15.433/4331, Fall 2025

Assignment 1 (6 points, Due Sunday, 9/21, 11:59pm)

Instructions: You can work in groups of up to 4 students per group. Submit one PDF write-up per group, including the names of all members, with clearly structured responses to each question. Any code should be placed in a well-labelled appendix at the end of the PDF, and the Python notebook must be submitted separately.

1. (3 points) Recall that recent evidence suggests that stock market returns are higher on days with certain macroeconomic news and FOMC announcements. The goal of this exercise is to test whether the pattern still holds in the last 5-10 years.
    a. Download daily returns of the U.S. stock market from WRDS/CRSP/CRSP Daily Stock. You can use the value-weighted returns of all stocks. Or you can use the return of an S&P 500 index ETF. Returns should be inclusive of "distributions" (i.e., dividends, buybacks). The sample should be at least 5 years, ideally 10 years or longer. WRDS does not have the most recent months of data, so it is fine if the sample ends in calendar year 2024.
    b. Pick a type of announcement and find out all the dates on which this announcement is made in your sample. For example, if you pick the FOMC announcement, you can find out all days of FOMC announcements from the Federal Reserve's website.
    c. Compare the average daily returns of U.S. stock market on days with and without the announcement of your choosing. For this step, it is useful to convert the comparison of two averages to a regression. Let r_t be the realized daily return of U.S. stock market on day t (close to close return). Run the regression:

$$r_t = \alpha + \gamma * 1(t \; is \; an \; announcement \; day) + \epsilon_t$$

where the indicator $1(t \; is \; an \; announcement \; day)$ is set to be 1 if day t has the announcement and 0 otherwise. The estimated coefficient $\hat{\gamma}$ is the additional average return earned on announcement days, compared to non-announcement days. Try different ways to compute the standard errors of $\hat{\gamma}$ and see if that makes a difference on your assessment of whether $\hat{\gamma}$ is statistically significant.

2. (3 points) This exercise goes through the estimation of betas and CAPM.
    a. Download the monthly returns of the 11 SPDR sector ETFs, including dividends, from WRDS. The tickers can be found at https://www.sectorspdrs.com/. Once you get into WRDS, monthly returns can be found on the "Monthly Stock File" page. Further, download the aggregate stock market returns, including dividends, for the same frequency and sample period. Because we are using the sector ETFs, the SPY ETF is the most natural choice as a proxy for the market return. Lastly, as a proxy for the risk-free rate, download the 4-week Treasury bill interest rate for the same sample period and the same frequency from CRSP Treasuries – Riskfree Series. (Note: because the ETFs are already sorted by sector, you don't need to sort individual stocks to portfolios for this exercise.)
    b. Calculate the beta's of the SPRD sector ETFs by running the regression as we discussed in class. Are their estimated α's significant statistically?
    c. Calculate the average excess returns of the sector ETFs. Convert all excess returns to annual frequency (multiplying by 12). Scatter plot the ETFs' beta's and their excess returns.
    d. Lastly, plot the CAPM prediction in the same chart. It is a straight line. You can use the sample average of 4-week Treasury bill rate as the intercept. There are multiple reasonable choices of the slope. The long-term estimates of the equity premium, $E(r_M) - r_f$, are generally between 6% and 8%. In recent samples, the estimated equity premium is likely higher. Does CAPM appear to hold with the sector ETFs as test assets?