

News or Noise?

Internet Message Board Activity and Stock Prices*

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Abstract

This paper examines the relationships between Internet message-board activity and abnormal stock returns and trading volume. The study focuses specifically on the RagingBull.com discussion forum, an extremely popular site whose format permits the construction of an objective measure of investor opinion. For stocks in the Internet service sector, we find that, on days with abnormally high message activity, changes in investor opinion correlate with abnormal industry-adjusted returns. These events days also coincide with abnormally high trading volume, which persists for a second day. However, we find that, in general, message-board activity does not predict industry-adjusted returns or abnormal trading volume. In contrast to the anecdotal evidence of investors using Internet forums to manipulate stock prices, the evidence in our sample is consistent with market efficiency.

Introduction

The Internet is clearly playing an ever-increasing role in financial markets and personal finance. Six large Internet brokerages, Ameritrade, DLJdirect, E*Trade, NDB, Schwab, and TD Waterhouse, cumulatively boasted over 12 million accounts in 1999 and are expecting account growth of 45% in 2000.¹ While initially the Internet revolution may only have facilitated security transactions, investors now benefit from a wide assortment of financial information available online. All official SEC filings can easily be found on the World Wide Web. Most established companies host web sites that provide investors with greater insight into management and long-term corporate strategies. Moreover, the Internet has helped personal investors learn from others through open discussion in security-market forums. Web sites like The Motley Fool (Fool.com), SiliconInvestor.com, and RagingBull.com have facilitated this discussion among thousands of investors.

Given this explosion of interest and information, it is not surprising that researchers have begun to explore both the valuation of Internet stocks and the effects of Internet activity on equity valuation. For example, Rajgopal, Kotha, and Vehkatchalam (2000) find that web traffic helps determine the value of Internet companies, after controlling for some accounting measures. Wysocki (1999) examines 3,000 stocks listed on Yahoo! message boards and finds Internet message-posting volume predicts changes in next-day trading volume and returns. Specifically, he finds that a doubling of overnight message postings relative to the average leads to a 0.18% average abnormal return. Rau, Dimitrov, and Cooper (2000) find that announcements of company name changes to Internet related names generate large positive abnormal returns.

Other studies take a more traditional approach to the valuation of Internet stocks. Trueman, Wong, and Zhang (2000) try to find relationships between Internet company stock prices and accounting information. In their research, they find a significant association between gross profits and valuation. Hand (2000) discovers a non-linear relationship between accounting data and stock pricing.

These papers represent the first forays into Internet stock pricing and, more generally, into examining the effects of the Internet on the valuation of more traditional companies. In general, they attempt to answer two key questions: (1) What are the determinants of stock prices? and (2) Are these prices consistent with market efficiency? The analysis presented in this paper is similar in spirit, but takes a very different perspective. Instead of using accounting data, web traffic, or message-posting volume to determine value, this paper looks at the opinions contained in Internet financial forums. Recently, the press has sensationalized the activity in these forums, linking it to egregious examples of stock-price

¹ Scott W. Appleby, Robertson Stephens Inc., E*Trade Analyst Research, January 4, 2000

manipulation. For example, in February 1999, the stock price of a small Milwaukee-based toy company, Alottafun Inc., soared 382% based on speculation started in Internet chat rooms.² In April 1999, a user of Yahoo! message boards posted a fraudulent Bloomberg.com press release that drove the stock price of PairGain Technologies up 31% in one morning.³ More recently, in September 2000, the Securities and Exchange Commission announced the uncovering of an Internet-based stock price manipulation scheme by a 15-year old in New Jersey.⁴ While these examples demonstrate the excesses of Internet-forum abuse, the vast majority of the discussion involves investors honestly expressing their opinions on securities markets.

The analysis presented in this paper evaluates the relationship between the valuation of Internet service companies and investor opinions using a specific Internet forum, RagingBull.com. This site was selected not only because of its popularity, but also because it lets users post their opinions using a standardized message template, a feature that enhances the accuracy of message interpretation and analysis. As a result, we can construct a straightforward and quantitative measure of investor opinion on a daily basis. We focus specifically on Internet service companies because, as a group, they are natural candidates to be most affected by information in Internet forums. However, in principle, the analysis presented here can easily be extended to any Internet forum and to any sector of the stock market.

This paper attempts to answer a straightforward question: Can message board activity help to predict stock returns and/or trading volume? Obviously, message board activity may help predict stock returns if these forums contain new information. For example, experts in a firm or sector may use messages on these boards to disclose private information or conclusions from proprietary analyses, perhaps after placing trades themselves. If the boards contain no new information per se, they may still provide a better indication of general market sentiment than is already contained in the trading record. Alternatively, even in the absence of any value-relevant information, large numbers of investors may follow the buy and sell recommendations of message board users, thereby inducing deviations in prices from their efficient levels. Furthermore, day traders may recognize the momentum generated by investors that use message boards, thus exaggerating this effect. In the absence of price effects, it is still interesting to see if Internet forums generate trading activity.

In order to examine these issues, we present both an event study and a vector autoregression (VAR) analysis of the data. The event study looks at abnormal stock returns and trading volume around days with abnormal message-board activity. Event days are defined as days when the number of message postings exceeds the five-day moving average number of message postings by two standard deviations. The results show that days with strong positive message board opinions are preceded by a small,

² Kathleen Gallagher, Milwaukee Journal Sentinel, Business Section, pg. 1, March 14, 1999

³ Jonathan Gaw, Los Angeles Times, Part A, pg. 1, April 8, 1999

abnormal increase in stock price. Furthermore, message board opinion and abnormal returns on the event day are related. However, there is little or no evidence that opinion predicts future returns. Trading volume increases significantly on the event day and generally remains high for one day thereafter.

The VAR analysis examines if daily returns, trading volume, the number of messages posted, and opinion can be used to predict these variables one-day in the future. Consistent with the results from the event study, it is not possible to predict returns using any of the variables. As is well known, trading volume is positively related to the previous day's trading volume. Furthermore, trading volume, number of messages, and opinion help predict the next day's number of message postings and the opinion in those messages.

The overall conclusion is that there does not appear to be any causal link from message board activity to stock returns and volume. In spite of the anecdotal evidence that messages posted to financial forums can be used to manipulate prices, this effect is not present for the public bulletin board and stock sector that we study. In fact, it is market information that influences message board activity rather than vice versa. These results are completely consistent with market efficiency.

The remainder of the paper is organized as follows. We first introduce Internet forums in greater detail so that the reader can understand the limitations created by analyzing a subset of financial forums. The paper then turns to the RagingBull.com site specifically and discusses how the site's configuration aids in accurate analysis of Internet discussion. The paper then presents the data, including descriptive statistics regarding the postings on RagingBull.com. An event study examining the effect of message group discussion follows. Finally, the paper presents a VAR analysis of the data and draws conclusions regarding the quality of discussion in Internet forums.

Overview

Internet financial discussion forums can be divided into two main categories: chat rooms and bulletin boards. Chat rooms are live forums in which participants discuss stock market developments. Patrons of Internet chat rooms are typically investors who wish to discuss "hot" stocks and transitory market trends. Chat rooms do not have historical archives of conversation and lack mechanisms by which an offline user can participate in the discussion.

Bulletin boards provide organized forums for users to discuss specific financial instruments. Bulletin boards are not live forums, but instead allow users to post messages for retrieval by others at a later time. A typical site contains distinct bulletin boards for each market security that users can discuss. A person wishing to search through previous messages may do so and reply to specific posts.

⁴ Michael Schroeder, Ruth Simon, and Aaron Elstein, Wall Street Journal, Section C, pg. 1, September 21, 2000.

Both chat rooms and bulletin boards can be further subcategorized into public and private sites. While public sites draw from the largest number of users, private sites may be home to most of the wild stock speculation associated with the Internet. Private sites are typically hosted by Internet personalities with large followings. The users of private sites value the opinions of their hosts, with names like TokyoJoe, WhizKid, and Lion Master, who have earned reputations for their ability to hype stocks on the Internet and create significant stock-price reactions.⁵ In fact, users of TokyoJoe's Society Anonyme web site pay \$200 per month for access to his stock picks.⁶

For this research, only public bulletin board forums are considered and only a single forum is analyzed. Public bulletin boards are the only financial forums considered because only public bulletin boards make available a large enough volume of historical data for a true scientific study. However, the use of public bulletin boards may introduce a bias into the study. Because the private-board subscribers pay for the lead investor's opinion, they may be more willing to speculate on recommended stocks. Public boards do not necessarily have investors whose opinion carries added weight. The users of these boards may scrutinize other user's opinions closely and be less likely to buy recommended stocks. Therefore, while the analysis presented below will draw a relationship between bulletin-board messages and stock performance, the relationship may be different for private Internet financial forums.

Moreover, the selection of a single financial site, RagingBull.com, for this analysis aids analysis by eliminating the need to group data from a variety of sources artificially. As financial discussion sites have proliferated, site format has been used as a means of differentiation. Some sites categorize posts by sector, while others organize posts by stock ticker. Therefore, it has become nearly impossible to understand and compare the full spectrum of thought on the web. Instead, it is better to focus on a leading Internet financial forum. RagingBull is extremely popular, with a large membership and a high number of page views per day. Between April and November 1999, the site membership tripled in size to 300,000, while averaging 6 million daily page views.⁷

Finally, focusing on RagingBull reduces the likelihood that user's opinions are off-topic or misinterpreted. Bulletin boards are only as useful as their users make them. As discussions in a particular board become off-topic, data relevant to an academic study becomes scarce. Screening out these off-topic messages is very difficult and would likely introduce error as potentially valuable messages are thrown out. Additionally, deciphering these messages can be very difficult. In some cases, postings do not explicitly state the user's opinion on a particular stock. Without this information, it is difficult to create a metric of users' opinions. The RagingBull.com site minimizes these errors because of its configuration. First, all bulletin boards are categorized by ticker symbol. This feature reduces the number of unrelated

⁵ Gregg Wirth, TheStreet.com, Tech Stocks Section, March 12, 1999

⁶ Source <http://www.tokyojoe.com/>

posts present in the study. Second, the site includes an “optional disclosure” feature. This feature is unique to the RagingBull.com site and lets users clearly indicate their opinion on the short and long-term prospects of the stock. Using radio buttons, RagingBull.com members can select from a number of preset stock opinions. They can select from long, short, or no position as their voluntary disclosure opinion. Similarly, users can issue strong buy, buy, hold, sell and strong sell ratings for both the short-term and the long-term. The screen capture in Figure 1 illustrates the message-posting system on RagingBull. These features make the RagingBull.com site attractive from an academic point of view, because the site eliminates the need to screen and decode messages.

Popular conception holds that bulletin-board opinions can greatly affect the prices of Internet stocks. It is possible that investors, trying to find sources of trading momentum in a volatile sector, use message boards to find the next “hot” stock. To evaluate this belief, only Internet companies were used in this analysis. Zacks’ Internet Services sector group was used to find an unbiased selection of 73 Internet service companies (see Table 1). This group not only includes well-known, large capitalization companies like Yahoo! and Prodigy, but also includes many obscure, small-capitalization firms. The sample sector had a median market capitalization of \$1.12 billion as of January 11, 2000. The minimum market capitalization was \$53.1 million (Biznessonline.com), while the maximum market capitalization was \$114.8 billion (Yahoo!).

The Data

Data were collected from RagingBull.com using a PERL script. For each message on the site, the script recorded the stock ticker of interest, the date of the post, the body of the message, and the short and long-term opinion of the investor. These data were immediately fed into an SQL database for data aggregation and analysis. Message data were available on the weekend and after market close each day. Occasionally, message data were available before a company’s IPO. The date of the first message posting for each ticker is listed in Table 1. Data were collected from April 17, 1999, the day when the opinion-disclosure feature was added to RagingBull, until February 18, 2000. A total of 181,633 messages were downloaded, with 10,723 unique ticker-day combinations. Of the 181,633 messages downloaded for this study, 43,794 (24.1%) had short-term opinions, 37,810 (20.8%) had long-term opinions, and 52,812 (29.1%) had a general “voluntary disclosure.” In addition, stock return and volume data was extracted from the Internet, with 13,023 unique ticker-day combinations.

⁷ Raging Bull press release, November 16, 1999, <http://www.ragingbull.com/community/press/11-16-99.html>

The average number of daily message postings was computed for each stock's message board. Averages were computed between the first day with a message and February 18, 2000. The mean stock message board had an average of 7.6 messages posted daily, while the median message board had 2.5 messages posted daily. The maximum average number of daily postings was 103.6 (CMGI Inc.). A histogram illustrating the distribution of average daily message postings is shown in Figure 2. The distribution is extremely right skewed, so average daily message postings are graphed on a logarithmic scale. Not surprisingly, daily average message postings and market capitalization are positively related, with a correlation of 0.47 between the logarithms of the two variables.

Messages that included a voluntary short-term opinion were used to calculate opinion measures for each message board/stock for each day.⁸ Messages with short-term strong-buy recommendations were assigned a value of +2. Similarly, messages with short-term buy, hold, sell, and strong-sell recommendations were assigned values of +1, 0, -1, and -2, respectively. On each day and for each ticker, these opinions were summed to calculate the daily weighted opinion. This daily opinion measure is designed to be centered at zero for a neutral (hold) recommendation, with positive (negative) numbers indicating positive (negative) sentiments. Stocks with large numbers of recommendations can have scores that are large in magnitude, either positive or negative, since values are summed. However, a large number of recommendations can also be associated with an opinion measure close to zero if there is a lack of consensus.

To get an understanding of the distribution of this opinion measure, the daily weighted opinion was averaged for each stock. The mean across the stocks of the average daily weighted opinion was 6.09, while the median was 3.44. The standard deviation of the average daily weighted opinion value was 9.49. The maximum was 56.64 (CMGI Inc.) while the minimum was 1.14 (TheGlobe.com). A histogram illustrating the distribution of average daily weighted opinions is shown in Figure 3. Perhaps surprisingly, average opinions for all the stocks in the sample are positive, although stocks do exhibit negative opinions on some days.

The magnitudes of these opinion measures are slightly difficult to interpret because they are heavily influenced by the number of messages. Consequently, for each ticker and each day, we also computed the average daily opinion. These daily averages were then averaged across days to produce a single average for each ticker. The mean across all stocks of this average daily opinion was 1.56, while the median was 1.64. These figures represent opinions between buy and strong buy. Clearly, either message board posters have generally positive sentiments about Internet stocks, which is understandable given their performance during the sample period (see below), or those posters with negative sentiments

⁸ We also experimented with using long-term opinions to calculate an opinion measure for each stock, but the results were weaker and are therefore not reported.

are reluctant to disclose their opinions. The empirical analysis that follows is based on weighted opinions, but average opinions produce qualitatively similar results.

The mean arithmetic average of daily return for the stocks in the sample was 0.677% and the median was 0.648%. The maximum average daily return was 2.53% (Be Free Inc) and the minimum was -0.58% (Flashnet Communications). The average standard deviation of daily returns was 7.59% and the median was 7.39%. The maximum standard deviation was 13.37% (Cobalt Group) and the minimum was 4.80% (Cybercash). Both the average return and standard deviation of returns are very high compared to average values in the stock market during the sample period. During the time period of the study, the Internet sector was very volatile and generated exceptional ex post performance.

During the sample period, the mean average trading volume was 857,000 shares and the median was 423,000 shares. The highest average daily trading volume was 8,765,000 shares (Yahoo!) and the minimum average daily trading volume was 75,000 shares (Claimsnet.com). While trading volume varied significantly, even the least active stocks exhibit a reasonable amount of liquidity.

Event Study Analysis

Methodology

An event study was conducted to determine the impact of high-message-volume days on securities prices and trading volume (see Brown and Warner (1985) and Campbell, Lo, and MacKinlay (1997) for a review of event study methodologies). The study looks at industry-adjusted returns and abnormal volume around days with abnormally high numbers of postings.

For each day in the sample period, the average and standard deviation of the number of daily message postings over the previous five days was computed. Event days were defined as those with a number of message postings that exceeded the previous five-day average by at least two five-day standard deviations. Event days in which fewer than 10 messages were posted were excluded from the sample. This was done to reduce error introduced by stocks with small bulletin board followings.

Two opinion metrics were examined to determine the strength of opinion changes on the event day. The first opinion metric, the raw change in weighted opinion, was calculated as the difference between the event-day weighted opinion and the average weighted opinion over the previous five days. The second opinion metric, the adjusted change in weighted opinion, was calculated as the raw change in weighted opinion divided by the standard deviation of weighted opinion over the previous five days. Both metrics produced similar results, so for brevity only the former are reported.

We found a total of 293 event days. 47 of these had opinions lower than the previous five-day average. These days were grouped into the “negatives” category in the analysis. 5 of these event days had opinion equal to the previous five-day average and were ignored. 241 of the event day opinions were

greater than the previous five-day opinion average. These events were split in half. The “strong positives” category contained the half of the event days with the strongest opinion change. The “weak positives” contained the remaining event days, i.e., those with the weakest positive opinion change. Table 2 presents descriptive statistics for the changes in opinion on the event days. The “weak positives” and the “negatives” appear to be roughly symmetric in that for both portfolios average opinion changes on event days correspond to a change of approximately 0.7 on our opinion scale. These changes are roughly equivalent in magnitude to a change of investor opinion from neutral to buy on the event day.

Adjustment of daily returns is necessary because of the high and volatile returns in this sector. A constant-mean-return model could be used to adjust returns, but many of the stocks in the study do not have enough data to calculate accurate historical mean returns. Adjusting returns using the CAPM and the S&P 500 as the market index is another possibility. However, beta calculations using the S&P 500 would have large errors due to the volatility of the stocks. Moreover, the CAPM may not be the correct model for normal returns of firms in the Internet sector. The final option, adjusting returns using an industry index, is both feasible and free of estimation error because beta estimates are not needed.

To find the correct index, an equally weighted portfolio of the 73 sample stocks was constructed. Daily returns for this portfolio were compared to the daily returns of the Philadelphia Stock Exchange Internet Index, the Amex Internet Index, the Chicago Board Options Exchange Internet Index, the Philadelphia Stock Exchange Semiconductor Index, the NASDAQ Composite Index, and the S&P 500 Index. The correlations between these portfolios are given in Table 3.

The equally weighted portfolio is highly correlated with all three Internet indices. In addition, the three Internet indices are highly correlated to one another. The PSE Internet Index has a correlation coefficient of 0.906 and 0.934 with the AMEX Internet Index and the CBOE Internet Index, respectively. The correlation coefficient between the AMEX and the CBOE Internet Index is also high, 0.920. The PSE’s Internet Index was the most highly correlated with the equally weighted portfolio returns and was chosen as the industry index for the study. The adjusted-return calculations should be insensitive to which of the Internet indices is used because of the high correlation between indices. As expected, the equally weighted portfolio was not as correlated with the market indices as it was with the Internet indices.

Returns were adjusted for industry returns. Each firm was assumed to have a beta of 1 relative to the Philadelphia Stock Exchange Internet Index. Therefore, industry adjusted return was defined as a stock’s daily return less the return on the Internet Index.

Abnormal trading volume, which is defined as the percentage change in trading volume on a given day compared to the average trading volume, was computed for each ticker and each day during the

sample period. A 20-trading-day period preceding the day in question was used to calculate the average trading volume.

Empirical Results

Figure 4 and Table 4 show the industry-adjusted returns and abnormal volume for a five-day period surrounding the event day. In all cases, results are presented for portfolios formed on the basis of changes in raw opinion. Results for changes in adjusted opinion are very similar. Using the raw change in weighted opinion, it is apparent that only stocks with strong-positive-opinion events show a statistically significant positive drift up prior to the event day (see Panel A of Figure 4 and Table 4). Cumulative abnormal returns in the relevant 5-day period are more than 3.5%. Returns for stocks with weak-positive-opinion events are basically flat leading up to the event day, although they do exhibit an anomalous negative and significant return on day -2. Stocks with negative-opinion event days appear to show a slight downward drift up to the event day, but the phenomenon is not statistically significant. On the event day, stocks with both strong and weak positive signals have statistically significant, positive industry-adjusted returns. Stocks with negative-opinion event days have a slightly negative industry-adjusted return that is not statistically significant. Returns for stocks within all the opinion groups are statistically flat after the event day.

Similarly, trading volume is relatively normal leading up to the event day (see Panel B of Figure 4 and Table 4). The study produces sporadic negative and significant abnormal volume on several days, but the magnitudes of these effects, which are generally smaller than 20%, indicate a potential absence of economic significance. In contrast, on the event day and on day +1, there is a sharp increase in trading volume, with magnitudes sometimes exceeding 100% and commonly reaching 50%. Stocks subject to strongly positive changes in weighted opinion show the most significant increase in trading volume, but the other groups exhibit a similar pattern. Trading volume retreats to more normal levels approximately two days past the event day.

The results show that message board activity is linked to stock price movements. However, abnormal message board activity does not help predict future stock price movements over a one-day or five-day window in the future. Each event day classification showed statistically insignificant changes in value after the event day. This observation is consistent with market efficiency. On the event day, strong-positive and weak-positive event days showed statistically significant returns in excess of the industry index. Therefore, abnormal message-board activity is coincident with abnormal stock returns. Unfortunately, using our methodology, it is impossible to determine whether event day activity on the message boards causes or is the result of abnormal returns on the stock. Further study examining the

intra-day relationship between message posts and stock returns would be necessary to determine causality.

The evidence on message board activity and volume is similar. In this case, however, volume does not appear to return to normal immediately after the event day. Given the evidence, one could speculate that message board activity is generating trading, but this evidence must also be evaluated in the context of the existing result that volume is positively autocorrelated. The VAR analysis addresses this issue.

VAR Analysis

Methodology

A VAR analysis was performed to analyze the general relationship among stock returns, trading volume, message postings, and weighted opinion. The analysis was performed on a stock-by-stock basis rather than over a pooled sample of all the stocks due to potential non-stationarity across securities. Specifically, since trading volume, number of messages, and weighted opinion differ in scale across stocks, there is no reason to believe that VAR coefficients should be the same across stocks. The alternative approach of normalizing these variables was rejected due to problems in formulating the correct normalization. Stocks with less than 30 observations were also eliminated from the dataset. Rather than examining the coefficients themselves, t-statistics were calculated, again to avoid interpretation problems associated with scale effects.

Define the vector of variables of interest on day t as follows:

$$Z_t = \begin{bmatrix} return_t \\ volume_t \\ \#ofmessages_t \\ weighted_opinion_t \end{bmatrix}$$

Then, the corresponding VAR(1) model is:

$$Z_{t+1} = A + BZ_t + e_{t+1}$$

where A is a vector constant, B is a four by four matrix of coefficients, and e is the error term vector. A , B and their associated standard errors were calculated on a stock-by-stock basis.

Empirical Results

The average t-statistics across stocks for each coefficient are shown in Table 5.⁹ Meaningful average t-statistics are in bold text. These represent coefficients for which a significant fraction of the individual t-statistics are significant at conventional levels. The magnitudes of the t-statistics for the majority of coefficients are small. Stock returns, trading volume, number of messages, and weighted opinion were not useful in predicting stock returns one day into the future. This result is again consistent with market efficiency. Trading volume shows an auto-regressive relationship. High trading volume days tended to precede days of high trading volume; low trading volume days tended to precede days of low trading volume. After accounting for this effect, the number of messages and weighted opinion had no marginal explanatory power.

For the message board activity, the number of messages posted on a given day on RagingBull.com is strongly positively related to the number of messages posted on the previous day. In addition, days with high trading volume and positive weighted opinions are followed by days with greater message activity. Finally, weighted opinion is dependent on the number of messages and opinions posted on the previous day. Positive opinion days tend to follow days with positive opinions. The dependency of weighted opinion on the number of messages posted is consistent with the simple summation method used to calculate weighted opinion and the observation that each message board had positive average daily weighted opinions. Perhaps surprisingly, returns do not seem to predict message board activity at all; although, given the contemporaneous correlation between returns and activity documented in the event study, lagged message board activity may be subsuming this effect due to the noise in the return series.

Overall, the VAR results are consistent with those of the event study. We cannot reject the efficiency of the market, and, if anything, the causality appears to run from the market to the financial forums.

Conclusion

It is fast becoming a truism that changes in information technology are ushering in a new age and, with it, a new economy. Although the larger implications of this are still being worked out, it is clear that Internet stocks are now, and will continue to be, a fundamentally important part of the financial landscape. This paper extends recent academic research by examining the effects of postings and opinions found on Internet message boards.

⁹ Median t-statistics generate qualitatively similar results.

The VAR analysis shows that the returns of Internet service sector stocks are not predictable using message-board data and a linear one-day lagged time-series model. This observation is consistent with market efficiency. Instead, it is possible to predict the number of messages posted on Internet financial forums using the previous day's trading volume, number of messages posted, and weighted opinion. The event study shows that returns following abnormal Internet message-board activity are statistically insignificant and consistent with market efficiency. However, statistically significant positive returns precede the days with strong positive opinions and abnormal message board activity. Furthermore, stock returns and message-board opinions on days of abnormal message-board activity appear to be related. While this observation may be consistent with market efficiency, additional research is needed to see if this relationship reflects a market inefficiency and if changes in opinions precede movements in stock price.

These results are significant because they counter the conventional wisdom that Internet service stocks are valued irrationally. Specifically, they contradict the anecdotal evidence that stock price manipulation via message board postings is rampant and widespread. In general, message board activity and opinion do not appear to impact stock prices in a significant, industry-adjusted fashion. Furthermore, abnormal message-board activity does not appear to predict significant abnormal returns.

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Ticker	Company	Market Cap (\$Billion)	First Message	Ticker	Company	Market Cap (\$Billion)	First Message
AKAM	Akamai Tech	26.11	11/2/99	ISLD	Digital Island	3.33	7/1/99
ASKJ	Ask Jeeves Inc	2.99	7/6/99	ITRA	Intraware Inc	1.69	4/19/99
ATHM	At Home Corp	15.26	4/19/99	ITVU	Intervu Inc	1.38	4/19/99
ATHY	AppliedTheory	0.52	5/5/99	JFAX	JFAX.com	0.2	7/27/99
BFRE	Be Free Inc	1.98	11/11/99	JPTR	Jupiter Comm	0.39	10/12/99
BIZZ	Biznessonline	0.05		JWEB	Juno Online Services	1.32	5/28/99
CAIS	Cais Internet	0.75	5/24/99	KOREA	Korea Thrunet		11/22/99
CBLT	Cobalt Grp Inc	0.38	8/9/99	LFMN	Lifeminders.com	0.88	11/23/99
CGLD	Cybergold Inc	0.32	9/27/99	MAIL	Mail.com Inc	0.74	6/22/99
CLAI	Claimsnet.com	0.06	4/19/99	MMXI	Media Metrix	0.89	5/11/99
CLKS	Click2learn.com	0.16	4/19/99	NAVI	Navisite Inc	2.57	10/26/99
CMGI	CMGI Inc	37.69	4/19/99	NBCI	NBC Internet	4.36	12/2/99
COVD	Covad Comm Grp	5.6	4/19/99	NCNT	Netcentives Inc	1.86	10/18/99
CPTH	Critical Path	3.21	4/27/99	NETZ	Netzee Inc	0.31	11/23/99
CTCH	Commtouch Software	0.52	7/15/99	NSOL	Network Solutions	7.51	4/19/99
CYBS	CyberSource Cp	1.17	6/28/99	NTCR	Netcreations	0.57	11/23/99
CYCH	Cybercash Inc	0.19	4/19/99	NZRO	NetZero Ince	2.7	9/28/99
DCLK	Doubleclick Inc	11.24	4/19/99	ONEM	Onemain.com	0.36	4/19/99
DDDC	Deltathree.com	0.85	11/26/99	ORCC	Online Res&Comm	0.16	6/8/99
DGIN	Digital Insight	0.49	10/7/99	PASA	Quepasa.com	0.15	6/29/99
DIGI	Digital Impact	0.98	11/26/99	PCNTF	Pacific Internet	0.9	4/23/99
DIGX	Digex Inc	3.92	8/3/99	PILT	Pilot Network	0.38	4/19/99
DRTN	Data Return Corp.	1.77	11/1/99	PRGY	Prodigy Comm	1.48	4/19/99
ELNK	Earthlink Network	1.42		PSIX	Psinet Inc	4.71	4/19/99
ENGA	Engage Tech	4.05	7/22/99	PXCM	Proxicom Inc	2.42	4/26/99
ENON	Euro909.com	0.28	4/19/99	SCNT	Scient Corp	4.95	5/18/99
EXDS	Exodus Comm Inc	17.73	4/19/99	SOFN	Softnet Systems	0.44	4/19/99
FLAS	Flashnet Comm	0.11	4/19/99	TFSM	24/7 Media Inc	1.08	4/19/99
FSHP	Freeshop.com	0.51	9/30/99	TGLO	TheGlobe.com	0.23	4/19/99
GBIX	Globix Corp	1.56	4/19/99	USIX	USInterNetworki ng	2.79	4/19/99
GEEK	Internet America	0.09	4/19/99	VOYN	Voyager.Net	0.35	7/23/99
HEAR	Hearme	0.65	5/4/99	VRIO	Verio Inc	4.65	4/19/99
HSAC	High Speed Access	0.99	6/8/99	WGAT	Worldgate Comm	0.94	4/20/99
IGLD	Internet Gold	0.39	8/10/99	XACT	Exactis.com	0.29	11/23/99
IIJI	Internet Init	4.84	8/6/99	YHOO	Yahoo! Inc	114.8	4/19/99
INAP	Internap Network	5.17	10/1/99	ZIPL	Ziplink Inc	0.2	5/28/99
INIT	Interliant Inc	1.61	7/12/99				

Table 1: The Internet Service Sector

Market capitalizations (in \$billions), start dates and ticker symbols for the 73 firms in the Internet service sector. The start date refers to the day of the first message posting on RagingBull.com for that firm.

Group	Raw Change in Weighted Opinion			Adjusted Change in Weighted Opinion		
	Strong Positives	Weak Positives	Negatives	Strong Positives	Weak Positives	Negatives
Average Value	27.97	3.11	-2.85	1.57	0.70	-0.76
Maximum	177.60	6.00	-0.33	2.00	1.14	-0.08
Minimum	6.00	0.25	-12.00	1.18	0.08	-1.81

Table 2 : Descriptive Statistics for Investor Opinion on Event Days

Average, maximum and minimum values of changes in raw and adjusted weighted opinion on event days. Stocks are sorted into portfolios based on the magnitudes of these changes.

	Equally Weighted Portfolio	Internet Index (PSE)	Internet Index (AMEX)	Internet Index (CBOE)	Semiconductor Index (PSE)	NASDAQ Composite
Internet Index (PSE)	0.849					
Internet Index (AMEX)	0.791	0.906				
Internet Index (CBOE)	0.820	0.934	0.920			
Semiconductor Index (PSE)	0.400	0.454	0.586	0.455		
NASDAQ Composite	0.690	0.789	0.903	0.775	0.743	
S&P500	0.524	0.585	0.715	0.574	0.622	0.838

Table 3: Correlations between Candidate Indices and the Sample Portfolio

Correlations between daily returns on various indices and an equally weighted portfolio of Internet service stocks.

Panel A: Returns

Day		-5	-4	-3	-2	-1	0	1	2	3	4	5
Strong Positives	Return	0.91%	-0.01%	0.10%	0.82%	1.55%	4.75%	-0.89%	-0.69%	0.21%	-0.32%	-0.44%
	Standard Error	0.62%	0.45%	0.45%	0.53%	0.65%	1.32%	0.64%	0.45%	0.53%	0.53%	0.56%
	Significance					★★	★★★					
Weak Positives	Return	-0.23%	0.47%	0.64%	-1.18%	0.10%	2.37%	0.62%	-0.49%	-0.14%	0.96%	0.93%
	Standard Error	0.44%	0.46%	0.66%	0.40%	0.67%	1.06%	0.79%	0.51%	0.49%	0.57%	0.51%
	Significance				★★★		★★					
Negatives	Return	0.19%	-0.05%	-0.28%	-1.16%	0.34%	-1.07%	1.12%	-0.64%	-0.18%	-1.15%	0.32%
	Standard Error	0.80%	0.93%	0.56%	0.59%	0.83%	1.16%	0.80%	0.75%	0.63%	0.67%	0.68%
	Significance				★★							

Day		Cumulative Prior 5-day Abnormal Returns					Cumulative Post 5-day Abnormal Returns				
Strong Positives	Return	3.54%					-2.07%				
	Standard Error	1.29%					1.27%				
	Significance	★★★									
Weak Positives	Return	-0.22%					1.72%				
	Standard Error	1.19%					1.18%				
	Significance										
Negatives	Return	-1.09%					-0.72%				
	Standard Error	2.29%					1.51%				
	Significance										

Panel B: Volume

Day		-5	-4	-3	-2	-1	0	1	2	3	4	5
Strong Positives	Abnormal Volume	3.3%	-2.4%	-10.5%	-0.1%	11.9%	160.6%	59.0%	5.9%	9.0%	18.0%	17.2%
	Standard Error	7.4%	7.0%	4.5%	6.3%	6.8%	65.9%	12.6%	5.7%	7.3%	10.1%	8.6%
	Significance			★★			★★	★★★				★★
Weak Positives	Abnormal Volume	-25.1%	-11.9%	-10.8%	-20.7%	-3.7%	45.3%	34.0%	14.2%	-7.2%	6.8%	3.5%
	Standard Error	5.3%	7.6%	6.5%	5.3%	12.6%	10.9%	13.1%	17.1%	7.1%	16.6%	11.5%
	Significance	★★★			★★★		★★★	★★★				
Negatives	Abnormal Volume	-5.2%	-5.0%	-12.3%	-23.5%	-16.2%	46.4%	20.1%	-3.3%	-12.1%	-18.0%	-14.7%
	Standard Error	18.2%	12.8%	9.1%	6.7%	7.6%	22.0%	13.8%	9.1%	7.5%	7.7%	6.5%
	Significance				★★★	★★	★★				★★	★★

Table 4: Abnormal Returns and Volume

Abnormal returns (Panel A) and volume (Panel B) around event days for portfolios formed on the basis of weighted opinion. ★★ and ★★★ denote significance at the 95% and 99% levels, respectively.

		<i>Independent Variable</i>			
		Return	Trading Volume	# of Messages	Weighted Opinion
<i>Dependent Variable</i>	Return	-0.275	-0.076	0.112	-0.069
	Trading Volume	0.064	3.933	0.480	0.213
	# of Messages	-0.395	0.855	2.203	1.082
	Weighted Opinion	0.251	0.279	1.825	0.929

Table 5: VAR Analysis

Average t-statistics from a firm-by-firm VAR analysis on daily returns, trading volume, number of messages, and weighted opinion. **Bold** text denotes statistically significant results.

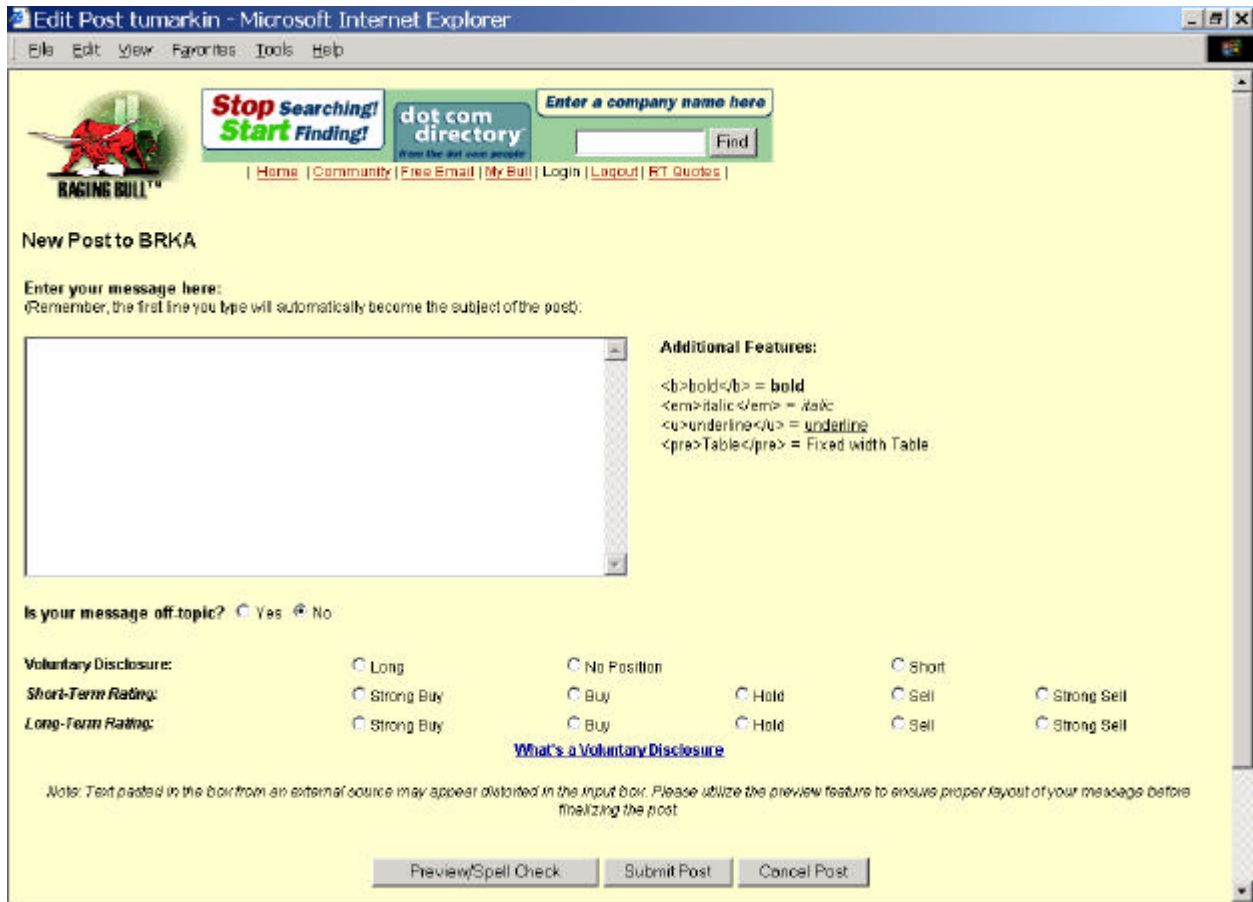


Figure 1 : Screen Capture from RagingBull.com

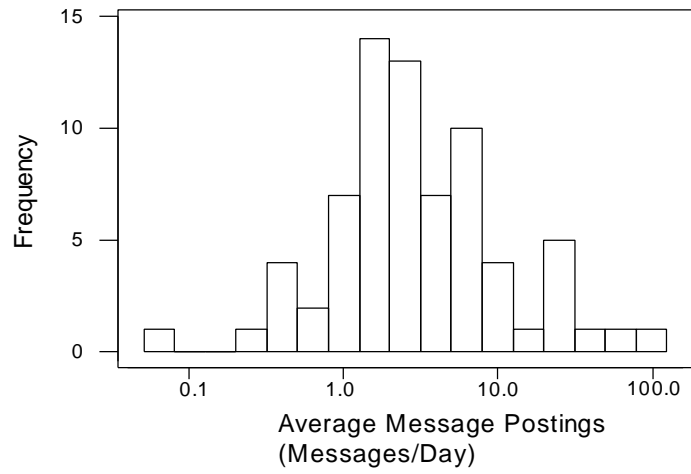


Figure 2: Daily Message Postings

This histogram shows the distribution of average daily message postings (average messages per day) across the 73 stocks in the sample. Note that the x-axis scale is logarithmic due to the skewness of the data.

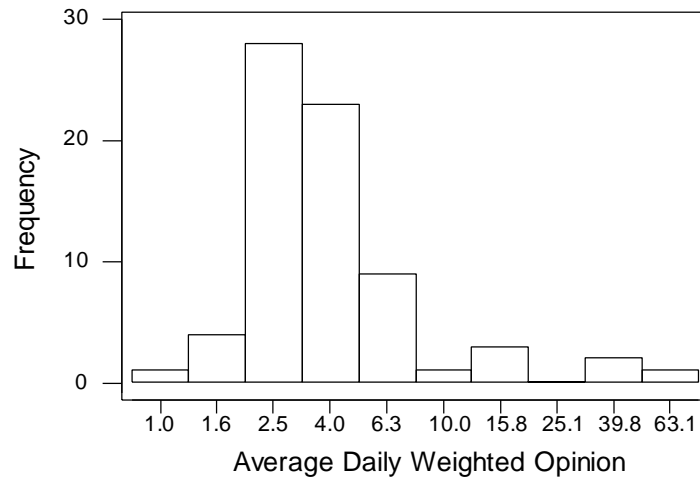
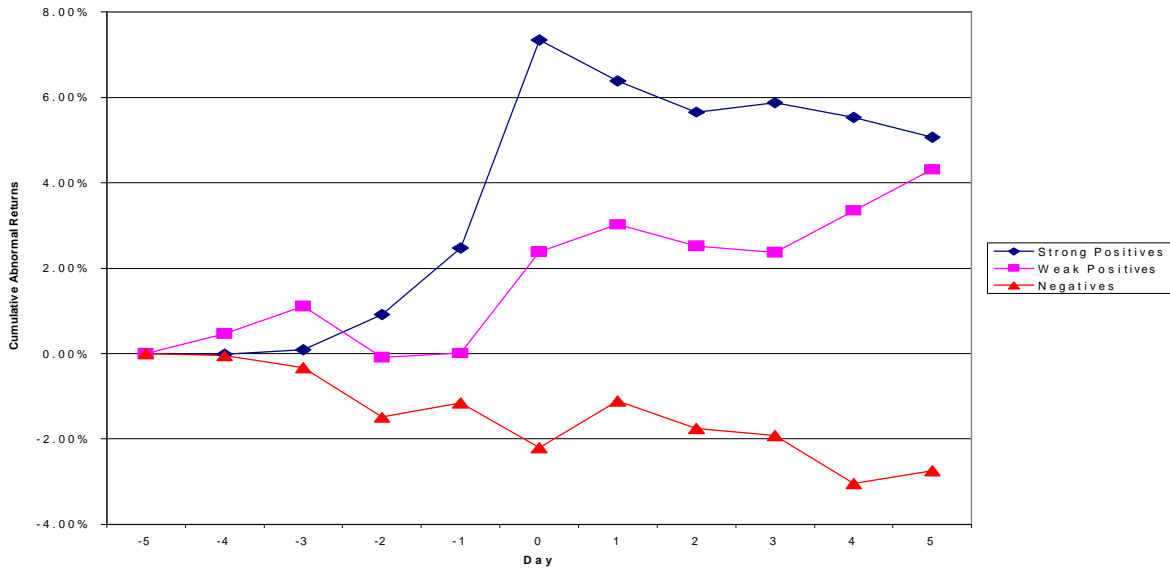


Figure 3: Daily Opinions

This histogram shows the distributions of average daily weighted opinions across the 73 stocks in the sample.

Panel A: Returns



Panel B: Volume

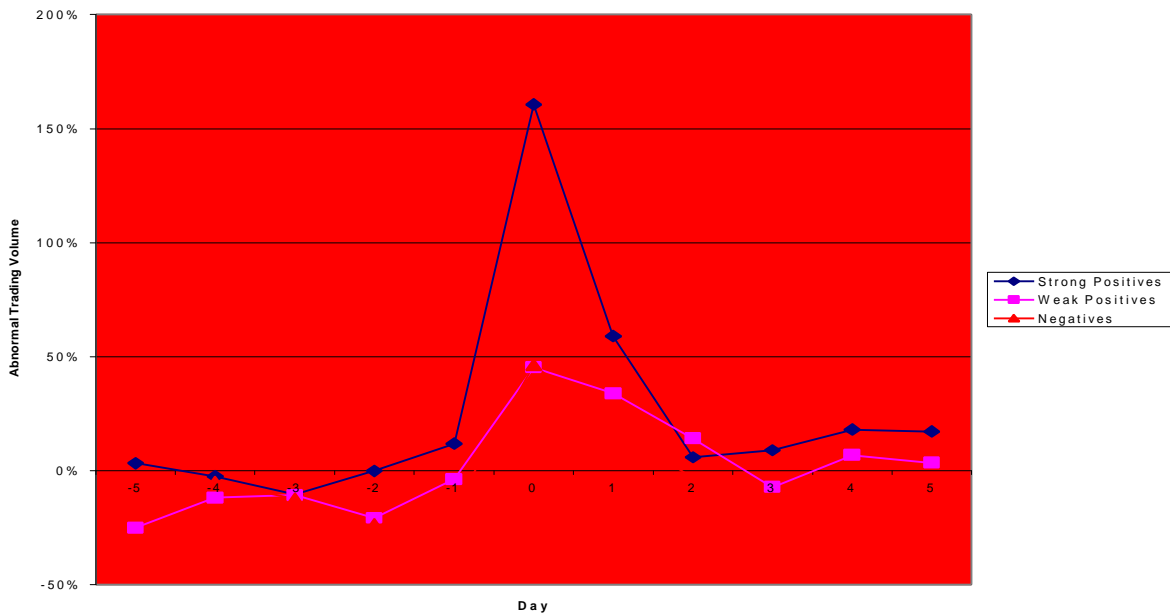


Figure 4: Abnormal Returns and Volume

Cumulative abnormal returns (Panel A) and abnormal trading volume (Panel B) around event days for portfolios formed on the basis of weighted opinion.