Nomura Hiring Assignment

Kindly take a look at the Final Results.xlsx file to see results of all simulations across both time periods: Apr to June’ 22 and July ‘22

Kindly take a look at any of the following files for the code of the simulations:

1. trading\_strategy\_backtest.py
2. trading\_strategy\_jupyter\_notebook.ipynb

Details

1. Assumptions

Sentence: ”We are trying to design a long only strategy where you hold a long position of 100 every day (constant notional) across the stocks that you think will rebound up.”

The meaning of the above sentence from the assignment document was not completely clear, hence the below assumption has been made.

Assumption: “A constant amount of CNY 100M is infused into the trading portfolio on day 1 and thereafter no extra amount is added. This would allow us to compare the returns with that of the benchmark(Another sentence from document: We are trying to do better than just buy and hold. We want to beat the 500 stocks equal-weighted.)”

1. Number of Stocks

486 stocks out of the 500 constituents(as of 2021-01-01) of CSI 500 have been used as complete data for 14 stocks was unavailable for the given time period 2022-03-15 to 2022-07-31(taken 15 extra days before 2022-04-01 to calculate indicators)

1. Features Used
   1. Moving Averages

Two moving averages are being used, one with a longer lookback period than the other. Both MAs can either be EMA or SMA. When the MA with shorter lookback period goes below the other MA, it is considered as a buy signal.

* 1. RSI

The lookback period used for RSI is same as that of the shorter moving average. RSI is used to ascertain a sideways market(Mean Reversion tends to perform better in a sideways market)

* 1. Z-Score

Z-Score is used to find relative weights of the stocks recommended by RSI and MAs.

* + - 1. When the Z-Score is between 0 to -1(or 0 to -0.75), we buy 1-unit weight of that stock
      2. When the Z-Score is between -1 to -2(or -0.75 to -1.5), we buy 2-unit weight of that stock.
      3. When the Z-Score is between above 0 or below to -2( or-1.5), we do not buy:
         1. Above 0: We have a long only strategy
         2. Below 2(or 1.5): Stop Loss

1. Hyperparameters
   1. Type of moving averages: SMA or EMA
   2. Lookback periods for SMA and EMA:

The lookback periods have been defined in this way:

* + 1. The LBP for Long MA can be any of [60, 72, 84, 96]
    2. The LBP of Short MA is LBP(Long MA)/factor where factor can be any of [2, 3, 4]
  1. The Z-Score can be centred at any of [-1,- 0.75]
  2. RSI can be bound in any of [(20, 80), (30, 70), (40, 60)]

1. Benchmark Performance
   1. The benchmark gives the following returns
      1. Apr to June’ 22: 3.2%
      2. July ’22: -1.4%
2. Metrics
   1. Total Return
   2. Volatility
   3. Max Drawdown
   4. Return per unit Risk = Total Return / Volatility
3. Backtest for Apr to June’ 22

The backtest for Apr to June’ 22 was run with 288 unique hyperparameter combinations

Best return per unit risk achieved in the following config of hyperparameters

|  |  |
| --- | --- |
| long\_ma\_type | sma |
| short\_ma\_type | sma |
| long\_window | 60 |
| long\_to\_short\_ratio | 4 |
| rsi\_bounds | [40, 60] |
| z\_score\_centre | 0.75 |
| total\_return\_percent | 10.20299 |
| volatility | 11.65736 |
| max\_drawdown | -16.2812 |
| return\_per\_unit\_risk | 0.87524 |

1. Approach on improvement
   1. For each value of each hyperparameter, mean value(across all iterations using that value – See Pivot Table Tab in Final Results.xlsx) of risk per unit return is calculated
   2. Combinations of values of hyperparameters that have the highest mean risk\_per\_unit\_return in the first backtest give the highest risk per unit return in the second back test(all 288 combinations were run for the second backtest as well for comparison) as well.