Earnings Announcements and Accounting Misrepresentation

Kyung-Chun Mun
Division of Business and Accountancy
Truman State University
Kirksville, MO 63501
Phone: (660) 785-4367
E-mail:amun@truman.edu

Sandra K. Fleak
Division of Business and Accountancy
Truman State University
Kirksville, MO 63501
Phone: (660) 785-4359
E-mail:sfleak@truman.edu

George Emir Morgan
Pamplin College of Business
Virginia Polytechnic Institute & State University
Blacksburg, VA 24061
Phone: (540) 231-7380
E-mail:gmorgan@vt.edu

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Abstract

This paper investigates how investors behave in the market as earnings information is released by firms with accounting irregularity allegations and how quickly investors adjust to earnings announcements made by these firms. We also examine whether stock volatility has any effect on the speed of adjustment. We find that after irregularity allegations are made, the market anticipates good news sufficiently with no significant market reaction following the good news while there is a significant amount of delayed short-term responses to bad news. We also find that the market responds more rapidly to good news than to bad news, as found in recent research. This asymmetric market response is significantly more acute after accounting irregularity allegations are made. We find no relation between stock volatility and the speed of adjustment to earnings announcements when the news is good. Yet, when the news is bad, stock volatility negatively affects the speed of adjustment and the effect is significantly lagged following irregularity allegations.

1. Introduction

Particularly following the collapse of Enron in November 2001, announcements of accounting irregularities and financial misrepresentation at other companies engulfed the financial market causing a crisis of confidence in management and financial reporting. Investor confidence plummeted and many investors suffered significant losses as market capitalizations fell dramatically. This study systematically investigates reactions of market participants to earnings announcement by firms that were allegedly engaged in accounting irregularities. We investigate whether investors change their behavior when firms with accounting irregularity allegations announce earnings and how rapidly investors adjust to earnings announcements by such firms.

Extant research on financial statement misrepresentation has focused mostly on descriptive data about restating firms and restatement characteristics (Kinney and McDaniel (1989); Defond and Jiambalvo (1991), Wu (2002), Palmrose and Scholz (2004), and Agrawal and Chadha (2005)).[1] These studies document that firms who restate financial information tend to have weak oversight of management. Relative to their industry, they tend to be smaller, more highly leveraged, less profitable, less likely to have audit committees, and more likely to be involved in litigation with shareholders. Other concurrent research focused on the relation between restatements and market returns, documenting that there is a significant negative average stock price reaction to restatement announcement (Dechow et al. (1996), Wu (2002), Anderson and Yohn (2002), and Palmrose et al. (2004)).

Our study extends the extant research on the financial statement misrepresentation by positing two questions about the market reaction to earnings announcement in conjunction with accounting irregularity allegations. The first question we ask is whether investors, facing accounting irregularity allegations, change their behavior in the market as earnings information is released and as a result, post-announcement abnormal returns are associated with the information content of irregularity allegations. It is well

[1] A firm's accounting problems are typically revealed through its financial report restatement. An earnings restatement is essentially an official admission by managers of past financial misstatement. Our paper is centered on the market response to allegations of accounting irregularities rather than official admission of irregularities.

documented in the literature that stock markets do not respond to earnings announcements in a manner that fully reflects the true earnings process (see, Rendleman et al. (1982), Foster et al. (1984), Freeman and Tse (1989), Bernard and Thomas (1989, 1990), Bartov (1992), Ball and Bartov (1996), and Bartov et al. (2000)). Since earnings information released by firms that are allegedly involved in accounting irregularities may not be credible to investors, one might expect to observe unusual market reaction to earnings announcements following irregularity allegations. We address this question by examining the time-series pattern of post-event abnormal returns. Specifically, we compute daily average abnormal returns from a series of out-of-sample forecasted returns and present autocorrelations for the abnormal returns, sorting our earnings announcement event sample into two groups – good and bad news. The market's reaction to earnings releases is measured by the cumulative average abnormal return (CAR) and buy-and-hold average abnormal return (BHAR) as well for a robustness check.

We find that in the presence of accounting irregularity allegations, the earnings announcement of good news induces lesser market response than that of bad news. It appears that good news in the presence of irregularity allegations is discounted by investors as they assess management's credibility as well as future earnings and cash flows. We find no significant post-earnings announcement drift for good news, while there is a short-term underreaction to bad news after irregularity allegations.

A number of studies have documented that stock prices do not adjust instantaneously to information contained in earnings releases (Ball and Brown (1968); Joy et al. (1977); Watts (1978); Rendleman et al. (1982); Foster et al. (1984), Bernard and Thomas (1989, 1990)). The second question we address is how rapidly investors adjust to earnings information for companies with accounting irregularity allegations. The speed of adjustment to earnings information is measured by the error-correction-type model allowing for partial adjustment of returns to new information. We focus attention on the possible asymmetry of the market response to good and bad news announcements with the market taking time to impound information conveyed by earnings releases. In an effort to explain why investors may change their speed of adjustment to earnings information, we test whether stock volatility helps explain the speed of adjustment to earnings announcement.

We find that the market responds more rapidly to good news than to bad news and the asymmetric market response to earnings surprises is significantly more acute after irregularity allegations are made. We also find that investors, facing accounting irregularity allegations, delay the speed at which they adjust to bad news while quickening the speed of adjustment to good news. We find no relation between stock volatility and the speed of adjustment to earnings announcement when the news is good. Yet, when the news is bad, stock volatility negatively affects the speed of adjustment, deterring investors from impounding earnings surprises into stock prices.

The rest of the paper is organized as follows: Section 2 presents the data and examines market reaction to earnings announcement. Section 3 develops an econometric model for the speed of adjustment to earnings announcement and examines the relation between stock volatility and the speed of adjustment. Section 4 provides conclusions.

2. Data and Methodology

2.1 Data

The sample companies are firms for which there are press releases and other media coverage reporting accounting irregularities over the period from July 1, 1997 to June 30, 2002. We initially identified 41 companies with allegations or news of accounting irregularities over the 5-year period by searching various sources of news releases and reports including Dow Jones and Lexis-Nexis. To identify companies, we searched for words such as ‘accounting fraud’ or ‘accounting irregularities’. We added to the resulting list by searching websites such as www.weissratings.com and www.forbes.com. We identified the dates when the firms were first publicly known to have been involved in accounting irregularities.

While identifying the sample companies, some firms were excluded for the following reasons. First, we excluded any firms with stock traded on the *Pink Sheets* because reliable return data were not available for these stocks. We also excluded any firms that had extensive data missing. Missing data were generally attributable to extended trading suspensions, stock delistings, bankruptcies, and mergers. The resulting sample includes 28 firms.

As our objective is to investigate any changes in market reaction to earnings announcements after accounting irregularity allegations, it is necessary to determine earnings announcement dates for the period before and after accounting irregularities are known to the public. To determine the announcement date, we explored various sources of news releases including Dow Jones and Lexis-Nexis, as well as finance websites such as finance.yahoo.com. We obtained earnings information that could be classified as good or bad news. For our purposes, a good (bad) news announcement is one when actual earnings are higher (lower) than expected by the *Wall Street* analysts. Announcement dates for the period prior to accounting irregularity allegations were identified for good and bad news at least six months before the month that accounting irregularities were known to the public. The corresponding dates for the period after accounting irregularity allegations were the earnings announcement dates following the first month of accounting irregularity allegations.

The sample period surrounding the earnings announcements runs for 31 business days: earnings announcement date, 10 days before, and 20 days after the announcement date. In cases where there were confounding effects of other information that was released near the time of the earnings announcement, we used the next available earnings announcement date. Firms that had announcements of the following events within a 31-day window were presumed to have a confounding effect: dividend changes, stock splits, credit rating changes, lawsuits, and new debt and equity financing. The return data were from the daily CRSP files with dividend adjustments.

<Insert Table 1 here>

Table 1 provides a brief description of accounting irregularity allegations by sample firms. As indicated in the table, the vast majority of irregularity allegations were made in the wake of Enron's collapse of November 2001 and were associated with manipulation of revenue-related items.

2.2 Market Reaction to Earnings Announcements

Since earnings information from a company involved in accounting irregularity allegations may not be credible to investors, it is reasonable that the market may react differently to earnings announcements following irregularity allegations. In this section, we examine market reaction to earnings announcements by analyzing the pattern of post-earnings announcement abnormal returns.

2.2.1 Abnormal Returns

Following Fama et al. (1969), abnormal returns are measured within the conventional market model for out-of-sample tests.[2] That is, we generate abnormal returns from a series of out-of-sample forecasted returns from rolling regressions of a stock's return on the market return, i.e.,

$$AR_{it} = R_{it} - E(R_{it} | R_{mt}) \quad (1)$$

where AR_{it} = the abnormal return for firm *i* at day *t*; R_{it} = the observed return on stock *i* at day *t*; $E(R_{it} | R_{mt})$ = the (out-of-sample) expected return for stock *i* at day *t* conditional on market returns; and R_{mt} = the equally-weighted S&P 500 return at day *t*.[3]

The daily average abnormal return across sample companies, AR_t, is obtained as

$$AR_t = \frac{1}{N}\sum_{i=1}^{N} AR_{it} \quad (2)$$

where N = the total number of sample companies.[4]

<Insert Table 2 here>

Panel A of Table 2 reports the means for daily average abnormal returns before and after accounting irregularity allegations for days *t* = 0 through 20 after the earnings announcement date for sample companies. As expected, the immediate abnormal

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[2] Fama (1998) claims that the market model approach can be preferably used to measure abnormal returns in studying the reaction of stock prices to earnings announcements. It is also suggested that the market model can circumvent the bad model problem in generating expected returns (see, for example, Schwert (1983), Fama and French (1993), and Kothari and Warner (1997)).

[3] Post-announcement expected returns for each company are obtained as follows: first, we initially estimate the intercept and slope coefficient from the regression of $R_{i,t}$ on $R_{m,t}$ using the data set of 100 observations from *t* = -11 to *t* = -110. The estimates of the two parameters will then be used to obtain expected returns for the following date (*t* = -10). Daily expected returns are successively estimated with 100-day moving window for each sample company over 20 days after earnings announcement (*t*=+20). Any confounding events (described earlier) within the 100-day window are excluded from the rolling regression by removing 25 daily observations of returns surrounding the event date (4 days before the event date, the event date, and 20 days after the event date) and adding 25 new observations, thus maintaining a 100-day window.

[4] Loughran and Ritter (2000) claim that equally-weighted approach is more relevant for the traditional event study analysis than value-weighted approach.

performance following earnings announcements is significantly positive (negative) for good (bad) news. The average abnormal return subsequent to the good news announcements is mostly higher than that subsequent to bad news announcements, a result consistent with the findings of Kadiyala and Rau (2004). The absolute values of abnormal returns following bad news announcements are mostly higher than those following good news, implying that post-earnings announcement drift is more evident following bad news. In the period prior to irregularity allegations, post-event abnormal returns show the same sign as the immediate performance over a 3-day event window (t = +1 through +3) but are statistically insignificant, indicating that there is no pronounced short-term drift in post-event abnormal performance. Similarly, post-event abnormal returns over a 20-day event window are all insignificant in the period prior to the irregularity allegations. In the period after irregularity allegations, there is a significant amount of delayed short-term responses of stock returns to earnings announcements for bad news, whereas there is no drift for good news. It appears that after irregularity allegations are made, the market anticipates good news sufficiently with no significant market reaction following the good news while the market underreacts to bad news.

To examine the time-series behavior of abnormal returns, Panel B of Table 2 presents autocorrelations for abnormal returns of sample companies. It shows that the autocorrelation coefficients for the first lag in the period prior to irregularity allegations are significantly positive for good news, implying the presence of speculative inefficiency, i.e., lagged abnormal returns might have contained information about future abnormal returns. The first-order autocorrelation coefficients are smaller and statistically insignificant for other cases. Since the square of the autocorrelation coefficient indicates the extent to which an abnormal return variation can be predictable, the smaller values of autocorrelation coefficients imply that abnormal return variations are difficult to predict for other cases. It follows that abnormal returns have become less predictable for both good and bad news after irregularity allegations are made. This phenomenon is salient for bad news and can be possibly explained by a higher volatility for bad news documented later in this paper. At two or three lags, autocorrelation coefficients are all insignificant, implying no evidence of abnormal return predictability. Similar results can be found from the Ljung-Box Q-statistics for which the null hypothesis is jointly-zero autocorrelation coefficients up to the *n*th lag. The calculated Q-statistics for three and five lags were all insignificant (except for good news before irregularity allegations are made), indicating that time dependence of abnormal returns is trivial.

2.2.2 Cumulative Average Abnormal Returns (CARs)

The cumulative average abnormal return (CAR) over days (-10, 20) is measured as

$$CAR_{-10,t} = \sum_{t=-10}^{+20} AR_t \qquad (3)$$

<Insert Figure 1 here>

Figure 1 plots the CARs over days (-10, +20) around earnings announcement based on the type of news for our sample companies. Up until day -3, the CARs of good news before irregularity allegations hover around zero and then drastically rise, reaching a high of 8.7% on the announcement date. After the announcement date the CARs rise insignificantly until day +7, and subsequently fall. This pattern suggests that there is no statistically significant post-earnings announcement drift for good news in the period prior to irregularity allegations, a result consistent with the findings of the recent literature on stock price reaction to news announcements (see Easterwood and Nutt (1999), Chan (2003), and Taffler et al. (2004)). A similar pattern can be observed for the period following irregularity allegations. The CARs rise insignificantly until day +3 and then fall. What distinguishes between the CARs of good news for two periods of pre- and post-irregularity allegations is that the CARs of good news jump to a lesser extent on the announcement date in the period following irregularity allegations relative to the period prior to irregularity allegations. This indicates that the earnings announcement of good news induces lesser market response in the presence of irregularity allegations.

The lower panel of Figure 1 presents the market response to a bad news earnings announcement. In the period prior to irregularity allegations, the CARs for bad news fall insignificantly until day +3 after the announcement date and then rise. After irregularity allegations are made, the corresponding CARs fall significantly until day +5 after the announcement date, indicating that there is a significant amount of short-term drift after earnings announcements. As opposed to the good news, the bad news remarkably experiences larger market responses in the presence of irregularity allegations.

Taken as a whole, while there is no significant drift after earnings announcements in the period prior to irregularity allegations, there is a significant amount of short-term post-earnings announcement drift for bad news in the period following accounting irregularity allegations. In the presence of accounting irregularity allegations, the magnitude of the market response is relatively small for good news but relatively large for bad news. The positive earnings surprise in the presence of irregularity allegations is presumably discounted by investors as they assess management's credibility as well as future earnings and cash flows.

2.2.3 Firm Size and Leverage Effect on CARs

It is widely known that stock price reactions to an earnings announcement can be affected by the size of the firm (see, for example, O'Brien and Bhushan (1990), El-Gazzar (1998), and Palmrose et al. (2004)) and the level of financial leverage (see, for example, Dhaliwal and Reynolds (1994), Fisher and Verrecchia (1997), Core and Schrand (1999), and Palmrose et al. (2004)). To test for the interactive effect with the firm size and level of financial leverage, we regressed the cumulative average abnormal returns (CARs) of sample companies on the average abnormal return differential between sample firms with high and low market values and the average abnormal return differential between firms with high and low debt-to-equity (D/E) ratios. To form these factors, we ranked all sample firms according to their market values and D/E ratios. We placed 10 sample firms with the highest market values and D/E ratios. Similarly, we placed 10 firms with the lowest market values and D/E ratios. These data were collected from the 10-K or 10-Q that immediately followed the announcement month. The test results are provided in Panel C of Table 2 by good news or bad news announcement type. The values of regression coefficients are small in magnitude and statistically insignificant for all cases, indicating that size and financial leverage are not significantly associated with CARs of our sample companies.

2.2.4 Buy and Hold Average Abnormal Returns (BHARs)

To check the robustness and sensitivity of the CAR measurement metric, we also reran our analyses using buy-and- hold abnormal returns.[5] The buy-and-hold abnormal return is given by:

$$BHAR_{in} = \prod_{t=1}^{n}(1+R_{it}) - \prod_{t=1}^{n}[1+E(R_{it})] \quad (4)$$

<Insert Figure 2 here>

The buy-and-hold average abnormal returns (BHARs) were obtained by averaging buy-and-hold abnormal returns across sample firms. Figure 2 plots the BHARs over days (-10, +20) around earnings announcement based on the type of news. As shown in the figure, results from the BHAR methodology are essentially the same as those from the CAR measurement metric. In the period following irregularity allegations, there is a significant amount of short-term drift with bad news, while there is no significant post-earnings announcement drift for good news. The extent to which the market responds to earnings announcement is smaller for good news but larger for bad news in the period following irregularity allegations.

3. Speed of Adjustment to Earnings Announcements

Many studies have reported evidence that the speed of adjustment to information contained in earnings releases is gradual rather than instantaneous. In this section, we investigate the speed at which markets adjust to earnings announcements in the presence of accounting irregularity allegations.

3.1 Measuring the Adjustment Speed

We consider the standard partial adjustment model for empirical analysis of adjustment speed because it can succinctly capture much of the lagged adjustment to new information. The process is specified as

$$R_{i,t} - R_{i,t-1} = (1-\lambda_i)(R^*_{i,t} - R_{i,t-1}) + u_{i,t}, \qquad 0 \le \lambda_i \le 1 \quad (5)$$

[5] It is often claimed in the literature that BHAR methodology is appropriate as it correctly measures investor experience (see Barber and Lyon (1997)). The main difference between CARs and BHARs come from the compounding effect: BHARs incorporate compounding while CARs do not.

where $R_{i,t}$ is the actual return on stock *i* at time *t*; $R^*_{i,t}$ is the expected rate of return on stock *i* at time *t*; and $u_{i,t}$ is the error term. Equation (5) represents that the change in stock return will respond partially to the difference between the expected rate of return and the past information on the return. This model is similar in spirit to that of Amihud and Mendelson (1987), Damodaran (1993), and Jones and Lipson (1999)). The rate of response is determined by the magnitude of the coefficient of adjustment, λ_i . As λ_i approaches zero (unity), stock returns adjust very rapidly (slowly) to new information.

Let the market model characterize the rate of return expected by investors when new information arrives to the market. Assuming that investors use the market model parameters estimated from previously-released return information to form an expected rate of return, we can consider the following equation for the expected return:

$$R^*_{i,t} = \alpha_i + \beta_i R_{m,t} \qquad (6)$$

where $R_{m,t}$ is the return on market portfolio at time *t*; α_i and β_i are parameter estimates obtained from regressions of $R_{i,t-1}$ on $R_{m,t-1}$.

Substituting equation (6) into equation (5) and rearranging give

$$R_{i,t} - R_{i,t-1} = -(1-\lambda_i)\left[R_{i,t-1} - (\alpha_i + \beta_i R_{m,t})\right] + u_{i,t} \qquad (7)$$

Adding and subtracting $\beta_i R_{m,t-1}$ inside the bracket of equation (7), and rearranging yield the following error-correction-type representation:

$$R_{i,t} - R_{i,t-1} = -(1-\lambda_i)\left[R_{i,t-1} - (\alpha_i + \beta_i R_{m,t-1})\right] + \beta_i(1-\lambda_i)(R_{m,t} - R_{m,t-1}) + u_{i,t} \qquad (8)$$

Equation (8) is estimated with constant term, δ_i , as follows:

$$\Delta R_{i,t} = \delta_i + \theta_i \Phi_{i,t-1} + \gamma_i \Delta R_{m,t} + u_{i,t} \ , \qquad -1 \le \theta_i \le 0 \qquad (9)$$

where $\Delta R_{i,t} = R_{i,t} - R_{i,t-1}$; $\theta_i = -(1-\lambda_i)$; $\Phi_{i,t-1} = R_{i,t-1} - (\alpha_i + \beta_i R_{m,t-1})$; $\gamma_i = \beta_i(1-\lambda_i)$; and $\Delta R_{m,t} = R_{m,t} - R_{m,t-1}$.

As specified, stock returns change in response to the previous period’s deviation from market model equilibrium, the change in market returns, and the stochastic shock. The large (small) negative values of θ_i imply that the change in stock returns is rapidly (slowly) responsive to previous period’s deviation from market model equilibrium. The regression for equation (9) was conducted in two steps. First, time series data of $\Phi_{i,t-1}$ were obtained by residuals from regression of $R_{i,t-1}$ on $R_{m,t-1}$ for each sample firm. Then, time-series estimates of θ_i were estimated using the rolling regression (in the same manner as conducted in abnormal return estimation) within the maximum likelihood method with a constraint of $-1 \le \theta_i \le 0$. The estimator of λ_i is deduced from $\hat{\lambda}_i = 1 + \hat{\theta}_i$.

<Insert Figure 3 here>

The results for cross-sectional average of λ_i are presented as time-series movements in Figure 3. It appears that in the period prior to irregularity allegations, the speed of adjustment in 10-day period following the earnings announcement is slower for bad news than for good news. This indicates that the market responds asymmetrically to good and bad news. Note that the larger the coefficient of adjustment, the slower is the market response to new information. This phenomenon is more salient in the period after irregularity allegations. For example, the estimated coefficient of adjustment at $t = +5$ before irregularity allegations is 0.0624 for good news and 0.0665 for bad news while the corresponding coefficient after irregularity allegations falls to 0.0408 for good news but rises to 0.0772 for bad news. This means that in the period after irregularity allegations, the market responds more rapidly to good news while it responds more slowly to bad news, thus magnifying the asymmetry of adjustment speed between good and bad news. Figure 3 further suggests that the short-term response to bad news is constantly slower than that to good news, regardless of irregularity allegations. This finding, as opposed to classic findings, is consistent with growing body of recent research that the market takes more time to incorporate bad news than good news (see, for example, Womack (1996), Easterwood and Nutt (1999), Hong et al. (2000), Brooks et al. (2003), Chan (2003), and Taffler et al. (2004)).[6]

Figure 3 also reveals that there is no noticeable change in adjustment speed following the good news announcements, whereas there is a sizable slowdown in adjustment speed for bad news, especially after irregularity allegations. This indicates that investors respond to good news with little or no change in the adjustment speed but

[6] In contrast, researchers in the earlier literature claim that the price adjustment to bad news is more rapid than that to good news (see, for example, Jones and Litzenberger (1970), Joy et al. (1977), and Ball (1978)).

take longer time to adjust when the news is bad. As mentioned earlier, this is because good news is sufficiently anticipated while bad news is not.

3.2 Test of Changes in Adjustment Speed

To examine more closely possible changes in adjustment speed in the presence of irregularity allegations, we employed three statistical tests: two nonparametric tests and a parametric *t*-test. The first nonparametric test is the sign test used by Brown and Warner (1980) and has the following test statistic:

$$z = \frac{|P - 0.5| - (0.5/n)}{0.5/\sqrt{n}} \tag{10}$$

where P is the actual proportion of positive changes in adjustment coefficient; and n is the total number of observations. In the sign test for a given sample, the null hypothesis is that the proportion of the adjustment coefficient of bad news being greater than the adjustment coefficient of good news is equal to 50%. The sample pairing procedure for the sign test was as follows: the observation for $t = 0$ of the (cross-sectional) average adjustment coefficient following irregularity allegations was matched with that for $t = 0$ of the average adjustment coefficient before irregularity allegations; the observation for $t = +1$ of the average adjustment coefficient after irregularity allegations was matched with that for $t = +1$ of the average adjustment coefficient before irregularity allegations; and so on until $t = +20$. This procedure provided a total of 21 daily paired-observations for comparisons of good and bad news. The second nonparametric test we used is the Wilcoxon signed rank test under which the null hypothesis is that distributions of adjustment coefficient are the same between the two types of news. We repeated the same test for comparisons of pre- and post-irregularity allegations.

<Insert Table 3>

The results are presented in Table 3. Panel A of Table 3 presents the results of the hypothesis that the adjustment coefficient before/after irregularity allegations are made is greater for bad news than for good news. In the period before irregularity allegations, there is little or no difference in the adjustment coefficient between the good and bad news over a 21-day period. Yet, the corresponding coefficient is significantly different as we observe an 11-day period (the result is not reported here): the adjustment coefficient is greater for bad news than for good news, indicating that the market responds rapidly to good news relative to bad news in the short run.

In the period following irregularity allegations, both the *t*-test and nonparametric tests confirm that the market responds significantly rapidly to good news relative to bad news. For example, Panel A of Table 3 reveals that after irregularity allegations are made, the adjustment coefficient is significantly greater (by an average of 0.024) for bad news than for good news with 100% of the time over a 21-day window. The results indicate that the market responds asymmetrically to good and bad news perhaps because good news is anticipated sufficiently while bad news is not.

Panel B of Table 3 presents the results of the hypothesis that the adjustment coefficient for good/bad news is greater in the period after irregularity allegations than in the period before the allegations. The results reveal that the speed at which the market responds to good news is more rapid in the period after irregularity allegations than in the period before irregularity allegations. On the other hand, investors seem to be significantly slower to react to bad news in the period after irregularity allegations than in the period before the allegations perhaps to ascertain whether there is any new pertinent information about returns.

In sum, the statistical evidence suggests that irregularity allegations lead investors to delay the speed at which they adjust to bad news. The market response becomes significantly more rapid to good news but slower to bad news in the period after irregularity allegations. The asymmetric market response to earnings surprises is more acute after irregularity allegations than before the allegations.

3.3 Volatility and the Adjustment Speed

One body of recent research documents that the post-earnings announcement drift is attributable to arbitrage risk (see, for example, Shleifer and Vishny (1997), Wurgler and Zhuravskaya (2002), and Mendenhall (2004)). As illustrated by these researchers, the major effect of arbitrage is to eliminate the drift but arbitrage may not be fully effective in doing so when stocks are volatile. If arbitrage activity is deterred due to greater stock volatility, the market response to earnings surprise can be delayed. This suggests that stock volatility affects the speed of adjustment to new information. We thus hypothesize that the speed of adjustment to new information is negatively affected by the stock volatility faced by investors. Existing theory suggests that the size of firm and the number of investment analysts have a positive effect on the speed of adjustment (see Lo and MacKinlay (1990), Holden and Subrahmanyam (1992), Foster and Viswanathan (1993), and Brennan et al. (1993)). Our test presents an additional important determinant that should be contained in explaining the speed of adjustment.

3.3.1 Measuring the Volatility

To examine the relationship between the volatility and the speed of adjustment to earnings information, we first measure the time series movement of return volatility around the earnings announcement date. Specifically, the conditional volatility of an individual sample stock is estimated from the time path of residual variance for which individual stock returns are regressed on constants within an exponential GARCH (EGARCH) framework developed by Nelson (1991).[7] The model has an error process that is conditionally heteroskedastic with time-varying variance given by

$$\ln(\sigma_{i,t}^2) = k_0 + k_1(\left|\pi_{i,t-1}\right| - E\left|\pi_{i,t-1}\right| + k_2\left|\pi_{i,t-1}\right|) + k_3 \ln(\sigma_{i,t-1}^2) \qquad (11)$$

where $\sigma_{i,t}^2$ is the conditional variance of residual for return on stock *i* at time *t*; $\pi_{i,t-1}$ is the standardized residual for return on stock *i* at time *t*; k_0, k_1, k_2, and k_3 are parameters.

<Insert Figure 4 here>

The results are presented in Figure 4. The upper panel of Figure 4 reveals that in the period before accounting irregularity allegations, the volatility gradually moves upward for bad news for about 10 days after the earnings announcement date. It thus appears that there exists a post-earnings volatility drift for bad news while there is little or no change in the volatility for good news. In the period following irregularity allegations, the volatility of stock returns steadily increases by a phenomenal magnitude for bad news

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[7] It is widely known that negative stock returns are followed by higher volatility than positive returns of an equal sample size, the so-called asymmetric effect of stock returns (see, for example, Black (1976) and Nelson (1991)). The asymmetric effect of innovation on volatility can be effectively captured by the EGARCH model.

after the earnings announcement date but there is virtually no change in the corresponding volatility for good news. This suggests that the volatility drift for bad news increases greatly after accounting irregularity allegations, while there is no noticeable change in the corresponding drift for good news.

3.3.2 Granger Causality Tests

In order to derive a test for the relationship between the stock return volatility and the speed of adjustment to earnings releases, we performed Granger causality regressions that allowed us to determine whether the volatility affects the adjustment speed or vice versa.[8] We consider the following version of the Granger causality regressions:

$$\lambda_t = a_0 + \sum_{j=1}^{J} b_j \sigma_{t-j} + \sum_{j=1}^{J} c_j \lambda_{t-j} + e_{1,t} \quad (12)$$

$$\sigma_t = a_1 + \sum_{j=1}^{J} d_j \lambda_{t-j} + \sum_{j=1}^{J} g_j \sigma_{t-j} + e_{2,t} \quad (13)$$

where λ_t and σ_t are the daily cross-sectional average of $\lambda_{i,t}$ and $\sigma_{i,t}$. If the volatility does not Granger cause the speed of adjustment, b_j (j=1,2,…,J) should be zero in equation (12). These regressions were fitted with J = 4 as it had the smallest value of Akaike Information Criterion. In running the regressions, the number of data points has expanded to 101 ($t = -50$ to +50) for the causality test and any confounding events were also removed for rolling regressions in the manner as described previously. To avoid a possible spurious regression, we first tested whether the sequences of λ_t and σ_t are stationary using the augmented Dickey-Fuller test. Although the results are not reported here, we found that the null hypothesis that the sequences are non-stationary cannot be accepted at the 5% significance level.

<Insert Table 4 here>

The results of the Granger causality tests are provided in Table 4. The tests for causality running from volatility to adjustment speed (denoted by $\sigma_i \rightarrow \lambda_i$) suggest that

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[8] As a preliminary screening of the relationship between the volatility and the speed of adjustment, we employed a rank-order correlation method. The rank-order correlations between the two variables were 0.87 and 0.94 (p value = 0.02 and 0.01) for bad news and 0.08 and 0.12 (p value = 0.87 and 0.75) for good news, indicating that there is a significant association between volatility and adjustment speed when the news is bad but the two variables are not associated when the news is good.

there is a unidirectional Granger causality running from volatility to adjustment speed when the news is bad, whereas there is no causality when the news is good. For the right half of the table (denoted by $\lambda_i \rightarrow \sigma_i$), there is no evidence that any set of lagged values of adjustment speed Granger causes stock volatility. Finally we note that volatility predicts adjustment speed well but the reverse is not held, as measured by R^2.

In sum, the direction of causality from volatility to adjustment speed is only supported as the news is bad. For good news, there is no causality relation between stock volatility and adjustment speed.

3.3.3 Hypothesis Tests

The relationship between stock volatility and speed of adjustment to earnings surprises is tested only for bad news as the two variables are not associated with each other for good news. As stated earlier, it is already known that the speed of adjustment to new information is positively affected by the size of the firm and the number of investment analysts. Thus, in looking for the effects of the stock volatility on the speed of adjustment we hold these two variables constant. As shown in the previous section, the adjustment speed is significantly delayed for bad news after irregularity allegations are made. In this section, we test whether the speed of adjustment is affected by stock volatility when earnings surprises are negative. It is possible that stock price adjustments due to movements in stock volatility take time, suggesting the inclusion of lagged values of stock volatility. In general the model can be written as

$$\lambda_t = \kappa_0 + \sum_{k=0}^{n} \phi_k \sigma_{t-k} + \eta_t \tag{14}$$

where κ_0 and ϕ_k are parameters to be estimated; and η_t = the error term. Equation (14) is estimated in OLS with White's (1980) heteroskedasticity-consistent covariance matrix. Significantly positive values of the coefficient ϕ_k (k=0,1,2,…,n) indicate that the speed of adjustment to earnings information is delayed due to higher volatility. Note that the greater the estimated values of ϕ_k, the slower is market response to earnings surprises. The regression results for samples of bad news in the period before and after irregularity allegations are presented in Table 5.

<Insert Table 5 here>

Panel A of Table 5 reveals that in regression 1, the parameter estimate of the coefficient on the contemporaneous volatility is positive (0.533) as predicted and significantly different from zero at the 1 percent level. In regressions 2 and 3, the coefficient estimates on the lagged volatility are positive but neither is significantly different from zero. The results suggest that in the period prior to irregularity allegations, the adjustment speed was contemporaneously affected by the stock volatility without any significant lagged effect. On the other hand, Panel B shows that the coefficient estimates for the first lag of stock volatility are all positive (0.223 for regression 1 and 0.221 for regression 2) and statistically significant, indicating that the adjustment speed after irregularity allegations is significantly delayed by contemporaneous and lagged stock volatility as well.

4. Conclusions

This paper investigates how investors behave in the market as earnings information is released by firms with accounting irregularity allegations and how quickly investors adjust to earnings announcements made by these firms. In order to offer any explanation for possible change in the speed of adjustment, we also examine whether stock volatility has any effect on the speed of adjustment. Earnings announcement can be either positive or negative surprise (good or bad news) to the market and both surprises are examined in this paper. For our purposes, a positive (negative) surprise is one when actual earnings are higher (lower) than expected by the *Wall Street* analysts.

We find that in the period before accounting irregularity allegations there is no evidence of post-earnings announcement drift in the market response to earnings releases whether good or bad news. After irregularity allegations are made, the market anticipates good news sufficiently with no significant market reaction following the good news while there is a significant amount of delayed short-term responses to bad news. That is, the earnings surprise induces greater market responses when surprises are negative than they are positive in the presence of irregularity allegations. It appears that good news in the presence of irregularity allegations is discounted by investors as they assess management’s credibility as well as future earnings and cash flows.

Evidence presented in this study indicates that the market response to earnings announcement is more rapid to good news than to bad news. Investors take more time for bad news perhaps to ascertain whether there is any new pertinent information about returns. The asymmetric market response to earnings surprises is significantly more acute after irregularity allegations are made. Investors, facing accounting irregularity allegations, delay the speed at which they adjust to bad news while quickening the speed of adjustment to good news.

We find no relation between stock volatility and the speed of adjustment when the news is good. Yet, when the news is bad, the stock volatility has a significantly negative contemporaneous effect on the speed of adjustment and the effect is significantly lagged in the period following irregularity allegations. Stock volatility appears to deter investors from impounding negative earnings surprises into stock prices. As suggested by past experiences in the stock market, bad news can lead to greater market volatility unless sufficiently anticipated by investors. Empirical evidence presented in this study indicates that the greater volatility arising from bad news leads to slower market responses.

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Table 1
Sample Companies with Accounting Irregularity Allegations

Company name	*Initial time of allegations*	*Allegations of accounting irregularities*
AOL Time Warner	July 2002	Used questionable accounting procedures to inflate advertising fees and sales.
Applied Digital Solutions	April 2002	Lacked proper accounting controls and recognized revenues before sales to customers were complete.
Bristol Myers Squibb	June 2002	Inflate revenues by forcing more inventory on wholesalers than would be sold.
Cendant Corporation	April 1998	Increased reported profit inappropriately by reporting membership fees earlier than the associated costs were amortized.
CMS Energy Corp	May 2002	Overstated revenues using round-trip trades, buying energy from other companies and then selling it back at the same price.
Computer Associates International Inc.	February 2002	Inflated revenue by extending contracts in the middle of the contract term and recording the revenue without writing down the revenue for the period overlapping with the old contract.
Dollar General	April 2001	Unspecified misstatements of income with possibly fraudulent accounting.
Duke Energy	July 2002	Increased revenues by using round-trip energy trades.
El Paso Energy	May 2002	Used round-trip trades to artificially increase trading volume and increase revenues.
Gerber Scientific	April 2002	Overstated earnings by inappropriately writing down inventory or establishing reserves.
Great Atlantic & Pacific Tea Company	May 2002	Used improper inventory accounting and vendor allowances.

Company name	*Initial time of allegations*	*Allegations of accounting irregularities*
Halliburton	May 2002	Included project cost overruns as revenue before customers agreed to pay, and failed to report losses to investors by not writing off disputed bills.
HUB Group	February 2002	Unspecified accounting irregularities in a subsidiary company.
Lucent Technologies Inc.	November 2000	Used revenue recognition policy not generally accepted, resulting in materially overstated revenues and net income.
Merck Co. Inc.	June 2002	Overstated its revenues by reporting copayments made to pharmacies as revenue even though retained by the pharmacy and never paid to Merk.
Microsoft	March 2002	Incorrectly reported unearned revenue thus incorrectly reporting income.
MicroStrategy Inc.	March 2000	Used improper revenue recognition for software sales and service contracts causing overstated revenues and earnings.
PNC Financial Services Group	January 2002	Shifted bad loans and investment losses to off-balance-sheet special purpose entities.
Qualcomm	February 2002	Improperly reported revenue related to equity received from startup companies in exchange for licenses.
Qwest Communications	February 2002	Inflated revenues through capacity swaps and reported revenues from sales of equipment with resultant agreements to purchase services from the equipment buyers using the same equipment.

Company name	*Initial time of allegations*	*Allegations of accounting irregularities*
Rayovac Corp.	April 2001	Created an impression of increased demand for company products by reporting revenues resulting from inducements for customers to take unneeded inventory
Rite Aid	October 1999	Improper accounting practices related to some stores it has closed.
Supervalu	June 2002	Intentionally misstated inventory for at least four years thus overstating income.
Trump Hotels & Casinos	January 2002	Misled investors by reporting pro forma income that departed from generally accepted accounting principle.
Tyco	December 1999	Used accounting methods that misled investors about the growth of acquired companies.
Waste Management, Inc.	November 1997	Improperly recognized revenue and exaggerated assets values.
Williams Companies, Inc	January 2002	Failed to disclosure contingent liabilities and the nature of assets and liabilities of an off-balance sheet special purpose entity.
Xerox	June 2002	Improperly recognized lease revenues, failed to write off bad debts, and improperly classified transactions.

Note that we express the initial time of irregularity allegations in month because it is very difficult to obtain the first date of allegations that is uniformly agreeable among data sources.

Table 2
Summary Statistics of Daily Abnormal Returns After Earnings Announcements

A. Mean (%)

	News	Days after earnings announcement (t)					
		0	+1	+3	+5	+10	+20
Pre-AIA	Good	8.751 (1.39)**	0.453 (1.12)	0.378 (1.16)	0.546 (1.88)	0.140 (1.25)	0.211 (0.66)
	Bad	-8.034 (1.71)**	-1.203 (0.92)	-1.410 (0.84)	-0.882 (1.31)	-1.203 (1.16)	1.491 (1.12)
Post-AIA	Good	6.002 (1.12)**	1.102 (1.02)	0.541 (0.88)	-0.616 (0.82)	-0.235 (0.70)	0.012 (0.36)
	Bad	-14.78 (1.45)**	-2.196 (1.03)*	-1.775 (0.88)*	-0.181 (0.91)	0.778 (1.03)	0.984 (0.64)

AIA represents accounting irregularity allegations.
Numbers in parentheses are (cross-sectional) standard errors.
** (*) represents 1% (5%) significance level.

B. Autocorrelation

AIA	News	ρ_1	ρ_2	ρ_3	Q_3	Q_5
Pre-AIA	Good	0.456*	0.293	0.165	9.38 (0.044)*	16.32 (0.026)*
	Bad	0.258	0.203	0.154	1.75 (0.63)	3.87 (0.52)
Post-AIA	Good	0.284	0.195	0.121	4.00 (0.26)	8.10 (0.15)
	Bad	0.115	0.129	0.142	1.58 (0.66)	5.05 (0.41)

AIA represents accounting irregularity allegations.
Numbers in parenthesis are *p*-values.
* represents 5% significance level.

C. Firm Size and Leverage Effect

The firm size and financial leverage effect on cumulative average abnormal return (CAR) is tested by running the following regression equation:

$$CAR_t \; = \; a + b_1 \Delta AR_t (market\, value) + b_2 \Delta AR_t (D / E\; ratio) + \eta_t$$

where $\Delta AR_t (market\, value)$ = the AR differential between sample firms with high and low market values; $\Delta AR_t (D / E\; ratio)$ = the AR differential between sample firms with high and low D/E ratios.

Estimates	Pre-AIA		Post-AIA	
	Good News	Bad News	Good News	Bad News
a	0.1153 (2.29)*	-0.0421 (-1.12)	0.0278 (1.78)	-0.1551 (-2.31)*
b_1	-0.0235 (-0.48)	-0.0312 (-0.43)	-0.0346 (-0.53)	-0.0236 (-0.36)
b_2	-0.0136 (-0.21)	-0.0326 (-0.56)	0.0094 (0.55)	0.0133 (1.64)

AIA represents accounting irregularity allegations.
Numbers in parentheses are *t*-statistics.
* represents 5% significance level.

Table 3
Tests of Changes in Adjustment Coefficient after Earnings Announcements:

A. Comparison of Good and Bad News

n	AIA	Nonparametric Test			Parametric test	
		% positive	Sign test	Wilcoxon signed rank test	Mean change (%)	*t*-statistic
21	Pre-AIA	71.43	1.75	1.53	0.0001	0.07
21	Post-AIA	100.0	4.36	4.80	0.024	12.12

Note: The pre (post)-AIA in the table indicates that the adjustment coefficient is greater for bad news relative to good news during the pre (post)- irregularity allegations. For a statistical comparison of good and bad news, 21 days (0 to +20) of adjustment coefficient for good news are compared with the identical length of days (0 to +20) of adjustment coefficient for bad news in both periods. The first nonparametric test is the sign test for which *z*-statistics are provided. The second nonparametric test is the Wilcoxon signed rank test of no difference in distributions between good and bad news. The parametric test has the null hypothesis that the difference in mean is zero and *t*-statistic is provided for the significance.

B. Comparison of Pre- and Post-Accounting Irregularity Allegations

n	News	Nonparametric Test			Parametric test	
		% positive	Sign test	Wilcoxon signed rank test	Mean change (%)	*t*-statistic
21	Good	0.00	-4.36	-4.80	-0.017	-16.21
21	Bad	90.48	3.49	3.66	+0.007	4.31

Note: Good (bad) news in the table indicates that the adjustment coefficient of good (bad) news is greater during the post-irregularity allegations relative to the pre-irregularity allegations.

Table 4. Granger Causality Tests

The following Granger causality regressions are run:

$$\lambda_{i,t} = a_0 + \sum_{j=1}^{J} b_j \sigma^2_{i,t-j} + \sum_{j=1}^{J} c_j \lambda_{i,t-j} + e_{1i,t}$$

$$\sigma^2_{i,t} = a_1 + \sum_{j=1}^{J} d_j \lambda_{i,t-j} + \sum_{j=1}^{J} g_j \sigma^2_{i,t-j} + e_{2i,t}$$

These regressions are fitted with J = 4.

AIA	News	$\sigma_i \rightarrow \lambda_i$		$\lambda_i \rightarrow \sigma_i$	
		Adjusted R^2	F(4,88)- statistic	Adjusted R^2	F(4,88)- statistic
Pre-AIA	Good	0.7029	0.8372 (0.505)	0.0449	0.7925 (0.533)
	Bad	0.8951	2.9008 (0.026)*	0.0550	0.5464 (0.702)
Post-AIA	Good	0.8165	1.8849 (0.120)	0.0938	1.5368 (0.198)
	Bad	0.9067	7.4355 (0.000)**	0.0880	1.4917 (0.266)

Figures in parentheses are *p*-values.
* (**) indicates statistical significance at 5% (1%) level.

Table 5. Tests for Relation between Adjustment Speed and Stock Volatility - The Case of Bad News

The model is of the following format:

$$\lambda_t = \kappa_0 + \sum_{k=0}^{n} \phi_k \sigma_{t-k} + \eta_t$$

where λ_t and σ_t are the cross-sectional average of adjustment speed and stock volatility, respectively; and κ_0 and ϕ_k (k=0,1,2,…,n) are parameters to be estimated; and η_t = the error term. Significantly positive values of the coefficient ϕ_k indicate that the speed of adjustment to earnings information is delayed due to higher volatility. Note that the greater the estimated values of ϕ_k, the slower is market response to earnings surprises. White's (1980) heteroskedasticity-consistent covariance matrix is used for the regression.

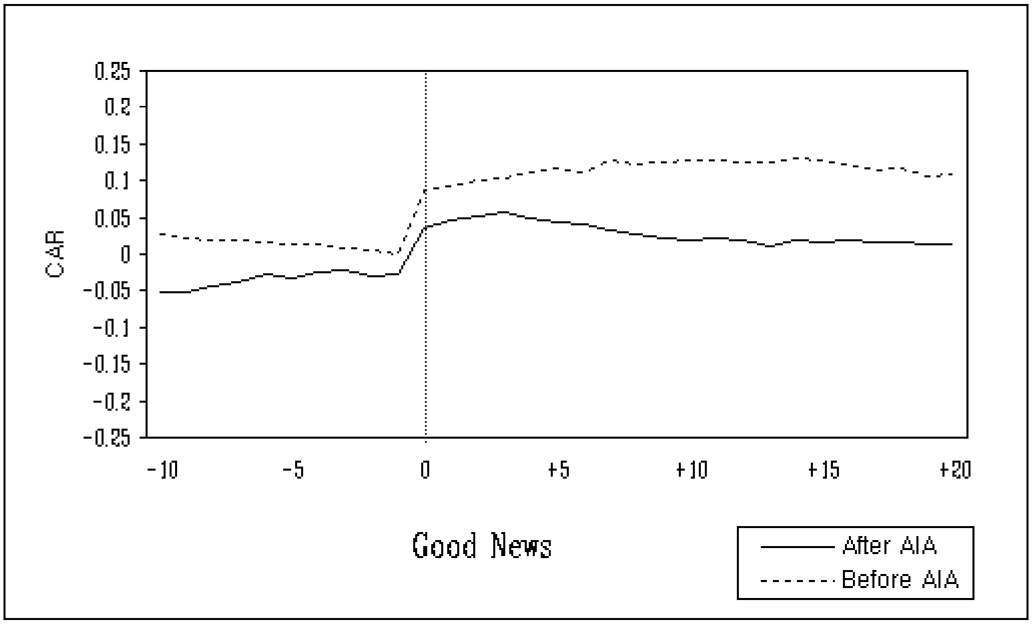
A. Regression Results Before Accounting Irregularity Allegations

Regression	Number of Lags	κ_0	ϕ_0	ϕ_1	ϕ_2	Adjusted R^2
1	n = 0	0.040 (20.02)**	0.533 (6.92)**	-	-	0.307
2	n = 1	0.041 (24.75)**	0.428 (4.36)**	0.103 (0.68)	-	0.352
3	n = 2	0.042 (30.84)**	0.406 (2.44)*	0.082 (0.15)	0.044 (0.06)	0.376

B. Regression Results After Accounting Irregularity Allegations

Regression	Number of Lags	κ_0	ϕ_0	ϕ_1	ϕ_2	Adjusted R^2
1	n = 0	0.041 (33.30)**	0.413 (11.82)**	-	-	0.668
2	n = 1	0.041 (38.76)**	0.206 (3.21)**	0.223 (3.20)**	-	0.687
3	n = 2	0.041 (39.93)**	0.200 (2.62)**	0.221 (2.37)*	0.002 (0.03)	0.695

Figures in parentheses are t-statistics.
* (**) indicates statistical significance at 5% (1%) level.



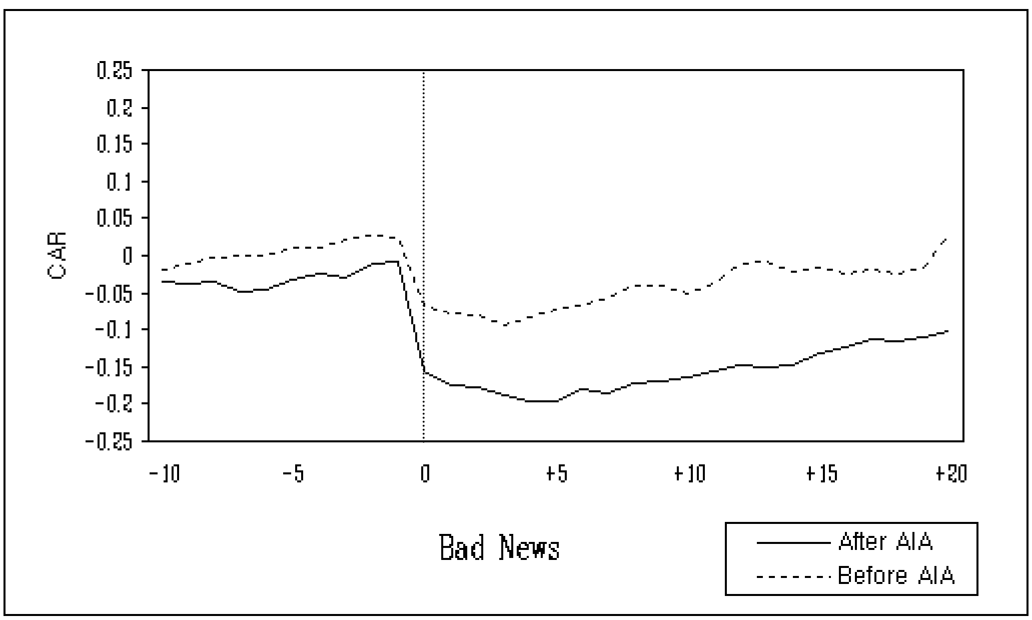
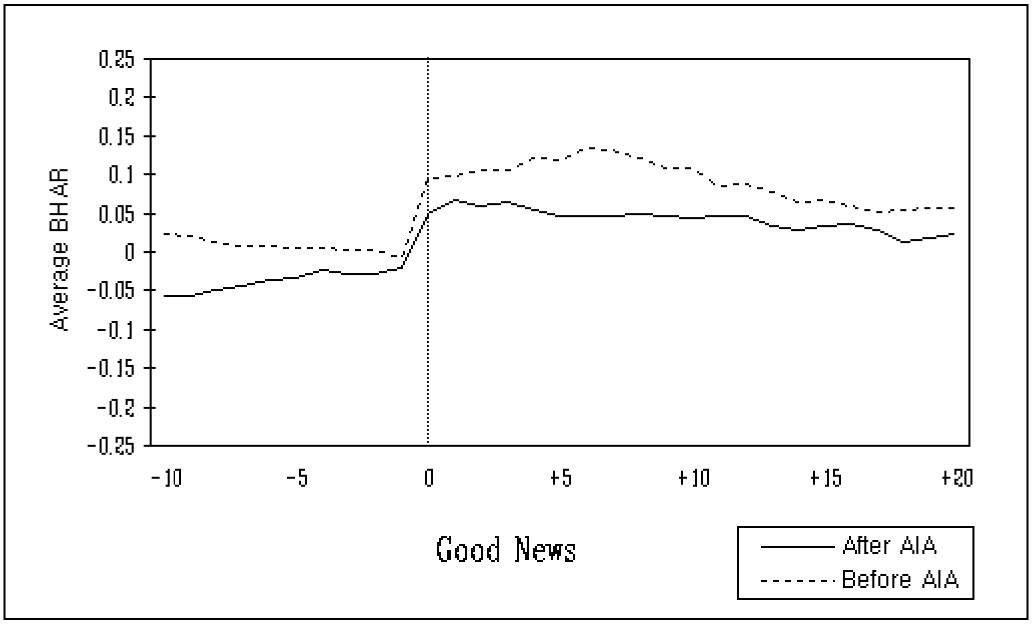


Figure 1. Cumulative Average Abnormal Return



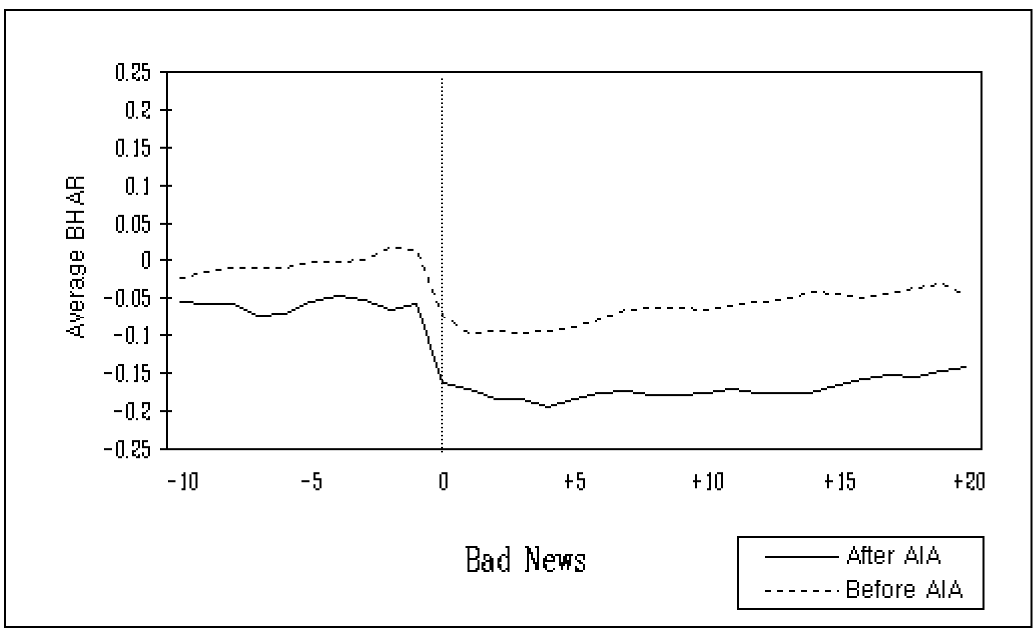
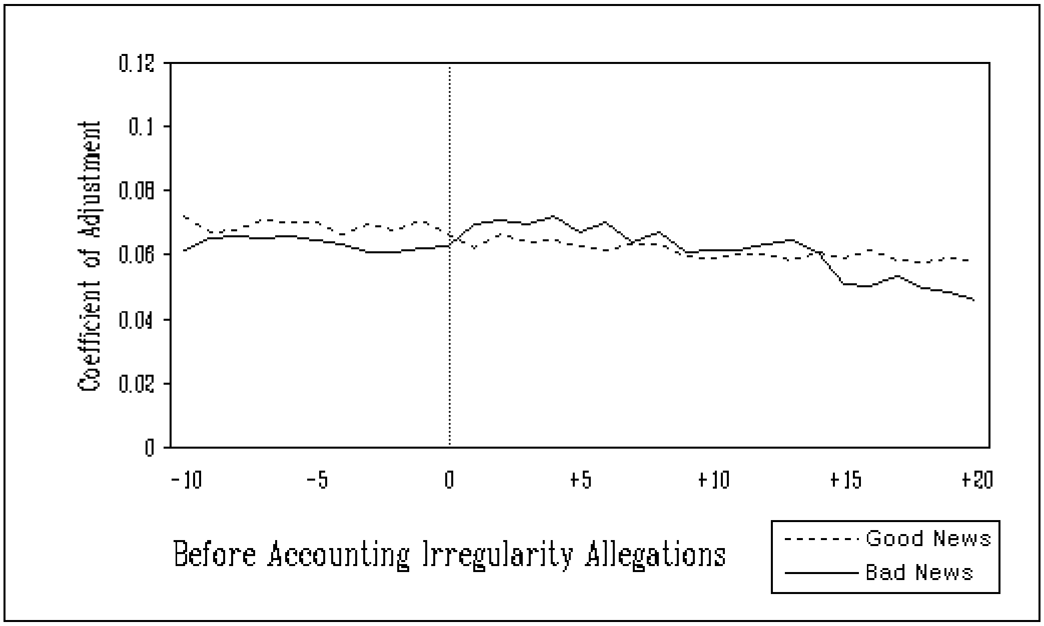


Figure 2. Buy-and-Hold Average Abnormal Return


0.12
0.1
0.08
0.06
0.04
0.02
0
Coefficient of Adjustment
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-5
0
+5
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+15
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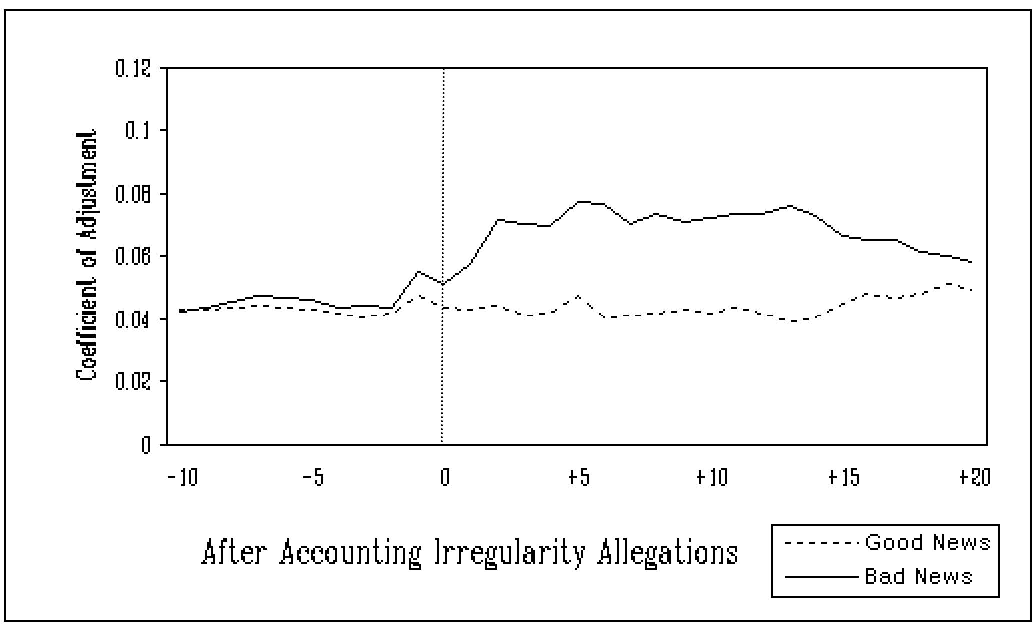
Before Accounting Irregularity Allegations
Good News
Bad News


0.12
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0
Coefficient of Adjustment
-10
-5
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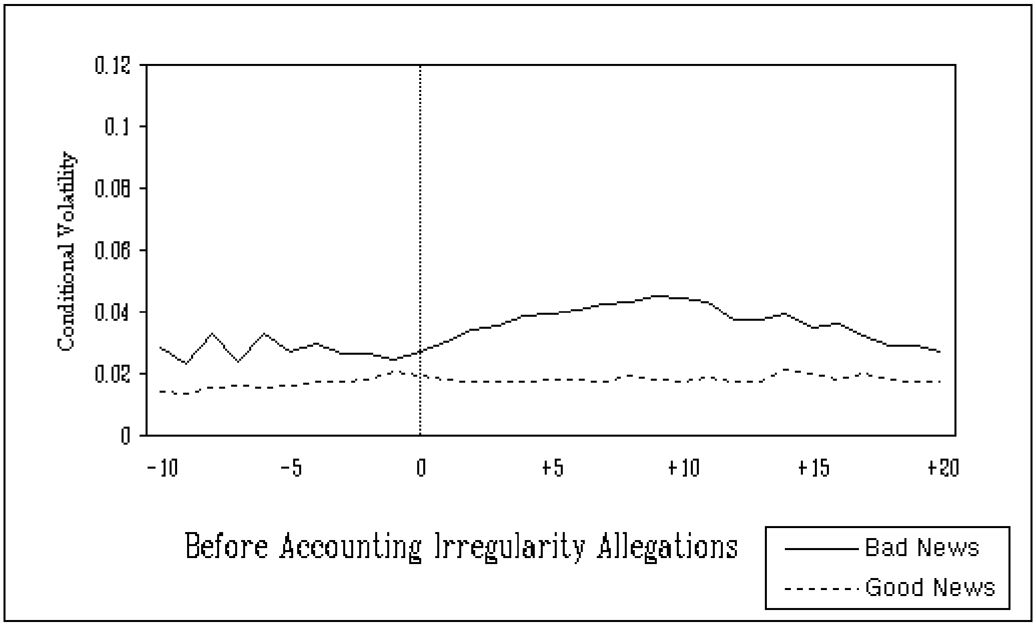
+5
+10
+15
+20
After Accounting Irregularity Allegations
Good News
Bad News

Figure 3. Speed of Adjustment to Earnings Announcement



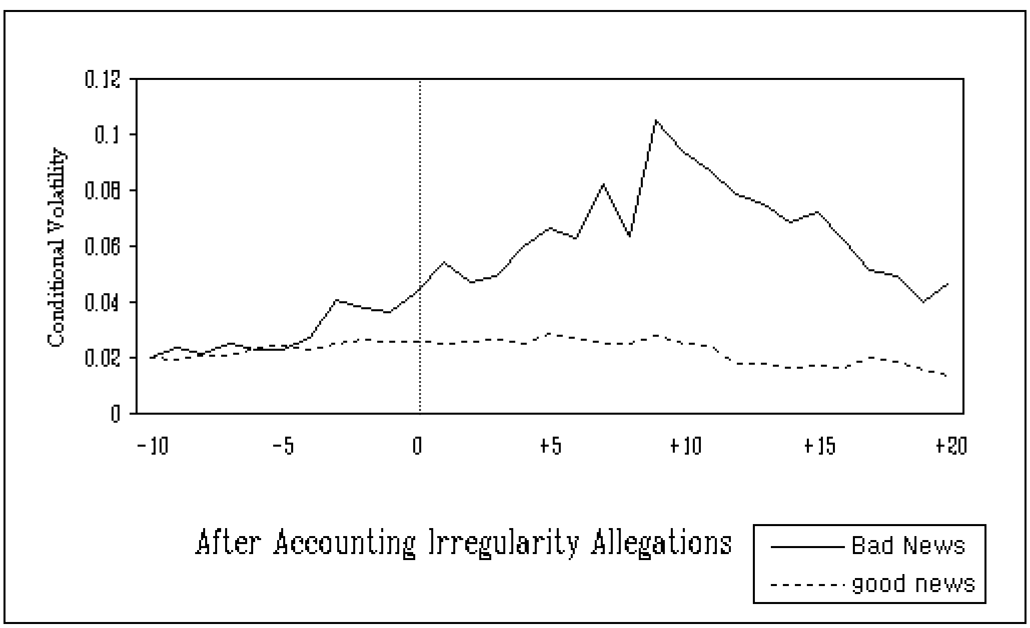


Figure 4. Conditional Volatility of Stock Returns