University of California, Los Angeles
Department of Statistics

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

Project

Select 30 stocks (plus the market $S\&P500$) from `http://finance.yahoo.com`. Please select stocks from 5 industries. To find the industry in which each stock belongs go to `https://finance.yahoo.com/industries`. To construct your portfolios use monthly data from 01-Jan-2010 to 01-Jan-2015 (5 years). For the testing period use monthly data from 01-Jan-2015 to 01-Apr-2018. Make sure that you have data available for all your stocks for the entire period, 01-Jan-2010 to 01-Apr-2018.

Project 1
Things to do:

a. Use `http://shiny.stat.ucla.edu:3838/c183c283/` or `https://stephensmith21.shinyapps.io/stockportfolio/` to access the data. Enter the tickers as follows: `^GSPC,AAPL,IBM,...`.

b. You will download the adjusted close prices for 30 stocks plus the $S\&P500$ in a csv file. Import the data in `R` and convert the adjusted close prices into returns. (Use the first 5-year data only!)

c. Compute the means of the 31 assets, the standard deviations, and the variance covariance matrix.

d. Plot the 31 assets on the space expected return against standard deviation.

e. Assume equal allocation portfolio using the 30 stocks. Compute the mean and standard deviation of this portfolio and add it on the plot of question (c).

f. Add on the plot the minimum risk portfolio.

Project 2
New! Updated on 11 April.
Trace out the efficient frontier using two different methods:

1. Hyperbola (see handout #11, #12).
2. Finding two portfolios on the efficient frontier first (see handout #18, #19).
3. Use appropriate value of R_f to find the point of tangency. Draw the tangent line (CAL).

Project 3
New! Updated on 16 April.
Please answer the following questions assuming the single index model holds::

1. Compute estimates for $\alpha_i, \beta_i, \sigma^2_{\epsilon_i}$, $i = 1, 2, \ldots, 30$ by regressing each stock's return on the $S\&P500$.
2. Construct the 30×30 variance covariance matrix based on the single index model.
3. Adjust the betas using Blume's and Vasicek's techniques. For the Blume technique use the two periods: 01-Jan-2010 to 01-Jan-2015 and 01-Jan-2015 to 01-Apr-2018. For the Vasicek technique use only period 01-Jan-2010 to 01-Jan-2015.

   For the Blume technique our goal is to adjust the betas in 01-Jan-2015 to 01-Apr-2018 to be better forecasts for the betas in period 01-May-2018 to 01-Apr-2022.

   For the Vasicek technique our goal is to adjust the betas in 01-Jan-2010 to 01-Jan-2015 to be better forecasts for the betas in period 01-Jan-2015 to 01-Apr-2018. Compute `PRESS` only for Vasicek technique.

Project 4
New! Updated on 30 April.
Please answer the following questions assuming the single index model holds::

a. Use only the stocks with positive betas in your data. Rank the stocks based on the excess return to beta ratio and complete the entire table based on handout #39:
`http://www.stat.ucla.edu/~nchristo/statistics_c183_c283/statc183c283_index_steps.pdf` . Note: Please use the same R_f as the one in Project 2, question (3).

b. Find the composition of the point of tangency with and without short sales allowed. Place the two portfolios on the plot with the 30 stocks, $S\&P500$, and the efficient frontier that you constructed in projects 1 and 2.

c. We want now to draw the efficient frontier when short sale are not allowed. One way to this is to use a `for` loop where you vary R_f. For each R_f you find the composition of the optimal portfolio (tangency point) and its expected return and standard deviation. Finally connect the points to draw the efficient frontier.

Project 5
New! Updated on 07 May.
Please answer the following questions assuming the constant correlation model holds::

a. Rank the stocks based on the excess return to standard deviation ratio and complete the entire table based on handout #46:
`http://www.stat.ucla.edu/~nchristo/statistics_c183_c283/statc183c283_rho_steps.pdf` . Note: Please use the same R_f as the one in Project 2, question (3).

b. Find the composition of the point of tangency with and without short sales allowed. Place the two portfolios on the plot with the 30 stocks, $S\&P500$, and the efficient frontier that you constructed in projects 1 and 2.

Assume the multigroup model holds with short sales allowed. Find the composition of the optimal portfolio and place it on the plot of part (b). Note: Please see the numerical example of handout #53 here for more details:
`http://www.stat.ucla.edu/~nchristo/statistics_c183_c283/statc183c283_multigroup_model.pdf` .

Project 6
New! Updated on 15 May.
Please evaluate your portfolios that you constructed in the previous projects. In your analysis you should include the following:

a. Time plots of the performance of all portfolios compared to the $S\&P500$ (see the graph on handout #55a).

b. Calculate the Sharpe ratio, differential excess return, Treynor measure, and Jensen differential performance index.

c. Decompose the overall evaluation using Fama's decomposition for the single index model with no short sales allowed.

d. Calculate the 99% 5-day VaR for the single index model no short sales allowed scenario. Use Monte Carlo simulations based on the linear model.