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Anomalous stock returns around internet firms' earnings announcements ☆

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Abstract

This paper presents evidence of anomalies in internet firms' stock returns surrounding their quarterly earnings announcements. There is a general runup in prices in the days prior to the earnings announcements, followed by a price reversal lasting for several days. The magnitude of the market-adjusted returns associated with these price movements exceeds 11 percent over a 10-day period. We find little evidence to suggest that these returns can be explained either by the earnings news disclosed or by risk changes. Additional analyses suggest that these return patterns are driven, at least in part, by price pressure.

JEL classification: M41; G14

Keywords: Capital market; Internet; Stock return; Earning announcement; Price pressure

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1. Introduction

The relatively high market valuations sported by many money-losing internet stocks during the late 1990s raises the issue of whether these firms were rationally priced, especially with respect to their fundamental accounting information. Prior academic studies of internet stock pricing indirectly addressed this question by testing for an association between market values and financial information. (See Hand, 2000, 2001; Rajgopal et al., 2003; Demers and Lev, 2001; Trueman et al., 2000.) In this paper we approach this issue by examining the nature of the price movements around these firms' quarterly earnings announcements. Our analysis documents anomalous stock return patterns which, for the most part, do not appear to be associated with the accounting information disclosed. This is consistent with some irrationality in the pricing of internet stocks.

For the period from January 1998 to August 2000 we find that the average market-adjusted return during the 5 days before a firm's earnings announcement (and extending through the open on the day immediately after the release) is a significant 4.9 percent. At this point, the price reverses, with an average market-adjusted return over the following 5 days of a significant −6.4 percent. We find that neither the reported earnings surprise nor the reported revenue surprise is significantly associated with the price runup in advance of the earnings announcement, thereby casting doubt on information leakage as a possible explanation for the positive returns. The post-announcement price reversal is also not significantly associated with unexpected earnings or revenues, as would be expected if these returns reflected a market overreaction to the news contained in the earnings report. Only the close-to-open return on the trading day subsequent to the earnings announcement is significantly related to the earnings news.

The pre-announcement returns are also too large to be explained by increases in risk around earnings releases.[1] We formally show this by allowing for daily changes in betas in the period before earnings announcements (as in Ball and Kothari, 1991), and confirm that the risk-adjusted abnormal returns remain significantly positive. We similarly calculate daily betas for the period after earnings announcements, and show that the risk-adjusted abnormal returns are significantly negative during that period, again implying that these returns cannot be explained by risk. This latter result is not surprising, though, given our finding that post-announcement *raw* returns are also negative; this could only be explained by risk if internet stocks were negatively correlated with the market (which they are not).

Additional analyses suggest the possibility that these returns may partly be driven by price pressure, whereby an unjustifiably high level of investor optimism and share demand (relative to a firm's expected future performance) is boosting prices in the days before an earnings announcement, and an abating of that demand is causing a subsequent price reversal. Several test results are consistent with this notion. First,

[1] Increases in stock return volatility in the period before earnings announcements has been documented by Beaver (1968), Patell and Wolfson (1981), and Ball and Kothari (1991), among others.

calculating the abnormal order imbalance statistic (Lee, 1992) reveals an unusually large number of buyer-initiated trades relative to seller-initiated trades in the 5 days prior to a firm's earnings announcement, an imbalance which disappears after earnings are released. Second, this abnormal order imbalance is not significantly correlated with the information in the forthcoming earnings announcement. Third, the price reversal subsequent to the earnings announcement results in a cumulative abnormal return over our entire event window that is insignificantly different from zero. Finally, the documented price pattern is more pronounced during the share lockup period than post-lockup, when there is a larger supply of firm shares available for trading in the marketplace.[2]

Two previous studies have examined short-term price movements around earnings announcements—Chari et al. (1988), covering the 1976–1984 period, and Ball and Kothari (1991), covering the years 1980–1988. There are two primary differences between their findings and ours. First, while the stocks in their samples do increase in price prior to earnings announcements, there is no consistent price movement (either positive or negative) afterwards. Second, the magnitude of the pre-announcement returns they found is very small in comparison to what we document (less than one-tenth in size). Furthermore, those returns are significant only for the day before and day of the earnings announcement.

The return reversals experienced by our sample firms subsequent to their earnings announcements are reminiscent of the short-term reversal patterns documented by Lehmann (1990). He found that New York and American Stock Exchange winners in a given week experienced negative abnormal returns, on average, during the following week. Lehmann, however, did not investigate whether these patterns were at all associated with firms' earnings announcements, as his sample covered both earnings and non-earnings announcement periods. Moreover, the returns he found were much smaller in magnitude than those we document.

Our stock return patterns stand in contrast to the returns attributable to the well-known post-earnings announcement drift (see, for example, Bernard and Thomas, 1989; Foster et al., 1984). That anomaly reflects a *continuation* of returns observed *subsequent* to the earnings release, rather than to a reversal of returns observed prior to the announcement. Additionally, the returns are much smaller in magnitude and extend over a significantly longer period of time than those we document.

The plan of this paper is as follows. In Section 2 we describe our sample selection criteria and research design, and provide descriptive statistics. This is followed in Section 3 by an examination of the abnormal returns surrounding internet firms' earnings announcements. Potential explanations for the observed price patterns are analyzed in Section 4. A summary section concludes the paper.

[2] Other papers that document anomalies in the pricing of internet stocks include Cooper et al. (2001), Ofek and Richardson (2003), and Schill and Zhou (2001).

2. The data, research design, and descriptive statistics

2.1. The data

Our initial sample consists of the complete list of the component firms of internet.com's twelve internet indices as of June 2000, as reported on its *Wall Street Research Net* web site. These indices are advertising, consultants & designers, content & communities, e-commerce enablers, e-tailers, financial services, ISP/access, internet services, performance software, search & portal, security, and speed & bandwidth. In order to minimize the effect of survivorship bias, we add to this set of firms all delisted companies which had been public at some point between January 1998 and June 2000 and which we classify as part of the internet industry. (The vast majority of these firms were delisted because they merged with, or were acquired by, other companies.) This augmented list is comprised of 403 firms.

For each firm-quarter whose earnings announcement falls between January 1998 and August 2000 we collect (1) the date and time of the formal announcement of that quarter's earnings, (2) the daily opening and closing stock prices for each of the 25 trading days prior to and after that earnings announcement (or for as long a period as possible, if the firm was not publicly traded during that entire time period), (3) bid and ask prices at the market opening and closing on each of those days, and, if available, (4) earnings and revenue surprises, calculated using analysts' one-quarter ahead earnings and revenue forecasts (as described in more detail below). *Dow Jones Interactive* is the source for the date and time of the earnings announcements. Since several of our analyses involve the close-to-open and open-to-close stock returns on the trading day immediately following the earnings release, 77 announcements (3.8 percent of the sample) for which no time is given (so that we cannot precisely identify the first trading day post-announcement) and 81 announcements (4.0 percent of the sample) made during regular trading hours (so that the open-to-close return on the earnings announcement day includes both pre- and post-announcement price changes) are deleted from the sample. This reduces our sample to 393 firms spanning 1,875 firm-quarters.

The *Trade and Quotation* (*TAQ*) database is the source of daily opening and closing prices, as well as bids and asks. To calculate abnormal returns we require a high-tech stock index with both opening and closing prices from the beginning of 1998. Only the Nasdaq Composite Index was found to satisfy these criteria and so is used in all of our analyses of abnormal returns.[3]

[3] Another high-tech stock index with historical open prices is *TheStreet.com* Internet index. However, its prices only go back to January 5, 1999. We repeated our main tests (restricted to the 1999–2000 period) using this index, and obtained results similar to those reported below. We also repeated these tests using an equal-weighted index comprised of our sample firms. Our results did not significantly change. This suggests that our findings are not driven by internet industry-wide events. To provide further assurances, we read the *Abreast of the Market* column of the *Wall Street Journal* for those dates which most frequently fell within the 5 days before or within the 5 days after the earnings announcements of our sample firms. No mention was made on any of those dates of potentially market-moving internet industry news.

The *I/B/E/S* database provides the individual analysts' earnings and sales forecasts. Using the *I/B/E/S* data, consensus analyst forecasts are computed by averaging the three most recent individual forecasts for the quarter, subject to the requirement that each forecast must have been issued within 45 days of the quarter-end. (The 45-day requirement is imposed in order to exclude stale forecasts from our computations.) If there are fewer than three such forecasts in the quarter, then all of the available one-quarter ahead forecasts satisfying this requirement are used. *I/B/E/S* is also the source for actual earnings per share, as the database adjusts eps to make it comparable to the number that is forecasted by analysts. Actual revenues are obtained from *Compustat* or, for the most recent quarters in which *Compustat* data were not yet available, the company's press releases. *I/B/E/S* is not used to obtain actual sales since the numbers are sometimes either missing or inconsistent with the revenues reported by the firms.[4]

2.2. Research design

For each firm-quarter we calculate the daily (close-to-close) raw return on each trading day t, $t \in \{-25, ..., -1, 1, ..., 25\}$, where $t = -1$ ($t = 1$) is the trading day just prior to (following) the quarter's earnings announcement. (We choose not to denote the earnings announcement date as day 0 since all of our announcements occur outside of regular trading hours. Under our convention, these announcements occur between the close of day -1 and the open of day 1.) We also decompose the raw return on trading day $t = 1$ into a close-to-open return (from the close on day -1 to the open on day 1) and an open-to-close return (from the open on day 1 to the close on that day).

We next calculate the abnormal return corresponding to each of these raw returns. Since the event window for most of our tests is very short (10 days in duration), the metric used for abnormal returns is likely to have little effect on our inferences (see Fama, 1998). For most of the analysis we use market-adjusted returns to measure abnormal returns. The close-to-close abnormal return for an individual stock is computed by subtracting the close-to-close return on the Nasdaq Composite Index from the stock's raw return. The close-to-open and open-to-close abnormal returns are similarly defined. The average abnormal return on a given event day is defined as the equal-weighted average of the individual stocks' abnormal returns. The t-statistic for each day's average abnormal return is calculated using the corresponding cross-sectional standard error.

We also report the results of cumulating the daily abnormal returns we find. Two commonly employed cumulative return metrics are the cumulative average abnormal return (CAR), which is the sum of the average daily abnormal returns, and the average buy-and-hold abnormal return (BHAR). The average BHAR is calculated by compounding the raw return for each security over a specified event period,

[4]Total actual and forecasted revenues are converted to per-share amounts by dividing them by the weighted average (basic) number of shares outstanding for the quarter. This number is taken from *Compustat* (or company press releases for the quarters in which *Compustat* data were not yet available).

subtracting the compound return on the market index over this period, and then averaging the excess returns over all securities. While these two methods are not likely to diverge much over short windows, we choose to report the average BHAR in our tables. Barber and Lyon (1997) suggest that this is the conceptually more appropriate measure to use.[5] The *t*-statistic for the average BHAR over a given window is calculated based on the corresponding cross-sectional standard error.

2.3. Descriptive statistics

Table 1 presents descriptive statistics on the 393 companies in our final sample. Reflective of high valuations relative to sales and earnings, the average firm market value is a large \$5.1 billion (the median is \$579 million), while the average market/book ratio is 15.46 (the median is 7.21). In contrast, average quarterly revenues is only \$65 million (median of \$118 million), while average quarterly earnings is a negative \$1.32 million (median of −\$3.21 million).

The average daily (close-to-close) raw return for our 1,875 firm-quarter observations during the 50 days surrounding their earnings announcements is 0.03 percent. The average close-to-open return is a larger 0.85 percent, while the average open-to-close return is −0.79 percent. These greater intraday returns are likely due to these stocks' tendency to close at their bid price and open at their ask price. The average bid–ask spread at the open of trading is 1.34 percent of the midpoint of the spread, while it is 1.29 percent of the midpoint at the close of trading. These spreads are somewhat larger than the average bid–ask spreads (of about 1 percent) reported by Carhart (1997) and Barber and Odean (2000). This is not surprising, given that our sample is comprised mostly of Nasdaq stocks, which typically have higher spreads.

Abnormal returns display a similar pattern to the raw returns. Over the 50 days surrounding our sample firms' earnings announcements, the close-to-close daily abnormal return averages −0.15 percent. The average close-to-open abnormal return is a larger 0.56 percent, while the average open-to-close abnormal return is a similarly large −0.68 percent.

3. Stock returns around earnings announcements

3.1. Event-time returns

Table 2, column 2, presents the average daily abnormal (market-adjusted) returns for event days $t \in \{-25, ..., -1, 1, ..., 25\}$, while column 3 reports the corresponding *t*-statistics. With just one exception, the returns for days −25 through −5 are

[5] On the other hand, Fama (1998) argues that the model of market equilibrium employed should determine the theoretically appropriate measure to use for cumulating returns. In our setting, pre- and post-announcement CARs and BHARs are similar. We supplement our BHAR event-time analysis with a calendar-time approach, suggested by Fama, in Section 3.2.

Table 1
Descriptive statistics
The sample consists of 393 publicly traded internet firms (see Section 2 for sample selection criteria). Summary statistics are presented for 1,875 firm-quarter earnings announcements, covering the period from January 1998 to August 2000. Market value of common shareholders' equity is calculated using the closing price on the day of the earnings announcement, multiplied by the weighted average number of shares outstanding during the quarter. The opening (closing) bid–ask spread is the difference between the opening (closing) bid and ask prices, scaled by the average of the two prices. The abnormal return is a market-adjusted return, with the Nasdaq Composite used as the market index.

Variable	Mean	Median	Std.dev.	Minimum	Maximum
Market value of equity ($MM)	5113.28	579.10	28067.06	3.42	461251
Market-to-book ratio	15.46	7.21	43.29	0.37	915.30
Quarterly revenues ($MM)	65.17	117.92	366.02	0	5720
Quarterly earnings ($MM)	−1.32	−3.21	63.65	−431.36	1127
Close-to-close daily raw return (%)	0.03	−0.13	1.48	−4.82	12.06
Close-to-open daily raw return (%)	0.85	0.76	0.97	−2.56	7.32
Open-to-close daily raw return (%)	−0.79	−0.80	1.50	−8.63	7.04
Close-to-close daily abnormal return (%)	−0.15	−0.03	1.32	−4.13	11.34
Close-to-open daily abnormal return (%)	0.56	0.44	0.95	−2.53	7.05
Open-to-close daily abnormal return (%)	−0.68	−0.69	1.42	−8.24	6.94
Opening bid-ask spread (%)	1.34	0.91	1.51	−0.58	10.19
Closing bid-ask spread (%)	1.29	0.92	1.25	−0.02	8.97

insignificant. Beginning on day −4 the average abnormal return becomes significant and positive, and remains so through day −1, where it equals 1.4 percent. The average abnormal return then switches sign and becomes significantly negative in each of the 5 days after the earnings announcement. Interestingly, while the close-to-close day 1 average abnormal return is a significant −1.6 percent, the close-to-open average abnormal return that day is significantly positive, at 1.6 percent, reflecting a continuation of the upward price movement of the prior few days. The open-to-close abnormal return on day 1 is a significant −3.1 percent. The average daily abnormal returns for days 6–25 are, with one exception, once again insignificantly different from zero.

Column 4 of Table 2 reports the average buy-and-hold abnormal return (BHAR) cumulated from the close on day −26. Fig. 1 depicts these returns graphically. Through day −5 the average BHAR remains below 2 percent in magnitude, showing no discernible trend over time. The average BHAR increases steadily from day −4, though, reaching a maximum of 5.3 percent at the open on day 1. From that point it begins to decrease, relatively rapidly at first, reaching a minimum of −2.3 percent on day 13. The average BHAR then turns back up, and from day 14–25 is close to zero; on day 25 the average BHAR is only –0.3 percent.

Since virtually all of the significant daily abnormal returns occur within the 5 days before and after the earnings announcement, the rest of our analysis focuses on this

Table 2
Average daily abnormal returns and buy-and-hold abnormal returns, January 1998–August 2000
The daily abnormal return on trading day t, $t \in \{-25,\ldots, -1, 1,\ldots,25\}$, is the close-to-close market-adjusted return, with the Nasdaq Composite used as the market index. The average abnormal return is an equal-weighted average of the abnormal returns of the individual stocks. Trading day –1 (1) is the trading day immediately preceding (following) the earnings announcement. The close-to-open return on day 1 is the return from the close on day –1 to the open on day 1. The open-to-close return on day 1 is the return from the open to the close that day. The buy-and-hold abnormal return (BHAR) for trading day t is the cumulative return from the close on day –26 to the close on day t, less the cumulative return on the Nasdaq Composite Index during that period. The average BHAR is the equal-weighted average of the BHAR's of the individual stocks. The BHAR through the open on day 1 is the cumulative return from the close on day –26 to the open on day 1, less the cumulative return on the Nasdaq Composite Index during that period. t-statistics in bold indicate statistical significance at the 5 percent level (two-tailed). The number of daily observations varies between 1,750 and 1,874 for the abnormal returns, and between 1,729 and 1,758 for BHAR.

	Daily abnormal return		BHAR		Daily abnormal return		BHAR
Trading day	Average	t-statistic	Average	Trading day	Average	t-statistic	Average
−25	−0.000	−0.02	−0.000	1 (close-to-open)	0.016	**9.54**	0.053
−24	0.000	0.07	−0.000	1 (open-to-close)	−0.031	**−16.14**	—
−23	−0.000	−0.04	0.000	1	−0.016	**−6.56**	0.021
−22	0.004	**2.35**	0.004	2	−0.012	**−7.38**	0.008
−21	0.000	0.05	0.005	3	−0.013	**−8.19**	−0.006
−20	0.002	1.00	0.007	4	−0.004	**−2.45**	−0.012
−19	0.003	1.39	0.008	5	−0.005	**−3.70**	−0.017
−18	−0.003	−1.52	0.005	6	−0.001	−0.57	−0.017
−17	0.002	0.95	0.007	7	−0.003	−1.82	−0.019
−16	−0.000	−0.05	0.007	8	−0.003	−1.85	−0.022
−15	0.002	1.17	0.010	9	−0.001	−0.77	−0.022
−14	0.003	1.31	0.014	10	−0.000	−0.03	−0.022
−13	0.002	1.06	0.017	11	−0.001	−0.79	−0.022
−12	−0.002	−0.93	0.015	12	−0.001	−0.55	−0.022
−11	−0.001	−0.47	0.014	13	−0.001	−0.79	−0.023
−10	0.000	0.02	0.013	14	0.002	1.13	−0.020
−9	0.002	1.28	0.015	15	0.002	1.01	−0.016
−8	−0.003	−1.55	0.015	16	−0.000	−0.06	−0.016
−7	0.001	0.28	0.018	17	0.000	0.08	−0.013
−6	−0.003	−1.67	0.013	18	0.002	0.74	−0.012
−5	0.002	0.95	0.014	19	−0.002	−1.11	−0.015
−4	0.006	**3.42**	0.019	20	−0.000	−0.23	−0.014
−3	0.004	**2.33**	0.022	21	−0.001	−0.69	−0.013
−2	0.008	**4.30**	0.030	22	−0.001	−0.77	−0.015
−1	0.014	**7.04**	0.040	23	0.002	1.30	−0.011
				24	0.001	0.60	−0.010
				25	0.004	**2.26**	−0.003

10-day window. As reported in the first row of Table 3, panel A, the average buy-and-hold abnormal return from the close on day –6 through the open on day 1, referred to as $R_{-6,1}$ below, is a significant 4.9 percent. The average abnormal return

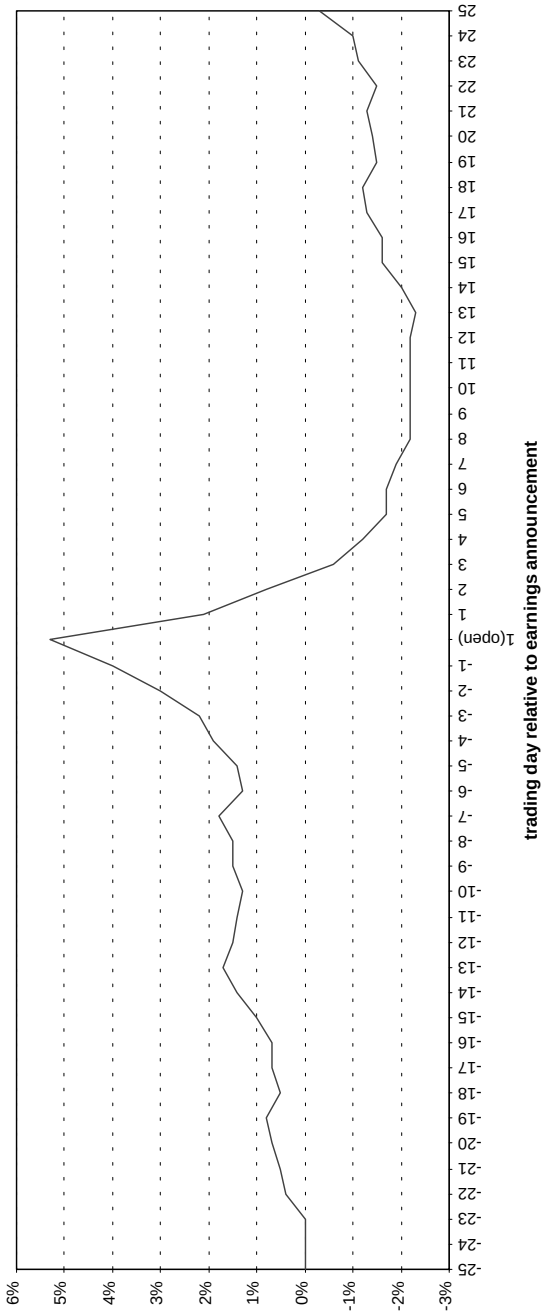

Fig. 1. Average buy-and-hold abnormal returns: January 1998—August 2000

Table 3
Abnormal returns from day −6 to day 5, January 1998–August 2000
Panel A reports event-time buy-and-hold abnormal returns (BHAR). The BHAR on an individual stock for a given period is the cumulative return over this period, less the corresponding cumulative return on the Nasdaq Composite Index. The average BHAR is the equal-weighted average of the BHAR's of the individual stocks. $R_{-6,1}$ denotes the average BHAR from the close on day −6 through the open on day 1, while $R_{1,5}$ is the average abnormal return from short-selling at the open on day 1 and covering at the close on day 5 (the negative of the period's average BHAR). Trading day −1 (1) is the trading day immediately preceding (following) the earnings announcement. Also reported are $R_{-6,1}$ and $R_{1,5}$ adjusted for earnings announcements clustered in time, by forming equal-weighted portfolios of stocks announcing on the same calendar date. These abnormal returns are computed based on the assumption that all buys (sells) take place at the ask (bid) price. They are reported for the full sample and for three size-partitioned subsamples. Panel B presents calendar-time abnormal portfolio returns. As of any day's close, the calendar-time pre-announcement portfolio is comprised of all stocks whose earnings will be announced sometime before the open five trading days hence. At each day's open, stocks whose earnings were announced while the market was closed are dropped, and the portfolio is rebalanced. As of any day's open, the post-announcement portfolio contains short positions in all stocks whose earnings were announced sometime between the close five trading days earlier and the current day's open. At each day's close, the positions of stocks whose earnings were announced after the market close five trading days earlier (and before the next day's open) are closed, and the portfolio is rebalanced. All purchases (sales) are assumed executed at the closing ask (opening bid) price. Both market-adjusted abnormal returns and Jensen's alpha are reported, under the alternative assumptions of equal-weighting and value-weighting. *t*-statistics in bold indicate statistical significance at the 5 percent level (two-tailed).

	Average	*t*-statistic	Average	*t*-statistic
Panel A: Event-time abnormal returns				
	$R_{-6,1}$		$R_{1,5}$	
Full sample	0.049	**11.37**	0.064	**19.17**
Bid–ask and cluster-adjusted:				
Full sample	0.045	**6.12**	0.043	**6.89**
Small firms	0.042	**2.49**	0.042	**4.07**
Medium-sized firms	0.041	**3.64**	0.052	**5.25**
Large firms	0.053	**4.40**	0.054	**5.93**
Panel B: Calendar-time portfolio returns				
	Pre-announcement portfolio		Post-announcement portfolio	
Equal-weighted, market-adjusted	0.009	**5.02**	0.006	**3.61**
Equal-weighted, Jensen's alpha	0.009	**5.07**	0.006	**3.61**
Value-weighted, market-adjusted	0.011	**5.42**	0.005	**3.26**
Value-weighted, Jensen's alpha	0.011	**5.52**	0.005	**3.29**

from a short sale at the open on day 1, followed by short covering at the end of day 5, referred to as $R_{1,5}$ below (the negative of the average buy-and-hold abnormal return over this period) is a significant 6.4 percent. The median abnormal returns are 2.4 and 7.7 percent, respectively.[6]

The significance of these short-window returns is likely overstated for two reasons. First, with many firms' earnings announcements clustered on the same calendar date, their abnormal returns may be positively cross-correlated, leading to biased test statistics.[7] To adjust for this, we form on each calendar date an equal-weighted portfolio of all stocks announcing earnings that day (along the lines of Chari et al., 1988). This portfolio formation process yields 388 separate observations.[8] Second, these returns are computed using a stock's closing price, which ignores the impact of the bid–ask spread. In reality we would expect most end-of-day purchases to fill at the closing *ask* price and beginning-of-day sales to fill at the opening *bid* price. To adjust for the bid–ask spread, we recompute returns assuming that all end-of-day purchases execute at the closing *ask* price while all beginning-of-day sales execute at the opening *bid* price.[9] This adjustment will have the effect of reducing the reported returns.

As reported in the second row of Table 3, panel A, after making these adjustments $R_{-6,1}$ is a significant 4.5 percent, while $R_{1,5}$ is a significant 4.3 percent. The medians of these abnormal returns are 2.8 and 5.3 percent, respectively. Even after adjusting for clustering and subtracting the bid–ask spread, the average abnormal returns remain economically large. In untabulated results, we find that the adjusted close-to-open abnormal return on day 1 averages an insignificant 0.4 percent, while the adjusted average abnormal return to a short sale at the open on day 1, followed by short covering at the close that day is a significant 1.9 percent.[10]

[6] We repeated our return analysis for the 77 firms for which we could not find an earnings announcement time and the 81 firms which announced during the trading day. The average buy-and-hold abnormal return from the close on day −6 to the close on day −2 for these firms was 0.87 percent, with an associated *t*-statistic of 0.76. (We cumulated returns only through day −2 since these firms announced earnings at different times during what we call day −1.) The low *t*-statistic is likely due to the small number of firms in this sample and the exclusion of the return from the close on day -2 through the open on day 1. The average abnormal return from a short sale at the open on day 1 and short covering at the close on day 5 was 3.50 percent, with an associated *t*-statistic of 3.61.

[7] Untabulated results show that approximately 36 percent of all trading days have only one announcement, while over three-quarters of the days have five or fewer announcements. The mean (median) number of announcements on a given day is 4.83 (2), with a maximum of 40 on a single day.

[8] Since the BHAR's span multiple days, individual observations are also cross-sectionally correlated. Therefore, the *t*-statistics we report for the BHAR's should be interpreted with caution, as they are upwardly biased (in absolute value). We reassess the significance of these results using a calendar-time portfolio approach in Section 3.2.

[9] Depending on the liquidity of the market at the time of order placement, the end-of-day purchase (beginning-of-day sale) of shares might be executed at a price different from the closing ask (opening bid).

[10] Adjusted for clustering, the close-to-close *daily* abnormal returns (Table 2) remain significant for days −4 to 3. The days 4 and 5 abnormal returns, though, lose their significance. After adding an adjustment for the bid-ask spread, each of the daily returns becomes insignificant. This is not surprising, as it simply reflects the fact that none of the one-day close-to-close returns is significantly greater than the bid–ask spread.

To test whether the pre- and post-announcement abnormal returns are driven by firms of a particular size, we repeat the previous bid–ask and cluster-adjusted computations for three separate market value-partitioned subsamples. The results are presented in the last three rows in panel A of Table 3. The abnormal returns are significant for all three size portfolios. $R_{-6,1}$ varies between 4.1 percent for the medium-sized firms and 5.3 percent for the large firms, while $R_{1,5}$ ranges from 4.2 percent for the small firms to 5.4 percent for the large ones.

3.2. Calendar-time returns

As an alternative to the calculation of event-time buy-and-hold abnormal returns, Fama (1998) suggests the use of a calendar-time approach. This methodology involves the formation of portfolios whose composition evolves over time according to the calendar date on which each firm's earnings are announced. This approach not only provides well-specified test statistics, as it takes into account the cross-correlation in stock returns (including the correlation induced by the clustering of events in calendar time), but also directly reflects the experience of a hypothetical investor over the sample period. In this section we estimate calendar-time returns, as a supplement to the event-time returns we have already computed.

The analysis begins with the construction of two portfolios, referred to as the pre-announcement and post-announcement portfolios. As of any day's close, the pre-announcement portfolio is comprised of all stocks whose earnings will be announced sometime before the open five trading days hence. At each day's open, every stock whose earnings were announced while the market was closed is dropped from the portfolio, and the portfolio is rebalanced. As of any day's open, the post-announcement portfolio contains short positions in all stocks whose earnings were announced sometime between the close five trading days earlier and the current day's open. At each day's close, the position of any stock whose earnings were announced after the market close five trading days earlier (and before the next day's open) is closed, and that portfolio is rebalanced. All purchases (including short-covering) for each of the portfolios are assumed to be executed at the closing ask price while all sales (including short-sales) are executed at the opening bid price. This has the effect of reducing our reported returns.[11] Untabulated results reveal that there are 15 (12) stocks on average in the pre-announcement (post-announcement) portfolio over our sample period.

The close-to-open (open-to-close) raw return for each portfolio on a given trading day is the equal-weighted return of each of the individual securities in the portfolio as of the prior day's close (that day's open). The close-to-close return for the trading day is the compounded portfolio return over the close-to-open and open-to-close periods. We calculate two alternative measures of each portfolio's daily abnormal return. The first is the market-adjusted return, computed using the Nasdaq Composite Index. The second is Jensen's alpha. As reported in the first two rows

[11] For any period of time in which a portfolio does not contain any stocks, we assume that it is entirely invested in the market (Nasdaq Composite) index.

of Table 3, panel B, the average daily market-adjusted return and Jensen's alpha for the pre-announcement portfolio are both equal to 0.9 percent (with *t*-statistics of 5.02 and 5.07, respectively), and are equal to 0.6 percent for the post-announcement portfolio (with a *t*-statistic of 3.61). These daily returns, when cumulated to 5-day returns, are roughly the same order of magnitude as the event-time returns previously documented. Hence, the significant price runup in the pre-announcement period as well as the significant price drop in the post-announcement period, which were documented in event time, are confirmed by the calendar-time portfolio methodology.

To determine whether these returns might be driven by the smaller firms in our sample, we repeat our calendar-time calculations using a value-weighting, rather than an equal-weighting, for our portfolios. (The weight of each stock is proportional to its market capitalization at the close of the previous day's trading.) There is little change in our results. (See the last two rows of Table 3, panel B.) The average daily market-adjusted return and Jensen's alpha are both significant and equal to 1.1 percent (with *t*-statistics of 5.42 and 5.52, respectively) for the pre-announcement portfolio. For the post-announcement portfolio both are significant and equal to 0.5 percent (with *t*-statistics of 3.26 and 3.29, respectively).[12]

4. Potential explanations for the observed price patterns

4.1. An information-based explanation

In this section we examine the extent to which the observed stock return patterns around internet firms' earnings releases can be explained by the information reflected in those announcements. Ex ante, it is doubtful that an information-based story could fully explain these price movements. To do so would require that generally favorable news leak out in advance of the earnings announcements, and that investors overreact to the leaks, necessitating a price reversal after the actual earnings are released.

We partition the 10-day buy-and-hold abnormal return surrounding each earnings announcement into four components: (i) the buy-and-hold abnormal return from the

[12] It might be tempting to conclude from these results that investors could have been expected to profit during our sample period from a strategy of purchasing internet stocks in advance of their earnings announcements and short-selling them afterwards. Such a conclusion should be approached very cautiously, for two reasons. First, it is unclear whether investors would have recognized, and taken advantage of, the strategy's profitability during the time period under study (hindsight bias). Second, even if they did, it is not clear that they would have implemented it as outlined here; other implementation strategies might have earned lower (or possibly negative) trading profits. Using very limited personal funds, the authors implemented an incomplete version of this strategy over a time which partially overlapped with our sample period. We sold short selected internet stocks on the morning after their earnings announcements and covered our positions at the end of the day. Our strategy met with mixed success.

close on day −6 through the close on day −1, (ii) the close-to-open abnormal return on day 1, (iii) the open-to-close abnormal return that day, and (iv) the buy-and-hold abnormal return from the close on day 1 through the close on day 5. Each return component is then separately regressed on the earnings and revenue surprises in the earnings announcement. Earnings surprise is defined as the difference between actual earnings per share and the consensus analyst earnings forecast, scaled by the beginning price of the return window. Revenue surprise is defined as the difference between actual revenues per share and the consensus analyst revenue forecast, again scaled by the beginning price of the return window.[13] Revenue surprise is chosen as an independent variable because of recent findings that internet firm stock prices are positively related to their reported revenue.[14] There are 856 (470) firm-quarters for which earnings (revenue) forecasts are available and for which earnings (revenue) surprises can be calculated.[15] In order to minimize the influence of outliers, we treat as missing an earnings (revenue) forecast if its absolute deviation from actual earnings (revenues), scaled by price, falls in the top or bottom 1 percent of the distribution.

Table 4 presents the regression results. For the 5 day period before the earnings announcement the coefficient on earnings surprise is an insignificant 0.360, while the coefficient on revenue surprise is an insignificant 0.416. These findings fail to provide support for the notion that the observed price runup in advance of the earnings announcement is due to the leakage of favorable news. For the close-to-open period on day 1 the coefficient on earnings surprise is a significant 0.992, indicating that investors' immediate reaction is at least partly consistent with the nature of the earnings news released. The R^2, though, is a very small 0.008. In contrast, the coefficient on revenue surprise is an insignificant 0.085.[16] Additionally, there is no significant relation between the open-to-close abnormal return on day 1 and either the earnings surprise or the revenue surprise (the regression coefficients are 0.064 and −0.113, respectively). The same is true for the abnormal return over the next 4 days, as well, where the coefficient on earnings surprise is an insignificant −0.560 and the coefficient on revenue surprise is an insignificant 0.127. Similar to the price runup in advance of the earnings release, these findings fail to provide support for the possibility that the post-announcement

[13] Our consensus earnings forecasts are composed of three individual analyst forecasts in 46.6 percent of the cases. They are composed of two individual analyst forecasts 21.5 percent of the time, and one forecast in 31.9 percent of the cases. For the consensus revenue forecasts, the corresponding percentages are 16.3, 25.9, and 57.9, respectively.

[14] See Davis (2001), Hand (2000), Rajgopal et al. (2003), Demers and Lev (2001), and Trueman et al. (2000).

[15] While earnings forecasts are available for the entire sample period, most of the available revenue forecasts are for the third quarter of 1998 or later.

[16] That the close-to-open day 1 return is not significantly related to the revenue surprise suggests that there may be a fair degree of measurement error in this variable (which would bias the estimated coefficient toward zero). This is consistent with evidence presented in Trueman et al. (2001) that analysts' revenue forecasts may not adequately reflect the market's expectation of the revenues of portals, content/community providers, and e-tailers.

Table 4
OLS regressions of buy-and-hold abnormal returns on earnings and revenue surprises, January 1998–August 2000
The earnings (revenue) surprise regressions are based on 823 (453) firm-quarter observations. The 10-day buy-and-hold abnormal return surrounding each earnings announcement is partitioned into four components: (i) the return from the close on day −6 through the close on day −1, (ii) the close-to-open return on day 1, (iii) the open-to-close return on day 1, and (iv) the return from the close on day 1 through the close on day 5. Each return component is separately regressed on earnings and revenue surprise. Trading day −1 (1) is the trading day immediately preceding (following) the earnings announcement. Earnings (revenue) surprise is defined as the difference between actual earnings (revenue) per share and the consensus analyst earnings (revenue) forecast, scaled by the beginning price of the return window. The *t*-statistics are underneath the estimated coefficients. Those in bold indicate statistical significance at the 5 percent level (two-tailed).

	Close on day −6 to close on day −1	Close on day −1 to open on day +1	Open on day +1 to close on day +1	Close on day +1 to close on day +5
Panel A: Earnings regressions				
INTERCEPT	0.036	0.017	−0.028	−0.034
(*t*-statistic)	**(6.44)**	**(7.90)**	**(−10.90)**	**(−8.84)**
Earnings surprise	0.360	0.992	0.064	−0.560
(*t*-statistic)	(0.45)	**(3.15)**	(0.17)	(−1.02)
Adjusted R^2	−0.001	0.008	−0.001	0.000
Panel B: Revenue regressions				
INTERCEPT	0.030	0.020	−0.030	−0.035
(*t*-statistic)	**(3.91)**	**(6.48)**	**(−8.75)**	**(−6.26)**
Revenue surprise	0.416	0.085	−0.113	0.127
(*t*-statistic)	(1.61)	(0.16)	(−0.98)	(0.64)
Adjusted R^2	0.003	−0.001	−0.000	−0.001

price decline is due to a market overreaction to the news contained in the earnings report.[17]

4.2. A risk-based explanation

We next examine whether the returns around internet firms' earnings announcements can be explained by changes in the risk inherent in these stocks. To do so we

[17] We reran these regressions, treating all earnings announcements falling on the same calendar date as if they were a single observation, with an earnings (revenue) surprise equal to the average earnings (revenue) surprise for all the individual announcements. In none of these regressions was the coefficient on the independent variable significant.

employ the Ibbotson (1975) methodology, which allows for risk changes in the estimation of abnormal returns. This analysis is motivated by prior studies which document increases in risk around the time of earnings announcements. We estimate the following cross-sectional regression, separately for each event day t:

$$R_{ict} - R_{fc} = \alpha_t + \beta_t(R_{mc} - R_{fc}) + \varepsilon_{ict}, \quad (1)$$

where R_{ict} is the daily return on security i for calendar date c and event day t; R_{fc} the daily risk-free rate of return on calendar date c for treasury bills having one month until maturity; R_{mc} the return on the Nasdaq Composite Index for calendar date c; α_t Jensen's alpha for event day t; β_t the estimated market beta for event day t; and ε_{ict} the regression error term.

The return R_{ict} includes a calendar date subscript, c, because for each security i there are multiple calendar dates on which event day t falls within our sample period (one for every quarter that the firm announces earnings), and for which a return must be measured. These regressions yield estimates of systematic risk, β_t, and abnormal return, α_t, for each event day t.

Table 5, columns 3 and 5, present the estimated α_t's and β_t's, respectively, for days -5 to 5. Columns 4 and 6 report the corresponding t-statistics, which are based on White's (1980) standard error. The α_t's are significantly positive, as well as significantly negative, on the same event days as are the market-adjusted returns, which are reproduced in column 2. (Untabulated results show the same to be true for

Table 5
Daily values of Jensen's alpha and systematic risk, January 1998–August 2000
For each event day t, security i's excess return is regressed on the excess market return (see Ibbotson, 1975), with the Nasdaq Composite used as the market. Trading day -1 (1) is the trading day immediately preceding (following) the earnings announcement. The table reports the estimated abnormal return, α_t (Jensen's alpha), the systematic risk estimate, β_t, and the adjusted R^2 for each daily regression. Also reported are the estimates for regressions based on the day 1 close-to-open returns and the day 1 open-to-close returns. All t-statistics are based on White's (1980) standard errors and are in bold if statistically significant at the 5 percent level (two-tailed).

Event day t	Average daily abnormal returns (from Table 2)	Regression estimates				
		α_t	t ($\alpha_t = 0$)	β_t	t ($\beta_t = 1$)	Adj. R^2
−5	0.002	0.002	0.94	1.200	**2.21**	0.147
−4	0.006	0.007	**3.85**	1.339	**4.25**	0.170
−3	0.004	0.006	**2.72**	1.308	**3.14**	0.162
−2	0.008	0.008	**4.36**	1.196	**2.30**	0.147
−1	0.014	0.013	**6.96**	1.304	**3.38**	0.144
1 (close-to-open)	0.016	0.014	**8.33**	1.984	**7.13**	0.095
1 (open-to-close)	−0.031	−0.031	**−15.63**	1.020	0.20	0.069
1	−0.016	−0.016	**−6.51**	1.157	1.49	0.068
2	−0.012	−0.012	**−7.20**	0.991	0.10	0.096
3	−0.013	−0.012	**−8.03**	1.000	0.00	0.127
4	−0.004	−0.004	**−2.57**	0.954	0.65	0.112
5	−0.005	−0.005	**−3.65**	1.068	0.99	0.123

days −25 to −6 and days 6–25.) Moreover, these two metrics never differ by more than 0.2 percentage points. The β_t's are significantly greater than one during the pre-announcement period, consistent with findings of prior research that stock return volatility increases during this time, and are highest between the close on day −1 and the open on day 1. The β_t's decrease after earnings are released, and are no longer significantly different from one. The stock return pattern documented for the market-adjusted returns clearly remains intact when estimating abnormal returns in this alternative manner, which accounts for changes in risk.[18]

A final piece of evidence suggesting that risk cannot fully explain our results is the untabulated finding that post-announcement *raw* returns are negative. Negative raw returns on a stock can only be justified by risk when the stock acts as a hedge against factors positively priced by the market. This is very unlikely to characterize internet firms.[19]

4.3. A price pressure explanation

An alternative potential explanation we now explore is that of price pressure, whereby an unjustifiably high level of investor optimism and share demand (relative to a firm's expected future performance) boosts prices in the days before an earnings announcement, and an abating of that demand causes a subsequent price reversal.[20] By causing prices to deviate from fundamental values, price pressure reflects a form of market inefficiency. The possibility that price pressure might be driving returns in our setting is suggested by the rather unique conditions surrounding the trading of internet stocks: a relatively large demand for shares from short-term retail investors, especially momentum traders (those who purchase shares of companies because their stock prices have recently risen),[21] and a small supply of firm shares available for trading in the marketplace.[22]

A necessary condition for price pressure to at least partially explain these stock return patterns is that there be an abnormally high number of buyer-initiated relative to seller-initiated trades in the days before an earnings announcement as well as a

[18] Cluster-adjusted, these findings remain qualitatively intact. In particular, the α_t's remain significantly positive for $t = -4$ to -1 and significantly negative for $t = 1$–3.

[19] As a further control for risk, we estimated risk-adjusted monthly returns for our pre-announcement and post-announcement calendar-time portfolios using the Fama and French (1993) three-factor model. (We compounded daily portfolio raw returns to obtain monthly raw returns.) Untabulated results show the average risk-adjusted pre-announcement and post-announcement portfolio returns to be significantly positive.

[20] Price pressure has been examined as a possible explanation for anomalous price patterns in a number of different settings. For example, Barber and Loeffler (1993) and Liang (1999) consider price pressure in the context of stocks recommended on the *Wall Street Journal's* "Dartboard" column, Harris and Gurel (1986) in the context of the announcement of a firm's inclusion in the S&P 500 Index, Holthausen et al. (1987) with respect to block trades, and Hess and Frost (1982) for seasoned equity offerings.

[21] See "Market on a High Wire: Momentum Players Ignore the 'Tomorrow Factor'," by Rebecca Buckman (*The Wall Street Journal*, January 18, 2000).

[22] As few as 10–15 percent of these firms' shares are sold in the initial public offerings. In addition, the shares held by insiders cannot be sold during the share lockup period, which normally lasts for at least 6 months. (See the discussion later in this subsection.)

positive association between the pre-announcement price runup and the magnitude of the abnormal order imbalance. Further, during the post-announcement period the abnormally high number of buyer-initiated trades should disappear. Finding that these relations hold, however, would not necessarily imply that price pressure is driving the documented price patterns, as most price increases, regardless of their causes, are likely to be accompanied by an abnormally large number of buyers relative to sellers.

We employ the tick test to determine the daily number of buyer-initiated and seller-initiated trades.[23] A trade is considered to be buyer-initiated if either the immediately preceding trade, as recorded on the *TAQ* database, is at a lower price or, if at the same price, the last non-zero price change is positive. Similarly, a trade is considered to be seller-initiated if either the immediately preceding trade is at a higher price or, if at the same price, the last non-zero price change is negative. We include trades made during normal market hours (9:30 a.m. until 4:00 p.m. Eastern time), but exclude those made either before market opening of after market closing.[24] Along the lines of Lee (1992), the order imbalance on event day $t \in [-5, 5]$ surrounding the quarter m earning announcement of firm i, denoted by OI_{itm}, is defined as

$$OI_{itm} = \frac{NBUY_{itm} - NSELL_{itm}}{NTRD_{itm}}, \tag{2}$$

where $NBUY_{itm}$ is the number of buyer-initiated trades for firm i on event day t in quarter m; $NSELL_{itm}$ the number of seller-initiated trades for firm i on event day t in quarter m; and $NTRD_{itm}$ the number of trades for firm i on event day t in quarter m.

As reflected by expression (2), the order imbalance is calculated by taking the difference between the number of buyer-initiated and seller-initiated trades each day and normalizing it by the total number of trades that day.

The abnormal order imbalance, denoted by AOI_{itm}, is given by

$$AOI_{itm} = OI_{itm} - \frac{1}{30}\left[\sum_{t=-25}^{-11} OI_{itm} + \sum_{t=11}^{25} OI_{itm}\right], \tag{3}$$

where the 'normal' order imbalance is the average of the order imbalances over the period $t = -25$ to -11 and $t = 11$–25 surrounding the quarter m earnings announcement of firm i.[25]

[23] Ellis et al. (2000) examine the accuracy of several trade classification algorithms using Nasdaq market data. They find that the tick test correctly classifies 77.66 percent of the trades and follows closely behind the Lee and Ready (1992) algorithm, which has a correct classification rate of 81.05 percent. Since the accuracy of these two methods are very similar, we expect that our results would be robust to the use of the alternative Lee and Ready algorithm.

[24] Including trades executed when the market is closed would have required us to identify, for each earnings release, those trades taking place before the after-hours announcement and those taking place afterwards. We do not expect that our results would change if these trades were included, especially given the relatively small amount of after-hours trading volume.

[25] In calculating the order imbalance for each day $t \in \{-25,..., -11,11,...,25\}$ we normalize the difference between the number of buyer-initiated and seller-initiated trades that day by the average number of trades per day over this 30 day interval. Scaling the daily order imbalances within our event window by this 30 day average, as well (as in Lee, 1992), only serves to strengthen our results.

Table 6
Abnormal order imbalance results, January 1998–August 2000
Panel A reports the average daily abnormal order imbalance over days −5 to 5. Trading day −1 (1) is the trading day immediately preceding (following) the earnings announcement. Daily order imbalance over each of these days is the number of buyer-initiated trades minus the number of seller-initiated trades, and is scaled by the total number of trades that day. Abnormal order imbalance is the order imbalance for that day less the average order imbalance over days −25 to −11 and 11–25 (scaled by the average daily number of trades over these days). Average abnormal order imbalance is an equal-weighted average of the individual stocks' abnormal order imbalances. *t*-statistics in bold indicate statistical significance at the 5 percent level (two-tailed). Panel B presents the results of regressing a stock's buy-and-hold abnormal return from the close on day −6 to the open on day 1 ($R_{-6,1}$) on its abnormal order imbalance averaged over days −5 to −1. The buy-and-hold abnormal return (BHAR) on an individual stock for the period is the cumulative return over the period, less the corresponding cumulative return on the Nasdaq Composite Index. The *t*-statistics are underneath the estimated coefficients. Those in bold indicate statistical significance at the 5 percent level (two-tailed).

Panel A: Average abnormal trade imbalance

Trading day	Average abnormal trade imbalance	*t*-statistic
−5	0.004	1.00
−4	0.008	1.79
−3	0.012	**2.66**
−2	0.017	**4.01**
−1	0.034	**8.09**
1	−0.001	−0.39
2	−0.014	**−3.48**
3	−0.015	**−3.81**
4	−0.006	−1.33
5	−0.005	−1.19

Panel B: OLS regression of $R_{-6,1}$ on pre-announcement abnormal trade imbalance

INTERCEPT	0.039
(*t*-statistic)	**(9.51)**
Abnormal order imbalance	0.665
(*t*-statistic)	**(17.36)**
Adjusted R^2	0.140

Table 6, panel A reports the average abnormal order imbalance for event days −5 to 5. The results are generally as expected. The average abnormal order imbalance is positive during each of the 5 days before the earnings announcement. It is significant on days −3, −2, and −1, reflecting an abnormally high number of buyer-initiated relative to seller-initiated trades. Furthermore, as reported in panel B of Table 6, $R_{-6,1}$ is significantly positively related to the average daily abnormal order imbalance over those 5 days. (The regression coefficient on the abnormal order imbalance is 0.665.) Once earnings are announced, the imbalance turns negative (see panel A), and is significant on days 2 and 3. The abnormal order imbalance is not significant in

either direction on day 1, consistent with the price reversal that occurs during that trading day.[26] These results compare to those of Lee (1992), who finds, for small dollar trades and an earlier time period, a positive abnormal order imbalance during the day before, day of, and day after earnings announcements.

As a check on our results, for each event day we calculated the percentage of firms with a positive order imbalance. Consistent with the finding of a positive (negative) abnormal order imbalance during the pre-announcement (post-announcement) period, the percentage of positive order imbalances is higher before the earnings announcement than after. Untabulated results reveal that the percentage varies between 45 and 53 for days -5 to -1, while it ranges from 38 to 43 for days 1–5.[27]

Additional support for the existence of price pressure is provided by the (untabulated) observations that (i) the pre-announcement abnormal order imbalance is not significantly associated with the information in the forthcoming earnings announcement (the correlation between the pre-announcement daily average abnormal order imbalance and earnings (revenue) surprise is -1.2 (-4.0) percent), (ii) $R_{-6,1}$ and $R_{1,5}$ are significantly positively correlated (the correlation coefficient is 10.7 percent),[28] and (iii) the positive pre-announcement BHAR is completely reversed within a few weeks after the earnings release (see Table 2).

Further evidence comes from a comparison of the price pattern during the lockup and post-lockup periods. During the lockup period insiders (such as managers, directors, employees, and venture capitalists) are prohibited from selling their shares; as a result, the share float is a small fraction (often 15 percent or less) of the total number of shares outstanding. To the extent that price pressure is a driving force behind the stock returns observed around earnings announcements, we would expect a more pronounced price pattern during the lockup period than afterwards.

To examine whether this is the case we divide our sample into those firm-quarters whose earnings announcements occur within the first 6 months after the initial public offering and those falling outside of that period. We choose 6 months as it is the normal share lockup period. There are 618 earnings announcements occurring within the lockup period and 1,257 announcements post-lockup. In untabulated results, we find the average $R_{-6,1}$ for the lockup period to be a significant 6.7 percent, while the average $R_{1,5}$ is a significant 7.4 percent. The corresponding post-lockup abnormal returns are smaller, consistent with the price pressure hypothesis, but they are still significant. The average $R_{-6,1}$ for the post-lockup period is 4.1 percent, while the average $R_{1,5}$ is 5.9 percent.[29]

[26] We repeated this analysis, treating all earnings announcements falling on the same calendar date as if they were a single observation having an abnormal order imbalance equal to the average abnormal order imbalance for all the individual announcements. For the pre-announcement period the results are qualitatively unchanged. For each of days 1–5, the average abnormal order imbalance is insignificantly different from zero, rather than negative.

[27] Adjusted for clustering, the percentage of positive order imbalances for days -5 to -1 varies between 50 and 59 percent, dropping to between 43 and 47 percent for days 1–5.

[28] To ensure that this result is not caused by a tendency for a stock's closing (opening) price to be at the bid (ask), we use closing and opening *ask* prices to measure $R_{-6,1}$ and $R_{1,5}$.

[29] Cluster-adjusted, the average $R_{-6,1}$ ($R_{1,5}$) is 0.071 (0.077) for the lockup period and 0.052 (0.048) for the post-lockup period.

4.4. Other possible explanations for the documented price patterns

Chambers and Penman (1984) and Kross and Schroeder (1984) provide evidence that firms tend to release good news earnings reports earlier than those containing bad news. If this is indeed the case, then the longer a firm goes without reporting its earnings, the less positive (or, alternatively, more negative) will investors expect the ultimate earnings news to be. This implies that a firm should experience negative stock returns from the end of its fiscal quarter up until the time of its earnings announcement. When the earnings are finally released by the manager, the stock price should rise (since investors built into the pre-announcement price the possibility that the manager could have delayed the release even longer and that the news could, as a consequence, have been even worse). This 'v'-shaped price pattern is clearly inconsistent with the inverted 'v' pattern observed in our data; consequently, a tendency to release good news early cannot explain our findings. Furthermore, one of the critical assumptions underlying the 'v'-shaped pattern—uncertainty over the disclosure date of earnings—does not generally characterize our data.

Another possible explanation for some of our findings requires the supposition that internet stocks' pre-announcement prices incorporate a very small chance of a large earnings surprise and corresponding post-announcement price jump, and a high likelihood of a small earnings disappointment and price decline. If this is the case, then our sample could be biased in the sense of capturing none of these very low likelihood, large positive outcomes. This could, at least theoretically, explain the negative post-announcement price change we observe (although it cannot account for the price runup in advance of the earnings release). Practically speaking, though, the relatively large post-announcement average price drop of 6.4 percent implies that, at least from investors' viewpoint, a large upside price movement is actually not a very low probability event.[30]

5. Summary and conclusions

This paper presents evidence of significant anomalies in the stock returns of internet firms surrounding their quarterly earnings announcements. Over the 5 days preceding these announcements, and extending through the market opening on the day immediately afterwards, the average buy-and-hold abnormal (market-adjusted) return is 4.9 percent. From the open that day through the close 4 days later the average abnormal return is an even greater −6.4 percent. This abnormal return

[30] For example, if the magnitude of the potential upside price move was 1,000 percent, the implicit probability of its realization would be more than one-half of one percent. (Assuming risk neutral pricing and an efficient market, this probability is the solution to $10 \cdot prob(up\ move) - 0.064 \cdot (1 - prob(up\ move)) = 0$.) This is not a very low probability, considering that, with our sample size and assuming independence across observations, it implies that the probability of at least one up move being observed is over 99.99 percent. Even under the very conservative assumption of perfect correlation between the abnormal returns of same-day announcements, this probability is almost 92 percent.

remains significant even after accounting for changes in risk around earnings announcements, the clustering in time of many of our observations, and the magnitude of the bid–ask spread.

There is little support for an information-based explanation for the returns we document. In particular, neither the earnings surprise nor the revenue surprise is significantly related to the price runup in advance of the earnings announcement, thereby casting doubt on information leakage as a possible explanation for these returns. As well, the post-announcement price reversal is not significantly related to either the earnings or revenue news contained in the earnings report. Only the close-to-open return on the trading day subsequent to the earnings announcement has a significant association with the earnings news.

Additional analyses suggest that these return patterns are at least partially driven by price pressure existing in the days prior to internet firms' earnings announcements. Consistent with price pressure, there is an abnormally high number of buyer-initiated relative to seller-initiated trades before earnings announcements, an imbalance which disappears after earnings are released. Moreover, the post-announcement price reversal results in an average buy-and-hold abnormal return over our entire event window that is insignificantly different from zero. Finally, the observed price patterns are more pronounced during the share lockup period than post-lockup, when there is a larger share float in the marketplace.

These results, taken as a whole, suggest a market inefficiency. However, there may be other, as of yet unexplored, explanations for these abnormal returns which are consistent with market efficiency. Given the magnitude of the documented returns, additional research aimed at understanding their origin may well be worthwhile.

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