**Spring 2023**

**AI for Finance**

**Project #1 (Due: March 26, 2023)**

**Consider that you are an analyst and you need to estimate the CAPM ‘Beta’ and ‘Alpha’ of stocks of a corporation/portfolio. First, you pick any corporation you want to investigate.**

1. **Collect price information of ‘your stock’ and stock market (S&P 500 index)**

**Download from Yahoo Finance is not available for that index - downloaded from investing.com(** [**https://help.yahoo.com/kb/SLN2311.html**](https://help.yahoo.com/kb/SLN2311.html%20-%20downloaded%20from%20investing.com) **)**

**"your stock" refers to a specific company's stock that you are interested in, while the "stock market (S&P 500 index)" refers to a broader index that tracks the overall performance of the US stock market.**

**from Yahoo Finance for the past 5 years, 15 years, and 30 years. Note that you have price information – not returns – calculate returns before you do anything since the CAPM is all about stock returns. Using Python calculate parts i) through iv) below. Risk-free returns can be downloaded @** [**http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data\_library.html**](http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html)

**Comment on your results.**

1. **Average Excess returns (excess returns are defined as “returns of a stock/portfolio minus risk-free returns)**
2. **Sharpe-ratio, which is Mean/Standard deviation of excess returns.**
3. **Alpha, which is the constant term in Ordinary Least Squares Regression (OLS).**
4. **Beta, which is the coefficient of the explanatory variable.**
5. **Comment on whether your estimates are correct (check for ‘beta’ that you can find in Yahoo Finance to compare).**

**Since you are estimating everything for the past 5, 15, and 30 years, show your calculations 3 times in a tabular form.**

1. **Now consider that you are a portfolio manager and you have $1 million to invest, and hence you want to diversify the risk of owning ‘your stock’. Pick any number of stocks (10 minimum) you want to create an equally weighted stock portfolio of stocks and calculate parts i) through iv) above for the portfolio. Comment on your results.**

**Since you are estimating everything for the past 10, 20, and 30 years, show your calculations 3 times in a tabular form. Importantly, make sure you have 30 years of data for all 11 stocks.**

1. **How did your portfolio perform during the recent crisis – August 2008 through March 2009?**
2. **Now add a risk-free bond to your portfolio. Assume that you are a risk-averse manager, and you want 40% of $1 million invested in risk-free rates and the rest (60%) in the stock portfolio you created in #3. Did the portfolio perform better than the “stocks” only portfolio during the 2007-2009 crisis?**
3. **Now go back to Fama-French website – use the Rm-RF (not the market risk premium you have calculated in step 1) given by those authors and redo Question #2.**
4. Using the US stock and the portfolio you’ve selected/created, please answer the following:
5. Fama-French talks about different factors for stock/asset returns. Pleases run a multifactor model for the stock and portfolio you have created. The factors are: a) Market; b) SMB; c) HML; d)TERM=difference in yields between 10 year and 3 months U.S. Treasuries; e) CREDIT=difference in yields between BAA and AAA rated U.S. corporate bonds. The factors can be found/created from the French/U.S. Federal Reserve website data.
6. (Use only returns, not excess returns)Assume, there is only one factor, the market factor. You’d like to hedge the systematic risk/market risk in your portfolio since you expect an economic downturn. One way to achieve the goal is to use futures contracts. Specifically, you may want to use S&P500 futures to hedge. To accomplish this, you need to calculate the optimal hedge ratio since your portfolio may be related to the S&P500 futures differently than it is related to the S&P500 index, and then find # of futures and establish a strategy. How many futures do you need and is your hedging strategy?

**Steps to hedge your portfolio:**

1. Download monthly S&P500 futures data from Investing.com website <http://www.investing.com/indices/us-spx-500-futures-historical-data>
2. Run a regression where the dependent variable is your portfolio returns and the explanatory variable is %change in futures prices; the coefficient of the explanatory variable is the “optimal hedge ratio”.
3. Find the number of futures needed, which is “optimal hedge ratio”\*(portfolio value/value of one S&P500 futures). Should be more or less the same as beta.

**HINTS:**

1. **Download data for 30 years, and then use the sample function of gretl to make it 10, 20, 30 years.**
2. **S&P500 futures data may not be available for 30 years. For this part of the analysis, use the time period that is available.**
3. **Do everything in Python. If you are not familiar with Python, you need extra time. So start early!**
4. **To compute Q1 Parts III and IV, you need to Run OLS. Also you need to read a bit about the CAPM model (lecture notes #3).**