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A Cross-Industry Analysis of Investors' Reaction to Information Surprises: Evidence from NASDAQ Sectors

Peter J. Busha [a], Seyed M. Mehdian [a], Mark J. Perry [a]

a. School of Management, University of Michigan-Flint, Flint, MI 48502

Abstract: We use daily stock returns from the NASDAQ composite and sector indexes to investigate the reaction of investors to information surprises in the framework of the Efficient Market , Overreaction , and Uncertain Information Hypotheses. We find strong statistical evidence of a corrective process of significantly positive cumulative abnormal returns following the arrival of both unexpected favorable and unfavorable information for the NASDAQ Composite and four of its sector indexes. The main implication of these mixed empirical results is that investor reactions vary significantly by sector, highlighting the value of analyzing these sectors in addition to composite indexes.

1. Introduction

1.1 General Introduction

The Efficient Market Hypothesis (EMH) has been part of the essential framework of modern financial theory since it emerged as a prominent theory in the early 1960s. While there have been a multitude of studies conducted on various securities markets that provide empirical support of the EMH, there has also been a fair amount of skepticism raised regarding some of the primary assumptions of the hypothesis. One of the assumptions most frequently questioned by both industry professionals and academics alike is the EMH's basic assumption of investor rationality. This fundamental criticism of the EMH has been buttressed by market observations that seem to indicate that counter to the claims of the EMH, potential opportunities to earn a greater-than-normal return do arise in many markets and can be exploited by some investors. In support of these observations, many studies have been conducted that provide evidence that markets are frequently inefficient, such that there is indeed a potential for investors to earn abnormally-high, risk-adjusted returns in a manner that contradicts the EMH.

One of these theories developed through these studies is the Overreaction Hypothesis (OH), proposed by De Bondt (1985), which observes that investors tend to overreact in the short term to news that significantly affects asset prices. Another of the counter-theories is the Uncertain Information Hypothesis (UIH), proposed by Brown et al. (1988), predicts that the volatility of asset returns increases following the release of unexpected information, because of investor uncertainty about how to correctly react to the news and set appropriate security prices.

1.2 Research Question and Approach

This study attempts to examine a gap in the research on market efficiency that could potentially shed further light on investor reaction to information surprises. While almost all of the previous studies focus on individual security prices or composite stock indexes, there has been little research conducted on the potential differences between the price movements of a composite index like the NASDAQ Composite and the price movements of the underlying sector indexes within that index. Using daily returns from 1994 to 2008 for both the NASDAQ Composite Index and its eight sector indexes, we examine each index individually and also assess the similarities (or differences) between the return patterns in them. The time period, 1994 to 2008, was chosen in order to ensure that we had the full set of sector indices throughout the entire study period. This approach provides insights on whether investor reaction is broad-based, universal, and consistent for the composite index and its sector indexes, which represent a wide variety of different industries like banking, telecommunications and computers, or whether investor reaction varies among the industries represented by the sector indexes.

To study investor reactions to information surprises in the NASDAQ Composite Index and its eight sector indexes, we first estimate GARCH (1, 1) models for the daily returns for each index and then compute a time series of standardized residuals from each of these models. We identify significantly favorable information surprises as that which results in standardized residuals greater than 2.50 in absolute value. This procedure provides us with approximately 25 favorable and 25 unfavorable information surprises for each index during the 1994–2008 sample period (both the number of surprises and sample periods vary slightly by sector index). We then follow a procedure proposed by Brown et al. (1988) and calculate cumulative abnormal returns (CARs) during a 30-day window after each event to empirically test whether investor reaction is consistent with the EMH, OH or UIH for the nine NASDAQ indexes (composite and eight sector indexes). Our empirical findings are somewhat mixed, and although we find strong statistical support for the UIH in the cases of the NASDAQ Composite and four sector indexes, we also find evidence of the OH for two sector indexes, and the EMH for one index, with one index remaining unexplained. These mixed empirical results imply that investor reaction is not universal across industry sectors in the NASDAQ, and in fact varies by sector, highlighting the value of analyzing investor reaction in different segments of the security markets.

1.3 Research rationalization

While the pervasive thought pertaining to behavioral biases is that they are symmetrical in nature, there is little research that has been conducted to provide insight into this notion. Pragmatically the observed reaction of the security and/or index to market news is the result of the underlying actions of the investor based on their interpretation of the news and the expected impact of that news on the investment vehicle. Based on the resultant connection it is plausible to ponder that the reaction of a specific stock or market index could differ based on the type of investor that is more likely to hold a particular investment. We could argue that the reaction of an institutional investor might be very different than that of a private investor to the same market information. By examining the reactions of the underlying sectors of NASDAQ and comparing their individual correlation to the movements of the overall NASDAQ to the same market information, we are looking to provide some initial insight into this potential anomaly.

This paper is organized as follows. In the next section we describe out data and also outline the specific methods used to empirically examine investor reaction. Section 3 discusses our empirical results and the major findings of our analysis. In Section 4, we present our summary and conclusions.

2. Data and Methods

2.1 Data

We use daily closing values for the NASDAQ Composite index and its eight sector indexes to compute daily returns for each of these nine indexes. Formally, we calculate daily returns (Rit) as:

$$Rit = Ln\ (Iit\ /\ Iit\text{-}1) * 100, \quad (1)$$

where Rit is the daily return of index i on day t such that i = 1, 2, 3, 4, 5, 7, 8, 9; Iit is the closing value of index i on day t; Iit-1 is the closing value of index i on day t-1; and Ln is the natural log. To test whether the series (Rit) is stationary, we conduct augmented Dickey Fuller unit root tests on the returns from each index and the results (not presented here) indicate that all series are stationary in their first differences.

Table 1.

Summary Statistics for the NASDAQ Composite Index and Sector Sub-Indexes

INDEX	Days	Mean Daily Return	Std. Dev.	Maximum Return	Minimum Return
NASDAQ Composite (9/30/1994)	3504	0.0459%	1.6468%	14.17%	-9.67%
NASDAQ SECTOR SUB-INDEXES					
Banks (9/30/1994)	3496	0.0372%	1.0507%	9.95%	-5.86%
Biotechnology (5/1/1996)	3098	0.0546%	2.0802%	10.81%	-12.53%
Computers (7/28/1995)	3289	0.0550%	2.1172%	18.07%	-10.24%
Industrial (9/301994)	3497	0.0372%	1.4996%	9.94%	-10.44%
Insurance (9/30/1994)	3497	0.0452%	0.9713%	5.51%	-4.58%
Other Financials (1/6/1997)	2925	0.0504%	1.7447%	12.08%	-10.30%
Telecommunications (5/13/1996)	3091	0.0231%	2.0191%	17.52%	-9.89%
Transportation (9/30/1994)	3497	0.0443%	1.3411%	7.20%	-13.06%

The sample periods above are from the inception dates of the sub-indexes (in parentheses above), and from September 30, 1994 for the composite index; all indexes go to August 29, 2008.

Table 1 displays the summary statistics of daily returns for the NASDAQ Composite and its eight sector indexes. Compared to the 0.0459% mean daily return for the overall composite index, five sectors average lower returns (banks, industrials, insurance, telecommunications, and transportation) and three sectors averaged higher returns (biotechnology, computers, and other financials). As can be seen, the computer sector records the highest daily mean return (0.055%) and standard deviation (2.1172%) while the daily mean return for the telecommunications sector (0.0231%) generates the lowest return among the sector indexes with a relatively high standard deviation (2.01%). The bank sector registers the lowest daily return volatility (1.05%) with a daily mean return of 0.0372%.

2.2 Methods

The methods used in this paper contain the following steps:

2.2.1 Identification of Information Surprises

In order to identify information surprises, we first estimate a GARCH (1, 1) model for each index using the calculated daily returns. To remove any serial correlation in the residuals, we incorporate an optimal number of autoregressive lags in each equation using standard time series techniques. To determine information surprises, we next compute standardized residuals from the estimated GARCH (1, 1) model for the composite index and each of the eight sector indexes. We identify significantly favorable information surprises as shocks that result in standardized residuals above the value of 2.50 on the day of the news, and significantly unfavorable surprises as shocks that result in standardized residuals below the value of -2.50. This procedure provides us with 25 favorable and 25 unfavorable surprises for the NASDAQ composite index, and a total of 181 favorable and 182 unfavorable surprises for the NASDAQ component sector indexes (an average of 22.6 positive surprises and 22.75 negative surprises per sector index). Table 2 displays the distributions of identified favorable and unfavorable surprises for the NASDAQ composite index and its eight sector indexes. As can be seen in Table 2, the number of information surprises ranges from 18 to 25 favorable and 19 to 25 unfavorable ones, depending on the specific sector index.

Table 2.
Number of Favorable and Unfavorable Information Surprises Identified for the NASDAQ Composite Index and Its Eight Sector-Indexes

Index	Favorable	Unfavorable
COMPOSITE	25	25
BANKS	25	25
BIOTECHNOLOGY	21	19
COMPUTERS	25	24
INDUSTRIALS	22	21
INSURANCE	18	23
OTHER FINANCAL	22	22
TELECOMMUNICATIONS	25	23
TRANSPORTATION	24	24

2.2.2 The Post-Information Surprise Volatilities of Returns

In order to determine whether information surprises result in a higher volatility of market returns, we track daily returns over a 30-day window following each favorable and unfavorable surprise for each index. We then calculate and compare the variance of all 30-day post-surprise periods (following both favorable and unfavorable) to the variance of non-surprise days—that is, the entire sample period excluding the post- surprise days, where the variance (*Var*) is computed using the following standard formula:

$$Var_t = \left(\sum_{t=1}^{N_J} \left(R_{it} - \overline{R}_{ij} \right)^2 \right) (1/N_j - 1), \qquad (2)$$

where Var_t is the variance of daily returns during time period t, N_j is the number of days in each category *j* (*j* = 1 for all post-surprises, 2 for favorable surprises, 3 for unfavorable surprises, and 4 for non-surprise days), R_{it} is the daily return of stock index *i* on day *t* (*i* = 1…..9), and $\overline{R}_{ij}$ is the average return for each category (post- or non-surprise days).

We next perform difference-of-variance tests and calculate *F*-statistics to compare the volatility of post-information surprise days to the volatility of non-information surprise days. The null hypothesis of these tests is that the variances of returns during the post-surprise windows are equal to (and not significantly different from) the variance of returns for the non-surprise days. A rejection of the null hypothesis indicates that there is a statistically significant difference between the volatility of returns during post-surprise windows and the volatility of returns in periods that do not follow an information surprise. Based on the UIH hypotheses that the arrival of information surprise typically generates higher uncertainty and increases post-surprise volatility; one can then expect the variance of returns during post-surprise windows to be statistically greater than the variance of returns in non-surprise windows. Furthermore, we employ similar procedures and statistical techniques to test for any differences between the variances of periods following favorable surprises and the variances following unfavorable surprises.

2.2.3 Statistical Tests for EMH, OH, and UIH

To investigate whether the reactions of investors, who trade securities based on the NASDAQ Composite index and its sector indexes, react to market surprises in ways that are consistent with the predictions of the EMH, OH or UIH, we employ a procedure used in Mehdian, Perry, and Nas (2007). Specifically, we calculate the daily post-surprise abnormal returns for each index and average them cross-sectionally for all days over the 30-day period following each set of favorable or unfavorable surprises in each index. Then, we add these 30-day abnormal returns consecutively from day 1 through day 30 to construct cumulative abnormal returns (CARs) for both sets of information surprises (favorable and unfavorable) for each index for the 30-day post-surprise window period. Formally, let AR_{itd} be the abnormal return for index *i* on day *t* following an information surprise *d* such that *t* = 1 ….. 30 days, so that:

$$AR_{itd} = R_{itd} - \overline{R_{non,i}}\,, \tag{3}$$

where *d* is 1…n, and n denotes the number of favorable or unfavorable surprises for index *i*, R_{itd} is the return of index *i* on day *t* for surprise *d*, and $\overline{K_{non,i}}$ is the mean return for index *i* (i = 1… 9) for non-surprise days.

The mean abnormal return on day *t* is computed as:

$$\overline{AK_{it}} = (1/n)\left(\sum_{d=1}^{n} AK_{itd}\right), \quad t = 1......30\,. \tag{4}$$

We calculate the CAR for each index *i* by summing the mean abnormal returns over *t* days so that:

$$CAR_{it} = CAR_{i(t-1)} + \overline{AK}_{it}\text{, and t= 1…30.} \qquad (5)$$

Following Ruback (1982), we test the statistical significance of the CARs by conducting a *t*-test of the null hypothesis in which the CARs for each day are equal to zero during the post-surprise windows for day 1 to day 30. This *t*-statistic follows a Student-*t* distribution and we calculate it as:

$$t - Value = \frac{CAR_{it}}{\sqrt{Var(CAR_{it})}}, \qquad \text{such that} \qquad (6)$$

$$Var(CAR_{it}) = d \times Var(AK_{it}) + (2(d-1)Cov(AK_{it}, AK_{i(t+1)}).$$

Moreover, we display the graphical representations of CARs for 30 days following favorable and unfavorable information surprises for each index to help determine whether investor reactions to surprises are supportive of the predictions of the EMH, OH, or UIH.

3. Empirical Results

Table 3 displays the daily mean returns for all non-surprise, post-surprise, favorable post-surprise, and unfavorable post-surprise days, along with the number of days for each sample period in parenthesis. As Table 3 shows, the post-surprise daily mean returns are higher than the non-surprise daily mean returns, not only for the NASDAQ Composite index, but also for all sector indexes except two, the Industrial and Transportation sectors. In addition, as the figures in Table 3 suggest, the daily mean returns for favorable post-surprise days are higher than the daily mean returns for unfavorable post-surprise days for four sector indexes: Biotech, Industrial, Financial, and Telecommunication. For the rest of the sector indexes as well as the NASDAQ Composite index, the daily mean returns for favorable post-surprise days are less than the daily mean returns for unfavorable post-surprise days.

Table 3.

Mean Daily Returns for Non-Surprise Days, All Post-Surprise Days, Post-Favorable Surprise Days and Post-Unfavorable Surprise Days

INDEX	Non- Surprise Days	All Post-Surprise Days	Post Favorable Surprise Days	Post Unfavorable Surprise Days
Composite	-0.0098%	0.0933%	0.0670%	0.1197%
	(1,952)	(1,500)	(750)	(750)
Banks	0.0241%	0.0595%	0.0553%	0.0637%
	(1,944)	(1,500)	(750)	(750)
Biotechnology	-0.0053%	0.1364%	0.1677%	0.1018%
	(1,857)	(1,200)	(630)	(570)
Computers	0.0437%	0.0498%	0.0343%	0.0660%
	(1,768)	(1,470)	(750)	(720)
Industrial	0.0392%	0.0210%	0.0811%	-0.0537%
	(2,165)	(1,290)	(660)	(630)
Insurance	0.0476%	0.0583%	0.0196%	0.0886%
	(2,229)	(1,230)	(540)	(690)
Other Finan.	0.0040%	0.0862%	0.1856%	0.0164%
	(1,592)	(1,320)	(660)	(660)
Telecomm.	-0.0001%	0.0388%	0.0646%	0.0109%
	(1,603)	(1,440)	(750)	(690)
Transport.	0.0423%	0.0408%	0.0248%	0.0444%
	(2,066)	(1,440)	(720)	(720)

Number of days is in parentheses.

Table 4 shows the variances of daily returns for all non-surprise, post-surprise, post-favorable surprise, and post-unfavorable surprise days, along with the sample size for the NASDAQ Composite index and its sector indexes, and two columns of *F*-statistics. In the first column of *F*-statistics (column 4 of Table 4), the first *F*-statistic labeled (a) is for the test of the null hypothesis in which the variance of returns for all surprise days is equal to the variance of returns for non-surprise days for each index. The second *F*-statistic labeled (b) is for the test of the null hypothesis in which the variance of returns during post-favorable surprise days is equal to the variance of returns during non-surprise days for each index. The third *F*-statistic labeled (c) is the test of the null hypothesis in which the variance of returns for post-unfavorable surprises is equal to the variance of returns for non-surprise days for each index. The *F*-value displayed in the last column of Table 4, labeled (d), is the test of the null hypothesis in which the variance of returns for post-favorable surprises is equal to the variance of returns for post-unfavorable market surprise days.

As can been seen in Table 4, the *F*-statistics indicate that the variance of returns for post-surprise days is statistically significant and higher than the variance of returns for non-surprise days for all of the NASDAQ indexes except for Computers. Therefore, these findings provide evidence to indicate that the volatility of market returns increases significantly in the days following information surprises. The findings also suggest that the variance of returns for post-favorable surprise days is statistically significant and higher than the variance of returns for non-surprise days for five NASDAQ sector indexes: Biotechnology, Industrial, Insurance, Telecommunication, and Transportation.

On the other hand, the null hypothesis in which the variance of returns of post-unfavorable surprises is equal to the variance or returns of non-surprise days is rejected for the NASDAQ composite index and all sector indexes, which is a sign that market volatility following unfavorable surprises is significantly higher than the volatility of non-surprise days. All in all, the findings presented in Table 4 support the hypothesis that the arrival of information surprises results in higher post-surprise market volatility and uncertainty of daily returns. This, of course, is consistent with the prediction of the UIH, which claims that market risk increases during a post-surprise period.

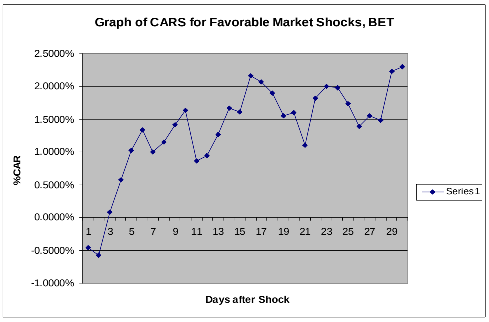
We note by reviewing the last column of Table 4 that the *F*-statistics are statistically significant for all indexes except for Biotechnology and Telecommunication, implying that post-surprise uncertainty generally is significantly higher in the periods following unfavorable surprises compared to the uncertainty following favorable surprises.

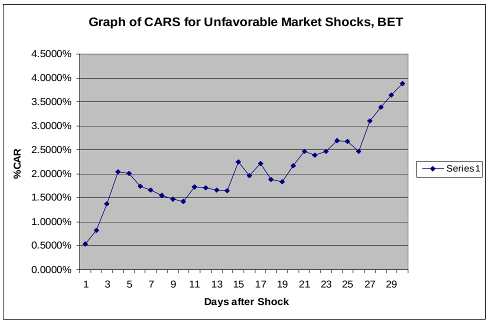
Tables 5a and 5b show the post-surprise CARs next to their related *t*-values for each of the 30 days following the favorable surprises, and Tables 6a and 6b display the same results for unfavorable surprises. We test the null hypothesis that the CARs are equal to zero using *t*-tests based on the formula in Equation 6. In addition, Figures 1-9 display the graphical representations of the CARs for 30-day windows for each of the NASDAQ indexes.

The numbers in Tables 5a, 5b, 6a, and 6b and the graphs in Figures 1–9 provide a set of identifiable patterns of daily returns for all nine indexes that allows us to determine whether the cumulative returns following information surprises are consistent with the predictions of the EMH, OIH or UI. Specifically, for the NASDAQ Composite index, and four of the sector indexes (Banks, Biotechnology, Other Financials, and Telecommunications), the patterns of the CARs are consistent with the prediction of the UIH, because in cases of both favorable and unfavorable surprises we observe an upward trend in the CARs following the arrival of information surprises. This pattern of daily stock returns implies that the arrival of information surprises creates uncertainty, such that market participants initially price stocks below their fundamental values. However, as time passes and the uncertainly generated by information surprises gradually dissipates, stock prices slowly converge with their fundamental values.

Post-Surprise Cumulative Abnormal Returns (CARs) for NASDAQ Sector Indexes

Figure 1. NASDAQ Composite

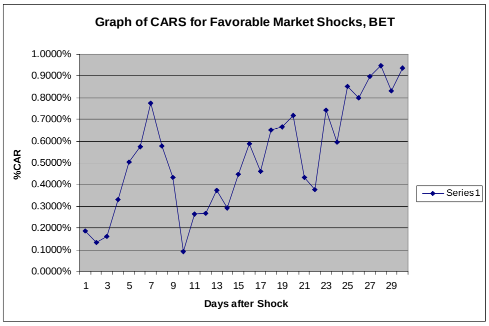


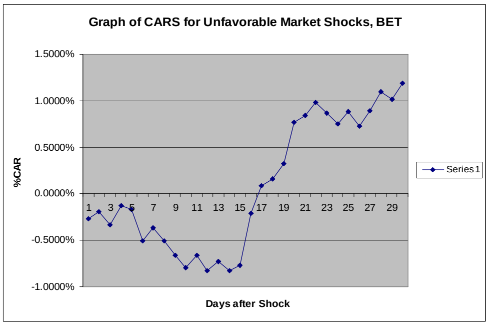


Positive Surprises

Negative Surprises

Figure 2. NASDAQ Banking Sector

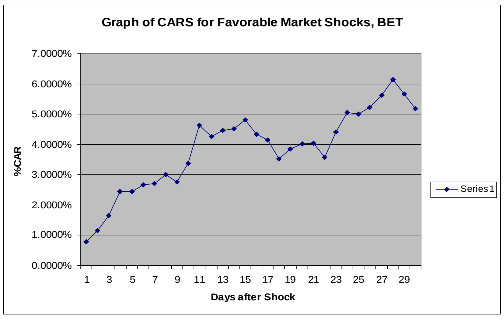


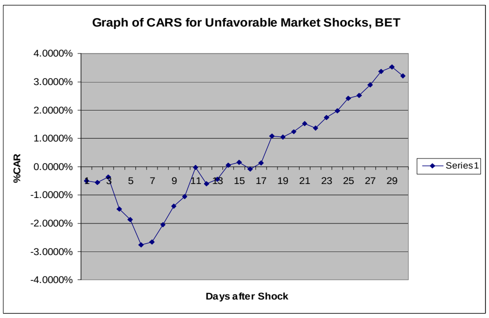


Positive Surprises

Negative Surprises

Figure 3. NASDAQ Biotechnology Sector

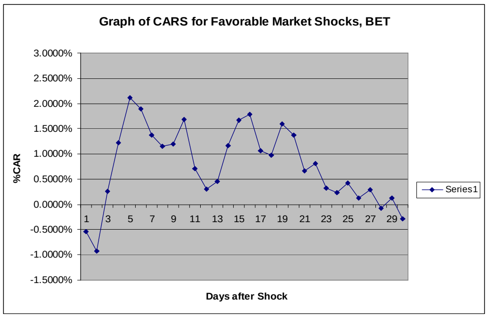




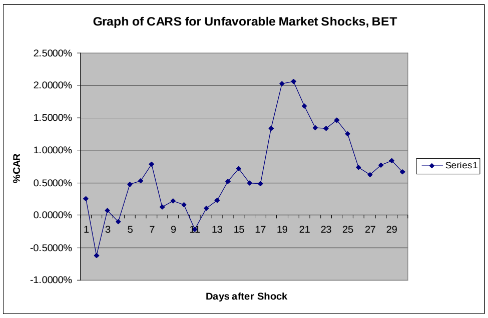
Positive Surprises

Negative Surprises

Figure 4. NASDAQ Computers Sector

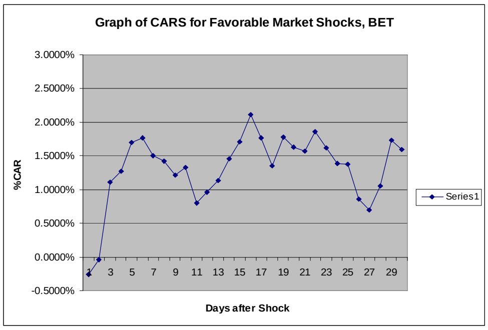


Positive Surprises

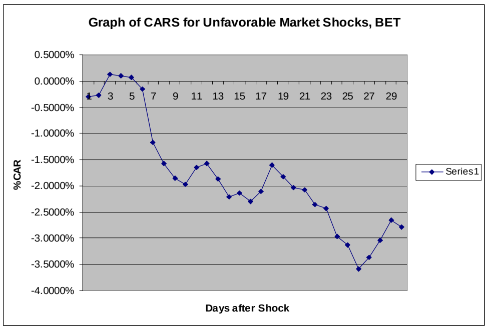


Negative Surprises

Figure 5. NASDAQ Industrials Sector

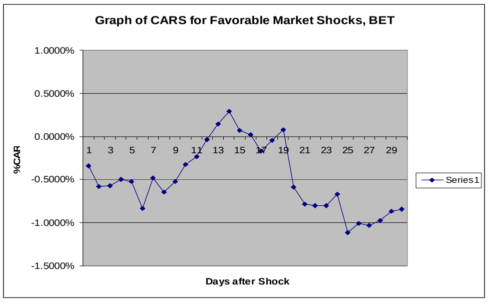


Positive Surprises

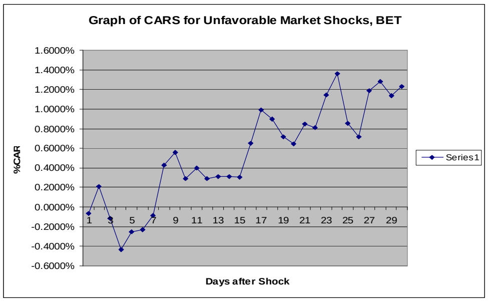


Negative Surprises

Figure 6. NASDAQ Insurance Sector

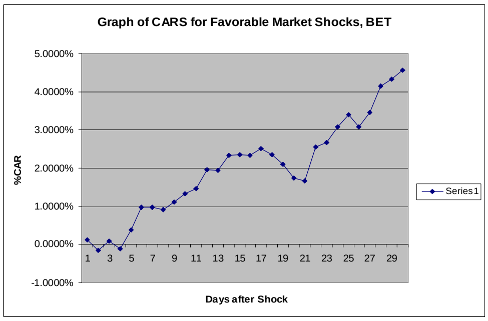


Positive Surprises

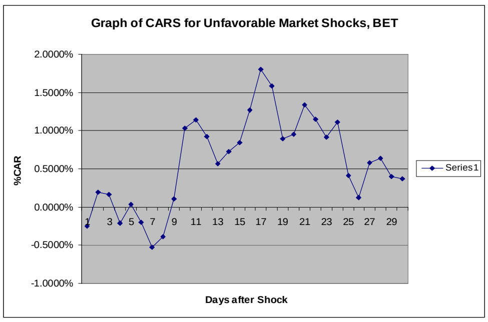


Negative Surprises

Figure 7. NASDAQ Other Financials Sector

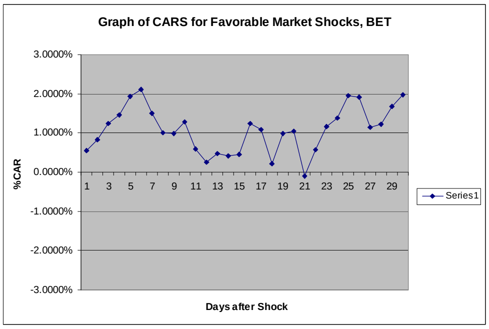


Positive Surprises

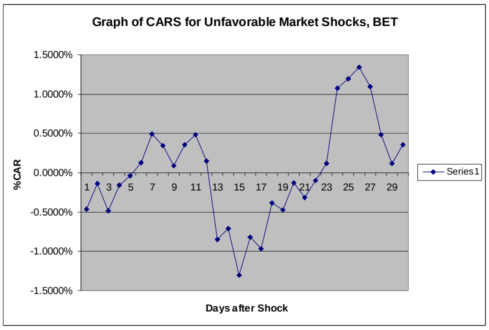


Negative Surprises

Figure 8. NASDAQ Telecommunications Sector

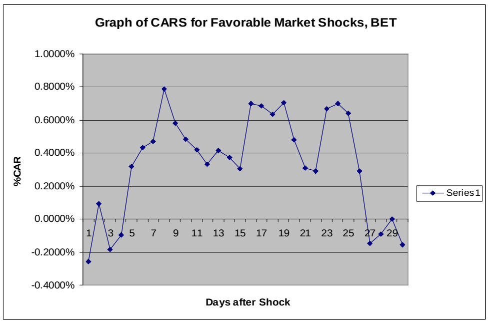


Positive Surprises

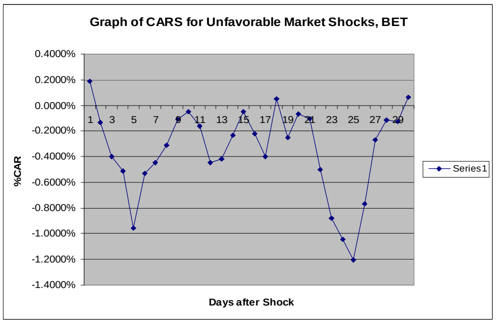


Negative Surprises

Figure 9. NASDAQ Transportation Sector



Positive Surprises



Negative Surprises

A further examination of Tables 5a and b and 6a and b reveal that the trends of the CARs are in line with the prediction of the OH for the Computer and Insurance sector indexes, since we observe downward trends in the CARs following the arrival of favorable surprises and upward trends in response to the arrival of unfavorable surprises. Therefore, in the case of these two sector indexes the reactions of investors following the arrival of information surprises can reasonably be characterized by subsequent price-reversals, implying that a contrarian trading rule of buying current losers and selling current winners can result in higher-than-normal, risk-adjusted returns. It should be noted that the predictions of the OH and UIH are exactly the same in the case of unfavorable surprises, so it is really the pattern of returns following favorable surprises that allows us to distinguish between the OH and UIH. Also, the results for both the Industrials and Transportation indexes are somewhat mixed, although one can plausibly interpret the behavior of CARs in these indexes as supporting the prediction of the EMH, at least for the Transportation index in which we observe a set of trendless CARs.

Table 4.

Variance of Returns for Non-Surprise Days, All Post-Surprise Days, Post-Favorable Surprise Days and Post-Unfavorable Surprise Days

Index	Sample	Variance	F-statistics	F-statistic
Composite	Non-Surprise Days	0.0213		
	Post-Surprise Days	0.0289	(a) 1.36***	
	Post-Favorable Surprises	0.0239	(b) 1.12	(d) 1.41***
	Post-Unfavorable Surprises	0.0338	(c) 1.59***	
Banks	Non-Surprise Days	0.0115		
	Post-Surprise Days	0.0092	(a) 1.25**	
	Post-Favorable Surprises	0.0110	(b) 1.05	(d) 1.47***
	Post-Unfavorable Surprises	0.0075	(c) 1.53***	
Biotechnology	Non-Surprise Days	0.0334		
	Post-Surprise Days	0.0505	(a) 1.51***	
	Post-Favorable Surprises	.0481	(b) 1.44***	(d) 1.10
	Post-Unfavorable Surprises	0.0527	(c) 1.58***	
Computer	Non-Surprise Days	0.0384		
	Post-Surprise Days	0.0441	(a) 1.15	
	Post-Favorable Surprises	0.0362	(b) 1.06	(d) 1.43***
	Post-Unfavorable Surprises	0.0517	(c) 1.35***	
Industrial	Non-Surprise Days	0.0149		
	Post-Surprise Days	0.0307	(a) 2.06***	
	Post-Favorable Surprises	0.0286	(b) 1.92***	(d) 1.25**
	Post-Unfavorable Surprises	0.0356	(c) 2.39***	
Insurance	Non-Surprise Days	0.0065		
	Post-Surprise Days	0.0130	(a) 2.00***	
	Post-Favorable Surprises	0.0145	(b) 2.23***	(d) 1.32***
	Post-Unfavorable Surprises	0.0110	(c) 1.69***	
Other Finan.	Non-Surprise Days	0.0240		
	Post-Surprise Days	0.0339	(a) 1.41***	
	Post-Favorable Surprises	0.0287	(b) 1.20	(d) 1.37***
	Post-Unfavorable Surprises	0.0392	(c) 1.63***	
Telecommun.	Non-Surprise Days	0.0274		
	Post-Surprise Days	0.0491	(a) 1.79***	
	Post-Favorable Surprises	0.0500	(b) 1.82***	(d) 1.04
	Post-Unfavorable Surprises	0.0483	(c) 1.76***	
Transportation	Non-Surprise Days	0.0130		
	Post-Surprise Days	0.0211	(a) 1.62***	
	Post-Favorable Surprises	0.0229	(b) 1.76***	(d) 1.30***
	Post-Unfavorable Surprises	0.0176	(c) 1.35***	

The first *F*-statistic (a) for each index is the test of the null hypothesis, which shows that the variance of returns after all surprise days is equal to the variance of non-surprise returns. The second *F*-statistic (b) for each index is the test of the null hypothesis, which shows that the variance of returns after unexpected favorable surprises is equal to the variance of non-surprise returns. The third *F*-statistic (c) for each index is the test of the null hypothesis, which shows that the variance of returns after unexpected unfavorable surprises is equal to the variance of non-surprise returns. The fourth *F*-statistic (d) for each index is the test of the null hypothesis, which shows that the variance of returns after unexpected favorable surprises is equal to the variance of returns after unexpected unfavorable surprises. Note: Post-surprise periods contain the days after both favorable and unfavorable surprises. The *** indicates statistical significance at the 1% level and ** at the 5% level.

Table 5a.

Post-Surprise Cumulative Abnormal Returns (CARs) for the NASDAQ Composite Index and Eight NASDAQ Sector Indexes: Favorable Surprises

	Composite		Banks		Biotech		Computers		Industrials	
Day	CARS	T-Stat	CARS	T-Stat	CARS	T-Stat	CARS	T-Stat	CARS	T-Stat
1	(0.0046)	(0.6418)	0.0019	0.7343	0.0079	0.5879	(0.0054)	(0.7167)	(0.0025)	(0.4862)
2	(0.0058)	(0.8106)	0.0013	0.5231	0.0115	0.8582	(0.0093)	(1.2277)	(0.0004)	(0.0862)
3	0.0009	0.1214	0.0016	0.6357	0.0165	1.2374	0.0025	0.3363	0.0111	**2.1362**
4	0.0058	0.8087	0.0033	1.3044	0.0244	**1.8254**	0.0122	1.6131	0.0127	**2.4319**
5	0.0103	1.4380	0.0050	**1.9958**	0.0244	**1.8261**	0.0211	**2.7862**	0.0170	**3.2667**
6	0.0133	**1.8704**	0.0057	**2.2707**	0.0266	**1.9886**	0.0189	**2.5031**	0.0177	**3.3898**
7	0.0100	1.4005	0.0077	**3.0609**	0.0270	**2.0216**	0.0138	**1.8193**	0.0150	**2.8798**
8	0.0116	1.6224	0.0058	**2.2831**	0.0302	**2.2566**	0.0114	1.5122	0.0142	**2.7188**
9	0.0142	**1.9889**	0.0043	**1.7199**	0.0275	**2.0592**	0.0119	1.5727	0.0122	**2.3360**
10	0.0164	**2.2963**	0.0009	0.3573	0.0338	**2.5315**	0.0168	**2.2213**	0.0134	**2.5615**
11	0.0086	1.2059	0.0026	1.0477	0.0463	**3.4622**	0.0070	0.9308	0.0080	1.5264
12	0.0094	1.3206	0.0027	1.0535	0.0428	**3.1982**	0.0031	0.4114	0.0097	**1.8538**
13	0.0127	**1.7806**	0.0037	1.4842	0.0447	**3.3453**	0.0046	0.6036	0.0113	**2.1702**
14	0.0167	**2.3447**	0.0029	1.1569	0.0451	**3.3709**	0.0116	1.5323	0.0145	**2.7848**
15	0.0162	**2.2690**	0.0045	**1.7649**	0.0480	**3.5886**	0.0167	**2.2124**	0.0171	**3.2774**
16	0.0216	**3.0343**	0.0059	**2.3300**	0.0434	**3.2488**	0.0179	**2.3615**	0.0211	**4.0433**
17	0.0208	**2.9133**	0.0046	**1.8311**	0.0415	**3.1033**	0.0106	1.3970	0.0177	**3.3840**
18	0.0190	**2.6704**	0.0065	**2.5802**	0.0353	**2.6371**	0.0097	1.2799	0.0136	**2.5982**
19	0.0155	**2.1759**	0.0067	**2.6411**	0.0385	**2.8773**	0.0159	**2.0993**	0.0178	**3.4202**
20	0.0160	**2.2407**	0.0072	**2.8442**	0.0403	**3.0126**	0.0137	**1.8111**	0.0163	**3.1241**
21	0.0110	1.5453	0.0043	**1.7173**	0.0405	**3.0259**	0.0066	0.8681	0.0157	**3.0156**
22	0.0182	**2.5475**	0.0038	1.4904	0.0356	**2.6651**	0.0081	1.0638	0.0186	**3.5650**
23	0.0201	**2.8200**	0.0074	**2.9360**	0.0441	**3.3002**	0.0033	0.4306	0.0161	**3.0926**
24	0.0198	**2.7783**	0.0060	**2.3610**	0.0506	**3.7867**	0.0024	0.3136	0.0139	**2.6618**
25	0.0175	**2.4487**	0.0085	**3.3771**	0.0501	**3.7472**	0.0043	0.5694	0.0137	**2.6335**
26	0.0140	**1.9627**	0.0080	**3.1630**	0.0522	**3.9026**	0.0013	0.1683	0.0085	1.6365
27	0.0156	**2.1847**	0.0090	**3.5574**	0.0562	**4.2034**	0.0029	0.3851	0.0070	1.3364
28	0.0148	**2.0786**	0.0095	**3.7471**	0.0613	**4.5829**	(0.0008)	(0.1025)	0.0106	**2.0286**
29	0.0223	**3.1297**	0.0083	**3.2959**	0.0567	**4.2379**	0.0013	0.1696	0.0173	**3.3248**
30	0.0230	**3.2324**	0.0094	**3.7105**	0.0519	**3.8803**	(0.0028)	(0.3734)	0.0159	**3.0513**

Note: The *t*-statistics in bold indicate statistical significance at the 10% level or higher.

Table 5b.

Post-Surprise Cumulative Abnormal Returns (CARs) for the NASDAQ Composite Index and Eight NASDAQ Sector Indexes: Favorable Surprises (continued)

	Composite		Insurance		Other Financial		Telecom		Transportation	
Day	CARS	T-Stat	CARS	T-Stat	CARS	T-Stat	CARS	T-Stat	CARS	T-Stat
1	(0.0046)	(0.6418)	(0.0034)	(0.8749)	0.0012	0.0936	0.0054	0.9359	(0.0026)	(0.8298)
2	(0.0058)	(0.8106)	(0.0058)	(1.4776)	(0.0016)	(0.1229)	0.0082	1.4117	0.0009	0.2948
3	0.0009	0.1214	(0.0057)	(1.4466)	0.0008	0.0612	0.0125	**2.1434**	(0.0018)	(0.5902)
4	0.0058	0.8087	(0.0050)	(1.2685)	(0.0012)	(0.0917)	0.0145	**2.4958**	(0.0009)	(0.3049)
5	0.0103	1.4380	(0.0052)	(1.3371)	0.0039	0.3022	0.0192	**3.3077**	0.0032	1.0273
6	0.0133	**1.8704**	(0.0083)	**(2.1253)**	0.0096	0.7453	0.0211	**3.6312**	0.0043	1.3907
7	0.0100	1.4005	(0.0048)	(1.2300)	0.0098	0.7585	0.0150	**2.5755**	0.0047	1.5085
8	0.0116	1.6224	(0.0064)	(1.6425)	0.0091	0.7045	0.0100	**1.7235**	0.0079	**2.5287**
9	0.0142	**1.9889**	(0.0052)	(1.3395)	0.0111	0.8605	0.0098	**1.6918**	0.0058	**1.8722**
10	0.0164	**2.2963**	(0.0033)	(0.8297)	0.0134	1.0319	0.0129	**2.2122**	0.0048	1.5582
11	0.0086	1.2059	(0.0024)	(0.6007)	0.0146	1.1265	0.0060	1.0282	0.0042	1.3461
12	0.0094	1.3206	(0.0004)	(0.0920)	0.0196	1.5113	0.0025	0.4306	0.0033	1.0709
13	0.0127	**1.7806**	0.0014	0.3613	0.0194	1.5011	0.0047	0.8021	0.0042	1.3350
14	0.0167	**2.3447**	0.0029	0.7374	0.0234	**1.8099**	0.0040	0.6959	0.0037	1.2019
15	0.0162	**2.2690**	0.0007	0.1827	0.0236	**1.8247**	0.0046	0.7893	0.0031	0.9807
16	0.0216	**3.0343**	0.0002	0.0634	0.0233	**1.7973**	0.0125	**2.1513**	0.0070	**2.2470**
17	0.0208	**2.9133**	(0.0017)	(0.4282)	0.0251	**1.9393**	0.0110	**1.8818**	0.0069	**2.2100**
18	0.0190	**2.6704**	(0.0004)	(0.1131)	0.0235	**1.8123**	0.0022	0.3744	0.0063	**2.0383**
19	0.0155	**2.1759**	0.0008	0.1993	0.0209	1.6178	0.0099	**1.6933**	0.0071	**2.2673**
20	0.0160	**2.2407**	(0.0059)	(1.5036)	0.0173	1.3398	0.0104	**1.7849**	0.0048	1.5364
21	0.0110	1.5453	(0.0078)	**(1.9992)**	0.0167	1.2868	(0.0009)	(0.1559)	0.0031	0.9896
22	0.0182	**2.5475**	(0.0080)	**(2.0346)**	0.0255	**1.9695**	0.0056	0.9669	0.0029	0.9280
23	0.0201	**2.8200**	(0.0080)	**(2.0392)**	0.0268	**2.0668**	0.0116	**1.9912**	0.0067	**2.1547**
24	0.0198	**2.7783**	(0.0067)	**(1.7144)**	0.0308	**2.3803**	0.0138	**2.3788**	0.0070	**2.2541**
25	0.0175	**2.4487**	(0.0112)	**(2.8494)**	0.0339	**2.6215**	0.0195	**3.3527**	0.0064	**2.0563**
26	0.0140	**1.9627**	(0.0100)	**(2.5598)**	0.0310	**2.3915**	0.0191	**3.2904**	0.0029	0.9393
27	0.0156	**2.1847**	(0.0103)	**(2.6375)**	0.0346	**2.6738**	0.0114	**1.9643**	(0.0015)	(0.4749)
28	0.0148	**2.0786**	(0.0097)	**(2.4799)**	0.0416	**3.2124**	0.0122	**2.1045**	(0.0009)	(0.2900)
29	0.0223	**3.1297**	(0.0086)	**(2.2071)**	0.0434	**3.3517**	0.0168	**2.8883**	0.0000	0.0088
30	0.0230	**3.2324**	(0.0084)	**(2.1412)**	0.0456	**3.5241**	0.0197	**3.3811**	(0.0015)	(0.4947)

Note: The *t*-statistics in bold indicate statistical significance at the 10% level or higher.

Table 6a.

Post-Surprise Cumulative Abnormal Returns (CARs) for the NASDAQ Composite Index and Eight NASDAQ Sector Indexes: Unfavorable Surprises

	Composite		Banks		Biotech		Computers		Industrials	
Day	CARS	T-Stat	CARS	T-Stat	CARS	T-Stat	CARS	T-Stat	CARS	T-Stat
1	0.0053	0.7079	(0.0027)	(0.3808)	(0.0049)	(0.2755)	0.0025	0.3878	(0.0030)	(0.2882)
2	0.0082	1.0939	(0.0020)	(0.2800)	(0.0055)	(0.3062)	(0.0063)	(0.9647)	(0.0027)	(0.2517)
3	0.0138	**1.8341**	(0.0033)	(0.4727)	(0.0036)	(0.2001)	0.0007	0.1006	0.0013	0.1229
4	0.0204	**2.7175**	(0.0013)	(0.1785)	(0.0151)	(0.8392)	(0.0010)	(0.1553)	0.0010	0.0944
5	0.0202	**2.6866**	(0.0017)	(0.2409)	(0.0188)	(1.0472)	0.0048	0.7328	0.0007	0.0708
6	0.0175	**2.3265**	(0.0051)	(0.7237)	(0.0275)	(1.5328)	0.0054	0.8272	(0.0015)	(0.1428)
7	0.0167	**2.2241**	(0.0037)	(0.5291)	(0.0265)	(1.4765)	0.0078	1.2097	(0.0117)	(1.1121)
8	0.0156	**2.0774**	(0.0050)	(0.7189)	(0.0206)	(1.1493)	0.0012	0.1904	(0.0158)	(1.4985)
9	0.0148	**1.9731**	(0.0067)	(0.9515)	(0.0140)	(0.7798)	0.0022	0.3426	(0.0185)	**(1.7559)**
10	0.0143	**1.9000**	(0.0079)	(1.1345)	(0.0104)	(0.5795)	0.0016	0.2452	(0.0198)	**(1.8778)**
11	0.0172	**2.2954**	(0.0067)	(0.9511)	(0.0003)	(0.0163)	(0.0022)	(0.3392)	(0.0165)	(1.5646)
12	0.0171	**2.2821**	(0.0083)	(1.1834)	(0.0062)	(0.3438)	0.0011	0.1643	(0.0157)	(1.4905)
13	0.0166	**2.2167**	(0.0073)	(1.0446)	(0.0044)	(0.2429)	0.0024	0.3661	(0.0186)	**(1.7698)**
14	0.0165	**2.2027**	(0.0083)	(1.1834)	0.0005	0.0278	0.0052	0.8054	(0.0221)	**(2.0995)**
15	0.0224	**2.9872**	(0.0077)	(1.1002)	0.0016	0.0887	0.0071	1.0993	(0.0214)	**(2.0306)**
16	0.0197	**2.6221**	(0.0021)	(0.3011)	(0.0007)	(0.0412)	0.0050	0.7672	(0.0230)	**(2.1793)**
17	0.0221	**2.9461**	0.0008	0.1201	0.0013	0.0728	0.0049	0.7523	(0.0211)	**(2.0039)**
18	0.0189	**2.5152**	0.0016	0.2228	0.0107	0.5983	0.0133	**2.0555**	(0.0160)	(1.5225)
19	0.0183	**2.4404**	0.0033	0.4658	0.0106	0.5886	0.0203	**3.1263**	(0.0183)	**(1.7359)**
20	0.0217	**2.8846**	0.0077	1.0962	0.0124	0.6895	0.0206	**3.1804**	(0.0203)	**(1.9250)**
21	0.0247	**3.2860**	0.0084	1.1979	0.0152	0.8444	0.0168	**2.5919**	(0.0207)	**(1.9646)**
22	0.0240	**3.1929**	0.0098	1.4003	0.0137	0.7641	0.0135	**2.0794**	(0.0235)	**(2.2348)**
23	0.0247	**3.2877**	0.0087	1.2360	0.0172	0.9612	0.0134	**2.0642**	(0.0242)	**(2.3009)**
24	0.0269	**3.5832**	0.0076	1.0777	0.0196	1.0949	0.0146	**2.2585**	(0.0296)	**(2.8110)**
25	0.0268	**3.5731**	0.0089	1.2656	0.0243	1.3517	0.0126	**1.9357**	(0.0312)	**(2.9644)**
26	0.0247	**3.2850**	0.0073	1.0373	0.0252	1.4038	0.0074	1.1432	(0.0359)	**(3.4087)**
27	0.0310	**4.1281**	0.0090	1.2781	0.0289	1.6128	0.0063	0.9643	(0.0336)	**(3.1907)**
28	0.0339	**4.5135**	0.0110	1.5641	0.0337	**1.8758**	0.0078	1.1962	(0.0304)	**(2.8872)**
29	0.0365	**4.8625**	0.0102	1.4530	0.0353	**1.9666**	0.0084	1.3020	(0.0266)	**(2.5221)**
30	0.0388	**5.1740**	0.0119	**1.6976**	0.0321	**1.7903**	0.0067	1.0319	(0.0279)	**(2.6447)**

Note: The *t*-statistics in bold indicate statistical significance at the 10% level or higher.

Table 6b.

Post-Surprise Cumulative Abnormal Returns (CARs) for the NASDAQ Composite Index and Eight NASDAQ Sector Indexes: Unfavorable Surprises (continued)

	Composite		Insurance		Other Financial		Telecom		Transportation	
Day	CARS	T-Stat	CARS	T-Stat	CARS	T-Stat	CARS	T-Stat	CARS	T-Stat
1	0.0053	0.7079	(0.0007)	(0.1324)	(0.0025)	(0.4195)	(0.0046)	(0.7141)	0.0019	0.5476
2	0.0082	1.0939	0.0021	0.4247	0.0020	0.3312	(0.0014)	(0.2171)	(0.0013)	(0.3923)
3	0.0138	**1.8341**	(0.0012)	(0.2341)	0.0016	0.2715	(0.0048)	(0.7432)	(0.0040)	(1.1737)
4	0.0204	**2.7175**	(0.0043)	(0.8621)	(0.0021)	(0.3445)	(0.0016)	(0.2440)	(0.0051)	(1.5050)
5	0.0202	**2.6866**	(0.0025)	(0.5068)	0.0004	0.0668	(0.0004)	(0.0555)	(0.0095)	**(2.7965)**
6	0.0175	**2.3265**	(0.0023)	(0.4546)	(0.0020)	(0.3330)	0.0013	0.1925	(0.0053)	(1.5496)
7	0.0167	**2.2241**	(0.0009)	(0.1742)	(0.0053)	(0.8806)	0.0049	0.7519	(0.0045)	(1.3140)
8	0.0156	**2.0774**	0.0043	0.8582	(0.0039)	(0.6461)	0.0035	0.5368	(0.0031)	(0.9131)
9	0.0148	**1.9731**	0.0056	1.1084	0.0010	0.1740	0.0008	0.1306	(0.0011)	(0.3223)
10	0.0143	**1.9000**	0.0029	0.5725	0.0103	**1.7208**	0.0035	0.5421	(0.0005)	(0.1421)
11	0.0172	**2.2954**	0.0040	0.7963	0.0114	**1.8959**	0.0049	0.7503	(0.0016)	(0.4708)
12	0.0171	**2.2821**	0.0029	0.5841	0.0092	1.5367	0.0015	0.2297	(0.0045)	(1.3084)
13	0.0166	**2.2167**	0.0031	0.6238	0.0057	0.9505	(0.0085)	(1.3022)	(0.0042)	(1.2250)
14	0.0165	**2.2027**	0.0031	0.6259	0.0073	1.2106	(0.0071)	(1.0931)	(0.0023)	(0.6856)
15	0.0224	**2.9872**	0.0030	0.6075	0.0084	1.4008	(0.0130)	**(2.0060)**	(0.0005)	(0.1534)
16	0.0197	**2.6221**	0.0065	1.3028	0.0127	**2.1071**	(0.0082)	(1.2540)	(0.0022)	(0.6539)
17	0.0221	**2.9461**	0.0099	**1.9724**	0.0181	**3.0063**	(0.0097)	(1.4848)	(0.0040)	(1.1694)
18	0.0189	**2.5152**	0.0090	**1.7926**	0.0158	**2.6352**	(0.0039)	(0.5994)	0.0005	0.1519
19	0.0183	**2.4404**	0.0072	1.4272	0.0089	1.4894	(0.0048)	(0.7349)	(0.0025)	(0.7308)
20	0.0217	**2.8846**	0.0065	1.2884	0.0095	1.5839	(0.0013)	(0.1973)	(0.0007)	(0.2003)
21	0.0247	**3.2860**	0.0085	**1.6961**	0.0133	**2.2223**	(0.0032)	(0.4933)	(0.0010)	(0.3025)
22	0.0240	**3.1929**	0.0081	1.6180	0.0115	**1.9231**	(0.0010)	(0.1497)	(0.0050)	(1.4745)
23	0.0247	**3.2877**	0.0114	**2.2792**	0.0091	1.5157	0.0012	0.1807	(0.0088)	**(2.5759)**
24	0.0269	**3.5832**	0.0136	**2.7071**	0.0111	**1.8471**	0.0107	1.6487	(0.0105)	**(3.0719)**
25	0.0268	**3.5731**	0.0086	**1.7105**	0.0041	0.6878	0.0119	**1.8372**	(0.0120)	**(3.5260)**
26	0.0247	**3.2850**	0.0071	1.4227	0.0013	0.2148	0.0134	**2.0626**	(0.0077)	**(2.2528)**
27	0.0310	**4.1281**	0.0119	**2.3674**	0.0058	0.9628	0.0110	**1.6916**	(0.0027)	(0.7866)
28	0.0339	**4.5135**	0.0128	**2.5489**	0.0064	1.0655	0.0049	0.7467	(0.0012)	(0.3425)
29	0.0365	**4.8625**	0.0114	**2.2670**	0.0040	0.6639	0.0012	0.1785	(0.0013)	(0.3810)
30	0.0388	**5.1740**	0.0123	**2.4497**	0.0037	0.6167	0.0036	0.5494	0.0006	0.1837

Note: The *t*-statistics in bold indicate statistical significance at the 10% level or higher.

Table 7.

Regression Analysis of CAR Trends for Favorable and Unfavorable News

Index	Type of Surprise	Coefficient for Trend	Adjusted R-Squared
Composite	Favorable	0.0609***	0.56
	Unfavorable	0.0750***	0.77
Banks	Favorable	0.0214***	0.55
	Unfavorable	0.0639***	0.64
Biotechnology	Favorable	0.1339***	0.77
	Unfavorable	0.1852***	0.82
Computer	Favorable	-0.0208	0.06
	Unfavorable	0.0458***	0.38
Industrials	Favorable	0.0199*	0.11
	Unfavorable	-0.1075***	0.80
Insurance	Favorable	-0.0175**	0.15
	Unfavorable	0.0514***	0.81
Other Financial	Favorable	0.1390***	0.90
	Unfavorable	0.0307**	0.20
Telecommunications	Favorable	0.0001	0.02
	Unfavorable	0.0271**	0.13
Transportation	Favorable	0.0001	0.01
	Unfavorable	0.0001	0.01

The *** indicates statistical significance at the 1% level, ** at the 5% level, and * at the 10% level.

In order to test the robustness of the above empirical results and our conclusions based on those findings, we next perform OLS estimations of the CARs regressed on a time trend for both favorable and unfavorable surprises, and those results are presented in Table 7. As can be seen, the trend coefficients for the CARs following both unfavorable and favorable surprises are positive and statistically significant for the NASDAQ Composite index and the sector indexes for Banks, Biotechnology, Other Financial, and Telecommunications, findings that support the predictions of the UIH. Additionally, we observe that the trend coefficient for favorable surprises is negative and the trend coefficient for unfavorable surprises is positive for both the Computer and Insurance sector indexes, which supports the predictions of the OH. Also, the conclusions made above regarding the Industrial and Transportation indexes are supported by the empirical OLS results presented in Table 7, which indicate no significant trends for the Transportation sector following either favorable or unfavorable surprises (mildly supporting EMH), and a significant, negative trend following unfavorable news for the Industrial sector (not predicted by any of the theories presented here).

4. Summary and Conclusions

In this study we investigate the reaction of investors to the arrival of unexpected information (both positive and negative) for the NASDAQ Composite Index and its sector indexes. We use daily stock returns from the NASDAQ composite index and its eight sector indexes (Banks, Biotechnology, Computers, Industrial, Insurance, Other Financials, Telecommunications and Transportation) over sample periods from 1994 to 2008 to test three competing hypotheses: the Efficient Market Hypothesis (EMH), the Overreaction Hypothesis (OH), and the Uncertain Information Hypothesis (UIH).

Although our empirical findings are somewhat mixed, we find strong statistical evidence of a corrective process of significantly positive cumulative abnormal returns following the arrival of both favorable and unfavorable information surprises for the NASDAQ Composite and four of the sector indexes (Banks, Biotechnology, Other Financials, and Telecommunications), and these outcomes are consistent with the prediction of the UIH regarding investor behavior. Specifically, the empirical findings for these five indexes suggest that investors in these markets systematically set security prices below their fundamental values in response to unexpected economic information. Such behavior is rational according to the UIH, since the arrival of information surprises (whether favorable or unfavorable) makes the equity market a more risky environment.

For the Computer and Insurance sector indexes, we observe downward trends in the CARs following the arrival of favorable surprises and upward trends in response to the arrival of unfavorable surprises, consistent with the predictions of the OH. Therefore, in the case of these two sector indexes, subsequent price-reversals follow information surprises, implying that a contrarian trading rule of buying current losers and selling current winners can result in higher-than-normal, risk-adjusted returns. For the remaining two sectors (Industrials and Transportation), the pattern of CARs following the arrival of information surprises is not strongly consistent with any of the theories of investor reaction presented here, although the trendless pattern of returns following information surprises for the Transportation index could be explained by the EMH.

One main implication of these mixed empirical results is that investor reaction is not universal across industry sectors, and in fact varies significantly by sector, highlighting the value of analyzing investor reaction in different segments of the security markets in addition to investigating composite indices. The corrective activity observed during this study does support the notion that sector reaction in a post-surprise environment does not appear to be symmetrical in nature but rather varies from sector to sector. While the root cause of this asymmetrical reaction is not evident, we postulate that the client groups that are actively involved in trading vary from sector to sector and their reaction to market information could likely vary based on a number of factors. The findings presented here suggest that further research in this area is warranted to shed light on the dynamics of why and how investor reaction varies by market sector.

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