Business Economics
Vol. 48, No. 1

Using Event Studies to Assess the Impact of Unexpected Events

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The quantitative assessment of the financial impact of unexpected events is the realm of the "event study." We examine how CEOs, boards, and public policymakers can utilize event studies to inform and improve their decision making. The breadth of application of event studies is surprisingly broad and ranges from situations involving the death of a CEO to emergency product recalls. We present illustrative event studies for two Steve Jobs-related announcements concerning his health in order to demonstrate both the potential and limitations of the technique.
Business Economics (2013) **48,** 58–66.
doi:10.1057/be.2012.34

Keywords: *event study, equity markets, Apple, Steve Jobs*

> *"The only certainty is that there is nothing certain."* Pliny the Elder, Roman author and philosopher (Pliny, A.D. 79).

Were Pliny the Elder alive today, he probably would observe that the world hasn't changed very much. Life continues to feature a host of uncertainties; recent events such as the earthquake in Japan and financial problems in Europe underline the necessity for economic decision makers at all levels to expect the unexpected. If anything, Taleb's now famous *Black Swans* [2007] seems to appear with increasing frequency.

The reality that unexpected events always have cluttered the landscape does not absolve business leaders, board members, and public policymakers from having to cope with such events. One of the many things such decision makers must do when faced with the unexpected is to assess the financial impact of those unanticipated events. Consider three brief examples, each of which we will discuss further later in this paper.

- In 2008, false bankruptcy information about United Airlines suddenly was flushed into the marketplace. If United were to pursue a legal remedy, then it had to estimate the costs imposed upon it by the false information.
- Suppose a firm's CEO dies, or is suddenly replaced. How does this impact the firm's value? What proportion of any share price changes that occur are due to the leadership change rather than to other influences?
- In 1982, malicious tampering with Johnson and Johnson's Tylenol pain reliever resulted in the deaths of seven consumers and a product recall. How did this tragic event affect Johnson and Johnson's market capitalization, and what ripple effects did it have on the value of other firms that were supplying close substitutes?

The quantitative assessment of the economic impact of unexpected events such as these is the realm of "event studies," a useful financial and statistical technique with which corporate economists, CEOs, board members, and public policymakers should be familiar. In this paper, we supply the most crucial nuggets of knowledge about event studies, beginning with a description of the mechanics of the technique and its assumptions, followed by examples and caveats about its appropriate use. We end with a specific, illustrative event study application relating to the illness and death of Steve Jobs and their subsequent effects on the share price of Apple stock.

1. The Event Study as a Business Economics and Managerial Tool

Event studies rely upon a factual-counterfactual model that takes the firm's actual stock price return

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after a specific event and compares it with a counterfactual share price return that assumes the event never took place. The difference between the actual return and the counterfactual return is an "abnormal return." The abnormal return is directly related to the change in a firm's market capitalization. Daily abnormal returns ("DARs") are computed for each post-event trading day in the analysis. Cumulative abnormal returns ("CARs") are the accumulation of DARs over a specific, limited number of days.

Campbell and others [1997, p. 149] suggest that the first published event study concerned the impact of announced stock splits on firms' share returns [Dolley 1933]. However, the event study methodology did not attain popularity or sophistication until the 1960s [Ball and Brown 1968; Fama and others 1969]. An important impetus for the Ball and Brown and Fama research was a desire to test variants of the efficient market hypothesis.

Since then, event studies typically have focused upon the impact of unanticipated announcements and events on share returns and have assumed that equity markets are relatively efficient. In short, "event study methodology has… become the standard method of measuring security price reaction to some announcement or event" [Binder 1998, p. 111]. Many early studies examined the impact on share returns of announcements of stock splits, actual and projected earnings, and mergers and acquisitions.

Soon after, other fields, including economics, law, management, and marketing, embraced event study methodology. There are hundreds of such studies and they span topics such as product tampering, product failures and recalls, regulatory changes, natural disasters, fraudulent acts, executive turnover, and executive compensation. Bowman [1983], Armitage [1995], MacKinlay [1997], McWilliams and Siegel [1997], Binder [1998], and Johnston [2007] have cataloged many of these studies and also have examined some of the theoretical and empirical issues that arise when one performs such studies.

It is often important that decision makers be able to assess the impact of unanticipated events. Thus, an organization's Board of Directors, in determining the compensation of its CEO and other top executives, is better situated if it is able to separate the performance impact of unanticipated events (either good or bad) from what would have been the case, but for the unexpected event. Event studies can be a useful analytical tool in such cases. McWilliams and Siegel [1997, p. 626] note that event studies have become an increasingly popular tool because they obviate the need to analyze potentially deceptive accounting-based measures of profits. Kane [2004] is one of many who have examined how accounting-based profit measures unfortunately can generate inaccurate perceptions of company prosperity—disinformation about the true status of a firm.

2. Illustrative Examples of Event Studies

The following examples provide insight into the breadth of circumstances in which event studies can be applied.

Product tampering: One of the most notable unanticipated events—in terms of its effect on a firm's market value—involved the 1982 malicious tampering with Tylenol, an over-the-counter (OTC) pain-reliever. The perpetrator added potassium cyanide to extra strength Tylenol tables in the Chicago metropolitan area, and ultimately this resulted in the death of seven consumers.[1] Using an event study method, Mitchell [1989] estimated that the CAR to Johnson and Johnson (J&J's) shares was −24.4 percent in the 20 days after the announcement of deaths due to product tampering (p. 609). This translated into a reduction in J&J's market cap of $2.11 billion (p. 609). Mitchell also estimated that $1.24 billion of this loss could be attributed to the diminished value of the J&J and Tylenol brand names (p. 612). J&J's misfortune, however, created additional ripples throughout the industry. Mitchell found that the average CAR in the same time period for 22 other OTC pharmaceutical firms was −6.8 percent. This translated into a collective $4.1 billion in diminished market cap for these other firms (p. 617).[2]

[1]The perpetrator(s) never were identified and convicted, though an individual was convicted of attempting to extort J&J after he offered to halt the tampering in return for a substantial sum. Several copycat adulterations of similar products occurred in subsequent years.

[2]A study by Dowdell and others [1992] suggests that in fact there were two events occurring in the 20-day period studied by Mitchell. They noted that approximately one week after J&J's announcement of product tampering, the Food and Drug Administration (FDA) made an unexpected announcement that it was holding hearing on product packaging and would promulgate new product packaging regulations for OTC drugs. Dowdell and others estimated J&J's CAR for the 7-day period after its initial product tampering announcement

Airline crashes: Corporate tragedies come in many forms and often have a major effect on the value of firms. Chance and Ferris [1987] examined the impact of 46 airplane crashes on the returns to the carrier involved in the crash as well as to other carriers. They found that the carriers involved in an airplane crash lost, on average, 1.2 percent of their market cap one trading day after the crash. They also found that the returns for carriers not involved in the crash were not affected by the crash of a rival carrier. In this vein, Chalk [1987] examined the impact of airplane crashes on aircraft manufacturers. Chalk limited his investigation to crashes where the aircraft involved in the crash was suspected to be a possible cause of the crash. Using an event study, he estimated the average CAR to an aircraft manufacturer after such an aircraft disaster to be −3.8 percent. He did not find evidence that such a crash impacted the situations of rival aircraft manufacturers.

False information: Rumors and false information are rampant in some markets. When such occur, what impact does the bad information have upon the share prices and market caps of related firms? Carvalho and others [2011] analyzed the impact of totally erroneous news that was distributed in 2008 about a prospective bankruptcy declaration by United Airlines. The trio found that United's share price quickly dropped by 76 percent after the false announcement and was down more than 11 percent even after the false nature of the information was firmly revealed. Indeed, they argued that the fallacious news even had statistically significant negative effects upon the share prices of airlines other than United. By contrast, Koch and others [2011] found that false Internet blog news that Steve Jobs had suffered a heart attack did not have a statistically significant impact on Apple's share price, although by the end of the event period, the "but for" price was lower than the actual price. Clearly, much depends upon the credibility of the news source and how quickly investors can determine what is factual.

Corporate litigation: Bhagat and others [1998] systemically reviewed the impact of corporate litigation on changes in market cap. The authors examined publicized lawsuits filed between 1981 and 1983 in which a corporation newly became a party to a lawsuit. They found that the average CAR of the defendant firm was −1.73 percent when the firm in question was sued by a government entity, −0.75 percent when it was sued by other firms, and −0.81 percent when filed by still other parties (p. 6). The lawsuits with the largest negative impact on a defendant firm were environmental cases (average CAR = −3.08 percent); security law cases (−2.71 percent); patent infringement (−1.50 percent); and product liability cases (−1.46 percent) (p. 18). Perhaps even more noteworthy, however, was their finding that the average CAR for plaintiff firms (those who filed the lawsuit) was not significant. For example, the average CAR for a plaintiff corporation filing an antitrust suit was only 0.13 percent (p. 18) and numerous plaintiff lawsuits resulted in negative CARs. The average CAR for a plaintiff alleging patent infringement was −0.31 percent (p. 18). This is useful information for decision makers contemplating a suit. Cichello and Lamdin [2006] provide a useful survey of the many different ways that event studies have been utilized in antitrust cases.

Management evaluation: "In 1991 defense contractor General Dynamics engaged a new management team that adopted an explicit corporate objective of creating shareholder value" [Dial and Murphy 1995, p. 261]. The question was could this commitment be translated into results? The duo found that from 1991 to 1993, the value of General Dynamics increased by $4.5 billion (p. 302). Employing an event study method, they estimated that $2.3 billion to $3.5 billion of the $4.5 billion increase was due to management's 1991 policy and implementation of that policy (p. 263). Boards of directors puzzling over executive compensation in similar circumstances should find this event study application useful.

CEO deaths and unexpected leadership turnover: How important is organizational leadership and how important are CEOs? These are perennial questions that have vexed observers and decision makers for many years because they impact how executives should be selected, what their duties should be, how much supervision they should receive, and how they should be compensated. An interesting way to obtain insight into these issues is provided by event studies that deal with the death of a CEO. A priori, it is unclear whether the death

to be −16.5 percent (p. 297). In addition, they estimated that the CAR for a sample of OTC firms that also sold pain relievers to be +2.0 percent (p. 297). While Dowdell and others concluded that J&J's OTC rivals initially benefited from J&J's problems, they also found that in the two and one-half week period after the FDA announced a public hearing and new product packaging rules, the CARs for both J&J and its OTC rivals were negative: −12.4 percent for J&J and −8.2 percent for its rivals (p. 297).

of a CEO should result in a negative or positive abnormal return [Haynes and Schaefer 1999; Nguyen and Nielsen 2010]. If the benefits to the firm under the direction of a recently deceased CEO exceed the market's estimate of the expected benefits to the firm under the direction of a new CEO, then the abnormal return will be negative, and vice versa.[3] Thus, one can acquire valuable information concerning the effectiveness of a new CEO as well as a post mortem on the value of the previous CEO.

Worrell and others [1986] found that the greatest negative impact on firm value occurred when a CEO (including CEOs-only and CEOs-Chairmen) died a sudden death. They found the average abnormal return for 41 firms that lost their CEO due to sudden death ranged from −1.3 to −2.7 percent (p. 682). For 61 firms that lost an executive (however, not necessarily because of a sudden death), the "market reacted positively to" the announcement of the Chairman's death (p. 682). The abnormal return was +0.78 percent (p. 683) on the day the Chairman's death was announced. Using a different data set, Nguyen and Nielsen [2010] reported an average CAR of −1.22 percent for 149 executives (81 CEOs, 28 Chairmen, and 40 "others" such as CFOs, COOs, and so on) that died suddenly.

These event studies generated several useful conclusions. First, leadership succession, even if born of tragic circumstances, is not necessarily disastrous. The negative impact on firm share prices in two of the three leadership categories was relatively modest. Second, the positive abnormal returns for the Chairman-only category may be due to the older age of these executives and that "…the market viewed such turnover as a positive sign and a chance for innovation and adaptation" [Worrell and others 1986, p. 686]. Indeed, Johnson and others' [1985] study of 47 unexpected deaths of founding senior executives (defined as Chairmen, CEOs or Presidents) found positive abnormal returns following the deaths of these individuals. Perhaps founding CEOs stay too long, become too narrowly focused, and fall into managerial ruts.

Haynes and Schaefer [1999] generalized this latter result in an event study that found an average abnormal return of 2.84 percent for firms whose CEOs died suddenly on the job (p. 136). Haynes and Schaefer suggest that their findings are consistent with the notions that older CEOs offer lower benefits to firms (ceteris paribus) and in any case that older CEOs are more likely to die suddenly. Thus, in defined circumstances, CEO turnover, even when the product of tragic circumstances, can be interpreted by investors as a positive development.

3. The Formal Event Study Methodology

Event studies usually "estimate abnormal returns at and around the time of some event relating to the shares concerned, for example, the announcement of a rights issue or a takeover bid" [Armitage 1995, p. 25]. Tests of statistical significance (typically t-tests) are then applied to these abnormal returns to ascertain if the event in question had an impact upon a firm's share prices independent of industry- or sector-wide share price behavior. The assumption is that rational investors will cause the effects of an event to "be reflected immediately in security prices" [MacKinlay 1997, p. 13]. Hence, brief daily share price "event windows" after the event in question ordinarily are preferred because they minimize the noise of other influences that might contaminate the analysis. A prototypical event study is based upon an estimating equation such as the following for an appropriately chosen, uncontaminated *estimation* period, typically just prior to the event.

$$R_t = \alpha + \beta R_{mt} + \varepsilon_t, \tag{1}$$

where:

$R_t =$ rate of return of a firm's stock on day t $(t = 1, 2, \ldots, n)$;
$R_{mt} =$ rate of return on day t of a market portfolio or index of stock;
$\alpha =$ intercept;
$\beta =$ the systematic risk associated with stock i; and
$\varepsilon_t =$ error term such that $E(\varepsilon_t) = 0$.

Relying on (1), *daily abnormal returns (DARs)* in the event period are estimated:

$$DAR_g = R_g - (a + \beta R_{mg}), \tag{2}$$

where: α and β are coefficient estimates obtained from (1) and, g refers to a particular day of the event period $(g = 1, 2, \ldots, m)$.

[3]Conceptually, the benefit to the firm is simply the profits the firm realizes from the CEO's employment. This is the incremental value of the cash flows the firm realizes under the CEO's management less the CEO's compensation.

Finally, cumulative abnormal returns (CARs)[4] are estimated as:

$$\mathrm{CAR}_g = \sum DAR_g \quad \text{for} \quad (g = 1, 2, \ldots, m). \tag{3}$$

Three critical assumptions underpin event studies. First, the event in question must have been substantially unanticipated. If many investors already have strong reason to expect an action to occur, then they will already have incorporated those expectations into the firm's share price and in essence the action has been transformed into a nonevent, financially speaking.

Second, event studies assume market efficiency. In practice, this usually means the investigator has adopted a "semi-strong" definition of market efficiency, that is, it is assumed that the prices of actively traded stocks reflect all publicly available information and rapidly adjust to any new information [Brealey and Myers 2003, p. 351]. An immediate issue, of course, is how rapidly markets actually do digest new information. That is, how long should the event window be in which one attempts to measure the impact of the original event? If one assumes market efficiency, then the event window should be brief, probably only one day in length.[5]

Third, both the estimation and measurement event windows must be free from the contamination of other significant intruding events that would amplify or cancel the event in question. Thus, if one seeks to estimate the impact of a new CEO on a firm's share price, but the estimation period includes other major firm-level happenings such as a positive earnings announcement, then the estimation period is contaminated and it will be very difficult to perform a legitimate event study.

4. Event Case Study One: Steve Jobs Announces Medical Leave

The charismatic and visionary Steve Jobs (1955–2011) of Apple, Inc. was one of the best known CEOs in the world. Jobs, who earned 313 patents, transformed multiple industries and in the process literally changed world culture. We now interact with each other and access information in very different ways because of Steve Jobs.

Table 1. Apple and Nasdaq Returns, December 3, 2010-January 18, 2011

Date	Apple Share Price	Apple Return	Nasdaq Index	Nasdaq Return
	Estimation period			
12/03/10	$317.44	−0.0022	2591.46	0.0047
12/06/10	320.15	0.0085	2594.92	0.0013
12/07/10	318.21	−0.0061	2598.49	0.0014
12/08/10	321.01	0.0088	2609.16	0.0041
12/09/10	319.76	−0.0039	2616.67	0.0029
12/10/10	320.56	0.0025	2637.54	0.0079
12/13/10	321.67	0.0035	2624.91	−0.0048
12/14/10	320.29	−0.0043	2627.72	0.0011
12/15/10	320.36	0.0002	2617.22	−0.0040
12/16/10	321.25	0.0028	2637.31	0.0076
12/17/10	320.61	−0.0020	2642.97	0.0021
12/20/10	322.21	0.0050	2649.56	0.0025
12/21/10	324.20	0.0062	2667.61	0.0068
12/22/10	325.16	0.0030	2671.48	0.0015
12/23/10	323.60	−0.0048	2665.60	−0.0022
12/27/10	324.68	0.0033	2667.27	0.0006
12/28/10	325.47	0.0024	2662.88	−0.0016
12/29/10	325.29	−0.0006	2666.93	0.0015
12/30/10	323.66	−0.0050	2662.98	−0.0015
12/31/10	322.56	−0.0034	2652.87	−0.0038
01/03/11	329.57	0.0215	2691.52	0.0145
01/04/11	331.29	0.0052	2681.25	−0.0038
01/05/11	334.00	0.0081	2702.20	0.0078
01/06/11	333.73	−0.0008	2709.89	0.0028
01/07/11	336.12	0.0071	2703.17	−0.0025
01/10/11	342.45	0.0187	2707.80	0.0017
01/11/11	341.64	−0.0024	2716.83	0.0033
01/12/11	344.42	0.0081	2737.33	0.0075
01/13/11	345.68	0.0037	2735.29	−0.0007
01/14/11	348.48	0.0081	2755.30	0.0073
Event period				
01/18/11	340.65	−0.0227	2765.85	0.0038

Jobs was labeled "the greatest leader our industry has ever known" [Swartz and Martin 2011]. Some stock analysts suggested that Apple was "possibly more dependent on its CEO than any other major company" [Bicheno 2009].

We will now compute DARs and CARs for two contrasting "events" for Steve Jobs and estimate the impact of those two events on Apple's share price and market cap.

On Monday, January 17, 2011, Steve Jobs took a medical leave [Kang 2011]. Although Jobs had been afflicted by health problems at least since 2004, this particular announcement was unanticipated.

[4]Because our event period is only one market period, DAR = CAR. When event periods are longer, then cumulative abnormal returns (CARs) are relevant.

[5]An anonymous referee noted that: (1) markets may not always respond quickly; and, (2) they respond based upon the state of their knowledge and judging after the fact, we may conclude that their responses were off target. Both comments have validity and underline why event studies, while useful, do not constitute an infallible approach to economic science.

Table 2. Summary of Two Events for Steve Jobs

No.	Date	Event Description	95 Percent Confidence Interval for Abnormal Returns				Actual share price	"But for" share price	Change in market cap (millions)
			Lower bound	Mean	Upper bound	*p*-value			
1	01/17/11	Jobs takes leave of absence	−0.039	−0.027	−0.015	0.000	340.650	349.930	−$8,547
2	08/24/11	Jobs resigns as CEO	−0.018	−0.005	0.027	0.681	373.720	372.020	+$1,580

Note: The abnormal returns are based upon a one-day event period.

Table 1 reports the actual share price of Apple's stock on January 18th (markets were closed on January 17th because of the holiday in honor of Dr. Martin Luther King, Jr.) and our "but for" estimate of what that share price would have been except for the announcement. Table 2 adds an additional wrinkle—a 95 percent confidence interval for the estimate of the abnormal return involved. We estimate that the abnormal return would range between −3.9 and −1.5 percent (with a mean of −2.7 percent) in 95 percent of the cases, were we able to draw a new sample from the same population.[6] We also estimate that when the news of Jobs' new health problem was flushed into the marketplace, this reduced Apple's share price by $9.28 and its market cap by $8.547 billion.

How did we generate these estimates? First, we calculated Apple's return. Formally, this return is calculated (assuming no dividends) as the $\ln(\text{APPL}_t/\text{APPL}_{t-1})$ where APPL_t is the Apple's closing share price on day t. We used the NASDAQ index as our measure of how the market as a whole was doing during a 30-day estimation period prior to this event. We calculated the market return as the $\ln(\text{NASDAQ}_t/\text{NASDAQ}_{t-1})$ where NASDAQ is the closing daily NASDAQ index value. We chose the 30-day estimation period because it was long enough to enable us to obtain an accurate read on what the market as a whole was doing, but not so long as to contain contaminating events, which occur frequently when a large, active company such as Apple is under consideration. We relied upon data from *Yahoo Finance* both for the values of Apple's share price and the NASDAQ index. The returns for December 3, 2010 to January 18, 2011 are shown in Table 1.

Second, we estimated equation (1) above where $R_t = \alpha + \beta R_{mt} + \varepsilon_t$. We found that:

$$R_t = 0.00153 + 0.68369 R_{mt}$$
$$t = 1.28 \quad t = 2.80$$
$$R^2 = 0.218$$

Third, relying upon the estimated results for equation (1), we estimated the daily abnormal

[6]Of course, it is impossible to draw another sample from the same population and, in any case, the underlying assumption that these phenomena are normally distributed could be contested. These realities should inspire a degree of modesty in those who draw excessively strong conclusions from event studies.

return specified in equation (2), or $DAR_g = R_g - (a + \beta R_{mg})$, where g is January 18, 2011. On that day, the first market day after the announcement of Jobs' medical leave, Apple experienced an abnormal return of −2.27 percent.[7] This was calculated as:

$$\begin{aligned} DAR_g &= R_g - (a + \beta R_{mg}) \\ &= -0.022725 - (0.00153 + [0.68369 * 0.003822]) \\ &= -0.022725 - 0.004143 \\ &= -0.026868 \end{aligned}$$

Fourth, we compared Apple's actual share price ($340.65) to the share price we predicted ($349.93) if Apple had imitated the NASDAQ index.[8] This difference was $9.28 per share and this reflected an $8.547 million (2.7 percent) decline in Apple's market capitalization.[9]

Fifth, we subjected this $9.28 per share price difference to a test of statistical significance (a t-test in this case) and found the difference to be statistically significant at the 0.000 level. Hence, we could reject our "null" hypothesis, which was that the announcement concerning Jobs' health made no difference in Apple's share price.

Sixth, we concluded that investors were made uneasy by this announcement concerning Job's health, but taking a larger view, their reaction was rather modest. By our event study reckoning, Jobs' presence at that point was worth only about 2.7 percent of Apple's market capitalization.

5. Event Case Study Two: Steve Jobs Announces Resignation

On Wednesday, August 24, 2011, Jobs announced his resignation as CEO [Pogue 2011]. Given the January revelation (Event One), this announcement was hardly a surprise and one easily could argue that its impact already had been thoroughly discounted by investors. Hence, a basic assumption of event studies did not hold. Witness the assessment of analyst Dirk Schmidt [2011]:

> I've shown repeatedly that Apple is trading at a discount to its growth and to its historic value and to its peer group, and since the health of their CEO is an uncertainty which must be discounted, the possibility exists that the de pressed value assigned to Apple is due to Steve Jobs' continuing presence in the company. If that is true then his departure should increase the stock price.

Using the same procedures as above, we found the 95 percent confidence interval estimate of the effect of Jobs' resignation on Apple's share price to be −1.8 to +2.7 percent, with a mean of +0.5 percent. We estimate that this announcement actually added $1.580 billion to Apple's market cap, though our estimate was not statistically significant.[10] Per Schmidt [2011], this suggests investors actually preferred having the uncertainty of Jobs' situation removed. It contradicts Bloomberg's [2011] snap judgment that Jobs' resignation had depressed overall equity markets by $52 billion. In light of apparent investor anticipation of Jobs' resignation, the application of event study techniques here is questionable. This is a lesson that decision makers should heed in order to avoid inappropriate application of event studies.

Steve Jobs' health became a *cause celebre* because many media analysts wrote and spoke as if they were positive that his health was critically connected to Apple's well-being and hence to its share price. Nevertheless, our two-event analysis as well as previous work [Koch and others 2011] suggest that by Summer 2011, equity markets investors overall were only mildly persuaded this was true.

Investors appear to have been confident that Tim Cook, who succeeded Jobs as CEO and who had stood in for him several times in the past when Jobs took leadership leaves, was highly capable and further that Cook was backed by a strong coterie of managers and scientists that was not going to disappear. This is a variant of the notion that Jobs was not Apple and Apple was more than Jobs. This view assumes, as did the *New York Times*, that

[7]Many event studies expand the regression to include both the estimation period as well as the event period by adding dummy variables to equation (1) to calculate the DARs and CARs directly from the regression [Binder 1998; Salinger 1992].

[8]Based on equation (1) results, *but for the event,* Apple's share price on January 18, 2011 would have been expected to grow by the market return, or 0.0041430, from its share price at close of the previous trading day. The predicted share price of $349.93 is Apple's actual closing price on January 18, 2011 divided by the antilog of the abnormal return—$340.65 divided by the antilog of −0.02686.

[9]Apple's market capitalization is based on a 10-Q SEC filing showing that it had 921,278,012 outstanding shares as of January 7, 2011 [Apple 2011].

[10]Apple's market capitalization is based on a 10-Q SEC filing showing that it had 927,090,886 outstanding shares as of July 8, 2011 [Apple 2012].

Apple had a "deep bench" [Helft and Miller 2011] and that Apple had succeeded in "recruiting a broad and deep talent base" [Lohr 2011].

At the end of the day, our event study evidence strongly implies that it was media pundits who bought into the notion that Jobs was irreplaceable, not investors.

6. Final Thoughts

It is not easy task for decision makers to isolate the contributions of specific employees, or to quantify the impact of unanticipated developments on the organizations. However, to the extent that decision makers can do so, they can make more knowledgeable decisions on matters ranging from employee compensation to whether they should initiate legal actions. Although event studies fall well short of qualifying as a universal mechanism to inform such decisions, they can be useful in defined situations. To wit, if an event is substantially unanticipated, the market involved is relatively efficient, and other intruding developments do not contaminate the situation in question, then event studies frequently can be a very useful managerial tool.

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