Effects of Web Traffic Announcements on Firm Value

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ABSTRACT: Data from independent rating firms on traffic to commercial Web sites are routinely used in financial valuation models and in determining advertising rates. These metrics are not always reliable because third-party estimates of Web traffic are vulnerable to technical and methodological weaknesses. Nonetheless, many companies issue press releases proclaiming their achievement of Web traffic milestones. In this article, standard event-study methodology is used to examine how Web traffic announcements affected firm value in the period from 1996 until 2001. The findings indicate that announcements increased firm value only in 1996–1999, and that the increases were indeed due to the announcements rather than the Internet Bubble. The announcing firms, regardless of business model, trading age, financial performance, and other characteristics, experienced value increases of about 5 percent around the time of the press release. This evidence documents the extent to which the market reacted to Web traffic indicators in the late 1990s despite their shortcomings.

KEY WORDS AND PHRASES: Event study, firm value, Internet bubble, Web traffic.

Web traffic constitutes the mass of visitors to an Internet site that can potentially be converted into sales or advertising revenue. Companies obtain true measures of the traffic to their Web sites from their server logs and tracking software, which show who is visiting the site and how often, which path visitors follow within the site, and how long they stay on each page. Data on Web site traffic are also available from independent rating firms, such as Media Metrix, Nielsen//NetRatings, and PC Data Online. These firms regularly release public reports on the number of visitors and other measures of usage at the top Web sites, and issue private reports to their subscribers with more detailed traffic statistics.

In the late 1990s, several articles in the popular press discussed the impact of Web traffic metrics on the market value of firms. *Business Week Online*, for instance, reported an extraordinary increase in the price of stock in Lycos after Media Metrix ranked it as the third-most-visited Web site in April 1999, ahead of Yahoo! and other well-known Internet firms [18]. However, the traffic reported by Media Metrix included the visitors to two companies recently acquired by Lycos even though the merger had not been completed. Thus, the

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traffic data for Lycos were the aggregate of three different Web sites. Investors were unaware of the reason for the favorable numbers reported by Media Metrix and therefore probably assumed that something significant—other than the mergers—had happened. As a result, Lycos shares jumped by more than a third that week [31].

One of the most revealing demonstrations of the value of Web traffic was the 1999 acquisition of BlueMountain.com—the leading Web site in free electronic greetings—by Excite@Home for $780 million. This amount represented more than half of Excite@Home's stock market value of $1.7 billion. BlueMountain was an attractive target because it consistently ranked among the top 10 Web properties in terms of traffic [3]. The acquisition allowed Excite@Home to increase its Internet audience by as much as 34 percent [6]. Unfortunately, Excite@Home never transformed this traffic into advertising revenue, and it sold BlueMountain.com to American Greetings in September 2001 for $36 million, incurring a $744 million loss. According to many analysts, this acquisition contributed to Excite@Home's bankruptcy.

During the Internet bubble,[1] some firms sought to increase their audiences by acquiring frequently visited Web sites. As a growth strategy, more Web traffic could translate into more sales, increased advertising revenue, or a more attractive initial public offering (IPO) for companies planning to go public at the time. Despite the uncertain connection between reported Web metrics and actual profitability, investors relied on the metrics as predictors of future performance [23]. Their overconfidence, based on dubious measures, may have drawn attention away from the negative signals provided by traditional financial and accounting indicators, which in fact pointed to the eventual demise of many dot-com firms and the bursting of the Internet bubble.

Despite an abundance of anecdotal evidence documenting the importance of Web site traffic, there is apparently no academic study measuring the direct impact of Web traffic on the market value of firms. Studying Web traffic is important because it is one of the most widely used metrics of Web site performance, a factor whose impact was not well understood in the early days of e-commerce and still isn't. The present article fills this gap in the literature by using the standard event-study methodology to examine whether press releases reporting traffic achievements affect firm value [4]. In particular, it investigates changes in firm value that can be attributed to Web traffic announcements.

The research reported in this article expands and complements the emerging body of e-commerce literature that analyzes market reactions to specific types of events. Its main objectives are to investigate whether investors react positively to announcements of Web traffic milestones, as they did with Internet-related name changes, acquisitions of net companies, and other e-commerce initiatives during the Internet bubble, and to test whether this reaction persists in the post-bubble era. There is considerable uncertainty about the reliability of Web traffic as an accurate measure of Web site activity. It is not obvious how or whether investors react to Web traffic information. The article also investigates the question of whether market reactions to Web traffic milestones are dependent upon firm characteristics.

Measuring Web Traffic

Web traffic is different from other types of network traffic because of the nature of the hypertext transfer protocol (HTTP). Clicking on hyperlinks generates traffic for each new page, image, or media file displayed or presented to the user even if they are all from the same site. From a technical standpoint, any item of viewable or usable data from a Web site received by the user (e.g., a Web page, an image, a video clip, or a sound file) is counted as a *hit.* Related items, such as different images on the same page, can generate several hits every time the page is requested.

A more accurate indicator is a *visit,* which refers to a single session with a single user, beginning the moment the user requests the information on the site (e.g., by manually entering the URL) and ending when the user leaves the site. Whereas all the files a user receives when visiting a site are considered hits, a visit counts every Web page requested by the same user only once regardless of how many objects are on the page. However, the number of visits does not necessarily produce an accurate count of visitors because a single user may visit a site more than once during any given period. Therefore, visits cannot reveal how many different users go to a site.

Since hits and visits can be misleading, other statistics, such as number of unique visitors, reach, and page views (impressions), are used to estimate traffic. *Number of unique visitors* gives unduplicated counts of how many people visit a Web site. *Reach* indicates the number of unique visitors expressed as a percentage of the active Internet population. *Page views* indicate how many times a Web page is viewed. Page views are different from user counts because a single visitor may view a page more than once. The exact definition and operationalization of these constructs vary across firms [1].

Companies can estimate their traffic volume by analyzing their server logs with special tracking software that pinpoints how long visitors spend on a page, how they get there, and how often they return, and then computes the number of visitors and page views. These site-centric metrics are useful for optimizing Web server performance and for logistical purposes. However, because of their technical limitations, Web server log data do not provide precise usage statistics and accurate counts of individuals visiting the site [12, 20, 29]. Moreover, these metrics are not comparable across sites.

Traffic figures estimated by independent audience-measurement firms provide more precise estimates of unique users or unduplicated user counts than site-centric data from server logs, and can be used to compare the popularity of different sites. Independent measurement companies, such as Media Metrix, Nielsen//NetRatings, and PC Data Online, estimate traffic using a sample of volunteers. There is a monitoring device on each volunteer's computer that tracks the volunteer's Web-browsing activity.

Third-party estimates of traffic are called *user-centric* measures because they are obtained directly from a sample of users. The rating firm, extrapolating from the results of its sample to the population at large, produces private traffic reports for its subscribers and public reports of the most visited Web sites as well as other traffic statistics. Companies register their Web sites to obtain their own audited and private traffic reports. Advertisers and media

planners also subscribe to audience-measurement firms to calculate advertising rates based on traffic statistics [19]. Industry researchers and investment analysts use traffic reports to study the prospects of firms or sectors of interest to them.

Because of the technical and methodological difficulty of measuring Web audiences, there is no industry-wide standard for site traffic. Consensus has yet to be reached on what to measure and how to measure it [20]. The user-centric estimates produced by different audience-measurement firms are not mutually consistent because each rating firm uses a different sample and methodology [15]. Notwithstanding their limitations, user-centric traffic milestones documented by independent rating firms are usually disclosed to the public via corporate press releases that identify the rating company that produced the data. Because traffic data are not always consistent or reliable [13, 18], it is reasonable to expect the market to be cautious and slow in incorporating independently audited Web traffic statistics in its valuations of Internet companies.

Literature Review and Hypotheses

User-centric Web traffic indicators were used during the late 1990s to analyze the success of e-commerce initiatives and to estimate the growth potential of firms in terms of increased ad revenues or higher sales. In the absence of earnings information, which was the norm in many dot-com firms, alternative firm-valuation models used the number of visitors or potential customers (or "eyeballs") as the basis for calculating the future growth of firms [28]. Therefore, current Web traffic was perceived as a leading indicator of future revenue [32].

Several academic studies documented the relevance of Web traffic for Internet stock prices and firm valuation in the late 1990s. The number of unique visitors was found to provide incremental power for explaining stock prices after controlling for basic accounting and economic variables in a multivariate context [14, 24, 32]. Although traffic is value-relevant, the associations between traffic and sales levels or traffic and sales growth were found to be weak and insignificant [24]. The empirical evidence indicated that the expectations created by traffic metrics failed, in most cases, to increase sales.

In order to sort out the relevance of the different user-centric traffic measures, Demers and Lev undertook a factor analysis of the raw metrics provided by Nielsen//NetRatings and extracted three factors that captured the most relevant dimensions of Web site performance [9]. The first was *reach*, the number of unique individuals who visit a site, as a percentage of the Web surfing population. The second was *stickiness*, the ability of the site to retain the visitor or the length of the visit. And the third was *customer loyalty*, the ability of site to generate repeat visits. These three measures have been found to be value-relevant for the stock prices of Internet companies.

Although several studies report a positive association between Web traffic volume and firm value [9, 11, 24, 32], the direct impact of a Web traffic announcement via a press release on the value of a firm has largely been

overlooked. Prior literature on Web traffic shows a correlation, but not a causal relation, between traffic metrics and stock prices. One way to investigate whether Web traffic announcements drive stock prices and firm-value increases is by using the event-study methodology. Academic research on other types of e-commerce announcements have used event-study methodology. In particular, e-commerce initiatives, Internet-related corporate name changes, and Internet-related acquisitions have been found to increase the value of the firm [7, 24, 30].

Cooper, Dimitrov, and Rau documented the positive reactions of stock prices when firms announced that they were changing their corporate names to Internet-related ("dot-com" or "dot-net") names [7]. The effect produced Cumulative Abnormal Returns (CARs) of approximately 74 percent for the 10 days surrounding the announcement date. Since there is no evidence of a post-announcement negative drift, the effect does not appear to be transitory. In addition, the effect is similar across firms, regardless of their actual level of involvement with the Internet. Association with the Internet through a name change is sufficient to prompt a large and permanent increase in firm value.

Subramani and Walden studied more than 250 e-commerce initiative announcements between October and December 1998 [30]. Their results suggest that business-to-consumer (B2C) firms experience larger valuation increases than business-to-business (B2B) firms as a result of e-commerce announcements. In addition, e-commerce initiatives involving tangible goods prompt higher value gains than initiatives involving digital products. Their findings validate the popular notion that capital markets anticipate and value the potential benefits of e-commerce, but do not explain how different types of announcements contribute to changes in firm value. These authors excluded Web traffic announcements from their sample, an issue that will be addressed in this study.

Ranganathan and Dadalt examined a sample of more than 150 Internet-related acquisitions in 1999 [25]. Their findings indicate that stock markets react favorably to announcements of Internet acquisitions. Although both acquiring and target firms experienced significant and positive gains in market value, the target firms benefited more than the buyers. Moreover, related acquisitions exhibited higher value increases than unrelated purchases.

The empirical literature suggests that e-commerce-related announcements increase the value of the firm [7, 30], and that independently audited traffic metrics are value-relevant to firms [9, 11, 24, 32]. Prior research also shows that site traffic indicators are linked to CEO compensation [8], indicating that Web traffic is a useful metric of value creation in contexts in which few other indicators of performance may be available. Traffic measures are easy to capture, but they suffer from methodological and conceptual problems [1, 22]. Despite these limitations, the disclosure of a traffic milestone signals the popularity of a Web presence and points to better prospects for future revenue and growth. Therefore, investors will react positively and adjust their expectations of future achievements. In light of this, one may hypothesize:

> *H1: The announcement of Web traffic milestones will increase the value of the firm.*

There are relatively few studies of Web traffic in the e-commerce literature, even though site traffic measures are a good surrogate for Web site efficiency and success [1, 22]. Several authors have examined the drivers of site traffic from different perspectives. For example, Alpar, Porembski, and Pickerodt present a model based on empirical data for a number of Web sites, to determine which sites are more efficient at generating Web traffic [1]. According to their model, Web sites with special-interest content are better traffic generators than those with general-interest content. This result suggests that information content is an important driver of traffic.

Using strategic and accounting variables, Rajgopal, Kotha, and Venkatachalam modeled the determinants of Web site traffic (i.e., reach) in terms of alliances with AOL, affiliate programs with other sites, media visibility, and marketing expenditures and cash constraints [24]. Their findings indicate that relations with traffic generators (alliance with AOL and affiliate programs) are positive but weakly associated with traffic, whereas media exposure and cash constraints exhibit strong and positive correlations with reach. This evidence indicates that media exposure creates traffic, whereas cash constraints restrict firms from chasing traffic.

Rajgopal, Kotha, and Venkatachalam imply that media exposure creates traffic [24]. The contention in this article is that traffic milestones receiving media exposure will increase the value of firms. In fact, any company achieving a traffic milestone endorsed by an independent rating firm will readily communicate this achievement so as to send a positive signal to investors, analysts, and potential customers about the popularity of its Web presence. According to signaling theory, the purpose of this kind of communication is to inform or influence the actions of the company's constituents (buyers, investors, competitors, analysts, customers, employees, etc.) [14].

In general, publicly traded companies typically use press releases to announce their projects, achievements, personnel changes, and strategic decisions. Firms with a relatively shorter trading life (i.e., having only recently gone public) usually have more uncertain prospects and unclear survival expectancy than firms that are more established in the market. Thus, any signal that provides investors with additional information about the likelihood of success of a young publicly traded company should produce comparatively larger valuation adjustments. These conjectures lead to:

> *H2: Younger firms will have larger valuation increases than older firms as a result of the announcement of Web traffic achievements.*

Attaining a large amount of Web traffic is an intermediate goal of most sites [1]. However, Web traffic is not equally important for every Internet firm [9, 24]. The role of Web traffic is dependent upon the firm's business model. For e-tailers (e.g., Amazon.com), Web traffic is mostly an indicator of the potential customer base and sales growth. For portals and content providers, traffic can be converted into money ("monetized") by charging higher advertising rates. Other on-line business models, such as Internet security firms, network infrastructure, and software providers, derive little benefit from increased traffic to their sites.

Therefore, announcing a traffic milestone is of strategic importance for firms whose revenues are directly related to the number of visitors. Because traffic data for commercial Web sites, released by independent rating companies, are a key factor in determining advertising rates, traffic is especially valuable for sites that earn revenue by selling advertising space [1, 19]. In particular, the pricing models of portals, search engines, and content/community sites are more dependent upon higher advertising revenues than the models for e-tailers and service sites, for which traffic is an indication of their potential customer base. Therefore, one would expect companies with ad-based business models to benefit more from the achievement of traffic milestones than other types of firms. Thus,

> *H3: Advertising-driven sites will experience significantly higher valuation increases than sales-driven companies as a result of Web traffic announcements.*

Historically, investors have rushed to buy shares of firms connected to an industry with significant growth potential and uncertainty [7]. The Internet's "gold rush" was no exception. One of the most striking characteristics of many publicly traded Internet companies in the late 1990s was their high valuation despite the absence of profits. Porter explains the high-valuation phenomenon by arguing that investors relied on "dubious measures of performance" and ignored the signals of traditional accounting indicators [23]. Web traffic metrics belong to this "dubious" category because of the inherent methodological and technical difficulties associated with producing user-centric traffic measures. In this context, communicating the achievement of a traffic milestone will have a stronger effect for firms that are not turning profits. Thus,

> *H4: Firms that are not profitable will experience larger valuation increases than profitable companies as a result of the announcement of Web traffic milestones.*

Using the event-study approach, these hypotheses were tested by analyzing investors' reactions around the announcement of Web traffic. Event studies have been widely used in several business disciplines to study the impact of managerial decision-making and other economic factors on the creation (or destruction) of firm value. In the IS field, this method has been used to study value creation through IT investments [10, 17], and ERP announcements [26], among others. Using regression analyses, previous studies of Web traffic have shown that these metrics are one of the many factors that influence firm valuation. The present research uses the event-study methodology to establish a causal link and quantify the extent to which traffic announcements increase the value of firms when they disclose Web traffic milestones via press releases.

Event-Study Methodology

The event-study methodology is based on the efficient market hypothesis [11]. According to this hypothesis, financial markets process publicly available in-

formation to assess current firm performance and to adjust expectations of future achievements. At any given time, the stock price of a publicly traded firm reflects all the available information about the firm's current and future profit potential. Thus, any news resulting from an unexpected event, or any additional information that may affect the firm's current and future earnings, will produce changes in the stock price of the firm that reflect the new assessment of the firm's value. The amount of change in the price of a security after an event, compared with its pre-event price, reflects the market's unbiased estimation of the economic value of the new information [4].

Any announcement that contains new information should prompt investors to adjust their expectations of the value of the firm and its potential for future revenues. In order to assess whether an announcement affects the stock price of a firm, one must estimate what the stock price would have been had the event not taken place. Abnormal stock returns are then computed by subtracting raw returns around the event date from the market model expected returns. If the difference between the expected stock return and the actual return earned by the firm is significant, then one may conclude that the announcement had an effect on the market valuation of the firm. The magnitude of this difference provides a quantifiable measure of the impact of the announcement on firm value.[2]

Event-study research examines how individual investors react to new information when it becomes public knowledge and the extent to which they adjust their expectations of the market value of the firms making the disclosures. The use of this methodology to study the behavior of Internet stocks makes sense because, as Demers and Lev point out, a significant percentage of the public floats of these companies is held by individual investors (including "day traders") who are likely to react to news or press releases about Internet companies [9].

The strength of the event-study method is its potential to associate changes in firm valuation with specific events as they become public knowledge. Since stock prices are naturally noisy, however, an event of interest must generate a significantly substantial change in value to be detected above the normal background noise of the market. Moreover, for some events, it is difficult to determine exactly when the actual information became available. In some instances, because of earlier leaks or announcements after trading is closed for the day, the date of the official announcement may not accurately indicate when the market received the news [5].

To conduct an event study, researchers must specify the estimation period and the event window. The *estimation period* is the length of time prior to the event over which the market model will be estimated. The duration of this period is usually one year (255 days) or six months (120 days) of trading data. The *event window* indicates the number of days before and after the announcement over which the abnormal returns will be accumulated. If the Cumulative Abnormal Returns are significantly different from the expected returns, one may conclude that the event affected the value of the firm. McWilliams and Siegel advise against long event windows, because the longer the window, the greater the likelihood that other news items in addition to the event under study may affect the returns [21]. Thus, many event studies use a

(–1, +1) event window—one day before and one day after—with "0" being the date of the announcement. Including "yesterday" captures whether reactions occurred shortly before the public announcement due to press leaks or insider trading. In contrast, including "tomorrow" ensures that a reaction is measured even if the event was announced late on (or at the close of) the previous trading day.

In order to attribute price changes to specific events, announcements must be "uncontaminated." A contaminated event occurs when the news of interest is released to the public simultaneously with other relevant information, such as management appointments, changes in the board of directors, or the launch of new products. In these cases, the stock price reaction may be due to events other than the one under study. For example, if firms announce traffic achievements along with dividend or earnings announcements, it would be difficult to establish which of these events caused the market reaction, and some events may offset others. To address and circumvent all these possible event announcement problems, the data were screened for some of the situations described above that could have contaminated the observations.

Data Collection

The LEXIS/NEXIS data-retrieval system was searched for press releases (PR Newswires or Business Wires), using the keywords "Media Metrix," "Nielsen," and "PC Data." These three firms are the leading providers of independent Web-traffic measures. Each search was narrowed further with the term "traffic" and the words "web site OR website." The search was conducted in the 1996 to 2001 period. Initially 1995 was set as the starting date, but the first announcement that qualified was found in 1996. An initial pool of more than 2,000 articles met these selection criteria.

The articles that were selected all described an individual traffic achievement of a Web property, whereas the discarded articles merely described alliances between independent rating companies or new methods for estimating audience statistics. Eliminated from the traffic milestone group were duplicate announcements (i.e., announcements referring to the same achievement) and news articles related to companies that were not publicly traded. Also excluded were firms that had experienced a news event on the same date as the announcement, such as a merger, earnings, or dividend, that could have contaminated the effect of the Web traffic press release. This screening procedure reduced the number of observations to 283 noncontaminated usable events referring to publicly traded companies.[3] Table 1 shows the total number of announcements by year and source after the filtering procedure.

These press releases highlighted individual traffic achievements by publicly traded firms, according to one of the independent rating firms (Media Metrix, Nielsen, or PC Data). In most cases, these companies were not part of the periodic reports of most visited Web properties freely released by the independent rating firms. In the few cases in which the company was clearly a major player, the particular traffic achievement or the significance of the milestone was not fully explained in the aggregated traffic report.

Source	1996	1997	1998	1999	2000	2001	Total
Media Metrix	0	1	16	57	69	68	211
Nielsen	2	0	0	5	21	12	40
PC Data Online	0	0	0	12	18	2	32
Total	2	1	16	74	108	82	283

Table 1. Traffic Announcements by Rating Firm and Year.

Because of the search strategy, all of the articles in the sample highlighted user-centric traffic measures. These traffic metrics had several advantages over site-centric data. They were estimated by a third party (i.e. independent rating firms), they produced more accurate counts of visitors, and they allowed comparison across different sites. However, traffic estimates for the same site produced by two different audience measurement companies may not be consistent because of the use of different panels and estimation techniques.

Results

A firm's expected return and the market model parameters were estimated from common stock returns from the database of the University of Chicago's Center for Research in Security Prices (CRSP). The market model parameters were estimated from 255 days of trading data (about one year) preceding the event window to 10 days before the event. With this estimation period, 10 observations were lost because of insufficient trading data. The Cumulative Abnormal Returns were computed on the (–1, +1) window, consistent with other event studies and with McWilliams and Siegel's recommendation of using short windows [21, 30]. This window was used for the complete sample (January 1, 1996–December 31, 2001), for the Internet bubble sample (January 1, 1996–December 31, 1999), and for the post-bubble sample (January 1, 2000–December 31, 2001). Table 2 shows the results of these tests.

The event-study results for the complete sample on the (–1, +1) window supported *H1*, which states that traffic announcements are expected to have an impact on the market value of the mentioned firms. The Cumulative Abnormal Returns for the three-day event window are, on average, 1.81 percent ($p < 0.05$), and 144 announcements prompted positive reactions, whereas 129 received negative ones. According to the generalized-sign z-test, the proportion of announcements with positive reactions was significantly higher (1%) than the number of firms experiencing positive returns in the estimation period.

The sample was then divided into two groups based on the year in which the announcement was produced. This chronological breakdown produced two subsamples: the Internet bubble group (announcements from 1996 to 1999) and the post-bubble group (press releases from 2000 to 2001). Event-study tests on each of these subsamples revealed that investors reacted positively to Web traffic announcements in the late 1990s, and that the same type of press releases did not produce significant CARs in 2000 and 2001. Thus, the significant results obtained for the sample at large were due to the high CARs experienced by the firms in the 1996–1999 period.

	Number of events	Average CAR (%)	t	Positive: Negative	Gen Sign Z
Complete sample (Jan. 1, 1996-Dec. 31, 2001)	273[a]	1.81	2.308*	144:129	2.671**
Internet bubble sample (Jan. 1,1996-Dec. 31, 1999)	87	5.47	3.325***	62:25	4.700***
Post-bubble sample (Jan. 1, 2000-Dec. 31, 2001)	186	0.10	0.11	82:104	0.015

Table 2. Event-Study Results Using a (–1, +1) Window.

[a] Ten observations cannot be used for this analysis for lack of trading data (six observations are lost in the Internet bubble sample, and four observations are lost in the post-bubble sample).

$p < +0.10$. *$p < 0.05$. **$p < 0.01$. ***$p < 0.001$

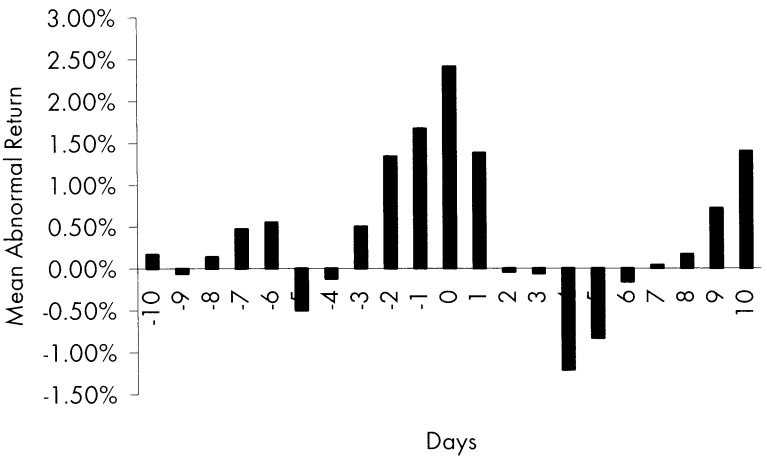

Figure 1. Abnormal Returns Around the Announcement Date for the 1996–1999 Sample

Announcements in the Internet bubble sample produced average CARs of 5.47 percent in the three-day event window (–1, +1). These CARs were significantly different from zero ($p < 0.001$). Moreover, 62 announcements produced positive reactions, which according to the z-statistic was significantly higher ($p < 0.001$) than the number of firms experiencing positive returns in the estimation period.

Figure 1 shows the average returns experienced by these firms 10 days before and 10 days after their respective traffic announcements, to compare the reactions day by day. The graph shows a spike in the firms' average abnormal returns around the announcement date. The highest average abnormal returns (about 2.5%) were observed the day of the announcement. The figure also suggests the presence of preannouncement leakage in the days before the press release and a one-day postannouncement delay.

The Internet bubble sample contained 93 traffic announcement events for 47 publicly traded companies, most of which were pure Internet companies,

or dot-coms. Because the late 1990s was a period in which the firms experienced consistent increases in their stock prices, it can be argued that these results are due to special characteristics of the period under study rather than the impact of the announcement per se. To test whether Web traffic announcements were indeed driving stock prices during the Internet bubble, and to rule out the possibility of other factors influencing the value of the firms in this period, the dates of the firms in the sample were scrambled and additional analyses were run.[4]

Forty alternative samples were assembled with the same firms linked to dates different from their own announcement date. To create the new samples, the announcement dates were randomly assigned to other firms. An event study was run with the same parameters for each of the samples in the (–1, +1) window. Table 3 shows the results of each of these permutations. The majority of these runs produced CARs that were not significantly different from zero. The mean of these CARs was 1.46 percent, and the standard deviation was 0.01. Only three samples were significant at 5 percent. Thus, the significant results obtained for the original 1996–99 sample were due to the impact of Web traffic announcements and not to the effect of the Internet bubble.

Cross-Sectional Analyses of 1996–1999 Sample

Because only announcements in the 1996–99 sample experienced significant CARs, all of the subsequent analyses were based on this sample and the (–1, +1) window. Financial and accounting data for the 47 firms in the sample were collected from Compustat. Table 4 presents descriptive statistics of the firms in terms of annual revenues, net income, and number of employees. Annual revenues ranged from $840,000 to $19,747,000, with an average of $637 million and a median of $45 million. Net income went from about $160 million to $7,785,000. The net income average was $161,500,000, and the median was $25 million. The number of employees per firm ranged from 71 to more than 31,000, and the average was 1,728 with a median of 403. Trading age was computed as the difference between the firm's IPO date and the date of the announcement. The average firm in the sample had been publicly traded for 580 days (19 months), with the youngest trading for about a week, and the oldest trading for more than 13 years.

Because most of the firms in the sample belonged to the Internet industry, the study followed the Wall Street Research Net (WSRN) classification (www.wsrn.com/apps/internetstocks/) and determined the type of firm in terms of the following categories: e-tail, content/communities, financial news/services, portal/search, services, consultant/designers, e-commerce enablers, Internet security, ISP/Access, software, advertising, and speed/bandwidth. About half of the companies in the sample (25/47) had only one traffic announcement, and about a third had two or three announcements. The remaining firms had more than three announcements during the four-year period. Table 5 reports the names of these firms, their Internet sector classification, and the number of announcements for each company.

Scrambled sample no.	Average CAR (%)	t	Positive: negative	Gen Sign Z
1	2.49%	1.588†	43:47	0.341
2	-1.02%	-0.546	23:39	-1.446†
3	2.19%	1.384†	46:42	1.181
4	0.41%	0.245	41:47	0.112
5	1.64%	0.956	41:46	0.233
6	2.54%	1.391†	41:43	0.506
7	2.78%	1.774*	46:38	1.66*
8	1.63%	0.978	42:41	0.811
9	2.12%	1.314†	42:41	0.769
10	1.60%	1.013	39:44	0.099
11	2.32%	1.331†	38:44	-0.018
12	0.76%	0.43	36:42	-0.001
13	1.05%	0.599	38:38	0.648
14	-0.15%	-0.088	34:43	-0.483
15	0.66%	0.364	34:43	-0.481
16	1.65%	0.951	37:40	0.226
17	2.46%	1.459†	44:34	1.808*
18	2.15%	1.27	45:32	2.150*
19	1.61%	0.989	35:41	-0.07
20	0.43%	0.252	37:39	0.406
21	1.48%	0.822	37:38	0.509
22	1.81%	1.08	37:37	0.619
23	0.71%	0.431	33:40	-0.223
24	1.24%	0.719	36:37	0.46
25	-0.02%	-0.011	29:43	-1.065
26	1.67%	0.972	39:33	1.315†
27	1.31%	0.776	34:38	0.116
28	3.09%	1.777*	37:34	0.914
29	2.87%	1.650*	40:30	1.771*
30	1.08%	0.634	34:35	0.404
31	1.84%	1.051	41:27	2.205*
32	2.44%	1.441†	39:28	1.873*
33	2.59%	1.567†	40:26	2.245*
34	0.57%	0.334	33:33	0.528
35	2.22%	1.319+	28:37	-0.631
36	1.39%	0.809	29:35	-0.284
37	-0.69%	-0.405	30:34	-0.058
38	-0.35%	-0.21	28:35	-0.434
39	2.60%	1.526†	31:30	0.543
40	1.30%	0.762	33:28	1.086

Table 3. Event-Study Results for Scrambled Samples.

$p <$ † 0.10. *$p < 0.05$. **$p < 0.01$. ***$p < 0.001$.

To test *H2*, the sample was divided according to the ages of the firms, computed as the number of calendar days from the IPO to the date of the announcement. The cutoff was 428 days (about 14 months), which was the median age of the firms in the sample. According to this criterion, 47 events were included in the "young" portion of the sample (IPO ≤ 14 months), and 46 in the "old" subsample (IPO > 14 months).

The third hypothesis, *H3*, required splitting the sample according to the Internet-sector classification of the firms. Using the classification of WSRN,

	M	(*SD*)	*Min*	*Max*	*Mdn*
Revenue (in $millions)	636.95	(2,905.17)	0.84	19,747	45.20
Net income (in $millions)	161.48	(1,134.43)	-159.90	7,785	-25.0
Employees	1,727.88	(4,981.40)	71	31,396	402.5
Trading age (in calendar days)	579.8	(709.3)	7	4,926	428

Table 4. Descriptive Statistics of Firms in Sample.

Sector	*n*	Companies (Number of Announcements)
Advertising	2	DoubleClick (1), TMP Worldwide (5)
Content/communities	15	Cnet (4), DrKoop (3), Go2Net (2), HealthCentral (1), HomeStore (2), Intelligent Life (1), iTurf (1), iVillage (2), Martha Stewart Living (1), Onhealth (7), Student Advantage (1), Sports Line (2), Talk City (3), The Globe (2), ZDNet (2)
E-tail	11	Amazon.com(1), Beyond.com (1), BigStar (2), CDNow (1), eBay (1), Global Sports (1), Egghead (1), PreviewTravel (6), PlanetRX (1), SportsAuthority (1), ShopNow (1)
Financial	1	CMGI (2)
Portal/search engine	9	AOL (3), AskJeeves (1), Banyan Systems (3), Disney's Go Network(2), Geocities (2), Lycos (7), LookSmart (1), Microsoft (1), Netscape (1)
Security	1	Network Associates (1)
Services	7	Imall (1), MyPoints (3), Mapquest (1), Mail (1), N2K (1), Xoom (2), Yesmail (1)
Software	1	International Microcomputer Software (2)

Table 5. Internet Sector Classification and Number of Announcements per Firm.

two subsamples were created. The advertising-driven portion contained 55 events from firms in the portal/search and content/communities sector. The sales-driven sample included 38 announcements for firms in the e-tail, services, financial, security, and software Internet sectors.

For *H4*, the sample was divided into firms without profits in the year of the announcement against firms with profits in the same period. Firms without profits were defined as those with negative net income at the end of the fiscal year in which the announcement was released. A total of 74 events were classified in the former group, and the remaining 19 in the latter. It is noteworthy that almost 80 percent of the traffic milestone announcements belonged to firms without profits.

Table 6 reports Cumulative Abnormal Returns for each of the subsamples over the (–1, +1) event window. The last column reports the *t*-statistic measuring the significance of the difference between the CARs in each of the subgroups.

In the analysis by trading age, firms trading for more than 14 months

Sample category	Sample size	Average CAR (%)	Positive: negative	*t*	Gen Sign Z	Comparison *t*
Breakdown by age						0.808
IPO ≤ 14 mos.(47)	42	4.38	29:13	0.948	3.261***	
IPO > 14 mos. (46)	45	6.48	33:12	3.697***	3.390***	
Breakdown by sector						0.489
Advertising-driven (55)	53	5.98	41:12	2.787**	4.497***	
Sales-driven (38)	34	4.67	21:13	1.927*	1.902*	
Breakdown by performance						0.492
Without Profits (74)	68	5.80	49:19	2.863**	4.357***	
With Profits (19)	19	4.30	13:6	1.689*	1.816*	

Table 6. Event Study Results by Subsample.

*$p < 0.05$. **$p < 0.01$. ***$p < 0.001$.

experienced CARs significantly different from zero over the event window (M CAR = 6.48%, $p < 0.001$). This was not the case for younger firms, whose CARs were not significantly different from zero. A t-test comparing the average CARs in the two age subsamples was not significant, suggesting that both groups experienced about the same CARs. Thus, *H2* was not supported by the data.

In the Internet-sector classification of the sample, advertising-driven firms experienced positive cumulative abnormal returns around the event window of about 5.98 percent ($p < 0.01$). Sales-driven firms also experienced CARs significantly different from zero around the dates of their respective announcements, but their average CAR of 4.67 percent was significant at 5 percent. Although the average magnitude of the cumulative returns for advertising-driven firms was higher than for sales-driven organizations (5.98% vs. 4.67%, respectively), a t-test confirmed that this difference in means was not significant ($t = 0.489$). Therefore, *H3* was not supported by the data. This result suggests that although traffic may be more important for advertising-driven sites than for sales-driven companies, the value-increasing effects of the disclosing traffic milestones are about the same for both types of firms.

In the analysis by performance, unprofitable firms experienced CARs on the order of 5.8 percent, significantly different from zero at 1 percent, whereas profitable firms experienced CARs of 4.3 percent, which were significantly different from zero at 5 percent. Even though the magnitude of the CARs of unprofitable firms was higher than the average CARs of firms turning a profit (5.8% vs. 4.3%, respectively), a t-test confirmed that the difference between these means was not significant ($t = 0.492$). Thus, *H4* was not supported by the data. Both types of firms (profitable and unprofitable) experienced about the same CARs regardless of their financial performance. Other measures of performance, such as operating income before depreciation and amortization, produces results similar to those reported here.

For all the subsamples, the number of events with positive returns was significantly higher than the fraction of firms with positive returns in the estimation period. The generalized-sign z was significant for the two subgroups in each breakdown. The fact that the fraction of firms with positive returns

was significantly higher than the fraction in the estimation period indicates that traffic announcements generated positive market reactions beyond what would normally have been expected if these events had not occurred. In other words, not only were the CARs positive and significant across subsamples, but the number of firms experiencing positive returns was significantly higher than those with positive returns in the estimation period.

Taken together, the results of *H2*, *H3*, and *H4* failed to support the hypothesized CAR differences in terms of trading age, Internet-sector classification, and financial performance, respectively. However, to consider the simultaneous effect of age, sector, and profit variables on the CARs that were obtained, a multivariate regression model was specified. The dependent variable was the CAR of the firm "*i*" on the (–1, +1) window, and the independent variables were trading age in calendar days, Internet sector, and yearly profits.

$$CAR_i = \beta_0 + \beta_1 age + \beta_2 sector + \beta_3 profit + \varepsilon_2 \quad (1)$$

The results of the multivariate analysis are presented in Table 7. The model was not significant and had a low square of multiple correlation. These results confirmed the cross-sectional analyses. The selected variables (age, sector, and profit) did not have any explanatory power regarding the observed CAR for the firms in the 1996–99 sample.

Discussion and Limitations of Results

The findings of this study suggest that Web traffic announcements generate positive market reactions, despite the shortcomings and lack of reliability of Web traffic metrics. Although the event-study results were significant for the entire sample (1996–2001), a chronological breakdown shows that the cumulative abnormal returns were only found in the Internet Bubble period (1996–99). This outcome confirms that "traffic buzz" increased the value of the firms during the late 1990s, when their stock prices increased, on average, 5 percent on the dates surrounding the announcement.

The results also show that the cumulative abnormal returns were similar across firms, regardless of their trading age, their Internet-sector classification, or their financial performance. Contrary to expectations, firms that had recently gone public (IPO ≤ 14 mos.) experienced CARs similar to those of companies with longer trading histories. Likewise, classification by Internet sector did not produce CARs of significantly different magnitudes for advertising-driven and sales-driven companies. Although the vast majority of the firms in the sample did not produce any profits at the time of the announcement, the added value of announcing a user-centric traffic milestone endorsed by an independent rating company was similar across firms in spite of their financial performance. All of these results could be an indication that in the 1996–99 period, the market's perceptions of traffic announcements were not affected by specific characteristics of the firms.

These results suggest that because of the novelty of e-commerce in the late

Independent Variables	Parameter	(*SE*)	*t*
Intercept	5.321	(4.096)	1.29
Age	0.004	(0.002)	1.90†
Sector	-1.726	(2.672)	-0.65
Profit	-0.003	(0.002)	-1.44
R^2	0.05		
F	1.30		

Table 7. Multivariate Analysis of CARs.

† $p < 0.10$.

1990s, traffic achievements were believed to be a key metric of success for all Internet-related firms. The nonsignificance of particular firm characteristics studied here (age, sector, and profit) does not support inferences about the role of the variables to explain abnormal returns due to traffic announcements. If these firm characteristics did not, in fact, affect the magnitude of the reactions, it can be argued that in the late 1990s, investors were not rational in their valuation of Internet-related companies. This argument is consistent with the notion put forth by Cooper, Dimitrov and Rau [7]. In the context of traffic announcements, this insight is noteworthy given the inconsistency of third-party estimates of Web traffic, which were often highlighted in the popular press [18, 31]. However, it is difficult to know whether investors were fully aware of the shortcomings of these measures.

These findings must be interpreted with caution for several reasons. First, it can be argued that in the late 1990s *any* announcement regarding an e-commerce initiative or achievement had a positive effect on the value of the firm. However, an event study on Web site redesign announcements in the late 1990s casts doubt on this statement [2]. According to the findings reported in the study, such announcements did not increase the value of the firm, as did other types of announcements in this period. Besides, even if any or most of the e-commerce-related announcements had a positive effect on the value of firms, it is necessary to determined whether the reactions were of different magnitudes depending upon the type of announcement. The present study is a first step in that direction.

The second factor pertains to the nature and size of the Internet Bubble sample. Because the 1996–99 sample was mainly composed of pure-Internet firms, or dot-coms, the results cannot be generalized to the universe of traditional "brick-and-mortar" firms starting Internet operations in this period. Moreover, the sample was composed of mostly young firms, with an average trading age of 580 days, and a median of 428 days. This could be why there were no significant differences in the abnormal returns of the trading age subsamples.

The size of the sample was governed by announcement availability and the need to screen observations to eliminate duplicates and contaminated events. These factors resulted in a sample of 93 observations from which six events were lost due to insufficient trading data in the estimation period. With a sample of this size, it may be difficult to detect significant differences in the

subsample hypotheses (*H2*, *H3*, and *H4*). However, it must be noted that event studies with fewer than 100 observations are not uncommon in the literature (e.g., [10]).

The third factor pertains to the Internet-sector classification model adopted in this study. The scheme categorizes firms according to the nature of their online business and not necessarily their sources of revenue. Many of the firms in the sample were relatively new, and their revenue streams may not yet have started or still have been unpredictable [1]. Furthermore, many firms may have a had mixed model in which they derived revenue from advertising and sales, or from advertising and subscriptions.[5] An alternative classification might shed some light on the differential effect of Web traffic metrics on Internet firms.

Notwithstanding these limitations, the results of this study have both research and practical implications. From the research standpoint, the study isolated the effects of Web traffic announcements on firm value during the late 1990s, and the years 2000 and 2001. By focusing on a specific type of announcement, it extends previous e-commerce event studies and documents the extent to which "Web traffic news" increases the value of firms. In particular, it complements Subramani and Walden by examining a type of announcement excluded from their investigation [30], and by extending the period to encompass the span of the Internet Bubble. It also analyzes the effects of this kind of announcement in the post-Bubble years and finds that after the Bubble burst, investor reactions did not produce significant increases in firm value due to Web traffic announcements.

From a pragmatic viewpoint, the findings of the study indicate that registering a firm with one of the independent rating agencies is an investment that paid off in the early days of the Internet as an e-commerce medium. Although these figures are not publicly available, Demers and Lev point out that subscriptions to commercial Web metrics databases cost approximately $50,000 per year [9]. Subscribing to a Web traffic measurement service gave the firm the ability to communicate audited traffic milestones to the market, and this, in turn, translated into higher firm valuation.

The research presented in this article makes two specific contributions to the literature. First, it advances the understanding of Web traffic by making a distinction between the two main sources of traffic metrics—site-centric measures and user-centric measures—and by analyzing the importance of user-centric data estimated by independent rating companies.

The second contribution comes from isolating the effects of Web traffic disclosures on the value of the firms making such announcements. Whereas prior research established the correlation between traffic metrics and other strategic and accounting variables [24], this study is the first to establish a causal link between Web traffic and firm value using the event-study methodology. Thus it is one of the pioneer studies that quantifies the extent to which Web traffic achievements increased the market value of firms when traffic milestones became public knowledge in the late 1990s. If disclosures of Web traffic milestones were quickly incorporated into stock prices, it is clear that this variable has a significant effect in the multivariate firm valuation models examined by other researchers [14, 24, 32].

Conclusion

Using the standard event-study methodology, it was shown that investors reacted favorably to announcements of Web traffic achievements during the Internet Bubble. Positive and significant abnormal returns were found around the dates when traffic achievements were announced. These results suggest that during the late 1990s, announcements highlighting traffic milestones had a direct and positive impact on the market value of most of the firms mentioned in the press releases. The findings of this study quantify how seriously investors relied on traffic metrics and document the importance of audited traffic measures for Internet firms. Interestingly, however, the results show that firms were equally favored by the announcement of traffic milestones, regardless of their particular characteristics. Neither firm age, profits, nor Internet-sector classification appears to have affected the magnitude of the CARs.

These insights suggest two future research directions. One extension would be to examine the power of alternative firm characteristics to explain variations in the cumulative abnormal returns. Another would be to investigate the link between the independent rating company endorsing the announcement and the magnitude of the reaction, to test whether some auditing firms have more credibility than others.

The results suggest that the use of Web traffic metrics could have been partially responsible for the severe overvaluations of Internet stock prices in the late 1990s. Subsequent recognition by investors that these metrics were not reliable predictors of financial performance could also account for the precipitous fall of the dot-com companies. The results for the post-Bubble era seem to indicate that the value-relevance of Web traffic is changing as the Internet evolves as a business medium. In the future, traffic measures are likely to be more reliable and standardized. In this new context, it would be interesting to refine our understanding of the different measures of Web site traffic and their importance for Internet-related firms.

NOTES

1. This term is used to describe the increase in Internet-related stock prices in the late 1990s. The *Wall Street Journal* first used the term in 1995, years before the NASDAQ reached its record high of 5,048.62 on March 10, 2000 [27].

2. For a technical explanation of the event-study methodology, see Brown and Warner [4].

3. This sample is available upon request from the first author.

4. We thank an anonymous reviewer for this suggestion.

5. AOL is a good example. According to the WSRN classification, AOL is a portal, but its revenues come from advertising and subscriptions.

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