

## Do Investors Care if Steve Jobs is Healthy?

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**Abstract** Steve Jobs of Apple, Inc., is one of the best known CEOs in the world, and some stock analysts have termed him “irreplaceable.” Using conventional event study methods, we test the magnitude of these announcements on Apple’s share price and its market capitalization. We focus upon nine “events” between 2004 and 2009 in which new information about Mr. Jobs’ health was flushed into the marketplace, on occasion by Apple itself, but more often by the commentary and speculations of media observers, stock analysts and bloggers. We find that the impact of these announcements upon Apple share prices is mixed, usually modest, and disappears over time. We conclude that Jobs’ health has an impact on Apple’s share price and market capitalization, but that impact is not always negative and not nearly as large as many observers apparently believe.

**Keywords** Event study · Equity markets · Apple · Steve Jobs

JEL · G11 · G12 · G14

*“Great things in business are not done by one person; they are done by a team of people.” Steve Jobs (2002)*

*“Apple’s stock has fluctuated on concerns about Mr. Jobs’ health for more than a year.” Joseph Menn and Richard Waters (2009)*

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## Introduction

Steve Jobs of Apple, Inc. is one of the best known CEOs in the world and was one of the founders of Apple, Inc. In May 1985 he was dismissed as the head of the Macintosh Division. In September 1985, he resigned his position as Chairman of the Board to pursue other interests. This turned out to be a new company, NeXT Computer. In 1986, he purchased a majority interest in Pixar, formerly known as the Computer Graphics Division of Lucasfilm, Ltd. Disney purchased Pixar for \$7.4 billion in Disney stock in 2006. The sale resulted in Jobs becoming the largest shareholder in Disney with 7% of Disney's stock. In 1996, Apple purchased NeXT Computer and Jobs returned to Apple. In July 1997, he took over as *de facto* CEO, was officially named CEO on an interim basis in September 1997, and the "interim" label was officially dropped from his title in 2000 (Wikipedia 2010).

From late July 1997 to early 2010, Apple's market capitalization increased from \$2.4 billion to \$210.1 billion. Many attribute this growth to Jobs. Indeed, some stock analysts suggest that Apple "is possibly more dependent on its CEO than any other major company" (Bicheno 2009), and even the Sage of Omaha, Warren Buffett, recently observed that "Certainly Steve Jobs is important to Apple." (Buffett 2009).

It is alleged that Apple's share price flutters up and down in response to reports about the health of the 54 year-old Jobs (Menn and Waters 2009). In one instance, an analyst predicted a one to five percent climb in Apple's share price if Steve Jobs even made an appearance at a June 2009 Apple software developers' conference, while another predicted as much as a ten percent decline if he did not (Baldwin 2009). A prominent Apple-oriented blog argued in early 2009 that "concerns over Jobs' health have triggered disruptions in the company's stock price" (Macnn.com 2009).

Charles R. Wolf, an analyst at Needham & Company, estimated that "Apple's valuation might fall by a third if Jobs were to depart" (Guglielmo 2007). Bary (2007), writing on *Barron's* web site, estimated Job's value to Apple at approximately 20% of its market capitalization, or \$16 billion dollars in March 2007, and in March 2010 with Apple's market capitalization over \$200 billion, upped his estimate to \$25 billion (Bary 2010).

In late July 2008, Wolf offered the view that "Apple is Steve Jobs and Steve Jobs is Apple" (Nocera 2008). Wolf also told Nocera that Apple's share price "... would drop 25% or more if he were to leave the company unexpectedly." In July 2008, this implied a value for Mr. Jobs of about \$32 billion. The Apple Insider Blog (2010) estimated Jobs' value to Apple to range between \$20 and \$25 million.

Even so, not all observers agree about Jobs. Piper Jaffray stock analyst Gene Munster (2009) opined that Tim Cook, Apple's Chief Operating Officer, was more valuable to the company than Mr. Jobs.<sup>1</sup> Others (Fox 2009; Marshall 2009) have noted that Apple has maintained its profitability and efficiency of operation whether or not Mr. Jobs has been in the driver's seat. They concede that Mr. Jobs' health is a material fact concerning Apple about which investors should have accurate information, but contend that his health really does not make much difference either

<sup>1</sup> Apparently Munster changed his mind. He previously stated in 2007 that if Jobs were to leave Apple that "It would be a disaster. He would be almost impossible to replace." (Guglielmo 2007).

in Apple's operations, or in its share price performance. They suggest that while Apple's legendary penchant for non-disclosure and secrecy with respect to its activities concerning Mr. Jobs' health may be inadvisable, or perhaps illegal, it has not really had a strong impact on Apple's share price.

The impact of Steve Jobs' health on Apple's share price devolves ultimately to an empirical question. We utilize a conventional event study methodology to examine whether his health has had a statistically significant (at the .05 level) impact on Apple, Inc.'s share price. We focus upon nine "events" in which new information about Mr. Jobs' health was flushed into the marketplace, on occasion by Apple itself, but more often by the commentary and speculations of media observers, stock analysts and bloggers.

The first of these occurred on August 1, 2004, when Mr. Jobs sent an e-mail to Apple employees indicating that he had a less malignant form of pancreatic cancer. The ninth event occurred on January 14, 2009, when it was announced that Jobs had liver transplant surgery at a Memphis, Tennessee hospital. We estimate daily abnormal returns (DARs) and cumulative abnormal returns (CARs) for these nine episodes.

The evidence (as a whole) indicates that Mr. Jobs' health does have an impact on Apple's share price and market capitalization. However, our findings differ considerably from the conventional wisdom as reported in the trade press. It is apparent to us that trade press "analyses" almost uniformly ascribe all changes in the Apple's share return to Jobs and fail to consider other factors that affect Apple's share returns, such as changes in market conditions, or other Non-Jobs events. In short, the trade press analysis often tends to follow a *post hoc ergo propter hoc* methodology and vastly overestimates the impact of his health on Apple's share price.

## Event Studies as an Investigatory Tool

While the first event studies were generated as early as the 1930s (Dolley 1933), they did not attain popularity or sophistication until the 1960s (Ball and Brown 1968; Fama et al. 1969). Since then, dozens, if not hundreds of event studies have appeared. Bowman (1983), Armitage (1995), MacKinlay (1997), McWilliams and Siegel (1997) and Binder (1998) catalog many of these studies and examine theoretical and empirical issues that have arisen as a consequence. Event studies have emerged as a "powerful tool to detect the impact of specific events on security prices" (Binder 1998, p. 122).

In most cases, event studies "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 firms' 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, daily share price data and brief measurement 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 a period prior to the event:

$$R_t = \alpha + \beta R_{mt} + \varepsilon_t \quad (1)$$

where:  $R_t$  = rate of return a firm's stock on day  $t$  ( $t=1, 2, \dots, n$ );  $R_{mt}$  = rate of return on day  $t$  of a market portfolio or index of stocks;  $\alpha$  = 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 in the event period are estimated:

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

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

Typically, the first day of the event period is the first trading day after the estimation period, or  $g=n+1$ . Finally, cumulative abnormal returns are estimated as:

$$CAR_g = \sum DAR_g \text{ for } g = 1, 2, \dots, m \quad (3)$$

The estimated regression (1) is based on actual returns observed in the estimation period. The parameters of the regression are then used to calculate the DARs and CARs in the event period. Many event studies expand the regression to include both the estimation period and the event period by utilizing dummy variables to calculate the DARs (or CARs) directly from the regression (Binder 1998; Salinger 1992) This is the procedure that we follow in the empirical work we report below.

An event study is based on the semi-strong definition of market efficiency or that the prices of actively traded stocks, such as Apple's, reflect all publicly available information and will adjust to new information. (Brealey and Myers 2003, p. 351) One immediate issue, however, is how long does it actually take for the market to digest new information—which is another way of asking, how long is the event window? In this paper, we follow a rule that if the daily abnormal return on a subsequent trading day is statistically significant, then we assume that the market is continuing to incorporate information on Jobs' health (Krivin et al. 2003, p.8).

## The Nine Steve Jobs Events

Our empirical analysis examines nine Steve Jobs news-making events:

- (1) Sunday, August 1, 2004: Jobs sends an e-mail to Apple employees telling them that he has a less malignant form of pancreatic cancer (Fried 2004).
- (2) Monday, August 7, 2006: Jobs looks "thin and gaunt" while making a presentation at the Worldwide Developers Conference (Kahney 2006).
- (3) Monday, June 9, 2008: Jobs makes an Apple iPhone presentation and is widely reported to look sick (Blodget 2008).
- (4) Sunday, June 22, 2008: Apple announces that Jobs' health is not a problem (Wikipedia 2010).

- (5) Saturday, July 26, 2008: A *New York Times* article by Nocera (2008) speaks of Apple's "Culture of Secrecy" and includes some information from a telephone call made by Jobs to Nocera. Nocera wrote: "While his health problems amounted to a good deal more than 'a common bug,' they weren't life-threatening and he doesn't have a recurrence of cancer."
- (6) Friday, October 3, 2008: Internet blogger "Johnntw" makes an early morning post on CNN's iReport that "Steve Jobs was rushed to the ER just a few hours ago." The report jumped to the top spot in Google's Hot Trends report (Perez 2008).
- (7) Tuesday, December 16, 2008: Apple announced that Jobs would not appear at the MacWorld Conference in January, even though he had attended for this past decade. Apple also announced that it would withdraw from the conference in succeeding years, sparking questions about the company's future product lineup (Stone 2008).
- (8) Monday, January 5, 2009: Jobs sends an e-mail to Apple employees stating that a "hormonal imbalance" is the cause of his weight loss but says he will remain on the job while being treated for this condition (BBC 2009).
- (9) Wednesday, January 14, 2009: Jobs takes a medical leave (BBC 2009).

## Event Study Tests

The peculiar background pertaining to each of the nine events could be examined in detail. However, it is not necessary to do so in order to gain an understanding of the event study analytical process and its particular application to our subject of interest—perceptions of Steve Jobs' health and the impact of those perceptions on Apple's share prices. We will focus on two illustrative events—Sunday, August 1, 2004 and Monday, June 9, 2008—and then provide summary statistical analysis for all nine events.

Sunday, August 1, 2004

On July 10, 1997, Jobs took over as CEO of Apple, albeit on a *de facto* and interim basis. On that day, the NASD index was 1,491, Microsoft's closing price was \$13.58, and Apple's closing share price was \$3.31. The dot.com bubble was in its infancy. However, by Friday, July 30, 2004, though the dot.com bubble had burst, the NASDAQ index was still 1,887, up 26% from its July 10, 1997 close. Microsoft's share price was \$24.04, up 77%, but Apple's share price was \$16.17, up 388%. Apple's market cap was \$2.4 billion when Jobs took over in 1997 and stood at \$12.55 billion on July 30, 2004. A trade press article summarized of Job's performance since taking over:

Since Jobs' return to Apple, the company has rejuvenated its PC line with such as the iMac, PowerMac and PowerBook. The online music market was still in a tidal pool when Apple's iTunes burst on the scene. Its iPod has been the most successful digital media player and has created what is called the iPod phenomenon for the market demand that it has experienced (Rider Research 2004).

The *post hoc ergo proctor hoc* view that Jobs was solely responsible for Apple's success was standard thinking in 2004 (and may still be today).

On Sunday August 1, 2004, Jobs sent an email to Apple employees informing them that he had pancreatic cancer (Krazit 2008). Jobs indicated that his form of cancer was a rare treatable form of cancer and that he would only be out of action for 1 month. On Monday morning, Knight Ridder/*Tribune Business News* (2004) reported:

Pancreatic cancer can come in different—and sometimes fatal—forms, but the rare type that Apple CEO Steve Jobs announced he had been treated for is among the most curable. . . . ‘These tumors tend to be less malignant,’ said Dr. Jeffrey Norton, a specialist in gastrointestinal oncology and pancreas surgery at Stanford University Medical Center. ‘If you remove all of the tumor, there is a high probability the patient is cured.’ Surgery is the best strategy for treating this form of pancreatic cancer, he said, adding that chemotherapy or radiation is rarely necessary as a follow-up treatment.

The news was ambiguous. Jobs had pancreatic cancer, but he had a treatable form of cancer. Apple's share price opened the morning of August 2, 2004 at \$31.18, down 3.6% from its previous close, which in turn was down 2.0%. Using the event study methodology outlined above, we found weak evidence that Apple's share price decline was driven by the initial Job's health announcement.<sup>2</sup> Table 1 provides the estimated cumulative abnormal returns for the four trading days of August 2 to August 5.

Table 1 shows that Apple's abnormal return at close-of-market August 2, 2004, the first trading day after the Jobs' announcement, was -2.88% ( $p=0.152$ ).<sup>3</sup> Assuming that all of the information on Jobs was digested by the market by close of business August 2, 2004, this suggests that “but for” Jobs' announcement, Apple's share price would have closed at \$32.50 on that day. In turn, this implies that Apple's of market cap would have \$358 million more than it actually was at closing. However, by close-of-business on August 5, Apple's actual share price (\$31.38) actually exceeded its but-for price (\$31.35).

These results provide only weak, non-statistically significant evidence that Jobs' change in health had an effect on Apple share prices not attributable to overall market trends.

Monday June 9, 2008

On Monday, June 9, 2008, Jobs presented Apple's new products at its Worldwide Developers Conference. In the weeks leading up to the conference, a number of

<sup>2</sup> The NASDAQ index was used as an estimate of the market return. Our results are materially unchanged using other indexes such as the Dow Jones index, or indexes limited to technology firms.

<sup>3</sup> Table 1 results are based on a 30-day trading day estimation window between May 28, 2010 and July 13, 2010. The period was chosen to avoid contamination that otherwise might have occurred because of Apple's earnings announcement on July 14, 2004. By itself, this latter event resulted in an abnormal stock return. A regression using a 30-day trading day estimation window between June 18, 2004 and July 30, 2004 (which includes the abnormal earning event July 15, 2004 trading day) resulted in a DAR on the first day in the event period of -2.72% ( $p=0.305$ ). Using the intervention method (Hakala 2010) to control for the July 15, 2004 announcement and also using the June 18-July 30 estimation window resulted in a first day DAR of -2.67% ( $p=0.318$ ).

**Table 1** Impact of Jobs' July 30, 2004 surgery on Apple's share price and market cap

Date	Apple Closing Share Price	Apple Cumulative Abnormal Return	P-Value	"But-For" Apple Share Price	Estimated Loss Market Cap (millions)
July 30, 2004	\$32.34				
Aug 2, 2004	31.58	-2.88%	0.152	\$32.50	\$358.20
Aug 3, 2004	31.30	-2.04%	0.480	31.94	\$249.62
Aug 4, 2004	31.80	-0.41%	0.909	31.93	\$50.43
Aug 5, 2004	31.38	0.09%	0.984	31.35	-\$10.56

articles appeared in the trade press speculating on what Apple's presentation at the conference might be. Markoff (2008) of the *New York Times* wrote that after a year of strong sales, Apple's ". . . had settled down to a less-than-spectacular pace. . ." Markoff suggested that without a new generation of iPhone, Apple would fail to reach its stated goal of selling 10 million iPhones in 2008. Markoff wrote that "Apple watchers have concluded that a new version will be introduced June 9, the opening day of Apple's Worldwide Developers Conference." (Markoff 2008).

On the morning of June 9, 2008, Jim Goldman, Silicon Valley Bureau Chief for CNBC described the scene.

It's all about the iPhone today and what could be the tech industry's worst kept secret. Steve Jobs should unveil the company's next-generation iPhone, which I've been reporting about for months. It'll run on AT&T's new and improved 3 G network, likely include carrier subsidies which could drive the price below \$200, possibly include video iChat, a new and improved touch-screen keypad, longer battery life and a thinner form factor. (Goldman 2008).

At the conference, Jobs presented the new iPhone. It contained more features, though not as many as some expected. In addition, Apple announced an anticipated new pricing strategy—it would drop the iPhone price in half, and forgo monthly subscription revenues from AT&T in exchange for payments from AT&T on new iPhone sales. Apple's new iPhone business model relied solely on low-price unit sales. Some analysts considered the change in the new business model a defeat for Apple, since it was retreating to the standard pricing/subsidy format for telephones employed by wireless carriers.

Jobs' appearance at the conference, however, inspired more than simple coverage of a new product or a price scheme. The *Los Angeles Times* (2008) reported that "The buzz at the Apple developer conference and on blogs afterward was that the 53-year-old CEO looked much gaunter than in previous public appearances."

This conjunction of what could amounts to two events—adverse health news combined with new product or new business model announcements—underlines one of the challenges associated with event studies. In general, event studies are not well suited when multiple relevant events occur on or very near the same date. In such circumstances, the event of interest may be contaminated by second and third event influences. Arguably, this could be the case here.

Apple's abnormal return was -1.81% at close-of-market June 8, 2008, the day after Jobs' presentation. The one-day probability attached to the abnormal return associated with this health news was only 0.19. The CAR after two trading days was +0.59% ( $p=0.763$ ), and the CAR after three trading days was +0.07% ( $p=0.977$ , see Table 2.) The CARs reported in Table 2 suggest strongly that whatever market effect that could be attributed to Jobs' presentation was slight (or undetectable statistically). One cannot reject the null hypothesis that perceptions that Jobs appeared to be in bad health at the conference had no statistically significant impact upon Apple's share price.

### Nine Event Summary

Table 3 contains summary statistical data for all nine events. In each, we assume the event window begins on the day of the announcement. One can see in Table 3 that the probabilities associated with the abnormal returns connected to adverse information concerning Jobs' health do not meet the 0.05 criterion in eight of the nine events. In these eight events, one cannot reject the null hypothesis that adverse information concerning Jobs' health had no impact upon Apple's share price. Further, on three of the nine occasions, the "health events" resulted in higher, not lower, Apple share prices, although these changes were not statistically significant. Of course, a failure to reject the null hypotheses in these situations, is not the same thing as concluding that the null hypotheses must be the true state of affairs.

In each of these nine events, except one, the daily abnormal return on the subsequent trading day (day 2 of the event window) was statistically insignificant. Thus, for eight events the hypothesis that the event had an effect on Apple's stock on the second trading day is rejected. For these eight events, we conclude that the market had responded fully to the announcement within one trading day. However, in the case of Event 7 (Apple's announcement on December 16, 2008 that Jobs would appear at the MacWorld conference in January 2009), the daily abnormal returns ("DARs") on the first two event or trading days (December 16th and December 17th) were -4.3% ( $p=0.068$ ) and -6.15 ( $p=0.010$ ). The market was apparently still digesting Apple's announcement on December 17, 2008. The DAR on the third trading day (December 18th) was positive, and not statistically significant, +0.2% ( $p=0.386$ ). Thus, for Event 7, we conclude that

**Table 2** Impact of Jobs' appearance and presentation at June 9, 2008 conference on Apple's share price and market cap

Date	Apple Closing Share Price	Apple Cumulative Abnormal Return	P-Value	"But-For" Apple Share Price	Estimated Loss Market Cap (millions)
Jun 6, 2006	\$185.64				
Jun 9, 2006	181.61	-1.81%	0.190	\$184.92	\$2,916.25
Jun 10, 2006	185.64	0.59%	0.763	184.55	\$961.15
Jun 11, 2006	180.81	0.07%	0.977	180.68	\$117.13

**Table 3** Summary of nine events

No.	Date	Event Description	95% Confidence Interval for			P-Value	Actual Share Price	"But For" Price	Change in Mkt. Cap
			Lower Bound	Mean	Upper Bound				
1	08/02/04	Jobs surgery	-6.9%	-2.9%	+1.1%	.152	\$ 31.58	\$ 32.50	-\$ 358 m.
2	08/08/06	Jobs looks sick at conference	-10.0%	-3.7%	+2.5%	.233	\$ 64.78	\$ 67.25	-\$2,103 m.
3	06/09/08	Jobs again looks sick at conference	-4.6%	-1.8%	+0.9%	.190	\$181.61	\$184.92	-\$2,916 m.
4	06/22/08	Apple announces that Jobs is OK	-3.3%	-0.6%	+2.2%	.675	\$173.16	\$174.16	-\$ 877 m.
5	07/26/08	<i>New York Times</i> article	-6.6%	-2.5%	+1.6%	.216	\$154.40	\$158.33	+\$3,482 m.
6	10/03/08	False heart attack	-2.9%	+0.2%	+3.3%	.898	\$ 97.07	\$ 96.88	+\$ 168 m.
7	12/16/08	Jobs skips Mac World conference	-17.1%	-10.5%	-3.9%	.003	\$ 89.16	\$ 99.04	-\$ 8,782 m.
8	01/05/09	Jobs hormone imbalance	-0.2%	+4.4%	+8.9%	.059	\$ 94.58	\$ 90.53	+\$ 3,610 m.
9	01/14/09	Jobs leave of absence	-3.7%	+0.9%	+5.5%	.707	\$ 85.33	\$ 84.60	+\$ 640 m.
		Averages	-6.2%	-1.8%	+2.5%	.348	\$107.96	\$109.80	-\$1,566 m.

All abnormal returns are based upon a one-day event period, except for event 7, which is 2 days.

the market digested information regarding Apple's announcement over two trading days. The two-day cumulative abnormal return for Event 7 was -10.5% ( $p=0.003$ )

Looking at all nine events, the average reduction in Apple's share price "but for" the adverse information about Jobs' health was \$1.84, and this scraped a total of \$1.6 billion from Apple's market cap in the situations analyzed.<sup>4</sup> Even so, only one of these events turned out to be statistically significant.

## Conclusions

One cannot show that the introduction of adverse information concerning Steve Jobs' health has a statistically significant impact on Apple's share price (0.05). Nevertheless, at least some investors believe his good health is critical to Apple's operation and profitability, and in six of nine cases, their expectations were given some support.

Steve Jobs' health has become a public matter (Krazit 2009) because many pundits and analysts write and speak as if they *know* it is critically connected to Apple's well-being and hence its share price. Our analysis suggests that equity markets remain largely unconvinced this is true. In only one instance can one reject at the 0.05 level the null hypothesis that adverse news about Jobs' health has no effect on Apple's share price.

Even if one applies a 0.10 level of statistical significance, the conclusions remain the same—in only one of the nine events do we conclude that Jobs' health had a negative impact on Apple's share price.<sup>5</sup> Further, in three of the nine cases, Apple's share price moved in the opposite direction of what the pundits have suggested.

The "but for" impacts of adverse information about Jobs' health are not huge in relative terms and range between zero and four percent of Apple's share price. These magnitudes belie suggestions in the trade press that Jobs' value to Apple was \$20 billion or greater. If investors truly believe that Jobs is crucial to Apple's future, then they are rather timid, and even confused, in demonstrating that conviction. At the end of the day, it appears that the media gives more credence to Jobs being irreplaceable than investors.

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<sup>4</sup> One could argue that the August 2, 2004 and the June 22, 2008 events might have been viewed as positive news about Jobs' health because he was not *in extremis*. The August 2 event news was that Jobs had a treatable form of pancreatic cancer and the June 22, 2008 event news was an announcement by Apple claiming that Jobs' health was not impaired. If we set these two events aside, our estimates of the impact of Jobs' health on Apple's market capitalization are not materially changed. We estimate that the remaining seven "health" events reduced Apple's market capitalization by \$1.8 billion.

<sup>5</sup> The abnormal return is positive, not negative, for the event where the  $p$ -value is below the 0.10 threshold and above the 0.05 threshold positive.

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