Project 3
Due February 16, 2016

This project concerns the realized and jump regressions. The 5-min data on the ETF SPY (tracks the S&P 500 Market Index), 2007–2015 have been uploaded to the course web site. Merge these data with your stock data. Note, the merge must be exact or subsequent research output will be corrupted. Be sure to delete the data for the two days of the flash crashes: 2013-04-23 and 2015-05-06.

1. Realized Beta.
   A For your two stocks, estimate the daily realized beta over the years 2007–2014. Make nice plot and very briefly discuss. (Use the same jump threshold parameters as in Project 3.)
   B Adapt the code for the realized correlation in Project 3 to form bootstrap 95% confidence intervals for the realized beta. The idea is exactly the same as with realized correlation except one of the pair of returns is the market return and the other a specific stock return. (Also use the same settings the jump and simulation parameters as in Project 3.)
   C Make nice plots of the realized betas and confidence intervals for the full sample, and a second plot that zooms in onto October 2008. Does the realized beta appear very stable over time?

2. (Initial look) Run the jump detection scheme on the market (SPY) to locate market jump indexes \( i_p \). Use the \( \alpha \) I assigned to you in a list in a web file in the Projects folder of the class web page. (If everyone used the same \( \alpha \) then you would all find the same set of market jumps; I assigned different \( \alpha \)s to each of you so we can see how the results vary across the choice of the truncation parameter \( \alpha \).)
   A Make a scatter plot of the stock returns versus the market jump at the jump times, i.e., plot \( \Delta^n_{i_p} Y \) against \( \Delta^n_{i_p} Z \) for just the \( p = 1, 2, \ldots, P_n \) points.
   B Does a linear relationship with high \( R^2 \) appear (visually) empirically plausible as a working hypothesis.

3. (Jump Regression) The OLS jump regression regression model is given in class notes. Do the following for each of your two stocks.
   A Compute the OLS jump beta. Add to the scatter of 2. the jump regression line \( y = z_{OLS} \) for \( 1.10 \min_p \Delta^n_{i_p} Z \leq z \leq 1.10 \max_p \Delta^n_{i_p} Z \). Use a fine grid for the \( z \)-axis; the 1.10 just extends
the horizontal axis a bit to improve the plot.

B What is the $R^2$ in A for each stock. Does it seem close to unity?

C Compute the estimated asymptotic standard error of the jump regression coefficient and form a 95% confidence interval.

D Split the sample into two sub-periods I: 2007–2011, and II: 2012–2015. Test the null hypothesis of equal jump regression coefficients are the sub-periods.

4. (Good beta, bad beta) Some would argue that the beta is different for up moves than down moves in the market. We would write this as

$$\Delta Y_{t_p} = \beta^+(\Delta Z_{t_p})_+ + \beta^-(\Delta Z_{t_p})_-$$

The above is the multiple regression version of jump regression.

A Sketch the asymptotic distribution theory for the multiple regression version of jump regression under the same assumptions as in the class notes. This only requires you to be careful about vectors versus scalars in the notation.

B For the full sample, estimate the model (1) for each stock. Is there evidence against there hypothesis $\beta^+ = \beta^-$?

References