EVENT STUDIES

The methodology of an event study is to examine the stock price reaction to an event as a way of testing an hypothesis about the nature of the event.

For instance, we might hypothesize that a particular government regulation will increase the profits of a set of firms. In this case we examine the stock price movement during the time that the regulation is being crafted. The expectation is that stock prices of the affected firms will increase.

We might hypothesize that disasters that are the fault of a particular firm will cause the profits of the firm to fall because consumers lose confidence in that firm. Again, the maintained hypothesis is that when such a disaster occurs, the stock price of the associated firm will decline.

We might hypothesize that certain business decisions of one firm will create competition that will cause the cash flows of rivals to fall. The hypothesis is that when these business decisions are announced, the stock price of the rivals will fall, while the stock price of the firm making the announcement will increase.

The methodology of the event study is to measure the hypothesized stock price reaction as precisely as possible. The maintained hypothesis is that sometime will cause the stock price of a firm to change at some point in time. Suppose that the maintained (or alternative) hypothesis is that the stock price will fall. This is the same thing as saying that the stock return during the event period will be negative. The null hypothesis is that the stock price will not change.

$$H_0: \overline{P}; H_A: P\downarrow \Rightarrow \left\{\frac{P_t}{P_{t-1}} - 1\right\}\downarrow = r_t \downarrow$$

By looking at the return instead of the level of the stock price, we can get an idea of how significantly the stock price did, in fact, change. Simply enough we can look at the variance of the return and compare the movement during the event period (the raw event return) to the variance over other times.

The CAPM gives us a way to refine this measurement. From CAPM, we have a prediction about the expected return:

$$E(r_T) = \alpha + \beta r_{mT}$$

and, the null hypothsis can be stated as:

$$\{r_T - E(r_T)\} \sim n(0, \sigma_\varepsilon)$$

The event period

The event period is the point in time when a firm's stock price is hypothesized to change. The precise period during which this is hypothesized to occur depends on what kind of event is being studied. For some events, the event period come after the announcement. For some it comes before. Sometimes the event window is long; sometimes it is short.

When we examine regulatory events, the period usually starts prior to the formal announcement of a ruling or issuance of a regulation. Some people try to identify event days in the formation of regulations. Mitchell and Netter claim to explain the 1987 crash based on Congressional hearings involving a controversial takeover tax. Usually, however, regulations are formed in a long an torturous way and there is little to way to link daily returns to the formation of the regulation.

The following is an excerpt from some of our electricity deregulation research:

By all accounts, the financial community became keenly aware of the immediate possibility of deregulation and competitive pricing in the electric utility industry during 1994. The equity value of the investor-owned electric utility firms declined significantly in 1994. From a high in 1993 of $282 billion, the equity value of the utility portfolio fell to $212 billion at the end of 1994. The cumulative return over this period was around minus twenty-five percent, market adjusted. The he ratio of market equity value to book equity value fell from 1.39:1 to 1.12:1. However, in spite of this decline in market equity, which can be reasonably related to a market perception of declining prices of electricity into the future, the market value of equity was still higher than the book value for the industry as a whole.

We have examined the stock market reaction to several news stories during this period.[1] On at least two occasions, news stories directly related to competition in electric power were met with sharp declines in the stock prices of investor-owned public utilities. These events are striking because of the near universal decline in industry stock prices in spite of the fact that these events related directly to only a couple of utilities.

During this period there were several significant event periods. Over a four day period, November 1-4, 1993, the portfolio of investor-owned electric utilities lost a cumulative 5.5 percent.[2] This period is centered on an announcement by Moody's that it had downgraded the credit rating on fifty of the top electric utilities because of the looming threat of competition. Over the month of February, 1994, the portfolio was down 4.7 percent. During this month, the *Wall Street Journal* carried a story describing the battle between two of California's largest utilities (SCE Corp and San Diego Gas & Electric Co.) and a number of independent power producers (IPPs).[3] Finally, in the first half of the month of May, the portfolio lost 9 percent. Much of this loss occurred simultaneously with two stories published by the *Wall Street Journal*. The first story, May 9, described the attempt by Las Cruces, NM, to "bypass" its utility (El Paso Electric Co) in favor of cheaper power on the wholesale market. The *Journal* reported this as a "test" of legality of wholesale wheeling and as "a warm up for a deregulatory trend that could easily spread across the US, bringing an onslaught of competition which could bankrupt some utilities."[4] The second story, on May 11, was a follow-up describing analysts' reports saying that electric utilities were a bad buy in the stock market because of the threat of deregulation.[5] In all, 20 points of the 25 percent decline in the equity value of the electric utility portfolio over the eighteen month period occurred contemporaneously with press reports detailing the potential threat of competition in the industry.

Aligning the firms

The best event studies have multiple firms. The event period may be the same date for all the firms or it may be different. If it is the same, then the returns to the affected firms should be averaged to form a portfolio return. The portfolio return is regressed on the market for a period of time before and including the event. A dummy variable is included in the regression; it has a value of 0 outside of the event, and 1 during the event. The estimated coefficient on the dummy variable is the estimated effect of the event on the return of the affected firms. Normal confidence testing is used to assess the statistical significance of this estimate.

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[1] Event analysis uses stock market and financial data to assess the impact that investors incorporate into their perception of future events. The technique is widely used in finance and economics. For an example of the methodology, see Maloney and McCormick, *A Positive Theory of Environmental Quality Regulation*, J.Law & Econ. 25(1) (April 1982) at 99.

[2] We used a simple market model to adjust the portfolio returns. We regressed the daily electric utility value-weighted portfolio return on the value-weighted market return over the period January 1, 1990, through May 31, 1993. The estimated portfolio beta over this period was .52. Estimates are based on data available from the Center for Research in Security Prices, University of Chicago.

[3] Andy Pasztor, *Who Will Make Electric Power in California?*, The Wall Street Journal, February 17, 1994 at B1.

[4] Caleb Solomon, *As Competition Roils Electric Utilities, They Look to New Mexico*, The Wall Street Journal, May 9, 1994, at A1.

[5] Warren Getler and Dave Kansas, *Stock buys by Utility Industry Insiders May Have Been Misguided, Analysts Say*, The Wall Street Journal, May 11, 1994, at C1.

Monthly returns, five years of data is commonly used prior to the event. With daily returns, one year of data is common. The estimation period can extend before or after the event, though it is most common to estimate beta prior to the event.

If the event dates are different for each firm, then the data for each firm can be pooled. This may run into large datasets if there are many firms. Take the example of airplane crashes. The data for each firm includes firm returns and market returns for one year prior to each crash plus two to five days following the crash. These data are stacked together for each firm.

In SAS the data set would include the variables:

PERM[6] CALDT RET MARKET[7] CRSHDAY1 CRSHDAY2[8]

The dataset for each airline has the same variables. The identifying variable, PERM, changes from one dataset to another. When the data are stacked, the variable PERM can be used to classify the data by firm.

SAS has a convenient procedure for dealing with classified data. It is PROC GLM.

The SAS code for doing the event study on the airline data is:

```
PROC GLM DATA=airlines;
CLASS PERM;
MODEL RET = PERM PERM*MARKET CRSHDAY1 CRSHDAY2;
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The 'class' statement tells SAS to create a dummy variable system with zeros and ones for each different value of the 'class' variable. In the model statement, where the 'class' variable, PERM, stands alone, SAS will return *n*-1 different estimates plus the intercept. These are the different estimates of the alphas for each firm. Where PERM is interacted with the market, SAS returns estimates of the different betas.

The variables for the event windows have the same name for each firm and are hypothesized to have the same effect. Hence, they are not interacted with PERM. The estimated value of the coefficient is the average effect across the multiple events. The standard tests of statistical confidence apply.

Alternatively, *n* different regressions could be run for each airline firm experiencing a crash. SAS code:[9]

```
PROC REG DATA=airlines; BY PERM;
MODEL RET=MARKET CRSHDAY1 CRSHDAY2;
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This would give *n* different values for the coefficients on CRSHDAY1 and CRSHDAY2. These could be averaged, but then, how would they be tested jointly?

Refining the estimates

It is arguable that informational events can change beta as well as the cash flows of a company. For short windows, such as two days as in an airplane crash, this is not a big issue. For longer windows as in the case of electricity deregulation, we may not really care whether the wealth impact on firms is due to cash flows or relative risk or both. (In electricity, indeed, we expect that beta did rise and that is part of the reason that stock prices fell.) At all events, measuring changing betas requires data on both sides of the event. Estimating beta before and

[6] In place of or in addition to PERM, the firm's name may be included as an identifier.
[7] MARKET is usually labeled EWRETD for the equally weighted return dividend adjusted or VWRETD for the value weighted return dividend adjusted.
[8] etc. for as many crash days as desired.
[9] The data must be sorted to use the 'by' statement.

after and comparing these statistically is fairly straightforward. Generally, if data are available it should be done.

Confounding events can contaminate the evidence apparently contained in stock price movements. If an airline crashes a plane on the same day that it has a bad earnings announcement, there is no way to tell whether the stock price movement is attributable to one or both. It is important in event studies to look for confounding events in the press. The standard practice is to throw out events that are contaminated.

The CAPM specification of the market model is not the only one that might be employed. Other indices can be included in the abnormal return regression, such as, industry indexes (so long as they exclude the affected firm) or commodity prices (as we did in the EQR paper).

Corroborating evidence

Event analysis is not in and of itself that compelling. The reason is that all that is found is a stock price movement at a given point in time. The stock price movement could be associated with anything. Certainly, for long window events, the results may not be much more than amusing.

Because of this, it is important to link the abnormal returns found for individual returns to independent measures hypothesized to be associated with the impact.

In the airline study, we predicted that at-fault crashes should have a larger stock price reaction than not-at-fault crashes. The joint test of this hypothesis strengthened the conclusion that crashes do in fact impose wealth losses on airlines. We also linked airline crashes to insurance costs and found that insurance rates react only to at-fault crashes. Furthermore we found that the stock market reaction was, as predicted, greater than the insurance effect (roughly double). At of these extended dimensions of the hypothesis testing adds confidence to the basic methodology and result.

Similarly, in the EQR paper, we hypothesized that cotton dust regulations would act as a cartel output restriction in the textile industry. It would raise prices and consequently increase profits. The relatively weak stock market evidence that we found for this hypothesis was greatly corroborated by the fact that the positive abnormal performance enjoy by individual firms was positively correlated with the amount of cotton fiber each processed.

The bottom line is that for event analysis to be received with much attention by the profession, it must be associated with some independent confirmation of the hypothesis other than merely timing of a stock price movement.