**12.** The International Association for Quantitative Finance (IAQF) will present its Financial Engineer of the year award to Cliff Asness of AQR Capital Management on February 27th in New York. This question touches on Dr. Asness’ work in an article published with his office colleagues:

Asness, C., Krail, R., Liew, J., Do Hedge Funds Hedge?, Journal of Portfolio Management, Fall 2001, pp.6-19

The idea to consider is that hedge fund managers may be pricing the securities in their hedge funds in a way that makes the funds’ performance look better to customers and prospects than it otherwise would. Specifically, the hedge fund managers may be only reflecting a portion of the movement in the price of their assets in the month that it happens, and may be reflecting the rest of the price movement in later months.

You will need market data, a risk-free interest rate, and hedge fund return data. The associated file contains S&P 500 monthly total returns and constant-maturity three-month treasury bill returns via the Federal Reserve’s H.15 report. It also contains an index of monthly hedge fund returns from lab.credit-suisse.com. Finally, the dataset contains two columns of month and year names, in two different formats for future convenience.

Although these data have a time element, follow the usual assumption that the market is efficient such that the market return for each month is independent of the returns in the previous months. Thus, use cross-section analysis and inference techniques. The data span is January 1993 to August 2016, 272 months.

Make use of the concept of the Capital Asset Pricing Model (CAPM) as described in “The ‘Beta’ of a Stock” (section 4.2).

1. Get the provided excel data. Start Stata, clear the memory, begin a log. Import the excel file. Check the box that tells Stata that the top row is for the variable names. Use either the describe (desc) command and/or the summarize (sum) commands to get a sense of the data.
2. Create the “excess” returns for the market and for the hedge fund index, by subtracting the risk-free returns. Form in your mind two new variable names, for the excess hedge fund returns and the excess market returns. Use the generate (gen) command to create the two excess return variables.
3. The CAPM suggests the idea of proportionality of the two excess returns:

When you investigate the relationship empirically, add a constant to the equation because the model of reality could be wrong, and because there is a random element to the data. Soon you will investigate whether the constant that the regression produces might be truly zero. So the regression model will be in the standard form:

The independent variable is the excess S&P 500 returns and the dependent variable is the excess hedge fund index returns. The terminology in the investment industry has developed such that investment professionals often refer to β0 as α, alpha, and refer to β1 as simply β.

Using the regress (reg) command with the robust option included, regress excess hedge fund returns on excess market returns.

1. Read the output and make your assessment whether you can reject the null hypothesis that the constant is truly zero at the 5% significance level. Cite two ways of examining the output in order to draw your conclusion. That is, cite two approaches using two different Stata-generated statistics to draw your conclusion, and a third way to draw your conclusion.
2. Read the output and make an assessment whether you can reject the null hypothesis that the constant is truly zero at the 1% (not 5%) level. Document your conclusion and your way of reaching it.
3. The slope coefficient, β1 is one type of measure of the riskiness of the hedge fund index. It is not usually helpful to use a null hypothesis of equality to zero because that would mean that the market has no effect on hedge fund returns. Rather, we often use a null hypothesis of equality to one, which means that the hedge fund index has the same riskiness as the market. In this situation, you must construct your own t-statistic, p-value and confidence interval. Using a 5% significance level, construct at least two of those (ideally all three) and state your conclusion about rejecting or failing to reject the null hypothesis that β1=1, documenting your work.
4. Heteroskedasticity-robust standard errors are more accurate than the homoskedasticity only ones unless the data is known to be homoskedastic. As a point of experience, notice the heteroskedastic-robust standard error for β1. Now re-run the regression without the robust option. Comment on the difference between the two standard errors. Comment on whether and how the use of homoskedastic-only standard errors would affect the risk of making a type 1 error in general and for this dataset.
5. The notion that hedge fund managers price their securities in a way that makes their risk appear lower than the true riskiness gives rise to another idea. Because managers may have some pricing flexibility, perhaps they price differently when the market goes up than when the market goes down. There are a variety of ways to investigate this. We will restrict ourselves to the tools presented in the course so far. You will “divide” the data into observations when the excess S&P return is positive, up markets, and when it is negative, down markets, and calculate the beta for each group.

Use the inspect command to look at your data again. Focus on the excess market return variable that you created. Note how many are negative or zero, and how many are positive. The purpose is to know that you have a reasonable quantity of observations in both groups before we start. How many are in each group? Are there sufficient observations in each group for our usual large-sample techniques?

1. Run the regression again adding the directive “if *your excess market return variable name*>0,robust” after the basic regression command components. Then do it again with the inequality <=. Examine the two β1 coefficients. Comment on the differential between the two. What is your sense of their possible equality? What components of the output might factor into your guess?
2. Look at the measures of fit for the two regressions, the R2 and the RMSE(Stata terminology)/SER(Stock and Watson terminology). Comment on their similarity or difference between the two regressions.