Reexamining the Value Relevance of E-Commerce Initiatives

BRUCE DEHNING, VERNON J. RICHARDSON, ANDREW URBACZEWSKI, AND JOHN D. WELLS

BRUCE DEHNING is an Assistant Professor of Accounting at Chapman University's Argyros School of Business and Economics. He holds a B.S. in Finance, an M.S. in Accounting, and a Ph.D. in Accounting from the Leeds School of Business at the University of Colorado. Professor Dehning's current research is on the returns to investments in information technology. He has published work in MIS Quarterly, Information and Management, Journal of Information Systems, Journal of Strategic Information Systems, and other academic journals. Professor Dehning’s work experience is in insurance and as an accounting information systems consultant for small businesses.

VERNON J. RICHARDSON is an Associate Professor and KPMG Faculty Scholar in the School of Business at the University of Kansas. Professor Richardson received his Ph.D. in accounting from the University of Illinois at Urbana–Champaign. His research considers the effect of the Internet and the New Economy on both accounting and information systems. His research interests include the value relevance of intangible assets and information technology investments. Professor Richardson has published articles in MIS Quarterly, Journal of Accounting and Economics, Communications of the ACM, Journal of Marketing, American Business Law Journal, and Financial Analysts Journal. He is currently an associate editor at the Journal of Information Systems and MIS Quarterly.

ANDREW URBACZEWSKI is an Assistant Professor of Management Information Systems at the University of Michigan–Dearborn. He received a Ph.D. in Information Systems from Indiana University, and also holds an MBA from West Virginia University and a B.S. in Finance (with honors) from the University of Tennessee. His research interests include wireless mobile collaboration, electronic commerce, and electronic monitoring of employees. His research has been published in several prestigious journals and conferences, including Communications of the ACM, Journal of Organizational Computing and Electronic Commerce, and Communications of the AIS.

JOHN D. WELLS is an Assistant Professor in the School of Accounting, Information Systems, and Business Law at Washington State University. He received his B.B.A. in Management from the University of Oklahoma and an M.S. and Ph.D. in Management Information Systems from Texas A&M University. He has worked as a systems engineer for Electronic Data Systems and the Oklahoma State Senate. His active research areas are electronic commerce, IT strategy, and interface design. His work has appeared in several academic journals and numerous international conferences.

ABSTRACT: This study reexamines the value relevance of e-commerce announcements using an event study methodology. Event studies have become an increasingly popu-
lar technique for information systems research by giving researchers a tool to measure the notoriously elusive value of information technology. We find evidence that the traditional event study methodology may not provide an accurate measure of abnormal returns during periods of high market volatility, and propose an alternative methodology. The alternative methodology does not use an estimation period, and takes into account extreme or unusual market movements in the period in which the e-commerce announcement was made. Using the alternative methodology, we find evidence of positive abnormal returns for e-commerce announcements made in the fourth quarter of 1998, but no abnormal returns to e-commerce announcements made in the fourth quarter of 2000. We also find significant differences in value depending on the type of e-commerce initiative. In 2000, e-commerce initiatives with a digital product were valued significantly more than e-commerce initiatives with a tangible product, while in 1998 no such difference existed. In 1998, business-to-business e-commerce initiatives, e-commerce initiatives with a tangible product, and e-commerce initiatives by pure-play Internet firms were valued more than similar initiatives in 2000. The study makes a significant contribution for understanding the value of e-commerce initiatives in highly volatile markets and demonstrates how market values of e-commerce changed from 1998 to 2000. Furthermore, this study shows the importance of carefully considering both the time frame examined and the methodology used when assessing the value relevance of e-commerce initiatives as to avoid inflating the magnitude of any observed effects.

**Key Words and Phrases:** business value, e-commerce announcements, electronic commerce, event study, market value.

**Understanding the Value That Results** from investments in information technology (IT) has been a persistent challenge for both academicians and practitioners. It is increasingly evident that IT is a key enabler for increasing productivity [5, 9]. Yet research seeking to gain insight into the relationship between IT and value realization has produced mixed results, with the inconsistency being attributed to insufficient productivity measures as well as the uncertain time lag that organizations experience when waiting for value to be realized [8, 10]. Given the apparent challenges associated with understanding IT investment and value realization, the emergence of the Internet has compounded the complexity of these challenges, prompting the investigation of the relationship between e-commerce investments and value assessment [16].

Because of the dynamic and unpredictable nature of e-commerce, gauging the value of IT initiatives becomes an even greater challenge. Davern and Kauffman [21] point to the importance of using leading indicators for IT valuation (i.e., potential value) as a complement to the existing emphasis on lagging indicators (i.e., realized value). Recently, the use of event studies has emerged as an effective means for assessing the potential value of IT investments [14, 30] and, particularly, e-commerce initiatives [19, 47]. Subramani and Walden (hereinafter referred to as S&W) [47] utilize an event study methodology to explore the relationship between e-commerce initiatives
announced by firms during the fourth quarter of 1998 and the value of the firm. While this research produced several interesting insights into the dot-com phenomenon, the recent economic downturn has stimulated a postmortem analysis of the dot-com carnage [17, 18, 34, 39, 44]. Along the same vein, an opportunity exists to compare and contrast the S&W study to an event window just beyond the bursting of the Internet bubble—the fourth quarter of 2000.

This paper extends the work of S&W [47] in three key areas. First, it examines the effect of e-commerce initiatives in 2000, arguably a fundamentally different market climate compared to 1998. By examining the effect of e-commerce announcements in the fourth quarter of 2000, insight can be gained to see if this effect can be generalized to a period other than the fourth quarter of 1998. Second, an alternative event study methodology is proposed and tested that provides a more accurate means for assessing the effect of e-commerce announcements on the market value of the firm, particularly in highly volatile markets. Finally, we revisit the exploratory variables proposed and tested by S&W that analyze the changes in different types of e-commerce initiatives—more specifically, initiatives focusing on “pure-play” e-commerce companies versus “bricks-and-clicks,” business-to-business versus business-to-consumer business models, and e-commerce initiatives selling digital versus tangible goods.

**Motivation**

**THERE HAS BEEN A BOOM IN E-COMMERCE** and the associated investments in IT over the past decade. However, there are issues associated with e-commerce initiatives that make it difficult for them to compete for funding in a traditional capital budgeting framework. These include demonstrating the tangible benefits such as profits or cost savings, measuring benefits that accrue many years into the future, and measuring the value of the intangible assets inherent in IT investments.

The market value of the firm’s equity is an effective measurement tool that can help overcome many of these difficulties of measuring tangible and intangible benefits [13]. For example, the current market value of the firm includes the present value of all future benefits to the firm, both short term and long term. This eliminates the problem of the time lag between e-commerce implementation and increased profitability or productivity. The market value of the firm also measures both tangible and intangible benefits from e-commerce initiatives, not just the tangible outcomes generally recorded in accounting measures of assets or profits. Based on this premise, we use the change in market values as measured by the event study methodology to assess the value of e-commerce initiatives.

S&W utilize an event study methodology to explore the relationship between e-commerce initiatives announced by firms during the fourth quarter of 1998 and the value of the firm. The authors derive the primary support for their hypothesis from Fama et al.’s [27] observations as to how stock prices are affected by new information and state that
announcements of e-commerce initiatives are a means for firms to convey favorable private information to investors such as the presence of an innovative, forward-looking, profit-oriented management team leveraging new technologies and acquiring organizational capabilities to address growing online markets. [47, p. 137]

S&W find significant abnormal stock market returns of 7.5 percent during an 11-day window and 16.7 percent during a 21-day window around e-commerce initiative announcements. However, since the fourth quarter of 1998, much has happened that might affect the stock market valuation of e-commerce initiatives.

Revisiting the Value Relevance of E-Commerce Initiatives

WHAT HAS HAPPENED SINCE 1998 THAT CAN HELP PREDICT the stock market reaction to e-commerce announcements made in 1998 and 2000? These time periods provide an opportunity to compare and contrast two key phases of the Internet revolution. In 1998, the Internet boom was sending stock indices to record levels while, conversely, the upward trend reversed itself in 2000, driving these same stock indices plummeting back to earth. With the benefit of hindsight, we can examine the potential impact of e-commerce on firm value and assess the changes after the crash of the dot-com boom.

The bursting of the dot-com bubble was similar to previous market crashes (e.g., October 1987), albeit not as severe. Economic theorists have hypothesized that these boom-and-bust dynamics can be attributed to rational human behavior [11]. Based on the theory of fads [6] and herd behavior [3], Lee [32] applies two concepts, informational cascade and informational avalanche, to explain the rapid rise and fall of market values, respectively. We apply the concepts of informational cascade and informational avalanche to both the 1998 and 2000 markets to predict that investor responses to e-commerce initiatives will significantly vary across these two time periods.¹

In 1998, S&W argued that e-commerce initiatives undertaken by firms may have reflected their commitment to build resources and capabilities necessary for aligning themselves strategically to compete effectively in an e-commerce environment. As a result, S&W hypothesized that investors would interpret announcements of e-commerce initiatives positively. This eventually led to a significant informational cascade. In financial markets, an informational cascade occurs when investors rely on information gleaned from observing previous actions of other investors rather than analyzing the information themselves [32], which has been attributed to herd behavior [3]. In 1998, e-commerce was in a relative state of infancy and reliable, accurate information was relatively scarce. Thus, we speculate that numerous investors relied on the previous actions of more informed investors, resulting in significantly high abnormal returns.

\[ H1a: \text{The abnormal returns attributable to e-commerce announcements in the fourth quarter of 1998 will be positive.} \]
Conversely, the market climate in 2000 had shifted downward, a significant shift away from the positive trend observed in 1998. Informational cascades are considered inherently fragile, as they are typically based on incomplete information and, once more complete information is revealed, a radical shift in direction typically occurs [6]. Lee [32] refers to such radical directional shift as an informational avalanche. In 2000, information emerged indicating that e-commerce initiatives were not realizing the potential expected in 1998. Thus, the more complete information that was available in 2000 represented an informational avalanche. As a result, investors were put on the defensive, and a massive selloff ensued, minimizing the effect of e-commerce announcements on abnormal returns.

**H1b:** The abnormal returns attributable to e-commerce announcements in the fourth quarter of 2000 will not be positive.

By arguing that 1998 was an instance of an informational cascade and 2000 was an instance of an informational avalanche, we posit that abnormal returns attributable to e-commerce announcements in 1998 will be more than the abnormal returns attributable to e-commerce announcements in 2000.

**H1c:** The abnormal returns attributable to e-commerce announcements in the fourth quarter of 1998 will be significantly greater than the abnormal returns attributable to e-commerce announcements in the fourth quarter of 2000.

S&W propose three other variables to explain the stock market reaction to e-commerce announcements: whether the firm is a bricks-and-mortar or pure-play Internet firm, whether the e-commerce initiative is business-to-business (B2B) or business-to-consumer (B2C) e-commerce, and whether the products being sold are tangible or digital goods. Because we propose that the 1998 market was part of an informational cascade, we maintain that the relationships of the exploratory variables observed in the S&W study reflected how investors were interpreting the available information at that point in time. Conversely, the information related to e-commerce in 2000 was arguably more complete and accurate [39], which we posit stimulated an informational avalanche and, as a result, prompts us to revisit these exploratory variables.

S&W claim that since the resources and capabilities of bricks-and-mortar firms are path dependent and relatively difficult to imitate, they have a sustainable competitive advantage when compared to Internet firms. An announcement coming from an Internet firm signals at best a temporary competitive advantage. S&W also point out a contrary argument to the above in that the source of the advantage for bricks-and-mortar firms, years of experience in a conventional market, may be a handicap when they operate in a dynamic environment such as that of e-commerce that is characterized by rapid changes. Further, it can be argued that Internet firms are exclusive to the online marketplace, while bricks-and-mortar firms leverage e-commerce initiatives as a complement to the offline offering, implying that overall growth potential is higher for Internet firms. Results from the S&W study indicate that e-commerce announcements by Internet firms produce higher cumulative abnormal returns (CARs) than bricks-and-mortar firms, although these results were not highly significant. Based
on this insight, we speculate that an e-commerce announcement coming from a bricks-and-mortar company in 1998 was being perceived as a temporary competitive advantage or even a competitive disadvantage. Conversely, an announcement coming from an Internet firm in the 1998 market was signaling a sustainable competitive advantage.

\textbf{H2a}: The market reaction to e-commerce initiative announcements made in 1998 by Internet-only firms will be significantly greater than the market reaction to announcements made by bricks-and-mortar firms.

While benefiting from a certain degree of hindsight, we contend the contrast between bricks-and-mortar and Internet firms needs to be reexamined. In a recent analysis of the dot-com carnage, Mahajan et al. [34] point to the importance of offline experience, an attribute typically assigned to bricks-and-mortar organizations. They go on to explain that organizations with offline experience are considered to be in a better position than Internet firms because of (1) knowledge about the retailing domain, (2) existing market-based assets (e.g., brand, customer base), and (3) integration of online and offline marketplaces [34, p. 480]. The issue of brand is particularly critical, as it has been identified as one of the primary culprits for the fall of a number of Internet firms [17]. Senn [44] argues that while bricks-and-mortar firms benefited from an established brand, the dot-com organizations either ignored the need for a brand or failed in their attempt to build it [48]. Therefore, while we acknowledge that Internet firms appear to have held the upper hand in 1998, we posit that this trend has reversed itself, shifting the advantage to bricks-and-mortar firms in 2000.

\textbf{H2b}: The market reaction to e-commerce initiative announcements made in 2000 by bricks-and-mortar firms will be significantly greater than the market reaction to announcements made by Internet-only firms.

\textbf{H2c}: The abnormal returns attributable to e-commerce announcements in the fourth quarter of 1998 by Internet-only firms will be significantly greater than the abnormal returns attributable to e-commerce announcements in the fourth quarter of 2000 by Internet-only firms.

\textbf{H2d}: The abnormal returns attributable to e-commerce announcements in the fourth quarter of 1998 by bricks-and-mortar firms will be significantly less than the abnormal returns attributable to e-commerce announcements in the fourth quarter of 2000 by bricks-and-mortar firms.

S&W then build their argument on projections for growth in two markets, B2B and B2C e-commerce. Given the larger current and projected size of B2B e-commerce, they argue that the profit potential in the B2B market is much stronger than in the B2C market. Yet their results prove inconclusive, with the directionality of these results—albeit statistically insignificant—favoring B2C initiatives. In 1998, it appears that investors were biased toward the goal of building a strong customer base (i.e., critical mass) in lieu of profitability [43]. As a result, organizations put the “cart before the horse” by emphasizing a B2C Web presence that was often operating on a
weak B2B infrastructure. Senn supports this contention by arguing that dot-com organizations “placed greater emphasis on their online front door—their Internet commerce site on the World Wide Web—than their back office” [44, p. 378].

**H3a:** The market reaction to e-commerce initiative announcements made in 1998 for B2C e-commerce initiatives will be significantly greater than the market reaction to announcements made for B2B e-commerce initiatives.

By 2000, more information emerged that qualified the relationship between B2C and B2B e-commerce. The projections of B2B e-commerce presented by S&W continued to hold, in that B2B was often considered a wiser investment than B2C [17, 18]. Also, it became evident that one of the key issues holding back B2C e-commerce was a lack of B2B infrastructure [44]. We consider B2B infrastructure to be a subset of a firm’s overall IT infrastructure [51] and the applications that integrate an organization with its suppliers, financial institutions, and distributors. Dell provides a good example of this dynamic. While Dell has an effective B2C sales channel via its Web site, its competitive advantage is grounded in its B2B infrastructure (e.g., just-in-time supply chain management) [36]. Thus, while the late 1990s saw investors rewarding organizations that were naively focused on the B2C channel, we expect that in 2000 investors will favor B2B initiatives.

**H3b:** The market reaction to e-commerce initiative announcements made in 2000 for B2B e-commerce initiatives will be significantly greater than the market reaction to announcements made for B2C e-commerce initiatives.

**H3c:** The abnormal returns attributable to e-commerce announcements in the fourth quarter of 1998 for B2C e-commerce initiatives will be significantly greater than the abnormal returns attributable to e-commerce announcements in the fourth quarter of 2000 for B2C e-commerce initiatives.

**H3d:** The abnormal returns attributable to e-commerce announcements in the fourth quarter of 1998 for B2B e-commerce initiatives will be significantly less than the abnormal returns attributable to e-commerce announcements in the fourth quarter of 2000 for B2B e-commerce initiatives.

From a strategic perspective, S&W argue that digital goods have an inherent advantage over tangible goods, as additional units can be produced and distributed at near-zero marginal cost [33]. Once again, S&W’s results were inconclusive, with the directionality—albeit statistically insignificant—favoring tangible products. Looking to the dot-com postmortem analysis, there are a couple of explanations as to why tangible products may have fared better in the early days of e-commerce, specifically 1998. First, a very small number of digital offerings existed. To compound the problem, goods and services that were eligible to be marketed in digital format (e.g., music, books) were being produced and distributed offline, not online [33]. Second, the organizations with strong brand and offline retail experience typically offered tangible goods, which garnered more credibility from stakeholders in 1998 [34].
H4a: The market reaction to e-commerce initiative announcements made in 1998 involving tangible goods will be significantly greater than the market reaction to announcements involving digital goods.

By 2000, the investment community was privy to information that qualified some of the market reactions that S&W expected to see in 1998. First, dot-com organizations were emerging that leveraged both a strong brand and fulfillment experience to deliver digital goods and services [44]. eBay and the travel portals (e.g., Expedia) are good examples of such organizations. Second, it was becoming increasingly evident that the digital congruency of online offerings (banking, travel, and financial services) was producing profit margins that were significantly larger than those of e-commerce initiatives offering tangible goods [17, 41]. For example, eBay was reporting gross margins in the neighborhood of 75 percent [40], which are approximately 4–5 times greater than margins enjoyed by most offline retailers. Thus, offering digital goods appears to be inherently more profitable as compared to tangible goods, a dynamic we expect to see emerge in 2000.

H4b: The market reaction to e-commerce initiative announcements made in 2000 involving digital goods will be significantly greater than the market reaction to announcements involving tangible goods.

H4c: The abnormal returns attributable to e-commerce announcements in the fourth quarter of 1998 involving tangible goods will be significantly greater than the abnormal returns attributable to e-commerce announcements in the fourth quarter of 2000 involving tangible goods.

H4d: The abnormal returns attributable to e-commerce announcements in the fourth quarter of 1998 involving digital goods will be significantly less than the abnormal returns attributable to e-commerce announcements in the fourth quarter of 2000 involving digital goods.

Methodology

Event studies have been employed extensively in the accounting and finance literature [2, 7] to study the effects of an assortment of events, ranging from corporate acquisitions [45, 46], to joint venture formations [31, 35], to CEO successions [22, 28]. Event studies are also becoming increasingly common in information systems (IS) research. In the IS literature, for example, Dos Santos et al. [24], Im et al. [30], and Dehning et al. [23] use event study methodology to measure the stock market impact of announcements of IT investments; S&W [47] measure the stockholder wealth effects of e-commerce announcements; and Chatterjee et al. [15] measure the stockholder wealth effects of newly created CIO position announcements. Recent event studies include IT failures [4], dot-com name changes [19], and IT security breaches [12, 26].

We use the event study methodology to measure the stock market returns to e-commerce initiatives in 1998 and 2000. We note, however, that in the fourth quar-
The market was in a period of extreme volatility. As shown in Table 1, the standard deviation of daily returns for the S&P 500 in 1998 was 1.28 percent, more than 1.8 times the average volatility of the S&P 500 from 1990 to 1995. In addition, the total return in 1998 was exceptionally high at 26.1 percent. The average annual return of the S&P 500 from 1990 to 2000 was 13.8 percent. Thus the total return in 1998 was 12.2 percent above the average return in the 1990–2000 period. While new information can have an effect on firm value, the information may be difficult to distinguish from the overall market movement during the fourth quarter of 1998.

As shown in Table 1, the market was also very volatile in 2000. The standard deviation of daily returns for the S&P 500 in 2000 was 1.40 percent, more than 2.0 times the average volatility from 1990 to 1995. In addition, the total return in 2000 was –9.3 percent, or 23.1 percent below the average annual return from 1990 to 2000. Because of the dramatic downward shift in the market that started in 2000, we selected the fourth quarter of 2000 to make such comparisons. The fourth quarter of 2000 was also selected to control for seasonal effects that might have a significant effect on e-commerce companies.

### Replication of Subramani and Walden

We begin our analysis by replicating S&W’s event study considering the market reaction to e-commerce initiative announcements. In the replication, we propose to add the more common shorter, three-day event window [15, 30] to the tests. McWilliams and Siegel [37] suggest that the most crucial research design issue is the length of the
event window used in an event study. Brown and Warner [7] show that using a long event window severely reduces the power of the test statistic, which can lead to false inferences about the significance of an event.

In addition, it has been empirically demonstrated that a short event window will usually capture the significant effect of an event [42]. For example, Dann et al. [20] find that the market price of a stock fully adjusts within 15 minutes of the release of firm-specific information. Because it is difficult to control for confounding effects when long windows are used, an event window should be as short as possible. It should be long enough to capture the significant effect of the event, but short enough to exclude confounding effects.

We calculate the CARs based on the event windows used by S&W, 11 days (–5/+5 days around the event) and 21 days (–10/+10 days around the event), in addition to three-day windows (–1/+1 days around the event). To maintain as much consistency as possible between the studies, our study mimicked S&W closely. Table 2 identifies the similarities, assumptions, and key differences in our approaches to the study.

Similar to S&W, we assume that the market model, which is based on the capital asset pricing model that is specified as follows, describes daily common stock returns:

$$R_{jt} = \alpha_j + \beta_j R_{mt} + \epsilon_{jt},$$

where $R_{jt}$ is the rate of return on the common stock of the $j$th firm on day $t$; $R_{mt}$ is the market rate of return using the S&P 500 index on day $t$; $\alpha_j$ is an intercept; $\beta_j$ is a slope parameter that measures the sensitivity of $R_{jt}$ to the market index; and $\epsilon_{jt}$ is disturbance terms with the usual ordinary least squares (OLS) properties.

The OLS market model is employed to estimate the abnormal return, $AR$, for the common stock of firm $j$ on day $t$, such that

$$AR_{jt} = R_{jt} - (\alpha_j + \beta_j R_{mt}).$$

To estimate these returns, a 255-day estimation period is used that begins 300 trading days before the event date, $t = –300$, and ends 45 trading days before the event date, $t = –45$. The event date, $t = 0$, is typically assumed to be the announcement date. Similar to S&W, we begin cumulating abnormal returns over 11- and 21-day event periods with the center being the date of the actual announcement (day 0). We also employ a more traditional three-day event period. Using the three-day event period as an example below, daily abnormal returns are averaged over the sample of $N$ firms and over the three days between $T_1 = \text{day } -1$ and $T_2 = \text{day } +1$ of the event period to yield cumulative abnormal returns, $\text{CAR}_{T_1, T_2}$:

$$\text{CAR}_{T_1, T_2} = \frac{\sum_{j=1}^{N} \sum_{t=T_1}^{T_2} AR_{jt}}{N}. $$
<table>
<thead>
<tr>
<th>Factor</th>
<th>S&amp;W</th>
<th>1998 S&amp;W replication</th>
<th>2000 announcements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length of analysis period</td>
<td>One quarter</td>
<td>One quarter</td>
<td>One quarter</td>
</tr>
<tr>
<td>Time period</td>
<td>Fourth quarter</td>
<td>Fourth quarter</td>
<td>Fourth quarter</td>
</tr>
<tr>
<td>Year chosen</td>
<td>1998</td>
<td>1998</td>
<td>2000(^1)</td>
</tr>
<tr>
<td>Source of news wires</td>
<td>Lexis-Nexis</td>
<td>Lexis-Nexis</td>
<td></td>
</tr>
<tr>
<td>Definition of publicly traded</td>
<td>Traded on NYSE, NASDAQ, AMEX</td>
<td>Traded on NYSE, NASDAQ, AMEX</td>
<td>Traded on NYSE, NASDAQ, AMEX</td>
</tr>
<tr>
<td>company</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Length of estimation period</td>
<td>120 days</td>
<td>255 days(^2)</td>
<td>255 days(^2)</td>
</tr>
<tr>
<td>Criteria for choosing stocks</td>
<td>Average daily trading price &gt; $1; average daily trading volume &gt; 50,000</td>
<td>Average daily trading price &gt; $1; average daily trading volume &gt; 50,000</td>
<td>Average daily trading price &gt; $1; average daily trading volume &gt; 50,000</td>
</tr>
<tr>
<td>with minimal inefficiencies</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Data source</td>
<td>Unknown</td>
<td>CRSP tapes (University of Chicago)</td>
<td>CRSP tapes (University of Chicago)</td>
</tr>
<tr>
<td>Market index</td>
<td>S&amp;P 500</td>
<td>S&amp;P 500 and NASDAQ(^3)</td>
<td>S&amp;P 500 and NASDAQ(^3)</td>
</tr>
<tr>
<td>Length of event windows</td>
<td>11, 21 days</td>
<td>3, 11, 21 days(^4)</td>
<td>3, 11, 21 days(^4)</td>
</tr>
</tbody>
</table>

Notes: \(^1\) To choose a time period in the market with different overall market trend but similar e-commerce announcements; \(^2\) three recent event studies [15, 23, 26] use the 255-day estimation window. We did compute the results using the 120-day estimation window used in S&W and find that the results remain robust to the different estimation windows; \(^3\) S&P 500 to maintain consistency with S&W, the NASDAQ index as an attempt to better measure abnormal returns; \(^4\) 11- and 21-day windows to maintain consistency with S&W, 3-day window to maintain consistency with other event studies.
The test statistic, $Z_{T_1,T_2}$, uses the standardized residual based on the standardized abnormal return, $SAR_{jt}$, which is derived by dividing firm $j$’s abnormal return ($AR_{jt}$) by its standard deviation ($s_{AR_{jt}}$).

$$SAR_{jt} = \frac{AR_{jt}}{s_{AR_{jt}}}$$

The test statistic, $Z_{T_1,T_2}$, tests whether $CAR_{T_1,T_2}$, with $T_1 = \text{day} - 1$ to $T_2 = \text{day} + 1$, in the case of the three-day window, corresponds to the event period dates, and $D_j$ is the number of trading-day returns used to estimate the parameters for firm $j$. The test statistic, $Z_{T_1,T_2}$, follows the normal distribution under the null hypothesis in this manner:

$$Z_{T_1,T_2} = \frac{1}{\sqrt{N}} \sum_{j=1}^{N} Z^j_{T_1,T_2},$$

where

$$Z^j_{T_1,T_2} = \frac{1}{\sqrt{Q^j_{T_1,T_2}}} \sum_{t=T_1}^{T_2} SAR_{jt}$$

and

$$Q^j_{T_1,T_2} = (T_2 - T_1 + 1) \frac{D_j - 2}{D_j - 1}.$$

Fourth Quarter 2000 E-Commerce Announcements Sample

After replicating the S&W study using their e-commerce announcements in 1998, we compare and contrast those results to event study results of similar e-commerce announcements from the fourth quarter of 2000. The second period was chosen because it is representative of the market correction that ensued after the unprecedented growth of the technology sector. We chose the fourth quarter to control for possible seasonal effects.

Using the fourth quarter of 1998 as the sample period, the S&W study used Lexis-Nexis to search the PR Newswire and Business Wire for relevant e-commerce announcements from publicly traded companies. They did this by searching for the terms “launch or announce” in the same sentence as “online” or “commerce,” which they settled on after a variety of search strategies. The S&W study reported 536 such announcements. We followed this search strategy exactly, and in the fourth quarter of 2000 there were 826 total e-commerce announcements from publicly traded companies. We interpret the larger number of announcements for the fourth quarter of 2000 as an indication that our search was at least as inclusive as the original S&W search.
This is also not surprising, given that the e-commerce industry was less experimental and more mainstream at this later date.

The S&W study reduced the original set of announcements produced from the Lexis-Nexis query by considering a number of different variables including nonviable e-commerce announcements, trading history, trading volume, and price. Also, S&W explicitly filtered announcements that referred to a stock that had traded less than 120 days prior to the event. By eliminating nonviable e-commerce announcements and by using the 120 days prior to the event to filter trading history, trading volume, and price, the number of announcements in the fourth quarter of 2000 was reduced to 609, while the elimination of events with missing data and confounding events such as additional abnormal information affecting the price (e.g., stock upgrades/downgrades, earnings warnings) further reduced the number of viable announcements to 542. The final announcement counts can be found in Table 3.

In a traditional event study, the goal is to determine the expected return for a particular company’s stock, and on the date that news is released, attribute any return that deviates from this expectation to the news in question [7]. In periods of rapidly rising or falling markets, it might not be possible to accurately model expected returns using traditional event study methodology. An event study using the fourth quarter of 1998 for analysis is a concern because the fourth quarter of 1998 was one of high volatility (as shown in Table 1). In such a period, the traditional event study methodology may fail to distinguish between the effect of a rapidly rising or falling market and the effect of an e-commerce announcement. Because the market conditions in 1998 and 2000 were marked by extreme swings in market valuation, we postulate that the traditional event study methodology might not properly measure the expected return for a company’s stock during these periods. Some evidence that the traditional event study methodology may not work properly in the fourth quarter of 1998 comes directly from S&W. Markets react very quickly to new information [20, 38], yet the CARs for the S&W sample grow with the size of the event window. S&W report a CAR for the 3-day window of 4.2 percent, for the 11-day window 7.5 percent, and for the 21-day window 16.2 percent. This implies that the CARs for these firms in non-event days have a nonzero (positive) mean. Therefore the traditional event study methodology may not be appropriate for this sample of firms during this particular time.

<table>
<thead>
<tr>
<th>Total events found (Lexis-Nexis)</th>
<th>2,991</th>
</tr>
</thead>
<tbody>
<tr>
<td>After eliminating miscellaneous announcements</td>
<td>2,034</td>
</tr>
<tr>
<td>After eliminating nonpublicly traded companies</td>
<td>826</td>
</tr>
<tr>
<td>After eliminating companies without 120 days of trading history</td>
<td>797</td>
</tr>
<tr>
<td>After eliminating companies with insufficient price or trading volume</td>
<td>715</td>
</tr>
<tr>
<td>After eliminating “duplicate” announcements between the two news wires</td>
<td>609</td>
</tr>
<tr>
<td>After eliminating events with adjacent e-commerce announcements, missing return data, confounding events, and so on</td>
<td>542</td>
</tr>
</tbody>
</table>

Table 3. Summary of Results from Fourth Quarter 2000 Event Search
period. To address this issue, we propose an alternative methodology, discussed in the next section.

Alternative Methodology

To account for the extreme market movements and volatility in 1998 and 2000 we present an alternative methodology. The alternative methodology differs from the traditional event study methodology by taking into account rapidly rising or falling market conditions. First, market-adjusted abnormal returns are computed for a 61-trading-day period starting 30 trading days before the event date and ending 30 trading days after the event date. We start with market-adjusted returns in this analysis so that the abnormal returns are not tied to the estimation period used in the traditional event study. This is beneficial because the estimation period may have returns very different from the time period of the analysis, causing misestimation of abnormal returns. Market-adjusted returns, $AR_j$, are computed by subtracting the observed return on the market index (S&P 500 index) for day $t$, $R_{mt}$, from the rate of return of the common stock, $R_{jt}$, of the $j$th firm on day $t$:

$$AR_j = R_{jt} - R_{mt}.$$  

These market-adjusted abnormal returns are then used as the dependent variable in the following regression model:

$$AR_j = \beta_0 + \beta_1 EVENT_j + \epsilon_j,$$  

where $AR_j$ is market-adjusted abnormal returns for firm $j$ on day $t$; $EVENT_j$ is a dummy variable that is equal to one during the firm’s event window and zero otherwise; and $\epsilon_j$ is disturbance terms with the usual OLS properties.

This technique differs from a standard event study in that the intercept term captures the average nonevent abnormal returns during the period. The coefficient on the dummy variable should capture only the abnormal returns that are different from other abnormal returns during the period, allowing us to attribute them to the announcement of the e-commerce initiative. If the alternative methodology properly captures abnormal returns attributable to e-commerce announcements, we can compare the abnormal returns from the two periods to test the first hypothesis. To accomplish this, we will combine both years into one model, as shown in Equation (3). In this model, the interaction term tests H1 ($EVENT_j \times YEAR_j$), whether the returns to e-commerce initiatives in 1998 were significantly greater than returns to e-commerce initiatives in 2000.

$$AR_j = \beta_0 + \beta_1 EVENT_j + \beta_2 YEAR_j + \beta_3 EVENT_j \times YEAR_j + \epsilon_j,$$  

where $AR_j$ is market-adjusted abnormal returns for firm $j$ on day $t$; $EVENT_j$ is a dummy variable that is equal to one during the firm’s event window and zero otherwise; $YEAR_j$ is a dummy variable that is equal to one if the e-commerce announcement occurred in 1998 and zero otherwise.
2000 and zero if the e-commerce announcement occurred in 1998; \( EVENT_j \times YEAR_j \) is interaction between the \( EVENT \) and \( YEAR \) dummy variables; and \( \varepsilon_{jt} \) is disturbance terms with the usual OLS properties.

As shown previously, S&W lay a foundation for analyzing additional characteristics of the firms making e-commerce announcements. In order to test these characteristics and H2, H3, and H4, we construct new models. The dependent variable in the model is the three-day cumulative abnormal return surrounding the e-commerce announcement. The explanatory variables in the model are as per S&W: whether the products being sold are digital goods or tangible goods \( (DIG) \), whether the e-commerce initiative is B2C or B2B \( (B2B) \), and whether the firm is a bricks-and-mortar or Internet firm \( (BRICK) \). To control for differences in abnormal returns due to firm size \([30]\), the natural log of the firm’s market capitalization at the end of the year before the e-commerce announcement \( (SIZE) \) was added as a control variable in each model. The model to test H2a, H2b, H3a, H3b, H4a, and H4b is as follows:

\[
CAR_0 = \beta_0 + \beta_1 BRICK + \beta_2 B2B + \beta_3 DIG + \beta_4 SIZE + \varepsilon_{jt},
\]

where \( CAR_0 \) is three-day \((-1, 0, +1)\) cumulative abnormal returns; \( BRICK \) is a dummy variable that is zero when the firm is mainly made possible by Internet technologies, otherwise one; \( B2B \) is a dummy variable that is one if the firm sells primarily to businesses, zero if the firm sells primarily directly to consumers; \( DIG \) is a dummy variable that is one if the firm sells digital goods, zero if the firm sells tangible goods; \( SIZE \) is natural log of the firm’s market capitalization at the end of the year before the e-commerce announcement; and \( \varepsilon_{jt} \) is disturbance terms with the usual OLS properties.

H2c, H2d, H3c, H3d, H4c, and H4d compare subsamples of the e-commerce announcements in 1998 and 2000. For example, H2c compares the reaction to e-commerce announcements by firms selling tangible goods in 1998 to e-commerce announcements by firms selling tangible goods in 2000. The model to test H2c, H2d, H3c, H3d, H4c, and H4d is as follows, where the model is repeated using the six subsamples stated in the hypotheses:

\[
CAR_0 = \beta_0 + \beta_1 TIME + \beta_2 SIZE + \varepsilon_{jt},
\]

where \( CAR_0 \) is three-day \((-1, 0, +1)\) cumulative abnormal returns; \( TIME \) is a time-period dummy variable that is one if the announcement was made in 2000, zero if it was made in 1998; \( SIZE \) is natural log of the firm’s market capitalization at the end of the year before the e-commerce announcement; and \( \varepsilon_{jt} \) is disturbance terms with the usual OLS properties.

Results

S&W report \( CARs \) for 251 e-commerce announcements in the fourth quarter of 1998. Table 4, Panel A, contains a summary of these results. Although not explicitly mentioned in S&W, the returns for the three-day window \(-1/+1\) can be calculated
Table 4. Random Date Comparison

Panel A: Traditional Event Study Methodology, Year 1998

<table>
<thead>
<tr>
<th></th>
<th>-1 to +1</th>
<th>-5 to +5</th>
<th>-10 to +10</th>
</tr>
</thead>
<tbody>
<tr>
<td>4Q1998 S&amp;W ISR paper (N = 251)</td>
<td>4.2 percent(^1)</td>
<td>7.5 percent(^{***})</td>
<td>16.2 percent(^{***})</td>
</tr>
<tr>
<td>4Q1998 S&amp;W replication (N = 244)</td>
<td>4.57 percent(^{***})</td>
<td>9.65 percent(^{***})</td>
<td>19.64 percent(^{***})</td>
</tr>
<tr>
<td>4Q1998 random dates (N = 244)</td>
<td>2.60 percent(^{***})</td>
<td>8.43 percent(^{***})</td>
<td>17.48 percent(^{***})</td>
</tr>
</tbody>
</table>

Paired t-tests of differences

\( t = 1.06 \)  
\( p = (0.29) \)  
\( t = 0.60 \)  
\( p = (0.55) \)  
\( t = 0.78 \)  
\( p = (0.44) \)

Panel B: Traditional Event Study Methodology, Year 2000

<table>
<thead>
<tr>
<th></th>
<th>-1 to +1</th>
<th>-5 to +5</th>
<th>-10 to +10</th>
</tr>
</thead>
<tbody>
<tr>
<td>4Q2000 announcements (N = 542)</td>
<td>-1.90 percent(^{***})</td>
<td>-6.42 percent(^{***})</td>
<td>-10.20 percent(^{***})</td>
</tr>
<tr>
<td>4Q2000 random dates (N = 538(^2))</td>
<td>-1.07 percent(^*)</td>
<td>-5.40 percent(^{***})</td>
<td>-8.73 percent(^{***})</td>
</tr>
</tbody>
</table>

Paired t-tests of differences

\( t = 1.06 \)  
\( p = (0.29) \)  
\( t = 0.89 \)  
\( p = (0.37) \)  
\( t = 0.98 \)  
\( p = (0.33) \)

Notes: 

\(^1\) S&W did not report a significance level for the –1 to +1 window; 
\(^2\) for the random dates \( N = 538 \) due to four firms that went bankrupt or stopped trading soon after the e-commerce announcement—for those firms, a random date was not selected; 
\(^*\) \( p < 0.05; \) \(^{**}\) \( p < 0.01; \) \(^{***}\) \( p < 0.001.\)
from their figure 1 [47, p. 145]. They find CARs of 4.2 percent in the –1/+1 window (no significance level stated), 7.5 percent during the –5/+5 window (significant at \( p < 0.001 \)), and 16.2 percent during the –10/+10 window (\( p < 0.001 \)). We were almost able to replicate S&W, but due to missing data for seven companies on the CRSP (Center for Research in Security Prices) tapes, and a different estimation window, we have slightly different results. We find CARs of 4.6 percent in the –1/+1 window (\( p < 0.001 \)), 9.7 percent during the –5/+5 window (\( p < 0.001 \)), and 19.6 percent during the –10/+10 window (\( p < 0.001 \)).

### Traditional Methodology Results

To test the effectiveness of the traditional event study methodology, the above tests were repeated using random dates during the fourth quarter of 1998. All of the CARs for the random dates were significantly different from zero at \( p < 0.001 \), clearly supporting our contention that the traditional methodology does not necessarily capture the true market reaction in times of extreme volatility. As shown in Table 4, Panel A, the CARs for the random dates were 2.6 percent in the –1/+1 window, 8.4 percent in the –5/+5 window, and 17.5 percent in the –10/+10 window. All of the CARs for the random dates are similar to the CARs for the e-commerce announcement dates. The results of paired \( t \)-tests comparing the CARs for the e-commerce announcements to the random dates also appear in Table 4. There were no significant differences between the CARs for the announcement dates and the random dates, which is further evidence of the inability of the traditional event study to isolate abnormal returns on the e-commerce announcement dates from abnormal returns on other dates around the e-commerce announcement.

In the fourth quarter of 1998, positive and significant abnormal returns were observed for both e-commerce announcements and random dates. In the fourth quarter of 2000, we find similar results, except that negative and significant abnormal returns were observed for both the e-commerce announcements and random dates. As shown in Table 4, Panel B, for the e-commerce announcements we find CARs of –1.9 percent in the –1/+1 window (\( p < 0.001 \)), –6.4 percent during the –5/+5 window (\( p < 0.001 \)), and –10.2 percent during the –10/+10 window (\( p < 0.001 \)). The results for the random dates are similar to the e-commerce announcement dates. For the random dates, we find CARs of –1.1 percent in the –1/+1 window (\( p < 0.05 \)), –5.4 percent during the –5/+5 window (\( p < 0.001 \)), and –8.7 percent during the –10/+10 window (\( p < 0.001 \)). All of the CARs on the random dates are significantly different from zero. In addition, there were no significant differences between the CARs for the announcement dates and the random dates. We propose an alternative to the traditional event study methodology as a solution to this problem.

### Alternative Methodology Results

We applied the alternative methodology discussed previously to the e-commerce announcements and random dates in 1998 and 2000. In the fourth quarter of 1998, the
average abnormal returns are 0.71 percent ($p = 0.027^*$) in the –1/+1 window when measured using the S&P 500 index, and 0.86 percent ($p = 0.009^{**}$) in the –1/+1 window when measured using the NASDAQ index. Note that the three-day window returns are not CARs, but the average abnormal return for the three days. This translates to a three-day CAR of approximately 2 percent when measured using the S&P 500 index, and 2.6 percent when measured using the NASDAQ index. When this same procedure is applied to longer windows (–5/+5 and –10/+10) around the e-commerce announcements, the returns are not statistically different from zero. This suggests the need to pinpoint with greater accuracy the dates where the returns can be expected to be different from zero.

Unlike the traditional event study methodology, when the alternative methodology is applied to the random dates, the observed abnormal returns are not significantly different from zero. As shown in Table 5, the average abnormal returns for the random dates are 0.20 percent ($p = 0.291$) in the –1/+1 window when measured using the S&P 500 index, and 0.29 percent ($p = 0.201$) in the –1/+1 window when measured using the NASDAQ index. Model $F$-statistics are shown in the parentheses below each regression.

In the fourth quarter of 2000 sample, none of the abnormal returns examined were significantly different from zero at an $\alpha = 0.05$ level. The average abnormal returns for the e-commerce announcements are –0.24 percent ($p = 0.097$) in the –1/+1 window when measured using the S&P 500 index, and –0.02 percent ($p = 0.452$) in the –1/+1 window when measured using the NASDAQ index. The average abnormal returns for the random dates are –0.13 percent ($p = 0.245$) in the –1/+1 window when measured using the S&P 500 index, and 0.04 percent ($p = 0.585$) in the –1/+1 window when measured using the NASDAQ index.

Table 5. Alternative Methodology

<table>
<thead>
<tr>
<th></th>
<th>S&amp;P 500</th>
<th>NASDAQ</th>
</tr>
</thead>
<tbody>
<tr>
<td>4Q1998 announcements</td>
<td>0.71 percent ($p = 0.027^<em>$) ($F = 3.69^</em>$)</td>
<td>0.86 percent ($p = 0.009^{**}$) ($F = 5.51^*$)</td>
</tr>
<tr>
<td>4Q1998 random dates</td>
<td>0.20 percent ($p = 0.291$) ($F = 0.30$)</td>
<td>0.29 percent ($p = 0.201$) ($F = 0.70$)</td>
</tr>
<tr>
<td>4Q2000 announcements</td>
<td>–0.24 percent ($p = 0.097$) ($F = 1.69$)</td>
<td>–0.02 percent ($p = 0.452$) ($F = 0.01$)</td>
</tr>
<tr>
<td>4Q2000 random dates</td>
<td>–0.13 percent ($p = 0.245$) ($F = 0.47$)</td>
<td>0.04 percent ($p = 0.585$) ($F = 0.05$)</td>
</tr>
</tbody>
</table>

Notes: Boldface text indicates significant abnormal returns. $^*$ All $p$-values as stated using a one-tailed test; $^*$ $p < 0.05$; $^{**} = p < 0.01$.

where $\text{AR}_j$ is abnormal returns for firm $j$ on day $t$; $\text{EVENT}_j$ is a dummy variable that is equal to one during the firm’s event window (–1, 0, +1) and zero otherwise (either the announcement dates or the random dates as denoted above); $\epsilon_j$ is disturbance terms with the usual OLS properties.
The above tests allow us to make inferences regarding H1. The results in Table 5 show that when we use the alternative methodology, we identify a positive and significant reaction to e-commerce announcements in 1998, but not in 2000. Thus H1a and H1b are supported. To test H1c, if the difference between 1998 and 2000 is significant, we run an additional model combining both years, as shown previously in Equation (3). The results of this analysis are shown in Table 6. On the day of the e-commerce announcements, the difference in the market reaction between 1998 and 2000 is significantly different from zero at $p = 0.010$ when the market index used is the S&P 500, and $p = 0.015$ when the market index used is the NASDAQ.4 Thus H1c is supported.

Hypotheses 2–4 Results

The regression models shown in Equations (4) and (5) were used to test H2, H3, and H4. As shown in Table 7, there were no significant differences in 1998 between any of the three dichotomies predicted in H2a, H3a, or H4a, although all results for 1998 are in the hypothesized direction. In 2000, the only significant variable of interest is DIG, representing e-commerce announcements made by companies selling digital goods versus e-commerce announcements made by companies selling tangible goods. The reaction to e-commerce announcements made by companies selling digital goods were on average 2.32 percent higher ($p = 0.019$) than e-commerce announcements made by companies selling tangible goods. Thus H4b is supported, but there is no support for H2b or H3b. As with prior event studies [30], in 1998 there was a significantly larger reaction to announcements made by smaller firms, but this was not the case in 2000, where there was no significant difference. Typically, the larger the firm, the more of the announcement that is known before the press release, whereas for small firms more of the news is actually a surprise [1].

The results comparing the reaction in 1998 to 2000 for the various subgroups are shown in Table 8. As predicted by H2c, there was a significantly greater reaction (5.49 percent) to e-commerce initiatives made by pure-play Internet firms in 1998 than in 2000 ($p < 0.001$). As predicted by H3c, there was a significantly greater reaction (5.66 percent) to B2B e-commerce initiatives in 1998 than in 2000 ($p < 0.001$). And as predicted by H4c, there was a significantly greater reaction (7.30 percent) to e-commerce initiatives where the product was a tangible good in 1998 than in 2000 ($p < 0.001$). None of the other hypotheses were supported at traditional levels of significance.

Discussion of Results

This paper was motivated by the need to test the value of e-commerce initiatives in the face of changing business and market conditions. S&W [47] performed a previous test of this valuation, exposing what they called the dot-com effect. Senn [44] identifies the change in the validity of the dot-com effect of business valuation, but does not give a new method for correctly valuing these businesses. The paper then also set out to identify a new means of showing the correct value for these businesses.
### Table 6. 1998 Versus 2000 CAR Comparison

<table>
<thead>
<tr>
<th>Event window</th>
<th>Intercept</th>
<th>YEAR</th>
<th>EVENT</th>
<th>EVENT × YEAR</th>
<th>F</th>
<th>Adj. R²</th>
</tr>
</thead>
<tbody>
<tr>
<td>S&amp;P 500 Days –1 to +1</td>
<td>Coefficient</td>
<td>0.92 percent</td>
<td>-1.27 percent</td>
<td>0.71 percent</td>
<td>-0.95 percent</td>
<td>93.92</td>
</tr>
<tr>
<td></td>
<td>Significance*</td>
<td>&lt; 0.001</td>
<td>&lt; 0.001</td>
<td>0.020</td>
<td>0.010</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>NASDAQ Days –1 to +1</td>
<td>Coefficient</td>
<td>0.71 percent</td>
<td>-0.75 percent</td>
<td>0.86 percent</td>
<td>-0.88 percent</td>
<td>36.69</td>
</tr>
<tr>
<td></td>
<td>Significance*</td>
<td>&lt; 0.001</td>
<td>&lt; 0.001</td>
<td>0.004</td>
<td>0.015</td>
<td>&lt; 0.001</td>
</tr>
</tbody>
</table>

*all p-values are stated using a two-tailed test

\[
AR_{jt} = \beta_0 + \beta_1 YEAR_{jt} + \beta_2 EVENT_{jt} + \beta_3 EVENT_{jt} \times YEAR_{jt} + \epsilon_{jt}
\] (3)

where \( AR_{jt} \) is abnormal returns for firm \( j \) on day \( t \); \( YEAR_{jt} \) is a dummy variable that is equal to one if the e-commerce announcement occurred in 2000 and zero if the e-commerce announcement occurred in 1998; \( EVENT_{jt} \) is a dummy variable that is equal to one during the firm’s event window and zero otherwise; \( EVENT_{jt} \times YEAR_{jt} \) is interaction between the EVENT and YEAR dummy variables; and \( \epsilon_{jt} \) is disturbance terms with the usual OLS properties.
Table 7. Multivariate Model Comparing Subgroups by Year

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1998</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coefficient</td>
<td>14.53</td>
<td>–0.36</td>
<td>–3.87</td>
<td>–0.82</td>
<td>–1.30</td>
<td>2.03</td>
<td>0.017</td>
</tr>
<tr>
<td>Significance*</td>
<td>0.001</td>
<td>0.447</td>
<td>0.078</td>
<td>0.377</td>
<td>0.005</td>
<td>0.091</td>
<td></td>
</tr>
<tr>
<td>2000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coefficient</td>
<td>–5.51</td>
<td>2.22</td>
<td>–1.86</td>
<td>2.32</td>
<td>0.30</td>
<td>2.72</td>
<td>0.013</td>
</tr>
<tr>
<td>Significance*</td>
<td>0.004</td>
<td>0.124</td>
<td>0.962</td>
<td>0.019</td>
<td>0.915</td>
<td>0.030</td>
<td></td>
</tr>
</tbody>
</table>

Notes: * Values in bold are significant at $p < 0.05$; all $p$-values are stated using a one-tailed test

$$CAR_{jt} = \beta_0 + \beta_1BRICK + \beta_2B2B + \beta_3DIG + \beta_4SIZE + \varepsilon_{jt},$$

where $CAR_{jt}$ is three day ($-1, 0, +1$) cumulative abnormal returns; $BRICK$ is a dummy variable that is zero when the firm is mainly made possible by Internet technologies, otherwise one; $B2B$ is a dummy variable that is one if the firm sells primarily to businesses, zero if the firm sells primarily directly to consumers; $DIG$ is a dummy variable that is one if the firm sells digital goods, zero if the firm sells tangible goods; $SIZE$ is natural log of the firm’s market capitalization at the end of the year before the e-commerce announcement; $\varepsilon_{jt}$ is disturbance terms with the usual OLS properties.
Table 8. Multivariate Model Comparing 1998 to 2000 by Subgroup

<table>
<thead>
<tr>
<th></th>
<th>Coefficient</th>
<th>Significance*</th>
<th>Coefficient</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Tangible goods</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intercept</td>
<td>7.66</td>
<td>0.002</td>
<td>5.13</td>
<td>0.009</td>
</tr>
<tr>
<td>TIME</td>
<td>-7.30</td>
<td>&lt; 0.001</td>
<td>-4.98</td>
<td>0.998</td>
</tr>
<tr>
<td>SIZE</td>
<td>-0.48</td>
<td>0.093</td>
<td>-0.16</td>
<td>0.285</td>
</tr>
<tr>
<td>$F$</td>
<td>12.55</td>
<td>&lt; 0.001</td>
<td>5.91</td>
<td>0.003</td>
</tr>
<tr>
<td>Adj. $R^2$</td>
<td>0.080</td>
<td></td>
<td>0.019</td>
<td></td>
</tr>
<tr>
<td><strong>Digital goods</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intercept</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TIME</td>
<td>-5.66</td>
<td>&lt; 0.001</td>
<td>-6.03</td>
<td>0.997</td>
</tr>
<tr>
<td>SIZE</td>
<td>-0.55</td>
<td>0.019</td>
<td>0.17</td>
<td>0.668</td>
</tr>
<tr>
<td>$F$</td>
<td>13.80</td>
<td>&lt; 0.001</td>
<td>4.25</td>
<td>0.015</td>
</tr>
<tr>
<td>Adj. $R^2$</td>
<td>0.048</td>
<td></td>
<td>0.023</td>
<td></td>
</tr>
</tbody>
</table>

| **B2C initiatives**  |             |               |             |             |
| Intercept            | 9.02        | < 0.001       | 1.74        | 0.263       |
| TIME                 | -5.66       | < 0.001       | -6.03       | 0.997       |
| SIZE                 | -0.55       | 0.019         | 0.17        | 0.668       |
| $F$                  | 13.80       | < 0.001       | 4.25        | 0.015       |
| Adj. $R^2$           | 0.048       |               | 0.023       |             |

| **B2B initiatives**  |             |               |             |             |
| Intercept            |             |               |             |             |
| TIME                 | -5.49       | < 0.001       | -2.91       | 0.803       |
| SIZE                 | -0.11       | 0.316         | -0.89       | 0.076       |
| $F$                  | 8.47        | < 0.001       | 2.26        | 0.108       |
| Adj. $R^2$           | 0.023       |               | 0.016       |             |

Notes: * Values in bold are significant at $p < 0.05$; all $p$-values are stated using a one-tailed test

$$\text{CAR}_e = \beta_0 + \beta_1 \text{TIME} + \beta_2 \text{SIZE} + \epsilon_e$$

where $\text{CAR}_e$ is three-day ($-1, 0, +1$) cumulative abnormal returns; $\text{TIME}$ is a time-period dummy variable that is one if the announcement was made in 2000, zero if it was made in 1998; $\text{SIZE}$ is natural log of the firm’s market capitalization at the end of the year before the e-commerce announcement; $\epsilon_e$ is disturbance terms with the usual OLS properties.

and events, providing a more correct value while operating under the assumption (and failing to disconfirm) that the markets behaved rationally.

We suggest that the use of the traditional event study methodology during periods of extreme market volatility may be inappropriate. The danger of using an inappropriate method is clear, as it could leave both researchers and investors with conclusions that are not necessarily in line with the data. The theoretical and financial disasters that can befall a researcher or investor relying on such a strategy cannot be overstated. This is demonstrated by showing that the traditional event study methodology produces CARs that are significantly different from zero on randomly selected dates when CARs should not be significantly different from zero. This means that the traditional event study methodology may not be able to differentiate between the abnormal returns on the event dates from those on random dates (taken from the same calendar quarter). Our analysis confirms that the traditional event study methodology is not able to differentiate the effect of e-commerce announcements from random
dates when there are large market movements in the overall stock market, as was observed in both the fourth quarter of 1998 and the fourth quarter of 2000. Great care must be taken when interpreting the finding that e-commerce announcements were associated with positive and significant cumulative abnormal returns as in 1998, or negative and significant abnormal returns in 2000, when abnormal returns on random dates were nearly an equal amount.

This has implications for future researchers interested in using the traditional event study methodology during periods of large market movements. When performing such tests, researchers should verify that abnormal returns detected on the event dates are attributable to the event in question. To do this, researchers should compare abnormal returns on the event dates to abnormal returns on random dates, as well as compare the abnormal returns on the random dates to zero.

We propose an alternative methodology for use in periods of extreme market volatility. The use of this alternative methodology suggests that researchers segregate abnormal returns on event dates from other abnormal returns in the period. Researchers should see if they have in fact identified an abnormal return for that firm due to the event in question. We also note that as the event window is increased beyond three days (days –1, 0, +1), the alternative methodology did not have sufficient power to identify an abnormal return. This suggests that researchers should continue to use the standard two-day or three-day event windows used in other IS studies [15] and in finance and accounting [25, 29].

Using an alternative methodology, we identify a positive and significant reaction to e-commerce announcements in 1998, but not in 2000. In 1998, the expectation was that companies announcing e-commerce initiatives would participate in a new industry with a higher level of profits. The evidence from this study suggests that the hype surrounding e-commerce produced an informational cascade, where investors were attempting to accurately assess this significant paradigm shift. Because e-commerce was in a relatively formative phase, the information available to the investment community in 1998 was inaccurate or incomplete. Thus, we propose that investors were simply following the lead of the “speculative” investors, which produced the high CARs observed during this time period.

By the fourth quarter of 2000, investors had a much clearer view of all of these factors. Our results suggest that two dynamics were at work that produced an informational avalanche in 2000. First, investors were presented with more accurate and complete information regarding the types of e-commerce initiatives that proved to be effective or ineffective. Second, as this information was assimilated, it became evident that a number of e-commerce–oriented organizations were significantly overvalued. Thus, with the additional knowledge of two years of experience, the same rational investors that increased the market value of firms making e-commerce initiative announcements in 1998 were not rewarding companies for the same behavior in 2000.

We believe that e-commerce initiatives can still pay off for certain companies, depending on the context, including the type of products and the way e-commerce is aligned with the overall company strategy. Perhaps contextual elements such as the innovativeness of the e-commerce initiative [24] or the strategic role of IT in the
company [23] may help determine the way that stock market participants ultimately value the e-commerce initiative. We call on researchers to continue to identify these contextual effects that may cause e-commerce initiatives to have overall positive valuation effects on the firm. We examine three of these contextual factors: bricks-and-mortar versus Internet firms, B2B versus B2C focus, and digital versus tangible goods. In addition, firm size was included as a control variable.

Of the three contextual factors, only the type of product (digital versus tangible goods) is a significant predictor of the differences in the market reaction to e-commerce initiatives, and only in 2000. While we expect organizations to become more effective at managing tangible product offerings online, we predict that the inherent advantages afforded to digital goods will continue to draw a distinction between these two types of offerings. Our results fail to confirm the hypothesized impact of announcement made by bricks-and-mortar versus Internet firms. Although there was a 2.22 percent larger CAR for announcements made by bricks-and-mortar firms in 2000, this difference was not significant (p = 0.124). One possible explanation for this is the relative size of an e-commerce initiative for a bricks-and-mortar firm versus an Internet firm. Announcement of an e-commerce initiative by a bricks-and-mortar firm might cause an increase in value that is very small relative to the overall value of the firm and therefore difficult to detect. It has been argued that bricks-and-mortar firms are just beginning to integrate their business models across the offline and online channels and, with time, will be able to easily compete with Internet firms [51]. To stay consistent with the S&W study, we limited our study to the fourth quarter of 2000, because 2000 represents the transition point for the downward turn in the Internet sector. We expect the contextual factors that we examined to become more distinguishable over time. Thus an opportunity exists to conduct a longitudinal study to explore these and other factors in more detail.

While we propose that some of these explanatory variables will become more pronounced over time, the inconclusive results associated with B2B versus B2C e-commerce initiatives appear more problematic. Our results show that announcements in 1998 and 2000 favored B2C initiatives. Yet the postmortem analysis of the dot-com phenomenon has cited the naive focus on B2C initiatives as a major issue [17, 18, 34, 44]. Some academics have proposed that the distinction between B2C and B2B is artificial [51], with a convergence being observed across various channels (e.g., B2B, B2C, C2C [customer-to-customer]) [40]. For example, eBay has moved from a C2C focus to supporting transactions across all types of e-commerce channels. Thus, while some explanatory distinctions (e.g., tangible versus digital goods) should persist over time, our results contrasting B2B and B2C initiatives support the notion that some distinctions may become irrelevant and, in the case of this study, difficult to isolate and observe.

Conclusion

This study reexamines the value relevance of e-commerce announcements. Our initial analysis using the traditional event study methodology suggested no dif-
ferences between market returns on the date of e-commerce announcements and random dates during the same period. This left us with a problem in attempting to correctly value e-commerce businesses and new e-commerce initiatives. To address this problem, we proposed an alternate methodology to disaggregate the effects of e-commerce announcements from overall market effects. The results of the tests of the new method show that it is much more appropriate for valuing nascent industries, such as e-commerce business initiatives, especially in periods of high market volatility, than the traditional event study analysis methods. Our analysis suggests that researchers must exercise great care in performing event studies to test for robustness. Comparing firm returns on event study dates to firm returns on random dates is a powerful robustness check to make sure that the event is capturing firm-specific phenomena rather than general movements in stock price. In addition, a shortened event-period window helps improve the power of the test statistic that may otherwise lead to false inferences about the significance of an event.

We apply theoretic arguments why announcements of e-commerce initiatives should be value relevant in 1998 but may no longer provide incremental value in later periods. Using an alternative methodology, we find a positive and significant stock market reaction to e-commerce announcements in the fourth quarter of 1998 and no stock market reaction in the fourth quarter of 2000, suggesting a change in investor attitudes toward e-commerce initiatives. No longer does an announcement that a firm is beginning an e-commerce initiative necessarily mean that the firm will experience a favorable reaction from stock market participants. Future research should carefully examine when e-commerce initiatives are value relevant to better understand how this electronic means of interaction between businesses and their customers can ultimately pay off.

Between the alternative methodology and comparison of 1998 and 2000, we have succeeded in extending the work of Subramani and Walden [47]. The comparison between 1998 and 2000 demonstrates that market volatility can have a significant impact on how researchers measure the market value of announcements of various initiatives. The alternative methodology allows us to more correctly measure the change in a leading indicator (equity price) as directly related to an individual event, such as an e-commerce announcement. The two techniques together give researchers and investors a better tool set for measuring business success/failure during conditions of high industry and market volatility.

IT and e-commerce are dynamic domains. As researchers continue to address the challenge of understanding the potential value of IT investments [21], particularly those related to e-commerce [16], it is reasonable to expect that the recent wave of IT-oriented event studies will continue [14, 15, 30, 47]. Future research should continue to look into methods where e-commerce valuation can continue to be measured more directly, as more and more noise can be stripped away to more accurately measure the true market effects and firm valuation.

Acknowledgments: Special thanks to Mani Subramani and Eric Walden for the use of their data and for their helpful comments. The authors also thank the anonymous reviewers, participants
at the 2003 American Accounting Association Annual Meeting, and the discussant, Angela Woodland, for their helpful comments and suggestions. Author names are listed in alphabetical order. All authors contributed equally to the production of this paper, and no relative amount of credit or contribution is implied nor should be inferred from the order of the names in the title section.

NOTES

1. The theory of informational cascades has recently been applied to the adoption of new technology [49, 50].
2. If a random date fell within the –10/+10 day event window for the announcing firm, another random date was chosen. This was repeated until none of the random dates fell within any of the –10/+10 event dates for the announcing firm.
3. The results are not shown here for brevity; the results are available from the authors.
4. The results of all empirical tests are similar whether the S&P 500 or NASDAQ indices are used. For brevity, only the S&P 500 index results will be reported in the remainder of the paper.

REFERENCES


