Assignment 2
FIE450
Spring 2021

Before you start read the following points carefully!

1. For each of the four tasks use a separate `R`-script labeled `Assignment-2-1.R`, `Assignment-2-2.R`, etc.
2. When you submit and Wiseflow wants you to submit a PDF file submit *this* file.
3. Start each `R`-script with the line `rm(list=ls())`.
4. Assign the results of each subtask to the variable names given in brackets. Only these variables are considered for grading. If they are missing or misspelled then no points are given for this subtask.
5. Do not round results.
6. Do not use any packages other than `quadprog`.
7. If something is unclear, make a reasonable assumption and continue working on this assignment.

Data

Your are working for an asset management firm and you are in charge for implementing and backtesting various trading strategies. Your intern is a current student at NHH. She has successfully completed FIE450 and compiled all the data that you need for your analysis (`FIE450-Assignment-2.RData`). The data comprises monthly returns of the 30% of the largest stocks traded in the US between 2005 and 2019 (`df`). The data also comprises a value-weighted market return (`mkt`). All returns are monthly excess returns and forward-looking, that is, r_t refers to the return between t and $t+1$.

Implementing the trading strategies

For every trading strategies that you backtest proceed as follows. Rebalance your portfolio monthly and always make sure that you only consider stocks at the end of a given month that have traded in *every* month the past 5 years, that is, ensure that there are 60 past return observations.

Task 1 (10 points)

Backtest a $1/n$ trading strategy. In a $1/n$ strategy you rebalance by equally weighting all stocks.

1. Compute the return series of this trading strategy [`r`]
2. Compute the annualized mean [`mu`]
3. Compute the annualized Sharpe ratio [`R`]
4. Compute the generated wealth over time if you would have invested 1 kr at the beginning [`V`]

Task 2 (10 points)

Backtest a minimum variance trading strategy. A minimum variance strategy is a strategy that invests in the optimal portfolio with the lowest variance. Estimate the optimal portfolio using a single-index model using a rolling window of the past 60 return observations.

1. Compute the return series that the optimal minimum variance strategy generates [`r`]
2. Compute the annualized mean [`mu`]
3. Compute the annualized Sharpe ratio [`sr`]

Task 3 (10 points)

Again, backtest a minimum variance trading strategy but this time make sure that the weights are bounded between 0 and 10%. Estimate the optimal portfolio using a single-index model using a rolling window of the past 60 return observations.

1. Compute the return series that the optimal minimum variance strategy generates [`r`]
2. Compute the annualized mean [`mu`]
3. Compute the annualized Sharpe ratio [`sr`]
4. Prove that the weights had always stayed between 0 and 10% by computing the minimum and the maximum weight over the entire time period [`w`]

Task 4 (10 points)

Implement a simplified version of a momentum strategy proposed in Jegadeesh and Titman (1993). A momentum strategy is a strategy where you buy the stocks that have performed well in the past 12 months and sell the stocks that have performed poorly during the same period. To be more precise, go long in the 20% of stocks with the highest cumulative return and short the 20% of stocks with the lowest cumulative return over the past 12 months. The stocks in the long and short portfolio shall be equally weighted.

1. Compute the return series that the momentum strategy generates [`r`]
2. Compute the annualized mean [`mu`]
3. Compute the annualized Sharpe ratio [`sr`]