**FBE 551 Homework #3**

**Due on 10/4/2023 by end of day**

This is a group homework assignment. You should work in a team of 2-6 students, and include all student names in a markdown cell on the program submission file.

To complete this homework assignment, you will need to use the ‘CRSP\_Dividends.csv’, ‘Yearly Betas.csv’, and US Treasury yields ‘^IRX.csv’ data sets.

Carry out the following calculations in a single Jupyter notebook. Make sure that I will be able to run it. For example, read in the CSV files from the current directory. I.e., do not write the full path of the file in your code. Do not have your code change directories to a pathway that is probably not valid on my computer. This will allow me to run your notebook in any directory on my own PC.

Please use markdown cells to help me understand what you are doing. (I know it may be obvious, but I want to see that you know how to use markdown.) Clearly highlight what parts of your notebook are used to answer each question below.

**Start**

Load in the ‘CRSP\_Dividends.csv’ file to a pandas dataframe. This file includes daily data for all CRSP common stocks (SHRCD = 10 or 11) on the day which they go ex-dividend. PERMNO and PERMCO are security identifiers; DISTCD indicates the type of distribution (I have filtered for USD cash distributions; more description here: [Distribution Codes | CRSP - The Center for Research in Security Prices](https://www.crsp.org/products/documentation/distribution-codes)). PRC is the closing price; VOL is volume of shares traded that day; RET is the total return, including dividends, over the last day; SHROUT is shares outstanding; OPENPRC is the opening price for the day; RETX is the return without dividends over the last day; BID and ASK are the prevailing bid and ask quotes at the close of the day; and vwretd is the return on the CRSP value-weighted index (a version of the market portfolio).

**Question 1**

Describe your data and take reasonable steps to clean the data. For example, you should:

* Remove negative and zero dividend amounts. You should also go ahead and remove dividend amounts less than 0.01. (These are tiny dividends that may greatly impact the average ratio.)
* Remove stocks that have a market capitalization below $50M. Market cap is price times shares outstanding; SHROUT values here are in 1,000. Micro-cap stocks are often illiquid and returns coming from them can be unreliable.
* Negative prices indicate a stock that did not trade that day; common practice is to set those equal to the absolute value of the price.
* Importantly, read through the remainder of this assignment and think about how you should handle observations where VOL = 0.
* At this point, don’t make any adjustments based on the OPENPRC variable.
* Be sure to document these and any other steps you take here in a markdown cell, and run a df.decsribe() statement to show the results.

**Question 2**

For each observation, calculate the closing price as of the prior day. You should be able to do this using the current PRC and the return. (Think about which return to use.) Create a column of (Pt-1 – Pt) / D. Describe the mean and range of this variable. In a markdown cell, discuss the findings – what does this variable signify? Is there a potential investment opportunity?

Suppose we were to attempt to form a profitable investment strategy by buying stocks at the close prior to the ex-dividend day, and selling them at the close the following day. Describe the annualized returns, standard deviation, and Sharpe[[1]](#footnote-1) ratio for this investment opportunity (using this event time framework). You will need to add in the risk free rate from the ^IRX data file to compute Sharpe ratios here.

**Question 3**

As noted in Kalay’s “Ex-Dividend Day Behavior” paper, looking at the close-to-close price change will incorporate a daily return impact beyond just the immediate dividend effect.

The data set “Yearly Betas.csv” includes a year-end beta for all stocks in the CRSP data set. You should merge this into your Dividend data based on PERMNO and Year. The beta for a particular stock will be from a CAPM regression using returns up until that date; think carefully about how to match up your dates in these two data sets in order to avoid look-ahead bias.

For each dividend event in your sample, compute the expected return from the CAPM model. In this sort of application, we assume that the alpha, as dictated by the CAPM, is equal to zero. Compute the abnormal return for each dividend event. How does this abnormal return compare to the annualized returns you found in Question 2? Is this abnormal return statistically significant?

**Question 4**

Suppose instead of holding the stock throughout the day, you were able to buy at the closing price on the prior day and sell at the open. What would be the annualized returns, standard deviation, and Sharpe ratio for this strategy? Are these returns statistically significant?

**Question 5**

As the Kalay paper notes, transaction costs may be a reason why a strategy like this shows potential profits in event studies or backtests. Compute the round-trip transaction costs using the bid and ask prices, as we discussed in class. After paying for these transaction costs, what are the annualized returns to this strategy? Use the full-day close-to-close returns you calculated in Question 2.

**Question 6:**

Choose one metric by which to add an additional filter. Rank the data into deciles by this metric and analyze the returns for each group (the “groupby” command will be helpful here). Your metric could be deciles of dividend yield (D/P) as done in the Kalay paper; market capitalization; beta; or the DISTCD, for example (here, this might not be deciles but rather the 27 separate codes – but don’t over-extrapolate results for codes with very few observations). You could also download additional firm characteristics from COMPUSTAT to sort on, but that is certainly not necessary for this homework assignment.

Is there evidence that we could improve returns to this strategy by sorting the data into different groups according to your metric? Write a markdown cell that summarizes your results and recommendation.

1. This is not technically a Sharpe ratio, as this is an event study with overlapping observations on single days. Do not worry about calculating portfolio returns for each day at this point – we will keep this as an event time study. [↑](#footnote-ref-1)