Problem Set 7: Portfolio allocation

1. (Continuation of Problem Set 6.) The file `sp500_2025.csv` contains daily returns for the (CRSP) S&P500 value-weighted index with dividends (column vwretd) from 1/3/1972 through 12/31/2024. Download the daily U.S. Treasury yield curve from here. That file has the daily parameters for the Nelson-Siegel-Svensson yield curve model discussed in class. With those parameters, you can calculate a zero-coupon bond yield for any maturity. Assume that the your coefficient of risk aversion, A, is equal to 4. How will you allocate your capital between bonds and the index? HINT: Arithmetic returns are more appropriate than geometric returns for this question.

2. The Excel file "lecture7p_2025.csv" contains daily market data for Microsoft, Intel, Southwest, McDonald's, and Johnson & Johnson from 12/29/1989 to 12/31/2024, obtained from CRSP. The file also includes a daily risk-free rate time series from Kenneth French's Data Library. Construct weekly simple total returns from the daily return data in (use ret, which includes dividends). Compute and report the weekly and annual mean and standard deviation for each stock. Compute the correlation matrix.

3. Construct the mean-variance frontier for the Intel-Microsoft combination. Indicate the minimum-variance portfolio and the efficient frontier (the efficient frontier is a set of expected returns - risks that you would want to consider investing in).

4. Add remaining stocks to the mix. Compute the mean-variance frontier and plot it on the same chart with the one from the previous question. Indicate the minimum-variance portfolio and the efficient frontier. How do they compare to those of the previous question?

5. Add the riskless asset and construct the tangent portfolio for the Intel-Microsoft case. Next, construct the tangent portfolio for the full set of stocks. Compare the Sharpe ratios of the two tangent portfolios.

6. Assume your risk aversion is $A = 3.5$. What is your optimal mix of assets (including the risk-free asset)?