Practical Procedures in the Use of Event Studies to Measure Economic Damages

In commercial litigation matters, damages analysts ("analysts") are often asked to identify the event that caused the claimants' economic damages. The analysts are then asked to measure the amount of damages suffered by the claimants as a result of the wrongful event caused by the defendants. In litigation claims related to fraud against the marketplace or accounting fraud and misrepresentation, analysts often perform event studies to identify the damages event. In addition, analysts often use event studies in dissenting shareholder appraisal rights litigation claims. In cases involving the merger or acquisition of a public corporation, analysts may use an event study to test whether the efficient market hypothesis applies with regard to the subject public company's stock price movements. This test is applied in order to determine whether the public company's pre-announcement stock price is an appropriate starting point from which to estimate the fair value of the acquired company's stock. In any event, this discussion summarizes the practical procedures that analysts should know when they use event tests to measure economic damages.

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Introduction

Economic event studies may be used by damages analysts ("analysts") to identify a damages event. Event studies may also be used by analysts to measure economic damages, particularly with regard to certain types of damages events. And, event studies may be used by analysts to prove a hypothesis or an assumption applied in a particular application of the efficient market hypothesis with regard to the stock trading price of a publicly traded company.

This efficient market hypothesis issue may be relevant in a dissenting shareholder appraisal rights analysis with regard to the acquisition (or going-private transaction) of a public company. One question in that fair value analysis may relate to whether the public company's stock price efficiently reflected all known information regarding that public company.

In other words, is the public company's public stock price a reasonable starting point from which to estimate the fair value of the public company stock? An event study may be used to test the application of the efficient market hypothesis with regard to the public company's stock price movements.

In addition to dissenting shareholder appraisal rights matters, event studies may also be used in fraud against the marketplace analyses. And, event studies may also be applied in related accounting fraud and misrepresentation litigation claims.

In any event, this discussion summarizes some of the best practices (and practical procedures) related to the analyst's use of event studies to either (1) identify the damages event or (2) measure the amount of damages suffered by the damaged party—as a result of the wrongful actions of the damaging party.

Event studies are typically used to measure the relationship between:

1. an identified economic "event" that affects a security (or a company) and
2. the investment rate of return on that security (or on that company).

Some types of economic events, such as a change in federal income tax rates or a change in a macroeconomic (e.g., monetary policy) variable, affect many securities contemporaneously. Other types of economic events, such as a change in the subject company management or the announcement that the subject company is a defendant in major litigation, are specific to an individual security.

Event Studies

Event studies are sometimes used by damages analysts to test the application of the efficient market hypothesis. For example, the following occurrences would tend to contradict the robustness of the efficient market hypothesis with regard to a particular subject:

1. An abnormal rate of return that continues after the subject economic event
2. An abnormal rate of return that is associated with an anticipated economic event

A classic application of an event study was published in 1969 by professors Fama, Fisher, Jensen, and Roll. The application of the study was presented in an article entitled "The Adjustment of Stock Prices to New Information." That article was published in February 1969 in the *International Economic Review* (volume 10, number 10, pages 1 to 21).

In that journal article, Fama, Fisher, Jensen, and Roll examined the impact of common stock splits on publicly traded security prices. These academics proved that abnormal rates of return dissipated rapidly following the announcement of stock splits, thereby proving the rigor of the efficient market hypothesis.

In addition to their use in confirming the application of the efficient market hypothesis, event studies are commonly used in the damages analysis and measurement of the economic impact (i.e., on a publicly traded security price or a public company value) of a particular defined event.

That is, event studies are often used by analysts to quantify the effect on a particular security's value (or on a particular public company's value) due to such economic "events" as the following:

"Event studies are sometimes used by damages analysts to test the application of the efficient market hypothesis."

- A breach of contract
- An announced merger or acquisition
- A failed merger or acquisition
- A lawsuit filing or an announced taxation dispute
- A settled lawsuit or a settled taxation dispute
- The announcement of a new contract or product
- The award of a patent or a franchise
- The disclosure of increased or decreased earnings

In addition event studies may be used to quantify the effect on a particular security's value due to the failure to appropriately disclose any of these economic "events."

Analytical Procedures in the Development of an Event Study

The following analytical procedures are commonly applied in any of the generally accepted methods for conducting an event study related to a company-specific economic "event."

1. **Define the specific economic event and identify the timing of that economic event.**

   The timing of the specific "event" is not necessarily the time period during which the event actually occurred. Rather, the relevant time period is often the typical investment holding period immediately preceding the announcement of the specific economic event.

2. **Array the subject public security rate of return data relative to the timing of the subject economic event.**

   If the subject event is disclosed to the public on a particular day with time remaining for the stock market to react, then the day of the disclosure is considered to be time period "zero." Then, the measurement periods both preceding and following the subject event are selected.

For example, let's assume that the 90 trading days immediately preceding the subject event and the 10 days immediately following the subject event are selected as the pre- and post-event time period.

In this example, the pre-event trading days would typically be designated as $t - 90$, $t - 89$, $t - 88$, . . . $t - 1$.

The event day itself would be designated as $t = 0$. And, the post-event observation trading days would be designed as $t + 1$, $t + 2$, $t + 3$, . . . $t + 10$.

Because the subject event is specific to each subject company, the observation time period should also be specific to each individual event.

3. **Separate the company-specific component of the rate of return from the public security's total return for the pre-event period.**

To achieve this total return disaggregation analysis, one common procedure is to use the typical "market model" to isolate the company-specific rates of return. For example, the subject security's daily returns during the pre-event measurement period from $t - 90$ through $t - 1$ may be regressed against the total market's returns during the same 90-day observation time period.

The company-specific returns are typically defined as the difference between:

a. the subject security's daily returns and

b. the daily returns predicted from the regression analysis equation.

In this regression analysis, the predicted daily returns are the subject security's alpha component plus its beta coefficient times the overall stock market's daily return.

This regression-based daily return estimation procedure may be described as follows:

$$A_{i,t} = R_{i,t} - \hat{a}_i - ß_i(R_{m,t})$$

where:

$A_{i,t}$ = the company-specific return of security i in time period t

$R_{i,t}$ = the total return of security i in time period t

$\hat{a}_i$ = the alpha component of security i, estimated from the pre-event measurement period

$ß_i$ = the beta coefficient of security i, estimated from the pre-event measurement period

$R_{m,t}$ = the total rate of return of the overall stock market in time period t

4. **Estimate the standard deviation of the daily company-specific returns during the pre-event measurement time period (e.g., from time period $t - 90$ through $t - 1$).**

This standard deviation of daily returns calculation procedure may be described as follows:

$$\alpha_i = \sqrt{\frac{\sum_{t=-90}^{-1}(Ai,t - Ai)^2}{n-1}}$$

where:

$\hat{a}_i$ = the standard deviation of the company-specific returns of security i, estimated from the pre-event measurement period

A_i = the average of the company-specific returns of security i, estimated from the pre-event measurement period

n = the number of days in the pre-event measurement period

5. **Quantify the company-specific return during (a) the specific event date and (b) the post-event time periods.**

To estimate the company-specific rate of return for each day during these time periods, subtract from each security's total return for each day:

a. the subject security's alpha component and beta coefficient times

b. the overall stock market's rate of return on that day.

For purposes of this comparison, the subject security's alpha and beta variables are the same as those variables estimated from the pre-event regression analysis. The procedure for estimating these rates of return is the same procedure described in paragraph (3) above.

The time subscript t, however, typically ranges from 0 to +10—rather than from -90 to -1.

6. **Aggregate (a) the company-specific rates of return and the (b) standard deviations across the sample of securities; perform this aggregation on (a) the "event" day and (b) the post-event days.**

That is, first, calculate the sum of the company-specific rates of return for each day and, second, divide this sum total amount by the number of securities in the sample.

This aggregation calculation procedure is illustrated below:

$$At = \frac{\sum_{i=1}^{N} Ai,t}{N}$$

where:

A_i = the average of the company-specific returns for all securities in the sample in time period t

N = the total number of securities in the sample

The standard deviations are then aggregated by squaring the standard deviation of each security's specific rate of return estimated during the pre-event time period.

This calculation procedure is performed by following these steps:

a. Sum all the standard deviation values across all of the securities

b. Quantify the square root of this sum total

c. Divide this sum total by the number of securities in the sample

The following equation illustrates this standard deviation aggregation procedure:

$$\sigma_N = \sqrt{\frac{\sum_{i=1}^{N} \sigma_i^2}{N}}$$

7. **Test the hypothesis that the company-specific returns (a) on the event day and (b) on the post-event days differ significantly from zero.**

The t statistic is typically calculated as the test of statistical significance. The t statistic is computed by dividing:

a. the average of the company-specific rates of return across all securities each day

b. by the aggregation of the standard deviations across all securities.

The calculation for the aggregation of standard deviations was described in the previous procedure.

Next, depending on the number of degrees of freedom, determine whether the subject economic "event" significantly affects the company-specific rates of return. This procedure to measure statistical significance is quantified as follows:

$$t\ statistic = \frac{At}{\sigma N}$$

If the subject economic event is unanticipated and if the t statistic is both statistically significant on the day of the event and statistically insignificant on the days following the subject event, then the analyst can reasonably conclude the following: the subject economic "event"

a. does affect the subject publicly traded security (or public company) returns but

b. does not contradict the efficient market hypothesis.

On the other hands, if the t statistic continues to be statistically significant on the post-event days, then the analyst may conclude the following:

> The market is inefficient—in that it does not quickly absorb such new information.

The analyst may also reasonably conclude that the market is inefficient if:

a. the analyst were to observe significant t statistics on the day of the subject event and

b. the analyst had reason to believe that the subject event (including its magnitude) was anticipated.

Issues in the Measurement of Specific Economic "Events"

When designing an event study, the quantitative measurement of the subject economic event is not always obvious. For example, let's assume that the subject event is the public announcement of the company's annual earnings. The public announcement that the company's annual earnings are $5.00 per share is not meaningful—unless this earnings

announcement is contrasted to the market's expectation about the subject company's earnings.

Moreover, the market's expectation of the subject company's earnings may be conditioned by management's earlier public disclosure as to the projected earnings.

Therefore, the first issue in measuring the subject event is to disaggregate:

1. the unanticipated component of the subject company's earnings public announcement from
2. the expected component of the subject company's earnings public announcement.

The unanticipated component of the subject event is likely to be positive for some securities—and negative for other securities. Therefore, the test of statistical significance may be conditioned on the direction of the subject event.

This directional component can be measured by disaggregating the observation sample into:

1. a subsample of securities for which the event was positive and
2. a subsample of securities for which the event was negative.

Another issue with regard to the measurement of the subject event is the influence of "confounding" factors. Let's assume that the subject event is defined as the public announcement of a proposed merger. For many securities, this public announcement may coincide with an information release or a public disclosure regarding the subject company's earnings.

This coincident information disclosure is typically called a "confounding event." That is, a "confounding event" is an event that may distort or camouflage the effect of the particular economic event on the subject company's rate of return.

Issues in Measuring and Normalizing the Rate of Return

In the above description of the analytical procedures related to an event study, we isolated the company-specific component of the rate of return by using the market model. The rates of return should be "normalized"—so that the expected value of the unanticipated component of the rates of return is equal to 0 percent.

It is acceptable that the expected value of the unanticipated component of the rate of return related to the subject event not be equal to zero. And, it is equally acceptable that the unanticipated component of the rate of return related to the absence of the subject event be systematically nonzero.

However, the probability-weighted sum of the unanticipated components of the rate of return should equal zero.

The Mean Adjustment

The use of the market model is a generally accepted procedure for adjusting rates of return. However, some event studies adjust rates of return by subtracting from these returns the average return of the securities during the pre-event time period.

This rate of return normalization adjustment procedure is called the "mean adjustment."

The Market Adjustment

Another generally accepted rate of return normalization adjustment procedure is to subtract (1) the market's coincident rate of return from (2) the subject security's actual rate of return.

This rate of return normalization adjustment procedure is called the "market adjustment."

Risk Adjustment Normalization Procedures

The above-described normalization adjustment procedure used to normalize the unanticipated component of the rate of return to zero—using the market model—is called the "risk adjustment."

The unanticipated component of the rate of return is estimated by:

1. computing an expected rate of return in time period t and then
2. subtracting the expected rate of return from the subject company's actual rate of return in time period t.

The first step in this normalization procedure is to estimate each security's beta coefficient. The beta coefficient is estimated by regressing:

1. the subject security's rates of return against
2. the total stock market's rates of return.

This regression analysis is performed over some pre-event measurement time period. Then, the rates of return across many securities in the same time period t are regressed against their historical betas, as of the beginning of time period t.

The intercept and the slope from this cross-sectional regression are then used to measure the subject company's expected rate of return.

Specifically, the subject security's expected rate of return in time period t is equal to (1) the cross-sectional alpha in time period t plus (2) the cross-sectional beta in time period t multiplied by (3) the subject security's historical beta.

Therefore, the subject security's unanticipated component of rate of return is equal to (1) the security's actual rate of return in time period t minus (2) the security's expected rate of return in time period t (i.e., estimated from the cross-sectional coefficients and the subject security's historical beta).

The final step in this normalization procedure for the unanticipated component of rate of return to equal zero uses a "control portfolio." A "control portfolio" of sample securities is artificially constructed so as to have a beta coefficient equal to 1.

The unanticipated component of the rate of return in an event-related time period is computed as:

1. the rate of return of "control portfolio" less
2. the rate of return of the overall stock market.

Issues in Evaluating the Results of an Event Study

In the earlier example, the t statistic was used to evaluate whether the subject economic event actually affected the subject security (i.e., the subject public company) rate of return. The use of the t test assumes that the rates of return of the securities from which the sample is drawn are normally distributed.

If the analyst has reason to believe that the rates of return of the sample securities are not normally distributed, then the analyst should use a "nonparametric" test to evaluate the event study result.

A "nonparametric" test, which is sometimes referred to as a "distribution-free" test, does not rely on the assumption of a normal distribution of rates of return.

The Sign Test

One of the simplest nonparametric tests is called the "sign test." Not only is the sign test distribution neutral, but it is also insensitive to the magnitude of the rates of return.

The sign test simply tests whether there are more positive returns (or more negative returns, as the case may be) than would be expected if the rates of return and the subject economic event are <u>not</u> related.

The calculation of the test statistic for the sign test is presented below:

$$Z = \frac{(X - 0.5) - 0.5N}{0.5\sqrt{N}}$$

where:

Z = the normal deviate

X = the number of company-specific returns that are positive (or negative)

N = the number of securities in the selected sample

For example, if 13 returns are positive out of a sample of 20 securities, then the normal deviate would equal 1.12. That result would mean that the analyst should fail to reject the null hypothesis. In this case, the null hypothesis is that the subject economic event has no effect on company-specific rates of return.

However, if 65 returns are positive out of a sample of 100 securities (i.e., the same proportion

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as 13 securities out of 20), then the normal deviate would equal 2.90. The analyst should reject the null hypothesis. Again, the null hypothesis is that the subject economic event has no effect on company-specific rates of return.

In other words, the analyst should conclude that the subject event does affect company-specific rates of return.

The sign test is one of the several "nonparametric" tests that analyst may use when:

1. the assumption of a normal distribution of rates or return is uncertain or
2. the subject securities' rate of return data are limited to ordinal values.

Tests of Cross-Correlation

The *t* statistic also assumes that the rates of return across the sample of securities are independent of one another. However, in many cases, security rates of return may not be mutually independent. This conclusion is true even after the rates of return are risk adjusted. That is, securities may have other common sources of risk—in addition to their exposure to the general stock market.

For example, the market-adjusted rates of return of public securities within the same industry may be correlated with each other. This type of cross-correlation is particularly common in event studies of mergers and acquisitions—when the propensity for merger/acquisition activity is an industry-wide phenomenon.

Damages analysts are often asked to identify events that may have caused economic damages. And, analysts are often asked to measure the amount of damages suffered by the claimant party. Analysts often use event studies to:

1. identify the damages event and
2. measure the amount of the economic damages suffered by the claimants.

The use of event studies is particularly common in commercial litigation claims of fraud against the market or of accounting fraud and misrepresentation. And, event studies are also useful to prove (or disprove) the application of the efficient market hypothesis in dissenting shareholder appraisal rights matters involving public company mergers and acquisitions.

Sometimes, the phenomenon of cross-correlation may be corrected by expanding the risk-adjustment procedure in order to account for the portion of the rate of return that arises from:

1. industry affiliation or
2. the exposure to some other source of industry-wide risk.

Summary and Conclusion

This discussion summarized the procedures related to the damages analyst's use of the event study to test the efficient market hypothesis. In particular, this discussion summarized the use of an event study in a damages analysis to quantify the affect of a specifically defined economic event on an individual public company's rate of return.

Such an economic event could relate to a management change, a particular management policy, a merger or acquisition, the award of a patent or license, and so on. Such an economic event could also relate to the failure of any of these expected events to actually occur.

This discussion presented the procedural mechanics for quantifying the effect of an event (or of a nonevent) on the rate of return of the subject publicly held security (or of the subject public company). From this analysis, it is relatively easy for the analyst to quantify the impact on the value of the subject company's stock (and, therefore, the subject company's overall value) of the specifically defined economic event.

This event study analysis may then be used to quantify the amount of economic damages, if any, suffered by the subject company stockholders related to the following:

1. An identified economic event
2. The nonoccurrence of an identified economic event
3. The failure to publicly announce or disclose the identified economic event

Analysts who identify such economic events and then measure the associated economic damages should be familiar with both the theoretical underpinnings and the quantitative applications of event analyses.