Financial Markets - 15.433 – Assignment #2
Professor Charles Hadlock

You should complete this assignment in a group of 3-6 students. The group should email a single copy of the assignment to (sloan15433ta@gmail.com) by **Tuesday, September 22th at 9:30 a.m.**. These exercises all require computer programming and you are free to use any language of your choice (Python, R, Matlab, Stata, or other). Your assignment should include a single pdf document that contains a summary of your tabulations from the computer/statistics work related to all of the exercises. You should then also include a document that includes your programming work and associated output. All questions related to the assignment should be directed to the course TAs. Please list all student names as they appear on Canvas along with your MIT ID numbers on the first page of your PDF submission. To complete this assignment you will need to go to Ken French's website https://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html and download the following files (exact names are important, there are other files on his site with similar names):

File 1: "Fama/French 3 Factors"
File 2: "Portfolios Formed on Size"
File 3: "Portfolios Formed on Book-to-Market"
File 4: "25 Portfolios Formed on Size and Book-to-Market (5 x 5)"
File 5: "Portfolios Formed on Market Beta"
File 6: "Portfolios Formed on Operating Profitability"

All t-statistics, p-values and statistical tests should use Newey-West standard errors with a lag of six to account for possible serial correlation in the time-series.

Exercise #1
(A) Calculate the mean excess returns and the associated t-statistics for each of the ten size decile portfolios using monthly returns for the entire sample period. Test for the difference between the mean returns of the largest decile portfolio and the smallest decile portfolio. [Decile portfolio returns for size are in File 2, risk-free rate is in File 1]

(B) Calculate the mean excess returns and the associated t-statistics for each of the ten Book-to-Market decile portfolios using monthly returns for the entire sample period. Test for the difference between the mean returns of the highest book-to-market decile portfolio and lowest book-to-market decile portfolio. [Decile returns for book-to-market are in File 3, risk-free rate is in File 1]

(C) Calculate the portfolio alphas with respect to the CAPM for each of the ten size decile portfolios using monthly returns for the entire sample period. Test for the difference between the alphas of the largest decile portfolio and smallest decile portfolio. [Size decile returns are in File 2, risk-free rate and market excess return is in File 1]

Exercise #2
(A) Calculate the mean excess returns and associated t-statistics for the portfolio of smallest size/highest book-to-market stocks and for the largest size/lowest book-to-market stocks using the 5x5 bivariate sorts. Test for differences between the mean excess returns of these two portfolios. Also, test for differences in the CAPM alphas of these two portfolios. [Bivariate portfolio returns are in File 4]

(B) Assign each portfolio in the 25 portfolios from the 5x5 bivariate sort a SIZE score from 1 to 5 based on the size quintile the portfolio is located in (SIZE=1 for smallest firm portfolios, SIZE=5 for largest firm portfolios). Also assign each portfolio a BM score from 1 to 5 based on the book-to-market quintile the portfolio is located in (BM=1 for lowest book-to-market portfolios, BM=5 for highest book-to-market portfolios). For each month, estimate a cross-sectional regression of each of the 25 portfolio's excess returns against SIZE and BM. Each of these regressions will have 25 data points. Collect the coefficients on the constant, SIZE, and BM and calculate their means and (Newey-West) t-statistics. This is the Fama-MacBeth approach. Is the evidence on the role of size and book-to-market here consistent with what you found in Problem #1?

(C) For each of the ten portfolios in the ten Market-Beta portfolios, assign each portfolio a BETA score from 1 to 10 based on the beta decile the firm is located in (BETA=1 for lowest beta portfolio, BETA=10 for highest beta portfolio). For each month, estimate a cross-sectional regression of each of the 10 portfolio's excess returns against BETA. Each of these regressions will have 10 data points. Collect the coefficients on the constant and BETA and calculate their means and t-statistics across all months. This is again the Fama-MacBeth approach. Is the evidence you find here good or bad news for the CAPM? [Returns data for the market-beta portfolio is located in File 5]

Exercise #3
(A) Estimate the CAPM alpha and associated t-statistic for firms in the lowest decile of operating profitability. Repeat this for firms in the highest decile. Are the differences in CAPM alphas for these two portfolios statistically significant? [Decile portfolio returns for operating profitability are in File 6]

(B) Estimate the Fama-French 3-factor (FF3) alpha and associated t-statistic for the portfolio of firms in the lowest decile of operating profitability. Repeat this for firms in the highest decile portfolio of operating profitability. Are the differences in FF3 alphas for these two portfolios statistically significant? What does this evidence tell you about the FF3 model?

Exercise #4

Data on the monthly returns for 100 stocks and their market capitalizations at the start of each month to which the return data pertain are contained in the file 100stocks.xlsx posted on Canvas. Combine the information in this file with the data from files used elsewhere in this assignment to complete the following tasks.

(A) Estimate the CAPM alpha and beta and associated t-statistics for an equally-weighted portfolio of these stocks. Repeat this exercise for a value-weighted portfolio.

(B) Estimate the FF3 model coefficients and associated t-statistics for the value weighted-portfolio of these stocks. What types of firms do you suspect were chosen for this sample based on your coefficient estimates?