Assignment 7

Prof: Pierre Collin-Dufresne
TA: Florian Perusset

1 Empirics: Factor Models

This exercise will make you compare two approaches to building risk models: the known factors/unknown exposure of Fama-French approach and the unknown factors/known exposure of Fama-MacBeth. For that we will construct the return to a momentum trading strategy and then analyze its exposure to market and industry factors, using the two different approaches. To this end, we will use data on the 500 stocks that are part of the S&P500 index, their standard industry classification (SIC) codes, and the returns to 12 value-weighted industry portfolios. The Python code for downloading the data is provided.

1. Construct the monthly return to a momentum strategy from 1980 to 2023 that goes long (short) every month t the value-weighted decile of stocks with the largest (smallest) return between $t-12$ and $t-1$ month. Plot the strategy cumulative return and compute its mean, standard deviation, and Sharpe ratio.

2. Regress the strategy return on the observable market and industry portfolio returns. Estimate the exposures and their t-statistic. Which factors are significant drivers of the strategy return based on this risk analysis? Do these risk factors explain the strategy performance well (look at the R^2 and and the α)?

3. Now we turn to the "observable exposure" approach. We will consider 1 market factor and 12 industry factors. For each stock estimate its market factor exposure by running a regression of the return on the VW CRSP index to estimate its market beta. For each stock estimate its industry exposure to the 12 different industry factors (this is simply a dummy variable equal to 1 if the stock belongs to that industry and zero otherwise).

Estimate the unobservable monthly factor returns by running every month a cross-sectional regression of the stock returns onto their exposures. The fitted values will be the estimated factor returns. Plot the time-series of estimated factor returns. Plot the time series of the monthly t-statistics. Report the average t-statistic associated with each factor as well as the average absolute value of the t-statistic. Which factors seem to be most important in explaining the cross-section of stock returns based on this analysis? How do you interpret the fact that certain t-statistics vary widely over time from +2 to -2 say?

4. Using the monthly weights of your momentum trading strategy and the individual stock exposures, compute the monthly time series of your strategy's exposure to the 13 factors. Plot the time series of the exposures to the two industries that you find are most relevant to explain the risk of the strategy. Compute the return to your momentum portfolio where you hedge the exposure to all industry factors. Compute the average return, the standard deviation, and the Sharpe ratio of the industry-hedged momentum strategy. What do you conclude?

2 Open Questions

Please provide short explanations along with your answers.

(a) The CAPM implies that stocks with the same expected return cannot have the same beta.

(b) The CAPM implies that two securities with different levels of idiosyncratic risk must have different expected returns, otherwise, no agent would choose to hold the security with higher idiosyncratic risk.

(c) According to the CAPM standard deviation is the right measure of risk for all assets? for some assets?

(d) According to the CAPM beta is the right measure of risk for all assets? For some assets?

(e) Suppose an asset has a positive alpha (i.e., it is above the security market line). Is this asset under or over-valued? Should you invest all your wealth in this asset if you are a mean-variance investor?

(f) Suppose the CAPM holds in an economy with 2 risky assets that have equal market capitalization. Can their idiosyncratic risk be uncorrelated?

Appendix

- The Standard and Poor's 500 (S&P500), is one of the most widely followed stock indices in the world. It tracks the stock performance of the 500 largest companies listed on stock exchanges in the United States.
- The monthly industry returns are constructed by Fama and French and are downloaded from Kenneth French's Website. Click Here to download the data yourself.