0.62	0.36	4.71%	0.52	0.35	2.63%	1.49%	1.55%	49.64%	51.2%	66.26%	61.79%
43	6-Day After	20	3.0%	0.29	0.23	3.98%	0.32	0.27	1.34%	0.73%	2.85%	48.8%	51.51%	65.85%	63.01%
44	7-Day After	20	3.59%	0.46	0.26	5.17%	0.57	0.37	1.91%	1.89%	2.4%	49.7%	51.39%	66.67%	63.41%
45	8-Day After	20	3.16%	0.45	0.24	4.48%	0.47	0.32	1.48%	1.2%	1.87%	49.46%	50.78%	66.67%	63.41%
46	9-Day After	20	2.97%	0.39	0.21	4.33%	0.43	0.28	1.26%	0.96%	1.7%	49.16%	50.84%	67.89%	65.85%
47	10-Day After	20	3.55%	0.46	0.23	5.88%	0.47	0.35	1.77%	2.49%	1.25%	49.46%	51.45%	70.33%	64.23%
48	11-Day After	20	3.14%	0.46	0.18	5.09%	0.48	0.27	1.35%	1.66%	2.73%	49.94%	50.78%	70.73%	65.45%
49	12-Day After	20	3.62%	0.54	0.20	6.44%	0.64	0.33	1.9%	3.09%	1.12%	50.0%	51.14%	67.89%	65.04%
50	13-Day After	20	2.87%	0.51	0.12	4.37%	0.45	0.16	1.14%	1.03%	0.39%	49.34%	49.58%	68.7%	63.82%

2. 4. 2 Long–Short Difference

We first calculate the sub factor. For numerator, subtract long strength from short strength, i.e. $\text{Close-Low}) - (\text{High-Close})$, while the denominator being High - Low, or the daily price range. Then we multiply the result with the daily transaction volume to get the difference standarized by daily range.

Then, we take EWMA of the values and calculate the difference for some past periods. The higher this factor value, the weaker the long strength compared to the short strength, and vice versa.

$$\text{Factor} = \text{EWMA} \left(\text{Volume} \times \frac{(\text{Close} - \text{Low}) - (\text{High} - \text{Close})}{\text{High} - \text{Low}}, \text{window1} \right) - \text{EWMA} \left(\text{Volume} \times \frac{(\text{Close} - \text{Low}) - (\text{High} - \text{Close})}{\text{High} - \text{Low}}, \text{window2} \right),$$

$\text{window1} > \text{window2}$

Where:

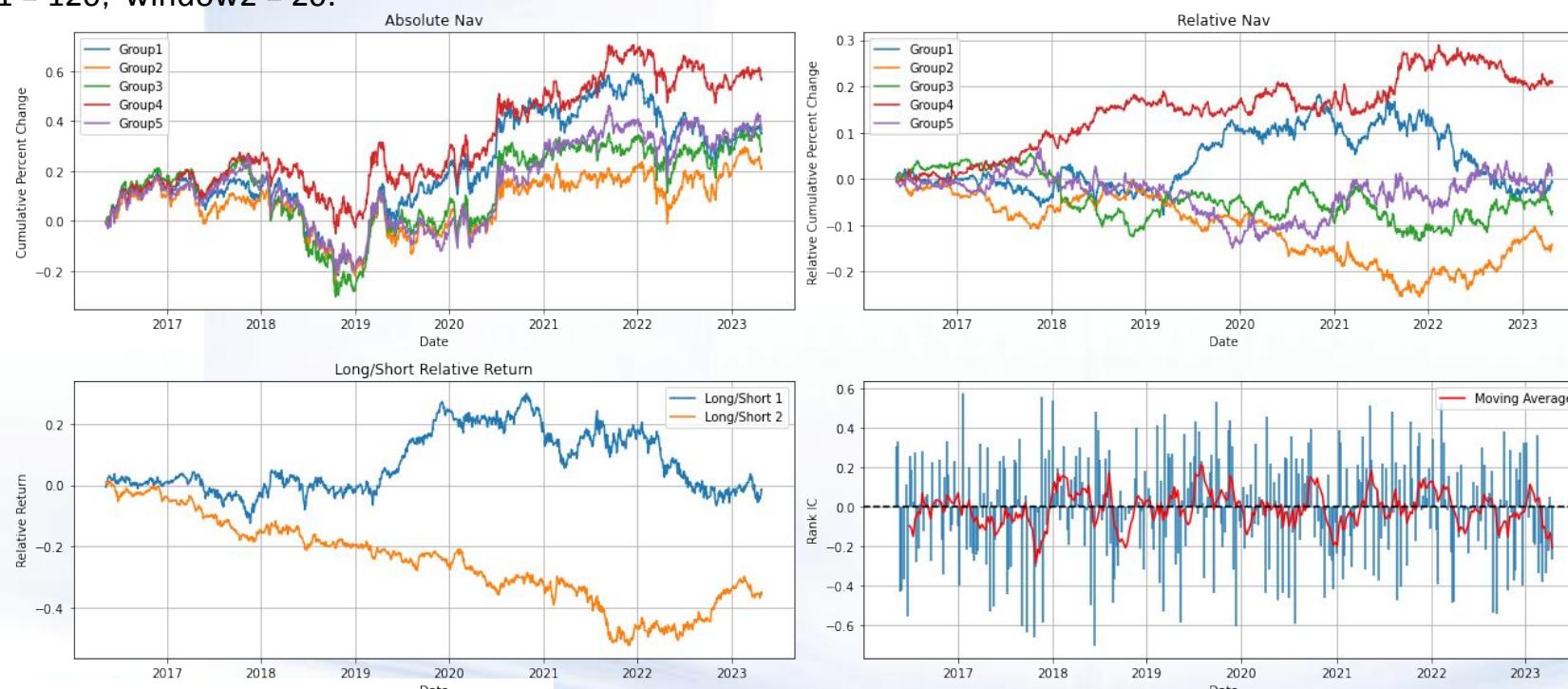
window_1 :长期每日多空力量对比的窗口期

window_2 :短期每日多空力量对比的窗口期

Window1: long-term window

Window2: short-term window

Take $\text{window1} = 120$, $\text{window2} = 20$:



Freq	Long Excess	Long Sharpe	Long Calmar	L/S Returns	L/S Sharpe	L/S Calmar	Long WR	L/S WR	rankIC	Short WR	Long TO	Short TO		
0	5	-0.34%	-0.24	-0.01	-0.94%	0.36	-0.02	-9.86%	-20.49%	-1.05%	49.32%	51.39%	94.44%	99.5%

2. 4. 2 Long–Short Difference

Rolling Rebalancing frequency backtest results

5 day rebalance frequency

	Start Date	Freq	多头超额	多头 Sharpe	多头 Calmar	多空收益	多空 Sharpe	多空 Calmar	多头扣费	多空扣费	rankIC	多头胜率	空头胜率	多头换手	空头换手
0	4-Day Priv	5	-3.42%	-0.81	-0.12	-5.57%	-0.33	-0.20	-12.96%	-25.25%	-1.09%	47.66%	50.8%	94.64%	100.6%
1	3-Day Priv	5	-0.9%	-0.22	-0.03	-2.69%	-0.04	-0.13	-10.47%	-22.5%	-2.5%	48.72%	50.45%	94.94%	101.59%
2	2-Day Priv	5	-4.45%	-0.95	-0.12	-9.79%	-1.06	-0.27	-13.94%	-29.51%	-1.08%	48.07%	49.26%	94.15%	101.49%
3	1-Day Priv	5	-1.56%	-0.55	-0.07	-4.19%	-0.43	-0.19	-11.12%	-24.13%	-0.4%	48.61%	49.73%	94.84%	102.98%
4	Origin	5	-0.34%	-0.24	-0.01	-0.94%	0.36	-0.02	-9.86%	-20.49%	-1.05%	49.32%	51.39%	94.44%	99.5%
5	1-Day After	5	-3.65%	-0.85	-0.13	-5.68%	-0.35	-0.20	-13.19%	-25.34%	-1.21%	47.66%	50.74%	94.64%	100.4%
6	2-Day After	5	-1.23%	-0.37	-0.06	-3.41%	-0.19	-0.18	-10.8%	-23.19%	-2.58%	48.55%	50.33%	94.94%	101.29%
7	3-Day After	5	-4.35%	-1.07	-0.13	-9.82%	-1.10	-0.28	-13.83%	-29.49%	-1.18%	47.95%	49.14%	94.05%	101.09%
8	4-Day After	5	-1.74%	-0.57	-0.07	-4.16%	-0.42	-0.18	-11.33%	-24.14%	-0.42%	48.61%	49.67%	95.14%	103.08%

20 day rebalance frequency

24	13-Day Priv	20	-0.21%	-0.20	0.02	-2.97%	-0.28	-0.10	-3.65%	-10.03%	-0.31%	48.49%	50.42%	136.59%	143.5%
25	12-Day Priv	20	0.19%	0.16	0.02	1.01%	0.24	0.03	-3.15%	-6.15%	0.75%	49.58%	50.36%	132.52%	151.63%
26	11-Day Priv	20	1.36%	0.06	0.06	-0.14%	0.09	0.02	-2.03%	-7.35%	1.04%	49.88%	51.2%	134.15%	152.03%
27	10-Day Priv	20	-0.6%	-0.11	-0.02	0.01%	0.22	-0.01	-4.12%	-7.36%	1.03%	48.73%	52.35%	139.84%	152.44%
28	9-Day Priv	20	-0.71%	-0.19	-0.01	-1.57%	0.04	-0.02	-4.28%	-9.02%	0.26%	48.86%	52.17%	141.46%	154.07%
29	8-Day Priv	20	3.44%	0.30	0.30	2.19%	0.17	0.17	-0.28%	-5.3%	-2.62%	49.94%	49.04%	147.56%	149.59%
30	7-Day Priv	20	-3.36%	-0.85	-0.12	-5.01%	-0.61	-0.18	-6.88%	-12.06%	1.54%	46.27%	49.4%	139.84%	139.84%
31	6-Day Priv	20	0.96%	-0.02	0.05	3.91%	0.21	0.26	-2.58%	-3.26%	0.13%	48.43%	51.2%	140.24%	144.31%
32	5-Day Priv	20	-0.99%	-0.20	-0.06	2.14%	0.04	0.07	-4.42%	-5.0%	1.48%	47.41%	52.59%	136.18%	147.15%
33	4-Day Priv	20	4.11%	0.43	0.32	6.58%	0.28	0.55	0.38%	-0.92%	1.52%	49.1%	50.0%	147.97%	149.59%
34	3-Day Priv	20	2.74%	0.19	0.22	1.62%	0.08	0.20	-0.85%	-5.68%	1.05%	49.28%	50.72%	142.68%	146.75%
35	2-Day Priv	20	2.51%	0.14	0.24	-1.07%	-0.11	0.04	-0.92%	-8.27%	0.85%	49.16%	50.24%	136.18%	149.59%
36	1-Day Priv	20	1.83%	0.17	0.12	-2.16%	-0.09	-0.04	-1.47%	-9.03%	0.43%	50.84%	49.64%	130.89%	141.87%
37	Origin	20	2.19%	0.09	0.10	1.26%	-0.02	0.01	-1.25%	-5.85%	-0.98%	50.06%	49.28%	136.59%	145.53%
38	1-Day After	20	-0.7%	-0.11	-0.01	-2.24%	-0.08	-0.02	-4.05%	-9.28%	2.97%	49.28%	50.9%	132.93%	146.34%
39	2-Day After	20	5.88%	0.71	0.45	6.33%	0.47	0.55	2.31%	-0.91%	-2.14%	51.39%	50.72%	141.46%	145.93%
40	3-Day After	20	-2.67%	-0.40	-0.09	-4.23%	-0.54	-0.15	-6.19%	-11.35%	-0.76%	49.28%	50.0%	139.84%	142.68%
41	4-Day After	20	-1.69%	-0.27	-0.05	-5.71%	-0.41	-0.14	-5.23%	-12.78%	0.78%	49.58%	48.86%	140.24%	140.24%
42	5-Day After	20	2.43%	0.42	0.27	1.21%	0.26	0.20	-1.18%	-5.93%	0.91%	49.1%	51.08%	143.5%	139.84%
43	6-Day After	20	2.67%	0.23	0.18	2.32%	0.35	0.20	-0.83%	-4.84%	-1.04%	50.24%	51.08%	138.62%	145.53%
44	7-Day After	20	-0.51%	-0.32	-0.02	-2.97%	-0.39	-0.14	-3.94%	-10.01%	-0.15%	48.25%	50.18%	136.18%	143.09%
45	8-Day After	20	0.09%	0.09	0.00	0.61%	0.24	0.03	-3.27%	-6.58%	0.3%	49.34%	50.6%	133.33%	152.03%
46	9-Day After	20	1.21%	-0.04	0.04	-0.23%	-0.02	-0.01	-2.2%	-7.48%	0.87%	49.58%	50.84%	135.37%	152.44%
47	10-Day After	20	-0.61%	-0.17	-0.02	-1.23%	0.16	-0.02	-4.16%	-8.63%	0.53%	48.73%	52.35%	141.06%	152.85%
48	11-Day After	20	-0.57%	-0.29	-0.04	-1.68%	-0.10	-0.08	-4.16%	-9.14%	0.34%	48.61%	52.11%	142.28%	154.07%
49	12-Day After	20	3.25%	0.24	0.29	1.57%	0.17	0.18	-0.5%	-5.94%	-2.73%	49.88%	49.58%	148.78%	149.19%
50	13-Day After	20	-3.06%	-0.91	-0.14	-5.47%	-0.71	-0.22	-6.62%	-12.56%	1.82%	46.14%	49.4%	141.06%	140.24%

Volume–Price Divergence

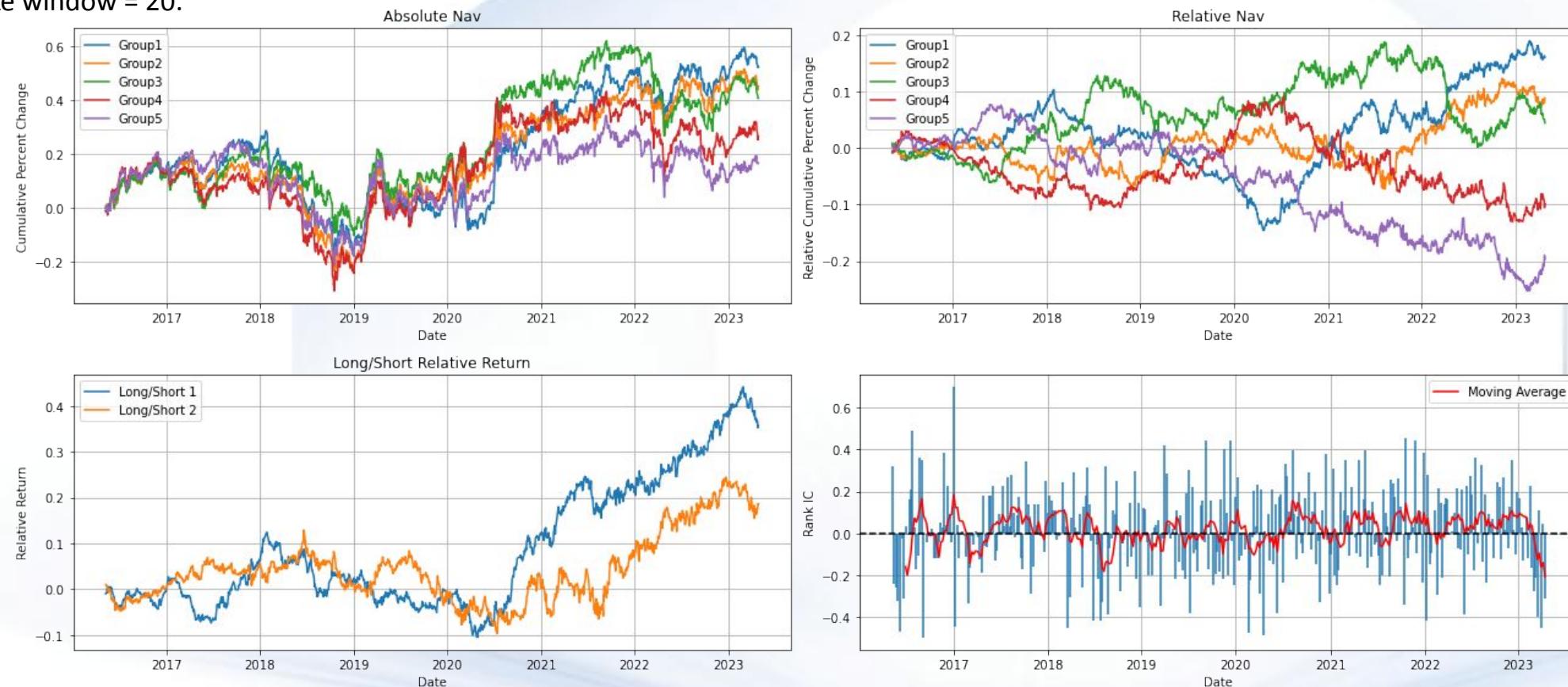
2.5.1 Volume–Price Divergence (ranking covariance)

We define the volume-price divergence as the opposite of the covariance between the closed price and its volume for some past period

$$\text{Factor} = -1 \times \text{rank}\{\text{covariance}[\text{rank}(Close), \text{rank}(Volume), \text{window}]\}$$

Where: *window* :窗口期

Take window = 20:



Freq	Long Excess	Long Sharpe	Long Calmar	L/S Returns	L/S Sharpe	L/S Calmar	Long WR	L/S WR	rankIC	Short WR	Long TO	Short TO		
0	5	2.32%	-0.81	0.1	5.55%	0.38	0.23	-8.02%	-11.06%	1.43%	48.84%	50.56%	102.58%	62.2%

2.5.1 Volume-Price Divergence

Rolling Rebalancing frequency backtest results

5 day rebalance frequency

	Start Date	Freq	多头超额	多头 Sharpe	多头 Calmar	多空收益	多空 Sharpe	多空 Calmar	多头扣费	多空扣费	rankIC	多头胜率	空头胜率	多头换手	空头换手
0	4-Day Priv	5	0.32%	-0.85	0.01	4.27%	0.27	0.26	-9.73%	-12.17%	1.51%	48.25%	51.69%	99.7%	63.39%
1	3-Day Priv	5	2.13%	-0.30	0.21	3.95%	0.27	0.38	-8.08%	-12.72%	2.93%	49.14%	51.22%	101.29%	64.09%
2	2-Day Priv	5	3.42%	0.25	0.41	7.85%	0.76	0.94	-6.71%	-8.64%	2.59%	50.92%	51.22%	100.5%	63.1%
3	1-Day Priv	5	4.83%	0.35	0.79	8.8%	1.05	1.46	-5.34%	-7.67%	2.75%	50.5%	52.17%	100.89%	62.5%
4	Origin	5	2.32%	-0.81	0.10	5.55%	0.38	0.23	-8.02%	-11.06%	1.43%	48.84%	50.56%	102.58%	62.2%
5	1-Day After	5	0.49%	-0.79	0.02	4.64%	0.34	0.28	-9.56%	-11.82%	1.51%	48.31%	51.75%	99.7%	63.59%
6	2-Day After	5	2.2%	-0.30	0.21	4.27%	0.27	0.38	-8.01%	-12.42%	2.93%	49.2%	51.22%	101.29%	64.29%
7	3-Day After	5	3.71%	0.27	0.42	8.31%	0.78	0.94	-6.41%	-8.19%	2.58%	50.92%	51.22%	100.4%	63.29%
8	4-Day After	5	4.94%	0.36	0.80	8.99%	1.05	1.46	-5.22%	-7.47%	2.74%	50.5%	52.17%	100.79%	62.5%

20 day rebalance frequency

24	13-Day Priv	20	4.24%	0.49	0.52	4.83%	0.47	0.63	0.54%	-2.04%	6.04%	51.2%	51.81%	146.75%	125.61%
25	12-Day Priv	20	5.01%	0.84	0.50	5.8%	0.63	0.58	1.42%	-0.93%	5.87%	52.35%	50.84%	142.28%	124.8%
26	11-Day Priv	20	3.16%	0.81	0.23	5.08%	0.82	0.36	-0.52%	-1.8%	4.83%	50.96%	51.69%	145.93%	127.24%
27	10-Day Priv	20	2.32%	0.47	0.22	3.99%	0.69	0.38	-1.44%	-2.91%	3.34%	50.18%	51.69%	149.19%	124.8%
28	9-Day Priv	20	1.5%	0.20	0.16	2.38%	0.34	0.26	-2.24%	-4.53%	3.67%	50.18%	51.87%	148.37%	125.61%
29	8-Day Priv	20	1.75%	0.41	0.17	3.93%	0.63	0.37	-1.97%	-3.08%	1.58%	49.34%	51.39%	147.56%	130.49%
30	7-Day Priv	20	-0.06%	-0.06	-0.00	1.43%	0.26	0.09	-3.86%	-5.53%	3.96%	48.01%	50.84%	150.81%	125.2%
31	6-Day Priv	20	3.7%	0.35	0.36	6.52%	0.75	0.67	-0.0%	-0.28%	1.34%	49.88%	52.05%	146.75%	123.17%
32	5-Day Priv	20	-0.73%	-0.51	-0.04	-0.43%	-0.12	-0.01	-4.33%	-7.21%	3.47%	48.43%	50.3%	142.68%	126.42%
33	4-Day Priv	20	0.87%	-0.11	0.10	2.45%	0.42	0.27	-2.87%	-4.54%	4.32%	49.04%	50.36%	148.37%	128.86%
34	3-Day Priv	20	3.92%	0.57	0.28	4.3%	0.59	0.33	0.24%	-2.53%	3.87%	51.57%	50.36%	145.93%	125.2%
35	2-Day Priv	20	1.2%	-0.20	0.06	1.91%	0.17	0.12	-2.48%	-4.96%	2.24%	48.49%	50.24%	145.93%	126.83%
36	1-Day Priv	20	2.21%	0.21	0.28	1.59%	0.30	0.26	-1.45%	-5.2%	2.36%	48.98%	50.0%	145.12%	124.39%
37	Origin	20	0.01%	-0.30	0.04	-1.19%	-0.09	-0.02	-3.66%	-7.92%	2.04%	48.01%	49.34%	145.53%	121.54%
38	1-Day After	20	-0.56%	-0.23	-0.00	0.69%	0.17	0.09	-4.22%	-6.11%	1.78%	49.28%	50.48%	145.12%	124.8%
39	2-Day After	20	0.09%	-0.07	0.00	2.77%	0.21	0.19	-3.58%	-4.16%	2.69%	49.04%	50.42%	145.53%	129.67%
40	3-Day After	20	3.93%	0.41	0.41	7.69%	0.79	0.85	0.29%	0.94%	3.49%	51.2%	50.84%	144.72%	123.17%
41	4-Day After	20	1.82%	0.28	0.14	5.16%	0.55	0.44	-1.8%	-1.56%	5.55%	48.31%	51.33%	143.5%	123.17%
42	5-Day After	20	3.98%	0.49	0.50	8.26%	0.73	1.04	0.33%	1.49%	4.22%	49.94%	51.02%	144.72%	123.98%
43	6-Day After	20	1.16%	0.02	0.13	4.33%	0.27	0.41	-2.43%	-2.33%	4.96%	48.86%	51.87%	142.68%	121.54%
44	7-Day After	20	4.43%	0.48	0.51	5.19%	0.42	0.59	0.75%	-1.65%	5.49%	51.27%	51.75%	145.93%	125.61%
45	8-Day After	20	4.76%	0.66	0.41	5.51%	0.47	0.47	1.19%	-1.21%	5.38%	51.99%	50.78%	141.87%	124.8%
46	9-Day After	20	3.2%	0.62	0.16	5.19%	0.66	0.28	-0.48%	-1.69%	4.29%	50.66%	51.45%	145.93%	127.24%
47	10-Day After	20	2.31%	0.36	0.18	4.35%	0.58	0.32	-1.45%	-2.55%	3.03%	50.0%	51.45%	149.19%	124.8%
48	11-Day After	20	1.71%	0.16	0.14	2.82%	0.29	0.23	-2.04%	-4.09%	3.17%	50.12%	51.75%	148.78%	125.61%
49	12-Day After	20	1.71%	0.33	0.13	4.09%	0.54	0.32	-2.01%	-2.92%	1.18%	49.22%	51.2%	147.56%	130.49%
50	13-Day After	20	-0.01%	-0.10	-0.01	1.27%	0.18	0.06	-3.81%	-5.68%	3.53%	47.95%	50.72%	150.81%	124.8%

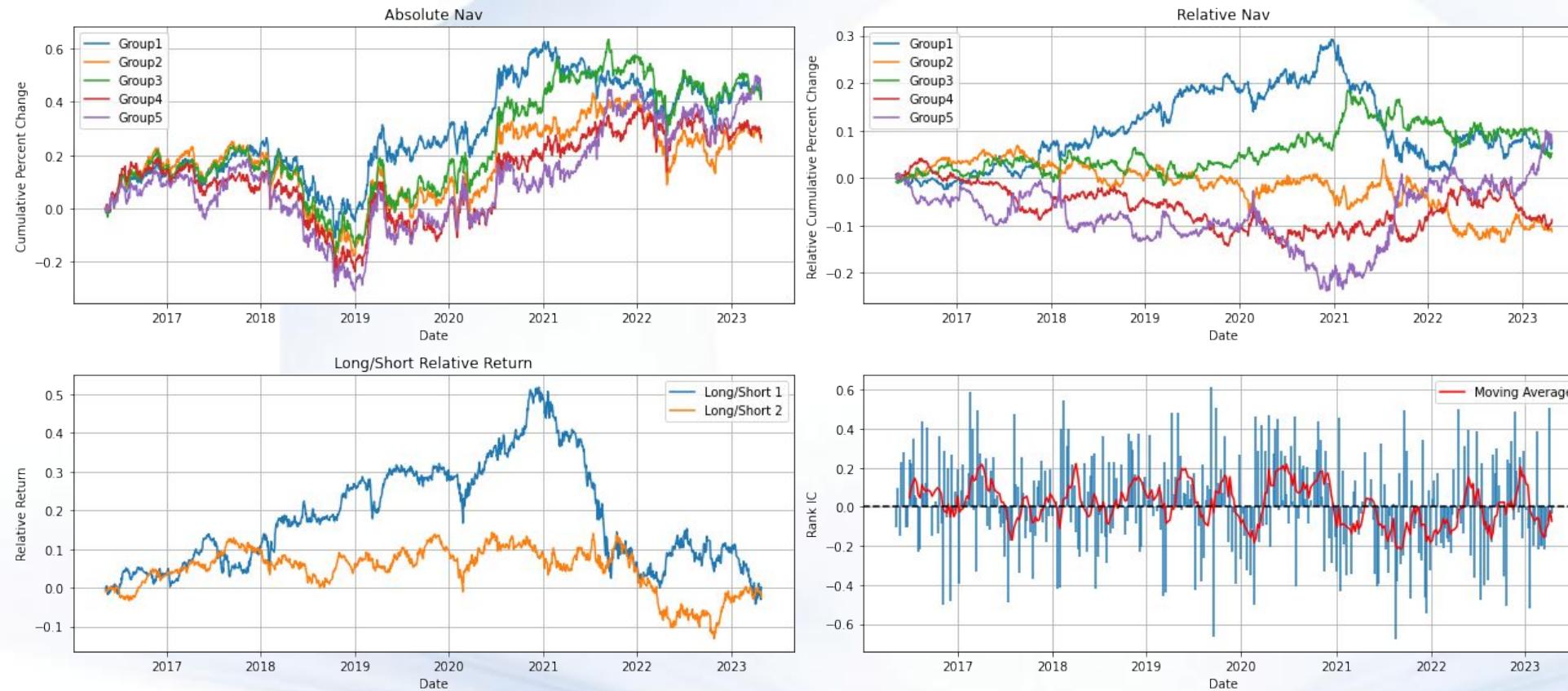
2.5.2 Volume-Price Correlation

Similar to the previous factor, here we define the factor as the correlation between its volume and closed price for some past period:

$$\text{Factor} = -\text{correlation}(\text{Close}, \text{Volume}, \text{window})$$

Where: *window* : 窗口期

Take window = 40:



Freq	Long Excess	Long Sharpe	Long Calmar	L/S Returns	L/S Sharpe	L/S Calmar	Long WR	L/S WR	rankIC	Short WR	Long TO	Short TO
0	5	1.14%	0.31	0.04	-0.19%	0.69	-0.01	-4.72%	-12.13%	1.44%	50.39%	50.68%

2.5.2 Volume–Price Correlation

Rolling Rebalancing frequency backtest results

5 day rebalance frequency

	Start Date	Freq	多头超额	多头 Sharpe	多头 Calmar	多空收益	多空 Sharpe	多空 Calmar	多头扣费	多空扣费	rankIC	多头胜率	空头胜率	多头换手	空头换手
0	4-Day Priv	5	2.11%	0.47	0.07	1.69%	1.00	0.05	-3.58%	-10.02%	1.74%	50.33%	51.04%	56.45%	59.72%
1	3-Day Priv	5	1.03%	0.85	0.03	2.74%	1.09	0.10	-4.6%	-9.12%	1.64%	49.61%	52.4%	55.85%	61.81%
2	2-Day Priv	5	0.52%	1.11	0.01	2.89%	0.99	0.11	-5.14%	-8.93%	1.47%	49.85%	52.23%	56.15%	61.11%
3	1-Day Priv	5	-0.44%	0.04	-0.02	1.04%	0.30	0.02	-6.03%	-10.62%	1.17%	49.55%	51.81%	55.46%	60.22%
4	Origin	5	1.14%	0.31	0.04	-0.19%	0.69	-0.01	-4.72%	-12.13%	1.44%	50.39%	50.68%	58.13%	60.32%
5	1-Day After	5	1.89%	0.46	0.08	1.54%	0.99	0.06	-3.8%	-10.14%	1.87%	50.39%	51.16%	56.45%	59.42%
6	2-Day After	5	0.82%	0.91	0.04	2.48%	1.11	0.11	-4.79%	-9.33%	1.76%	49.67%	52.52%	55.65%	61.51%
7	3-Day After	5	0.44%	1.18	0.03	2.49%	1.04	0.12	-5.19%	-9.27%	1.58%	50.03%	52.34%	55.85%	60.81%
8	4-Day After	5	-0.47%	0.06	-0.02	0.95%	0.33	0.03	-6.04%	-10.69%	1.31%	49.55%	51.81%	55.26%	60.22%

20 day rebalance frequency

24	13-Day Priv	20	0.11%	0.18	0.01	3.87%	0.85	0.19	-3.3%	-3.1%	0.06%	48.43%	51.63%	134.96%	141.46%
25	12-Day Priv	20	-0.63%	0.06	-0.01	2.99%	0.63	0.11	-3.99%	-3.91%	0.02%	49.1%	51.57%	133.33%	140.24%
26	11-Day Priv	20	-2.27%	-0.31	-0.06	0.46%	0.30	0.03	-5.65%	-6.51%	-0.16%	48.13%	51.39%	134.15%	142.68%
27	10-Day Priv	20	-1.58%	-0.33	-0.04	0.03%	0.23	0.02	-4.89%	-6.88%	-0.12%	48.37%	50.96%	131.3%	143.09%
28	9-Day Priv	20	-1.8%	-0.31	-0.05	-2.09%	0.12	-0.02	-5.14%	-8.97%	0.86%	49.4%	50.54%	132.52%	140.24%
29	8-Day Priv	20	-0.81%	0.03	-0.03	-0.33%	0.24	0.02	-4.19%	-7.17%	-0.76%	49.94%	50.66%	134.15%	137.4%
30	7-Day Priv	20	-0.98%	0.02	-0.03	-2.6%	0.03	-0.06	-4.31%	-9.41%	-1.1%	49.34%	50.12%	132.11%	138.21%
31	6-Day Priv	20	-0.54%	0.06	-0.02	-0.85%	0.19	0.00	-3.79%	-7.56%	0.73%	49.82%	50.36%	129.27%	136.99%
32	5-Day Priv	20	-0.18%	-0.13	-0.01	0.23%	0.18	0.05	-3.46%	-6.55%	0.84%	48.49%	50.84%	130.08%	139.02%
33	4-Day Priv	20	0.64%	0.10	0.04	1.79%	0.39	0.13	-2.65%	-4.85%	-1.01%	48.43%	50.66%	130.49%	132.93%
34	3-Day Priv	20	-0.54%	-0.05	-0.02	-0.14%	0.23	0.03	-3.8%	-6.8%	-0.85%	48.07%	50.72%	129.27%	135.37%
35	2-Day Priv	20	-1.19%	-0.29	-0.04	-0.8%	0.23	0.02	-4.43%	-7.41%	-1.09%	46.93%	50.42%	128.86%	133.74%
36	1-Day Priv	20	-1.98%	-0.46	-0.07	-3.23%	-0.05	-0.07	-5.23%	-9.9%	-2.11%	47.47%	49.58%	129.27%	135.37%
37	Origin	20	-1.39%	-0.31	-0.04	-4.09%	-0.09	-0.11	-4.69%	-10.79%	-1.25%	48.19%	49.16%	130.89%	134.96%
38	1-Day After	20	0.23%	0.02	0.02	-1.51%	0.35	-0.01	-2.98%	-8.05%	0.55%	48.55%	50.36%	127.64%	132.11%
39	2-Day After	20	1.57%	0.48	0.06	2.81%	0.84	0.12	-1.68%	-3.82%	2.55%	48.73%	51.39%	129.27%	133.74%
40	3-Day After	20	1.33%	0.42	0.05	3.93%	0.89	0.16	-1.91%	-2.62%	3.47%	49.52%	52.41%	128.46%	131.3%
41	4-Day After	20	2.74%	0.76	0.11	5.04%	1.13	0.23	-0.57%	-1.71%	4.19%	50.72%	50.9%	131.3%	136.59%
42	5-Day After	20	1.84%	0.77	0.09	3.87%	0.97	0.21	-1.53%	-2.97%	2.7%	50.84%	50.54%	133.74%	137.4%
43	6-Day After	20	1.8%	0.59	0.08	5.08%	1.00	0.24	-1.66%	-1.86%	0.35%	49.76%	51.51%	137.4%	138.21%
44	7-Day After	20	-0.22%	0.12	0.00	2.91%	0.67	0.13	-3.63%	-4.07%	-0.62%	48.31%	51.27%	135.37%	141.46%
45	8-Day After	20	-0.63%	-0.01	-0.02	2.31%	0.50	0.08	-4.0%	-4.61%	-0.49%	48.8%	51.39%	133.74%	140.65%
46	9-Day After	20	-2.47%	-0.36	-0.07	-0.66%	0.16	-0.00	-5.86%	-7.64%	-0.46%	47.95%	51.08%	134.55%	142.68%
47	10-Day After	20	-1.52%	-0.36	-0.05	-0.57%	0.09	-0.01	-4.84%	-7.5%	-0.26%	48.13%	50.66%	131.71%	143.09%
48	11-Day After	20	-1.4%	-0.33	-0.05	-2.0%	-0.02	-0.06	-4.75%	-8.89%	0.62%	49.28%	50.3%	132.93%	140.24%
49	12-Day After	20	-0.53%	-0.00	-0.03	-0.8%	0.12	-0.03	-3.91%	-7.64%	-0.98%	49.7%	50.6%	134.15%	137.4%
50	13-Day After	20	-0.53%	-0.03	-0.04	-2.87%	-0.10	-0.11	-3.86%	-9.68%	-1.52%	49.04%	50.0%	132.11%	138.21%

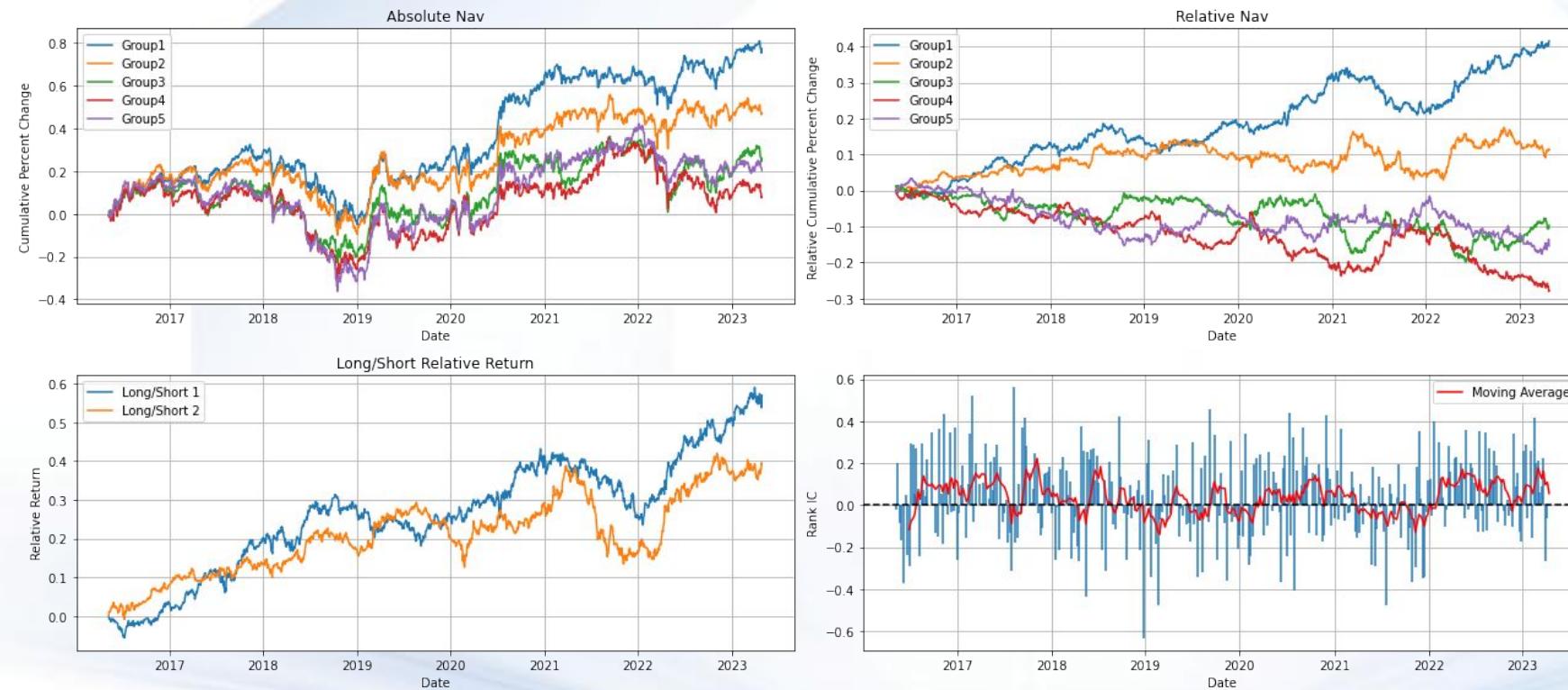
2.5.3 First-order Volume-Price Divergence

The first-order change in trading volume is the change in today's trading volume relative to yesterday's trading volume, and the first-order change in price is close / open. First-order Volume-Price divergence, that is, the degree of correlation between the abovementioned ranked changes for some past periods/window. This value going up means that, the trading volume is accelerating while close/open is decreasing, for example.

$$\text{Factor} = -\text{correlation}\left[\text{Rank}\left(\frac{\text{Volume}_i}{\text{Volume}_{i-1}} - 1\right), \text{Rank}\left(\frac{\text{Close}_i}{\text{Open}_i} - 1\right), \text{window}\right]$$

Where: *window* : 窗口期

Take window = 40:



Freq	Long Excess	Long Sharpe	Long Calmar	L/S Returns	L/S Sharpe	L/S Calmar	Long WR	L/S WR	rankIC	Short WR	Long TO	Short TO
0	5	6.16%	1.29	0.46	8.3%	1.49	0.64	0.7%	-2.19%	3.68%	51.75%	52.52%

2.5.3 First-Order Volume-Price Divergence

Rolling Rebalancing frequency backtest results

5 day rebalance frequency

	Start Date	Freq	多头超额	多头 Sharpe	多头 Calmar	多空收益	多空 Sharpe	多空 Calmar	多头扣费	多空扣费	rankIC	多头胜率	空头胜率	多头换手	空头换手
0	4-Day Priv	5	4.79%	0.68	0.39	7.47%	1.27	0.62	-0.53%	-2.71%	3.24%	50.92%	53.06%	52.78%	48.21%
1	3-Day Priv	5	3.04%	0.42	0.19	5.19%	0.94	0.33	-2.35%	-5.22%	3.28%	50.86%	52.58%	53.47%	49.8%
2	2-Day Priv	5	4.09%	0.42	0.24	5.41%	0.94	0.32	-1.27%	-4.9%	3.67%	50.39%	52.64%	53.17%	49.11%
3	1-Day Priv	5	4.05%	0.42	0.27	5.24%	0.90	0.34	-1.44%	-5.18%	4.24%	51.34%	52.17%	54.46%	48.91%
4	Origin	5	6.16%	1.29	0.46	8.3%	1.49	0.64	0.7%	-2.19%	3.68%	51.75%	52.52%	54.17%	49.9%
5	1-Day After	5	5.07%	0.77	0.43	7.57%	1.28	0.63	-0.27%	-2.63%	3.22%	50.98%	53.0%	52.98%	48.21%
6	2-Day After	5	3.06%	0.45	0.20	4.68%	0.90	0.31	-2.33%	-5.72%	3.26%	50.92%	52.46%	53.47%	49.7%
7	3-Day After	5	4.07%	0.46	0.26	5.03%	0.95	0.33	-1.31%	-5.29%	3.74%	50.45%	52.64%	53.37%	49.01%
8	4-Day After	5	4.14%	0.46	0.28	5.13%	0.95	0.37	-1.36%	-5.31%	4.39%	51.34%	52.23%	54.56%	49.01%

10 day rebalance frequency

	Start Date	Freq	多头超额	多头 Sharpe	多头 Calmar	多空收益	多空 Sharpe	多空 Calmar	多头扣费	多空扣费	rankIC	多头胜率	空头胜率	多头换手	空头换手
9	7-Day Priv	10	3.87%	0.57	0.23	7.06%	0.98	0.40	0.01%	-0.14%	4.77%	49.76%	52.26%	76.45%	66.47%
10	6-Day Priv	10	4.68%	0.63	0.33	6.87%	1.14	0.51	0.79%	-0.48%	5.75%	51.01%	53.1%	77.25%	68.66%
11	5-Day Priv	10	4.08%	0.68	0.27	7.14%	1.27	0.48	0.26%	-0.24%	5.18%	50.6%	52.44%	75.85%	70.46%
12	4-Day Priv	10	4.46%	0.51	0.35	8.4%	1.25	0.66	0.69%	1.08%	4.19%	50.06%	53.27%	74.85%	70.46%
13	3-Day Priv	10	4.29%	0.82	0.30	6.56%	1.15	0.46	0.51%	-0.79%	3.9%	50.83%	52.62%	75.05%	70.86%
14	2-Day Priv	10	4.23%	0.67	0.25	5.09%	0.92	0.31	0.53%	-2.17%	4.32%	50.48%	53.39%	73.45%	70.66%
15	1-Day Priv	10	2.57%	0.55	0.11	3.96%	0.85	0.19	-1.01%	-3.23%	4.64%	51.07%	52.38%	71.06%	71.66%
16	Origin	10	6.01%	0.89	0.30	7.9%	1.19	0.41	2.39%	0.8%	4.06%	50.3%	52.62%	71.86%	68.86%
17	1-Day After	10	5.49%	0.77	0.32	7.92%	1.10	0.47	1.71%	0.7%	4.0%	50.83%	52.5%	75.05%	68.26%
18	2-Day After	10	2.18%	0.26	0.11	4.52%	0.71	0.23	-1.66%	-2.87%	4.21%	49.88%	53.15%	76.25%	70.46%
19	3-Day After	10	4.06%	0.58	0.23	6.84%	0.96	0.39	0.2%	-0.37%	4.6%	49.76%	52.26%	76.65%	66.47%
20	4-Day After	10	5.18%	0.65	0.32	7.27%	1.08	0.46	1.3%	-0.08%	5.62%	51.01%	52.92%	77.05%	68.86%
21	5-Day After	10	4.66%	0.72	0.28	7.61%	1.24	0.46	0.82%	0.23%	4.96%	50.48%	52.2%	76.05%	70.46%
22	6-Day After	10	4.8%	0.54	0.35	8.55%	1.20	0.63	1.02%	1.22%	3.95%	50.12%	53.1%	75.05%	70.46%
23	7-Day After	10	4.39%	0.84	0.29	5.88%	1.12	0.44	0.6%	-1.46%	3.8%	50.77%	52.5%	75.05%	70.66%

20 day rebalance frequency

24	13-Day Priv	20	3.21%	0.64	0.15	4.43%	0.59	0.20	0.63%	-0.61%	3.04%	50.36%	51.63%	102.03%	97.97%
25	12-Day Priv	20	4.74%	0.90	0.23	6.12%	0.92	0.31	2.2%	0.97%	3.92%	51.33%	54.58%	100.81%	103.66%
26	11-Day Priv	20	3.18%	0.60	0.14	4.3%	0.81	0.20	0.62%	-0.87%	3.24%	50.0%	53.92%	101.63%	103.66%
27	10-Day Priv	20	3.74%	0.48	0.17	5.6%	0.77	0.25	1.2%	0.53%	3.67%	50.24%	54.28%	100.41%	100.81%
28	9-Day Priv	20	4.42%	0.69	0.25	5.61%	0.83	0.34	1.86%	0.55%	3.55%	51.02%	53.37%	101.63%	99.19%
29	8-Day Priv	20	2.33%	0.20	0.10	3.41%	0.61	0.14	-0.23%	-1.7%	3.99%	49.58%	53.01%	101.63%	101.22%
30	7-Day Priv	20	4.45%	0.62	0.33	7.72%	1.04	0.55	1.87%	2.63%	4.36%	49.94%	53.31%	102.44%	99.59%
31	6-Day Priv	20	5.2%	0.78	0.36	7.13%	1.03	0.48	2.59%	2.05%	5.55%	50.06%	52.59%	103.66%	97.97%
32	5-Day Priv	20	5.01%	0.72	0.30	8.41%	1.13	0.49	2.46%	3.26%	6.48%	50.54%	52.47%	100.81%	103.66%
33	4-Day Priv	20	4.4%	0.66	0.23	9.15%	1.31	0.47	1.78%	3.89%	5.37%	50.24%	53.67%	104.07%	104.47%
34	3-Day Priv	20	2.08%	0.41	0.10	5.49%	0.93	0.26	-0.52%	0.37%	5.65%	49.22%	52.77%	103.25%	100.0%
35	2-Day Priv	20	2.73%	0.43	0.11	6.67%	0.98	0.30	0.15%	1.59%	4.66%	48.86%	52.89%	102.03%	99.59%
36	1-Day Priv	20	2.3%	0.51	0.07	5.94%	1.00	0.21	-0.24%	0.92%	5.89%	50.78%	52.65%	100.81%	98.37%
37	Origin	20	3.4%	0.56	0.14	5.9%	0.86	0.23	0.77%	0.75%	5.37%	49.04%	51.81%	104.47%	100.0%
38	1-Day After	20	2.39%	0.39	0.11	4.94%	0.84	0.22	-0.34%	-0.28%	4.57%	48.86%	51.87%	108.54%	98.37%
39	2-Day After	20	1.18%	0.43	0.05	4.63%	0.87	0.18	-1.46%	-0.53%	4.61%	49.88%	52.65%	104.88%	100.0%
40	3-Day After	20	0.52%	0.37	0.03	2.23%	0.59	0.09	-2.01%	-2.75%	4.87%	50.48%	51.57%	100.41%	97.15%
41	4-Day After	20	2.08%	0.51	0.13	4.59%	0.88	0.26	-0.5%	-0.54%	4.71%	51.75%	53.25%	102.44%	100.81%
42	5-Day After	20	2.34%	0.55	0.14	4.55%	0.94	0.26	-0.29%	-0.49%	3.54%	51.02%	52.65%	104.07%	95.93%
43	6-Day After	20	2.31%	0.31	0.13	4.97%	0.66	0.26	-0.3%	-0.13%	3.24%	49.7%	52.17%	103.66%	98.37%
44	7-Day After	20	3.16%	0.65	0.15	4.5%	0.62	0.21	0.59%	-0.57%	3.38%	50.36%	51.81%	102.03%	99.19%
45	8-Day After	20	4.88%	0.97	0.25	6.17%	0.96	0.33	2.33%	0.98%	3.93%	51.14%	54.64%	101.22%	104.47%
46	9-Day After	20	3.29%	0.68	0.16	4.44%	0.82	0.20	0.72%	-0.77%	3.36%	50.18%	53.98%	102.03%	104.88%
47	10-Day After	20	3.9%	0.53	0.18	5.18%	0.77	0.26	1.35%	0.05%	3.77%	50.24%	54.16%	101.22%	102.03%
48	11-Day After	20	4.8%	0.70	0.25	6.14%	0.75	0.30	2.23%	1.04%	3.67%	50.84%	53.01%	102.03%	100.41%
49	12-Day After	20	2.7%	0.23	0.11	3.4%	0.61	0.14	0.13%	-1.73%	4.18%	49.22%	52.95%	102.03%	101.63%
50	13-Day After	20	4.77%	0.64	0.34	7.69%	1.06	0.56	2.18%	2.55%	4.56%	49.76%	53.19%	102.85%	100.81%

Magnitude Factor

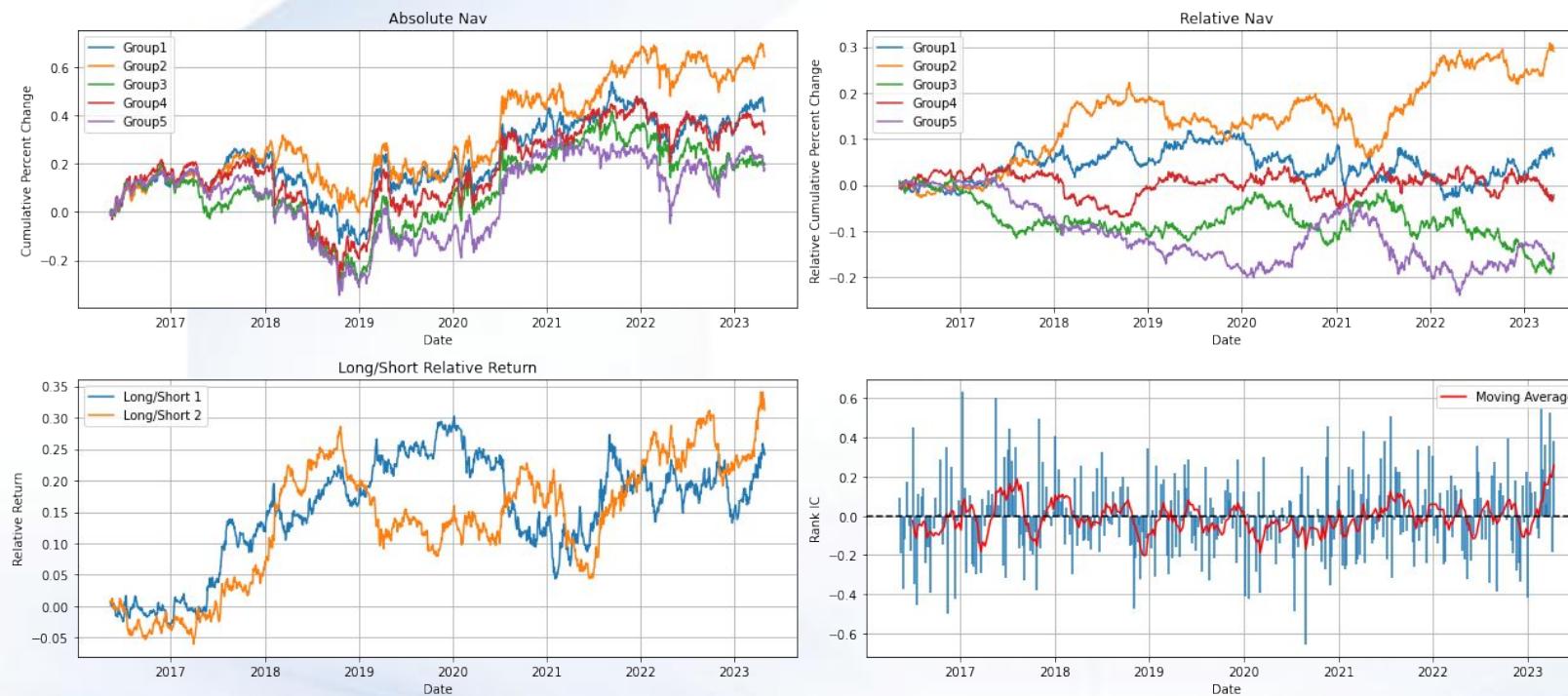
2.6.1 Co-directional Factor

The co-directional Factor is defined as the correlation in the same direction of volume and prices. A high factor value means the volume is accelerating while the price is dispersing, and vice versa.

$$\text{Factor} = \text{correlation}[\text{Rank}\left(\frac{\text{Volume}_i}{\text{Volume}_{i-1}} - 1\right), \text{Rank}\left(\frac{\text{High}_i}{\text{Low}_i} - 1\right), \text{window}]$$

Where: *window* :窗口期

Take window = 60:



Freq	Long Excess	Long Sharpe	Long Calmar	L/S Returns	L/S Sharpe	L/S Calmar	Long WR	L/S WR	rankIC	Short WR	Long TO	Short TO		
0	5	1.23%	-0.68	0.07	3.76%	0.31	0.23	-2.93%	-4.34%	-0.95%	48.78%	52.23%	41.27%	39.09%

2.6.1 Co-directional Factor

Rolling Rebalancing frequency backtest results

5 day rebalance frequency

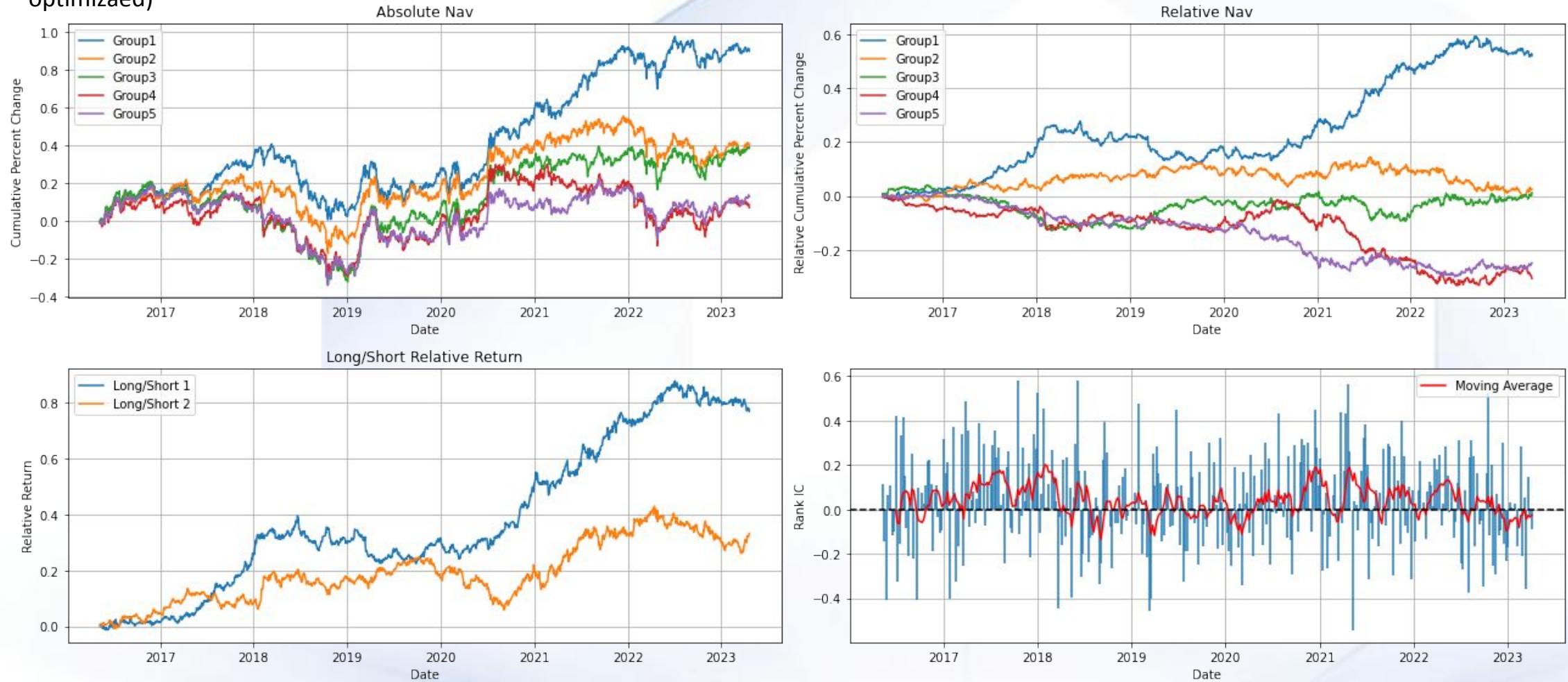
	Start Date	Freq	多头超额	多头 Sharpe	多头 Calmar	多空收益	多空 Sharpe	多空 Calmar	多头扣费	多空扣费	rankIC	多头胜率	空头胜率	多头换手	空头换手
0	4-Day Priv	5	2.77%	-0.24	0.30	5.21%	0.22	0.55	-1.36%	-3.02%	-0.31%	49.14%	52.88%	40.97%	40.67%
1	3-Day Priv	5	2.79%	-0.38	0.24	4.53%	-0.02	0.39	-1.18%	-3.49%	-0.59%	48.37%	51.45%	39.38%	40.18%
2	2-Day Priv	5	2.42%	-0.12	0.22	4.9%	0.43	0.45	-1.67%	-3.18%	-0.72%	49.26%	52.88%	40.58%	39.58%
3	1-Day Priv	5	1.68%	-0.83	0.17	5.38%	0.52	0.54	-2.57%	-2.83%	-1.08%	48.84%	52.64%	42.16%	39.29%
4	Origin	5	1.23%	-0.68	0.07	3.76%	0.31	0.23	-2.93%	-4.34%	-0.95%	48.78%	52.23%	41.27%	39.09%
5	1-Day After	5	2.5%	-0.26	0.27	4.91%	0.17	0.50	-1.62%	-3.3%	-0.38%	49.2%	52.82%	40.87%	40.58%
6	2-Day After	5	2.58%	-0.42	0.23	4.29%	-0.08	0.36	-1.38%	-3.71%	-0.65%	48.37%	51.45%	39.29%	40.08%
7	3-Day After	5	2.29%	-0.14	0.21	5.02%	0.39	0.42	-1.78%	-3.02%	-0.78%	49.2%	52.94%	40.38%	39.38%
8	4-Day After	5	1.32%	-0.84	0.16	5.31%	0.51	0.53	-2.92%	-2.88%	-1.12%	48.78%	52.76%	42.06%	39.19%

20 day rebalance frequency

24	13-Day Priv	20	1.78%	-0.12	0.11	3.41%	0.10	0.20	-0.32%	-0.69%	-0.19%	48.67%	50.9%	83.33%	79.27%
25	12-Day Priv	20	0.53%	0.05	0.00	3.3%	0.33	0.18	-1.62%	-0.77%	-0.28%	49.64%	51.69%	85.37%	76.02%
26	11-Day Priv	20	0.36%	-0.15	-0.01	2.54%	0.18	0.11	-1.72%	-1.37%	-0.32%	47.71%	50.9%	82.52%	72.76%
27	10-Day Priv	20	-0.16%	-0.23	-0.04	1.86%	0.06	0.05	-2.13%	-1.98%	-0.64%	47.77%	51.14%	78.05%	74.39%
28	9-Day Priv	20	0.74%	-0.12	0.01	1.85%	-0.02	0.05	-1.29%	-2.09%	-1.49%	48.07%	51.33%	80.49%	75.61%
29	8-Day Priv	20	-0.38%	-0.35	-0.07	0.59%	-0.10	-0.04	-2.36%	-3.37%	-1.92%	47.29%	50.72%	78.46%	78.86%
30	7-Day Priv	20	-0.77%	-0.40	-0.07	-0.43%	-0.17	-0.07	-2.72%	-4.26%	-1.61%	47.17%	50.6%	77.24%	74.8%
31	6-Day Priv	20	-0.43%	-0.46	-0.07	0.9%	-0.12	-0.01	-2.39%	-3.02%	-1.86%	47.53%	50.96%	77.64%	78.05%
32	5-Day Priv	20	0.46%	-0.35	-0.01	1.31%	-0.09	0.03	-1.51%	-2.63%	-0.76%	47.11%	50.66%	78.05%	78.46%
33	4-Day Priv	20	-1.54%	-0.53	-0.07	-0.64%	-0.35	-0.04	-3.49%	-4.49%	-0.43%	47.29%	51.81%	77.64%	75.2%
34	3-Day Priv	20	-2.16%	-0.64	-0.08	-0.74%	-0.28	-0.04	-4.11%	-4.71%	-0.8%	47.77%	51.75%	77.24%	80.08%
35	2-Day Priv	20	-0.83%	-0.56	-0.06	0.87%	-0.23	0.04	-2.84%	-3.09%	0.78%	47.83%	52.29%	79.67%	77.64%
36	1-Day Priv	20	1.28%	-0.03	0.08	4.8%	0.46	0.38	-0.74%	0.83%	-0.78%	48.43%	52.41%	80.08%	77.64%
37	Origin	20	-0.23%	-0.24	-0.04	2.95%	0.19	0.11	-2.29%	-1.05%	-0.43%	48.37%	51.27%	81.71%	76.83%
38	1-Day After	20	0.47%	-0.24	0.00	3.21%	0.11	0.12	-1.65%	-0.76%	-0.37%	48.31%	51.45%	84.15%	73.58%
39	2-Day After	20	0.41%	-0.16	0.01	2.66%	0.08	0.14	-1.64%	-1.29%	-0.68%	47.53%	51.14%	81.3%	75.61%
40	3-Day After	20	0.33%	-0.26	0.00	3.63%	0.24	0.22	-1.68%	-0.29%	-0.8%	47.11%	52.35%	79.67%	75.61%
41	4-Day After	20	0.07%	-0.06	-0.01	2.71%	0.21	0.16	-2.14%	-1.38%	-1.07%	48.31%	51.14%	87.8%	74.8%
42	5-Day After	20	-1.1%	-0.28	-0.06	2.45%	0.21	0.12	-3.3%	-1.73%	-0.27%	48.73%	51.81%	87.4%	78.46%
43	6-Day After	20	0.36%	-0.20	-0.01	2.7%	0.11	0.15	-1.81%	-1.45%	-0.81%	48.49%	51.27%	86.18%	78.86%
44	7-Day After	20	1.96%	-0.06	0.14	3.94%	0.19	0.26	-0.14%	-0.16%	0.25%	48.86%	51.2%	83.33%	79.27%
45	8-Day After	20	1.11%	0.15	0.06	4.38%	0.47	0.27	-1.02%	0.34%	0.37%	50.12%	52.11%	84.55%	76.02%
46	9-Day After	20	0.84%	-0.07	0.03	3.77%	0.28	0.19	-1.22%	-0.12%	0.06%	47.95%	51.2%	82.11%	72.36%
47	10-Day After	20	0.03%	-0.19	-0.02	2.52%	0.15	0.09	-1.94%	-1.32%	-0.3%	47.89%	51.63%	78.05%	74.39%
48	11-Day After	20	0.89%	-0.03	0.07	2.4%	0.10	0.16	-1.14%	-1.53%	-1.24%	48.31%	51.81%	80.49%	75.2%
49	12-Day After	20	-0.36%	-0.27	-0.03	1.01%	0.01	0.02	-2.32%	-2.94%	-1.59%	47.47%	51.02%	77.64%	78.86%
50	13-Day After	20	-0.89%	-0.32	-0.04	0.05%	-0.05	-0.02	-2.83%	-3.78%	-1.33%	47.47%	51.02%	76.83%	74.8%

2.7.1 Composite Factor

Taking the second-order momentum, momentum spread, turnover rate change, long-short total, volume-pricing ranking covariance and first-order volume-price divergence, composing together with standardization and equally weighting (the weighting could be potentially optimized)



Freq	Long Excess	Long Sharpe	Long Calmar	L/S Returns	L/S Sharpe	L/S Calmar	Long WR	L/S WR	rankIC	Short WR	Long TO	Short TO		
0	5	7.7%	0.96	0.49	11.37%	1.59	0.73	0.29%	-2.06%	3.77%	51.63%	53.77%	73.57%	59.72%

2.7.1 Composite Factor

Rolling Rebalancing frequency backtest results

5 day rebalance frequency

	Start Date	Freq	多头超额	多头 Sharpe	多头 Calmar	多空收益	多空 Sharpe	多空 Calmar	多头扣费	多空扣费	rankIC	多头胜率	空头胜率	多头换手	空头换手
0	4-Day Priv	5	7.03%	0.92	0.74	11.18%	1.35	1.20	-0.17%	-2.11%	4.16%	51.31%	53.39%	71.38%	60.43%
1	3-Day Priv	5	6.46%	1.27	0.56	13.34%	1.79	1.16	-0.87%	0.06%	4.37%	51.07%	53.99%	72.74%	58.92%
2	2-Day Priv	5	8.08%	0.64	0.93	14.26%	1.98	1.63	0.74%	0.98%	3.95%	50.36%	53.81%	72.75%	58.9%
3	1-Day Priv	5	5.26%	0.04	0.33	12.37%	1.74	0.76	-2.36%	-1.04%	3.66%	50.54%	54.46%	75.65%	57.41%
4	Origin	5	7.62%	0.99	0.50	11.34%	1.61	0.75	0.21%	-2.09%	3.81%	51.67%	53.69%	73.49%	59.7%
5	1-Day After	5	6.78%	0.85	0.69	11.03%	1.31	1.12	-0.38%	-2.24%	4.04%	51.13%	53.39%	71.08%	60.53%
6	2-Day After	5	6.32%	1.20	0.54	13.07%	1.76	1.13	-1.02%	-0.24%	4.24%	50.89%	53.99%	72.84%	59.12%
7	3-Day After	5	8.09%	0.60	0.87	14.07%	1.94	1.54	0.77%	0.8%	3.84%	50.3%	53.81%	72.65%	59.0%
8	4-Day After	5	5.28%	-0.04	0.31	12.26%	1.66	0.74	-2.32%	-1.12%	3.51%	50.42%	54.4%	75.43%	57.31%

10 day rebalance frequency

	Start Date	Freq	多头超额	多头 Sharpe	多头 Calmar	多空收益	多空 Sharpe	多空 Calmar	多头扣费	多空扣费	rankIC	多头胜率	空头胜率	多头换手	空头换手
9	7-Day Priv	10	5.92%	1.00	0.81	11.58%	1.44	1.57	1.14%	2.78%	4.51%	50.6%	53.65%	95.0%	79.55%
10	6-Day Priv	10	4.47%	0.51	0.32	9.99%	1.24	0.69	-0.31%	1.36%	4.21%	50.36%	52.93%	94.84%	76.31%
11	5-Day Priv	10	5.45%	0.84	0.45	8.65%	1.11	0.68	0.56%	-0.05%	6.01%	50.36%	52.57%	97.01%	75.52%
12	4-Day Priv	10	6.46%	0.75	0.68	11.78%	1.24	1.20	1.79%	3.26%	5.66%	51.44%	53.83%	92.66%	76.52%
13	3-Day Priv	10	7.65%	1.01	0.54	14.03%	1.49	0.96	2.87%	5.26%	5.92%	51.08%	53.29%	94.76%	79.38%
14	2-Day Priv	10	7.93%	0.84	0.78	14.27%	1.48	1.37	3.05%	5.5%	6.31%	51.14%	52.81%	96.77%	77.4%
15	1-Day Priv	10	7.89%	0.88	0.54	14.19%	1.51	0.96	3.02%	5.5%	6.01%	52.22%	53.35%	96.74%	75.6%
16	Origin	10	7.37%	1.21	0.50	13.9%	1.77	0.95	2.5%	5.02%	4.43%	52.87%	54.49%	96.64%	79.58%
17	1-Day After	10	6.53%	0.59	0.54	10.27%	0.90	0.83	1.66%	1.28%	6.6%	51.32%	52.99%	96.69%	81.68%
18	2-Day After	10	7.65%	1.26	0.63	13.48%	1.58	1.11	2.79%	4.7%	5.14%	52.1%	52.75%	96.36%	77.83%
19	3-Day After	10	5.96%	0.93	0.78	11.76%	1.35	1.53	1.2%	2.97%	4.31%	50.42%	53.53%	94.4%	79.95%
20	4-Day After	10	4.56%	0.47	0.31	10.01%	1.20	0.67	-0.22%	1.37%	3.89%	50.24%	52.87%	94.74%	76.71%
21	5-Day After	10	5.43%	0.76	0.42	8.58%	1.05	0.65	0.55%	-0.15%	5.7%	50.18%	52.57%	96.91%	76.36%
22	6-Day After	10	6.27%	0.64	0.62	11.69%	1.20	1.16	1.6%	3.14%	5.51%	51.14%	53.95%	92.58%	76.93%
23	7-Day After	10	7.82%	0.98	0.52	14.08%	1.52	0.97	3.05%	5.3%	5.91%	51.02%	53.47%	94.76%	79.38%

20 day rebalance frequency

24	13-Day Priv	20	6.21%	0.76	0.41	12.4%	1.54	0.84	3.25%	7.07%	9.02%	51.69%	53.86%	117.72%	93.68%
25	12-Day Priv	20	7.14%	0.90	0.55	15.69%	1.78	1.19	4.07%	10.4%	7.92%	51.63%	54.4%	121.75%	88.0%
26	11-Day Priv	20	7.12%	1.05	0.39	13.57%	1.66	0.73	3.96%	8.0%	7.34%	53.43%	53.61%	125.41%	95.5%
27	10-Day Priv	20	6.21%	0.89	0.30	12.82%	1.47	0.61	3.09%	7.34%	5.44%	52.71%	54.46%	123.46%	94.37%
28	9-Day Priv	20	5.13%	0.73	0.31	8.8%	1.07	0.51	2.05%	3.26%	5.84%	50.36%	52.95%	122.24%	97.82%
29	8-Day Priv	20	3.94%	0.56	0.17	8.51%	1.11	0.37	0.71%	2.81%	5.06%	50.12%	52.77%	128.17%	98.07%
30	7-Day Priv	20	3.93%	0.62	0.20	7.53%	0.94	0.37	0.76%	1.78%	6.29%	49.58%	52.95%	125.98%	102.06%
31	6-Day Priv	20	4.94%	0.61	0.27	9.31%	1.22	0.51	1.96%	3.9%	5.68%	50.6%	53.19%	118.17%	96.4%
32	5-Day Priv	20	4.91%	0.75	0.35	7.75%	0.99	0.60	1.95%	2.35%	6.79%	50.3%	52.59%	117.62%	96.6%
33	4-Day Priv	20	6.83%	0.91	0.65	8.74%	0.87	0.85	3.84%	3.32%	7.31%	51.87%	52.89%	118.8%	96.05%
34	3-Day Priv	20	7.88%	1.18	0.71	12.23%	1.31	1.10	4.94%	6.77%	6.25%	51.87%	52.35%	116.75%	99.67%
35	2-Day Priv	20	7.31%	1.06	0.77	9.29%	1.13	0.97	4.36%	3.87%	5.37%	51.39%	50.42%	117.13%	97.97%
36	1-Day Priv	20	5.57%	0.64	0.47	6.96%	0.72	0.61	2.7%	1.63%	6.75%	51.57%	51.08%	114.0%	97.44%
37	Origin	20	3.23%	0.60	0.27	7.64%	0.96	0.60	0.34%	2.15%	6.85%	51.08%	52.29%	114.41%	103.25%
38	1-Day After	20	5.97%	0.97	0.57	10.42%	1.18	0.98	3.15%	5.12%	6.6%	52.05%	53.07%	111.83%	98.83%
39	2-Day After	20	6.95%	1.04	0.62	11.49%	1.35	1.01	4.1%	6.19%	6.35%	52.59%	53.07%	113.21%	97.07%
40	3-Day After	20	4.53%	0.84	0.45	8.62%	1.05	0.82	1.53%	3.26%	5.78%	51.51%	53.01%	119.21%	93.86%
41	4-Day After	20	4.9%	0.72	0.47	9.99%	1.17	0.91	1.94%	4.73%	7.35%	50.66%	52.59%	117.11%	91.51%
42	5-Day After	20	6.41%	0.91	0.69	11.07%	1.12	1.09	3.44%	5.73%	8.56%	51.08%	52.59%	118.09%	93.48%
43	6-Day After	20	6.92%	0.77	0.58	11.97%	1.25	0.96	3.95%	6.75%	7.32%	51.57%	52.71%	117.85%	89.26%
44	7-Day After	20	5.87%	0.73	0.40	12.6%	1.51	0.83	2.9%	7.25%	9.0%	51.51%	54.1%	118.13%	94.09%
45	8-Day After	20	7.37%	0.98	0.56	15.96%	1.85	1.22	4.31%	10.67%	8.05%	51.69%	54.7%	121.34%	88.61%
46	9-Day After	20	7.32%	1.01	0.38	13.78%	1.63	0.72	4.16%	8.21%	7.14%	53.37%	53.49%	125.41%	95.91%
47	10-Day After	20	6.22%	0.82	0.28	12.66%	1.39	0.59	3.12%	7.17%	5.29%	52.47%	54.34%	123.05%	94.72%
48	11-Day After	20	5.6%	0.70	0.30	9.51%	1.07	0.51	2.51%	3.93%	5.63%	50.3%	53.01%	122.85%	98.43%
49	12-Day After	20	4.18%	0.55	0.17	8.9%	1.07	0.36	0.94%	3.19%	5.12%	50.3%	52.65%	128.25%	98.24%
50	13-Day After	20	4.02%	0.56	0.19	7.8%	0.89	0.36	0.85%	2.06%	6.09%	49.34%	52.83%	125.57%	102.26%

Tackling sector allocation through the residual income model and reproduction of fundamental factors

1 Book-to-Market Ratio

1.1 Changes in BM ratio

2 Net sales profit Margin

2.1 change in net sales profit margin

3 Total Asset Turnover Ratio

3.1 Change in total asset turnover ratio

4 Equity Multiplier

Factors that outperformed were labeled as red

4.1 Change in EM

5 Cost of Equity

5.1 Dividend Capital Model

5.1.1 Change in the value of dividend capital model

5.2 CAPM

5.2.1 Change in CAPM

5.3 Fama-French

5.3.1 Change in Fama-French

6 Composite Factor 1

Composite Factor 2

Composite Factor 3

Theory Derivation

By Residual Income Model (*Preinreich, 1938*)

$$EV = BV_0 + \sum_{t=1}^{\infty} RI_t \cdot (1+r)^{-t}$$

$$RI_t = X_t - r \cdot BV_{t-1}$$

Substitute, we get :

$$\begin{aligned} EV &= BV_0 + \sum_{t=1}^{\infty} (X_t - r \cdot BV_{t-1}) \cdot (1+r)^t \\ &= BV_0 + \sum_{t=1}^{\infty} (ROE_t - r) \cdot BV_{t-1} \cdot (1+r)^{-t} \end{aligned}$$

Divide both sides by MV_0 ,

$$\begin{aligned} \frac{EV}{MV_0} &= \frac{BV_0}{MV_0} + \sum_{t=1}^{\infty} (ROE_t - r) \cdot \frac{BV_{t-1}}{MV_0} \cdot (1+r)^{-t} \\ &= BM_0 + \sum_{t=1}^{\infty} (ROE_t - r) \cdot BM_{t-1} \cdot (1+r)^{-t} \end{aligned}$$

Applying Dupont analysis on ROE,

$$\begin{aligned} ROE_t &= \frac{X_t}{BV_{t-1}} \\ &= \frac{X_t}{Asset_{t-1}} \cdot \frac{Asset_{t-1}}{BV_{t-1}} \\ &= \frac{X_t}{Sales_t} \cdot \frac{Sales_t}{Asset_{t-1}} \cdot \frac{Asset_{t-1}}{BV_{t-1}} \\ &= MOS_t \cdot ATO_t \cdot EM_{t-1} \end{aligned}$$

Where:

MOS : 销售净利率

ATO : 短期每日多空力量对比的窗口期

EM : 权益乘数

MOS: Net profit margin

ATO: Short-term daily

multi-effort volume

comparison window period

EM: Equity Multiplier

Residual income with variable dynamics:

$$\text{剩余收益} = f(BM \uparrow, MOS \uparrow, ATO \uparrow, EM \uparrow, r \downarrow)$$

Calculate cost of equity r :

$$r = \frac{D_1}{P} + g \quad (1)$$

$$r = r_f + b \cdot (r_m - r_f) + s \cdot SMB + h \cdot HML \quad (2)$$

where:

r_m : Market return

r_f : risk-free rate

SMB, HML are size and value factors, respectively.

Financial Variables

The four financial variables of book-to-market ratio, net sales profit margin, total asset turnover rate, and equity multiplier can be directly observed. First, these are calculated separately for each individual stock, and the values go through winsorization to remove extreme values at 5%, lastly the mean is acquired.

3.1.1 BM Ratio

BM Effect: Companies with higher BM ratios tend to outperformed those with lower BM ratios. However, this effect was not observed through backtest, thus, we leave out this factor.



3.1.1 BM Ratio

Rolling backtest results:

The rebalance frequency is low (quarterly), as the financial reports are reported quarterly, which are usually the end of April, August, October and January.

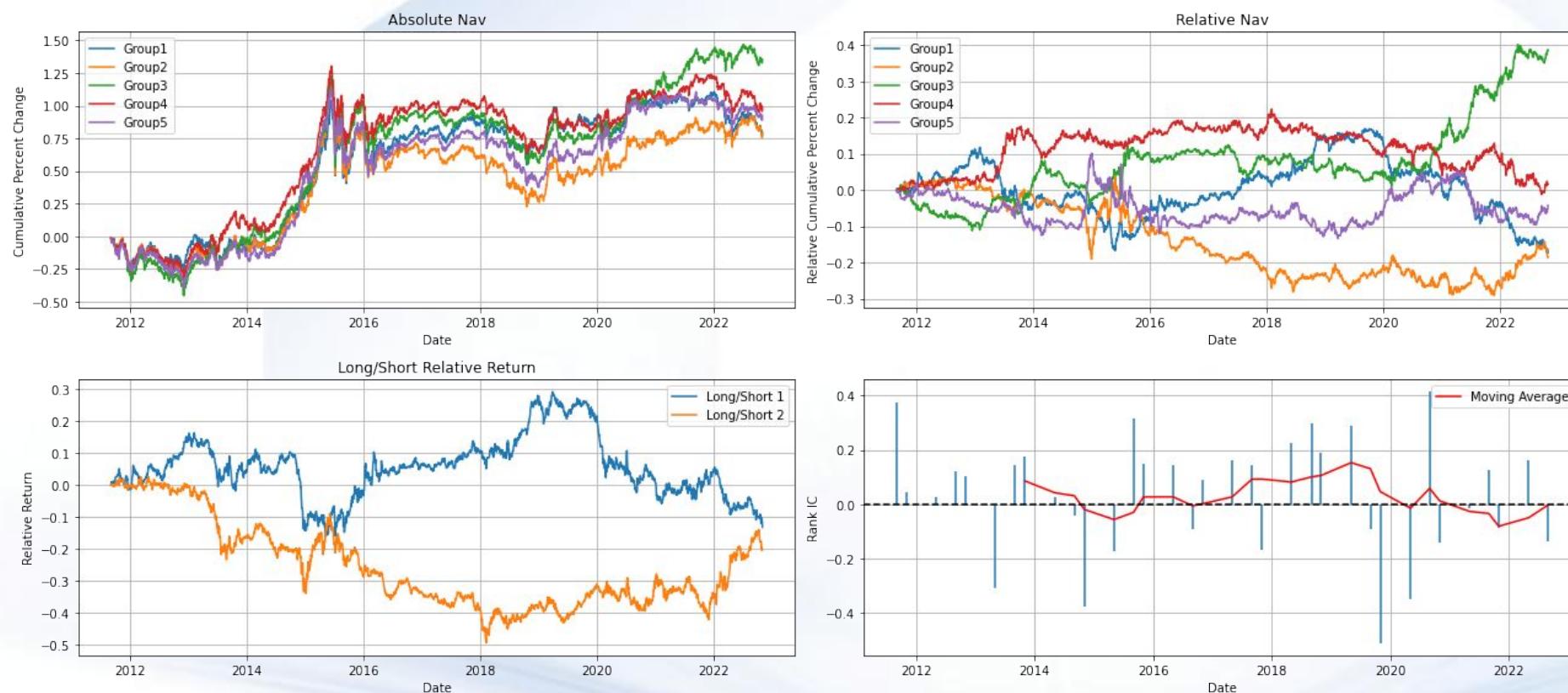
We set the rebalance dates to be the first of the following months.

Freq	Long_Excess	Long_Sharpe	Long_Calmar	L/S Returns	L/S Sharpe	L/S_Calmar	Long WR	L/S WR	rankIC	Short WR	Long TO	Short TO
0	Origin	1.29%	-0.07	-0.01	0.26%	-0.06	-0.10	1.18%	-0.01%	-0.78%	48.42%	49.91%
1	1-Day After	1.22%	-0.05	-0.01	0.36%	-0.08	-0.10	1.12%	0.08%	-0.1%	48.5%	49.84%
2	2-Day After	1.2%	-0.07	-0.01	0.5%	-0.05	-0.08	1.1%	0.23%	-0.76%	48.52%	49.96%
3	3-Day After	1.24%	-0.01	0.00	0.47%	0.02	-0.06	1.14%	0.2%	-0.11%	48.64%	50.21%
4	4-Day After	1.31%	0.03	0.01	0.67%	0.05	-0.05	1.21%	0.39%	0.41%	48.77%	50.12%
5	5-Day After	1.38%	0.08	0.01	0.69%	0.11	-0.05	1.27%	0.41%	1.8%	48.75%	50.21%
6	6-Day After	1.49%	0.08	0.01	0.65%	0.05	-0.08	1.39%	0.37%	1.63%	48.7%	50.15%
7	7-Day After	1.35%	-0.04	-0.03	0.73%	-0.05	-0.11	1.24%	0.45%	0.91%	48.64%	50.08%
8	8-Day After	1.55%	0.01	-0.03	0.8%	-0.07	-0.12	1.45%	0.52%	1.31%	48.61%	49.76%
9	9-Day After	1.38%	0.00	-0.03	0.62%	-0.07	-0.12	1.28%	0.35%	1.19%	48.43%	49.64%
10	10-Day After	1.31%	-0.04	-0.03	0.58%	-0.11	-0.12	1.21%	0.31%	0.33%	48.24%	49.45%

3.1.2 Change in Book-to-Market Ratio (Raw Value)

Raw Value VS Direction of Change

- It is obviously less ideal to select sectors according to the raw value of the BM ratio, since the inherent structures of different sectors vary greatly. For example, the banking sector always has a higher BM ratio
- On the contrary, it is more practical to choose sectors according to the direction of the change in BM ratios for some past periods.



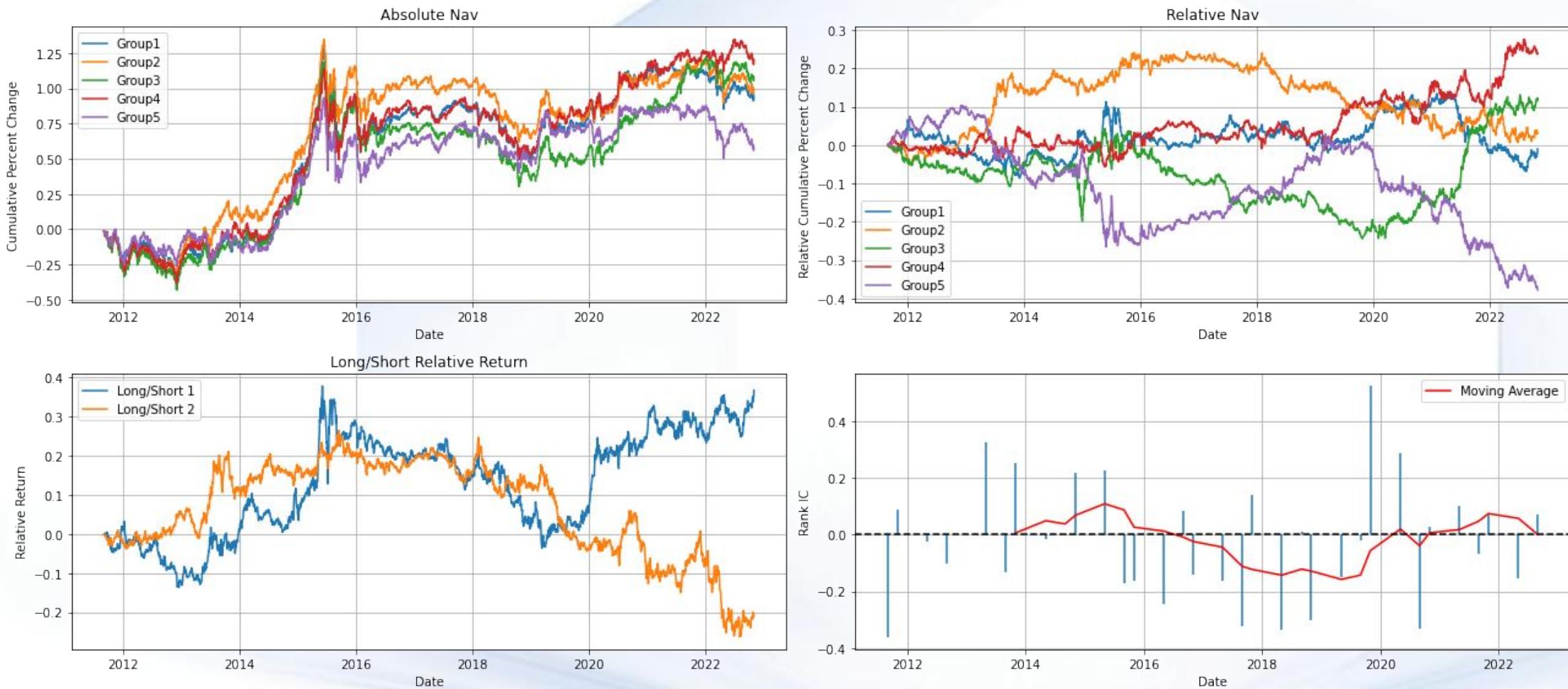
Freq	Long Excess	Long Sharpe	Long Calmar	L/S Returns	L/S Sharpe	L/S Calmar	Long WR	L/S WR	rankIC	Short WR	Long TO	Short TO	
0	-1.62%	0.22	0.0	-1.22%	0.44	0.07	-2.53%	-3.05%	3.65%	50.11%	53.59%	151.96%	152.94%

3.1.2 Change in Book-to-Market Ratio (Raw Value)

Rolling backtest results:

	Freq	Long Excess	Long Sharpe	Long Calmar	L/S Returns	L/S Sharpe	L/S Calmar	Long WR	L/S WR	rankIC	Short WR	Long TO	Short TO	
0	Origin	-1.62%	0.22	0.00	-1.22%	0.44	0.07	-2.53%	-3.05%	3.65%	50.11%	53.59%	151.96%	152.94%
1	1-Day After	-0.64%	0.51	0.06	-0.21%	0.62	0.15	-1.55%	-2.04%	4.04%	50.76%	53.62%	151.96%	152.94%
2	2-Day After	-0.3%	0.55	0.07	0.44%	0.73	0.17	-1.21%	-1.39%	2.49%	50.75%	53.91%	151.96%	152.94%
3	3-Day After	-0.36%	0.54	0.08	0.21%	0.69	0.19	-1.27%	-1.62%	1.07%	50.58%	53.9%	151.96%	152.94%
4	4-Day After	-0.61%	0.42	0.07	-0.11%	0.51	0.16	-1.53%	-1.94%	1.58%	50.43%	53.53%	151.96%	152.94%
5	5-Day After	-0.75%	0.31	0.05	0.18%	0.51	0.16	-1.66%	-1.65%	2.66%	50.14%	53.79%	151.96%	152.94%
6	6-Day After	-0.61%	0.43	0.06	0.84%	0.61	0.18	-1.53%	-0.99%	2.65%	50.17%	53.56%	151.96%	152.94%
7	7-Day After	-0.72%	0.47	0.05	0.61%	0.72	0.17	-1.63%	-1.22%	3.34%	50.36%	53.62%	151.96%	152.94%
8	8-Day After	-0.6%	0.53	0.06	0.52%	0.71	0.17	-1.51%	-1.31%	1.45%	50.23%	53.28%	151.96%	152.94%
9	9-Day After	-0.65%	0.47	0.05	0.28%	0.69	0.16	-1.56%	-1.55%	0.97%	49.88%	53.18%	151.96%	152.94%
10	10-Day After	-1.03%	0.34	0.03	-0.35%	0.52	0.11	-1.94%	-2.18%	2.71%	49.83%	52.87%	151.96%	152.94%

3.1.2 Change in BM ratio (YoY) — -1*Change Direction



Freq	Long Excess	Long Sharpe	Long Calmar	L/S Returns	L/S Sharpe	L/S Calmar	Long WR	L/S WR	rankIC	Short WR	Long TO	Short TO	
0	-0.09%	-0.33	-0.07	3.42%	-0.21	0.05	-1.04%	1.55%	-2.24%	48.07%	52.25%	157.84%	154.9%

3.1.2 Change in BM ratio (YoY) — -1*Change Direction

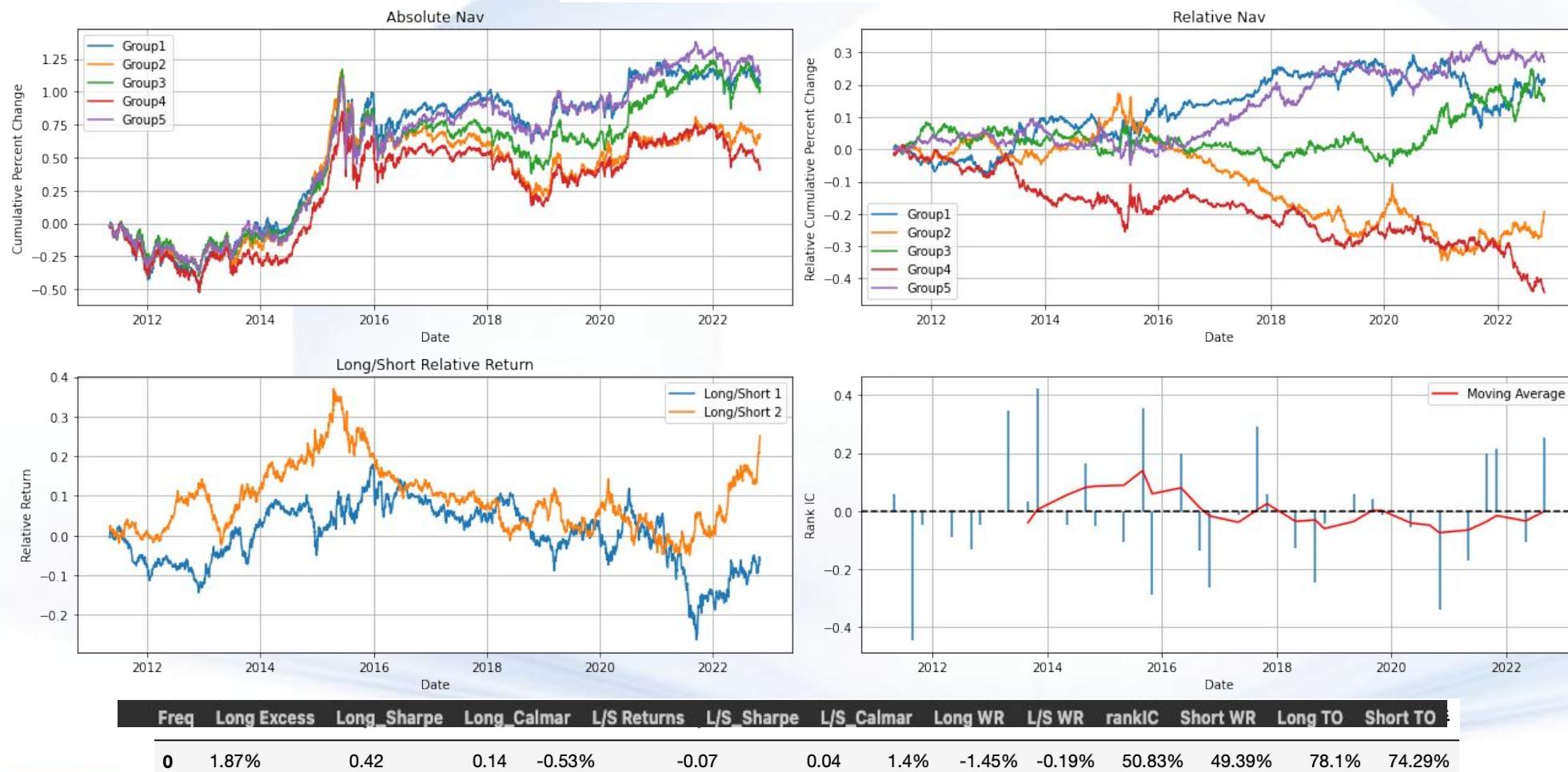
Rolling backtest results:

Freq		Long Excess	Long Sharpe	Long Calmar	L/S Returns	L/S Sharpe	L/S Calmar	Long WR	L/S WR	rankIC	Short WR	Long TO	Short TO	
0	Origin	-0.09%	-0.33	-0.07	3.42%	-0.21	0.05	-1.04%	1.55%	-2.24%	48.07%	52.25%	157.84%	154.9%
1	1-Day After	-0.1%	-0.32	-0.10	3.24%	-0.20	0.02	-1.05%	1.36%	-2.51%	48.2%	51.94%	157.84%	154.9%
2	2-Day After	-0.36%	-0.42	-0.13	2.56%	-0.34	-0.04	-1.3%	0.68%	-1.24%	48.03%	51.98%	157.84%	154.9%
3	3-Day After	0.01%	-0.39	-0.13	2.58%	-0.32	-0.06	-0.93%	0.71%	-1.31%	47.86%	51.91%	157.84%	154.9%
4	4-Day After	-0.03%	-0.33	-0.12	2.48%	-0.30	-0.08	-0.98%	0.6%	-1.26%	48.13%	51.81%	157.84%	154.9%
5	5-Day After	-0.37%	-0.39	-0.12	2.13%	-0.30	-0.05	-1.32%	0.25%	-1.95%	47.81%	51.98%	157.84%	154.9%
6	6-Day After	-0.59%	-0.37	-0.11	1.83%	-0.33	-0.05	-1.54%	-0.05%	-1.53%	47.9%	52.11%	157.84%	154.9%
7	7-Day After	-0.36%	-0.45	-0.10	2.37%	-0.35	-0.03	-1.31%	0.49%	-2.21%	47.69%	52.06%	157.84%	154.9%
8	8-Day After	-0.33%	-0.41	-0.12	2.5%	-0.30	-0.02	-1.28%	0.63%	-0.82%	47.76%	52.68%	157.84%	154.9%
9	9-Day After	-0.67%	-0.49	-0.14	2.16%	-0.30	-0.03	-1.62%	0.29%	0.16%	47.8%	52.76%	157.84%	154.9%
10	10-Day After	-0.67%	-0.52	-0.15	2.26%	-0.34	-0.06	-1.62%	0.38%	-1.26%	47.56%	52.55%	157.84%	154.9%

3. 2. 1 Net Sales Profit Margin (MOS Ratio)

The net sales profit margin changes in the same direction as the company's net profit. Ideally, companies that increase their net profit margin while their sales revenues are increasing tend to have higher net sales profit margin. This reflects the profitability of the company.

$$\text{销售净利润率 (MOS)} = \frac{\text{净利润}}{\text{营业收入}} \quad \text{MOS} = \text{Net Profit} / \text{Sales}$$



3.2.1 Net Sales Profit Margin (MOS Ratio)

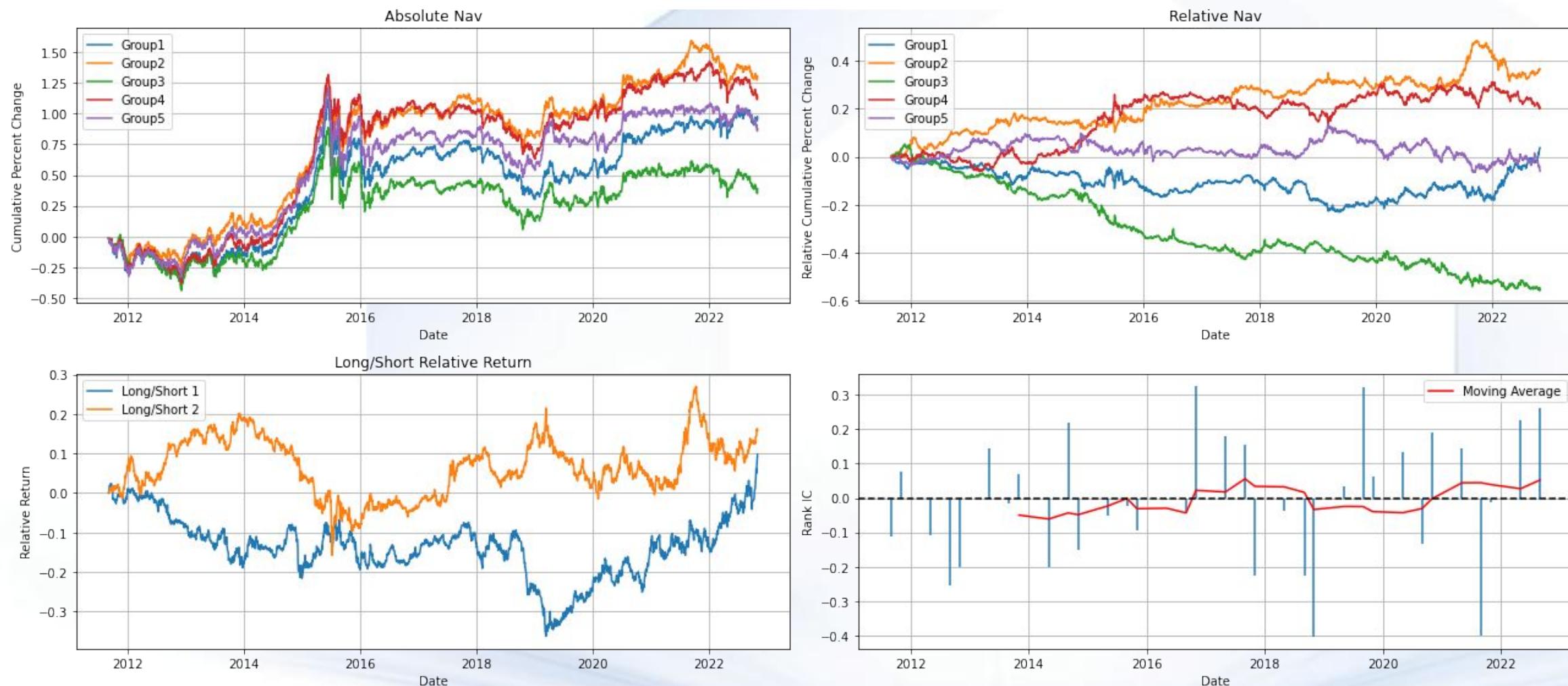
Rolling backtest results:

Freq		Long_Excess	Long_Sharpe	Long_Calmar	L/S Returns	L/S Sharpe	L/S Calmar	Long WR	L/S WR	rankIC	Short WR	Long TO	Short TO	
0	Origin	1.87%	0.42	0.14	-0.53%	-0.07	0.04	1.4%	-1.45%	-0.19%	50.83%	49.39%	78.1%	74.29%
1	1-Day After	1.89%	0.49	0.15	-0.44%	-0.04	0.06	1.42%	-1.36%	-1.57%	51.08%	49.37%	78.1%	74.29%
2	2-Day After	1.7%	0.34	0.12	-0.69%	-0.16	0.01	1.23%	-1.61%	-1.94%	50.74%	49.15%	78.1%	74.29%
3	3-Day After	1.54%	0.27	0.11	-0.89%	-0.20	0.00	1.08%	-1.8%	-1.5%	50.78%	49.3%	78.1%	74.29%
4	4-Day After	1.9%	0.32	0.11	-0.34%	-0.20	0.01	1.43%	-1.26%	-1.14%	50.66%	49.25%	78.1%	74.29%
5	5-Day After	1.86%	0.40	0.14	-0.3%	-0.13	0.04	1.4%	-1.21%	-0.68%	50.72%	49.36%	78.1%	74.29%
6	6-Day After	1.69%	0.38	0.13	-0.14%	-0.08	0.05	1.22%	-1.05%	-1.16%	50.77%	49.25%	78.1%	74.29%
7	7-Day After	1.54%	0.36	0.12	-0.15%	-0.10	0.04	1.07%	-1.06%	-1.76%	50.49%	49.16%	78.1%	74.29%
8	8-Day After	1.37%	0.28	0.13	-0.07%	-0.12	0.06	0.9%	-0.98%	-0.85%	50.49%	49.47%	78.1%	74.29%
9	9-Day After	1.44%	0.20	0.11	-0.03%	-0.19	0.05	0.97%	-0.95%	-1.0%	50.21%	49.37%	78.1%	74.29%
10	10-Day After	1.21%	0.18	0.10	-0.21%	-0.21	0.03	0.74%	-1.12%	-0.6%	50.11%	49.43%	78.1%	74.29%

3.2.2 Change in Net Sales Profit Margin (Raw)

$$\text{MOS} = \text{MOS}_t - \text{MOS}_{t-1}$$

$$\text{MOS 一阶变量} = \text{MOS}_t - \text{MOS}_{t-1}$$



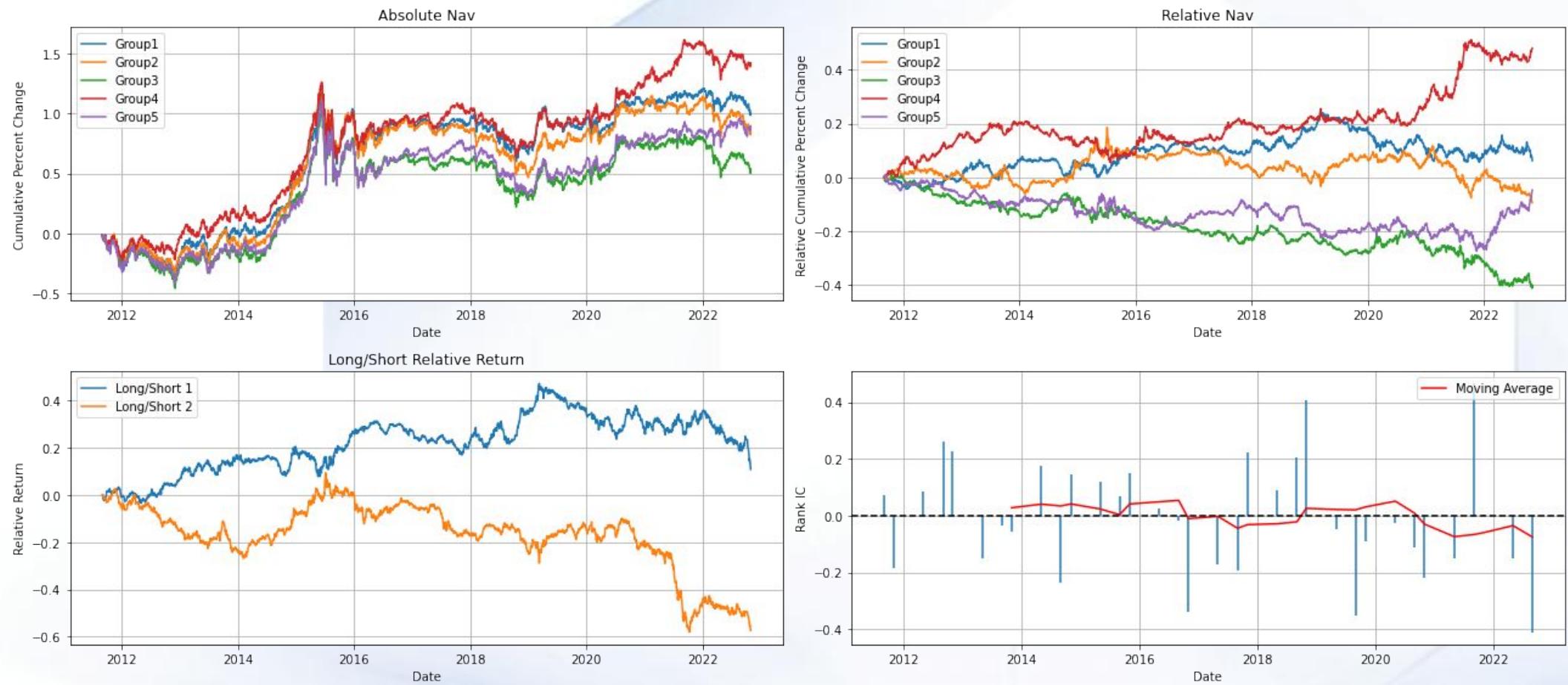
Freq	Long Excess	Long Sharpe	Long Calmar	L/S Returns	L/S Sharpe	L/S Calmar	Long WR	L/S WR	rankIC	Short WR	Long TO	Short TO	
0	0.36%	-0.07	0.0	0.91%	-0.02	0.02	-0.63%	-1.04%	-0.43%	49.05%	51.43%	165.69%	158.82%

3.2.2 Change in Net Sales Profit Margin (Raw)

Rolling backtest results:

	Freq	Long Excess	Long Sharpe	Long Calmar	L/S Returns	L/S Sharpe	L/S Calmar	Long WR	L/S WR	rankIC	Short WR	Long TO	Short TO	
0	Origin	0.36%	-0.07	0.00	0.91%	-0.02	0.02	-0.63%	-1.04%	-0.43%	49.05%	51.43%	165.69%	158.82%
1	1-Day After	0.28%	-0.04	0.01	0.52%	0.04	0.02	-0.71%	-1.42%	-1.96%	49.45%	51.45%	165.69%	158.82%
2	2-Day After	0.14%	-0.03	0.00	-0.25%	-0.06	-0.04	-0.85%	-2.19%	-2.28%	49.2%	50.92%	165.69%	158.82%
3	3-Day After	-0.22%	-0.18	-0.03	-0.38%	-0.10	-0.04	-1.21%	-2.33%	-1.38%	48.85%	51.19%	165.69%	158.82%
4	4-Day After	0.29%	-0.09	-0.01	0.05%	-0.06	-0.04	-0.71%	-1.9%	-1.13%	49.06%	51.18%	165.69%	158.82%
5	5-Day After	0.3%	-0.04	0.00	0.16%	-0.05	-0.04	-0.69%	-1.79%	-1.17%	49.04%	50.88%	165.69%	158.82%
6	6-Day After	0.43%	0.05	0.01	0.15%	-0.02	-0.03	-0.57%	-1.8%	-2.2%	49.15%	50.95%	165.69%	158.82%
7	7-Day After	0.34%	-0.02	-0.01	-0.02%	-0.17	-0.08	-0.65%	-1.96%	-3.29%	48.99%	50.74%	165.69%	158.82%
8	8-Day After	-0.18%	-0.17	-0.03	-0.22%	-0.17	-0.06	-1.18%	-2.17%	-2.82%	48.71%	50.89%	165.69%	158.82%
9	9-Day After	0.18%	-0.17	-0.02	-0.07%	-0.17	-0.05	-0.81%	-2.02%	-2.97%	49.04%	50.95%	165.69%	158.82%
10	10-Day After	0.12%	-0.11	-0.01	-0.26%	-0.12	-0.04	-0.88%	-2.2%	-1.19%	49.17%	51.04%	165.69%	158.82%

3.2.2 Change in Net Sales Profit Margin (YoY)



Freq	Long Excess	Long Sharpe	Long Calmar	L/S Returns	L/S Sharpe	L/S Calmar	Long WR	L/S WR	rankIC	Short WR	Long TO	Short TO	
0	0.59%	0.13	0.05	1.01%	0.14	0.06	-0.41%	-0.97%	-0.63%	49.61%	50.24%	165.69%	163.73%

3.2.2 Change in Net Sales Profit Margin (YoY)

Rolling backtest results:

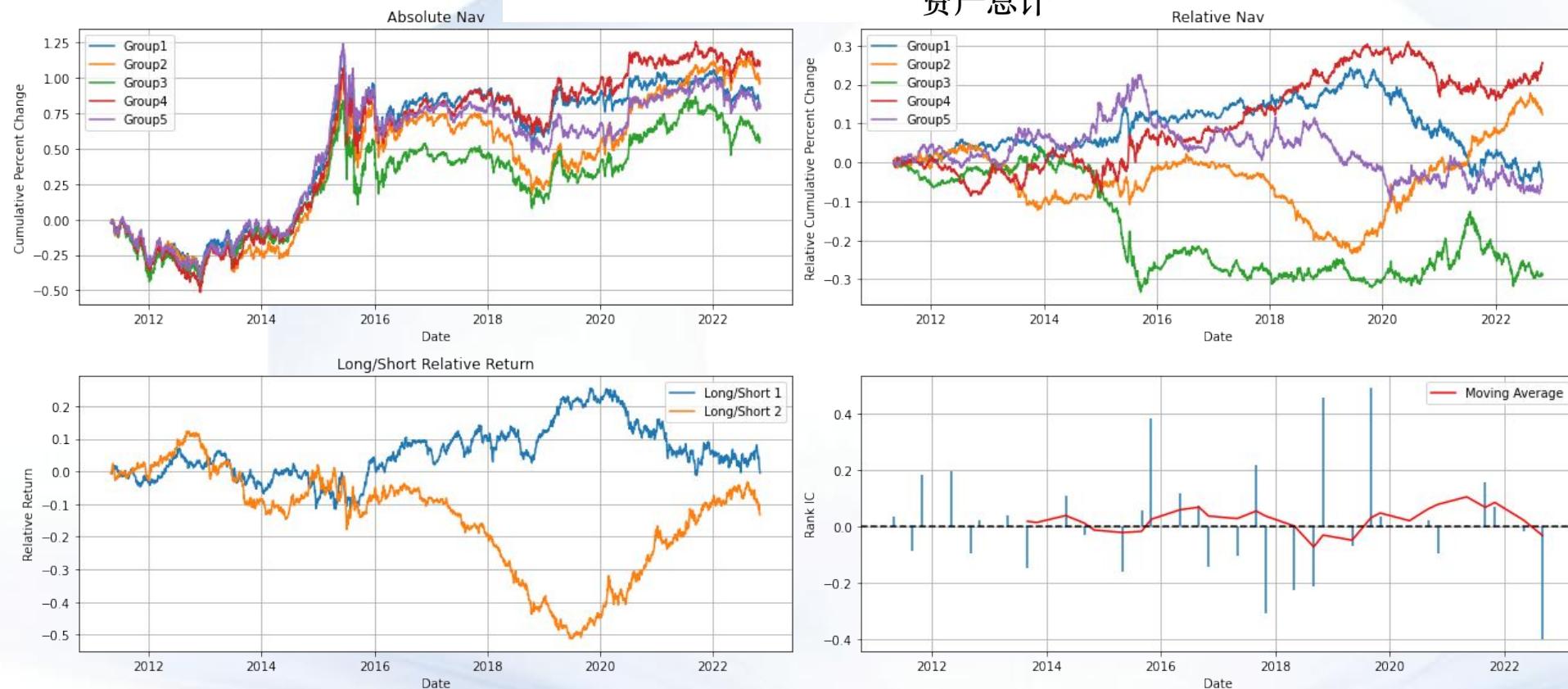
	Freq	Long Excess	Long Sharpe	Long Calmar	L/S Returns	L/S Sharpe	L/S Calmar	Long WR	L/S WR	rankIC	Short WR	Long TO	Short TO	
0	Origin	0.59%	0.13	0.05	1.01%	0.14	0.06	-0.41%	-0.97%	-0.63%	49.61%	50.24%	165.69%	163.73%
1	1-Day After	0.77%	0.09	0.05	1.03%	0.06	0.04	-0.23%	-0.94%	0.19%	49.65%	49.77%	165.69%	163.73%
2	2-Day After	1.14%	0.15	0.08	1.51%	0.09	0.07	0.14%	-0.47%	0.58%	49.85%	50.06%	165.69%	163.73%
3	3-Day After	1.26%	0.17	0.09	1.77%	0.15	0.09	0.27%	-0.21%	-0.22%	49.64%	50.31%	165.69%	163.73%
4	4-Day After	1.19%	0.12	0.09	1.17%	0.08	0.08	0.19%	-0.81%	-0.53%	49.66%	50.2%	165.69%	163.73%
5	5-Day After	1.19%	0.15	0.10	1.29%	0.12	0.10	0.19%	-0.69%	-0.18%	49.82%	50.4%	165.69%	163.73%
6	6-Day After	1.34%	0.23	0.12	1.33%	0.13	0.12	0.35%	-0.64%	1.1%	50.02%	50.26%	165.69%	163.73%
7	7-Day After	1.25%	0.26	0.13	1.34%	0.26	0.15	0.26%	-0.63%	1.88%	50.05%	50.51%	165.69%	163.73%
8	8-Day After	1.03%	0.22	0.12	1.52%	0.28	0.17	0.03%	-0.45%	1.56%	50.12%	50.94%	165.69%	163.73%
9	9-Day After	1.11%	0.18	0.11	1.53%	0.28	0.17	0.11%	-0.45%	1.54%	49.86%	51.05%	165.69%	163.73%
10	10-Day After	1.33%	0.24	0.11	1.71%	0.29	0.15	0.33%	-0.27%	-0.13%	49.98%	51.02%	165.69%	163.73%

3. 3. 1 Total Asset Turnover (ATO Ratio)

Total asset turnover rate is an important index to comprehensively evaluate the management quality and efficiency in utilizing company's total asset. Generally speaking, high frequency for the turnover means high efficiency in its management.

$$ATO = \text{Operation gain} / \text{Total Asset}$$

$$\text{总资产周转率 (ATO)} = \frac{\text{营业收入}}{\text{资产总计}}$$



Freq	Long Excess	Long Sharpe	Long Calmar	L/S Returns	L/S Sharpe	L/S Calmar	Long WR	L/S WR	rankIC	Short WR	Long TO	Short TO	
0	-0.4%	0.03	-0.01	0.0%	0.12	0.01	-0.76%	-0.67%	1.6%	48.76%	52.36%	60.95%	50.48%

3. 3. 1 Total Asset Turnover (ATO Ratio)

Rolling backtest results:

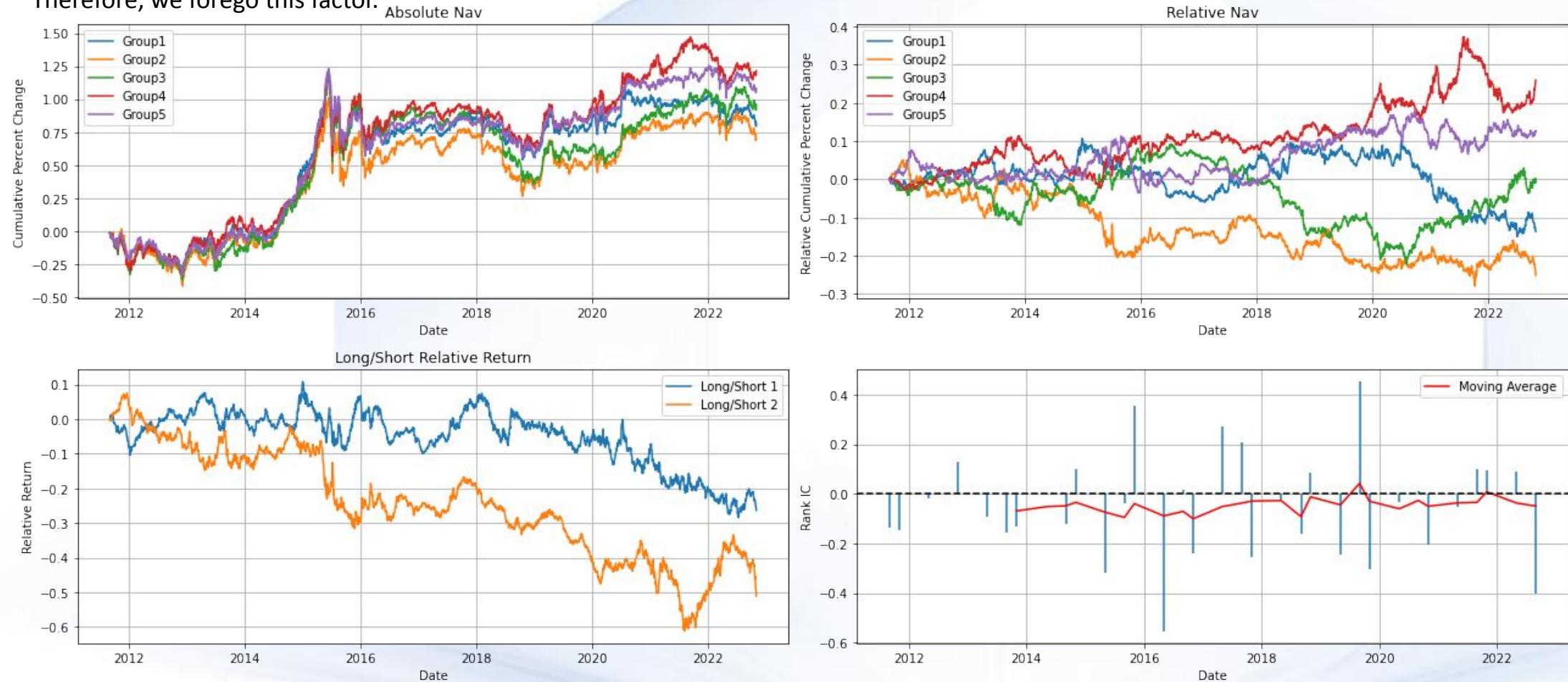
Freq		Long Excess	Long Sharpe	Long Calmar	L/S Returns	L/S Sharpe	L/S Calmar	Long WR	L/S WR	rankIC	Short WR	Long TO	Short TO	
0	Origin	-0.4%	0.03	-0.01	0.0%	0.12	0.01	-0.76%	-0.67%	1.6%	48.76%	52.36%	60.95%	50.48%
1	1-Day After	-0.76%	0.01	-0.02	-0.57%	0.06	-0.01	-1.12%	-1.24%	1.78%	48.67%	52.12%	60.95%	50.48%
2	2-Day After	-0.84%	0.03	-0.03	-0.66%	0.07	-0.01	-1.21%	-1.33%	1.56%	48.59%	52.3%	60.95%	50.48%
3	3-Day After	-0.88%	-0.02	-0.03	-0.79%	0.02	-0.02	-1.24%	-1.45%	1.85%	48.55%	52.41%	60.95%	50.48%
4	4-Day After	-0.81%	-0.00	-0.02	-0.5%	0.07	-0.01	-1.18%	-1.17%	2.85%	48.6%	52.64%	60.95%	50.48%
5	5-Day After	-0.71%	-0.01	-0.02	-0.24%	0.10	-0.00	-1.07%	-0.91%	2.84%	48.72%	52.74%	60.95%	50.48%
6	6-Day After	-0.61%	-0.04	-0.02	0.01%	0.15	0.02	-0.98%	-0.65%	3.1%	48.67%	52.96%	60.95%	50.48%
7	7-Day After	-0.72%	-0.06	-0.03	-0.04%	0.19	0.03	-1.08%	-0.71%	3.87%	48.64%	53.1%	60.95%	50.48%
8	8-Day After	-0.84%	-0.10	-0.03	0.24%	0.20	0.04	-1.21%	-0.42%	1.66%	48.5%	53.39%	60.95%	50.48%
9	9-Day After	-0.99%	-0.16	-0.04	0.25%	0.20	0.04	-1.35%	-0.42%	2.64%	48.42%	53.69%	60.95%	50.48%
10	10-Day After	-0.91%	-0.12	-0.03	0.35%	0.23	0.03	-1.28%	-0.32%	2.61%	48.41%	53.51%	60.95%	50.48%

3. 3. 2 Total Asset Turnover (Raw)

$$ATO = ATO_t - ATO_{t-1}$$

$$ATO \text{ 一阶变量} = ATO_t - ATO_{t-1}$$

Through the performance of this factor in backtesting, we observed that the performance is opposite to the theoretical correlation. Therefore, we forego this factor.



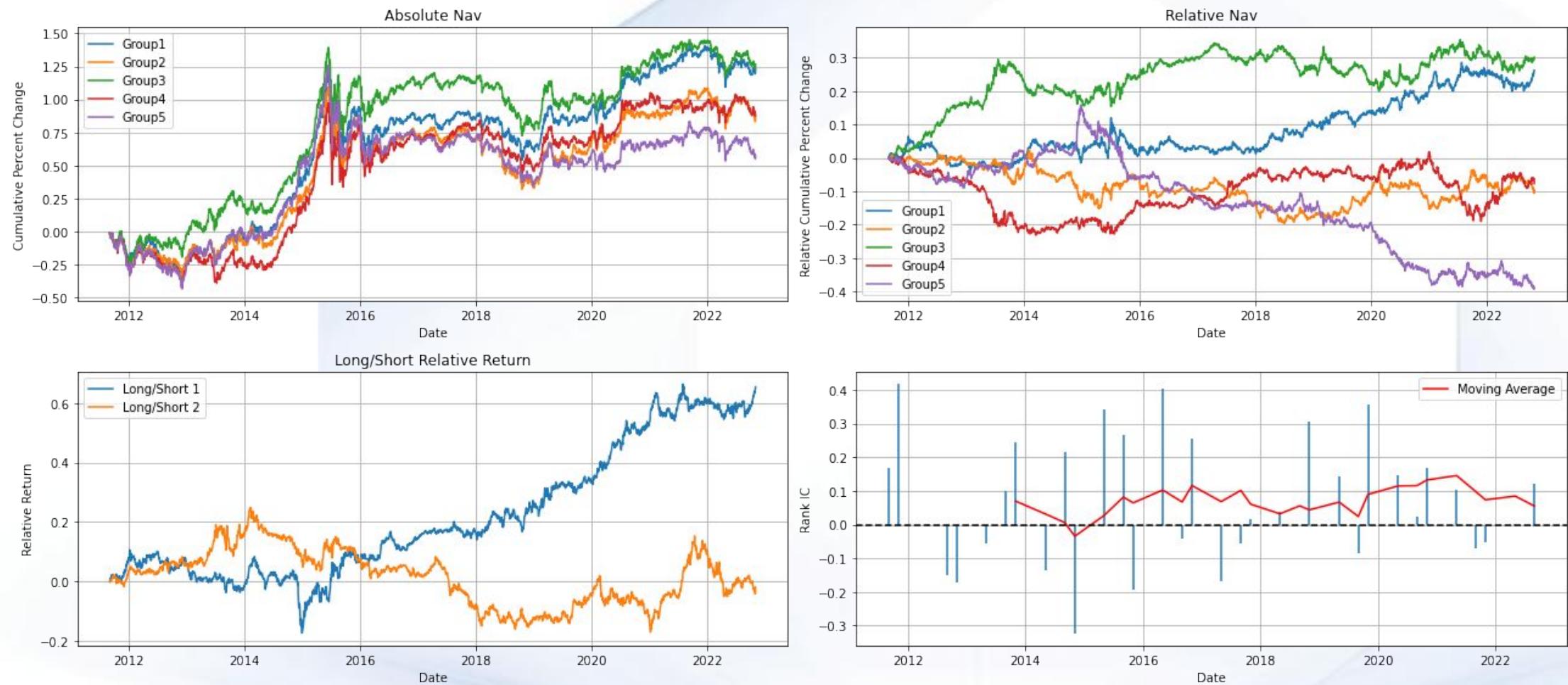
Freq	Long Excess	Long Sharpe	Long Calmar	L/S Returns	L/S Sharpe	L/S Calmar	Long WR	L/S WR	rankIC	Short WR	Long TO	Short TO	
0	-1.27%	-0.43	-0.09	-2.44%	-0.42	-0.12	-2.28%	-4.43%	-5.01%	47.44%	50.03%	168.63%	162.75%

3. 3. 2 Total Asset Turnover (Raw)

Rolling backtest results:

	Freq	Long Excess	Long Sharpe	Long Calmar	L/S Returns	L/S Sharpe	L/S Calmar	Long WR	L/S WR	rankIC	Short WR	Long TO	Short TO	
0	Origin	-1.27%	-0.43	-0.09	-2.44%	-0.42	-0.12	-2.28%	-4.43%	-5.01%	47.44%	50.03%	168.63%	162.75%
1	1-Day After	-0.95%	-0.36	-0.08	-1.95%	-0.35	-0.10	-1.96%	-3.94%	-4.46%	47.36%	50.14%	168.63%	162.75%
2	2-Day After	-0.46%	-0.17	-0.06	-1.46%	-0.29	-0.09	-1.47%	-3.45%	-3.77%	47.67%	50.13%	168.63%	162.75%
3	3-Day After	-0.23%	-0.22	-0.04	-1.31%	-0.31	-0.08	-1.24%	-3.3%	-3.78%	47.76%	50.07%	168.63%	162.75%
4	4-Day After	-0.09%	-0.14	-0.04	-0.9%	-0.22	-0.06	-1.1%	-2.89%	-3.61%	47.76%	50.28%	168.63%	162.75%
5	5-Day After	-0.23%	-0.17	-0.03	-0.96%	-0.21	-0.05	-1.24%	-2.94%	-2.86%	47.83%	50.43%	168.63%	162.75%
6	6-Day After	0.19%	-0.11	-0.02	-0.47%	-0.14	-0.02	-0.82%	-2.46%	-1.35%	47.76%	50.65%	168.63%	162.75%
7	7-Day After	0.26%	-0.10	-0.02	-0.07%	-0.02	0.00	-0.75%	-2.06%	-0.77%	47.65%	51.1%	168.63%	162.75%
8	8-Day After	0.46%	-0.06	0.00	0.17%	0.02	0.04	-0.55%	-1.81%	-1.9%	47.93%	51.28%	168.63%	162.75%
9	9-Day After	0.43%	-0.09	0.01	0.39%	0.05	0.06	-0.58%	-1.6%	-0.49%	48.03%	51.42%	168.63%	162.75%
10	10-Day After	0.6%	-0.05	0.02	0.84%	0.14	0.09	-0.41%	-1.15%	-0.04%	48.04%	51.47%	168.63%	162.75%

3. 3. 2 Total Asset Turnover (YoY)



Freq	Long Excess	Long Sharpe	Long Calmar	L/S Returns	L/S Sharpe	L/S Calmar	Long WR	L/S WR	rankIC	Short WR	Long TO	Short TO	
0	2.45%	0.05	0.11	6.08%	0.72	0.55	1.4%	4.04%	6.88%	49.97%	54.89%	174.51%	165.69%

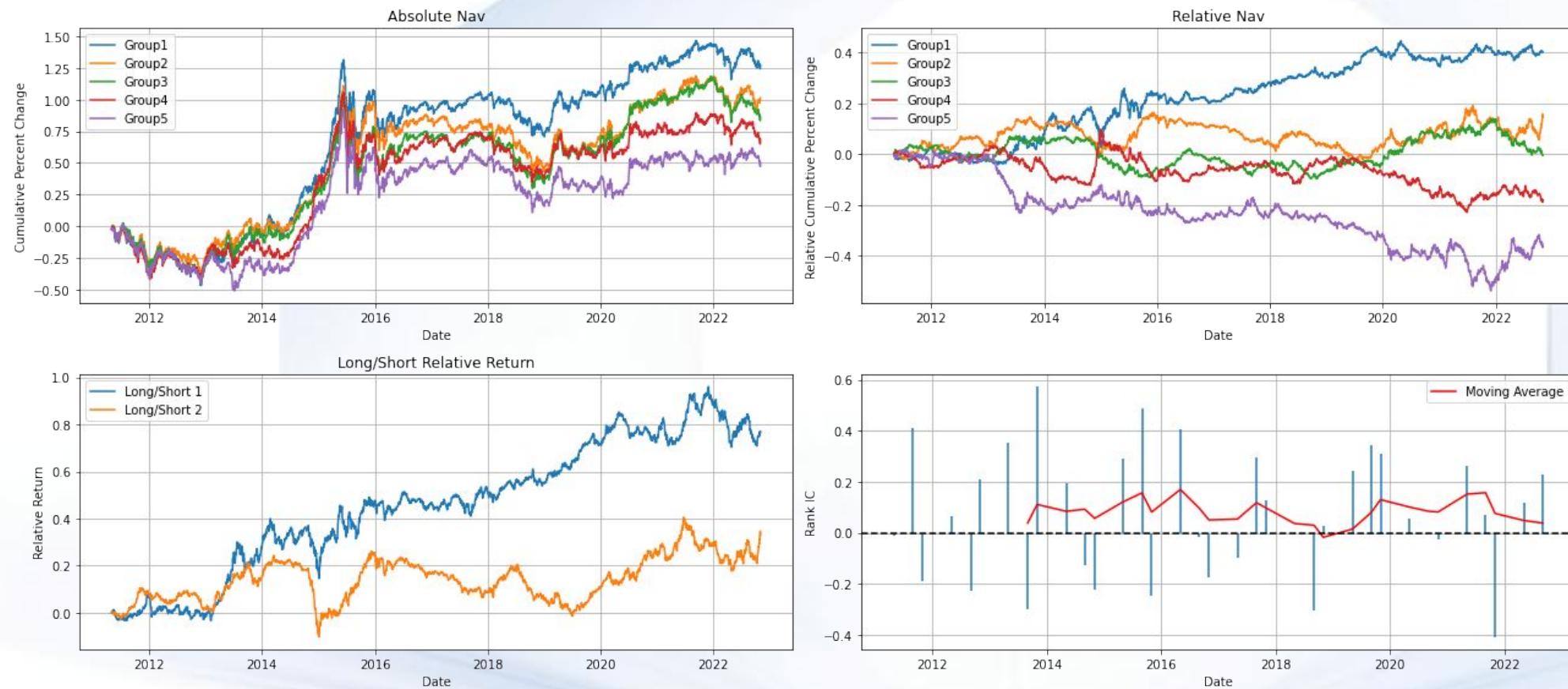
3. 3. 2 Total Asset Turnover (YoY)

Rolling backtest results:

	Freq	Long Excess	Long Sharpe	Long Calmar	L/S Returns	L/S Sharpe	L/S Calmar	Long WR	L/S WR	rankIC	Short WR	Long TO	Short TO	
0	Origin	2.45%	0.05	0.11	6.08%	0.72	0.55	1.4%	4.04%	6.88%	49.97%	54.89%	174.51%	165.69%
1	1-Day After	2.28%	0.03	0.11	6.45%	0.80	0.64	1.23%	4.41%	5.76%	50.0%	55.1%	174.51%	165.69%
2	2-Day After	2.22%	0.04	0.08	6.35%	0.79	0.57	1.17%	4.31%	6.03%	49.84%	55.09%	174.51%	165.69%
3	3-Day After	1.89%	0.04	0.06	5.77%	0.77	0.46	0.84%	3.72%	4.89%	49.81%	54.82%	174.51%	165.69%
4	4-Day After	1.78%	-0.02	0.03	5.38%	0.64	0.39	0.74%	3.34%	4.83%	49.82%	54.58%	174.51%	165.69%
5	5-Day After	1.97%	0.12	0.07	5.22%	0.65	0.38	0.93%	3.18%	5.18%	49.93%	54.42%	174.51%	165.69%
6	6-Day After	2.18%	0.09	0.07	5.64%	0.66	0.36	1.13%	3.6%	3.59%	49.71%	54.13%	174.51%	165.69%
7	7-Day After	2.27%	0.18	0.10	5.39%	0.74	0.44	1.23%	3.35%	3.52%	49.84%	53.91%	174.51%	165.69%
8	8-Day After	2.46%	0.17	0.10	6.0%	0.76	0.52	1.42%	3.96%	2.92%	49.71%	54.03%	174.51%	165.69%
9	9-Day After	2.72%	0.23	0.15	6.09%	0.74	0.57	1.68%	4.05%	0.75%	49.76%	53.83%	174.51%	165.69%
10	10-Day After	2.2%	0.08	0.05	5.0%	0.55	0.33	1.15%	2.96%	0.12%	49.49%	53.37%	174.51%	165.69%

3. 4. 1 Equity Multiplier (EM Ratio)

The equity multiplier is the ratio of total assets divided by total shareholders' equity. The larger this number, the smaller proportion of the capital is coming from the shareholders, thus the company is more in debt, leading to higher financial leverage. On the contrary, small values are not always good either -- there exists an optimal equity-debt structure that should limit the EM ratio in a certain range.



Freq	Long Excess	Long Sharpe	Long Calmar	L/S Returns	L/S Sharpe	L/S Calmar	Long WR	L/S WR	rankIC	Short WR	Long TO	Short TO	Mean
0	3.65%	0.62	0.28	6.92%	0.9	0.54	3.19%	6.21%	7.78%	52.12%	53.07%	77.14%	41.9%

3. 4. 1 Equity Multiplier (EM Ratio)

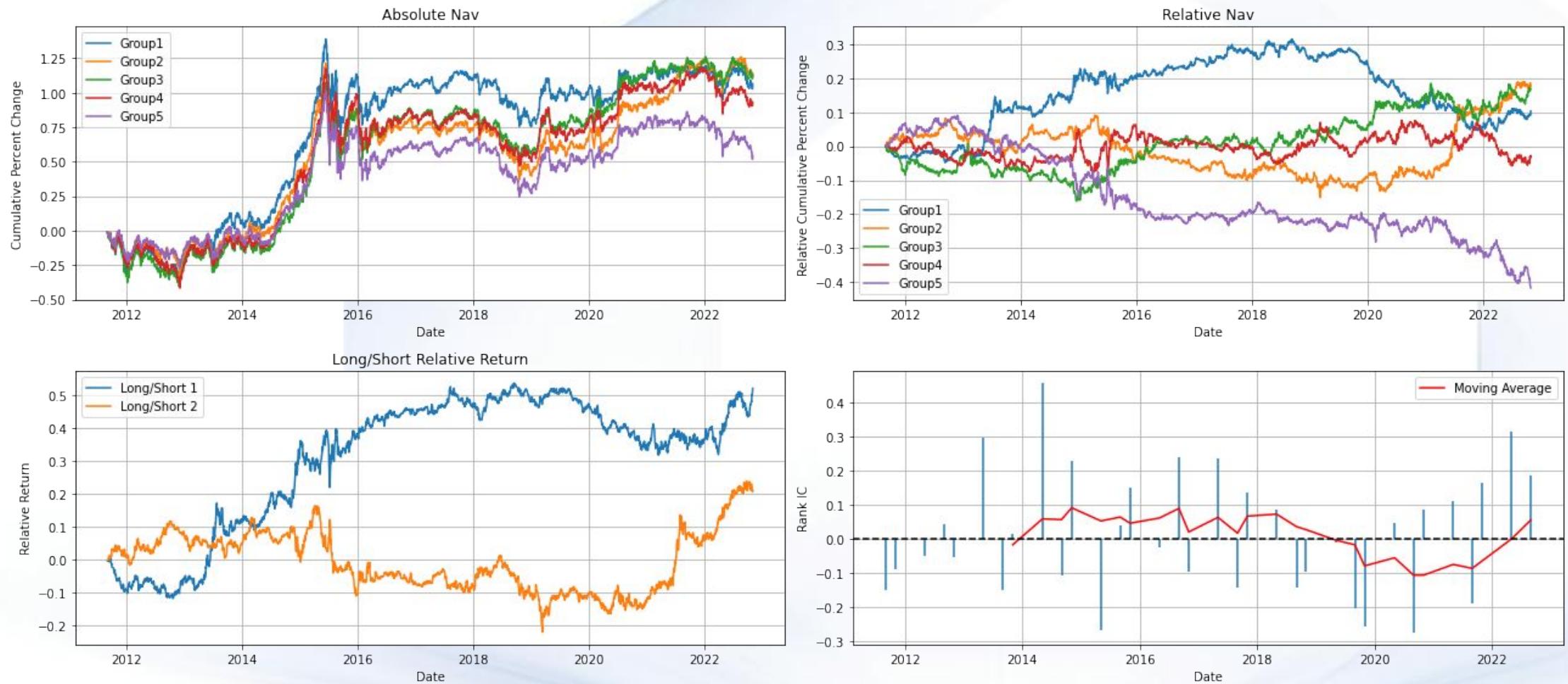
Rolling backtest results:

Freq		Long Excess	Long Sharpe	Long Calmar	L/S Returns	L/S Sharpe	L/S Calmar	Long WR	L/S WR	rankIC	Short WR	Long TO	Short TO	
0	Origin	3.65%	0.62	0.28	6.92%	0.90	0.54	3.19%	6.21%	7.78%	52.12%	53.07%	77.14%	41.9%
1	1-Day After	3.88%	0.73	0.30	6.96%	0.93	0.54	3.42%	6.24%	6.98%	52.39%	52.86%	77.14%	41.9%
2	2-Day After	3.97%	0.70	0.29	7.06%	0.94	0.56	3.51%	6.35%	7.78%	52.32%	52.93%	77.14%	41.9%
3	3-Day After	3.95%	0.69	0.29	6.94%	0.88	0.53	3.48%	6.23%	7.89%	52.08%	52.79%	77.14%	41.9%
4	4-Day After	4.05%	0.66	0.29	7.28%	0.90	0.55	3.59%	6.57%	8.1%	51.87%	52.97%	77.14%	41.9%
5	5-Day After	4.3%	0.75	0.31	7.54%	1.00	0.60	3.83%	6.83%	7.76%	51.71%	53.12%	77.14%	41.9%
6	6-Day After	4.41%	0.79	0.33	7.96%	1.10	0.66	3.95%	7.24%	8.68%	51.66%	53.32%	77.14%	41.9%
7	7-Day After	4.71%	0.93	0.35	8.27%	1.18	0.68	4.25%	7.56%	8.66%	51.75%	53.28%	77.14%	41.9%
8	8-Day After	4.59%	0.95	0.37	8.2%	1.21	0.69	4.13%	7.48%	8.12%	51.62%	53.54%	77.14%	41.9%
9	9-Day After	4.64%	0.91	0.34	8.29%	1.17	0.67	4.18%	7.58%	7.86%	51.27%	53.45%	77.14%	41.9%
10	10-Day After	4.59%	0.91	0.34	8.31%	1.16	0.66	4.12%	7.59%	7.67%	51.15%	53.51%	77.14%	41.9%

3.4.2 Change in EM (Raw)

$\text{Change in EM} = \text{EM}_t - \text{EM}_{t-1}$

$EM\text{-一阶变量} = EM_t - EM_{t-1}$



Freq	Long Excess	Long Sharpe	Long Calmar	L/S Returns	L/S Sharpe	L/S Calmar	Long WR	L/S WR	rankIC	Short WR	Long TO	Short TO	
0	0.97%	-0.26	-0.02	4.87%	0.05	0.08	-0.06%	2.89%	1.47%	48.74%	52.04%	171.57%	157.84%

3.4.2 Change in EM (Raw)

Rolling backtest results:

Freq		Long Excess	Long Sharpe	Long Calmar	L/S Returns	L/S Sharpe	L/S Calmar	Long WR	L/S WR	rankIC	Short WR	Long TO	Short TO	
0	Origin	0.97%	-0.26	-0.02	4.87%	0.05	0.08	-0.06%	2.89%	1.47%	48.74%	52.04%	171.57%	157.84%
1	1-Day After	0.68%	-0.25	-0.03	4.22%	0.07	0.07	-0.35%	2.25%	1.55%	48.75%	51.99%	171.57%	157.84%
2	2-Day After	0.64%	-0.19	-0.02	3.97%	0.09	0.08	-0.39%	1.99%	2.6%	48.8%	52.01%	171.57%	157.84%
3	3-Day After	1.22%	-0.08	0.01	4.71%	0.23	0.12	0.2%	2.73%	3.66%	49.35%	52.19%	171.57%	157.84%
4	4-Day After	1.95%	0.05	0.04	5.91%	0.47	0.18	0.92%	3.94%	3.52%	49.82%	52.82%	171.57%	157.84%
5	5-Day After	1.94%	0.16	0.06	5.84%	0.58	0.21	0.91%	3.86%	4.16%	50.1%	52.68%	171.57%	157.84%
6	6-Day After	1.61%	0.07	0.04	5.0%	0.49	0.18	0.58%	3.02%	3.51%	49.95%	52.38%	171.57%	157.84%
7	7-Day After	1.34%	0.05	0.03	4.36%	0.35	0.14	0.31%	2.38%	3.43%	50.05%	52.06%	171.57%	157.84%
8	8-Day After	1.0%	0.08	0.04	3.68%	0.42	0.14	-0.03%	1.7%	3.27%	50.09%	52.11%	171.57%	157.84%
9	9-Day After	0.71%	0.01	0.02	2.94%	0.29	0.10	-0.32%	0.97%	3.35%	49.93%	51.88%	171.57%	157.84%
10	10-Day After	0.49%	-0.06	0.01	2.87%	0.28	0.10	-0.54%	0.89%	3.42%	49.77%	51.98%	171.57%	157.84%

3. 4. 2 Change in EM (YoY)



Freq	Long Excess	Long_Sharpe	Long_Calmar	L/S Returns	L/S_Sharpe	L/S_Calmar	Long WR	L/S WR	rankIC	Short WR	Long TO	Short TO	
0	1.23%	-0.3	-0.04	6.84%	0.27	0.21	0.24%	4.89%	3.07%	49.28%	52.81%	164.71%	158.82%

3. 4. 2 Change in EM (YoY)

Rolling backtest results:

Freq		Long Excess	Long Sharpe	Long Calmar	L/S Returns	L/S Sharpe	L/S Calmar	Long WR	L/S WR	rankIC	Short WR	Long TO	Short TO	
0	Origin	1.23%	-0.30	-0.04	6.84%	0.27	0.21	0.24%	4.89%	3.07%	49.28%	52.81%	164.71%	158.82%
1	1-Day After	0.7%	-0.31	-0.04	5.69%	0.22	0.15	-0.29%	3.74%	2.86%	49.32%	52.68%	164.71%	158.82%
2	2-Day After	0.66%	-0.29	-0.04	5.34%	0.17	0.15	-0.33%	3.4%	3.77%	49.23%	52.69%	164.71%	158.82%
3	3-Day After	1.07%	-0.21	-0.02	5.82%	0.30	0.19	0.09%	3.88%	5.01%	49.51%	52.88%	164.71%	158.82%
4	4-Day After	1.9%	-0.04	0.03	6.99%	0.53	0.26	0.91%	5.05%	4.95%	49.87%	53.24%	164.71%	158.82%
5	5-Day After	2.03%	0.17	0.07	7.05%	0.70	0.32	1.04%	5.11%	5.32%	50.38%	53.38%	164.71%	158.82%
6	6-Day After	1.77%	0.06	0.05	6.26%	0.56	0.29	0.78%	4.32%	4.29%	50.04%	53.01%	164.71%	158.82%
7	7-Day After	1.39%	0.03	0.03	5.51%	0.37	0.21	0.4%	3.56%	4.17%	49.95%	52.59%	164.71%	158.82%
8	8-Day After	1.08%	0.03	0.04	4.83%	0.42	0.24	0.09%	2.88%	3.45%	49.99%	52.66%	164.71%	158.82%
9	9-Day After	0.6%	-0.05	0.01	3.7%	0.23	0.14	-0.38%	1.76%	3.36%	49.54%	52.33%	164.71%	158.82%
10	10-Day After	0.46%	-0.07	0.01	3.57%	0.23	0.15	-0.53%	1.63%	3.36%	49.51%	52.52%	164.71%	158.82%

3.5.1 Required Rate of Return — Dividend Capital Model

The cost of equity is the price that an enterprise has to pay for acquiring and using equity capital. It includes the financing expenses, which can also be interpreted as the investment reward required. Low cost of equity implies the risk associated with the enterprise is low, hence the required reward is low.

$$r = \frac{D_1}{P} + g \quad \text{Where } D_1 \text{ is the dividend next year, } P \text{ is the current price, and } g \text{ is the growth rate}$$

There are three estimation methods for the long-term average growth rate g : historical dividend growth rate, sustainable growth rate, and the consensus growth rate by analysts. Since the sustainable growth rate approach requires more assumptions, the historical dividend growth rate is widely used in practice.

In the research report that I was reading, they only used the dividends since last year to get the dividend yield while assuming the dividend growth rate to be 0. There are mainly two reasons. First, it is hard to accurately estimate the future growth rate of dividends for smaller or rapidly growing enterprises, while their historical growth rate fluctuates too much; Second, they want to focus on the change of equity cost rather than the raw estimates, hence the value of the long-term dividend growth rate won't directly impact the analysis results.

$$r = \frac{D_1}{P} + g \Rightarrow r = \frac{D_{t-1}}{P_t} \quad \text{Calculation approach used in the research report}$$

However, when reproducing, I decided to use the dividend obtained based on the historical three-year period

$$r = \frac{D_1}{P} + g \Rightarrow r = \frac{\mathbb{E}[D_t | \mathcal{F}_{t-3:t-1}]}{P_t}, \quad \text{Calculation approach here}$$

D_t : 总现金分红 , P_t : 总市值2 D_t : Dividend at year t, P_t : Price at year t

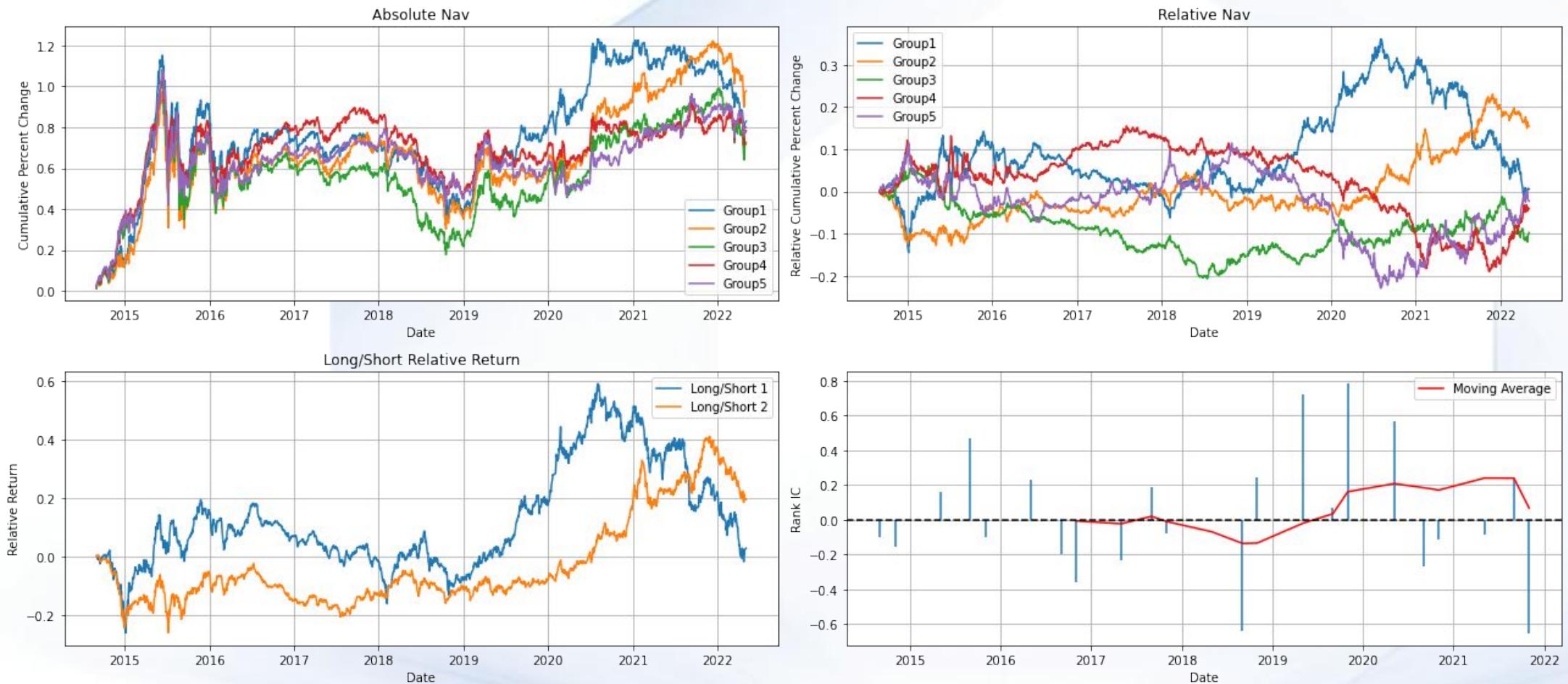
Specific dividend processing:

- If there is a continuous change in dividends within 3 years, it is predicted based on the mean growth rate
- If there are 2 years of continuous changes in dividends within the 3 year period, it is still predicted based on the mean growth rate
- If there is a dividend in the third year, the growth rate will be assumed to be 0 and the dividend is the same as the last dividend
- If the dividend stopped within the last three years, the predicted dividend will be 0 as well.
- If the company started paying fixed dividends in the last 3 years, the predicted dividend will be the same as the last dividend paid.

3.5.1 Required Rate of Return — Dividend Capital Model

$$r = \frac{D_1}{P} + g \Rightarrow r = \frac{\mathbb{E}[D_t | \mathcal{F}_{t-3:t-1}]}{P_t},$$

D_t : 总现金分红 , P_t : 总市值2



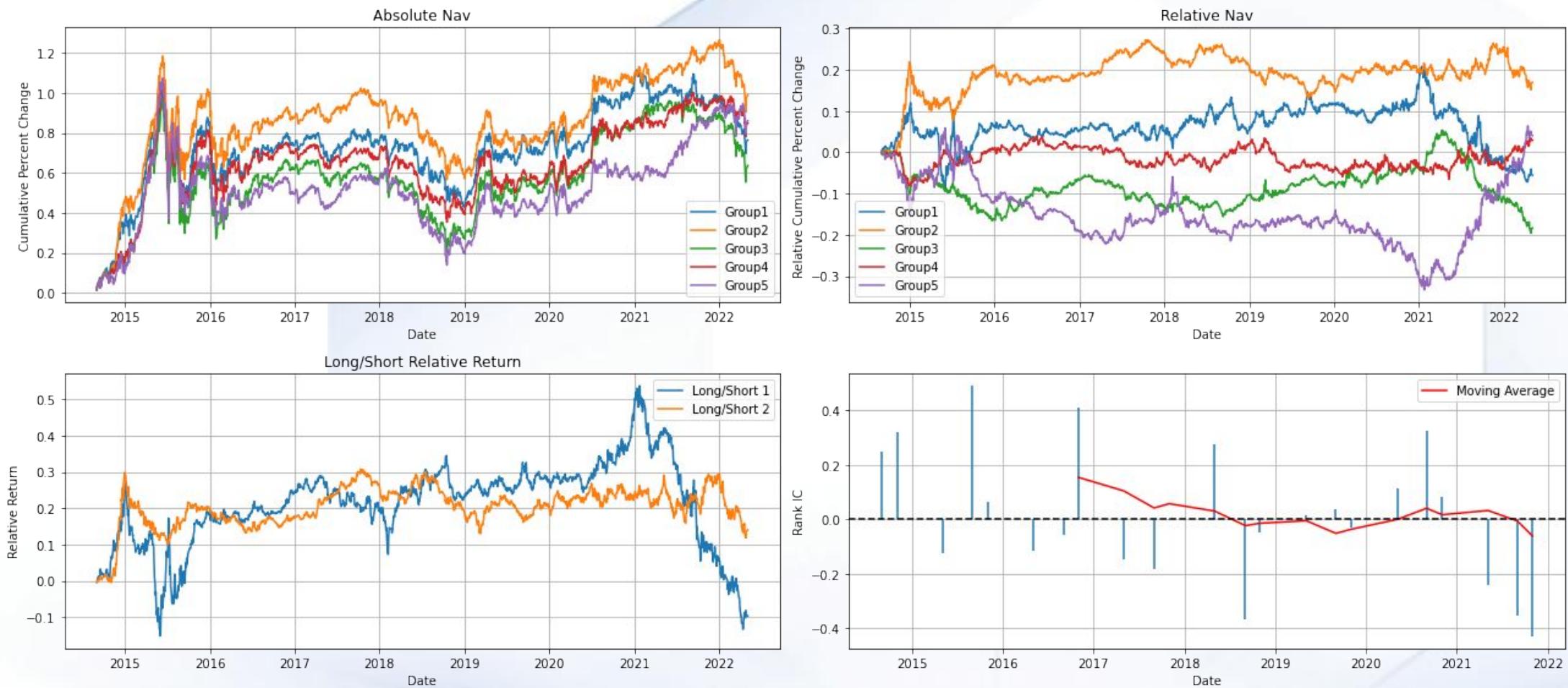
	多头超额	多头_Sharpe	多头_Calmar	多空收益	多空_Sharpe	多空_Calmar	多头扣费	多空扣费	rankIC	多头胜率	空头胜率	多头换手	空头换手
0	0.03%	0.01	0.01	0.35%	0.16	0.03	-0.11%	0.02%	3.05%	50.28%	52.71%	23.19%	31.88%

3.5.1 Required Rate of Return — Dividend Capital Model

Rolling backtest results:

Freq		Long Excess	Long Sharpe	Long Calmar	L/S Returns	L/S Sharpe	L/S Calmar	Long WR	L/S WR	rankIC	Short WR	Long TO	Short TO	
0	Origin	0.03%	0.01	0.01	0.35%	0.16	0.03	-0.11%	0.02%	3.05%	50.28%	52.71%	23.19%	31.88%
1	1-Day After	0.16%	0.12	0.03	0.74%	0.30	0.07	0.02%	0.41%	3.66%	50.23%	52.91%	23.19%	31.88%
2	2-Day After	-0.03%	0.07	0.02	0.46%	0.25	0.06	-0.17%	0.13%	3.05%	50.19%	53.0%	23.19%	31.88%
3	3-Day After	0.34%	0.06	0.02	0.91%	0.25	0.06	0.2%	0.58%	4.23%	50.22%	53.07%	23.19%	31.88%
4	4-Day After	0.39%	0.07	0.02	1.27%	0.32	0.09	0.25%	0.94%	3.74%	50.43%	53.32%	23.19%	31.88%
5	5-Day After	0.42%	0.07	0.02	1.29%	0.32	0.09	0.28%	0.96%	3.19%	50.48%	53.35%	23.19%	31.88%
6	6-Day After	0.17%	-0.00	0.01	0.95%	0.27	0.08	0.03%	0.62%	2.87%	50.34%	53.2%	23.19%	31.88%
7	7-Day After	0.08%	0.02	0.02	0.84%	0.34	0.09	-0.06%	0.51%	2.31%	50.22%	53.33%	23.19%	31.88%
8	8-Day After	0.01%	0.04	0.02	1.06%	0.32	0.09	-0.13%	0.73%	2.2%	50.26%	53.52%	23.19%	31.88%
9	9-Day After	-0.02%	0.01	0.01	0.99%	0.26	0.07	-0.16%	0.66%	1.44%	50.22%	53.64%	23.19%	31.88%
10	10-Day After	0.04%	0.03	0.01	1.25%	0.28	0.08	-0.1%	0.92%	2.18%	50.35%	53.7%	23.19%	31.88%

3.5.1 Required Rate of Return — Dividend Capital Model (Raw)



Freq	Long Excess	Long Sharpe	Long Calmar	L/S Returns	L/S Sharpe	L/S Calmar	Long WR	L/S WR	rankIC	Short WR	Long TO	Short TO	
0	-0.76%	0.09	-0.0	-1.25%	0.4	0.01	-1.66%	-3.1%	1.28%	49.33%	52.41%	150.72%	156.52%

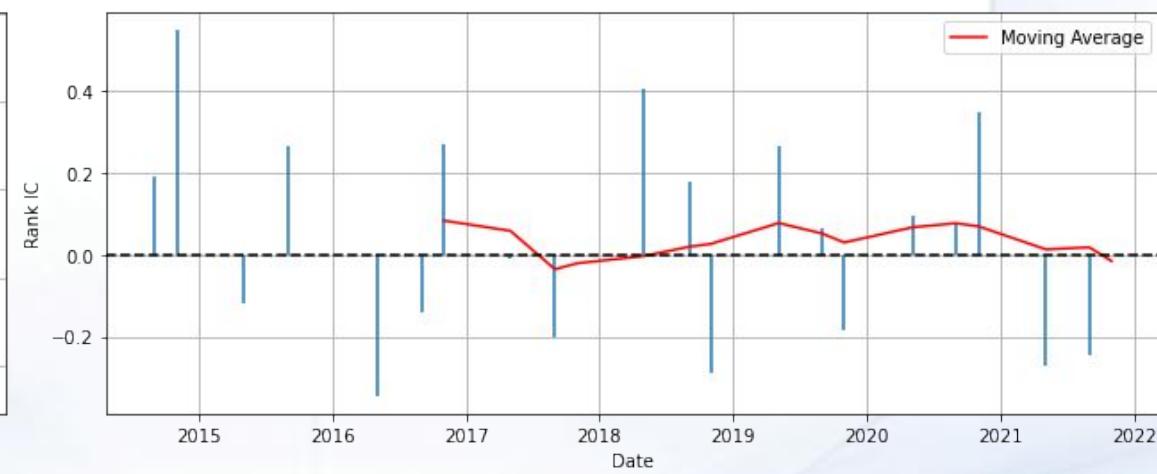
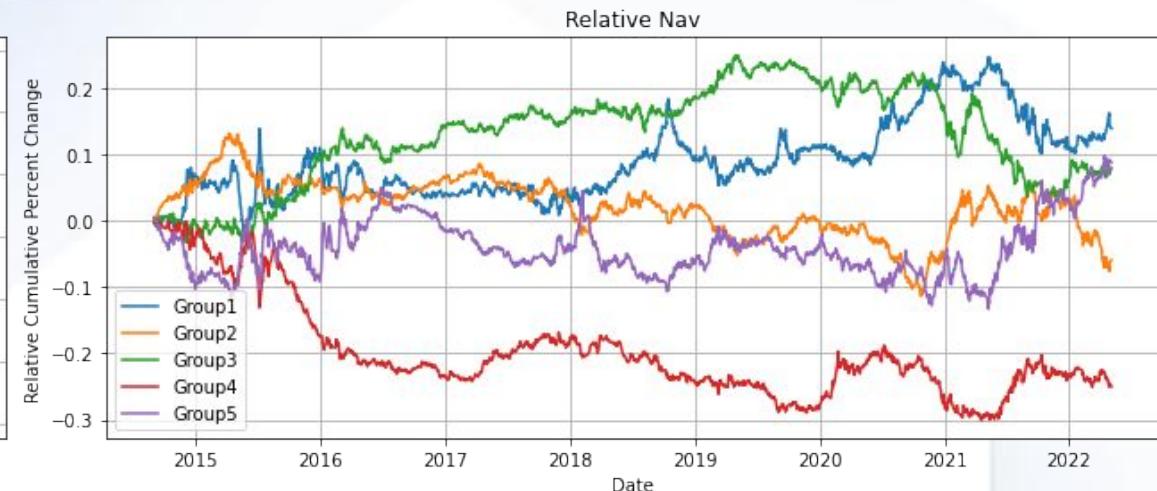
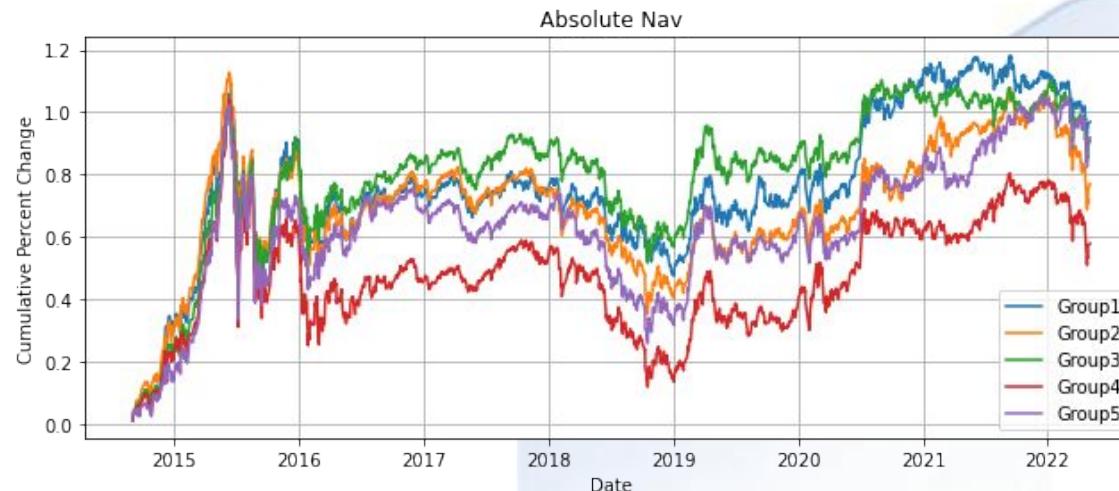
3.5.1 Required Rate of Return — Dividend Capital Model (Raw)

Rolling backtest results:

When the direction of change is negative, the factor scores higher, which conforms to the correlation logic

Freq		Long Excess	Long Sharpe	Long Calmar	L/S Returns	L/S Sharpe	L/S Calmar	Long WR	L/S WR	rankIC	Short WR	Long TO	Short TO	
0	Origin	-1.27%	-0.12	-0.04	-2.27%	0.17	-0.05	-2.21%	-4.18%	0.2%	48.78%	52.35%	156.06%	162.12%
1	1-Day After	-0.67%	-0.15	-0.05	-0.57%	0.19	-0.02	-1.61%	-2.48%	-0.1%	48.79%	52.54%	156.06%	162.12%
2	2-Day After	-0.57%	-0.06	-0.03	-0.55%	0.27	0.00	-1.5%	-2.46%	0.38%	49.04%	52.91%	156.06%	162.12%
3	3-Day After	-0.72%	-0.00	-0.02	-0.42%	0.34	0.02	-1.66%	-2.33%	0.06%	48.94%	52.61%	156.06%	162.12%
4	4-Day After	-1.68%	-0.18	-0.10	-1.97%	0.10	-0.09	-2.62%	-3.88%	0.21%	48.35%	52.45%	156.06%	162.12%
5	5-Day After	-2.07%	-0.34	-0.13	-2.61%	-0.05	-0.15	-3.01%	-4.52%	-1.6%	48.04%	52.13%	156.06%	162.12%
6	6-Day After	-1.83%	-0.31	-0.13	-2.53%	-0.01	-0.15	-2.77%	-4.44%	-0.3%	48.3%	52.35%	156.06%	162.12%
7	7-Day After	-1.48%	-0.17	-0.12	-2.02%	0.20	-0.12	-2.41%	-3.93%	0.21%	48.34%	52.56%	156.06%	162.12%
8	8-Day After	-1.07%	-0.14	-0.12	-1.49%	0.20	-0.11	-2.01%	-3.39%	0.75%	48.4%	52.29%	156.06%	162.12%
9	9-Day After	-0.46%	-0.05	-0.08	0.16%	0.38	-0.02	-1.4%	-1.75%	1.14%	48.61%	52.94%	156.06%	162.12%
10	10-Day After	-0.82%	-0.19	-0.11	-0.32%	0.26	-0.07	-1.75%	-2.23%	3.11%	48.27%	52.73%	156.06%	162.12%

3.5.1 Required Rate of Return — Dividend Capital Model (YoY)



Freq	Long Excess	Long Sharpe	Long Calmar	L/S Returns	L/S Sharpe	L/S Calmar	Long WR	L/S WR	rankIC	Short WR	Long TO	Short TO	
0	1.82%	0.23	0.14	0.63%	0.33	0.05	0.8%	-1.32%	3.83%	52.05%	52.27%	169.57%	156.52%

3.5.1 Required Rate of Return — Dividend Capital Model (YoY)

Rolling backtest results:

When the direction of change is negative, the factor scores higher, which conforms to the correlation logic

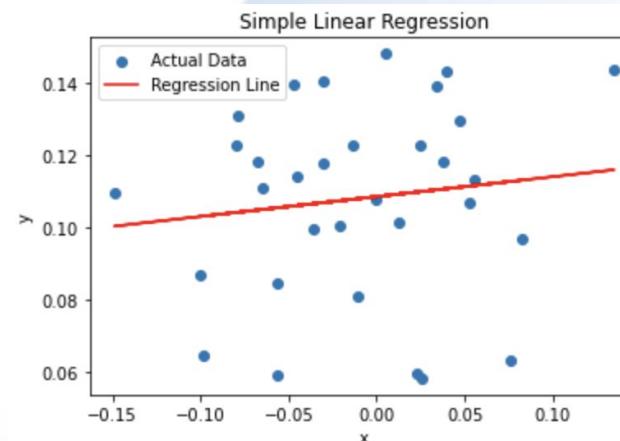
Freq		Long Excess	Long Sharpe	Long Calmar	L/S Returns	L/S Sharpe	L/S Calmar	Long WR	L/S WR	rankIC	Short WR	Long TO	Short TO
0	Origin	1.82%	0.23	0.14	0.63%	0.33	0.05	0.8%	-1.32%	3.83%	52.05%	52.27%	169.57%
1	1-Day After	2.52%	0.14	0.15	2.52%	0.27	0.09	1.51%	0.57%	5.91%	52.04%	52.34%	169.57%
2	2-Day After	3.4%	0.43	0.33	4.08%	0.57	0.34	2.38%	2.12%	5.72%	52.93%	52.88%	169.57%
3	3-Day After	3.23%	0.42	0.28	4.09%	0.52	0.29	2.22%	2.14%	4.28%	52.73%	52.8%	169.57%
4	4-Day After	2.98%	0.45	0.20	3.45%	0.50	0.20	1.97%	1.49%	3.64%	52.11%	52.72%	169.57%
5	5-Day After	2.47%	0.20	0.11	2.34%	0.28	0.03	1.45%	0.39%	3.66%	51.69%	52.48%	169.57%
6	6-Day After	2.37%	0.20	0.10	2.65%	0.30	0.05	1.35%	0.69%	4.14%	51.87%	52.62%	169.57%
7	7-Day After	2.67%	0.37	0.15	3.23%	0.55	0.14	1.65%	1.27%	2.35%	52.02%	53.1%	169.57%
8	8-Day After	1.86%	0.11	0.05	1.5%	0.16	-0.04	0.84%	-0.46%	1.69%	51.44%	52.06%	169.57%
9	9-Day After	2.68%	0.18	0.08	2.85%	0.24	0.00	1.66%	0.9%	2.35%	51.57%	52.41%	169.57%
10	10-Day After	2.84%	0.26	0.12	3.5%	0.43	0.10	1.82%	1.54%	4.13%	51.75%	52.55%	169.57%

3.5.2 Cost of Equity (Required Rate of Return) — CAPM

In my approach, r refers to individual stock's cost of equity and I only used the $(r_m - r_f)$ factor

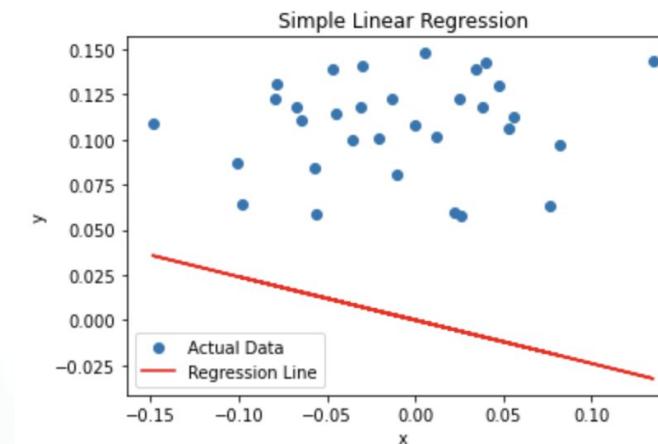
My approach:
$$r_i - r_f = b_i \cdot (r_m - r_f)$$

Further, if we didn't include an intercept in the regression, the predicted cost of equity is biased downward. This is because the absence of an intercept term causes the regression model to pass through the origin:



Intercept: 0.10841035870529601
Coefficient: 0.05495812479872353

with intercept



Intercept: 0.0
Coefficient: -0.24014627850849898

without intercept

Thus, we added an intercept term to the model

$$r_i - r_f = b_0 + b_i \cdot (r_m - r_f)$$

3.5.2 Cost of Equity (Required Rate of Return) — CAPM

In the actual replication, since r uses historical data and is calculated based on the dividend growth model, we take the growth rate as 0

$$r = \frac{D_1}{P}$$

Using the past 3 years of monthly data to predict the next month's cost of equity, we conduct rolling predictions. The market return rate (rm) and risk-free rate (rf) use data from the China Asset Management Center: <https://sf.cufe.edu.cn/kydt/kyjg/zgzcglyjzx/xzzq.htm>

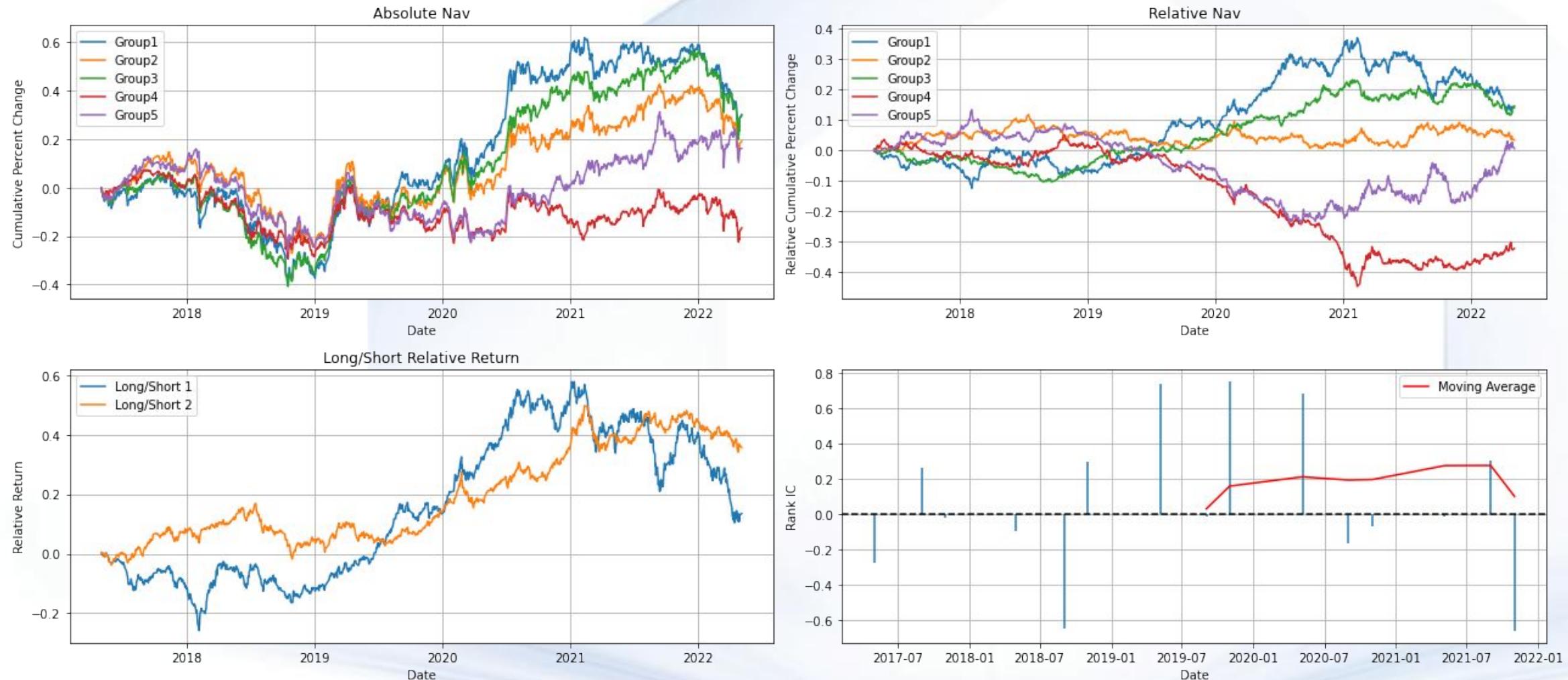
And we set the data delay to be 1 month

	trdmn	mkt_rf	smb	hml	umd	rf
201503	0.17143085	0.08184806	-0.0272058	0.01669743	0.00206	
201504	0.19930117	0.00592351	0.06378077	0.09834308	0.00206	
201505	0.11338862	0.16792727	-0.1795062	-0.0466735	0.001856	
201506	-0.0904646	-0.0302301	0.10540739	-0.1226965	0.001652	

Further, the market return rate can be obtained through methods such as monthly market index average; the risk-free rates could be obtained through one-year treasury rate.

3.5.2 Cost of Equity (Required Rate of Return) — CAPM

The backtest results show that rankIC is negative, so it can be inferred that the smaller the cost of equity, the better the performance. Therefore, the factor value is taken as the opposite of the original value.



Freq	Long Excess	Long Sharpe	Long Calmar	L/S Returns	L/S Sharpe	L/S Calmar	Long WR	L/S WR	rankIC	Short WR	Long TO	Short TO	
0	2.84%	0.22	0.06	2.75%	0.46	0.12	2.8%	2.63%	7.03%	50.3%	53.28%	6.67%	13.33%

3.5.2 Cost of Equity (Required Rate of Return) — CAPM

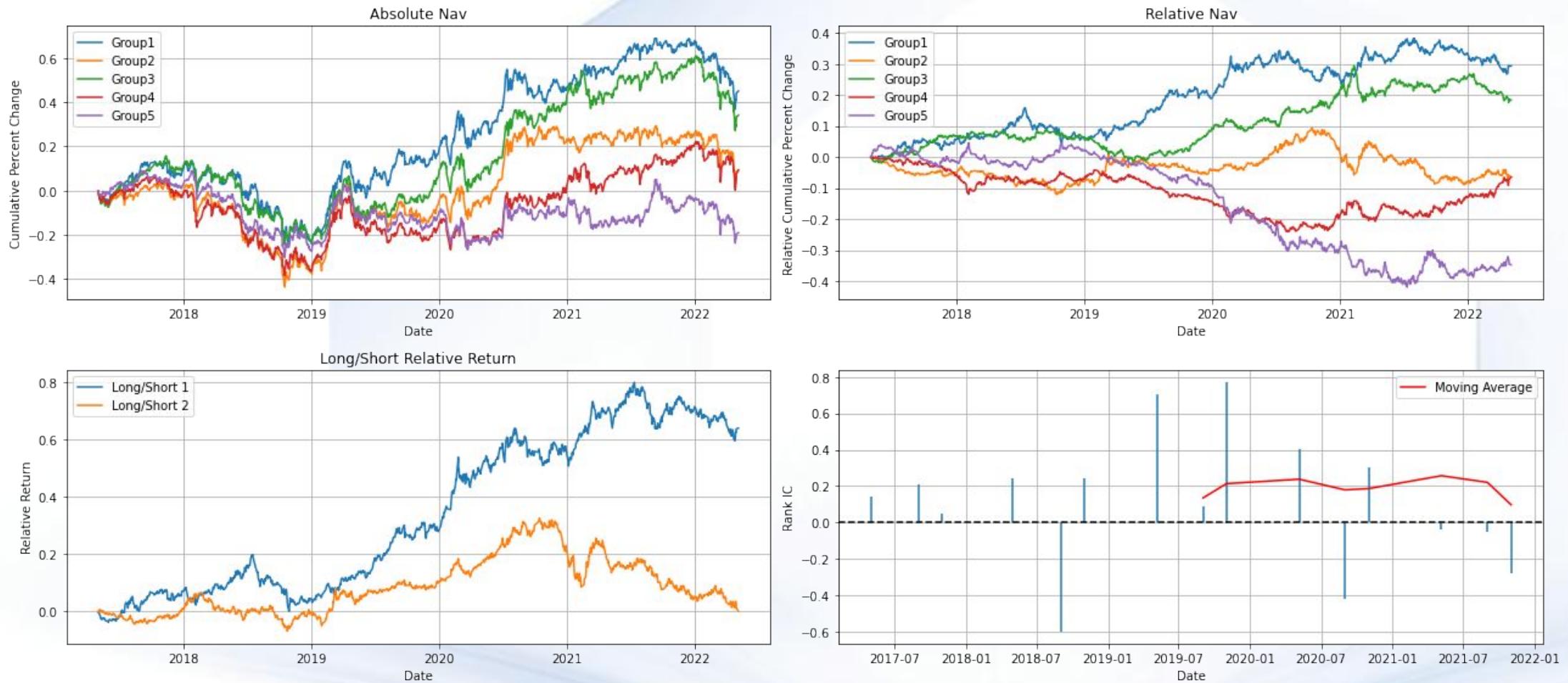
Rolling backtest results:

Turnover rate is low since sectors which pay more and less dividends are rather fixed.

Freq		Long Excess	Long Sharpe	Long Calmar	L/S Returns	L/S Sharpe	L/S Calmar	Long WR	L/S WR	rankIC	Short WR	Long TO	Short TO
0	Origin	2.84%	0.22	0.06	2.75%	0.46	0.12	2.8%	2.63%	7.03%	50.3%	53.28%	6.67%
1	1-Day After	2.75%	0.30	0.10	2.89%	0.59	0.20	2.71%	2.77%	7.64%	50.25%	53.44%	6.67%
2	2-Day After	2.6%	0.22	0.08	2.74%	0.53	0.18	2.56%	2.62%	8.17%	50.15%	53.66%	6.67%
3	3-Day After	2.94%	0.25	0.08	3.28%	0.57	0.19	2.9%	3.16%	8.94%	50.12%	53.54%	6.67%
4	4-Day After	3.11%	0.35	0.12	3.64%	0.69	0.28	3.07%	3.52%	9.42%	50.29%	53.85%	6.67%
5	5-Day After	3.22%	0.37	0.13	4.03%	0.78	0.31	3.18%	3.91%	9.26%	50.36%	54.12%	6.67%
6	6-Day After	3.09%	0.39	0.15	3.68%	0.76	0.34	3.05%	3.56%	9.42%	50.6%	53.93%	6.67%
7	7-Day After	3.01%	0.36	0.13	3.57%	0.75	0.32	2.97%	3.45%	9.3%	50.48%	53.98%	6.67%
8	8-Day After	2.99%	0.51	0.17	3.48%	0.90	0.36	2.95%	3.36%	10.58%	50.89%	54.08%	6.67%
9	9-Day After	2.88%	0.54	0.17	3.35%	0.84	0.34	2.84%	3.23%	10.5%	50.79%	53.97%	6.67%
10	10-Day After	2.83%	0.50	0.16	3.39%	0.77	0.32	2.79%	3.27%	10.36%	51.0%	53.82%	6.67%

3.5.3 Cost of Equity (Required Rate of Return) — CAPM Value of Change (Raw)

When the change direction of r is negative, the factor score is higher.



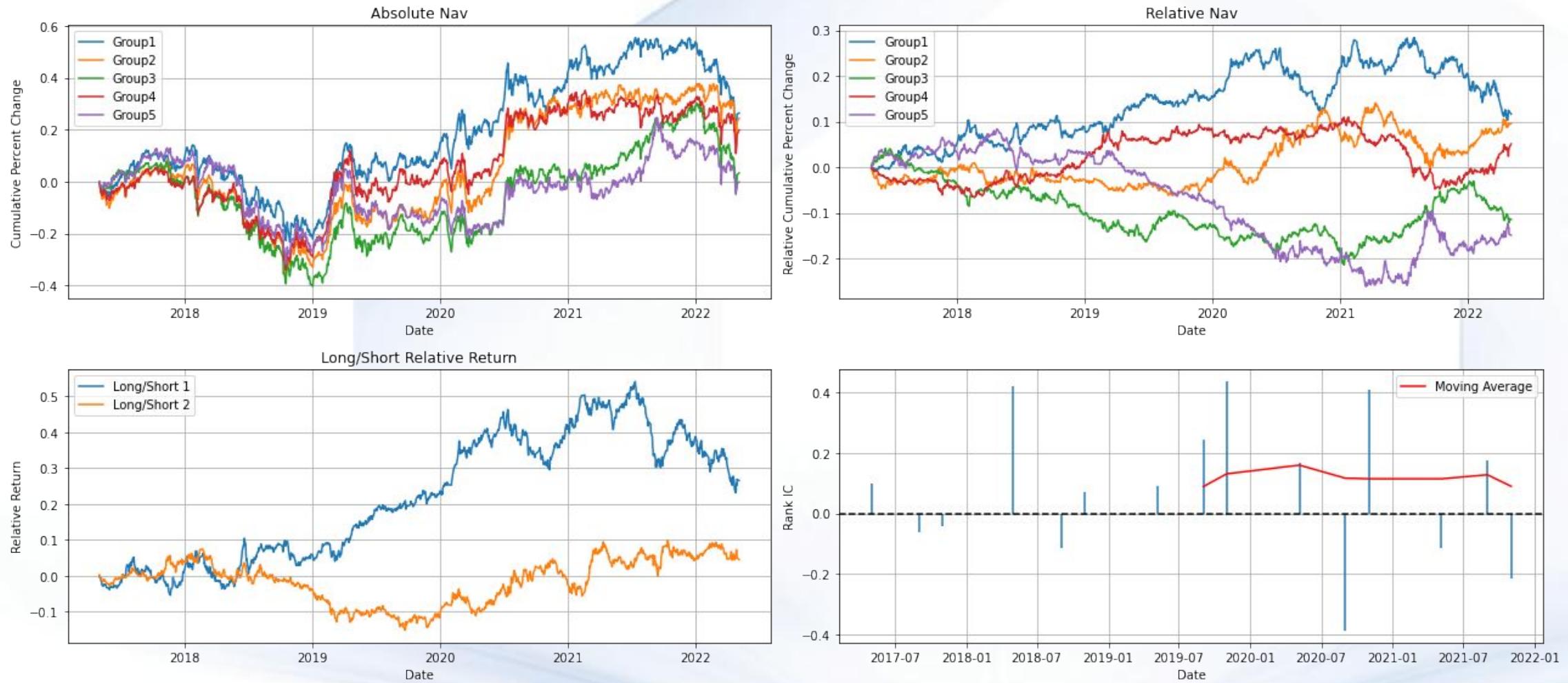
Freq	Long Excess	Long Sharpe	Long Calmar	L/S Returns	L/S Sharpe	L/S Calmar	Long WR	L/S WR	rankIC	Short WR	Long TO	Short TO	
0	6.1%	0.36	0.19	13.32%	0.96	0.7	5.51%	12.2%	11.75%	51.36%	54.74%	97.78%	88.89%

Rolling backtest results:

Freq		Long Excess	Long Sharpe	Long Calmar	L/S Returns	L/S Sharpe	L/S Calmar	Long WR	L/S WR	rankIC	Short WR	Long TO	Short TO	
0	Origin	6.1%	0.36	0.19	13.32%	0.96	0.70	5.51%	12.2%	11.75%	51.36%	54.74%	97.78%	88.89%
1	1-Day After	6.08%	0.32	0.19	13.35%	0.91	0.66	5.49%	12.23%	11.03%	51.47%	54.29%	97.78%	88.89%
2	2-Day After	6.34%	0.36	0.21	14.15%	0.99	0.77	5.75%	13.03%	11.17%	51.93%	54.16%	97.78%	88.89%
3	3-Day After	6.48%	0.34	0.20	14.73%	1.00	0.71	5.89%	13.61%	10.89%	51.91%	53.96%	97.78%	88.89%
4	4-Day After	6.34%	0.53	0.29	14.27%	1.18	0.89	5.75%	13.15%	11.16%	52.46%	54.44%	97.78%	88.89%
5	5-Day After	6.75%	0.49	0.27	14.5%	1.13	0.83	6.17%	13.38%	12.14%	52.34%	53.95%	97.78%	88.89%
6	6-Day After	6.79%	0.67	0.39	14.36%	1.30	1.10	6.2%	13.24%	10.2%	52.38%	54.4%	97.78%	88.89%
7	7-Day After	5.99%	0.63	0.32	12.99%	1.20	0.93	5.41%	11.87%	10.08%	52.11%	54.12%	97.78%	88.89%
8	8-Day After	5.15%	0.48	0.19	11.52%	1.09	0.63	4.56%	10.4%	11.3%	52.2%	54.17%	97.78%	88.89%
9	9-Day After	5.81%	0.60	0.27	12.27%	1.16	0.71	5.22%	11.15%	11.54%	52.75%	54.28%	97.78%	88.89%
10	10-Day After	5.54%	0.71	0.29	11.99%	1.20	0.75	4.95%	10.87%	11.08%	52.73%	54.18%	97.78%	88.89%

3.5.3 Cost of Equity (Required Rate of Return) — CAPM Value of Change (YoY)

When the change direction of r is negative, the factor score is higher.



Freq	Long Excess	Long Sharpe	Long Calmar	L/S Returns	L/S Sharpe	L/S Calmar	Long WR	L/S WR	rankIC	Short WR	Long TO	Short TO	
0	2.44%	0.02	-0.04	5.54%	0.37	0.14	1.89%	4.48%	7.86%	52.02%	53.59%	91.11%	86.67%

3.5.3 Cost of Equity (Required Rate of Return) — CAPM Value of Change (YoY)

Rolling backtest results:

	Freq	Long Excess	Long Sharpe	Long Calmar	L/S Returns	L/S Sharpe	L/S Calmar	Long WR	L/S WR	rankIC	Short WR	Long TO	Short TO	
0	Origin	2.44%	0.02	-0.04	5.54%	0.37	0.14	1.89%	4.48%	7.86%	52.02%	53.59%	91.11%	86.67%
1	1-Day After	2.63%	0.07	-0.00	5.94%	0.40	0.23	2.08%	4.88%	7.64%	52.42%	53.3%	91.11%	86.67%
2	2-Day After	3.13%	0.18	0.05	6.91%	0.49	0.30	2.58%	5.84%	6.85%	52.47%	53.02%	91.11%	86.67%
3	3-Day After	3.12%	0.11	0.01	7.06%	0.32	0.19	2.57%	5.99%	6.66%	52.35%	52.57%	91.11%	86.67%
4	4-Day After	4.03%	0.26	0.11	7.95%	0.47	0.37	3.49%	6.88%	6.94%	52.56%	52.67%	91.11%	86.67%
5	5-Day After	4.25%	0.26	0.11	8.52%	0.50	0.39	3.71%	7.46%	8.82%	52.66%	52.41%	91.11%	86.67%
6	6-Day After	4.6%	0.50	0.23	8.89%	0.72	0.62	4.05%	7.82%	8.34%	53.48%	52.54%	91.11%	86.67%
7	7-Day After	4.12%	0.46	0.21	7.75%	0.62	0.53	3.57%	6.69%	7.65%	53.4%	51.82%	91.11%	86.67%
8	8-Day After	3.55%	0.34	0.14	6.51%	0.40	0.35	3.0%	5.45%	8.84%	53.25%	51.66%	91.11%	86.67%
9	9-Day After	3.88%	0.31	0.12	6.82%	0.40	0.32	3.33%	5.75%	8.38%	53.05%	51.58%	91.11%	86.67%
10	10-Day After	3.91%	0.30	0.12	6.98%	0.39	0.32	3.36%	5.91%	9.39%	52.52%	51.53%	91.11%	86.67%

3.5.4 Cost of Equity (Required Rate of Return) — Fama-French three factor model

Similar to CAPM, the regression:

$$r_i - r_f = b_0 + b_i \cdot (r_m - r_f) + s_i \cdot SMB + h_i \cdot HML$$

Market return (r_m), risk-free rate (r_f), SMB, and HML are from Chinese Asset Management

Center: <https://sf.cufe.edu.cn/kydt/kyjg/zgzcglyjzx/xzzq.htm>

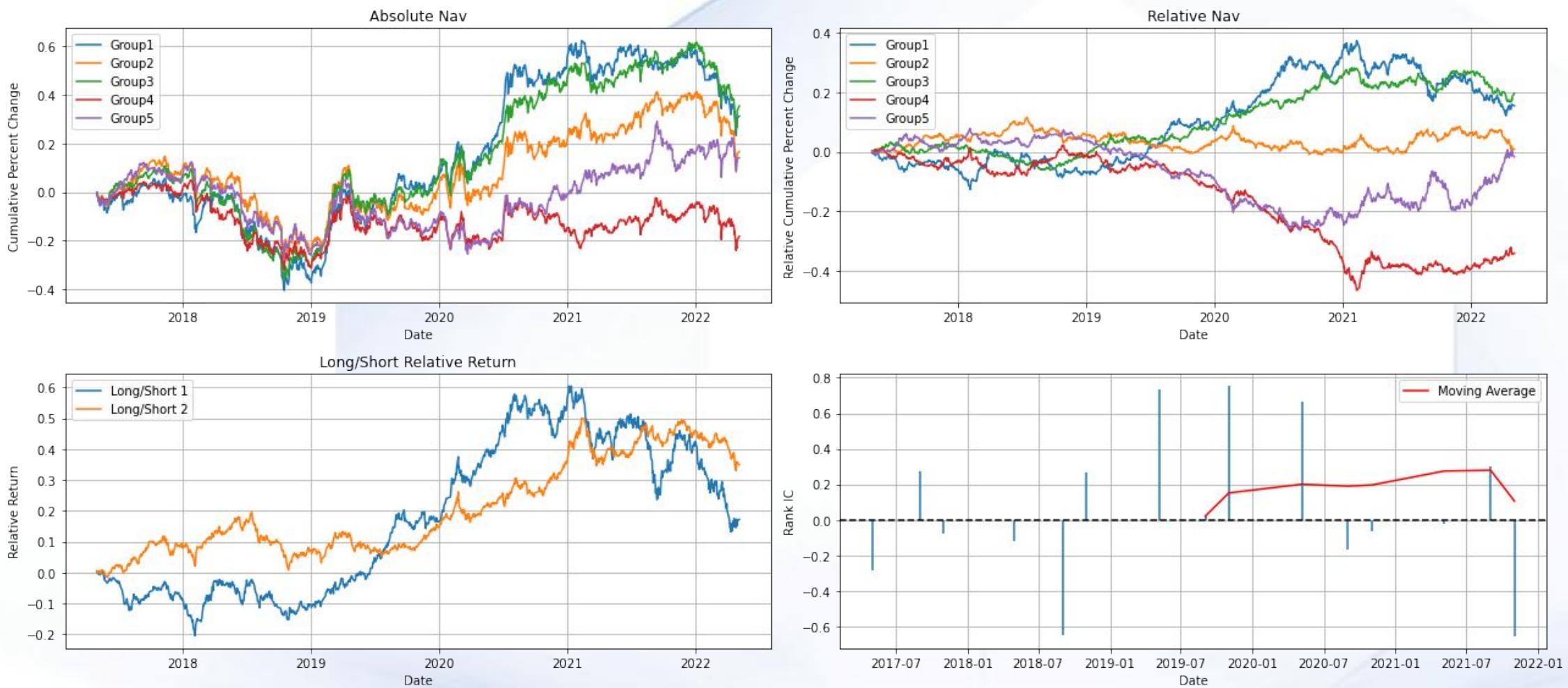
Data delay set to 1 month

Furthermore,

1. The market factor can be obtained by taking monthly market individual stocks grouped by market value, calculating the difference between the average returns of small-cap stocks and the average returns of large-cap stocks;
2. The value factor can be obtained by taking monthly market individual stocks grouped by book-to-market ratio, calculating the difference between the average returns of high book-to-market stocks and the average returns of low book-to-market stocks.

3.5.4 Cost of Equity (Required Rate of Return) — Fama-French three factor model

The backtest results show a negative rankIC, so it can be inferred that the smaller the cost of equity, the better the performance



Freq	Long Excess	Long_Sharpe	Long_Calmar	L/S Returns	L/S Sharpe	L/S_Calmar	Long WR	L/S WR	rankIC	Short WR	Long TO	Short TO	
0	3.14%	0.24	0.07	3.52%	0.57	0.14	3.07%	3.37%	6.66%	49.95%	52.68%	11.11%	13.33%

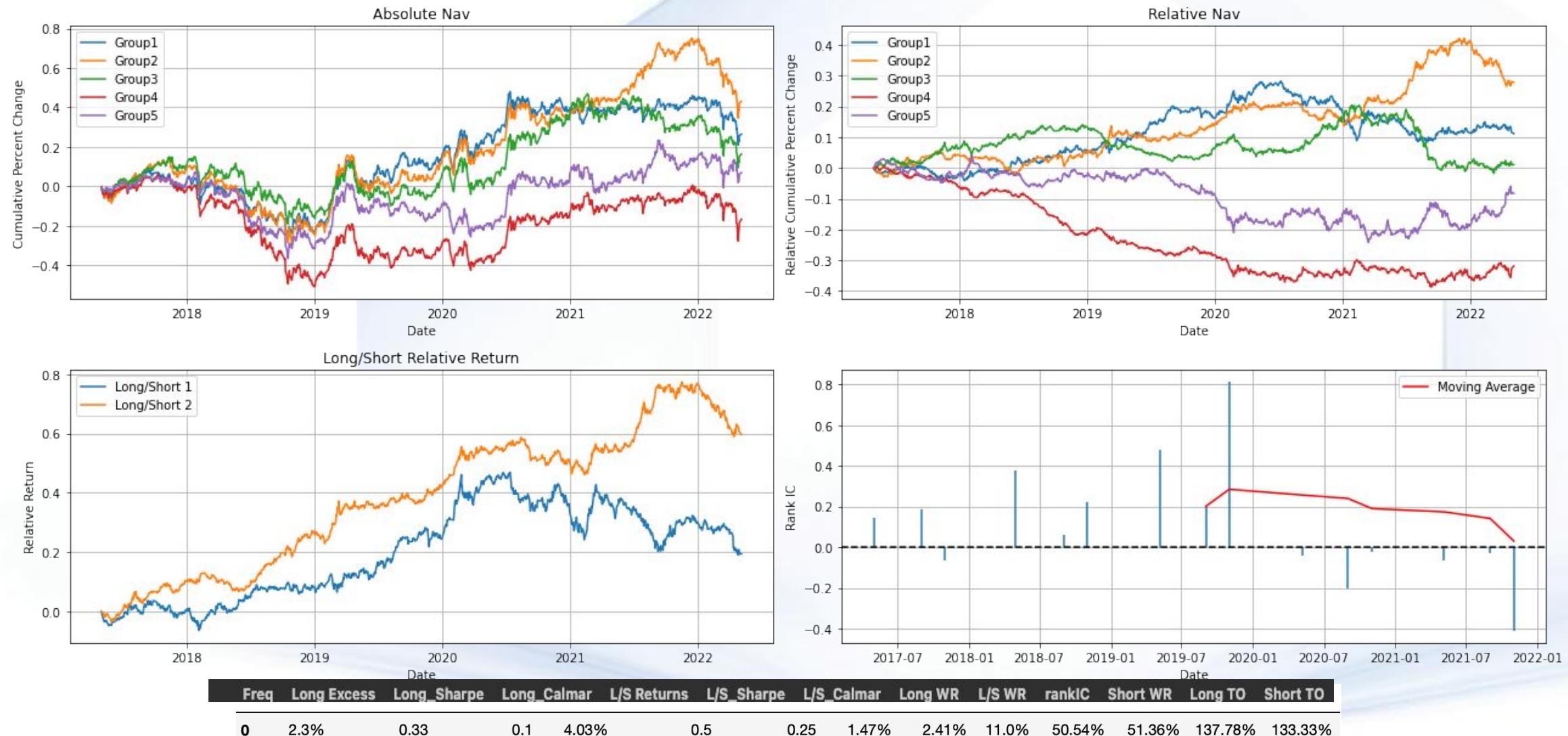
3.5.4 Cost of Equity (Required Rate of Return) — Fama-French three factor model

Rolling backtest results:

Turnover rate is low since sectors which pay more and less dividends are rather fixed.

Freq		Long Excess	Long Sharpe	Long Calmar	L/S Returns	L/S Sharpe	L/S Calmar	Long WR	L/S WR	rankIC	Short WR	Long TO	Short TO	
0	Origin	3.14%	0.24	0.07	3.52%	0.57	0.14	3.07%	3.37%	6.66%	49.95%	52.68%	11.11%	13.33%
1	1-Day After	3.11%	0.34	0.11	3.52%	0.69	0.22	3.05%	3.38%	7.07%	49.9%	52.62%	11.11%	13.33%
2	2-Day After	2.82%	0.22	0.08	3.08%	0.57	0.18	2.75%	2.93%	7.66%	49.67%	52.61%	11.11%	13.33%
3	3-Day After	3.11%	0.24	0.08	3.57%	0.59	0.19	3.04%	3.42%	8.42%	49.65%	52.48%	11.11%	13.33%
4	4-Day After	3.19%	0.32	0.12	3.86%	0.70	0.28	3.12%	3.72%	8.82%	49.82%	52.64%	11.11%	13.33%
5	5-Day After	3.36%	0.35	0.13	4.13%	0.74	0.30	3.29%	3.98%	8.52%	50.06%	52.84%	11.11%	13.33%
6	6-Day After	3.16%	0.35	0.13	3.71%	0.75	0.33	3.09%	3.56%	8.59%	50.3%	52.71%	11.11%	13.33%
7	7-Day After	3.1%	0.31	0.12	3.51%	0.69	0.30	3.04%	3.37%	8.54%	50.18%	52.49%	11.11%	13.33%
8	8-Day After	3.13%	0.48	0.16	3.55%	0.86	0.35	3.07%	3.41%	9.61%	50.86%	52.53%	11.11%	13.33%
9	9-Day After	3.06%	0.51	0.16	3.33%	0.81	0.34	2.99%	3.18%	9.52%	50.84%	52.16%	11.11%	13.33%
10	10-Day After	3.08%	0.50	0.17	3.25%	0.72	0.32	3.02%	3.1%	9.5%	51.0%	51.9%	11.11%	13.33%

3.5.4 Cost of Equity (Required Rate of Return) — Fama–French change of value (Raw)

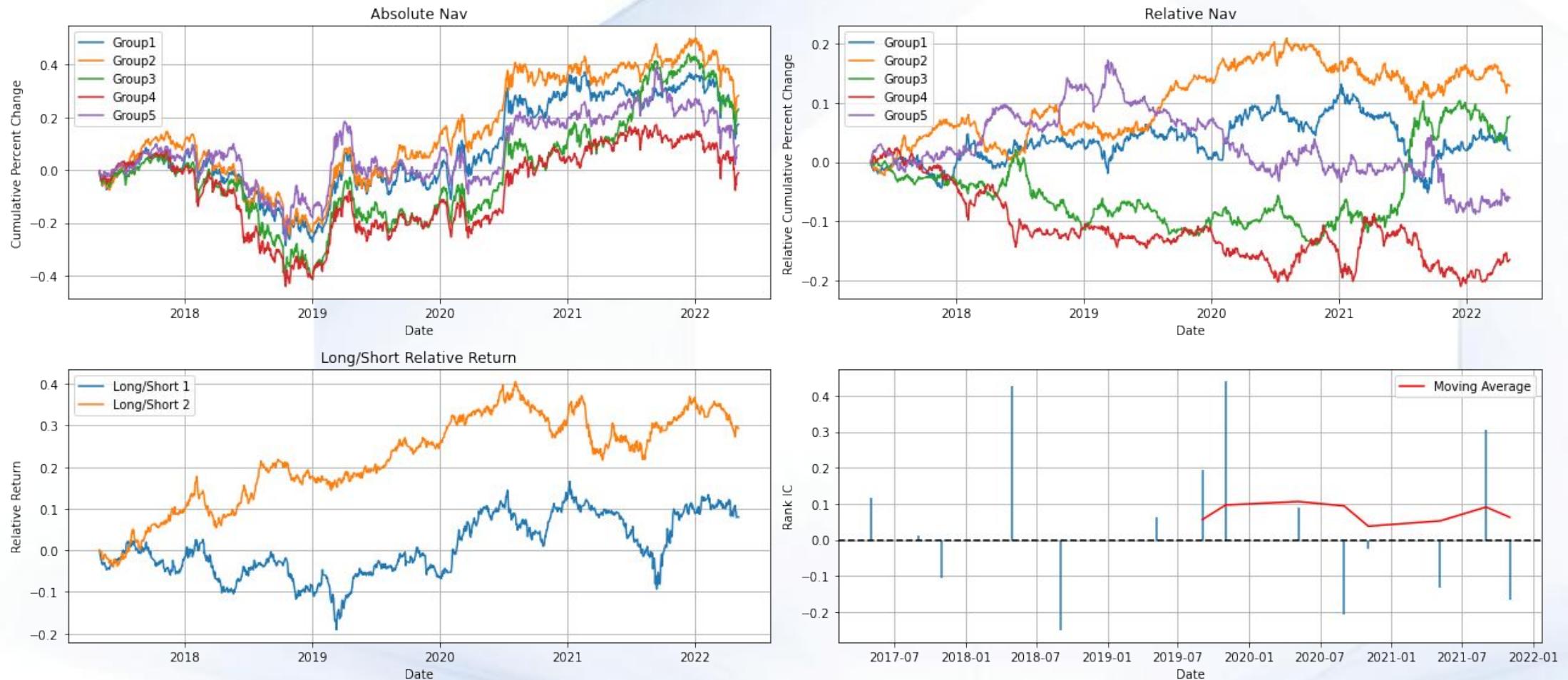


3.5.4 Cost of Equity (Required Rate of Return) — Fama–French change of value (Raw)

Rolling backtest results:

	Freq	Long Excess 额	Long Sharpe _Sharpe	Long Calmar _Calmar	L/S Returns 盈	L/S Sharpe _Sharpe	L/S Calmar _Calmar	Long WR 費	L/S WR 費	rankIC 率	Short WR 率	Long TO 率	Short TO	
0	Origin	2.3%	0.33	0.10	4.03%	0.50	0.25	1.47%	2.41%	11.0%	50.54%	51.36%	137.78%	133.33%
1	1-Day After	1.85%	0.14	0.05	3.79%	0.44	0.19	1.03%	2.16%	9.52%	50.0%	51.35%	137.78%	133.33%
2	2-Day After	1.94%	-0.06	-0.01	4.64%	0.33	0.16	1.11%	3.01%	9.24%	49.32%	51.64%	137.78%	133.33%
3	3-Day After	1.67%	-0.11	-0.01	4.84%	0.27	0.16	0.84%	3.21%	9.89%	49.3%	51.5%	137.78%	133.33%
4	4-Day After	1.33%	-0.01	0.02	4.02%	0.44	0.23	0.5%	2.4%	10.21%	49.72%	51.82%	137.78%	133.33%
5	5-Day After	2.24%	0.11	0.05	5.35%	0.47	0.26	1.41%	3.73%	10.69%	49.95%	51.56%	137.78%	133.33%
6	6-Day After	2.98%	0.27	0.13	6.02%	0.74	0.45	2.15%	4.39%	10.31%	50.58%	52.11%	137.78%	133.33%
7	7-Day After	2.37%	0.00	0.05	4.59%	0.54	0.32	1.54%	2.96%	8.91%	49.43%	51.52%	137.78%	133.33%
8	8-Day After	0.92%	-0.16	-0.03	2.41%	0.32	0.14	0.1%	0.78%	9.76%	49.25%	51.29%	137.78%	133.33%
9	9-Day After	1.28%	-0.18	-0.02	3.72%	0.40	0.20	0.45%	2.09%	10.8%	49.51%	51.79%	137.78%	133.33%
10	10-Day After	1.86%	-0.09	0.02	4.13%	0.47	0.26	1.04%	2.5%	10.24%	49.93%	51.55%	137.78%	133.33%

3.5.4 Cost of Equity (Required Rate of Return) — Fama-French change of value (YoY)



Freq	Long Excess	Long Sharpe	Long Calmar	L/S Returns	L/S Sharpe	L/S Calmar	Long WR	L/S WR	rankIC	Short WR	Long TO	Short TO	
0	0.39%	-0.13	0.05	1.67%	-0.14	0.11	-0.41%	0.1%	5.04%	50.07%	53.12%	133.33%	128.89%

Rolling backtest results:

	Freq	Long_Excess	Long_Sharpe	Long_Calmar	L/S Returns	L/S_Sharpe	L/S_Calmar	Long WR	L/S WR	rankIC	Short WR	Long TO	Short TO	
0	Origin	0.39%	-0.13	0.05	1.67%	-0.14	0.11	-0.41%	0.1%	5.04%	50.07%	53.12%	133.33%	128.89%
1	1-Day After	-0.16%	-0.20	0.00	1.0%	-0.19	0.07	-0.96%	-0.58%	4.36%	49.74%	53.31%	133.33%	128.89%
2	2-Day After	0.05%	-0.39	-0.04	2.3%	-0.21	0.08	-0.75%	0.73%	4.0%	49.27%	53.39%	133.33%	128.89%
3	3-Day After	-0.0%	-0.43	-0.06	2.32%	-0.27	0.04	-0.8%	0.74%	3.34%	48.86%	53.03%	133.33%	128.89%
4	4-Day After	-0.07%	-0.25	0.00	1.53%	-0.21	0.11	-0.87%	-0.04%	3.06%	49.28%	52.56%	133.33%	128.89%
5	5-Day After	0.61%	-0.22	0.03	3.29%	-0.07	0.22	-0.19%	1.71%	2.48%	49.47%	52.85%	133.33%	128.89%
6	6-Day After	0.49%	-0.25	0.03	3.18%	-0.06	0.27	-0.31%	1.6%	3.45%	49.37%	53.0%	133.33%	128.89%
7	7-Day After	1.04%	-0.33	0.01	4.13%	-0.05	0.26	0.24%	2.55%	2.76%	49.47%	53.1%	133.33%	128.89%
8	8-Day After	0.37%	-0.23	0.05	3.27%	-0.10	0.30	-0.43%	1.7%	4.91%	49.93%	53.05%	133.33%	128.89%
9	9-Day After	1.24%	-0.07	0.08	5.17%	0.13	0.39	0.44%	3.6%	4.71%	49.68%	53.43%	133.33%	128.89%
10	10-Day After	1.28%	-0.10	0.09	4.88%	0.11	0.40	0.48%	3.31%	6.96%	49.59%	53.27%	133.33%	128.89%

Required Rate of Return Factor Industry Rotation Observation (based on factor value)

Taking the FF3 factor model as an example, observe whether the longing group in each period contain high-dividend industries and whether the shorting group in each period contain the low-dividend industries.

It turns out that this is true.

Longing Group:

including industries like real-estate, retail, mining, industries that are mature

Group1			
2017-05-02	[煤炭, 建材, 商贸零售, 非银行金融, 房地产, 交通运输]	2019-11-01	[国防军工, 餐饮旅游, 医药, 食品饮料, 电子元器件, 计算机]
2017-09-01	[石油石化, 煤炭, 钢铁, 餐饮旅游, 银行, 房地产]	2020-05-06	[钢铁, 建筑, 建材, 餐饮旅游, 房地产, 交通运输]
2017-11-01	[煤炭, 钢铁, 建材, 商贸零售, 餐饮旅游, 房地产]	2020-09-01	[建筑, 国防军工, 餐饮旅游, 医药, 电子元器件, 计算机]
2018-05-02	[电力及公用事业, 餐饮旅游, 纺织服装, 银行, 非银行金融, 交通运输]	2020-11-02	[石油石化, 煤炭, 电力及公用事业, 钢铁, 建筑, 银行]
2018-09-03	[石油石化, 钢铁, 银行, 交通运输, 传媒, 综合]	2021-05-06	[石油石化, 煤炭, 电力及公用事业, 建筑, 商贸零售, 银行]
2018-11-01	[煤炭, 建材, 国防军工, 餐饮旅游, 食品饮料, 电子元器件]	2021-09-01	[石油石化, 商贸零售, 纺织服装, 农林牧渔, 交通运输, 传媒]
2019-05-06	[食品饮料, 农林牧渔, 通信, 计算机, 传媒, 综合]	2021-11-01	[电力设备, 农林牧渔, 房地产, 交通运输, 传媒, 综合]
2019-09-02	[电力设备, 家电, 食品饮料, 农林牧渔, 通信, 综合]	2022-05-05	[石油石化, 煤炭, 建筑, 商贸零售, 纺织服装, 房地产]

Shorting Group:
Including banking, tech, media, industries that are new

Group5			
2017-05-02	[石油石化, 钢铁, 医药, 银行, 计算机, 传媒]	2019-11-01	[有色金属, 非银行金融, 房地产, 交通运输, 传媒, 综合]
2017-09-01	[建筑, 纺织服装, 非银行金融, 交通运输, 通信, 传媒]	2020-05-06	[煤炭, 有色金属, 国防军工, 食品饮料, 银行, 综合]
2017-11-01	[石油石化, 医药, 通信, 计算机, 传媒, 综合]	2020-09-01	[石油石化, 商贸零售, 家电, 非银行金融, 传媒, 综合]
2018-05-02	[煤炭, 有色金属, 建材, 商贸零售, 房地产, 综合]	2020-11-02	[有色金属, 电力设备, 农林牧渔, 通信, 传媒, 综合]
2018-09-03	[建材, 机械, 国防军工, 餐饮旅游, 食品饮料, 电子元器件]	2021-05-06	[电力设备, 农林牧渔, 非银行金融, 通信, 计算机, 综合]
2018-11-01	[电力及公用事业, 纺织服装, 银行, 非银行金融, 交通运输, 传媒]	2021-09-01	[钢铁, 建筑, 轻工制造, 国防军工, 银行, 计算机]
2019-05-06	[煤炭, 钢铁, 建筑, 非银行金融, 房地产, 交通运输]	2021-11-01	[煤炭, 电力及公用事业, 钢铁, 轻工制造, 国防军工, 银行]
2019-09-02	[煤炭, 建筑, 轻工制造, 银行, 房地产, 交通运输]	2022-05-05	[国防军工, 医药, 食品饮料, 非银行金融, 通信, 综合]

Longing Group:

including industries like real-estate, retail, mining, industries that are mature

Group1

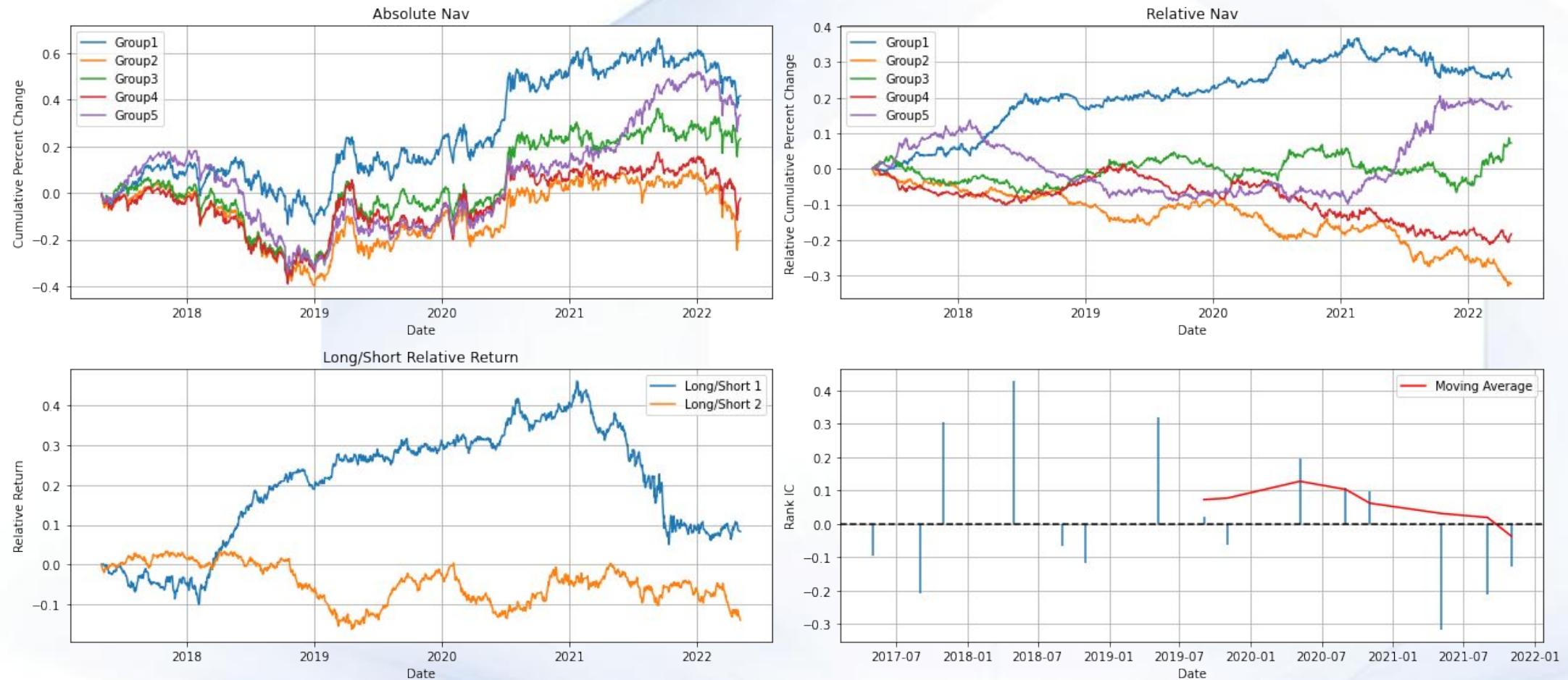
2017-05-02	[有色金属, 建材, 国防军工, 商贸零售, 非银行金融, 交通运输]	2019-11-01	[石油石化, 建材, 餐饮旅游, 医药, 银行, 计算机]
2017-09-01	[石油石化, 煤炭, 钢铁, 餐饮旅游, 银行, 房地产]	2020-05-06	[建材, 餐饮旅游, 农林牧渔, 交通运输, 电子元器件, 计算机]
2017-11-01	[煤炭, 钢铁, 建材, 商贸零售, 餐饮旅游, 房地产]	2020-09-01	[建筑, 国防军工, 餐饮旅游, 医药, 银行, 交通运输]
2018-05-02	[电力及公用事业, 餐饮旅游, 纺织服装, 银行, 非银行金融, 交通运输]	2020-11-02	[煤炭, 钢铁, 建筑, 国防军工, 餐饮旅游, 银行]
2018-09-03	[石油石化, 轻工制造, 医药, 银行, 计算机, 传媒]	2021-05-06	[石油石化, 煤炭, 电力及公用事业, 建筑, 餐饮旅游, 银行]
2018-11-01	[煤炭, 有色金属, 钢铁, 建材, 商贸零售, 房地产]	2021-09-01	[石油石化, 有色金属, 商贸零售, 餐饮旅游, 农林牧渔, 传媒]
2019-05-06	[电力设备, 纺织服装, 农林牧渔, 通信, 传媒, 综合]	2021-11-01	[电力设备, 餐饮旅游, 医药, 农林牧渔, 电子元器件, 通信]
2019-09-02	[电力设备, 家电, 食品饮料, 农林牧渔, 通信, 综合]	2022-05-05	[石油石化, 煤炭, 电力设备, 纺织服装, 农林牧渔, 房地产]

Shorting Group:**Including banking, tech, media, industries that are new**

Group5			
2017-05-02	[石油石化, 轻工制造, 医药, 银行, 计算机, 传媒]	2019-11-01	[有色金属, 电力设备, 家电, 非银行金融, 传媒, 综合]
2017-09-01	[建筑, 机械, 非银行金融, 交通运输, 通信, 传媒]	2020-05-06	[煤炭, 有色金属, 国防军工, 食品饮料, 银行, 综合]
2017-11-01	[石油石化, 国防军工, 医药, 通信, 计算机, 传媒]	2020-09-01	[有色金属, 家电, 农林牧渔, 非银行金融, 传媒, 综合]
2018-05-02	[煤炭, 有色金属, 基础化工, 轻工制造, 商贸零售, 综合]	2020-11-02	[电力设备, 农林牧渔, 电子元器件, 通信, 传媒, 综合]
2018-09-03	[煤炭, 建材, 商贸零售, 餐饮旅游, 非银行金融, 房地产]	2021-05-06	[电力设备, 农林牧渔, 电子元器件, 通信, 计算机, 综合]
2018-11-01	[国防军工, 医药, 银行, 通信, 计算机, 传媒]	2021-09-01	[钢铁, 建筑, 轻工制造, 国防军工, 银行, 非银行金融]
2019-05-06	[煤炭, 建筑, 轻工制造, 国防军工, 餐饮旅游, 非银行金融]	2021-11-01	[煤炭, 电力及公用事业, 钢铁, 建筑, 银行, 非银行金融]
2019-09-02	[煤炭, 建筑, 轻工制造, 国防军工, 餐饮旅游, 银行]	2022-05-05	[国防军工, 食品饮料, 银行, 非银行金融, 通信, 综合]

3. 6. 1 Fundamental Compound Factor 1

Take MOS, EM, Cost of Equity Change (YoY) , and go through dates matching, standardization, and ranking, we can observe that the backtest results are mediocre.



Freq	Long Excess	Long Sharpe	Long Calmar	L/S Returns	L/S Sharpe	L/S Calmar	Long WR	L/S WR	rankIC	Short WR	Long TO	Short TO	
0	5.31%	0.83	0.35	1.69%	0.25	-0.13	4.75%	0.26%	1.81%	53.4%	51.17%	92.67%	147.14%

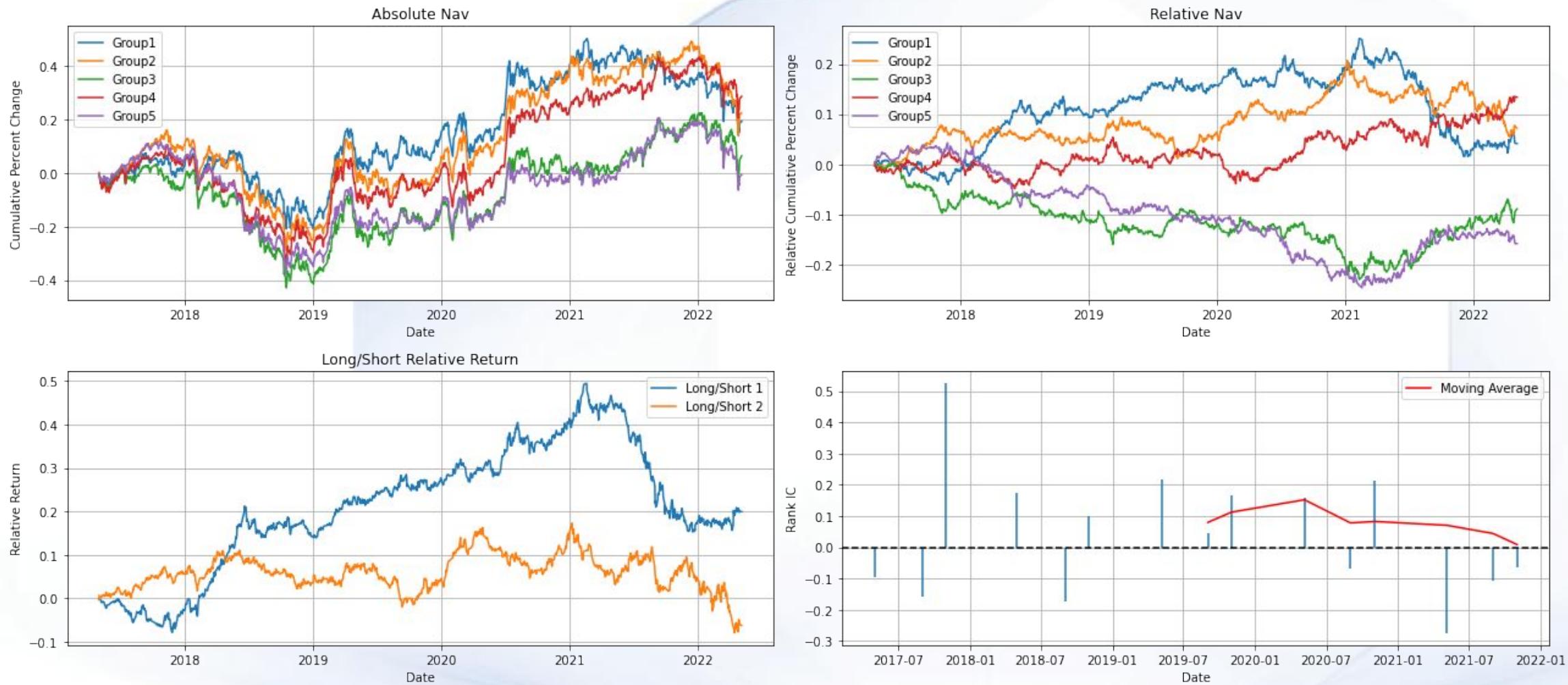
3. 6. 1 基本面复合因子1 — 研报方法

Rolling backtest results:

Freq		Long Excess	Long Sharpe	Long Calmar	L/S Returns	L/S Sharpe	L/S Calmar	Long WR	L/S WR	rankIC	Short WR	Long TO	Short TO	
0	Origin	5.31%	0.83	0.35	1.69%	0.25	-0.13	4.75%	0.26%	1.81%	53.4%	51.17%	92.67%	147.14%
1	1-Day After	5.99%	0.89	0.51	2.8%	0.23	-0.05	5.43%	1.36%	3.27%	53.57%	50.85%	92.67%	147.14%
2	2-Day After	5.78%	0.90	0.45	1.84%	0.27	-0.01	5.23%	0.4%	4.38%	53.63%	51.22%	92.67%	147.14%
3	3-Day After	5.62%	0.91	0.48	2.19%	0.27	-0.01	5.07%	0.75%	3.62%	53.6%	50.83%	92.67%	147.14%
4	4-Day After	5.79%	0.87	0.44	1.95%	0.14	-0.11	5.23%	0.51%	2.9%	53.24%	50.77%	92.67%	147.14%
5	5-Day After	4.91%	0.71	0.28	1.14%	0.03	-0.25	4.36%	-0.3%	3.39%	52.86%	50.52%	92.67%	147.14%
6	6-Day After	5.77%	0.87	0.45	2.53%	0.20	-0.17	5.22%	1.09%	3.69%	53.05%	51.35%	92.67%	147.14%
7	7-Day After	5.5%	0.89	0.48	2.88%	0.27	-0.06	4.95%	1.44%	3.31%	53.07%	51.96%	92.67%	147.14%
8	8-Day After	5.42%	0.88	0.42	1.96%	0.15	-0.25	4.86%	0.52%	3.5%	52.94%	51.69%	92.67%	147.14%
9	9-Day After	5.7%	0.90	0.43	2.42%	0.22	-0.21	5.14%	0.98%	3.91%	53.15%	51.75%	92.67%	147.14%
10	10-Day After	5.48%	0.99	0.44	2.67%	0.28	-0.15	4.93%	1.23%	3.76%	53.14%	51.88%	92.67%	147.14%

3. 6. 2 Fundamental Compound Factor 2 — Improved

Keeping the same structure except replacing the cost of equity factor predicted from FF3 to CAPM, yields much better backtesting results. However, the rankIC is also trending down.



Freq	Long Excess	Long Sharpe	Long Calmar	L/S Returns	L/S Sharpe	L/S Calmar	Long WR	L/S WR	rankIC	Short WR	Long TO	Short TO	
0	0.92%	-0.21	-0.11	4.18%	0.04	-0.02	0.27%	2.75%	4.44%	49.4%	52.51%	107.78%	129.92%

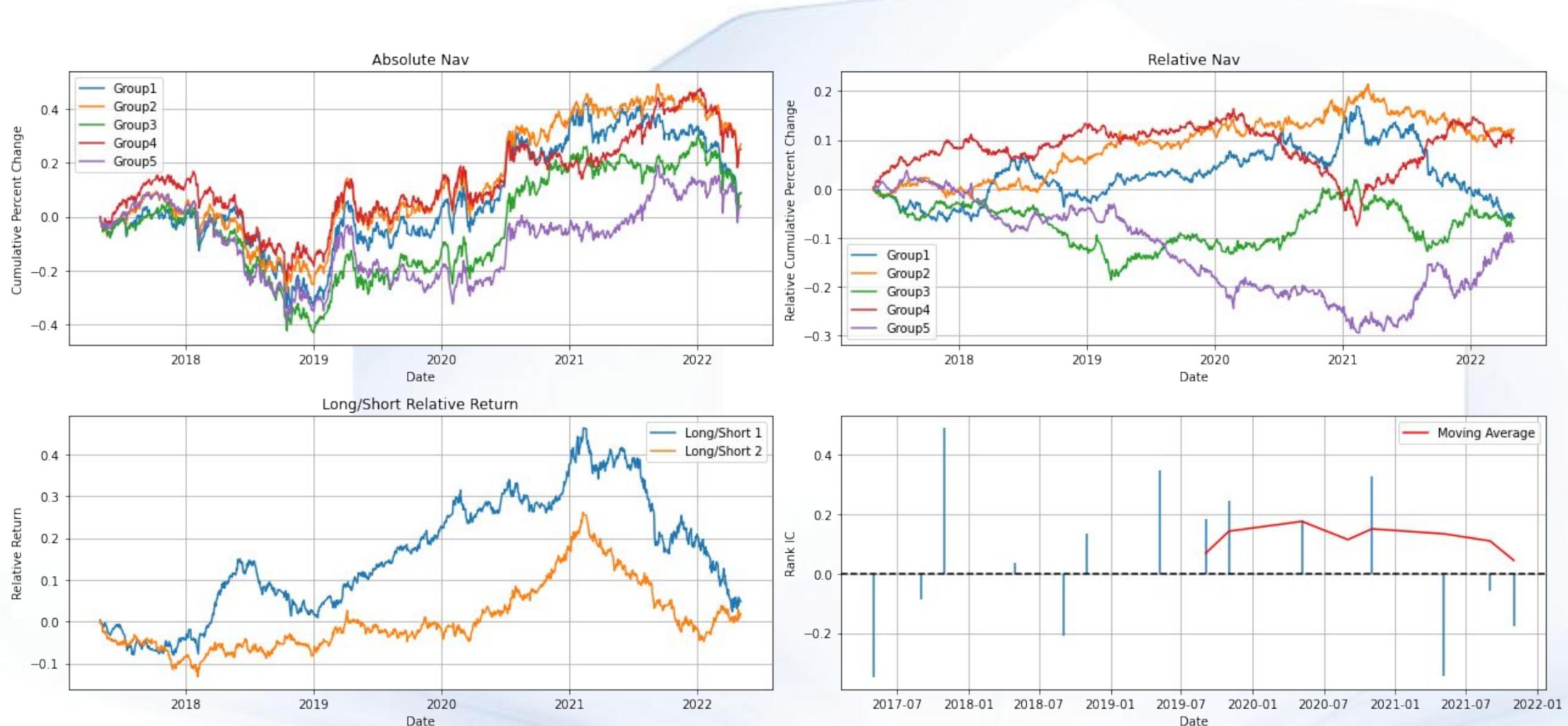
3. 6. 2 Fundamental Compound Factor 2 — Improved

Rolling backtest results:

Freq		Long Excess	Long Sharpe	Long Calmar	L/S Returns	L/S Sharpe	L/S Calmar	Long WR	L/S WR	rankIC	Short WR	Long TO	Short TO	
0	Origin	0.92%	-0.21	-0.11	4.18%	0.04	-0.02	0.27%	2.75%	4.44%	49.4%	52.51%	107.78%	129.92%
1	1-Day After	0.97%	-0.27	-0.13	4.54%	-0.08	-0.04	0.33%	3.11%	5.63%	49.36%	51.9%	107.78%	129.92%
2	2-Day After	1.12%	-0.13	-0.07	4.46%	0.09	0.03	0.47%	3.03%	5.91%	49.57%	52.1%	107.78%	129.92%
3	3-Day After	1.44%	-0.08	-0.09	5.01%	0.18	0.02	0.79%	3.58%	5.39%	49.5%	52.26%	107.78%	129.92%
4	4-Day After	1.57%	-0.22	-0.12	4.93%	0.05	-0.00	0.92%	3.5%	5.18%	49.35%	52.37%	107.78%	129.92%
5	5-Day After	1.22%	-0.29	-0.15	4.62%	0.03	-0.06	0.58%	3.19%	6.54%	49.06%	52.33%	107.78%	129.92%
6	6-Day After	1.5%	-0.26	-0.14	5.43%	0.23	0.02	0.85%	4.0%	6.18%	49.32%	52.8%	107.78%	129.92%
7	7-Day After	0.8%	-0.32	-0.14	4.57%	0.21	0.02	0.16%	3.14%	6.74%	49.49%	53.32%	107.78%	129.92%
8	8-Day After	0.56%	-0.36	-0.18	3.61%	0.12	-0.06	-0.09%	2.19%	7.46%	49.14%	53.18%	107.78%	129.92%
9	9-Day After	0.62%	-0.34	-0.18	3.24%	0.02	-0.11	-0.03%	1.82%	6.93%	48.79%	52.58%	107.78%	129.92%
10	10-Day After	0.89%	-0.13	-0.13	3.71%	0.23	-0.06	0.24%	2.28%	6.58%	49.03%	52.48%	107.78%	129.92%

3. 6. 2 Fundamental Compound Factor 3 — Adding Total Asset (ATO)

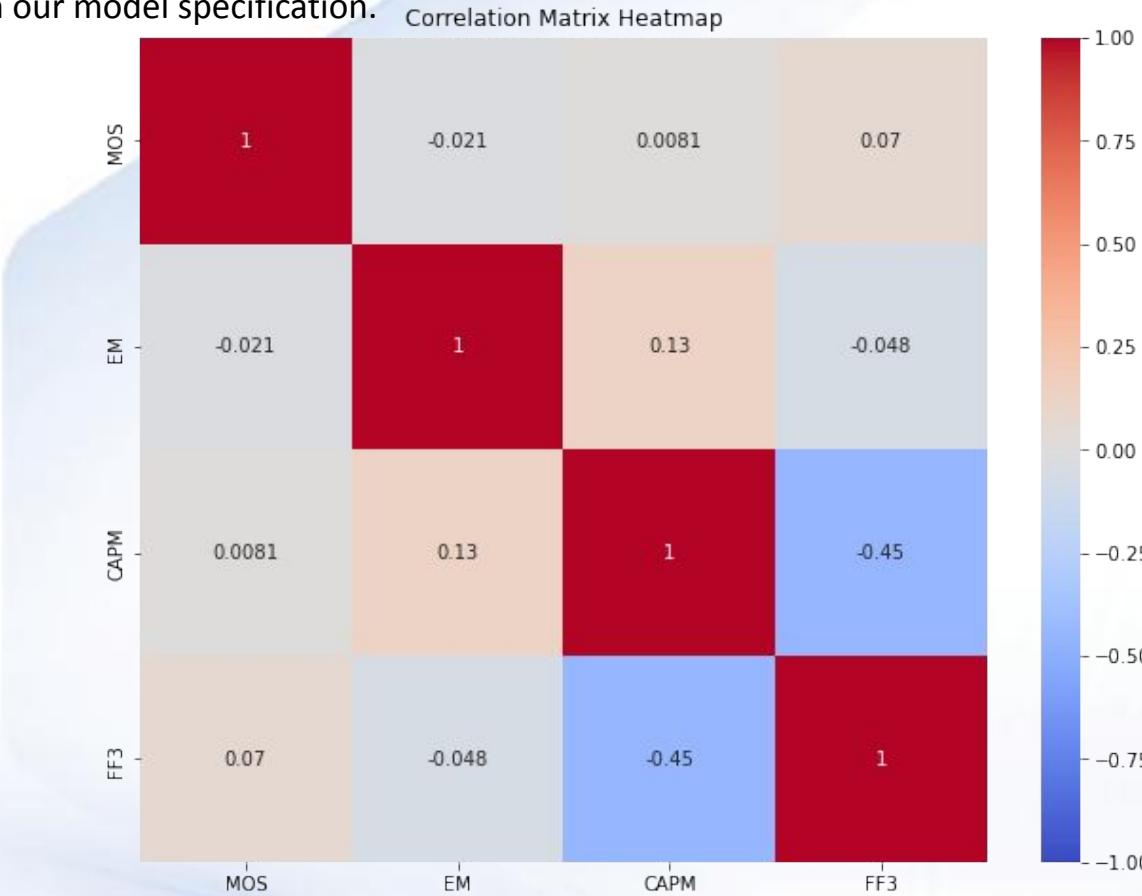
Keeping the same structure except adding the ATO factor yields much better backtesting results. However, the rankIC is also trending down.



Freq	Long Excess	Long Sharpe	Long Calmar	L/S Returns	L/S Sharpe	L/S Calmar	Long WR	L/S WR	rankIC	Short WR	Long TO	Short TO	
0	-1.24%	-0.77	-0.23	0.91%	-0.19	-0.13	-1.9%	-0.54%	4.81%	48.74%	53.44%	109.78%	131.11%

3.6.1 Fundamental Compound Factor 2 — Correlation Matrix

Following on the replacement of cost of equity prediction method, by taking a closer look at the covariance matrix, we can easily spot a negative correlation between FF3 and CAPM, which confirms the replacement effectiveness according to linear regression assumptions as both models aim to predict the same variable (cost of equity). Therefore, we retain CAPM for its superior predictive power and avoid potential multicollinearity issues in our model specification.



Compound Factor Based on Two Research Reports

- 4. 1. 1 Rebalancing Quarterly (according to fundamental factor cycle)
- 4. 1. 2 Rebalancing every 5 day (according to volume and price factor cycle)

4. 1. 1 Rebalancing Quarterly

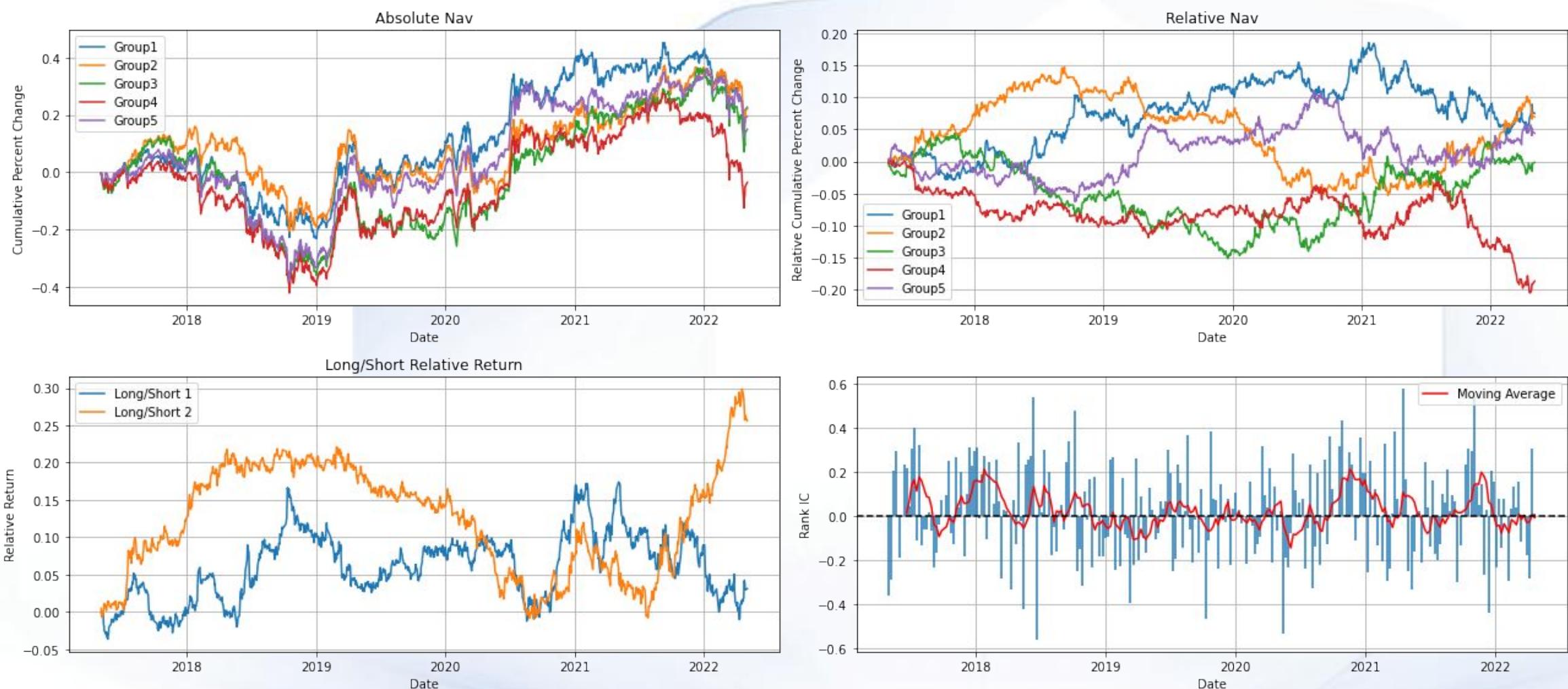
Took the effective factors from the two sections through standarization and compounded equally weighted. The final backtesting result doesn't look good, possibly due to mismatch in information periods. Improvements could be done.



Freq	Long Excess	Long Sharpe	Long Calmar	L/S Returns	L/S Sharpe	L/S Calmar	Long WR	L/S WR	rankIC	Short WR	Long TO	Short TO	
0	2.97%	0.01	0.05	3.17%	-0.01	0.12	2.11%	1.48%	1.45%	50.26%	50.97%	144.44%	137.78%

4. 1. 2 Rebalancing Every 5 day

Took the effective factors from the two sections through standarization and compounded equally weighted. The final backtesting result doesn't look good, possibly due to mismatch in information periods. Improvements could be done.



Freq	Long Excess	Long Sharpe	Long Calmar	L/S Returns	L/S Sharpe	L/S Calmar	Long WR	L/S WR	rankIC	Short WR	Long TO	Short TO
0	5	1.53%	0.63	0.13	0.65%	0.33	0.05	-4.62%	-11.43%	2.35%	50.12%	50.29%
											61.02%	58.82%

Conclusion

The backtesting conclusions largely align with those in the previous research report, particularly regarding the fundamental composite factors, which show great similarity in factor performance with the second research report. This is reflected in: Among the variables mentioned in the research, only sales-to-profit ratio, equity multiplier, and cost of equity showed relatively good predictive power in the backtesting, with total asset turnover ratio also showing good predictive power in the actual backtesting. Among these, the cost of equity predictions (using Dividend Growth Model, CAPM model, and Fama-French three-factor model) showed good rankIC, possibly because these models incorporate more market information, although FF3's actual return rate performance is less ideal.

At the composite factor level, single-category (value, fundamental) composite factors in backtesting performed better than most individual factors within the same category. However, it's worth noting that since 2021, the rankIC of fundamental composite factors has shown a downward trend. But from the backtesting results, composite factors' performance is shown to be more stable than individual factors in terms of excess returns, with smaller maximum drawdowns in multi-factor combinations. If we further control for risk factors' exposure and more efficient weighting, the results could be even better.

Finally, when equally weighting the composite factors from both research reports to obtain new factors (composite² factors), the performance was mediocre. Overall, the backtesting results were not as good as single composite factors, possibly due to misalignment between information cycles and trading cycles.