

Last Homework (Final project))

December 11, 2019

Please solve one of the following problems. As always you are welcome to solve both.

1 Problem 1: (Momentum Crashes)

Please, read the paper "Momentum Crashes" (attached) Long term sector-neutral price momentum is commonly used as one of the factors to tilt market neutral portfolios . There are few instruments which try to track the performance of this factor: DJTMNMO (index), MOM (ETF), MTUM (long only ETF).

Question 1: Try to write down the logic and intuition described in the paper.

Question 2: Compare price series of DJTMNMO and MOM for the overlapping interval.

Question 3: Try to replicate the price series of DJTMNMO using MTUM and SPY returns.

Question 4: Using insights/ideas from the paper, try to come up with a quantitative strategy which trades momentum factor, while being market neutral (hedged by SPY (ETF)). The list of factors to consider VIX, relalized market volatility, seasonality etc.

Question 5: Try to come up with a model which estimates the trade volume of people who track momentum factor.

2 Problem 2 (Multiperiod Optimization)

Assume you have a sequence of the forecasts at time "t", $\alpha(t), \dots, \alpha(t+h)$ where $\alpha(t+h)$ is the forecast of a return between time "t+h" and "t+h+1"

To generate optimal position for the next period "t+1" for this forecast we want to maximize the following utility function (in a single stock case):

$$U = \sum_{h=0}^T n(t+h+1)\alpha(t+h) - H \sum_{h=0}^T \frac{(n(t+h+1) - n(t+h))^2}{V(t+h)}$$

where $n(t)$ - current position, $P(t)$ - current price, $V(t+h)$ - projected volume between time "t+h" and "t+h+1"

Question 1: Find optimal solution for $n(t)$ under given assumption

Question 2: Assume some decay of your forecast i.e. $\lim_{h \rightarrow \infty} \alpha(t+h) = 0$, how this case would differ from the case where $\alpha(t+h) = \text{const.}$ How would you use this optimization to improve scheduling in trading algorithm.

Question 3: Generalize the problem to multidimensional case of "N" stocks. How would you impose market neutrality in utility function?

Question 4: How would you modify your utility function if you would like to take into account uncertainty in your forecasts?