Stock Filter Document

Contents

Section 1 - Project Description

1.1 Project

Stock filter is a system recommending the top three stocks everydays for a short holding period (60 trading days).

1.2 Revision History

Date	Source Code	Note	Author
2024/05/02	https://github.com/A1QKT/smart-beta	None	Ta Quang Khoi
2024/05/10	https://github.com/A1QKT/smart-beta	Add Fee Rate	Ta Quang Khoi

Section 2 - Criteria

In this project, we use financial and technical types of signals.

2.1 Financial Signal

Financial signals are calculated after a month to each quarter of the year.

2.1.1 Return on Equity (ROE)

$$ROE = \frac{Net\ Profit\ After\ Tax}{Shareholder\ Equity},\ Median(ROE) < ROE < \infty$$

2.1.2 Earning Per Share (EPS)

$$EPS = \frac{NetProfit\ Attribute\ To\ Shareholder}{Share\ Outstanding},\ Median(EPS) < EPS < \infty$$

2.1.3 Gross Margin (GM)

$$GM = \frac{Gross\ Revenue}{Gross\ Profit},\ Median(GM) < GM < \infty$$

2.1.4 Quick Ratio (QR)

$$QR = \frac{Cash + Investment + Receivable}{Liabilities},\ Median(QR) < QR < \infty$$

2.1.5 Turnover Inventory (TI)

$$TI = \frac{COGS}{Inventory},\ Median(TI) < TI < \infty$$

2.2 Technical Signal

Stocks are sorted by **Round(RSI, 2)** signal in descending order.

2.2.1 Liquidity (LIQ)

Liquidity is calculated by the median of **20 days** before. Each day has the value equal to:

Close Price * Daily Volume

The liquidity signal of each firm must be in the range of 1 billion to 5 billion VND (adjustable). Daily volume will equal to 0 if stock is not traded.

2.2.2 Exponential Weighted Mean RSI (RSI)

$$RSI = 1 - \frac{1}{1 + \frac{average\ gain}{average\ loss}}, 0.6 \leq RSI \leq 0.7$$

Average gain and average loss are calculated by exponential weighted mean:

$$Average\ gain\ /\ loss = \frac{x_t + (1-\alpha)x_{t-1} + (1-\alpha)^2 x_{t-2} + \ldots + (1-\alpha)^t x_0}{1 + (1-\alpha) + (1-\alpha)^2 + \ldots + (1-\alpha)^t}$$

We sort the firms by RSI in descending order. Note that in some days, all filtered firms have RSI outside the range [0.6, 0.7], hence the number of stocks these days will be 0.

Section 3 - Benchmark Method

3.1 Method

We buy and hold 3 stocks each day for a 60 days period. Stocks are bought and sold with the **close price** of the firms. For benchmarking, each day will have its own metrics including: sharpe ratio, maximum drawdown, positive percentage of cumulative return (for now we call **PP**), absolute cumulative return and expected monthly return. Each metric will be compared with VNINDEX.

3.2 Metrics of System

3.1.1 Expected Sharpe Ratio

$$ESR = mean\left(\frac{252 * mean\,(DailyReturn_i) - RiskFreeRate}{\sqrt{252} * std\,(DailyReturn_i)}\right)$$

Where $DailyReturn_i$ is daily return calculated from date i to 60 days after day i.

3.1.2 Maximum of MDD

$$MMMD = max\,(MaximumDrawdown_i)$$

Where $MaximumDrawdown_i$ is the maximum drawdown calculated from date i to 60 days after day i.

3.1.3 Number of days having positive PP

We calculate the probability that a day will meet one cumulative return greater than a risk free rate (in our system, will use 5% as a risk free rate for this metric) in its holding period:

$$PPP = \frac{Number\ of\ day\ have\ positive\ pp}{Number\ of\ day\ in\ in{-}sample\ period}$$

3.1.4 Mean, Max and Min of Absolute Cumulative Return

Mean, max and min of the absolute cumulative return in the in-sample period:

$$MAR,\ MIR,\ MER\ =\ Max,\ Min,\ Mean\ (CumulativeReturn_i)$$

Where $CumulativeReturn_i$ is the absolute cumulative return calculated from date i to 60 days after day i.

3.1.5 Expected Monthly Return

Expected monthly return is the average monthly return of each day:

$$EMR\ =\ Mean\ (MonthlyReturn_i)$$

Where $MonthlyReturn_i$ is the expected monthly return calculated from date i to 60 days after day i.

Section 4 - Backtesting

4.1 Backtesting Settings

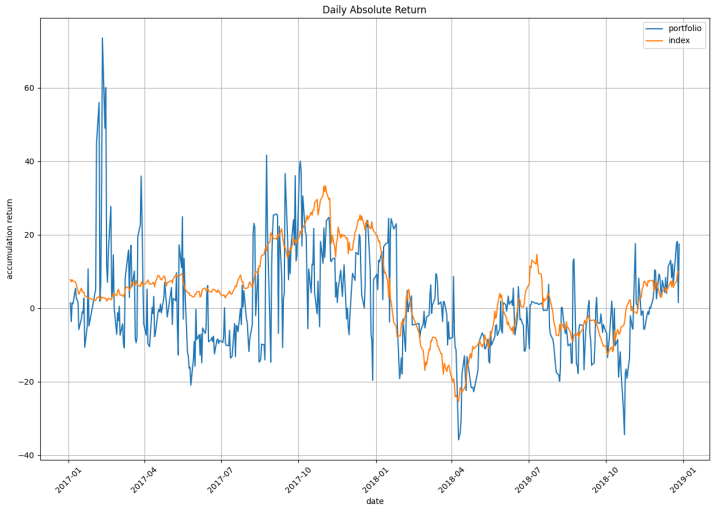
- In-sample period: from 2017/03/01 to 2018/12/28
- Number of Stocks Each day: 3
- Using VNINDEX as a benchmark to evaluate portfolio performance.
- Parameters:
    - RSI in range [0.6, 0.7], window = 60
    - Median liquidity in range [1, 5] billion VND, window = 20
    - Buy fee rate: 0.06%
    - Sell fee rate: 0.06%

4.2 In-sample Period Evaluation

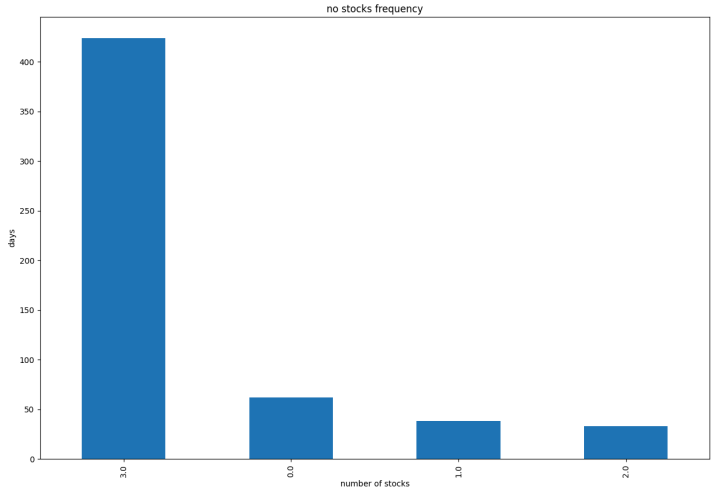
We evaluate the in-sample period by each single factor.

4.2.1 EPS

	ESR	MMMD	PPP	MAR	MIR	MER	EMR
Portfolio	-0.042	-12.085%	60.563%	73.507%	-35.785%	0.880%	0.143%
Index	1.512	-25.319%	67.807%	33.306%	-25.319%	4.281%	1.305%



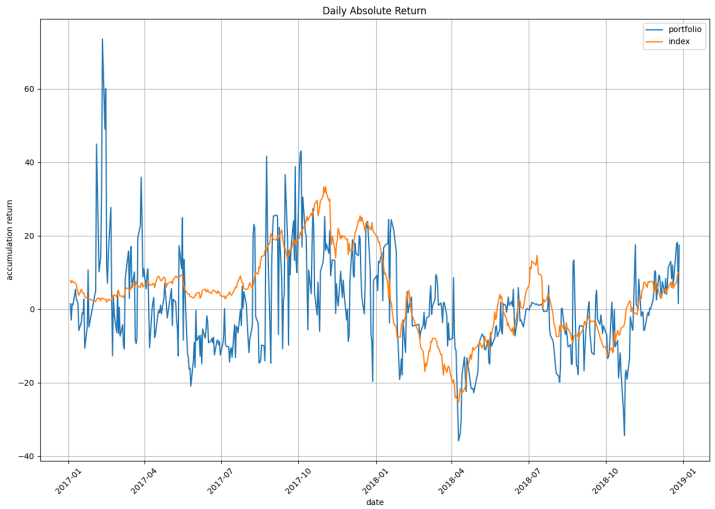
Cumulative Absolute Return



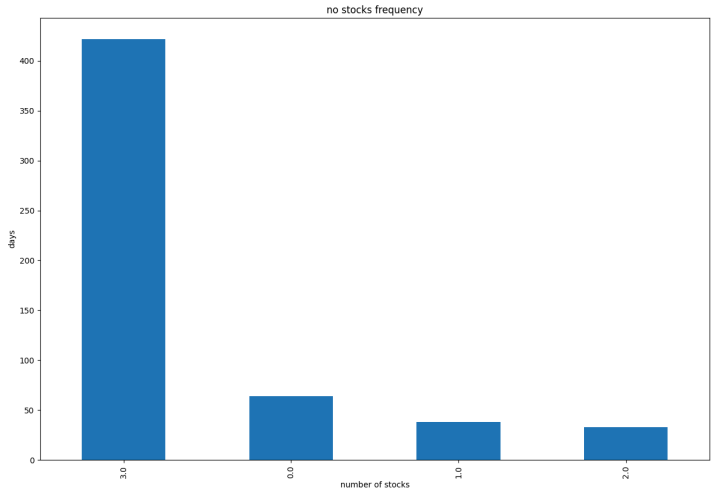
Number of Stocks Each Day

4.2.2 ROE

	ESR	MMMD	PPP	MAR	MIR	MER	EMR
Portfolio	-0.036	-12.049%	59.800%	73.507%	-35.784%	0.865%	0.097%
Index	1.512	-25.319%	67.807%	33.306%	-25.319%	4.281%	1.305%



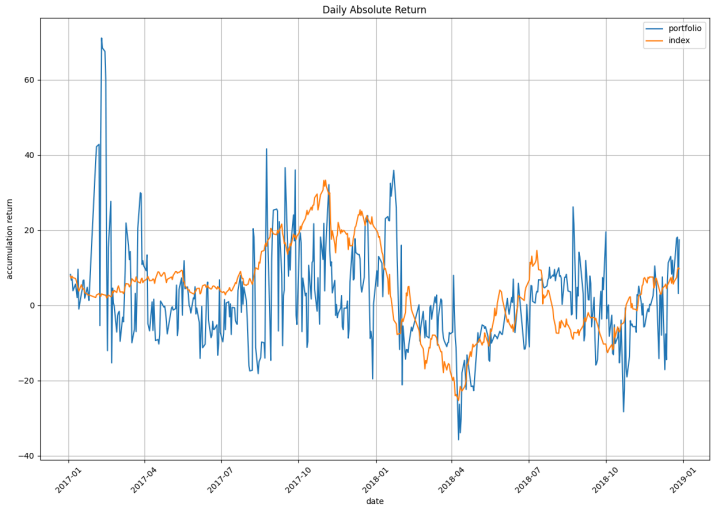
Cumulative Absolute Return



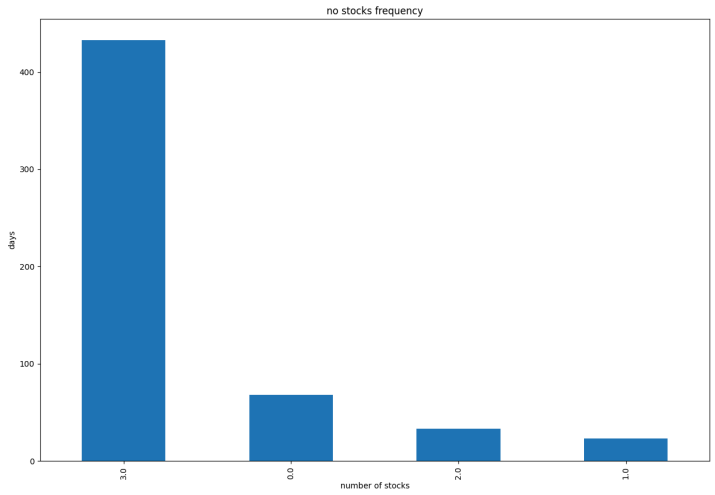
Number of Stocks Each Day

4.2.3 GM

	ESR	MMMD	PPP	MAR	MIR	MER	EMR
Portfolio	0.203	-11.375	61.507%	71.150%	-35.785%	1.884%	0.538%
Index	1.512	-25.319%	67.807%	33.306%	-25.319%	4.281%	1.305%



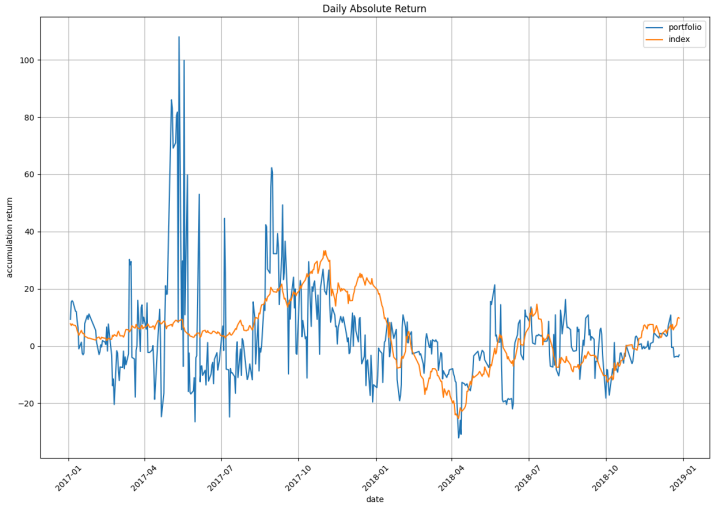
Cumulative Absolute Return



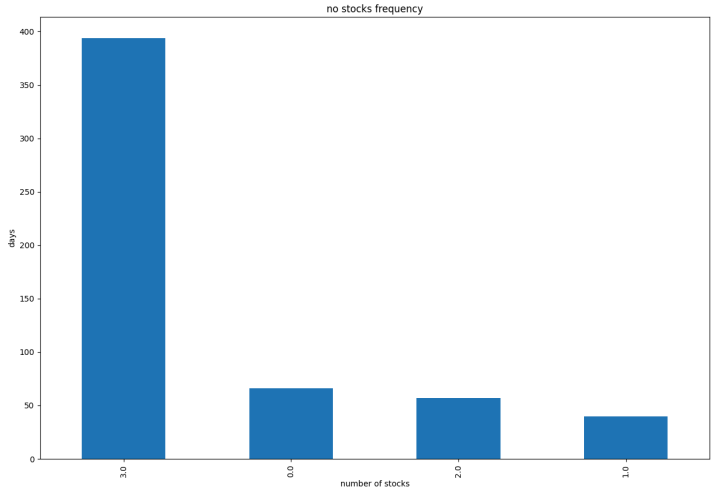
Number of Stocks Each Day

4.2.4 TI

	ESR	MMMD	PPP	MAR	MIR	MER	EMR
Portfolio	0.223	-11.770%	59.714%	108.048%	-32.122%	2.893%	0.737%
Index	1.512	-25.319%	67.807%	33.306%	-25.319%	4.281%	1.305%



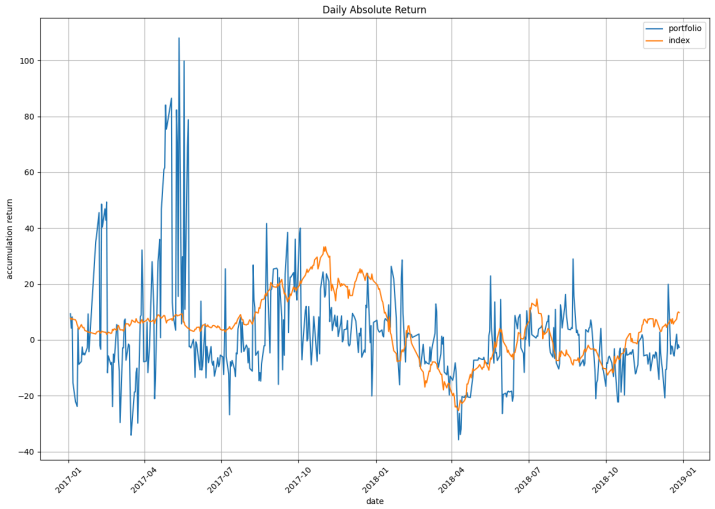
Cumulative Absolute Return



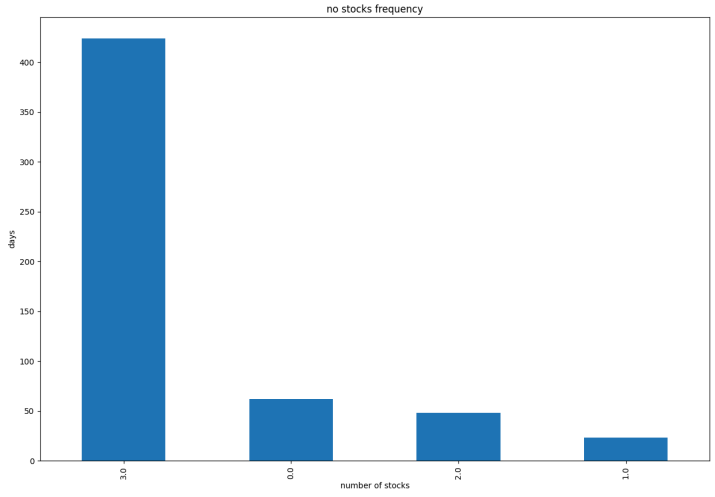
Number of Stocks Each Day

4.2.5 QR

	ESR	MMMD	PPP	MAR	MIR	MER	EMR
Portfolio	-0.068	-13.094%	59.959%	108.048%	-35.785%	1.774%	0.238%
Index	1.512	-25.319%	67.807%	33.306%	-25.319%	4.281%	1.305%



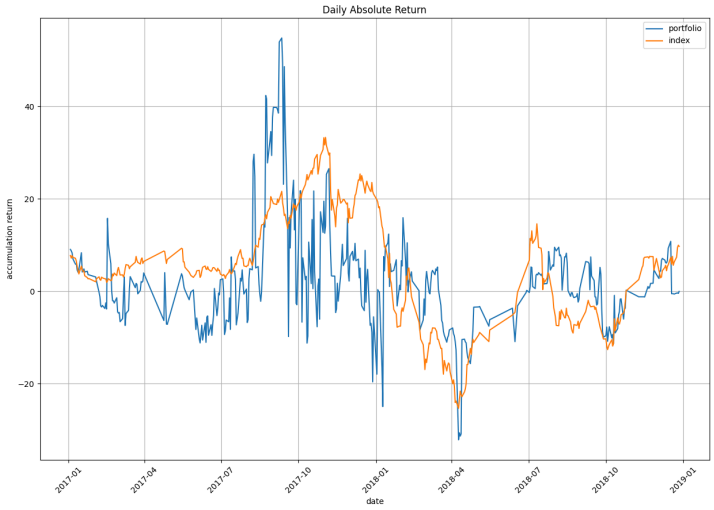
Cumulative Absolute Return



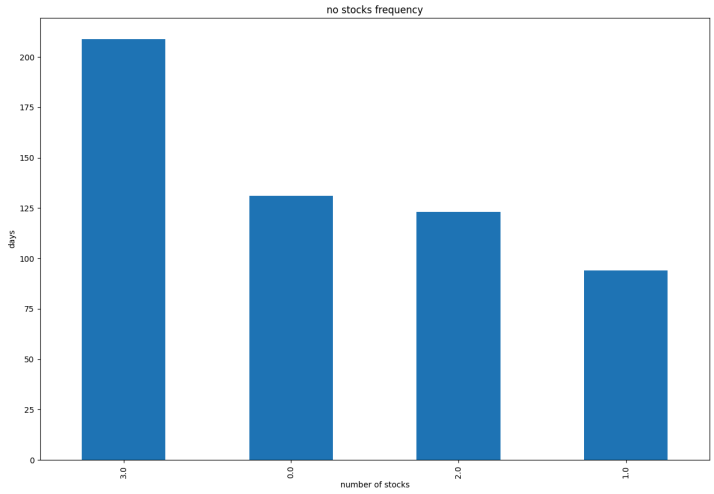
Number of Stocks Each Day

4.2.6 Combination (TI and GM)

	ESR	MMMD	PPP	MAR	MIR	MER	EMR
Portfolio	0.229	-9.160%	52.644%	54.834%	-32.122%	2.157%	0.597%
Index	1.512	-25.319%	67.807%	33.306%	-25.319%	4.281%	1.305%



Cumulative Absolute Return



Number of Stocks Each Day

Section 5 – In-sample Optimization

5.1 Optimization Settings

- In-sample period: from 2017/03/01 to 2018/12/28
- Validation period: from 2019/01/02 to 2021/12/31
- Number of Stocks Each day: 3
- Objective function is the average of sharpe ratio
- Number of Trials: 1000
- Hyperparameters: lower bound and upper bound of median liquidity
- Fixed parameters:
    - RSI in range [0.6, 0.7], window = 60
    - Window liquidity = 20
    - Buy fee rate: 0.06%
    - Sell fee rate: 0.06%

5.2 Performance Measurement

5.2.1 Training Period

Top 5 highest score:

Liquidity Range	ESR
3.5 billion VND - 4 billion VND	0.449
3 billion VND - 4 billion VND	0.393
7 billion VND - 7.5 billion VND	0.387
3 billion VND - 4.5 billion VND	0.267
3.5 billion VND - 4.5 billion VND	0.171

5.2.2 Validation Period

Billion VND	ESR	MMMD	PPP	MAR	MIR	MER	EMR
[3.5, 4]	0.595	-7.201%	54.285%	215.584%	-14.214%	4.885%	1.303%
[3, 4]	0.487	-8.569%	52.710%	254.785%	-20.966%	6.215%	1.911%
[7, 7.5]	0.501	-6.771%	55.223%	34.755%	-11.813%	3.347%	0.916%
[3, 4.5]	0.488	-8.555%	51.715%	254.785%	-20.966%	5.995%	1.933%
[3.5, 4.5]	0.471	-7.701%	51.582%	215.584%	-14.033%	4.731%	1.500%
Index	0.945	-33.511%	57.554%	31.757%	-31.346%	4.166%	1.303%