Understanding the Event Study

ABSTRACT

Event studies are widely used in business research. Conducting an event study involves identifying an event of interest, estimating abnormal stock returns relating to the event and then testing the significance of the event. This paper describes the application of event study methodology, and reviews the practice and variations of the method.
Understanding the Event Study

INTRODUCTION

An event study is an empirical analysis that is normally used to measure the effect of an event on stock prices (returns). Although the majority of previous literature investigates stock prices, several studies examine stock trading volume, or return volatility. The event study is of importance because it can be used to evaluate the impact of company policies on firm value. The empirically conducted study is based on the following assumptions.

- Under the market efficiency hypothesis, the impact of an event will be instantly reflected in stock prices. Therefore, the market reaction to the event can be measured by stock returns over the study time period.

- The event is unforeseen. Abnormal (excess) stock returns indicate the market reaction to the unanticipated event.

- During the event window, there are no confounding effects, meaning that the effect of other events is isolated.

This paper discusses the purposes of an event study and provides examples of previous event studies. The discussion includes an explanation of the applications and procedures in conducting such a study. The last part of the paper describes the limitations of the event study method.

PURPOSES AND EXAMPLES OF EVENTS

An event study is commonly developed to attempt to measure whether an unanticipated event could have an effect on stock prices and the direction and magnitude any perceived effects might have on those stock prices. The event study method is applied in different research areas, such as accounting and finance, management, marketing, information technology, law and economics. Early literature on event studies are include an investigation of the impact of annual earnings announcement on stock prices (Ball and Brown, 1968) and a study of the announcement of stock splits on stock returns (Fama et al., 1969).

Ball and Brown (1968) concluded that annual accounting income data contains information that is related to stock prices. They found that income forecast errors, which are measured by the difference between announced and expected accounting earnings, have a positive impact on the abnormal performance index around the annual report announcement date.

Fama et al (1969) also note that stock prices appear to adjust to new information. Stock splits generally occur following periods when stock prices significantly increase relative to the market. They found that, after a split announcement, stock prices seem to quickly reflect all available information and do not generate any abnormal returns. The results demonstrate the efficiency of the capital market.

In this paper, examples of events are provided, including firm-specific events and economy-wide events. The firm-specific events mainly involve a change in or a new implementation of company policy. Examples of firm-specific events used in previous event studies are as follows.

- The announcement and completion of a takeover bid/divestiture (Agrawal and Mandelker, 1990; Lys and Vincent, 1995; Gregory, 1997; Bruner, 1999)

- Initial public offering (Ritter, 1991; Loughran and Ritter, 1995; Espenlaub et al., 2001)

- Seasoned equity offering (Loughran and Ritter, 1995; Carlson et al., 2006)

- Earning management practices before IPO and SEO (Teoh et al., 1998a; Teoh et al., 1998b)
• Obtaining new bank loans or loan renewal (Lummer and McConnell, 1989)
• Selecting an auditor and its reputation (Weber et al., 2008)
• An appointment of a new CEO with financial expertise (Defond et al., 2005)
• Top executive changes (Bonnier and Bruner, 1989; Dahya et al., 1998)
• Sudden CEO vacancy (Lambertides, 2009)
• Compensation plan policy (DeFusco et al., 1990; Yermack, 1997; Yeo et al., 1999)
• An internet name change (Mase, 2009)
• An advertising campaign (Kim and Morris, 2003; Choong et al., 2007)
• Football results of listed European clubs (Benkraiem et al., 2009)
• IT investments (Roztocki and Weistroffer, 2009)
• Enterprise resource planning system (ERP) implementation (Benco and Prather, 2008)

Economy-wide events are often used in large sample event studies, which examine the effect of a particular event on relevant firms. The following studies are examples of economy-wide events.
• A new item of legislature (Schipper and Thompson, 1983; Schumann, 1988)
• Sarbanes Oxley Act (Small et al., 2007)
• A financial crisis (Baek et al., 2004)
• The “9/11” terrorist attack in New York (Homan, 2006)

RESEARCH DESIGN AND PROCEDURES OF AN EVENT STUDY

Event studies can be designed in different ways to reflect specific purposes and research questions. The event study can be used in both clinical studies and large sample studies. A clinical study investigates the effect of an event on stock prices of a single company, such as an analysis of the market reaction to a takeover announcement; where the study focuses on the acquiring firm and/or on the target firm (Lys and Vincent, 1995; Bruner, 1999). Large sample studies examine the impact of an event on prices of different sample stocks. Examples of this type of event study include the effect of company policy implementation in a large sample of listed firms, such as a stock split, a top management compensation policy, or a director appointment policy (Fama et al., 1969; Yermack, 1997; Defond et al., 2005).

In addition to the effect of an event on stock returns, researchers have examined the impact of an event on stock volatility (DeFusco et al., 1990; Engle and Ng, 1993; Jayaraman and Shastri, 1993), on stock trading volume (Benkraiem et al., 2009; Karafiath, 2009), or on accounting performance (Barber and Lyon, 1996). Furthermore, not only company stocks, but also other types of securities can be considered in the event study. Prior research using event studies has analyzed effects on company bonds, where abnormal bond returns can demonstrate the market impact of event announcements (Gugler et al., 2004; Asquith and Wizman, 1990; DeFusco et al., 1990; Steiner and Heinke, 2001).

When designing an event study, the length of the event periods and the expected availability of data will be considered in determining the return frequency. Choices of return frequency can be daily, weekly, monthly, or annually. Daily and monthly returns are commonly found in previous literature. Daily data is often used for short-term event studies (Lummer and McConnell, 1989; Small et al., 2007), whilst monthly data is normally chosen for long-term studies (Ritter, 1991; Teoh et al., 1998b).
Understanding the Event Study

In this part, I will describe the five main steps in conducting an event study.

**Step 1.** Identifying the event of interest and selecting sample firms/stocks.

The first step requires researchers to identify the event of interest and to specify the date of this event. The event date is defined as the announcement date of the event, or ‘day 0’. Using the defined event and event date, sample firms (stocks) can be selected and classified into different groups. If the event type is company-specific, and a number of companies are to be included in the study, then the event date may be different for each of the companies. Researchers are required to record data for each sample firm according to its event date.

**Step 2.** Identifying the timeline of an event study.

In each event time period, researchers have to identify the test period (TP) and the estimation period (EP). The test period is also called the event window. The impact of an event on stock prices/returns will be examined in the test period, which is in a range of \(-T_2 \) to \(T_3\) around the event date/announcement date (day 0) as shown in Figure 1. Many studies focus on the effect of the event on stock prices over short event window(s) around the event, such as a 2-day (-1,0) period (Lummer and McConnell, 1989; Bruner, 1999), and a 3-day (-1,1) window period (Small et al., 2007). Long-term event window(s), which cover months or years before or after the event date, are also reported in several papers, such as a 36-month window (Ritter, 1991; Hertzel et al., 2002) and a 60-month window (Gregory, 1997; Teoh et al., 1998b).

The estimation period, which is in a range of \(-T_1 \) to \(-T_2\), as demonstrated in Figure 1, covers a period over which the expected return of sample stocks will be estimated. This period is reasonably long; however, the number of days/weeks/months selected for the estimation period is set to reflect the expected frequency of data availability, such as 150 days (Lummer and McConnell, 1989), 225 days (Small et al., 2007) and 239 days (Brown and Warner, 1985; Defond et al., 2005). In some cases, such as a takeover event, the estimation period might be specified to occur after the event window.

**Step 3.** Estimating the expected return for each sample stock over an estimation period.

![Figure 1: Time line of an event study](image-url)
The expected return, \( E(R_{ij}) \), is used as the benchmark return in the normal situation to compare with the actual return during the event window(s). The benchmark return represents the return that is not related to the event of interest. There are choices of model to estimate expected returns.

3.1) Mean-adjusted return
\[
E(R_{ij}) = \overline{R}_i
\]
The mean return is the average return over the estimation period. Each stock can use the average return during the estimation period as its own expected return (Brown and Warner, 1985; Lambertides, 2009).

3.2) Market-adjusted return
\[
E(R_{ij}) = R_{m,t}
\]
The expected return is the market return \( (R_{m,t}) \) at the same period of time, assuming that all stocks, on average, generate the same rate of return (Ritter, 1991; Bruner, 1999; Teoh et al., 1998b; Weber et al., 2008). Using the market-adjusted return method does not require an estimation period.

3.3) Market-model-adjusted return
\[
E(R_{ij}) = \hat{\alpha}_i + \hat{\beta}_i (R_{m,t} - R_{f,t})
\]
The expected return is computed based on a single factor market model. The parameters of the market model, i.e. \( \hat{\alpha}_i \) and \( \hat{\beta}_i \), are estimated using Ordinary Least Square (OLS) regression over the estimation period. This method is used to control the relation between stock returns and market returns, or allows for the variation in risk associated with a selected stock. The market-model-adjusted return is commonly found as an expected return in previous event studies (Bonnier and Bruner, 1989; Lummer and McConnell, 1989; Schipper and Thompson, 1983; Homan, 2006; Small et al., 2007).

3.4) CAPM-adjusted return
\[
E(R_{ij}) = R_{f,t} + \hat{\beta}_i (R_{m,t} - R_{f,t})
\]
Using the Capital Asset Pricing Model (CAPM), the expected return is the outcome of the risk-free rate return \( (R_{f,t}) \) plus market risk premium (Espenlaub et al., 2001). \( \hat{\beta}_i \) of the model measures the risk of stock \( (i) \), assuming that an investor requires higher return to compensate for higher risk.

3.5) Reference portfolios
The expected return in this method is the return of the reference portfolio. The portfolio comprises stocks based on the criteria of size, the book-to-market ratio, or both size and the book-to-market ratio. To calculate this benchmark expected return, the estimation period is not required. Researchers generally rank all firms into different groups by a particular characteristic; for example, into ten size-different groups. Then an average return for all stocks in each group is calculated as the expected return of a reference portfolio. Examples of event studies using this method are Ritter (1991) and Barber & Lyon (1997).

3.6) Matched firm approach
Similar to the reference portfolio method, the expected return is assumed to be the same as the return of matched stocks during the test period. The matching process will be done on the basis of relevant risk characteristics and the matched stocks not being exposed to the event of interest. The common matching characteristics are size (i.e. equity market value), the book-to-market ratio, and the combination of both. For example, using size characteristics, the abnormal return of an event stock is the difference between its actual return and the portfolio return of matched stocks in the same range of equity market value (Ritter, 1991; Loughran and

---

\(^1\) Reference portfolio: by size (Ritter, 1991; Barber & Lyon, 1997), by book-to-market ratio (Barber & Lyon, 1997), by size and book-to-market ratio (Barber & Lyon, 1997).
**Understanding the Event Study**

Ritter, 1995; Barber and Lyon, 1997). Several authors have reported the use of combined size and book-to-market matching (Barber and Lyon, 1997; Teoh et al., 1998a; Hertzel et al., 2002; Carlson et al., 2006).

3.7) Fama-French three factor model

\[ E(R_{jt}) = R_{jt} + \hat{\beta}_1 (R_{kt} - R_{f,t}) + \hat{\beta}_2 SMB_t + \hat{\beta}_3 HML_t, \]

This method is an extension of the CAPM-adjusted return, combining more risk factors, i.e. a market excess return factor, \((R_{kt} - R_{f,t})\) a factor for size (small minus big, SMB) and a factor for book-to-market-equity ratio (high minus low, HML) (Fama and French, 1993). SMB is the difference between average returns of small stock portfolios and those of big stock portfolios. HML is the difference in average returns between high and low book-to-market stock portfolios. This method uses monthly returns over a long period of time. It can be implemented as in the CAPM and is widely used in previous work (Barber and Lyon, 1997; Loughran and Ritter, 1995; Teoh et al., 1998b; Hertzel et al., 2002; Dutta and Jog, 2009).

**Step 4. Computing abnormal (or excess) returns.**

An abnormal return for an individual stock is the difference between the actual return on time \(t\) in the event window and the expected return of an individual stock.

\[ AR_{jt} = R_{jt} - E(R_{jt}) \]

To calculate the cumulative abnormal return (CAR) for an individual stock, the abnormal return of each stock is aggregated over the event window \((-T_2 to T_3)\).

\[ CAR_{jt} = \sum_{t=-T_2}^{T_3} AR_{jt} \]

The buy-and-hold abnormal return (BHAR) for an individual stock is the difference between the buy-and-hold return of a sample firm and that of the benchmark expected return, assuming that an investor buys a stock and holds it until the end of the event period (Ritter, 1991; Teoh et al., 1998a; Hertzel et al., 2002).

\[ BHAR_{i(t,-T_2,T_3)} = \prod_{t=-T_2}^{T_3} (1 + R_{jt}) - \prod_{t=-T_2}^{T_3} (1 + E(R_{jt})) \]

The average abnormal return for all sample stocks on time \(t\) can be calculated as follows.

\[ \overline{AR}_t = \frac{1}{N} \sum_{i=1}^{N} AR_{jt} \]

**Step 5. Testing the significance of abnormal (excess) returns.**

To test the significance of abnormal returns, most event studies use a parametric test of t-statistics (e.g. Brown and Warner, 1985; Barber and Lyon, 1997); however, non-parametric tests, such as a sign test, or a rank test (e.g. Benco and Prather, 2008; Benkraiem et al., 2009), can be applied to confirm the results2.

For an individual firm \((i)\), whether or not the abnormal return is different from zero can be tested by t-statistics as follows.

\[ t_{st} = \frac{AR_{i,t}}{S_{AR_{i,t}}} \]

Across \(n\) firms, the following formulae give parametric test statistics, which are used to investigate if the average cumulative, or buy-and-hold abnormal returns are equal to zero.

---

2 Parametric tests have some specific assumptions, such as normal distribution of returns; while non-parametric tests allow for any distribution of data.
LIMITATIONS OF THE EVENT STUDY

The event study is a simple research method which allows uncomplicated interpretation of results. The method has been commonly used by researchers to examine how events can affect both gains and losses in company value as perceived by the market. It is also used to measure the market-based performance in terms of abnormal stock returns in situations where researchers anticipate that inaccuracies in financial statements may give an inaccurate measure of company performance. Although the event study methodology is useful in several ways, there are some major limitations.

First of all, the assumptions used in event study methodology are not valid in some circumstances. Due to market inefficiency observed stock prices may not fully and immediately reflect all information. Furthermore, events might be anticipated in some situations, whilst unforeseen coexisting events could also have an effect on the sample stocks, which could lead to biased stock returns. Therefore, abnormal returns are not entirely the result of market reaction to the specific event of interest.

Secondly, variations in estimation and test periods are commonly found in event studies. Precise estimation periods are not easy to determine. The length of the estimation period is subject to a tradeoff between improved estimation accuracy and potential parameter shifts. Moreover, the estimation period is difficult to control for other confounding effects if researchers select long test periods, or long event windows.

Thirdly, the choice of model to estimate expected returns will have a bearing on the results in the magnitude and the significance of abnormal returns. For example, using the average return method is simple, but it produces upwardly, or downwardly biased abnormal returns in bull and bear markets, respectively. Ritter (1991) also documents that using different market indices to calculate market-adjusted returns can show differences in long-term performance results. More importantly, if the expected return is incorrectly estimated, other factors that are not properly controlled could lead to biased information in the event study results.

Fourthly, not all stocks trade every day. Thin trading over the estimation and test period is a problem in event studies. For example, stock and market returns might not be available on the selected days throughout the estimation period if researchers apply the market model or Fama-French three factor model.

Fifthly, calendar time clustering of events is a problem of cross-sectional dependence if test periods, or event dates of sample stocks are clustered in the same calendar time period (Brown and Warner, 1980). When the test periods of those stocks overlap in calendar time, the problem of cross-correlation in abnormal returns could exist. However, in traditional large sample studies, the event of interest is assumed to be isolated from other effects. Calendar time is not expected to be problematic because the effects of other events are supposed to be cancelled out across the large sample of firms.
Understanding the Event Study

Bibliography


LAMBERTIDES, N. (2009) Sudden CEO vacancy and the long-run economic consequences. Managerial Finance, 35,
**Understanding the Event Study**

645-661.


