# Stock Analysis

## Project 8

### Compute the returns

1. **Construct weekly simple total returns from the price data (use Adj Close to include dividends). Compute and report the weekly and annualized mean and standard deviation for each stock. Compute the correlation matrix.**

   Start with the standard deviation:

   |         | msft    | intc    | luv     | mcd     | jnj     |
   |---------|---------|---------|---------|---------|---------|
   | mean-1w | 0.464   | 0.346   | 0.329   | 0.284   | 0.263   |
   | sd1w    | 4.057   | 4.883   | 4.767   | 3.089   | 2.812   |
   | mean-1y | 27.208  | 19.702  | 18.653  | 15.901  | 14.637  |
   | sd-1y   | 29.253  | 35.213  | 34.379  | 22.278  | 20.278  |

Now compute the correlation matrix:

|      | msft    | intc    | luv     | mcd     | jnj     |
|------|---------|---------|---------|---------|---------|
| msft | 100.000 | 49.766  | 29.649  | 29.119  | 28.839  |
| intc | 49.766  | 100.000 | 29.297  | 25.661  | 20.904  |
| luv  | 29.649  | 29.297  | 100.000 | 30.843  | 24.905  |
| mcd  | 29.119  | 25.661  | 30.843  | 100.000 | 31.890  |
| jnj  | 28.839  | 20.904  | 24.905  | 31.890  | 100.000 |

2. **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).**

   Start by creating a some generic functions for computing the minimum variance frontier.

Next, run the functions for the two focal stocks and plot the results:
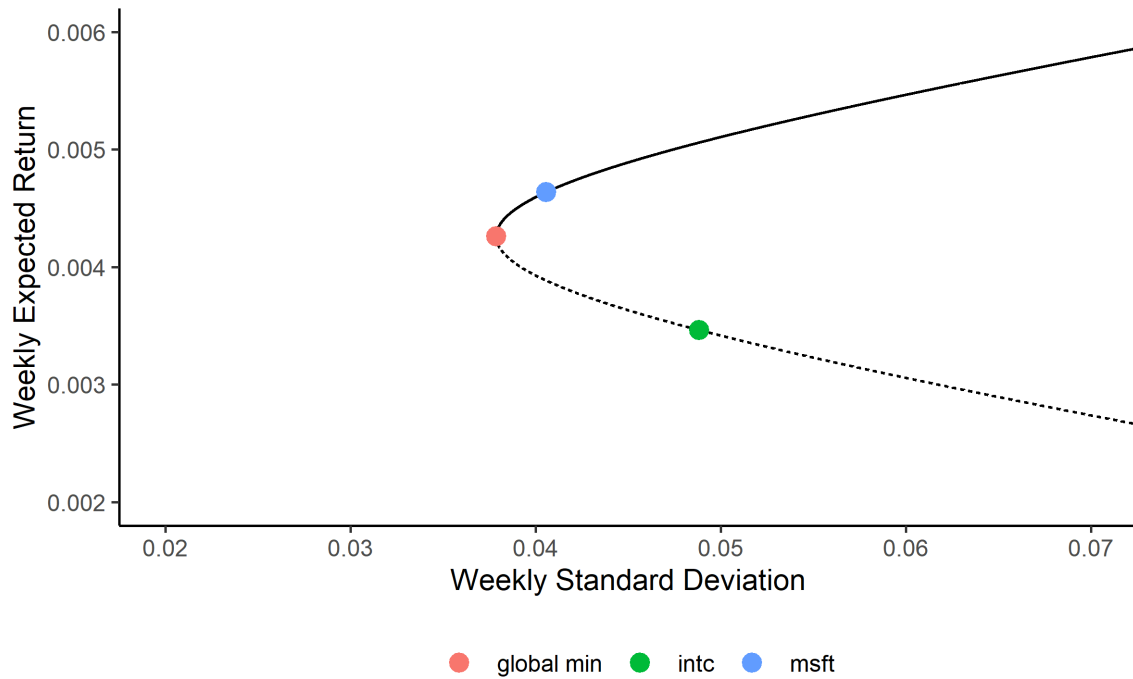
3. **Add remaining stocks to the mix. Compute the mean-variance frontier and plot it on the same chart with the one from the previous question. Indicate the minimum-variance portfolio and the efficient frontier. How do they compare to those of the previous question?**

We already did most of the workin in the previous question. Adding more assets is just a matter of calling the functions for more stocks.

The additional stocks move the minimum frontier upward and inward. Of course, the marginal effect declines as the number of assets increases.
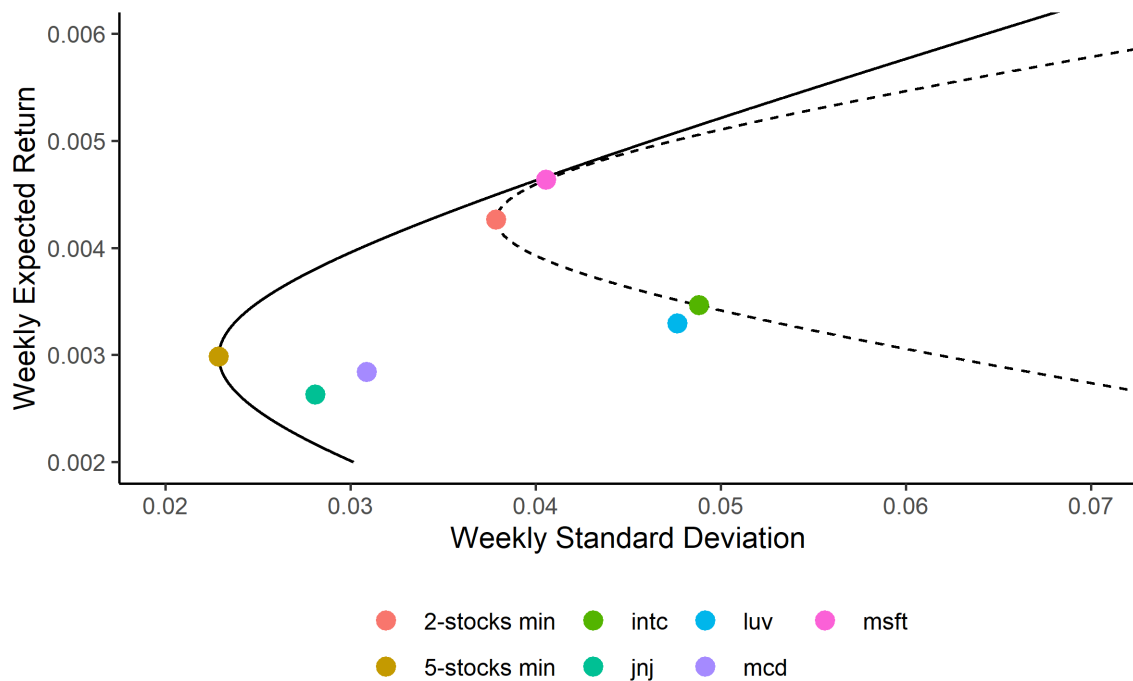


4. **Add the riskless asset and construct the tangent portfolio for the Intel-Microsoft case. Next,**

**construct the tangent portfolio for the full set of stocks. Compare the Sharpe ratios of the two tangent portfolios.**

Construct the tangency portfolios given the risk free rate of 0.0476%.
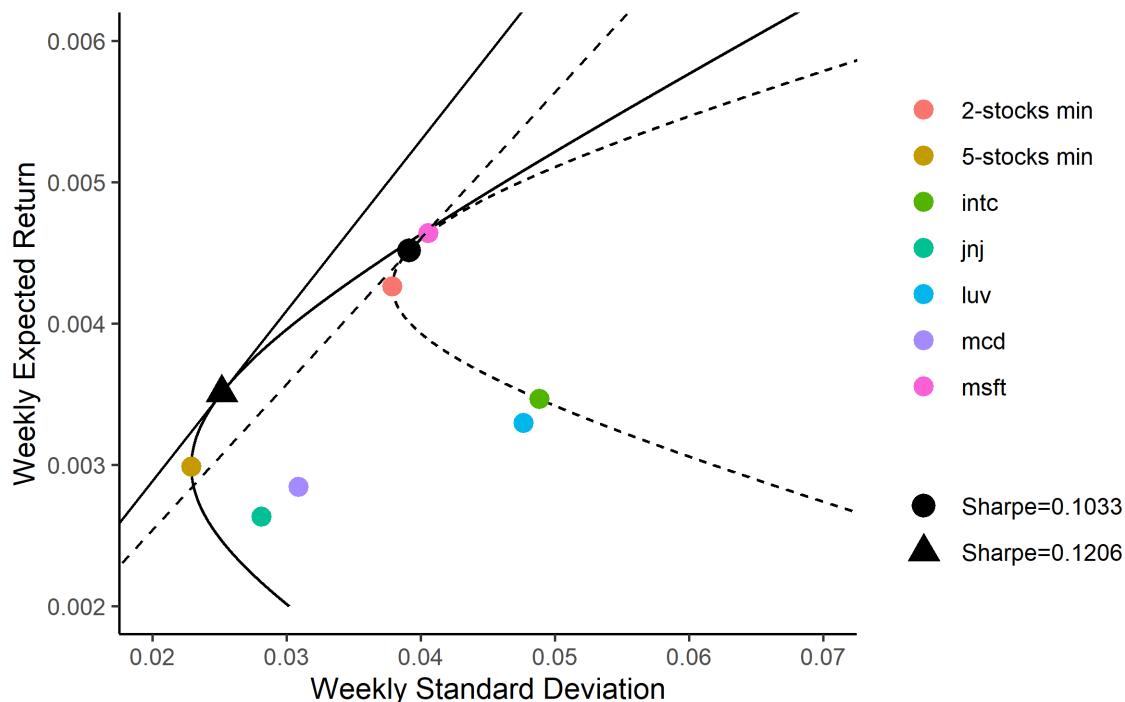


5. **Assume your risk aversion is A = 3.5: What is your optimal mix of assets?**

Use the formula:
$$w_{risky} = \frac{E(R_{tang}) - R_f}{A \cdot V(R_{tang})}$$

Compute the portfolio weight as the product of the tangency weights and the weight on the tangency portfolio. The risk-free portfolio weight is the residual. The negative weight implies borrowing, while a positive rate would have implied a risk-free bond investment.

| | wtangent | w(A=3.5) |
|---|---|---|
| msft | 38.694 | 53.003 |
| intc | 0.696 | 0.954 |
| luv | 6.639 | 9.094 |
| mcd | 25.083 | 34.358 |
| jnj | 28.889 | 39.572 |
| RFR | NA | -36.980 |

The weight on the risky portfolio is 136.98, implying a weight of -36.98 on the risk-free asset.

. **Regress excess stock returns on excess market returns to obtain estimates of the betas of the five stocks. Compute the standard errors of your estimates.**

Run the regressions. Specifically I run the following:

$$R_i - R_f = \beta_i \times (R_m - R_f) + \alpha_i + \epsilon$$

By running the regressions this way, I can interpret the intercept as $\alpha$ in excess of the risk free

Now just format and print the tables:

|      | beta  | error (Mod-White) |
|------|-------|-------------------|
| msft | 0.984 | 0.034 |
| intc | 1.168 | 0.041 |
| luv  | 1.062 | 0.041 |
| mcd  | 0.639 | 0.027 |
| jnj  | 0.553 | 0.025 |

7. **What are the estimates of the alphas, and the standard deviation of these estimates? Further estimate the idiosyncratic risk.**

This is just reading off different parts of the regression results. The idiosyncratic risk is the standard deviation of the residuals.

|      | alpha (bp) | alpha se (bp) | idiosync. risk (bp) |
|------|------------|---------------|---------------------|
| msft | 25.474     | 8.041         | 331.041 |
| intc | 10.723     | 9.751         | 401.424 |
| luv  | 10.757     | 9.818         | 404.217 |
| mcd  | 13.179     | 6.534         | 269.007 |
| jnj  | 12.464     | 6.032         | 248.326 |

8. **Compute the sample average excess return and compare the value with the return predicted by the CAPM. Based on the data, how well does the CAPM predict the level returns? How well does the CAPM predict relative performance?**

Again, the work is already complete. Since we used excess returns on the LHS of the regression, the expected CAPM return is just the expected realized return less the expected alpha. Plug in the means to get the estimates:

|      | beta  | predicted r (bp) | actual r (bp) | predicted excess (bp) | actual excess (bp) |
|------|-------|------------------|---------------|-----------------------|--------------------|
| msft | 0.984 | 20.912           | 46.386        | 16.153                | 41.627 |
| intc | 1.168 | 23.921           | 34.644        | 19.162                | 29.885 |
| luv  | 1.062 | 22.188           | 32.945        | 17.429                | 28.186 |
| mcd  | 0.639 | 15.240           | 28.419        | 10.481                | 23.660 |
| jnj  | 0.553 | 13.840           | 26.304        | 9.081                 | 21.545 |

The CAPM predicts a high return for INTC and a low return for MCD and JNJ. This is indeed the case, though the rank ordering changes a small amount. However, the CAPM markedly misses the level of returns, with substantial alphas. From the estimates in part b, the alphas for each stock are either significant or nearly significant. Overall, the data suggest that the CAPM is misspecified, though it retains some power to explain differences in returns between stocks.