

### Homework 1

1. In HW1.xls, you will find the daily closing prices of 50 stocks and the HS300 from 2010 to 2021. Suppose that you always use the data from the past five years to estimate the expected return and covariance matrix, and you rebalance your portfolio every 4 months by solving the Markowitz portfolio selection problem every 4 months, starting from the first trading day of 2015. Suppose that the risk-free rate is 3% per annum and your target annualized expected return is 6%, shorting is allowed. Plot the performance of this strategy over the period of 2015-2021, and also plot the performance of HS300 over the same period. What can you learn from the comparison?
2. In HW1.xls, pick up any six stocks. For each stock, compute the beta value using 12 years of data and using HS300 to represent the market portfolio, and test whether the corresponding  $\alpha = 0$  at the 95% level. Assuming the risk-free rate is 3% per annum.
3. Suppose that we have a European put option whose strike price  $K = 40$ , and the stock price is currently at \$40 as well. The option expires in 18 months. Furthermore, suppose that the volatility of the stock is 40% per annum and the risk-free interest rate is 3% per annum.
  - (a) Construct an  $m$ -step binomial tree model to price this option. You may set  $m=10, 50$  and  $100$ , and compare the values with the Black-Scholes formula.
  - (b) If the option is American style, use the binomial tree model with  $m=100$  to determine its price.

The homework is due on October 11. You may hand it in to the professor before the class starts.