Corporate Governance and Investor Rationality: Evidence from the 1990s' Technology Bubble

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Several studies document irrational investor behavior related to Internet firms during the 1990s' technology bubble. This paper investigates whether investors display the same behavior towards non-Internet firms that adopt Internet technology in the same time period. I find a positive association between short- and long-term metrics of firm performance related to the launching of commercial web sites by non-Internet companies. However, the extent to which this positive association exists is largely driven by the quality of the firms' corporate governance. These results indicate that investors were not *universally* irrational during the 1990s technology bubble. In addition, my findings also highlight the relevance of corporate governance in mitigating information asymmetry when technological innovations with an uncertain impact on firm value affect the economy.

Key words: Bubbles; Uncertainty; Technological Innovations; Corporate Governance

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On August 22, 1997 Shopko Stores, Inc. a retailer located in Green Bay, Wisconsin, unveiled its new web site. The public relations newswire announcing the event mentioned that "Green Bay Packers fans from around the world can [now] purchase a variety of select Green Bay Packers merchandise via the ShopKo web site." Unfortunately, investors did not receive Shopko's web site announcement favorably. Table 1 reports that the 3-day cumulative abnormal return (*CAR*) related to ShopKo's web site announcement is -2.54%. Many retailers, manufacturers, and service firms launched commercial web sites in the mid to late 1990s. However, unlike ShopKo's case, the launching of a web site was sometimes enthusiastically received by market participants. For example, Table 1 also reports a 2.53% *CAR* associated with the launching of a new web site by Cost Plus, Inc. a firm in the same 3-digit SIC as ShopKo.[1]

Why did the launching of a commercial web site generate opposite market responses for two retailers in the same industry? Differences between the two firms, reported in Table 1, may provide some clues. For example, Shopko launched its web site two years earlier than Cost Plus. However, ShopKo's *CAR* does not suggest a first mover advantage from launching it earlier. In addition, Cost Plus' shares trade in the NASDAQ whereas ShopKo's trade in the NYSE. As I discuss later, there is considerable evidence on the dramatic increase in the NASDAQ composite index during the late 1990s, which may explain Cost Plus' positive *CAR*. Moreover, based on market capitalization, Cost Plus is smaller than ShopKo. Therefore, it is possible that the benefits of launching a web site maybe a function of firm size. Another difference of potential importance between ShopKo and Cost Plus is the level of protection these firms grant their shareholders as measured by the Gompers, Ishii, and Metrick (2003) governance index (G-index). According to Gompers *et al*., a G-index of 5 classifies Cost Plus as a well-governed firm. In contrast, a G-index of 11 implies that ShopKo has weak corporate governance. Consequently, it is also possible that differences in corporate governance might be related to the difference in *CARs* reported in Table 1.

1. The reactions reported in Table 1 are unlikely to be the result of confounding events, since a Lexis/Nexis search during the 10 days surrounding the web site launching yields no other meaningful events such as executive dismissals or retirements, debt or equity upgrades or downgrades, earning or dividend announcements, etc.

In this paper, I use a broad sample of firms to study whether, based on the way companies are governed, investors react differently to firms' adoptions of new technologies. I also study whether investors' reactions to the adoption of new technologies are rational. The 1990s technology bubble provides an excellent setting to study these research questions. This period witnessed the emergence of the Internet as new commercial medium. The efficacy of this new technology was the source of considerable uncertainty. Several finance studies, discussed in the next section, document irrational investor behavior around tech stocks during the 1990s technology bubble.[2] However, none of the existing studies document whether investors were *universally* irrational during the period. That is, whether the irrational behavior was limited to tech stocks or whether investors were able to moderate uncertainty and act rationally.

To address my research questions, as in the case-study of ShopKo and Cost Plus, I examine the effect of launching a commercial web site during the 1990s on firm value in non-Internet companies. This choice is motivated by the notion that establishing a web site is a necessary --though not sufficient-- condition for any firm in order to adopt and implement the new technology and perhaps conduct business on the Internet.[3] I recognize that results supporting irrational investor behavior might also be consistent with investors' short-term or myopic behavior, (Stein (1989)), and with the notion that stock prices fail to reflect future earnings (Sloan, 1996). To address this issue, I supplement the short-term event-study evidence with the long-term payoffs to companies related to their launching of commercial web sites.[4] Both short- and long-term payoffs are necessary to test for rational investor behavior because, under efficient markets, one would only expect to observe meaningful short term stock revaluations for events that investors believe will have a lasting and positive effect on the firm's future cash flows and profitability. In addition, the study of short- and long-term performance metrics enables me to dispel concerns over myopic investor behavior.

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2. For example, Cooper, Dimitrov, and Rau (2001) show positive share price reactions to name changes that included the words "dot com" or "Internet" in a sample of firms during the 1990s. A striking finding in their study is that firms that did not even launch a web site were also the subject of a positive price reaction upon the name change.
3. In the late 1990s, firms could also contract with web hosting companies, organizations that provided web site and electronic commerce capabilities in return for a fee (see, for example, Carlton (1998)). Observations related to firms that use web hosting services are not part of my sample.
4. Commercial uses of the Internet began in the mid 1990s (Ghosh, 1998).

My initial proxy for corporate governance is the G-index, which counts restrictions on shareholder rights. Therefore, a lower (higher) G-index is commonly interpreted to proxy for strong (weak) shareholder rights and stronger (weaker) governance quality. I am aware that the use of the G-index as an appropriate proxy for corporate governance is also the subject of debate. In robustness tests, the G-index is replaced with alternative governance metrics which yield qualitatively similar results.

Initial results show that, on average, investors receive the introduction of commercial web sites enthusiastically, but I also find that operating performance declines in the years following the launching. Taken together, these results suggest that investors were overly excited in their initial evaluation of the impact of web sites on firm value and profitability, and appear consistent with both irrational and myopic behavior by investors. However, further tests which incorporate corporate governance to the analysis, do not lend support to the either one of these conjectures and allow me to reject irrational and myopic behavior hypotheses.

Subsequent analyses show that the extent to which investors react positively to web site introductions is largely driven by whether the firm's level of investor protection is strong. Moreover, I also find improvements in industry adjusted changes in operating performance for the years surrounding the launching event, and again find that only well governed firms exhibit such improvements. Campello and Graham (2006) argue that the mispricing observed during the 1990s bubble has its roots in investors' inability to correctly forecast the impact of technology innovations on the firm. My results show that, facing the situation described by Campello and Graham, investors act rationally with respect to their evaluation of the impact of web sites on firm value. This occurs because investors rely on the firms' corporate governance in order to mitigate the uncertainty inherent in Internet investment projects. In this context, my results are entirely consistent with those in Core, Guay, and Rusticus (2005), who find that investors expect lower returns from companies with weak corporate governance. Additional findings indicate that short interest increases for poorly-governed firms that adopt the new Internet technology. In contrast, well-governed firms that also adopt the technology experience an increase in institutional ownership. In addition, other results indicate that earning revisions around the adoption of the new

technology by equity analyst are favorable for well-governed companies but not for weakly governed ones. These results are robust to numerous controls such as trading market, first mover's advantage, industry classification, and firm size. Overall, the evidence in this paper overwhelmingly supports rational investor behavior.

This study adds to the growing debate of whether corporate governance structures affect firm value.[5] In addition, because I track the launching of web sites during the 1990s as the key event, my study also contributes to the literature on investor rationality during the recent technology bubble.

The rest of the paper is organized as follows. Section 1 reviews the relevant literature on stock market bubbles and develops my research questions. Section 2 describes the data. Section 3 presents the event study tests. Section 4 contains the test related to irrational investor behavior. Section 5 presents the robustness tests. Section 6 provides additional corroborating evidence using different samples and techniques. Section 7 concludes.

1. The technology bubble of the 1990s

During the 1990s, the E-Business and Internet Technology Network was the source of ISDEX, an Internet Stock Index. ISDEX rose from about 100 in January 1996 to 1100 in February 2000, this amazing increase of 1000 percent in four years was followed by a precipitous drop in the next four months. In May of 2000, ISDEX was down to 600.[6] The catastrophic Internet stock index drop suggests

5. In the recent wave of corporate scandals, from Enron to Tyco, poor corporate governance structures are frequently cited as the key contributing factor. The tales of excess compensation, financial misrepresentations, and, occasionally, outright theft, have fueled the debate on the importance of corporate governance for safeguarding and enhancing shareholder wealth. Recent academic work on this area provides evidence on both sides of the debate. On the one hand Gompers, Ishii, and Metrick (2003) show that companies with strong shareholder rights perform better. On the other hand, Larcker, Richardson, and Tuna (2004) maintain that corporate governance has very limited ability to explain managerial behavior and organizational performance.

6. ISDEX was a 100% Internet index featuring 50 leading publicly traded Internet companies representing twelve Internet sectors including the software, hardware, content, commerce and communication/access sectors. ISDEX was reviewed quarterly to ensure that it included the most representative list of Internet stocks for investors. The ISDEX was a modified capitalization-weighted index, restricting the weighting of the largest component stocks so that no single stock had an excessive influence. During the period, ISDEX was quoted on a regular basis in leading financial media including the *Wall Street Journal*, Reuters, Dow Jones Newswire, Bloomberg, Bridge, CNBC, SmartMoney magazine and others. The Kansas City Board of Trade (KCBT) was the exchange listing for ISDEX futures and futures options contracts until January 28, 2003 when the board of directors of the KCBT voted to delist and declare dormant the ISDEX futures and options contracts traded at the exchange. The action was taken because ISDEX contracts had no significant trading volume for several months.

that investors exhibit irrational behavior during the period, or at least poor judgment, particularly in their evaluation of technology stocks and Internet related initiatives.

Most economists agree that the latter half of the 1990s witnessed a period of significant overvaluation, leading to a stock market bubble.[7] While few dispute that a bubble took place, the causes of the bubble are not yet well understood. The events related to previous bubble episodes provide certain clues that might be helpful in understanding the recent bubble. For example, Kindleberger (1978) traces the history of financial bubbles from the Dutch tulip mania of the 17th century through the Great Depression that began with the October 29, 1929 stock market crash. Kindleberger argues that although the facts change over time, the basic story remains the same: Investors get overly excited about some new development or technology, such as railroads or automobiles, and in a speculative binge, bid prices up to unjustifiable levels. When the situation becomes unsustainable, investors panic, prices plummet, and bubbles burst. An important clue from Kindleberger's study is that, because the level of uncertainty related to the effectiveness of the new technology, investors are often unable to assess the economic impact of new technologies on firm value, which, in turn, leads to speculation, overvaluation, and financial bubbles.

Recent theoretical work by Abreu and Brunnermeier (2003) suggests that even under the presence of rational arbitrageurs, financial bubbles can persist due to the inability of these agents to coordinate their selling strategies, which makes the elimination of the mispricing more difficult. Other researchers such as Schwartz and Moon (2000) and Pástor and Veronesi (2006), investigate rational explanations for the recent bubble, and independently argue that the period was flooded with great uncertainty arising from the new technology. Pástor and Veronesi (2006) develop and calibrate a model in which they incorporate uncertainty and find that the high levels of stock prices and volatility observed in the 1990s matched the implied uncertainty that existed during the period. Given their results, Pástor and Veronesi argue that the existence of a bubble in the late 1990s should not be taken for granted and that investor irrationality

7. See, for example, Shiller (2000), Malkiel (2003), and Jensen (2004).

should not be held as self-evident truth. The results presented herein, showing that irrational behavior during the period was not universal, are consistent with these arguments by Pástor and Veronesi (2006).

My study is not the only one to consider the behavior of non-Internet firms during the recent technology bubble. Campello and Graham (2006) use a sample of non-tech manufacturers to study the impact of mispricing on firm financial policies. Campello and Graham find that financially constrained firms in non-bubble sectors issued more shares in response to mispricing during the technology bubble, while unconstrained firms in those same sectors did not. Another closely related paper by Agarwal, Bharath, and Viswanathan (2004) finds that the adoption of the Internet by "traditional" firms increases stock return volatility. However, those studies are different from this one because unlike them, the focus herein is on whether corporate governance affects investor rationality during the period.[8]

1.1 The reduced uncertainty hypothesis

A natural question that arises from the results and arguments in Pástor and Veronesi (2006) is whether uncertainty affects investors' evaluations of the impact of a new technology on firm value. I frame this question in the classical case of asymmetry of information and refer to it as the reduced uncertainty hypothesis. The idea here is that investors cannot form accurate beliefs related to the impact of the new technology on the profitability of the firm because of uncertainty inherent in the new technology. In contrast, managers are less uncertain about the impact of the new technology on firm value. Therefore, to circumvent the issue of asymmetry of information, investors observe firm characteristics with the goal of identifying managerial quality. Once managerial quality is identified, investors may use it as a proxy for the firm's reputation or quality. Firm reputation might be useful for investors in mitigating technological uncertainty and to rationally evaluate the impact of the new

8. In addition, Agarwal *et al*. (2004) use a sample of traditional firms from which 30 percent belong to the software, computer hardware, or electronics industry. Due to the potential affinity of firms in these businesses and the Internet, my sample does not include firms from these industries. Moreover, their sample also includes adoptions occurring during 2000, a year that witnessed the dramatic collapse of NASDAQ. On April 14, NASDAQ closed at 3321, down over 35% from a recent high of 5133 on March 10. The inclusion of adoptions during 2000 might be problematic given the large market fluctuations and inherent volatility that marked that year. Also, it is unclear how many firms in the sample used in Agarwal, et al. are NASDAQ firms. Schwert (2002) indicates that from 1998 onward, technological firms in NASDAQ exhibited unusually high volatility, so it is possible that these types of firms, and not the adoption of Internet technology, drive the results in Agarwal *et al*.

technology on firm value. Given these conjectures, I hypothesize that whenever investors can mitigate technological uncertainty, they will rationally evaluate the impact of a new technology on firm value and profitability.

A possible caveat with the empirical tests needed to investigate this hypothesis is that bad-quality firms might imitate or mimic the characteristic of good-quality firms, a situation that will make it difficult for investors to moderate technological uncertainty. This situation underscores the importance of identifying a firm trait that is hard to imitate or change. In the analyses, I use the level of protection that firms grant their investors, measured by the G-index, as a proxy for the firm's reputation. Investors can in turn use this information to moderate the asymmetry of information inherent in the new technology. Given the reduced uncertainty hypothesis, I expect that the performance of firms arising from the adoption of the new technology is a function of their governance. The G-index is a metric that is particularly well suited as a proxy for the quality of corporate governance and several studies use the index for this purpose.[9] Moreover, because the G-index is a composite that adds several governance attributes, it is unlikely that firms could quickly alter it for mimicking purposes or to disguise their true level of investor protection. Nonetheless, to test the robustness of the results, in subsequent tests, the G-index is replaced with an alternative metric of corporate governance.

As a proxy for the adoption of the new Internet technology, I use the introduction of a commercial web site. I believe that a web site is a necessary condition for adopting the new technology. Unlike personal web sites, acquiring equipment and personnel to operate and staff a large-scale commercial web site could require substantial capital. A conservative back of the envelope calculation would suggest that the present value (PV) of the costs related to a web site were about $17.5 million. In addition, the financial press reports that maintaining, marketing, and updating a web site could be just as

9. However, I recognize that the G-index really measures anti-takeover provisions, and as such, the index is also a proxy of managerial entrenchment. Under this interpretation, more entrenched firms are bad-quality firms while less-entrenched firms are better-quality ones.

costly (Loftus, 1999). Therefore, it appears that introducing a commercial web site had sizeable present value costs during the 1990s.[10]

I am sensitive to the possibility that the investment in web technology is not really unique or different from any other investment firms make. Put differently, it might be the case that there is as much uncertainty with any other R&D or capital expenditure as there is with an investment in web technology. In the robustness tests section, I investigate whether this is the case.

1.2 The irrational behavior hypothesis and its alternatives

A growing literature in finance suggests that the technology bubble of the 1990s was largely due to investors bidding prices up to levels that could not be justified by the firms' fundamentals. Most papers in this literature focus on technology companies and Internet firms and pay little attention to non-Internet companies. For example, Ofek and Richardson (2003) find that during the bubble, Internet stocks account for only 6% of the NASDAQ market value but account for 20% of its trading volume. The authors also indicate that new investors entered the market and fueled prices of Internet companies to unjustifiable levels. In addition, Cooper, Dimitrov, and Rau (2001) examine investors' reactions to announcements of name changes by publicly traded firms between June 1998 and July 1999, in which the new name contains the word "dotcom." They document share revaluations in the order of 74 percent for the 10 days surrounding the announcement day. Perhaps the most amazing finding in Cooper, Dimitrov, and Rau (2001) is that their results hold regardless of each company's actual involvement with the Internet. The authors conclude that their results are evidence of irrational investor behavior. Finally, Lamont and Thaler (2003) provide a compelling case study supporting irrational investor behavior during the period. Lamont and Thaler (2003) analyze the market value of Palm, Inc. a manufacturer of hand-held personal assistants during the year 2000, and show that the firm valuation exceeded that of its parent company by about 23 billion dollars, a spectacular violation of the law of one price in which most rational asset pricing models based on fundamental values are anchored. Given that the evidence on irrational investor

10. This estimate is obtained by assuming initial costs of $1 million (Diederich, 1999) and perpetual annual maintenance costs of $0.5 million discounted at a real rate of 3%.

behavior in the literature is focused on technology stocks and Internet firms, this paper investigates whether investors also display irrational behavior towards non-Internet firms that adopt Internet technologies in the 1990s. Put differently, this paper investigates whether investors' irrational behavior during the period was universal or just limited to tech and Internet firms.

The sample used to investigate this question consists of non-Internet firms that adopt Internet technology by establishing a commercial web site. As a first test for investor irrationality, I compare the investor reactions to the announcements of the adoption of Internet technologies across groups based on corporate governance. If investors are indeed irrational, reactions to such announcements should be the same regardless of the governance of the firm. To fully test for irrationality, I estimate both short- and long-term payoffs. Under rational and efficient markets, short term valuation improvements should partially reflect improvements in long-term operating performance. An absence of this association would be consistent with the irrational behavior hypothesis and with several other alternatives. First, it could reflect short-term, or myopic, investor behavior as modeled by Stein (1989) and discussed in Lewis (2004). Second, it could also be a sign that stock returns fail to capture future improvement in operating performance (Sloan, 1996). Another possibility is that it may reflect the entrance of day traders and new investors most likely attracted by reports of soaring stock returns. This behavior, described in the literature as "positive feedback trading" may contribute to a raise in prices in the short-run.[11] I note that these alternatives and the irrational investor behavior hypothesis are not necessarily mutually exclusive. However, the empirical evidence in this paper lends little support for investor trading behavior that is irrational, myopic, or consistent with positive feedback. Instead, the empirical evidence presented herein indicates that traders acted rationally.

2. Data

I view the launching of a commercial web site as the implementation of a capital expenditure in web technology. Therefore, I use the introduction of the new commercial web presence to identify the

11. See De Long, Shleifer, Summers, and Waldman (1990).

capital expenditure and to put together a viable sample of firms. I begin by searching the Lexis/Nexis data retrieval system for corporate press releases with the following keywords (launch OR new) AND (web site OR web site), for 1994 to 1999. I focus only on articles released via press release (PR) Newswire or Business Wire due to the widespread distribution of such announcements by other outlets. This selection mechanism returns 3041 announcements, 2176 of which are discarded because the announcements relate to (a) companies that use their existing web sites to introduce new products, (b) companies that launch non-commercial web sites, or (c) non-for profit entity. From the remaining 865 firms, I retain only 533 announcements referring public companies trading in the major U.S. stock exchanges (AMEX, NYSE, NASDAQ) identified by the Standard and Poor's company as either large-, mid-, or small-cap stocks. An additional 152 are eliminated due to confounding events occurring around the launching of the new commercial web sites.[12] From the remaining 381 firms, 234 are lost because corporate governance data are not available form the Investor Responsibility Research Company (IRRC) and 7 are deleted because either trading data are not available from the Center for Research in Security Prices (CRSP) or accounting data are not available from Compustat for at least two years preceding the event. The final sample consists of 147 non-tech/non-Internet firms that announce the introduction of a general-purpose commercial web site for the first time during 1994-1999.[13]

Table 2 shows the distribution of announcements by industry affiliation based on the Fama and French (1997) classification. Announcements appear to be evenly distributed throughout the sample period, with the exception of 1996, a year for which 34% of the announcements occur. Observations encompass 36 of the 48 Fama and French (1997) industrial sectors, and 17 out the 147 observations, or 11.56%, occur in the business services sector, however, observations appear evenly distributed in the remaining industrial sectors.

12. Deleted observations are the subject of simultaneous but separate press releases about other events -- such as management or board changes, earnings or dividend announcements -- which are likely to affect the value of the firm and to confound or contaminate the effect of the web site launching announcement.
13. This size of this final is comparable to the one used in Agarwal *et al*. (2004) who study the adoption of the Internet by traditional firms from 1995 to 2000.

Despite the efforts in eliminating Internet firms from the sample, it is possible that SIC codes cannot identify Internet firms because these companies often span several different industry classifications (Schultz and Zaman, 2000). However, the data appear immune to this concern since none of the sample firms are either in the ISDEX, in the "Internet Stock List" maintained at www.Internetnews.com. or in the "Internet 50" list published by USA Today during the sample period. Finally, none of the sample firms has or changes its name to include the words "Internet" or "dotcom."

Panel A of Table 3 presents summary statistics for key firm characteristics estimated with data from CRSP and from Compustat. The table reports descriptive data on the firms' total assets, total sales, number of employees, and market value of equity in the year of the event. The average firm in the sample has about 7 billion dollars in assets, 3.4 billion dollars in annual sales and 15 thousand employees. In addition, the average G-index is 8.42 and the median value is 9. Firms in the sample appear to be fairly established in terms of age, which is recorded based on each firm's date of incorporation. The average firm is about 20 years old (the median is 13), and the youngest firms in the sample (6 observations) are in existence at least 3 years before they launch their commercial web site. Panel B shows that the bulk of the sample firms, over 71 percent, trade in the NYSE, 1 firm trades in the AMEX, and the remaining 28 percent trade in NASDAQ.

3. Empirical analyses

3.1 Event study

I conduct an event study around the date in which firms announce the launching of their commercial web site. Market model parameters are computed from one year of trading data preceding the event window and *CARs* are estimated over the three-day period running from the day before the announcement until the day after, using standard event-study methodology (Dodd and Warner, 1983).[14] Table 4 reports mean and median *CARs* for all firms and across subsamples by the median G-index. For

14. To control for possible bias on the market model parameters, *CARs* are reestimated with simple net-of-market returns in place of market model returns. This estimation generates similar results to those obtained with the market model parameters.

all firms, investors' reactions are positive and significant, with a mean value of 1.24% (*t*-statistic = 2.67) and a median of 0.91% (*Z*-statistic = 2.86). These results have a non-trivial economic impact on the value of the firm. For the median firm in the sample, the reaction increases the market value of equity by almost $12 million over the three-day period.

Abnormal returns sorted by the median G-index reveal that investors' reactions are largely driven by well-governed firms. Companies in which the composite index is lower than 9 are associated with mean and median abnormal returns statistically higher than firms for which the index is 9 or higher. The mean *CAR* for well governed firms is 1.82% (*t*-statistic = 3.25), while the mean *CAR* for weakly-governed firms is 0.66% (*t*-statistic = 0.72), the difference between these two values is significant at the 5 percent level. Similar differences arise between the median *CAR* for the two subgroups. These findings are consistent with those related to the case-study of ShopKo and Cost Plus reported in Table 1. One explanation for these results is that, during the 1990s, the future cash flows arising from investing in a commercial web site were the subject of a non-trivial level of uncertainty. Given the event study results and because the index reflects the level of protection that firms grant to their shareholders, it is likely that investors had more confidence on web sites launched by well-governed firms than on those launched by poorly-governed firms. Put differently, investors used the level of protection each firm grants them as a proxy for the firm's reputation in order to evaluate the likelihood of success of the web site launching initiative. If this is the case, the event-study results are consistent with rational investor behavior.

The idea of using a certain firm characteristic as a proxy for its reputation in situations in which asymmetry of information or uncertainty exist is not new. For example, Beatty and Ritter (1986) find that the history of an investment bank in underpricing initial public offerings (IPOs) is a useful proxy for the banks' reputation because it helps predict the underpricing of future IPOs. The event-study results sorted by the G-index suggest that the G-index is a valuable proxy for the firm's reputation; because the quality of corporate governance appears to help investors dissipate the uncertainty inherent to some projects or new technologies.

The results in Table 4 support the reduced uncertainty hypothesis. Nonetheless, there are alternative explanations for the event study results sorted by the G-index. It is possible that the results are driven by firms that are first to establish a web site in their respective industries or a toe-hold in the Internet, and that well-governed firms recognize the competitive advantage that being a first mover can create. In addition, Hendershot (2004) argues that Internet projects in the years prior to 1997 result in significant wealth creation even after the bubble had burst, in contrast with projects created later in the decade, which had disappointing returns. Likewise, Agrawal *et al.* (2004) find that firms that adopt the Internet as a commercial vehicle after 1998 display high stock return volatility. These findings underscore the importance of controlling for time trends in the analyses. Another potential concern arises due to the fact that since 1998, large technology firms traded in NASDAQ exhibit unusually large volatility (Schwert, 2002). Although the sample herein is void of technology firms, 27 percent of the sample firms are traded in NASDAQ. The multivariate analysis presented next addresses all of these issues.

3.2 Multivariate analysis

In order to investigate the alternative explanations discussed earlier, the investor reactions are used as the dependent variable in an ordinary least squares regression. The key explanatory variable in the regression is the G-index. The regression includes a (0,1) "leader" indicator variable that takes the value of 1 for firms that are first in their industries to launch a commercial web site. Although the coding for the leader indicator variable is initially based on the surviving observations of the sample, I check that these are indeed the first-movers in their respective industries. A 2-digit SIC industry classification to code first-movers is used because the 2-digit criterion provides a finer match than the Fama-French industrial classification. The accuracy of the coding is verified by (a) taking into account the contaminated observations discarded previously and by (b) performing an extended search on Lexis/Nexis and the *Wall Street Journal* Index. Other independent variables include the natural log of the firm's assets, the firm's debt-to-equity ratio, and the firm's capital expenditures divided by sales. These variables are intended to control for the firm's size, leverage, and growth opportunities, respectively. In addition, the regression model also controls for operating performance for two years preceding the event. The firms' return on

assets (ROA) proxies for operating performance.[15] To address the issue of time trends, the regression incorporates time effects by assigning an intercept to each year in the sample. Similarly, the model includes a dummy variable that is 1 for NASDAQ firms and is 0 otherwise, aimed at controlling for potential stock market effects.

The results of the multivariate test are reported in Table 5. The leader indicator variable is positive and significant. The coefficient estimate for this variable indicates that investor reactions are 2% more positive for first movers. The coefficient for the G-index is negative and significant at the 3 percent level, and robust to the inclusion of the control variables as well as to time and stock market effects. In terms of the economic magnitude of the coefficient, the estimate indicates that a 1 point reduction in the governance index increases abnormal returns by about 45 basis points over the 3 day period. Because a lower index identifies firms with better investor protection, the results of the multivariate test are in agreement with those of the event study and offer support for the reduced uncertainty hypothesis.

4. Irrational investor behavior

So far, the results related to the announcement of a new commercial web site indicate that investors are enthusiastic about these initiatives if the firm has strong corporate governance. These results offer support for the reduced uncertainty hypothesis and are consistent with rational investor behavior as well. However, the tests conducted until this point are not enough to reject the irrational behavior alternative hypothesis. In order to fully test for rational investor behavior I need to evaluate whether the short-term value gains are related to future improvements in firm profitability. Given the results of the event study, under efficient markets, I expect meaningful improvements in long-term operating performance resulting from commercial web site projects. Nonetheless, Sloan (1996) argues that stock prices in general and abnormal returns in particular, might not *fully* reflect information in cash flows

15. ROA is calculated as follows. The numerator is operating income before depreciation (Compustat item 13) plus the decrease in receivables (Compustat item 2), the decrease in inventory (Compustat item 3), the increase in current liabilities (Compustat item 72) and the decrease in other current assets (Compustat item 68). The denominator is the average of beginning- and ending-year book value of total assets (Compustat item 6).

about future profitability. With this caveat in mind, rational investor behavior predicts that enthusiastic investor reactions arising from the adoption of the new technology should *partially* capture investors' expectations of future improvements on firm profitability.

Figure 1 shows average operating performance, measured by the firm's ROA for the 5 years surrounding the introduction of a web site for all firms in the sample. In the Figure, "0" represents the year in which the commercial web site is launched. Therefore, -1 and +1 represent the years occurring before and after the launching, respectively. The Figure clearly shows that operating performance reaches a peak around the year of the announcement and falls quickly after the launching of the web site. The Figure suggests that, instead of having a positive effect on profitability, web sites had a detrimental effect. Although not comparable, Figure 1 is reminiscent of the upswing and dramatic crash experienced by the ISDEX during the period. Together with the event-study results, the decline in ROA illustrated in Figure 1 suggests that investors may have been irrational in their evaluations of the impact of web sites on firm value.

4.1 Changes in industry-adjusted performance

A possible caveat with Figure 1 is that it illustrates levels of operating performance around the launching of the web site without taking into account the performance of the industry in which each firm operates. Therefore, it is possible that, relative to previous levels, firms perform poorly after the launching of the web site, but still outperform other firms in their respective industries. Moreover, Hoberg and Phillips (2007) show that real and financial outcomes following market booms are related to industry characteristics, such as the level of competitiveness. To account for potential industry effects, Figure 2 presents a plot of the average operating performance adjusted by the median ROA for firms in the same 2-digit SIC for the 5 years surrounding the launching of a web site. The timing convention in Figure 2 is similar to that in Figure 1, with "0" representing the year the web site is launched.

The pattern in operating performance that Figure 2 illustrates is very different from that in Figure 1. In Figure 2, industry adjusted performance rises sharply in the years following the launching of a commercial web site. In fact, during the first and second years after the launching, industry-adjusted

performance reaches levels that exceed performance levels during the two years prior to the launching. The evidence in Figure 2, coupled with the event study results, casts doubt on the idea that investors acted either irrationally or myopically with respect to their evaluation of the introduction of commercial web sites. However, it is not ex-ante obvious that the improvement in industry-adjusted operating performance around the web site initiation that Figure 2 shows is either significant or related to the introduction of the web site.

To assess the statistical significance of the performance improvements that Figure 2 illustrates, I perform a multivariate analysis in which the dependent variable is the change in industry-adjusted ROA in year 1 minus the industry-adjusted ROA in year -1. The key independent variable in the model is the *CAR* from Table 4. This variable directly tests the rational investor hypothesis under the premise that reactions by rational investors capture future improvements in firm profitability. I note that unlike investor reactions, which are estimated with stock market data, changes in operating performance are estimated with accounting data. As such, changes in operating performance are unlikely to be driven or affected in any way by market sentiment or perceived growth opportunities.

Table 6 reports two regressions of changes in operating performance. Model (1) includes firms with a G-index less than 9 and model (2) includes firms with a G-index equal or greater than 9. The coefficient for *CAR* is positive (0.84179, *p*-value = 0.0057) in model (1). In contrast, the coefficient for *CAR* is not significant in model (2). The positive *CAR* coefficient in model (1) indicates that the highest investor reactions are associated with firms that exhibit the most favorable change in terms of industry-adjusted performance. This finding casts doubt on the idea that investors were driven by positive feedback trading, myopic, or irrational behavior in their evaluation of commercial web site initiations. The results lend support to rational investor behavior. In addition, the findings of these multivariate regressions also highlight the importance of corporate governance on firm value, particularly when firms adopt technology for which the effect on performance is uncertain. In sum, the results support the hypothesis that investors acted rationally in evaluating introductions of commercial web sites by established companies during the technology bubble of the 1990s.

5. Additional Evidence

5.1 Short selling and institutional ownership

Aside from the abnormal returns documented earlier, the stock of firms adopting the new technology might be affected in different ways due to the launching of a web site. For example, if a company's adoption of the new technology is viewed as beneficial; more investors might want to hold that company's stock. Otherwise, investors might want to short it. Such trading patterns may provide additional evidence on rational investor behavior. To test this conjecture, I follow Asquith, Pathak, and Ritter (2005) and collect both short sales and institutional ownership data for the sample firms. Asquith, Pathak, and Ritter indicate that short interest and institutional ownership are proxies for the supply and demand of stocks, respectively.

The level of short interest in individual stocks is collected monthly from the *Wall Street Journal, Barron's,* the *New York Times*, and *Bloomberg*. Theses sources limit their coverage of short interest positions to stocks with the largest number of shares sold short or stocks with large changes in short interest. The limited reporting reduces the sample to 96 observations. Short interest is the total number of shares of a particular stock that have been sold short by investors but have not yet been covered or closed out. The financial press reports both the current and past month short interest together. Short interest data are sometimes revised the following month. As Asquith, Pathak, and Ritter (2005) indicate, these revisions, which are often quite small, occur primarily because a firm is late in reporting, and its short interest misses the current month reported. The analyses herein, uses the revised numbers. A large increase or decrease in a stock's short interest from the previous month can be a very telling indicator of investor sentiment. An increase in the short interest often indicates that investors believe the stock price will decrease. A possible caveat is that the short interest for any given stock can fluctuate during my monthly measuring window and that such fluctuation might be due to events other than the web site initiation. Notwithstanding this issue, these data are used to evaluate whether short interest changes following the launching of a web site.

Institutional ownership data are collected from SEC form 13-F reported in the Thomson Financial's CDA/Spectrum Institutional Holdings database. The SEC requires money managers with at least $100 million in assets to file this form with the SEC 45 days after the end of any quarter.[16] These data, available for a subsample of 118 firms, are used to compute changes in institutional ownership surrounding adoptions of Internet technologies.

Table 7, Panel A, reports changes in short interest. For the entire subsample there is no significant change in the short interest. However, when the sample is split based on the Gompers *et al* (2003) governance index the change associated with weakly governed firms is significant. Indeed, firms with indices greater than or equal to nine, exhibit a modest, but statistically significant, increase in their short interest of 5.9 million shares (*t*-statistic = 2.08). In contrast, well-governed firms display no meaningful changes in short interest.

Panel B of Table 7 reports changes in institutional ownership around the launching of a web site. On average, results show no significant changes in institutional ownership for the institutional ownership subsample. However, when firms are sorted by their governance index a statistically significant increase in ownership of 3.3% (*t*-statistic = 1.99) emerges on the well governed firms subsample. The opposite patterns arise for weakly governed companies. These firms exhibit a drop in institutional ownership following the adoption of web technologies. However, such decline is not statistically significant.

The changes in short interest and institutional ownership appear to support the earlier findings on rational investor behavior during the 1990s technology bubble. Poorly-governed firms that invest on Internet technologies experience an increase in their short interest, which likely occurs due to an increase in the demand to borrow their stock. In contrast, institutional investors increase their ownership in well-governed firms that launch web sites. As with the earlier results, these new findings also suggest that corporate governance helps investors distinguish the prospects of firms that adopt new technologies. Moreover, the new findings also indicate that investors acted rationally.

16. Given that these data are reported quarterly, it is possible that events, other than the adoption of Internet technologies, cause institutional ownership to change.

5.2 Firms that do not launch a web site

A natural question to ask is whether there is a reaction to firms not investing in the new technology when others firms in the same industry are doing so. It is possible that certain companies may experience negative reactions if rational investors realize these firms will perform worse in the future due to their non-adoption of the new technology. Moreover, given my earlier results, it is likely that these reactions will differ by the governance of the company.

I am able to construct a matching sample of firms that do not adopt Internet technologies. Matching firms are identified by controlling for industry, pre-event performance, and firm size as suggested in Barber and Lyon (1996). Total assets in the year prior to the filing proxy for firm size, industry-adjusted return on assets (ROA) proxies for firm performance, and 2-digit SIC codes are used to control for industry classification. After screening each of the matching observations and removing those in which confounding announcements occur, I am able to assemble a matching sample of 121 firms. From the 121 matching firms, 64 have a G-index greater than or equal to 9.

Table 8 reports event-study results for the matching firms sorted two different ways. Consistent with earlier tests, matching firms are split by the median G-index. In addition, matching firms are also split by the sign of the reaction accruing to adopting firms. Results indicate that sorting *CARs* this way provides important information. For example, for well-governed matching firms (G-index < 9) reactions are not different from zero when the adopting firm's reaction is positive. However, for these firms reactions are positive and significant when adopting firms earn negative reactions. The first result suggests that investors believe that well-governed matching firms that should adopt the new technology but do not do so, will still do well. The second result suggests that well-governed matching firms will benefit from the investment errors of their competitors. In contrast, poorly governed companies (G-index $\geq$ 9) are punished by investors when they fail to adopt as evidenced by the negative and significant reaction on these firms (-0.75%, *t*-statistic = 1.83). Overall, the event-study evidence on the matching firms supports rational investor behavior and also indicates the awareness of traders with respect to the effect of corporate governance on firm value.

6. Robustness Tests

6.1 Time trends

I am sensitive to concerns that the time period studied may be driving the results. Hendershot (2004) argues that Internet-related projects initiated in the early 1990s are more profitable than those that begin later in the decade. To address this issue, the sample is split by web sites launched from 1994 to 1996 (72 observations) and those launched from 1997 to 1999 (75 observations) the results hold in both of these subsamples.

6.2 Investment opportunities

Pástor and Veronesi (2006) argue that during the 1990s stocks with the highest market-to-book ratios also had some of the highest return volatilities and therefore also had the most uncertain future profitability. Their study suggests that controlling for the market-to-book ratio value is particularly important. The results reported in Table 6 are robust to the inclusion of the market-to-book ratio as an independent variable.[17] Replacing the market-to-book ratio for alternative proxies for investment opportunities such as the ratio of capital expenditures over sales, the ratio of depreciation expenditures to sales, the ratio of research and development (R&D) to sales, the earnings-to-price ratio, and the variance of common stock returns does not alter the results.

6.3 Other proxies for firm size and different measurement intervals

The analyses presented in Table 6 is repeated using different proxies for firm size, replacing the natural log of assets by both the natural log of capital and the natural log of sales, the use of these alternative size proxies does not alter the significance and inferences related to the *CAR* variable.[18] In addition, I repeat all tests replacing the 3-day *CARs* with 5- and 2-day *CARs*, as well as with the day 0 *ARs*. The results are robust to the use of these different abnormal return windows. Finally, in unreported

17. The market-to-book ratio is the market value of the firm's equity at the end of the year plus the difference between the book value of the firm's assets and the book value of the firm's equity at the end of the year, divided by the book value of the firm's assets at the end of the year. This calculation closely follows that of Smith and Watts (1992).

18. Total capital adds the market value of the firm's equity, book value, long-term debt, and an estimated market value of preferred stock. I calculate the market value of preferred stock by dividing preferred dividends over the prevailing yield on Moody's index of high-grade industrial preferred stocks.

tests, I use the two-year change in industry-adjusted operating performance, that is, industry-adjusted ROA in year +2 minus industry-adjusted ROA in year -2, as the dependent variable and run regressions similar to those in Table 6. Results from these tests generate inferences similar to those reported.

6.4. Alternative proxies for corporate governance

So far, the tests use the G-index as a proxy for investor protection and corporate governance. Gompers, Ishii, and Metrick (2003) construct the index by counting the number of anti-takeover provisions firms have in their corporate charter or by-laws using 24 provisions tracked by the IRRC. Because these provisions are viewed as restricting shareholder rights, a high index means that the firm has weak shareholder rights. Alternatively, given the way in which it is constructed, the index could also be viewed as a measure of managerial entrenchment. Therefore, it is possible that G is not an accurate metric of corporate governance for all firms. Moreover, Core, Guay, and Rusticus (2006) indicate that low G-index firms outperform high G-index firms during the late 1990s but that such phenomenon reverses during 2000-2003. So a possible caveat with the results linked to the G-index is that my data are from the 1990s, the period flagged by these authors. However, I believe that my results are immune to the phenomenon described in Core, Guay, and Rusticus because these authors also assert that the differential return phenomenon related to the G-index during the 1990s is sensitive to the exclusion of technology, Internet, and new economy firms in general. The sample used in this paper is void of these types of firms.

Given the issues related to the G-index and to evaluate the robustness of my results, I use a different metric of corporate governance. For this purpose, I construct an index based on the effect of board structure on firm value.[19] A firm earns 1 point to its board index score in the following circumstances: (a) If its board size exceeds the median board size for firms in the same industry; (b) If its board is not independent, as defined in Weisbach (1988); and (c) If its board is busy, as defined in Fich and Shivdasani (2006). Thus, the board index can range from zero (best board), to three (worst board). It is possible that other features

19. For example, Yermack (1996) find higher market valuations for firms with smaller boards of directors. In addition, several papers present evidence suggesting that effective governance and firm performance increase with board independence (for example, see Brickley et al., (1994); Byrd and Hickman, (1992); Weisbach, 1988). Recently, Fich and Shivdasani (2006) find an inverse association between busy boards, those in which the majority of outside directors hold three or more directorships, and firm performance.

related to the board of directors could be added to index. However, these features are either not necessarily related to governance or used as a measure of managerial entrenchment. For example, board meeting frequency is excluded from the index because Vafeas (1999) shows that abnormal board meeting activity often indicates financial distress. In addition, staggered boards, founding family representation in the board, and the fraction of directors appointed by the current CEOs are not included in the index because these variables may proxy for managerial entrenchment.[20]

Panel A of Table 9 sorts *CARs* to web site announcements by the board index. Based on this sorting, firms with stronger governance (lower board index) exhibit higher investor reactions (1.93%, *t*-statistic = 3.49) than (higher board index) weakly governed firms (0.73%, *t*-statistic = 0.79). Indeed, reactions to better governed firms are 1.23% higher than those for weakly governed companies, and this difference is statistically significant at the 5 percent level. These results are consistent with those reported earlier and indicate that investors rationally use corporate governance to assess the effect of new technologies on firm value.

6.5 Different use of the technology

This paper is not the first to analyze the effects of the launching of a web site on the firm. Several studies in the information systems (IS) literature study this issue as well. Although the main focus of the IS literature is not to assess the impact of web sites on firm value, some factors addressed in IS studies deserve some attention as they could affect my results.[21] For example, Agarwal and Venkatesh (2002) explain that commercial web sites and other e-commerce activities can be broadly classified as either informational or transactional. This difference arises mainly due to the nature of the products and services firms offer. For example, companies such as Coca-Cola and Ford are more likely to use web sites as an information or promotion vehicle rather than as a tool to sell their products to individual consumers. In contrast, bookstores, insurance companies, and other retailers are more likely to transact business through

20. See, for example, Faleye (2007) on staggered boards, Anderson and Reeb (2003) on family firms, and Shivdasani and Yermack (1999) on CEO influence over the selection of new directors.
21. An exception is a study by Subramani and Walden (2001) in which web sites and other e-commerce announcements by net and non-net firms are considered.

their web sites. Given the diverging uses of commercial web sites, it is possible that the investor reactions obtained herein are driven by the type of web site launched. To address this issue, I classify firms based on their type of web site (informational or transactional) and evaluate *CARs* to the web site launch announcement based on this classification. Panel B of Table 9 reports the results of this test. The *t*-statistic associated with the difference in *CARs* between the two subgroups (*t*-statistic = 0.53) is not statistically significant. On the one hand, this result alleviates concerns that the type of web site, and not corporate governance, is the main driver of the results. On the other hand, the result might be surprising if one believes that transactional web sites are better poised to have a material effect on firm value.

6.6 Earnings forecast revisions around adoptions of new technology

Gilchrist, Himmelberg, and Huberman (2005) also consider the 1990s bubble and develop a model in which shocks to the dispersion of investor opinion cause stock prices to rise above their fundamental values. They test their model using the variance of analysts' earnings forecasts to proxy for shocks to the dispersion of investor beliefs. Gilchrist *et al.* (2005) argue that earnings forecasts effectively identify a portion of the "bubble" component in a firm's investment opportunities.

As an additional test for whether corporate governance affects the way in which markets evaluate the impact of new technology adoptions on firm value, I examine equity analysts' revisions of earnings estimates for companies that launch a new commercial web site. The advantage of this approach is that it provides evidence from individuals that are not market participants but are nonetheless informed about the company's performance and prospects. The drawback, however, is that analyst forecasts can be biased, and are also not updated frequently. The time lag involved in forecast revisions implies that other events that also affect forecasts could have occurred during my measurement window.

With these caveats in mind, from the sample of firms I select those for which annual data on analysts' EPS forecasts can be obtained from I/B/E/S for the 1994-1999 period. This selection mechanism yields a subsample of 111 firms. For each firm, the annual change in the average EPS forecast is calculated by subtracting the average EPS forecast at the end of the year from the average EPS forecast at the beginning of the year. The results of this computation are reported in Panel C of Table 9. The sample

is divided by the level of investor protection each firm grants to its investors using the G-index. Revisions in analysts' EPS forecasts are positive and significant (*t*-statistic = 1.83) when well-governed firms launch a web site during the year, but negative and statistically insignificant when the launching firms' governance is weak. These results, which support the reduced uncertainty hypothesis, are in line with the findings in Core, Guay, and Rusticus (2005); they show that analysts anticipate lower returns from firms with weak corporate governance.

6.7 Are the firms adopting the new technologies to become attractive takeover targets?

It is possible that the adoption of the new technology is aimed at luring a bid from a prospective acquirer. Put differently, if many firms attempt to do "window dressing" in order to become attractive targets (Aboody, Kasznik and Williams, 2000), then launching a web site may help this effort. Since the G-index is viewed as a measure of takeover resistance, it is possible that my results really show that low G firms, those more likely to be acquired, are also more likely to adopt a web site. To address this issue, I divide the sample by the median G-index and follow all firms from their adoption of the technology until 2005. I then search the Securities Data Company (SDC) mergers and acquisitions (M&A) database to establish whether any of the sample companies are subsequently acquired. Untabulated results show that a total of 17 firms are sold after the adoption of the new technology. From these 17 firms, 10 are considered weakly governed (G-index above 9) and 7 are well governed (G-index below 9). These results suggest that the adoption of the new technology is not aimed at attracting a takeover bid.

6.8 Is the new technology really unique?

Central to my results is the idea that the new technology is unique given that the level of uncertainty associated with it is not trivial. I test whether this is indeed the case. For my 147 sample firms, I collect announcement information on previous capital and/or research and development (R&D) expenditures. I am able to assemble a sample of 288 uncontaminated announcements for such events which enables the estimation of 3-day *CARs*. As in previous tests, I separate *CARs* using the board index. However, in this instance I find no statistical differences between subgroups. I repeat the procedure using the median G-index to split the announcements and obtain similar results. Malmendier and Tate (2005)

find no relation between investment performance and corporate governance. My findings suggest that corporate governance is not a good predictor of the success or failure of less uncertain investments.

7. Summary and Conclusions

The academic literature in finance provides ample evidence on irrational behavior with respect to Internet firms during the 1990s technology bubble; however, there is comparatively little evidence on whether non-Internet firms that adopt Internet technologies also incite irrational investor behavior. In this paper, I test for rational investor behavior in the context of non-Internet firms that adopt Internet technology. I develop the study relying on three premises. The first is that an investment or capital expenditure is likely to affect the future cash flows of the firm which, under efficient markets, should trigger share revaluations upon the announcement of the new investment. The second premise is that when the investment or capital expenditure announced relates to a new technology, the impact that the technology has on firm value is uncertain. The last premise states that, faced by the uncertain situation just described, investors will rely on an observable firm characteristic as a proxy for the firm's reputation or quality and use it to evaluate the impact of the new technology on firm value and profitability. Based on these premises, I postulate the *reduced uncertainty* hypothesis. This hypothesis states that investors will use firm reputation in order to ameliorate uncertainty and evaluate the impact of new technologies on firm value. The alternative hypothesis is the *irrational investor* hypothesis. This alternative hypothesis, which states that investors will become overly excited about the new technology and will bid share prices to unjustifiable levels, appears quite adequate because other studies find support for it during the same period I study and around firms closely related to Internet technology.

I use the launching of a commercial web site as an indication that a firm has adopted the new Internet technology. I base this choice on the idea that a commercial web site is a necessary (although not sufficient) condition to adopt the new technology. Event study results related to the launching of a commercial web site indicate that investors enthusiastically receive these initiatives. However, I also find that such enthusiasm is largely driven by the level of investor protection each firm grants to its shareholders, proxied with the Gompers, Ishii, and Metrick (2003) governance index (G-index). Put

differently, my findings reveal that reactions are positive and significant for well-governed firms, but not significant for poorly-governed firms. Because during the 1990s there was much uncertainty about the impact of Internet investments on firm value, I view my event study results as evidence that investors used the firm's governance to mitigate uncertainty.

Multivariate tests reveal a positive and significant association between short- and long-term payoffs related to the introduction of a commercial web site. I again find that the positive association only holds in well-governed firms. I also find that revisions of earning forecasts around the year of the web site launching are significantly more favorable for better-governed firms. In other tests, I document that after web sites are launched, poorly-governed firms experience a modest, but statistically significant, increase in their short interest. In contrast, well-governed firms display no meaningful changes in short interest. Likewise, after the web site is launched, I detect a statistically significant increase in institutional ownership on a subsample of well governed firms. These results provide direct evidence counter to the irrational behavior hypothesis and consistent with the rational investor behavior that the reduced uncertainty hypothesis predicts.

Overall, results show that during the 1990s technology bubble mispricing was attenuated by the firms' governance. This finding is robust to numerous controls such as the type of web site launched, alternative proxies for growth opportunities and firm size, different measuring windows, the exchange in which firms' trade, an out-of-sample test using matching firms, and a metric of corporate governance different that the one proposed by Gompers, Ishii, and Metrick (2003).

Another contribution that arises from this study is the identification of corporate governance as a valuable proxy to dissipate uncertainty whenever the firm adopts new and uncertain technologies. In this vein, my result adds to the debate on whether governance really matters to shareholders' wealth. Indeed, the result related to the G- and the board-index is opposite to the findings in Larcker, Richardson, and Tuna (2004). They argue that corporate governance has very limited ability to explain managerial behavior and organizational performance.

Despite the clear link of the firms I analyze and the Internet, I document *rational* investor behavior during the 1990s technology bubble. This result is in contrast with other papers in the literature which document irrational investor behavior during the same period. Given my results and the overwhelming evidence on irrational investor behavior related to tech stocks and Internet firms in other studies, I suspect that the bubble was not so much driven by the new technology, but by the new firms that the new technology spawned.

I do not want this study to be viewed as dismissing either the existence of the 1990s technology bubble or the irrational behavior that investors exhibited at the time. However, my study shows that investors were not *universally* irrational during the period. I believe that the effect of the Internet on the market value and profitability of firms was not well understood in the 1990s and it is still not well understood today. Therefore, this paper should be viewed as an attempt to add to our knowledge in this area. Specifically, my study highlights the effect of observable corporate governance attributes in reducing uncertainty when new technological innovations with an unknown impact on firm value affect the economy.

References

Aboody, David, Ron Kasznik, and Michael Williams, 2000, Purchase versus pooling in stock-for-stock acquisitions: Why do firms care? *Journal of Accounting and Economics* 29, 261-286.

Abreu, Dilip, and Markus K. Brunnermeier, 2003, Bubbles and crashes, *Econometrica* 71, 173-204.

Agarwal, Ritu, and Viswanath Venkatesh, 2002, Assessing a firm's Web presence: A heuristic evaluation procedure for the measurement of usability, *Information Systems Research* 13, 168-186.

Agrawal, Deepak, Sreedhar T. Bharath, and Siva Viswanathan, 2004, Technological change and stock return volatility: Evidence from e-commerce adoptions, *Working Paper*, The University of Michigan, Ann Arbor.

Anderson Ronald C., and Reeb David M. Reeb, 2003, Founding-family ownership and firm performance: Evidence from the S&P 500, *Journal of Finance* 58, 1301-1327.

Asquith, Paul, Parag A. Pathak, P., and Jay R. Ritter, 2005, Short interest, institutional ownership, and stock returns, *Journal of Financial Economics* 78, 243–276.

Barber, Brad, M., and John D. Lyon, 1996, Detecting abnormal operating performance: The empirical power and specification of test statistics, *Journal of Financial Economics* 41, 359-399.

Beatty, Randolph P., and Jay R. Ritter, 1986, Investment banking, reputation, and the underpricing of initial public offerings, *Journal of Financial Economics* 15, 213-232.

Brickley, James, Coles, Jeffrey, and Rory L. Terry, 1994, Outside directors and the adoption of poison pills, *Journal of Financial Economics* 35, 371–390.

Byrd, J.W., and K.A. Hickman, 1992, Do outside directors monitor managers? Evidence from tender offer bids, *Journal of Financial Economics* 32, 195–222.

Campello, Murillo, and John Graham, 2006, Do stock prices influence corporate decisions? Evidence from the technology bubble, *Working paper*, Duke University.

Carlton, Jim, 1998, Exodus finds web hosting may be profitable niche, *Wall Street Journal*, April 23.

Core, John E., Wayne R. Guay, and Tjomme O. Rusticus, 2006, Does weak governance cause weak stock returns? An examination of firm operating performance and investors' expectations, *Journal of Finance* 61, 655-687.

Cooper, Michael J., Orlin Dimitrov, and P.Raghavendra Rau, 2001, A rose.com by any other name, *Journal of Finance* 56, 2371-2388.

Diederich, Tom, 1999, Launching e-commerce sites takes deep pockets, CNN Interactive, May 31.

De Long, J. Bradford, Andrei Shleifer, Lawrence Summers, and Robert J. Waldman, 1990, Positive feedback investment strategies and destabilizing rational speculation, *Journal of Finance* 45, 375-395.

Dodd, Peter, and Jerold Warner, 1983, On corporate governance: A study of proxy contests, *Journal of Financial Economics* 11, 401-438.

Faleye, Olubunmi, 2007, Classified boards, firm value, and managerial entrenchment, *Journal of Financial Economics* 83, 501-529.

Fama, Eugene, and Kenneth French, 1997, Industry costs of equity, *Journal of Financial Economics* 43, 153-193.

Fich, Eliezer M., and Anil Shivdasani, 2006, Are busy boards effective monitors? *Journal of Finance* 61, 689-724.

Ghosh, Shikhar, 1998, Making business sense of the Internet, *Harvard Business Review* 76, 2.

Gilchrist, Simon, Himmelberg, Charles P., and Gur Huberman, 2005, Do stock price bubbles influence corporate investment? *Journal of Monetary Economics* 52, 805-827.

Gompers, Paul, Joy Ishii, and Andrew Metrick, 2003, Corporate governance and equity prices, *Quarterly Journal of Economics* 118, 107-155.

Hendershot, Robert, 2004, Net value: Wealth creation (and destruction) during the Internet boom, *Journal of Corporate Finance* 10, 281-299.

Hoberg, Gerard and Gordon Phillips, 2007, Real and financial industry booms and busts, *Working Paper*, The University of Maryland.

Jensen, Michael C., 2004, The agency costs of overvalued equity and the current state of corporate finance, *European Financial Management* 10, 549–565.

Kindleberger, Charles, P., 1978, Manias, panics and crashes: A history of financial crises, New York: Basic Books.

Lamont, Owen, and Richard Thaler, 2003, Can the market add and subtract? Mispricing in tech stock carve-outs, *Journal of Political Economy* 111, 227-268.

Larcker, David, Scott A. Richardson, and Irem Tuna, 2004, Does corporate governance really matter? *Working Paper*, The Wharton School – University of Pennsylvania, Philadelphia, PA.

Lewis, Michael, 2004, The irresponsible investor, *The New York Times*, Magazine Section, June 6.

Loftus, Peter, 1999, Relaunching a web site can be confusing and expensive; and, sometimes, necessary, *Wall Street Journal*, November 22.

Malkiel, Burton, 2003, The efficient market hypothesis and its critics, *Journal of Economic Perspectives* 17, 59-82.

Malmendier, Ulrike and Geoffrey Tate, 2005, CEO overconfidence and corporate investment, *Journal of Finance* 60, 2661-2700.

Ofek, Eli, and Matthew Richardson, 2003, Dotcom mania: The rise and fall of Internet stock prices, *Journal of Finance* 58, 1113-1137.

Pástor, Lubos, and Pietro Veronesi, 2006, Was there a Nasdaq bubble in the late 1990s? *Journal of Financial Economics* 81, 61-100.

Shivdasani, Anil, and David Yermack, 1999, CEO Involvement in the selection of new board members: An empirical analysis, *Journal of Finance* 54, 1829-1853.

Schwert, G. William, 2002, Stock market volatility in the new millennium: How wacky is Nasdaq? *Journal of Monetary Economics* 49, 3-26.

Schultz, P., and M. Zaman. 2001, Do the individuals closest to Internet firms believe they are overvalued? *Journal of Financial Economics* 59, 3, 347-381.

Schwartz, Eduardo S., and Mark Moon, 2000, Rational pricing of Internet companies, *Financial Analyst Journal* 56, 62-75.

Shiller, Robert J., 2000, Irrational Exuberance, Princeton University Press.

Sloan, Richard G., 1996, Do stock prices fully reflect information in accruals and cash flows about future earnings? *Accounting Review* 71, 289-315.

Smith, Clifford, and Ross Watts, 1992, The investment opportunity set and corporate financing, dividend and compensation policies, *Journal of Financial Economics* 40, 263-292.

Stein, Jeremy, 1989, Efficient capital market, inefficient firm: A model of myopic corporate behavior, *Quarterly Journal of Economics* 104, 655-669.

Subramani, Mani, and Eric Walden, 2001, The impact of E-Commerce announcements on the market value of firms, *Information Systems Research* 12, 135-154.

Vafeas, Nikos, 1999, Board meeting frequency and firm performance 53, *Journal of Financial Economics* 20, 113-142.

Weisbach, Michael, 1988, Outside directors and CEO turnover, *Journal of Financial Economics* 20, 431–460.

Yermack, David, 1996, Higher market valuation of companies with a small board of directors, *Journal of Financial Economics* 40, 185–212.

Figure 1
Operating performance surrounding the launching of a commercial web site

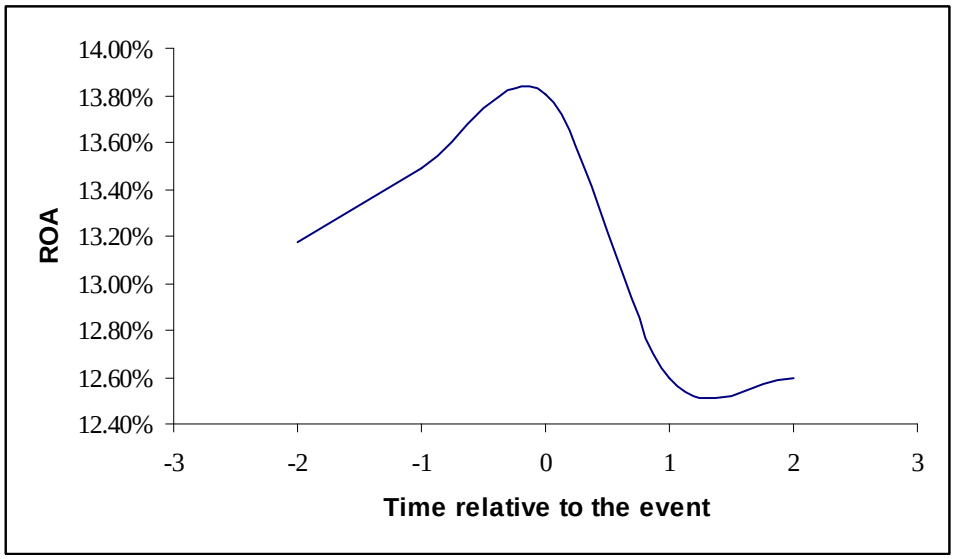

Figure 2
Industry-adjusted performance surrounding the launching of a web site

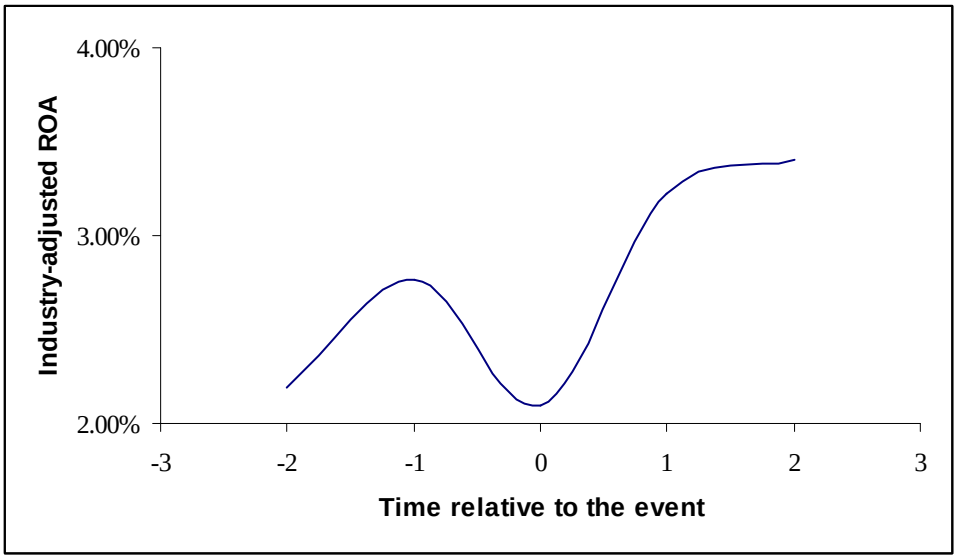

Table 1
The Case of ShopKo and Cost Plus

This table reports 3-day cumulative abnormal returns (*CARs from* -1 to +1) arising from the announcement of a web site by ShopKo Inc. and by Cost Plus Inc. The first column reports the date of the event announcement (day "0"). *CARs* are computed using the standard methodology described in Dodd and Warner (1996). The proxy for firm size is the natural logarithm of the company's market capitalization. The table reports *p*-values from a two-tailed test in parenthesis.

Event Date	Firm Name	Firm Location	Firm Size	3-digit SIC	3-day CAR	Exchange	G-Index
August 22, 1997	ShopKo Stores Inc.	Green Bay, WI	6.49	533	-2.54% (0.001)	NYSE	11
April 29, 1999	Cost Plus Inc.	Oakland, CA	5.84	533	2.53% (0.001)	NASDAQ	5

Table 2
Sample Distribution

This table sorts my sample by Industry and year. The sample consists of 147 publicly traded firms that announce the launching of a commercial web site. The industry classification is based on Fama and French (1997).

Industrial Classification	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**Total**	**pct.**
Aircraft	0	1	0	1	0	0	2	1.36%
Agriculture	0	0	1	0	0	0	1	0.68%
Automobiles and Trucks	0	0	1	1	1	1	4	2.72%
Banking	0	0	2	2	1	1	6	4.08%
Construction Materials	0	0	0	1	2	0	3	2.04%
Printing and Publishing	0	0	5	1	0	1	7	4.76%
Business Services	0	7	5	1	1	3	17	11.56%
Chemicals	0	1	2	2	0	0	5	3.40%
Electronic Equipment	0	2	3	0	0	1	6	4.08%
Apparel	0	0	0	1	0	0	1	0.68%
Computers	0	3	0	1	0	0	4	2.72%
Construction	0	0	2	1	0	0	3	2.04%
Pharmaceutical Products	0	0	2	4	1	2	9	6.12%
Electrical Equipment	0	0	0	2	0	1	3	2.04%
Petroleum and Natural Gas	0	1	1	0	0	0	2	1.36%
Trading	0	0	5	0	2	0	7	4.76%
Food Products	0	0	0	0	2	1	3	2.04%
Entertainment	0	0	1	0	0	0	1	0.68%
Healthcare	0	0	2	0	1	1	4	2.72%
Consumer Goods	0	1	2	0	0	1	4	2.72%
Insurance	0	1	1	3	1	0	6	4.08%
Measuring and Control Equipment	0	0	0	0	0	1	1	0.68%
Machinery	0	0	1	1	0	1	3	2.04%
Restaurants, Hotel, Motel	0	0	0	1	1	0	2	1.36%
Medical Equipment	0	0	1	0	0	0	1	0.68%
Business supplies	0	0	0	0	0	1	1	0.68%
Personal Services	0	0	1	0	0	0	1	0.68%
Retail	0	0	3	2	1	4	10	6.80%
Rubber and Plastic Products	0	0	1	0	0	1	2	1.36%
Steel Works, etc.	0	0	1	1	1	1	4	2.72%
Telecommunications	1	1	0	0	0	1	3	2.04%
Textiles	0	0	1	0	0	0	1	0.68%
Recreational Products	0	1	0	0	0	0	1	0.68%
Transportation	0	1	1	2	0	1	5	3.40%
Utilities	0	0	5	2	0	0	7	4.76%
Wholesale	0	1	0	1	2	3	7	4.76%
Total	1	21	50	31	17	27	147	100.00%
pct.	0.68%	14.29%	34.01%	21.09%	11.56%	18.37%	100.00%	

Table 3
Summary Statistics

In Panel A of this table I report sample characteristics for 147 firms that launch a commercial web site from 1994 to 1999. The G-index is the Gompers, Ishii, and Metrick (2003) governance index. All other variables are drawn or calculated from Compustat for the year of the launching. Panel B provides the distribution of the 147 firms in the sample related to the stock exchange in which the firms trade.

Panel A			
Characteristic	**Mean**	**Median**	**Standard deviation**
Assets ($M)	7,366.445	897.8	1,9431.17
Sales ($M)	3,403.909	946.23	7,466.157
Number of employees (thousands)	15.42656	4.7	33.35474
Market value of equity ($M)	4,262.13	934.957	11,382.22
Long term debt ($M)	917.4288	209.44	1,954.511
Earnings ($M)	220.8178	48.85	540.4906
Firm age (years since incorporation)	20.41	13	15.57
G-index	8.421769	9	2.67132

Panel B			
	NYSE	**AMEX**	**NASDQ**
Number of firms	105	1	41
Percentage	71.43%	0.007%	27.89%

Table 4
Event Study: Launching of a commercial web site

This table reports investor reactions to announcements of the launching of a commercial web site. I estimate cumulative abnormal returns (*CARs*) over the 3 day period (-1 to +1) surrounding the announcement. Market model parameters α and β, are estimated following Dodd and Warner (1996). The *CARs* are sorted by the median Gompers, Ishii, and Metrick (2003) governance index (G-index). I report mean and median differences with a 2-tail t-statistic and a Wilcoxon Z statistic, respectively.

	N	**Mean *CAR***	**Median *CAR***
All firms	147	1.24% (2.67)	0.91% (2.86)
G-index < 9	73	1.82% (3.25)	1.04% (1.71)
G-index ≥ 9	74	0.66% (0.72)	0.44% (1.05)
Mean differences across G-index (*t*-statistic)		2.03	
Median differences across G-index (Wilcoxon *Z*)			2.63

Table 5
Multivariate analysis: Investor reactions

This table reports ordinary least squares estimates of the cumulative abnormal returns (*CARs*) over the 3-day window surrounding the announcement of the launching of a commercial web site (from day -1 to day 1). The sample includes 147 firms that make such announcement from 1994 to1999. Leader is a dummy variable that takes the value of 1 if the firm is the first its industry to launch a commercial web site. Return on assets (ROA) is operating income before depreciation (Compustat item 13) plus the decrease in receivables (Compustat item 2), the decrease in inventory (Compustat item 3), the increase in current liabilities (Compustat item 72), and the decrease in other current assets (Compustat item 68). This measure is divided by the average of beginning- and ending-year book value of total assets (Compustat item 6).I report standard errors in parenthesis below each coefficient estimate.

	Dependent variable: *CAR* (-1,1)	
	Estimate	***p*-value**
Intercept	0.08273 (0.02613)	0.0019
G-index	-0.00452 (0.001930)	0.0208
Firm size (natural log of assets)	-0.006 (0.00324)	0.0663
Leader (0,1)	0.0206 (0.01013)	0.044
Debt to equity ratio	0.00798 (0.00349)	0.0238
Capital expenditures/sales	0.01396 (0.06624)	0.8335
ROA_{t-1}	-0.02077 (0.03055)	0.4978
ROA_{t-2}	0.00604 (0.04207)	0.886
Time effects	Yes	
Stock market effects	Yes	
Adjusted R^2	0.0786	
F-value	2.66	

Table 6
Multivariate analysis: Industry-adjusted differences in operating performance

Coefficient estimates of the annual changes in industry-adjusted performance. I measure operating performance as the firm's return on assets (ROA). I estimate ROA as operating income before depreciation (Compustat item 13) plus the decrease in receivables (Compustat item 2), the decrease in inventory (Compustat item 3), the increase in current liabilities (Compustat item 72), and the decrease in other current assets (Compustat item 68). This measure is divided by the average of beginning- and ending-year book value of total assets (Compustat item 6). I then adjust this measure by the median ROA for the industry matching by 2-digit SIC. For each firm, I estimate the change in operating performance by subtracting industry adjusted ROA in year +1 from industry adjusted ROA in year -1, where year 0 corresponds to the year in which the firm launches a commercial web site. Standard errors appear in parentheses below each coefficient estimate.

	Dependent variable: Δ industry adjusted ROA			
	(1)		**(2)**	
	G-index < 9		**G-index ≥ 9**	
	Estimate	***p*-value**	**Estimate**	***p*-value**
Intercept	0.19397 (0.05249)	0.0005	0.23469 (0.07752)	0.0036
CAR (-1,1)	0.84179 (0.29393)	0.0057	0.3175 (0.23167)	0.1756
Firm size (natural log of assets)	-0.01611 (0.00759)	0.0378	-0.00917 (0.01064)	0.3922
Leader (0,1)	-0.04462 (0.0243)	0.0712	0.03903 (0.03169)	0.2229
Debt to equity ratio	0.00452 (0.01143)	0.6937	0.01907 (0.00951)	0.0494
Market-to-book ratio	0.08625 (0.1575)	0.586	0.24086 (0.21908)	0.276
Stock market adjusted return $_{t-1}$	-0.01063 (0.05946)	0.8587	0.20077 (0.27793)	0.4729
Stock market adjusted return $_{t-2}$	-0.90247 (0.16854)	0.0001	-0.93315 (0.20048)	0.0001
F-value	19.88	0.0001	13.6	0.0001
Adjusted R^2	0.6636		0.5647	
N	73		74	

Table 7
Changes in Stock Demand and Supply

Panel A reports monthly changes in short interest surrounding the launching of a web site. Short interest is the total number of shares of a particular stock that have been sold short by investors but have not yet been covered or closed out. The level of short interest in individual stocks is collected monthly from the *Wall Street Journal, Barron's*, the *New York Times*, and *Bloomberg*. Panel B reports changes in institutional ownership around the quarter launching of a web site. Institutional ownership data are collected from the SEC Form 13-F filings reported in the Thomson Financial's CDA/Spectrum Institutional (13-F) Holdings database. The SEC requires money managers with at least $100 million in assets are required to file this form with the SEC 45 days after the end of any quarter. To assess the statistical significance in both panels, the last column provides *t*-statistics in parenthesis. The symbols *,**,*** denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Panel A: Changes in Short Interest (millions of shares)			
	After Internet technology	**Before Internet technology**	**Δ**
All firms (*N*=96)	33.8	29.7	4.1 (1.3)
G ≥ 9 (*N*= 54)	37.1	31.2	5.9** (2.08)
G < 9 (*N*= 42)	29.6	27.8	2.2 (0.96)
Panel B: Changes in Institutional Ownership (% of common)			
	After Internet technology	**Before Internet technology**	**Δ**
All firms (*N*=118)	42.6	42.6	0.0 (0.00)
G ≥ 9 (*N*= 72)	33.2	35.3	-2.1 (1.59)
G < 9 (*N*= 46)	57.4	54.1	3.3* (1.99)

Table 8
Reaction to firms that do not adopt Internet technologies

This table reports the results of an event-study related to the adoption of Internet technologies on matching firms that do not adopt such technology. The matching sample is created following Barber and Lyon (1996) and also matching firms by 2-digit SIC industry codes. I report *t*-statistics under the coefficient estimates.

Adopting firm reaction	**Matching firm reaction**	
(-1,+1) *CARs*	**G-index < 9 (*N*= 57)**	**G-index ≥ 9 (*N*=64)**
Positive	-0.03% (0.45)	-0.75% (1.83)
Negative	0.65% (1.70)	0.13% (0.84)
***t*-statistic of the difference**	2.88	1.66

Table 9
Robustness Tests

Panel A presents the three-day cumulative abnormal returns (*CARs*) associated with announcements of the launching of a commercial web site. We analyze 147 firms that make the announcement anytime between 1994 and 1999. *CARs* are estimated using the standard event-study methodology (Dodd and Warner, 1983). Market model parameters are estimated from one year of daily trading data prior to the event period. The *CARs* are then sorted by a Board index which is constructed based on the board's independence, size, and busy status as described in the text. Numbers in parentheses are two-tailed *t*-statistics.

Panel B presents the three-day cumulative abnormal returns (*CARs*) associated with announcements of the launching of a commercial web site sorted by whether the firms launches an informational or a transactional web site.

Panel C presents the change in the average earnings per share (EPS) forecast by market analysts during the year the web site is launched. From our sample of 147 firms we identify 111 companies for which data on analysts' EPS forecasts can be obtained from I/B/E/S during 1994-1999. The change in the average EPS during the year is calculated by subtracting the average EPS at the end of the year from the average EPS at the beginning of the year. A *t*-statistic from a two-tailed test is reported below each estimate.

Panel A: CAR Decomposition by Board Index						
All firms		**Board-index $\leq$ 1**		**Board-index $\geq$ 2**		**Mean differences across B-index (*t*-statistic)**
N	**Mean *CAR***	***N***	**Mean *CAR***	***N***	**Mean *CAR***	
147	1.24%	63	1.93%	84	0.73%	1.23%
	(2.67)		(3.49)		(0.79)	(2.36)

Panel B: CAR Decomposition by type of Web Site						
All firms		**Informational**		**Transactional**		**Mean differences types (*t*-statistic)**
N	**Mean *CAR***	***N***	**Mean *CAR***	***N***	**Mean *CAR***	
147	1.24%	67	1.05%	80	1.39%	-0.34%
	(2.67)		(2.08)		(2.88)	(0.53)

PANEL C: Change in EPS forecast during the year the new technology was adopted	
G-Index	**Change in the average EPS forecast (from t_0 to t_1)**
G-index < 9 ($N = 54$)	0.0203 ($t = 1.83$)
G-index ≥ 9 ($N = 57$)	-0.0167 ($t = 0.84$)