Step 1: Performance indices for all strategies

1. Daily basis: Annualized return, standard deviation, Sharpe ratio, Maximum Drawdown, Kelly ratio, VaR, SkewnessKurtosis ratio, etc.

2. Trading signals and frequency related: total number of transactions, winning percentage, odds, expected earnings, total profit, total loss.

Step 2: The ranking process

We first rank all the strategies by its performance indices calculating from its log-return, and then select top ranking strategies to enter into portfolio analysis.

1. cluster analysis

(hclust pachage in R) we cluster all the performance indicies and select one of the most significant one in each cluster as our ranking standards.

(Annualized return, Sharpe ratio, Maximum Drawdown, Loss ratio)

2.PCA (Principle component analysis)

we grab the most important factor from the orthogonal basis corresponding to our performance index.

(Burke Ratio, Drawdown Deviation, expectation, continuous loss days)

3. create our own index based on different indicator ratio

(1) 25% Burke Ratio + 25% Drawdown Deviation + 25% expectation + 25% continuous loss days

(2) 50% Annualized return + 40% Sharpe ratio + 10% Maximum Drawdown

(3) 75% Loss ratio + 15% Sharpe ratio + 10% Maximum drawdown

4. Rank regression

select the factor who has most significant coefficient, and use it as the ranking criteria ("prospect ratio", "Annualized Sharpe (Rf = 0%)", "Worst Drawdown", "gain ratio"). The top 5 for each indicator, take the union as a new strategy set

5. long-short quantile type

select the top 20 strategy based on one index and then, among these strategy, we select 10 strategy according to another index.

1) top10 MDD => top5 Annualized return

2) top10 Annualized return => top5 MDD

3) top10 Sharpe ratio =>top5 MDD

Step 3: Portfolio Optimization

In this step, we allocate the optimal weight for each strategy selected from step 2 using several portfolio optimization methods.

There are eight kinds of rolling methods: the moving method is divided into two types: fix start and block (see explanation below). The window size is divided into monthly and weekly, and the training data set is selected from 2018-2019 and 2019 respectively.

1. fix start
fixed start date, each time rolling, moving backward to expand the train data set of a window;

2. block
Each time rolling, the beginning and the end of the train set are moved by the length of a window, keeping the length of the train consistent.

- Uniform Porfolio
- GMVP Portfolio
- Markowitz Portfolio
- Alternative Risk Measurement based Portfolio
  1. Downside risk;
  (1) risk−neutral (alpha=1)
  (2) risk−averse (alpha=2)
  (3) more risk−averse (alpha=3)
  2. VaR
  3. CVaR
  4. Drawdown
- Risk−Parity Portfolio
  1. Closed−form solution for diagonal case
  2. Convex formulation
  3. General formulations with nonlinear solvers
  4. SCA method

Step 4: Final Objective Function

In order to test the effects of the above several combinations of optimization methods, we draw a curve of cumulative return and select 13 indicators to detect the combination of return.

Annualized Return, Annualized Standard Deviation, Sharpe ratio, Maximum Drawdown, Sortino ratio, Conditional Drawdown5% & 10%), VaR (95% & 99%), Calmer ratio, (return/conditional drawdown) * 0.95 (or * 0.5), (return/VaR 95%) * 0.95, (return / VaR 99%) *0.99.

Step 5: Practical Analysis

For all the weighting methods, the number of tradings in the actual operation is calculated according to the allocations obtained. And in actual operation, rebalance by month.