Statistics C183/C283   **Instructor: Nicolas Christou**

Project 3

Access the following data:

`http://www.stat.ucla.edu/~nchristo/statistics_c183_c283/statc183c283_5stocks.txt.`

In R you can access the data from the command line as follows:

`a <- read.table("http://www.stat.ucla.edu/~nchristo/statistics_c183_c283/statc183c283_5stocks.txt", header=T)`

These are close monthly prices from January 1986 to December 2003. The first column is the date and P_1, P_2, P_3, P_4, P_5 represent the close monthly prices for the stocks Exxon-Mobil, General Motors, Hewlett Packard, McDonalds, and Boeing respectively.

   a. Convert the prices into returns for all the 5 stocks. Important note: In this data set the most recent data are at the beginning. You will need to consider this when converting the prices into returns.

   b. Compute the mean return for each stock and the variance-covariance matrix.

   c. Use only Exxon-Mobil and Boeing stocks: For these 2 stocks find the composition, expected return, and standard deviation of the minimum risk portfolio.

   d. Plot the portfolio possibilities curve and identify the efficient frontier on it.

   e. Use only Exxon-Mobil, McDonalds and Boeing stocks and assume short sales are allowed to answer the following question: For these 3 stocks compute the expected return and standard deviation for many combinations of x_a, x_b, x_c with $x_a + x_b + x_c = 1$ and plot the cloud of points. You can use the following combinations of the three stocks:

     `a <- read.table("http://www.stat.ucla.edu/~nchristo/datac183c283/statc183c283_abc.txt", header=T)`

   f. Assume $R_f = 0.001$ and that short sales are allowed. Find the composition, expected return and standard deviation of the portfolio of the point of tangency G and draw the tangent to the efficient frontier of question (e).

   g. Find the expected return and standard deviation of the portfolio that consists of 60% and G 40% risk free asset. Show this position on the capital allocation line (CAL).

   h. Refer to question (g). Use the expected value (E) you found in (g) to compute
$\mathbf{x} = \frac{(E - R_f)\mathbf{\Sigma}^{-1}(\bar{\mathbf{R}} - R_f \mathbf{1})}{(\bar{\mathbf{R}} - R_f \mathbf{1})'\mathbf{\Sigma}^{-1}(\bar{\mathbf{R}} - R_f \mathbf{1})}$. What does this $\mathbf{x}$ represent?

   i. Now assume that short sales are allowed but risk free asset does not exist.

     1. Using $R_{f1} = 0.001$ and $R_{f2} = 0.002$ find the composition of two portfolios A and B (tangent to the efficient frontier - you found the one with $R_{f1} = 0.001$ in question (f)).

     2. Compute the covariance between portfolios A and B?

     3. Use your answers to (1) and (2) to trace out the efficient frontier of the stocks Exxon-Mobil, McDonalds, Boeing. Use a different color to show that the frontier is located on top of the cloud of points from question (e). Your graph should look like the one below.
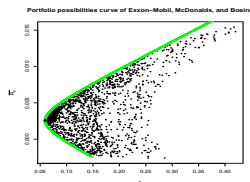
     4. Find the composition of the minimum risk portfolio using the three stocks (how much of each stock) and its expected return, and standard deviation.