EVENT STUDY LECTURE

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Source Note:

The source material for the Lecture Notes that follow were from the following texts:

Campbell, John Y., et al., The Econometrics of Financial Markets New Jersey: Princeton University Press (1997), Chapter 4.

Seiler, Michael J., Performing Financial Studies A Methodological Cookbook New Jersey, Prentice Hall (2004), Chapter 13.

Introduction:

What is an Event Study?

An event study measures the impact of new information on the return of financial assets.

It could also be broader than just the impact on a firm, such as the impact on an economy, but usually an event study is associated with the impact of information on the value of a firm.

How does this apply to economics?

Economists are in the profession of testing the effects of information (an event) on assets or an economy.

However, the cost of information is expensive. That is, if an event has no impact on the value of a firm, then regulators need to know this so that they regulate those events that impact the value of a firm.

The court system is also interest in the effects of information on the financial markets and the court system uses event studies to measures the results of events on financial systems to measure economic damages.

Some background on Financial Markets:

It is generally understood that stock prices reflect information that is known about a firm's future. Thus, when new information reaches the market the price of a stock should change accordingly. If the market if perfectly efficient, we should see the stock price change instantaneously to reflect this newly learned information. However, this is not always the case.

Because of breakdowns in the market such as leaks of information, the impact hits the market before the official announcement or filing of the data (information) with the SEC. The news is replete with examples of insiders learning about information and acting on it by buying and selling shares of stock while the general public learns about the information long after the insiders made the big gains.

It also could take the market time to interpret the new information, so the impact does not happen instantaneously. For example certain decisions by the courts and government are so nebulous that the impact on a firm's value is not readily determined.

In short, economists care about event studies because it's a practical way to determine what factors move an individual firm's stock price, the market as a whole, or an entire economy.

Also, the event study not only measures the factors (variables) moving stock prices but also the degree of their significance. That is, does the new information significantly change the stock's price.

<u>STEPS in an Event Study</u>

1. Identify the event date (the date on which the event occurred).
2. Define the event window.
3. Define the estimation period.
4. Select the sample of firms.
5. Calculate "normal" (nonevent) returns (the returns that would have occurred in the absence of the event).
6. Calculate abnormal returns (ARs) (the actual returns that occurred because of the event minus the returns that would have occurred without the event, that is, nonevent returns).

7. Calculate cumulative abnormal returns (CARs) (the aggregation of the ARs).

8. Determine the statistical significance of the ARs and CARs.

Step 1 - Identify the Event Date:

Identifying the event date sounds like it should be very straightforward, but it does require consideration. The event date is defined as the time when the market first learns of the relevant new information (the event).

For example, when a company experiences a change in its bond rating, should you measure the event as the date when the first data provider notes the change, or do you wait till its confirmed from two data sources. There are often discrepancies and reporting delays among providers. So the simple object of identifying the event date is not straightforward.

The goal is to accurately and narrowly define the event date, since this will allow you to more accurately measure the impact of the event on a firm.

Accordingly, it is best to narrow the event date to one date.

Step 2 - Define the Event Window:

Once the event date is determined, the next step is to define the event window. The event window is the number of trading days preceding and following the event date that are considered necessary to capture both the leakage and the time needed for the data to effectively reach the marketplace.

There is no set number of days to include in the event window. It is a matter of judgment for the researcher. It is preferable to have the fewest number of days necessary in the event window, since if it is too broad then there may be a problem of multiple events within an event window.

Thus, the more certain you are about the event date, the smaller the event window can be, and the more powerful will be your measurement of the significance of the event on the firm's stock price.

Step 3 - Define the Estimation Period:

The **estimation period** is the period of time over which no event has occurred. It is used to establish how the returns should behave normally (i.e., in the absence of the event).

The **estimation period** is before, during, or after the event window. Usually the estimation period is chosen as some period before the event window. For example if the event window is 10 days before (referred to as -10) the event date (referred to as 0), and 10 days after (referred to as +10) the event date, then the estimation period could be 30 days before the event window (referred to as (-40 to –11).

The theory behind making sure that the event window and the estimation period do not overlap is to make sure you have an unbiased estimate of how the firm's stock prices would behave normally without the event's occurrence. Otherwise the normal return is contaminated by the event; this is referred to as contamination.

An example of an estimation period that is after the event window would be when the event is an IPO (initial public offering). You cannot have a meaningful estimation period prior to the event date in this instance. In this instance, you would possible select the estimation period as +30 to +60, so you would see what the normal returns are after the initial price reaction resulting from the IPO.

Further, you may even be forced to have the estimation period overlap part of the event window. Assume the event window is –10 to +10, then the estimation period may be +5 to +10 if events occurred on –11 and +12 that would prevent you from going before or after the event window to determine the estimation period, of course this will result in contamination of the results by the event, but you will avoid contagion effects (i.e., more than one event during the time period, which results in the inability to distinguish the effects of the individual events).

There is no set standard for the number of periods to include in the estimation period. However, the goal is to make the estimation period wide enough to capture the relationship between the stock and the market, but not to large of a period so that the estimation period has no connection with the firm at the event date.

Step 4 - Select the Sample of Firms:

To select the sample of firms it is necessary to define a criterion to screen the firms so you can select the firms. Suggested approaches are to look at firms only on major exchanges, with frequent trading. Also, there may be a need to exclude firms with more than one event over the periods covering the estimation period and the event window. This is necessary if you cannot determine which event is driving the returns of the stock.

Step 5 - Calculate "Normal" (nonevent) Returns (the returns that would have occurred in the absence of the event):

The normal returns are calculated under four methods as follows:

Mean Return

Market Return

Proxy (or control) Portfolio Return, and

Risk Adjusted Return.

Mean Return Method:

The Mean Return method assumes that the mean of the stock's return over the event window is expected to be the same as the mean over the estimation period. This is the simplest of methods to measure the normal returns. The consensus is that this method may not be as good as some of the more advanced methods but its not that much worse either.

Problems with Mean Return Method

But, this method results in problems if the firms in the sample have event dates close together. This is called event clustering. Event clustering is associated with **market-wide events** such as the Federal Reserve raising or lowering interest rates, or changes in accounting regulations. Event clustering can occur with specific firms as previously discussed, or with certain industries because of government regulations or court decisions. But, the firm clustering can be dealt with by removing that firm from the sample, while the market wide event clustering means you may have to reconsider using the mean return method.

More Problems with Mean Return Method

The mean return method does not respond well when the market is trending up or down (i.e., bull or bear market). Thus the estimates will trend up or down, but those conditions may no exist during the event window.

The mean return method also does not respond well when certain industries are experiencing uncertainty and significant variation in returns.

When To Use the Mean Return Method

Mean return method works when the firms have event dates that are spread far apart, and when the returns on the firms in the sample are relatively stable.

Formal Presentation Mean Return Method:

Let R_t be an (Nx1) vector of assets returns for calendar time period t. R_t is independent multivariate normally distributed with mean μ and covariance matrix Ω for all t.

Let μ_t, the *i*th element of μ, be the mean return for asset i. Then the mean return (also referred to as the constant return) model is

$$R_{it} = \mu_i + \xi_{it}$$

$$E[\xi_{it}] = 0 \qquad Var[\xi_{it}] = [\sigma_{\xi i}]^2$$

Where R_{it}, the *i*th element of Rt, is the period-*t* return on security i, ξ_{it} is the disturbance term, and, $[\sigma_{\xi i}]^2$ is the (i,i) element of Ω.

Market Return Method:

The Market return method of measuring the normal returns assumes that the mean of the **stock's** return over the event window is expected to be the mean of the **market's** return over the event window. This method does not require an estimation period, which makes it particularly attractive in the IPO setting (as previously discussed it is difficult to determine the estimation period in the IPO setting).

The market is generally measured by the S&P500 return.

Problems occur with this method if the event dates for the firms in the sample occur around the same time period (clustering). Otherwise, this method is just as valid as the more advanced methods.

The formal presentation for the Market Return Method follows:

(Note: this model is the same for the Proxy (or Control) Portfolio Return and the Risk-Adjusted Return methods except the measurement for the market return R_{mt} is different in each model)

For any security i we have

$$R_{it} = \alpha_i + \beta R_{mt} + \xi_{it}$$

$$E[\xi_{it}] = 0 \qquad Var[\xi_{it}] = [\sigma_{\xi i}]^2$$

Where R_{it}, and R_{mt} are the period-*t* returns on security i and the market portfolio, respectively, and ξ_{it} is the zero mean disturbance term. α_i, β_I, and $[\sigma_{\xi i}]^2$ are the parameters of the market model.

Proxy (or Control) Portfolio Return Method:

The proxy (or control) portfolio return method to measure the normal returns is a lot like the market return method except instead of using the market measurement as the S&P500 you use an industry return.

This better controls for the risk for the specific firms in the sample, and thus should produce a more accurate measurement of the normal returns for the firms in the sample.

Like the market method, this method does not require an estimation period. But it still has the clustering problem previously mentioned.

Risk-Adjusted Return Method:

The risk adjusted return method is the most commonly used method to generate the expected returns over the event window. In this method, the estimate of the expected returns for each day in the event window is determined by using a regression.

The texts cited note that a single independent variable regression model using the market estimator such as the S&P500 works just as well as the multiple independent variable regression models.

Some researchers have argued that the nominal returns are not the proper measurement of the returns for the estimation period, but only the excess returns should be measured. It is argued that this is consistent with the Capital Assets Pricing Model (each class of assets presents different levels of risk and therefore have different required rates of return). However, studies have shown flaws in the CAPM (i.e., the marketplace does not always abide by the rates of return suggested by the CAPM). Thus, due to the flaws in CAPM and since the restriction imposed by the CAPM can be relaxed at little cost, researchers have ceased using CAPM in event studies.

Others have suggested that the market measurements for the normal returns should consider the Arbitrage Pricing Theory (one competitor in the market place has a cost structure that makes it profitable for them to pay above the market price). Studies have shown little practical advantage to using this in event studies, plus it complicates the implementation of the event studies.

Step 6 - Calculate abnormal returns (ARs) (the actual returns that occurred because of the event minus the returns that would have occurred without the event, that is, nonevent returns):

To calculate the abnormal returns (ARs) you take the actual return for the sample firms for each day in the event window and you subtract the estimated (predicted) normal return for each day in the event window.

Formally:

For each firm i and event date τ we have

$$\xi_{it} = R_{it} - E[R_{it} \mid X_t]$$

where ξ_{it}, R_{it}, and $E(R_{it})$ are the abnormal, actual, and normal returns, respectively, for time period t. X_t is the conditioning information for the normal performance model (i.e., the market measurement under the mean return, market return, proxy portfolio return, or risk-adjusted return methods).

Step 7 - Calculate cumulative abnormal returns (CARs) (the aggregation of the ARs):

The cumulative abnormal returns (CARs) are simply the sum of the ARs.

Step 8 - Determine the statistical significance of the ARs and CARs:

By determining the statistical significance of the ARs and CARs, you are then determining the significance of the event, which is the punch line of an event study. Did the particular event impact the stock price.

The Z statistic is the most common test statistic used in event studies. The calculation of the Z statistic is straightforward. Attached are the formulas needed to calculate the Z statistic and the variance for the abnormal returns.

See calculations 1 through 5 attached, which were copied from Chapter 13 of the Seiler text.

When evaluating the Z Statistic, the null hypothesis is that the event has no impact on asset value and the alternative hypothesis is that the event does impact the asset value.

This is assuming a large enough sample so that you can use a normal return, note if negative and positive abnormal returns are expected then a two-sided test is required. This can be combined with nonparametric sign and rink tests to check the robustness of the parametric tests.

Example of an Event Study:

The Campbell text presents a detailed example of an event study relating to quarterly earnings announcements.

The purpose of the study is to investigate the information content of the quarterly earnings announcement for the thirty firms in the Dow Jones Industrial Index over the five-year period from January 1989 to December 1993. The filing is considered good news, bad new or no news.

If the actual earnings exceed the expected by more than 2.5% the announcement is designated as good news.

If the actual return is more than 2.5% less than expected the announcement is designated bad news.

Those announcements where the actual earnings is in the 5% range centered about the expected earnings are designated as no news.

The event window was choose as one day.

The estimation periods were 20 preevent days and 20 post event days.

The results of this example strongly support the hypothesis that earnings announcements do indeed convey information useful for the valuation of firms.

Focusing on the announcement day, the sample average ARs for the good-news firms is .965%, since the standard error of the one-day good news average is .104%, the Z test statistic is 9.28, thus the null hypothesis that the event has no impact is strongly rejected.

For the bad news firms the ARs is -.679%, with a standard error of .098%, leading to a Z test statistic of –6.93, again this is strong rejection of the null hypothesis that the event has no impact.

For the no news firms the ARs are -.091%, with a standard error of .098%, here the null hypothesis is accepted as expected.

Current Research Project – Restricted Stock Filing Event Study

The null hypothesis will be that event of the filing, issuance or announcement of restricted stock has no impact on the stock price of the firm.

The alternative hypothesis is that the restricted stock event does influence the stock price of the firm.

Background

Restricted stock is generally awarded to executives in corporations as an incentive or payment for performance or it is the private placement of stock. The restricted stock issuance that will be studied relates to the private placements.

Previously the holding period was two years than it was reduced to one year in 1990.

The filing requirements for the issuance of restricted stock previously allowed corporations to report the award to the SEC 45 days after the end of the fiscal year. The new rules pursuant to the Sarbanes-Oxley Act require filing within two business days.

Restricted stock studies are used in valuations of closely held business to assist the valuator in measuring the level of discounts to be applied in valuing illiquid securities.

Previously in my Econometrics 615 paper, it was determined that the reduction in the holding period from two to one year suggests reduced discounts for the illiquid security.

The issuance of restricted stock in relations to private placements is in effect a decision by the managers of a firm as to the capital structure that is determined necessary for the risk involved. The firms' managers have the options of seeking debt or capital to obtain the financing for a new investment.

Purpose in Applying Event Study Methodology to Restricted Stock Issuance

The grant of restricted stock may be more than merely the issuance of equity. Accordingly, the grant may be a signal to the market that the corporation cannot obtain debt financing which would signal confidence by a bank of a certain risk level. The need to obtain equity financing indicates a higher risk level and could potentially signal that the firm is taking risks and negative abnormal returns will result.

Thus, the result is that the private placement of restricted stock results in a discount for the additional risk and thus the restricted stock is issued at a discount. Further, the market negatively reacts to this in the form of negative abnormal returns because of the increased risk and the need to obtain equity versus debt financing.

Application of the Event Study Methodology to Restricted Stock Issuance

Step 1: Identify the event date (the date on which the event occurred).

The event date will be the earliest of the filing, issuance or announcement.

Step 2: Define the event window.

The event window is estimated at –10 to +10.

Step 3: Define the estimation period.

The estimation period is estimated at –40 to –11.

Step 4: Select the sample of firms.

The Silber sample.

Step 5: Calculate "normal" (nonevent) returns (the returns that would have occurred in the absence of the event).

The mean return and market return models will both be used, however, Temple is in the process of obtaining WRDS, so the event study may have to be restricted if WRDS is not obtained within the next few weeks, since alternate data sources will need to be obtained on short notice.

Step 6: Calculate abnormal returns (ARs) (the actual returns that occurred because of the event minus the returns that would have occurred without the event, that is, nonevent returns).

Pending receipt of data.

Step 7: Calculate cumulative abnormal returns (CARs) (the aggregation of the ARs).

Pending receipt of data.

Step 8: Determine the statistical significance of the ARs and CARs.

Pending receipt of data.

Calculation 1:

$$SAR_{jt} = \frac{AR_{jt}}{\sqrt{s^2_{AR_{jt}}}} \tag{13.2}$$

where

SAR_{jt} = SAR for firm j at time t

AR_{jt} = AR for firm j at time t

$\sqrt{s^2_{AR_{jt}}} = s_{AR_{jt}}$ = square root of the variance of the AR for firm j at time t
= standard deviation of the AR for firm j at time t

The calculation of AR is relatively straightforward. Unfortunately, the formula for standard deviation is quite lengthy. For now, let's focus strictly on the formula for the variance (which is just the part inside the radical). The formula for variance is given by the following equation.

$$s^2_{AR_{jt}} = \left(\frac{\sum_{t=-115}^{-16} \left(AR_{jt(est.period)} - \overline{AR}_{j(est.period)} \right)^2}{D_j - 2} \right) * \left(1 + \frac{1}{D_j} + \frac{\left(R_{mt(event.window)} - \overline{R}_{m(est.period)} \right)^2}{\sum_{t=-115}^{-16} \left(R_{mt(est.period)} - \overline{R}_{m(est.period)} \right)^2} \right) \tag{13.3}$$

where

$s^2_{AR_{jt}}$ = variance of the AR for firm j at time t

$AR_{jt(est.period)}$ = AR for firm j at time t over the estimation period

$\overline{AR}_{j(est.period)}$ = mean AR for firm j over the estimation period

D_j = number of observed trading day returns for firm j over the estimation period

$R_{mt(event.window)}$ = return on the market (S&P 500) at time t over the event window

$R_{mt(est.period)}$ = return on the market (S&P 500) at time t over the estimation period

$\overline{R}_{m(est.period)}$ = mean return on the market (S&P 500) over the estimation period

Calculation 2:

$$AR_{jt(event.window)} = R_{jt(event.window)} - \alpha_{j(est.period)} - \beta_{j(est.period)} \times R_{mt(event.window)} \quad \textbf{(13.4)}$$

where

$AR_{jt(event.window)}$ = AR on stock *j* for each day in the event window
$R_{jt(event.window)}$ = return on stock *j* for each day in the event window
$\alpha_{j(est.period)}$ = intercept term for stock *j* measured over the estimation period
$\beta_{j(est.period)}$ = slope term for stock *j* measured over the estimation period
$R_{mt(event.window)}$ = return on the market for each day in the event window

Calculation 3:

$$Z - statistic_t = \frac{TSAR_t}{\sqrt{\sum_{j=1}^{N} \frac{D_j - 2}{D_j - 4}}} \qquad \textbf{(13.5)}$$

where

$Z - statistic_t$ = Z – statistic for each day in the event window
$TSAR_t$ = TSAR for each day in the event window
D_j = number of observed trading day returns for firm *j* over the estimation period
N = number of firms in the sample

Calculation 4

$$CumulativeTSAR_{T_1,T_2} = \sum_{t=T_1}^{T_2} TSAR_t \qquad (13.6)$$

where

$Cumulative\ TSAR_{T_1,T_2}$ = cumulative TSAR for each day in the event window
$TSAR_t$ = TSAR for each day in the event window
T_1 = earliest date in the event window (–15)
T_2 = later date in the event window (ranges from –15 through +15)

Calculation 5

$$Z_t = \left(\frac{1}{\sqrt{N}}\right)\left(\frac{\left(\sum_{T_1}^{T_2} SAR_{jt}\right)}{\sqrt{(T_2 - T_1 + 1)\left(\frac{D_j - 2}{D_j - 4}\right)}}\right) \quad (13.7)$$

where

Z_t = the Cumulative TSAR Z-statistic for each day in the event window
N = number of firms in the sample (40)
SAR_{jt} = SAR for firm j for each day in the event window
T_1 = earliest date in the event window (–15)
T_2 = later date in the event window (ranges from –15 through +15)
D_j = number of observed trading day returns for firm j over the estimation period