Rutgers Business School--Newark & New Brunswick
MQF 22:839:571, Financial Modeling I, Spring 2020
Assignment V
Assigned: 4/1/20, Due 4/18/20

In this assignment, you will learn how to implement some asset pricing tests. As an exercise, we can just use the small sample of data for the 10 stocks that you collected before. Serious tests of this kind should use the full sample of all stocks available in the CRSP database.

1. For each of the 10 stocks you selected in the previous assignment, you run sequentially the following *time-series regression* using prior 60 observations:

$$r_{i,t} - r_{f,t} = \alpha_i + \beta_{im}(r_{m,t} - r_{f,t}) + \varepsilon_{i,t}$$

Take the IBM stock as an example. Suppose that your sample starts in 1999.1 and ends in 2018.12. You use observations from 1999.1-2003.12 (with 60 observations) to estimate the above *time-series regression* for IBM stock and obtain a beta, called $\hat{\beta}_{im,t}$, where t = 2004.1. Then in 2004.2, you use observations from 1999.2-2004.1 (again with 60 observations) to re-estimate the model and obtain another $\hat{\beta}_{im,t}$, where t = 2004.2. You do this repeatedly until the end of your sample. Then you have a time-series of betas for IBM, $\hat{\beta}_{im,t}$, where t = 2004.1–2018.12 (15 years with 180 estimates of betas).

You do the above exercise for each of the 10 stocks. Then you obtain 10 time series of betas, each with 180 observations.

Now for each time period t, where t goes from 2004.1 – 2018.12), you run the following *cross section regression*:

$$r_{i,t} - r_{f,t} = \gamma_{0,t} + \gamma_{1,t}\hat{\beta}_{im,t} + \delta_{i,t} \qquad (1)$$

where i =1, 2, …, 10, i.e., you use 10 observations (the number of firms at time t in your specific sample) to run this regression. Note that $\hat{\beta}_{im,t}$ is treated as the regressor here.

You obtain a time series of parameter estimates: $\{\hat{\gamma}_{0,t}, \hat{\gamma}_{1,t}\}_{t=1}^{T}$, where T is 180 observations in this particular sample. Now you compute the time-series average of each of these parameters and test for the statistical significance of these parameters using the standard t-test. Are they statistically significant? Do you find a trade-off between the market beta and expected return? Is the market risk premium you estimated from the regressions statistically different from the empirical risk premium estimated using the sample averages? Do you find a significant mis-pricing?

2. You aggregate your monthly returns to annual returns for the 10 stocks you selected. Now from Compustat in WRDS, you collect annual observations for market value of equity (denoted by ME) and book value of equity (denoted by BE) for each of the 10 firms over the same sample period. You take the natural log of these two variables, add them into your equation (1), and run the following *cross-section regression* for each year t,

$$r_{i,t} - r_{f,t} = \gamma_{0,t} + \gamma_{1,t}\hat{\beta}_{im,t} + \gamma_{2,t}\ln(ME)_{i,t} + \gamma_{3,t}\ln(BE/ME)_{i,t} + \delta_{i,t} \qquad (2)$$

where i = 1, 2, …, 10, i.e., you use 10 observations to run each regression. Again $\hat{\beta}_{im,t}$ is treated as a regressor along with the other two variables, $\ln(ME)_{i,t}$ and $\ln(BE/ME)_{i,t}$, in the above regression.

You obtain a time-series of parameters $\left\{\hat{\gamma}_{0,t}, \hat{\gamma}_{1,t}, \hat{\gamma}_{2,t}, \hat{\gamma}_{3,t}\right\}_{t=1}^{T}$ from model (2). Now compute the time-series average of these parameters and test for the statistical significance of these parameters using the standard *t*-test. Are they statistically significant? Do you find a trade-off between market beta and expected return? Are size and book to market ratio important variables to explain the cross-section stock returns?

Appendix

To get the book value of equity, you can go to WRDS

Then go to
Compustat - Capital IQ
North America - Annual Updates
Fundamentals Annual

Then from the variable list, you get the following variables:

BKVLPS (Book Value Per Share)
CSHO (Common Shares Outstanding)

The product of these two variables give you the total book value of equity.

To get the market value of equity, you can go to CRSP monthly stock file

Then get the stock price share. Multiple this variable by the common shares outstanding will give you the total market value of equity.

I have posted data for a sample company (IBM):

IBM_BookValuePerShare_AnnualData
IBM_PricePerShare_Monthly