

MIT SLOAN SCHOOL OF MANAGEMENT

Advanced Analytics of Finance
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Problem Set 4

(Due: 7:30 AM, Tuesday, April 13)

1. Interview questions.

- (a) True or false (explain in words, not formula): A longer estimation window helps us estimate the baseline model coefficients more precisely, which in turn reduces the variance of the abnormal returns in the event window. Thus, we should make the estimation window as long as possible.
- (b) In an event study of stock returns around earnings announcements, how should we deal with the fact that multiple firms could announce their earnings on the same day?

2. Event Study: FOMC Announcement Effect.

Download the data file FOMC.csv. The file contains historical data on daily S&P 500 returns and the FOMC announcement dates from 1993 to 2016 (the time series actually starts in 1980). We will use daily return data to examine the FOMC announcement effect (for more background information on FOMC see Lucca and Moench 2015).

- (a) Describe the procedure of the study, including the following steps: (1) define the event and event window; (2) specify the reference model for “normal” returns; (3) state the null hypothesis; (4) aggregate the “abnormal” returns and characterize their distribution under the null; (5) perform hypothesis testing.
- (b) Carry out the steps described in part (a).
- (c) Use kernel density plots to compare the distribution of abnormal returns on event dates versus non-event dates. (In R, you can generate kernel density using the function *density()*.)
- (d) Interpret your findings. Based on these findings, what trading strategy would your recommended? Be specific with your recommendation, and list those practical issues (those that might affect trade execution or performance) that you think are important.
- (e) Extend the study to include the sample period after 2016 and different financial assets. Answer the following questions:
 - i. Is the FOMC return still significant post 2016 (L-M was published in 2015)?
 - ii. Can you find any interesting return patterns in the cross section? (Some ideas – no need to try them all: Treasuries, various sector ETFs, corporate bonds, commodity, etc. There are also ETFs tracking various corporate bond and commodity indices.)

3. Event-driven strategy: PEAD.

After learning about Bernard and Thomas (1985), you are wondering whether your own hedge fund can build a trading strategy based on the PEAD. You thought of a different way to identify stocks with positive and negative earnings surprises. Instead of using accounting data, we can sort stocks based on the **standardized excess return on the day after** the announcement (assuming earnings are released after the market closes):

$$s_{i,t} = \frac{R_{i,t} - R_{m,t}}{\sigma_{i,t}},$$

where $R_{i,t}$ is stock i 's return on day t , $R_{m,t}$ is the market return, and $\sigma_{i,t}$ is the volatility of stock i 's excess return (which can be estimated using past returns, say the past 60 days).

Data: Download the data at <https://goo.gl/Ahxa9A>, which contains two files. The first is PEAD.csv, which contains historical daily return data for the 1000 largest stocks (based on market cap at the end of 2010). The field “cap” is the market capitalization of the company. The field “ann” is a dummy variable that is equal to 1 on the day after the company's earnings announcement and zero otherwise. The second file is market.csv, which contains the daily market return from the same sample period.

- (a) Design an event study to test the null hypothesis that “*stocks with the most positive (negative) standardized excess returns on the day after the announcement have the same average returns in the next 30 days.*” You can define “most positive (negative)” as those stocks with $s_{i,t} > k$ ($s_{i,t} < -k$) for some k (e.g., $k = 3$, but you can also experiment with the threshold).
- (b) “Hypothesis testing is boring.” You want to directly back-test the following trading strategy:

Go long the stocks with the most positive standardized excess returns (as defined in (3a)) the day after the announcement and short the stocks with the most negative standardized excess returns (assuming that you transact at the closing prices on the day after the announcement). In each case, you would close the position (sell the long position or cover the short) in n days. Assume that to fund a net long position each day, you can borrow at the annualized rate of 3%; for the net short position, you can earn interest at the annualized rate of 1%. Produce CAR plots based on this strategy for the period from 2011 to 2018 for $n = 5, 10, 20, 30$.

- (c) Analyze the results of the back-test using the procedure laid out in HW3, Q3a-3b. Does this strategy generate alpha relative to the 3-factor model?