

Is There Less Informed Trading After Regulation Fair Disclosure?

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Keywords: earnings announcements, informed trading, regulation, summary informativeness

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1. Introduction

Prior to 2001, many companies disclosed important information to a privileged group of securities analysts and investment institutions before issuing a public statement. This form of selective disclosure put ordinary investors at a distinct disadvantage while currying favor with a preferred group of analysts. Regulation Fair Disclosure (Reg FD) was intended to eliminate selective disclosure of private information to securities markets participants. The Securities and Exchange Commission (SEC) passed the regulation on August 10, 2000 and implemented it on October 23, 2000. Since then, firms can no longer selectively disclose material information. And if such a disclosure does occur, the firm is required to issue a public announcement within twenty four hours.

Reg FD was designed by the SEC staff and sold to the Commission as a tool to restore public confidence in US securities markets. The economic significance of the regulation was to be manifest in improved flow of information from corporations to financial markets. Opponents of Reg FD – and there were many, including most corporations, investment banks and the Securities Industry Association – claimed that just the opposite would occur. Reg FD would result in decreased information flow as firms “clammed up” for fear of facing SEC sanctions in the event of an unintended disclosure of material information.

In this study, I use the Hasbrouck (1991a) econometric model and summary informativeness measure to assess the impact of regulatory changes on informed trading in the stock market. Standard t-tests establish a statistically significant decrease in informed trading after Reg FD for every firm in the sample. A comparison of the summary informativeness measure from earnings announcement days to non-

announcement days reveals a decline in informed trading on the second day following the announcement. Regulation bears no incremental impact on this decrease. Panel regression models test and control for the impacts of firm-specific liquidity, time series dependence, day of the week effects, regulatory changes, and earnings announcement effects on the summary informativeness measure. The first result is confirmed by the regression models: there is a significant decrease in summary informativeness following the implementation of Reg FD. However, the change to penny pricing has an approximately thirty-fold greater impact on informed trading. The models also show that regulation exerts minimal impact on informed trading around earnings announcements.

The next section reviews recent empirical studies addressing the impact of Reg FD on information asymmetry during the earnings announcement period. Section 3 outlines the relations between liquidity, information and regulatory changes with emphasis on earnings announcements. Section 4 describes the data and variable construction and presents some preliminary results. Section 5 provides the panel regression models and discusses the results. Section 6 summarizes and concludes the paper.

2. Literature review

Does Reg FD improve information flow as the SEC claims? Or has an information dam hindered the US securities markets since the implementation of Reg FD? This debate has obsessed both academics and practitioners, alike. Several recent studies investigate the impact of Reg FD on information flow. While these studies report the effects of Reg FD on liquidity, trading costs and return volatility, none directly address the effect of regulatory change on trade informativeness.

The very concept of information flow requires some market participants to have more or better information than others. This information asymmetry results in increased trading costs and decreased liquidity as liquidity traders seek to protect themselves from traders with superior information. For example, Lee, Mucklow, and Ready (1993) show quoted spreads widen and quoted depths decrease during periods of perceived greater information asymmetry. Spread decomposition methods attempt to discern the adverse selection component of the spread attributable to asymmetric information.

Chiyachantana, Jiang, Taechapiroontong, and Wood (2004) report improved liquidity, with lower spreads, larger depths and reduced adverse selection costs during the post Reg FD pre earnings announcement period. Eleswarapu, Thompson, and Venkataraman (2004) also employ a spread decomposition methodology to measure trading costs and find that information asymmetry has decreased after Reg FD, especially for small stocks.

Spread decomposition can be an inaccurate method for calculating adverse selection costs (Van Ness, Van Ness, and Warr, 2002). Mathew, Michayluk, and Kofman (2002) employ activity-based measures of spreads and depths and find decreased liquidity after Reg FD. Straser (2002) avoids the vagaries of spread decomposition by employing a specific market microstructure model (the Easley, Kiefer, O'Hara, and Paperman (1996) model) to measure the proportion of informed traders for a select group of New York Stock Exchange stocks during a 146 day period centered on the Reg FD implementation date and finds that the proportion of informed traders decreased after Reg FD. Straser's results are suggestive: any attempt to discern the impact of regulation on market behavior during the earnings announcement period must control for the overall impact of the regulation on market behavior for the entire period.

Return volatility and abnormal trading volume are often proposed as proxies for total information flow.¹ Eleswarapu, et al. find no significant change in stock price variance during earnings announcement periods after Reg FD. Heflin, Subramanyam, and Zhang (2001) report increased volatility during earnings announcement periods post Reg FD, but attribute it to factors other than the enforcement of Reg FD. Mathew, Hughen, and Ragan (2004) report a temporary increase in volatility following Reg FD and attribute this transience to decimalization. After controlling for the impact of decimalization, Bailey, Li, Mao, and Zhong (2003) find no significant change in volatility around earnings announcements during the post Reg FD era.² Taken together, these studies suggest that any change in volatility during earnings announcement periods after the implementation of Reg FD is due to something other than enforcement of fair disclosure.

Earnings announcements present the financial researcher with an excellent opportunity to study the behavior of informed traders. Information announcements – including earnings announcements – compel investors to reevaluate their perceptions of company valuations and adjust their portfolios accordingly. Announcements often contain significant information other than the earnings number. For example, forward-looking statements regarding operations are often made during conference calls with analysts. Investors who possess superior information are afforded the opportunity to trade on this information before its dissemination to the public. Announcement dates and

¹ Practitioners argued that infrequent but concentrated information releases would result in large price swings when inexperienced investors over-react to the news and originally pointed to increased return variance as an indication of the unintended consequences of regulation. Theoretical justification for the linkage between volume, volatility and information flow is the Mixture of Distributions Hypothesis of Clark (1973) and Tauchen and Pitts (1983).

² Bailey, et al. report a significant increase in trading volume during the earnings announcement period after Reg FD and attribute it to differences in opinion.

times are published in advance, enabling informed investors to devise appropriate trading strategies to maximize their information advantage.

While most previous research focuses on earnings announcements, none attempts to directly address the most important question: Is there really less informed trading after Regulation Fair Disclosure? Straser measures information asymmetry within a well-specified microstructure model, thereby providing a proportion of informed traders, but fails to focus on earnings announcements. Moreover, reliance on any one stylized market microstructure model could yield model-dependent results. This study employs an econometric model that is not dependent on any particular microstructure theory to discern the level of informed trading.

The Hasbrouck Vector Autoregression (VAR) model has traditionally been utilized as one of several approaches to quantify the level of asymmetric information in the equity market.³ I chose this approach for two reasons. First, stock price variance can be decomposed into trade-related (i.e., informed) and trade-unrelated (uninformed) components. Second, the permanent price impact of signed equity trades can be determined, providing additional insight into whether the unanticipated component of signed equity trades contains any information about subsequent equity prices (i.e., the trades are informed). Most spread decomposition models attribute the adverse selection component to perceived informed trading. But, the adverse selection component also depends on inventory costs, market making costs, and the market power of the specialist. Additionally, adverse selection costs are positively related to total return variance (Hasbrouck, 1991a). Unlike most spread decomposition models the summary informativeness measure of stock trades takes into account the current and lagged impact

³ The others are the spread decomposition and Bayesian models discussed above.

of stock trades on stock returns while ascribing a portion of total stock return variance to informed trades. And, the variance decomposition methodology is consistent with a variety of securities market microstructure models.

3. Liquidity, information and regulation

The objective of this study is to measure firm-level informed trading and liquidity during the earnings announcement period relative to the non-announcement period and then test for the impact of regulation on these measures. Hasbrouck's (1991a) summary informativeness statistic provides a measure of informed trading. Heflin and Shaw's (2004) relative depth statistic serves two purposes. First, it serves as a proxy for firm-level liquidity. And, since relative depth is a function of both quoted depth and trade size, it controls for changes in other market-wide influences such as time-varying specialist risk-aversion. If Reg FD successfully reduces information asymmetry then informed trading should decline and liquidity should improve. Since Reg FD primarily concerns information flow from firms to analysts (and then to the market), any improvement in market quality should be revealed during the earnings announcement period when information asymmetry is expected to be more prominent (Kim and Verrecchia, 1994). The remainder of this section outlines possible regulatory influences on the proposed liquidity and informed trading measures during the earnings announcement period.

Proponents of Reg FD argue that prior to enactment of the regulation corporations supplied preferred analysts with early access to material information regarding the future performance of the firm. In turn, analysts passed the information along to favored

institutional customers and in-house proprietary traders. The resulting slow leak of private information into the market at the firm's direction put liquidity suppliers, such as retail traders, limit order traders, and possibly the specialist, at a disadvantage. To counter a perceived increased probability of trading with an informed trader, the specialist could increase the bid-ask spread, decrease the number of shares available at the quoted prices, or both. Other liquidity suppliers could also decrease the number of shares per limit price or set limit prices further away from the specialist quote, or both. However, if private information is expected to exert substantial influence on future prices, an informed trader would willingly break up his trade, hitting the quoted depth and perhaps several of the limits. The result is a series of trades that are correlated with future stock returns and an increase in the Hasbrouck summary informativeness measure for that stock on that day. If Reg FD is enforced, then there should be no preferential access to private information. Liquidity should improve with fewer trades hitting the quoted depth and informed trading should decline subsequent to the regulation.

HYPOTHESIS 1. Informed trading is significantly lower after implementation of Regulation Fair Disclosure than before.

HYPOTHESIS 2. Trade size relative to quoted depth is significantly lower after implementation of Regulation Fair Disclosure.

If Reg FD prohibits the selective release of material information regarding firm performance, then this information becomes concentrated on the earnings announcement day. Several possible empirical effects obtain. First, prior to Reg FD, informed trading could be higher than normal during the one or two days prior to the announcement because analysts apply more pressure on firms to supply guidance. Second, after Reg

FD, informed trading could be higher during preannouncement due to increased diligence on the part of analysts to independently discern private information or because there is a lack of enforcement.

HYPOTHESIS 3A. In the pre Regulation Fair Disclosure era, there is more informed trading during the pre earnings announcement period relative to the non-announcement period.

HYPOTHESIS 3B. Following the implementation of Regulation Fair Disclosure, there is more informed trading during the pre earnings announcement period relative to the non-announcement period.

Most firms schedule earnings announcements and associated conference calls during hours when the market is closed. If material private information is disclosed at this time, then the price change will be reflected in the opening price as the specialist clears the market via the auction process. However, there will be no informed trading unless there is a difference in public information processing ability among market participants (Kim and Verrecchia, 1994). If the proponents of Reg FD are correct, then there should be no new information released in the earnings announcement during the pre Reg FD era. That is, all worthwhile information will be disseminated to a few select analysts before the announcement and conference call. Therefore, there should be no significant change, or perhaps a decline in informed trading after the earnings announcement. However, if compliance with Reg FD results in material information being concentrated in the earnings announcement and associated call, then the presence of superior public information processors should result in increased informed trading after the earnings announcement in the post Reg FD era.

HYPOTHESIS 4A. *In the pre Regulation Fair Disclosure era, there is either no change or a decline in informed trading during the post earnings announcement period relative to the non-announcement period.*

HYPOTHESIS 4B. *Following the implementation of Regulation Fair Disclosure, informed trading increases during the post earnings announcement period relative to the non-announcement period.*

4. Data and variables

The sample period is centered on the Reg FD implementation date and ranges from August 1, 1999 to January 31, 2002. Stock transaction data for this study, including quotes with time stamps as well as trades with time stamps and volume, are extracted from the NYSE's Transactions and Quotes Database. The initial sample consists of NYSE listed stocks in the S&P 100. Firms were eliminated if IBES did not report accurate earnings announcement dates or if there was a major corporate event such as a merger or acquisition during the sample period, resulting in a final sample of 82 NYSE listed large capitalization firms. While testing the impact of Reg FD on small firms might be interesting, I do not apply the Hasbrouck model to small firms for several reasons. First, the VAR/VMA model requires at least 20 trades per day for estimation and considerably more than 20 trades per day for reliable inference.⁴ Second, many small firms stopped reporting immediately after Reg FD for fear of running afoul of the regulation. The regression models presented in Section 5 require firms that had

⁴ Eleswarapu, et al. (2004) report that small firms had an average of 12 to 29 trades per day (Table 1). The relative economic value of the impact of Reg FD on small firms is questionable. In the Eleswarapu, et al. study, small firms accounted for 1.6 to 1.65 percent of the trades and 0.28 to 0.86% of the market capitalization of the entire sample.

identifiable earnings announcements outside of trading hours for every quarter in the sample period.

The summary informativeness measure is calculated for each firm and each day following Hasbrouck (1991a, 1991b). Returns are calculated from consecutive log quote midpoints. Stock trades are classified with the midpoint rule of Lee and Ready (1991). A stock trade is classified as a buy if the transaction price is above the quoted midpoint, a sell if the transaction price is below the quoted midpoint and as indeterminate if the transaction price is equal to the quoted midpoint.⁵ For each trade, stock volume (in round lots) is signed by matching trade price with a quote that occurred at least 5 seconds before the trade. Trades occurring within five seconds of each other with no intervening quote are batched and the volume cumulated. The first transaction of the day is dropped. Also, all transactions occurring after 4:00 p.m. are omitted. Dropping the first transaction of the trading day avoids data generated by the opening procedure employed by the specialist. This procedure is more closely associated with a call market, while the remaining trades of the day occur in a continuous market. The VAR is estimated using ten lags of the variables and the vector moving average with twenty lags. Both are estimated by ordinary least squares regression. The average daily summary informativeness statistic ranges from 11.15% (LTD) to 23.96% (C). Figure 1 presents a representative distribution and Figure 2 provides a time series plot.⁶

The liquidity measure for this study is the relative depth statistic of Heflin and Shaw (2004). Each signed trade is scaled by the depth on the appropriate side of the quote:

⁵ I do not employ the “tick test” suggested by Lee and Ready (1991). Trades that are at the midquote are considered uninformed crossed trades.

⁶ Firm-level summary statistics for the summary informativeness and relative depth measures are available at <http://www.huizenga.nova.edu/collver/documents/RegFDtables.pdf>.

trade volume for stock sales is matched with the bid depth and stock purchases with the ask depth. Following Heflin and Shaw, trades with volume exceeding the depth on the appropriate side of the quote are considered upstairs trades and are excluded from the liquidity measure. The resulting statistic ranges from -1 to 1 for each eligible trade, with values near the extremes indicating lower liquidity and values below 0 indicating a preponderance of public sell orders. The daily average relative depth measure ranges from -0.94% (T) to 4.34% (LEH). Figure 3 presents a representative distribution and Figure 4 a time series plot.

4.1. Preliminary tests

It is necessary to assess the impact of Reg FD on the daily firm-level summary informativeness and relative depth measures for the entire sample before attempting to discern any differential impact during earnings announcements. Standard t-tests measure the significance of changes in the mean firm-level summary informativeness and relative depth measures.⁷ For every firm in the sample, the average daily summary informativeness measure is lower in the post Reg FD period than in the pre Reg FD period, and, with the exception of HAL, the difference is statistically significant. The decline in informed trading after the fourth quarter of 2000 is also apparent in Figure 2. These results provide some evidence in support of Hypothesis 1: informed trading is significantly lower in the post Reg FD period.

The impact of Reg FD on relative depth is less substantial. For exactly half of the firms in the sample, the mean absolute value of the daily relative depth is greater in the post Reg FD period, and only twenty-five of the differences are significant at standard

⁷ Firm-level comparisons of the pre versus post Reg FD summary informativeness measures and relative depth measures as well as the associated t-statistics are available at <http://www.huizenga.nova.edu/collver/documents/RegFDtables.pdf>.

levels. For the other half of the sample, one firm (FDX) exhibited no change in the mean absolute value of the daily relative depth and eighteen of the remaining forty firms showed a statistically significant decline in the relative depth measure. While Reg FD seems to impact liquidity, as measured by the absolute value of the mean daily relative depth, the direction of the impact appears to be firm specific. These results provide little overall support for Hypothesis 2: when the difference in trade size relative to quoted depth is statistically significant, it is firm specific. This suggests that relative depth should control for changes in time varying firm-specific liquidity that are unrelated to Reg FD.

The initial tests of the impact of Reg FD on informed trading and liquidity provide some interesting insights with respect to previous work. First, the relative depth measure (theoretically) uses only the quotes that are associated with “downstairs” trades. All other quotes are ignored. When this proxy for actual liquidity at the time of the trade is employed, the impact of Reg FD on liquidity is equivocal. Chiyachantana et al. (2004) and Eleswarapu et al. (2004) both report improved liquidity post Reg FD. Mathew et al. (2002) find the opposite with their activity-based liquidity measures. Overall, the results of this study, in combination with past research, suggest that while liquidity proxies may measure perceived probabilities of informed trading, they can be poor measures of actual information flow in the financial markets. Second, average daily informed trading, as measured by the summary informativeness measure, declined post Reg FD. By definition, the averages are a function of each day in the sample period, not merely the earnings announcement period. Almost all previous research seeks to compare market behavior around earnings announcements in the pre vs. post Reg FD trading environment

without controlling for the overall impact of the regulation on market behavior for *every* trading day.⁸ As a result, the impact of regulation on market behavior for any random day in the sample may be inappropriately ascribed to regulatory impact on earnings announcements periods.

4.2. Earnings announcement tests

The earnings announcement window is defined as the day of the announcement (day 0), two days before the announcement (day-2 and day-1) and two days after the announcement (day+1 and day+2). The preliminary tests show significantly lower summary informativeness measures in the post Reg FD period for nearly every firm. To control for the overall impact of Reg FD on informed trading during the earnings announcement period, the firm-level period-specific (pre vs. post Reg FD) daily mean is subtracted from the summary informativeness measure calculated for each announcement window day. The result is a set of demeaned summary informativeness measures for each firm-announcement day in both the pre and post Reg FD time period. The mean absolute value of the relative depth measure receives similar treatment.

The tabular results of this treatment and tests for announcement window differences in the pre vs. post Reg FD period are available on the author's website. Eleven firms exhibit statistically significant (at 10%) differences in average demeaned announcement window summary informativeness and one additional firm shows a significant difference at the 5% level. Of these twelve firms, nine firms show an increase in summary informativeness after Reg FD. Thirteen firms exhibit statistically significant differences in demeaned announcement window relative depth, with seven showing an increase in demeaned relative depth (decreased liquidity) post Reg FD. After controlling for the

⁸ The Eleswarapu et al. (2004) study is an exception.

general impact of Reg FD on daily summary informativeness and relative depth, the impact of the regulation on these measures during the announcement period is mostly insignificant.

There are several plausible explanations for the observed lack of impact of Reg FD on summary informativeness and liquidity during the earnings announcement window. For example, summary informativeness (or liquidity) could be abnormally high on earnings announcement days in both periods, with a minimal difference between periods after controlling for regulatory impact. To test for this possibility, the daily summary informativeness and relative depth measures from the earnings announcement window are compared to their respective firm-specific empirical distributions for each period, pre vs. post Reg FD. The sample is limited to those firms with an identifiable earnings announcement outside normal trading hours for every quarterly announcement in the sample period.⁹ While the test should generally be considered descriptive, it does have the benefit of not relying on a particular distribution assumption. For example, if informed trading in IBM is significantly higher during the pre-earnings announcement window, then the summary informativeness measures for those days should be in the 95th percentile of the entire distribution of summary informativeness for IBM.

Table 1 presents some summary results from this analysis.¹⁰ During the pre Reg FD period, the summary informativeness measures for the two days prior to and one day after the announcement day appear to be slightly larger than would be expected if the earnings day measures occurred randomly throughout the empirical distribution, while the day+2

⁹ There are 10 quarterly announcements for each firm. The firm is included in the sample if all ten announcements were reported by the Dow Jones News Service or PR Newswire before 9:30 am or after 4:00 pm Eastern. Forty-nine firms met this criterion.

¹⁰ The empirical distributions for each measure and each firm are available upon request.

summary informativeness measures appear to be considerably lower than expected. In the post Reg FD period, the earnings announcement day summary informativeness measures appear in the top 90th and 95th percentiles with similar frequencies. These results suggest that *after* controlling for the impact of Reg FD on the entire empirical distribution of summary informativeness measures there is no change in informed trading in the pre vs. post Reg FD earnings announcement windows.

The proportion of relative depth measures from the earnings announcement window that fall in the 5th and 10th percentile is little changed in the post Reg FD period. The proportion of relative depth measures from the earnings announcement window that fall in the 95th and 90th percentile is slightly lower in the post Reg FD period. Interestingly, a higher than expected proportion of relative depth measures fall in the 90th and 95th percentile during the post announcement period in both the pre Reg FD and post Reg FD samples. Overall, the relative depth measure is more likely to fall in the upper tail of the distribution on post announcement days. These results suggest that liquidity deteriorates during the two days following an earnings announcement, and this deterioration is unaffected by regulatory change.

5. Regression models

The distribution results of the previous section are best viewed as descriptive. Several pooled cross section regressions test the incremental impact of regulation, firm-specific liquidity and earnings announcement window effects on the level of informed trading. All of the models control for individual fixed effects, individual AR(1)

components and day of the week effects.¹¹ Additionally, each model provides pooled estimates for the impact of firm-level liquidity and earnings announcement day effects. The models are estimated by generalized least squares with the weighting matrix correcting for both cross-section heteroscedasticity and contemporaneous correlation. Due to the presence of individual AR(1) components, the coefficients and matrix weights are sequentially iterated until convergence. The standard errors are corrected for cross-section heteroscedasticity and contemporaneous correlation with a White-type standard error correction (White, 1980 and Wooldridge, 2002).

The baseline model (Model 1) has the following form:

$$\begin{aligned}
 SI_{i,t} = & \alpha + \beta_1 AbsRD_{i,t} + \beta_2 NegRD_{i,t} + \beta_3 Monday_t + \gamma_i SI_{i,t-1} + \delta_1 Day-2_{i,t} \\
 & + \delta_2 Day-1_{i,t} + \delta_3 Day+1_{i,t} + \delta_4 Day+2_{i,t} + \mu_i + \varepsilon_{i,t}
 \end{aligned} \tag{1}$$

where $SI_{i,t}$ is the daily summary informativeness measure for each firm i and day t ; $AbsRD_{i,t}$ is the absolute value of the relative depth measure for each firm i and day t ; $NegRD_{i,t}$ is the absolute value of the relative depth measure for each firm i and day t when relative depth is negative; $Monday_t$ is an indicator; $Day-2_{i,t}$, $Day-1_{i,t}$, $Day+1_{i,t}$, $Day+2_{i,t}$ are announcement window day indicators; and μ_i is the individual firm fixed effect in excess of α . $AbsRD$ controls for firm-specific time-varying liquidity. For example, stocks in the S&P 100 are managed by several different specialist groups on the NYSE, each of whom could display divergent and time varying levels of risk aversion. Additionally, there are a variety of other non-earnings related news announcements that could systematically affect liquidity in all stocks. $NegRD$ takes on the value of $AbsRD$

¹¹ The fixed effects model controls for differences across firms and specialists that remain stable over time. However, the model does not control for time varying effects such as changing macroeconomic or microstructure conditions. The liquidity variables are expected to proxy for these time varying influences.

only if the raw relative depth measure is negative. On days when average relative depth is negative, the preponderance of trades occur near the bid. It is more likely that the specialist is building inventory during a period of falling prices, while discretionary liquidity providers back away. NegRD allows for assessment of the impact of liquidity on informed trading when prices are falling. As such, β_2 measures the incremental impact of relative depth on summary informativeness when daily average relative depth is negative.

Table 2 reports the regression results for the baseline model.¹² β_1 is negative and significant, suggesting that an increase in relative depth (decrease in liquidity) is associated with decreased informed trading. β_2 is equal to β_1 , but opposite in sign, indicating that the positive relation between liquidity and informed trading holds only when relative depth is positive. The Monday indicator is positive, marginally significant and on the scale of the individual effects, suggesting increased informed trading on the first day of the week.¹³ The Day+2 indicator is negative and significant, signifying a decrease in informed trading on the second day following the earnings announcement.

To test for the incremental impact of Reg FD on summary informativeness an indicator variable for the post Reg FD period is included in the regression model. Interaction terms allow for testing of the incremental impact of liquidity and earnings announcement window days on informed trading. The Reg FD model (Model 2) takes the following form:

$$SI_{i,t} = \alpha + \beta_1 AbsRD_{i,t} + \beta_2 NegRD_{i,t} + \beta_3 Monday_t + \gamma_i SI_{i,t-1} + \delta_1 Day-2_{i,t}$$

¹² The individual fixed effects and AR(1) coefficients are not presented in Table 2, but are available upon request.

¹³ None of the other days of the week were significant in any of the models.

$$\begin{aligned}
& + \delta_2 \text{Day-1}_{i,t} + \delta_3 \text{Day+1}_{i,t} + \delta_4 \text{Day+2}_{i,t} + \text{FD} * (\alpha_{\text{FD}} + \beta_{\text{FD},1} \text{AbsRD}_{i,t} + \\
& \beta_{\text{FD},2} \text{NegRD}_{i,t} + \delta_{\text{FD},1} \text{Day-2}_{i,t} + \delta_{\text{FD},2} \text{Day-1}_{i,t} + \delta_{\text{FD},3} \text{Day+1}_{i,t} \\
& + \delta_{\text{FD},4} \text{Day+2}_{i,t}) + \mu_i + \varepsilon_{i,t} \tag{2}
\end{aligned}$$

where α_{FD} picks up the incremental impact of Reg FD on summary informativeness; the $\beta_{\text{FD},i}$ account for the incremental impact of liquidity on summary informativeness in the post Reg FD period; and the $\delta_{\text{FD},i}$ transmit the incremental impact of the earnings announcement days on summary informativeness in the post Reg FD period.

Table 2 presents the estimation results for Model 2. The baseline results remain essentially unchanged: β_1 is negative and significant; β_2 is similar in size to and opposite β_1 ; the Monday indicator is positive; and the Day+2 indicator (δ_4) is negative and significant, but larger than the baseline model estimate. The Reg FD indicator is negative and significant at the 1% level, suggesting that Reg FD does reduce informed trading. $\beta_{\text{FD},1}$ is positive and significant and nearly as large as β_1 . Liquidity appears to exert a significantly lower impact on informed trading in the post Reg FD period. Decreased liquidity is associated with decreased informed trading but the relation is considerably weaker after implementation of Reg FD. $\beta_{\text{FD},2}$ is negative and significant, suggesting an attenuating effect of liquidity on informed trading when relative depth is negative. The sum of the four β coefficients is -0.0736. Overall, liquidity exerts a considerably larger impact on informed trading when relative depth is negative. None of the $\delta_{\text{FD},i}$ are significant suggesting that Reg FD exerts negligible incremental impact on earnings window summary informativeness.

The estimates from Model 2 appear to support Hypothesis 1 and Hypothesis 4a. Informed trading decreases after Reg FD, but after controlling for this overall influence,

there appears to be no change in informed trading on earnings announcement days. The large negative estimate for δ_4 and statistically insignificant estimate for $\delta_{FD,4}$ suggests that the decline in informed trading post earnings announcement is not influenced by implementation of Reg FD.

It is possible that the effects on informed trading attributed to Reg FD could also be due to another SEC regulation: the switch to penny pricing on the NYSE. Some previous research attempts to control for the impact of decimalization on information asymmetry before attributing any specific causal effects solely to Reg FD. For example, Bailey et al. (2003) include a decimal dummy in their volatility regressions and Eleswarapu et al. (2004) include a decimal regime in their trading costs regressions. This study follows more closely the method of Bailey et al. (2003). A decimalization indicator variable is constructed for each firm in the sample. Most firms were switched to penny pricing on January 29, 2001. Two firms in this sample switched on September 25, 2000: CI and CL. The Decimalization model (Model 3) takes the following form:

$$\begin{aligned}
SI_{i,t} = & \alpha + \beta_1 AbsRD_{i,t} + \beta_2 NegRD_{i,t} + \beta_3 Monday_t + \gamma_i SI_{i,t-1} + \delta_1 Day-2_{i,t} \\
& + \delta_2 Day-1_{i,t} + \delta_3 Day+1_{i,t} + \delta_4 Day+2_{i,t} + DEC * (\alpha_{DEC} + \beta_{DEC,1} AbsRD_{i,t} + \\
& \beta_{DEC,2} NegRD_{i,t} + \delta_{DEC,1} Day-2_{i,t} + \delta_{DEC,2} Day-1_{i,t} + \delta_{DEC,3} Day+1_{i,t} + \\
& \delta_{DEC,4} Day+2_{i,t}) + \mu_i + \varepsilon_{i,t}
\end{aligned} \tag{3}$$

where α_{DEC} picks up the incremental impact of decimalization on summary informativeness and the other parameters transmit the appropriate incremental effects. For example, the $\delta_{DEC,i}$ transmit the incremental impact of the earnings announcement days on summary informativeness in the post decimalization period.

Table 2 presents the estimation results for Model 3. The baseline (pre regulation) results remain essentially unchanged from Model 2. This is not particularly surprising since Reg FD and penny pricing were implemented within a few months of each other. The Decimal indicator is negative and significant at the 1% level, suggesting that decimalization may explain the reduction in informed trading in the post Reg FD period. The effect of liquidity on informed trading is similar to that in Model 2: $\beta_1 = -0.1819$ and is statistically significant, suggesting that increased relative depth (decreased liquidity) is associated with decreased informed trading; $\beta_2 = 0.1351$, indicating that the impact of relative depth is attenuated when the relative depth is negative in the pre decimalization period; $\beta_{DEC,1} = 0.2633$, suggesting that the impact of relative depth on informed trading is reversed in the post decimalization period; and $\beta_{DEC,2} = -0.2643$ suggesting that liquidity impacts informed trading in the post decimalization era only when relative depth is positive. Overall, liquidity is positively associated with informed trading in the pre decimalization period and negatively associated with informed trading and in the post decimalization period when relative depth is positive. $\delta_{DEC,4}$ (0.0126) is statistically significant and nearly equal, but opposite in sign, to δ_4 (-0.0143). While informed trading appears to decline on post announcement Day+2 in the pre decimalization period, the overall impact of the Day+2 indicator is negligible in the post decimalization period.

The estimates from the Reg FD model and the Decimalization model yield two puzzling outcomes. First, is the reduction in informed trading after the third quarter of 2000 due to Reg FD, penny pricing, or both? Second, does either regulation explain the differential impacts of relative depth on informed trading? Model 4 includes the incremental impact of both regulations:

$$\begin{aligned}
SI_{i,t} = & \alpha + \beta_1 AbsRD_{i,t} + \beta_2 NegRD_{i,t} + \beta_3 Monday_t + \gamma_i SI_{i,t-1} + \delta_1 Day-2_{i,t} \\
& + \delta_2 Day-1_{i,t} + \delta_3 Day+1_{i,t} + \delta_4 Day+2_{i,t} + FD*(\alpha_{FD} + \beta_{FD,1} AbsRD_{i,t} \\
& + \beta_{FD,2} NegRD_{i,t} + \delta_{FD,1} Day-2_{i,t} + \delta_{FD,2} Day-1_{i,t} + \delta_{FD,3} Day+1_{i,t} + \\
& \delta_{FD,4} Day+2_{i,t}) + DEC*(\alpha_{DEC} + \beta_{DEC,1} AbsRD_{i,t} + \beta_{DEC,2} NegRD_{i,t} \\
& + \delta_{DEC,1} Day-2_{i,t} + \delta_{DEC,2} Day-1_{i,t} + \delta_{DEC,3} Day+1_{i,t} + \delta_{DEC,4} Day+2_{i,t}) \\
& + \mu_i + \varepsilon_{i,t}
\end{aligned} \tag{4}$$

Table 2 presents the estimation results for Model 4. The baseline (pre regulation) results remain essentially unchanged from Models 2 and 3. Again this is to be expected since Reg FD and penny pricing were implemented at about the same time. The Monday indicator is positive and statistically significant suggesting increased informed trading on the first day of the week. Day of the week effects are well documented for stock returns (e.g., Gibbons and Hess, 1981 and French, 1980). Increased information gathering and analysis over the weekend could explain the increase in informed trading on Monday. The impact of liquidity on informed trading in the pre regulation period is similar to that in Models 2 and 3: $\beta_1 = -0.1858$ and $\beta_2 = 0.1526$, with similar interpretations.

The Reg FD indicator is considerably smaller than in Model 2 (-0.0027 vs. -0.0554) and statistically insignificant. Reg FD exhibits no impact on informed trading after controlling for the incremental impact of decimalization. The Decimal indicator is negative and significant at the 1% level, and marginally smaller than in Model 3 (-0.0713 vs. -0.0734) suggesting that decimalization explains the reduction in informed trading in the post Reg FD period. Taken together these results suggest that decimalization, not Reg FD, had the greatest impact on informed trading.

Why should the switch to penny pricing affect informed trading? The summary informativeness measure is based upon a variance decomposition method. The measure seeks to attribute a portion of the variance in efficient stock price changes (the denominator) to the variance in signed stock volume (the numerator). A decrease in the summary informativeness measure could be due to an increase in the denominator or a decrease in the numerator. The latter explanation seems more likely.¹⁴ Decimalization has resulted in decreased liquidity on the NYSE, including smaller depths, smaller stock trades and decreased quoted and effective spreads (Chakravarty, Wood, and Harris, 2002 and Bessembinder, 2003). The resulting decrease in the variance of (signed) stock trade size could explain the decrease in the summary informativeness measure after decimalization. However, the firm specific daily liquidity measures (i.e., AbsRD and NegRD) should control for this systematic change in liquidity. But, these measures are daily averages of the relative depth for each trade and therefore do not completely control for the intra-daily variation in liquidity.

The results of Model 4 also help to disentangle the impact of liquidity on informed trading in the post regulation period. $\beta_{FD,1}$ and $\beta_{FD,2}$ are insignificant. The incremental impact of the absolute value of relative depth in the post Reg FD period is $\beta_1 + \beta_{FD,1} = -0.1767$. The positive relation between liquidity and informed trading holds in the post Reg FD period. The incremental impact of negative relative depth is $\beta_1 + \beta_{FD,1} + \beta_2 + \beta_{FD,2} = -0.1368$. An increase in negative relative depth (decreased liquidity on “down market” days) is associated with decreased informed trading in the post Reg FD era, and

¹⁴ Hasbrouck (1991a) terms the numerator absolute informativeness and the denominator total return variance. In unreported tests, absolute trade informativeness is significantly lower in the post decimalization period for 81% of the firms in this study and total return variance is significantly higher for 1.27% of the firms. The statistical test results are available upon request.

this decrease is primarily due to the incremental post Reg FD impact of NegRD (not AbsRD). $\beta_{DEC,2}$ is insignificant and $\beta_{DEC,1} = 0.2581$ and statistically significant. For the two firms affected by early implementation of decimalization, the impact of AbsRD on informed trading in the post decimalization period is $\beta_1 + \beta_{DEC,1} = 0.0723$. The positive relation between liquidity and informed trading is reversed in the post decimalization period, but it is somewhat weaker than in the pre decimalization period. The incremental impact of negative relative depth is $\beta_1 + \beta_{DEC,1} + \beta_2 + \beta_{DEC,2} = 0.0560$. An increase in negative relative depth (decreased liquidity on “down market” days) is associated with a slight increase in informed trading in the post decimalization era, and this increase is due mostly to the incremental post decimalization impact of AbsRD.

For most firms in the sample, decimalization occurred after Reg FD. For these firms, the true impact of decimalization on liquidity and informed trading results from the incremental impacts of both regulations. The total impact of AbsRD on summary informativeness is the sum of β_1 , $\beta_{FD,1}$ and $\beta_{DEC,1}$ ($= 0.0814$). The impact of AbsRD on informed trading is negative in the pre regulation period and positive in the post regulation period. The total impact of NegRD on summary informativeness is the sum of β_1 , $\beta_{FD,1}$, $\beta_{DEC,1}$, β_2 , $\beta_{FD,2}$ and $\beta_{DEC,2}$ ($= -0.0476$). The impact of NegRD on informed trading is predominantly a post regulation phenomenon. To summarize, decreased liquidity when relative depth is positive (“up market” days) is associated with decreased informed trading in the pre regulation period and increased informed trading in the post regulation period. Decreased liquidity when relative depth is negative (“down market” days) is associated with decreased informed trading in the post decimalization period. In general, prices in US equity markets were rising in the pre regulation period and falling in

the post regulation period. It is entirely possible that these two observations can be explained by the general overall direction of prices in the two sample periods.

The final interpretations involve the impact of earnings announcement days on summary informativeness. δ_4 is a statistically significant -0.0139, suggesting that informed trading declines on Day+2, the second trading day after the announcement. Both $\delta_{FD,4}$ and $\delta_{DEC,4}$ are insignificantly different from zero. Regulation appears to have no incremental impact on the level of informed trading on Day+2. After controlling for the overall impact of Reg FD and decimalization, there is no statistical evidence to support any incremental change in informed trading during the days surrounding earnings announcements.

6. Conclusion

Regulation Fair Disclosure is intended to prevent selective disclosure of private information to a preferred group of analysts. A growing body of research seeks to address the impact of Reg FD on analyst behavior.¹⁵ Others measure volatility and trading costs in the markets.¹⁶ To date, no research has addressed the question of informed trading directly. Is there less informed trading after Reg FD? Whether analysts receive information early or not becomes less important if the information does not impact the market. This study adds to the understanding of regulatory impact on financial markets by measuring the incremental impact of two SEC regulations on

¹⁵ See for example Zitzewitz (2002), Sunder (2002), Hutton (2003), Mohanram and Sunder (2003), Brown, Hillegeist, and Lo (2003), Bushee, Matsumoto, and Miller (2004), Gintschel and Markov (2004), and Agrawal, Chadha, and Chen (2006).

¹⁶ This research is reviewed in Section 2.

informed trading in a sample of NYSE listed large capitalization firms.¹⁷ Overall, the results of this study support the view that informed trading declined after implementation of Reg FD (Hypothesis 1 is confirmed), but the regression model results show that this decline is not due to Reg FD. The implementation of penny pricing results in an approximately thirty-fold larger impact on informed trading.

Traders possessing superior information regarding actual earnings or any other private information expected to be disclosed at the conference call will likely trade a day or two before the announcement in order to avoid any adverse market-wide price moves. Superior public information processors are likely to trade soon after the announcement and conference call. For this reason, most previous research involving the impact of Reg FD on analyst or market behavior focuses on earnings announcements. But past research has failed to provide unanimous or definitive evidence in support of regulatory impact during the earnings announcement period. This study provides some descriptive data suggesting that informed trading has not changed during the earnings announcement window in the post Reg FD era. And, the regression results provide scant statistical evidence to support any regulatory impact on informed trading during the earnings announcement window after controlling for the overall impact of regulation and firm specific liquidity. There is compelling evidence that informed trading declines on the second day after the earnings announcement regardless of the regulatory period. The regression results support Hypothesis 4a but not 4b. Prior to Regulation Fair Disclosure, there is a decline in informed trading during the post earnings announcement period. This observation remains unchanged in the period following implementation of Reg FD.

¹⁷ Due to the fixed effects specification of the regression models, inferences are limited to large cap firms.

There is no evidence that decimalization incrementally impacts informed trading in the days surrounding earnings announcements.

Bailey et al. (2003) report a significant increase in abnormal trading volume during the earnings announcement period post Reg FD and attribute it to increased differences in opinion resulting from improved information gathering and processing by analysts. Kim and Verrecchia (1994) attribute abnormal volume during the earnings announcement window to two possible sources: improved private information gathering pre announcement and superior public information processing post announcement. Bailey et al. (2003) do not attempt to separate pre and post announcement trading. The results of this study suggest that there is no significant increase in informed trading in the pre announcement period under either regulatory regime. However there is a decrease in informed trading following the announcement and this decrease is not specific to either decimalization or Reg FD. Chiyachantana et al. (2004) find increased retail trading activity after earnings announcements in both regulatory periods. Taken together, these results suggest that post announcement abnormal volume does not result from superior public information processing, but more likely from increased noise trading originating from retail trading activity. While there may be abnormal trading volume following an earnings announcement, it is not due to superior information processing or to changes in the regulatory environment.

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Table 1

Distribution of earnings announcement window summary informativeness and relative depth measures

Summary Informativeness										
Percentile	Pre FD					Post FD				
	window	day-2	day-1	day+1	day+2	window	day-2	day-1	day+1	day+2
>90th	9.61%	11.91%	10.92%	10.13%	5.33%	10.04%	12.05%	10.98%	10.51%	6.67%
>95th	5.02%	7.23%	3.93%	6.17%	2.67%	5.61%	6.43%	6.67%	6.23%	3.14%

Relative Depth										
Percentile	Pre FD					Post FD				
	window	day-2	day-1	day+1	day+2	window	day-2	day-1	day+1	day+2
<5th	3.60%	4.68%	4.37%	1.32%	4.00%	3.74%	4.02%	5.10%	2.33%	3.53%
<10th	8.52%	10.21%	8.30%	5.29%	10.22%	8.27%	9.24%	10.98%	6.61%	6.27%
>90th	11.35%	8.51%	8.73%	16.74%	11.56%	10.43%	10.44%	4.31%	13.62%	13.33%
>95th	5.35%	2.55%	2.18%	10.57%	6.22%	4.63%	4.82%	1.57%	7.39%	4.71%

The subsample of firms includes each firm with an identifiable earnings announcement outside of normal trading hours for every quarterly announcement between 8/1/1999 and 1/31/2002. The summary informativeness measure is calculated for each firm and each day of the period from 8/1/1999 to 1/31/2002. The relative depth measure is the average signed trade size relative to quoted depth on the appropriate side of the quote for each firm and each day. For each firm and each measure, the announcement day measure is compared to the distribution of the measure for the appropriate period (pre Reg FD or post Reg FD). Table 1 reports the percentage of the measures across all firms above (below) the 90th and 95th (5th and 10th) period-specific firm-level percentiles for each announcement day.

Table 2
Pooled cross section estimation of the summary informativeness equation

	Model 1		Model 2		Model 3		Model 4	
abs. val. relative depth	-0.0773***	(-3.20)	-0.1718***	(-5.10)	-0.1819***	(-5.85)	-0.1858***	(-5.57)
neg. relative depth	0.0727**	(1.69)	0.1485***	(2.57)	0.1351***	(2.60)	0.1526***	(2.65)
day-2 indicator	0.0048	(1.24)	0.0017	(0.31)	0.0033	(0.68)	0.0016	(0.29)
day-1 indicator	-0.0002	(-0.04)	0.0035	(0.58)	0.0027	(0.49)	0.0027	(0.46)
day+1 indicator	-0.0048	(-0.98)	-0.0099	(-1.44)	-0.0114*	(-1.90)	-0.0109	(-1.62)
day+2 indicator	-0.0085*	(-1.95)	-0.0132**	(-2.13)	-0.0143**	(-2.52)	-0.0139**	(-2.27)
Monday indicator	0.0044	(1.61)	0.0047**	(2.21)	0.0054***	(3.52)	0.0053***	(3.49)
<u>Incremental effects of:</u>								
Reg FD indicator			-0.0554***	(-21.8)			-0.0027	(-0.82)
abs. val. relative depth*Reg FD			0.1444***	(3.23)			0.0091	(0.11)
neg. relative depth*Reg FD			-0.1947**	(-2.54)			-0.1127	(-0.90)
day-2 indicator*Reg FD			0.0065	(0.85)			0.0100	(0.91)
day-1 indicator*Reg FD			-0.0054	(-0.66)			0.0002	(0.01)
day+1 indicator*Reg FD			0.0120	(1.26)			-0.0019	(-0.13)
day+2 indicator*Reg FD			0.0104	(1.27)			-0.0011	(-0.07)
Decimal indicator					-0.0734***	(-41.0)	-0.0713***	(-22.4)
abs. val. relative depth*Decimal					0.2633***	(6.41)	0.2581***	(3.31)
neg. relative depth*Decimal					-0.2643***	(-3.78)	-0.1689	(-1.40)
day-2 indicator*Decimal					0.0034	(0.49)	-0.0048	(-0.44)
day-1 indicator*Decimal					-0.0071	(-0.97)	-0.0073	(-0.51)
day+1 indicator*Decimal					0.0157*	(1.73)	0.0171	(1.15)
day+2 indicator*Decimal					0.0126*	(1.69)	0.0134	(0.91)
Adjusted R ²	0.123		0.175		0.209		0.209	

Table 2 continued

This table presents the results of GLS regressions of summary informativeness on liquidity and indicators for announcements days, post Reg FD (FD), and post decimalization (Decimal) along with interactions of the indicator variables. Individual fixed effects and AR(1) coefficients are unreported. Standard errors are corrected for cross-section correlation and heteroscedasticity. t-statistics are in parentheses. The dependent variable is the summary informativeness statistic measured for each firm and each day of the sample. $AbsRD_{i,t}$ is the absolute value of the relative depth measure for each firm i and day t ; $NegRD_{i,t}$ is the absolute value of the relative depth measure for each firm i and day t when relative depth is negative; $Monday_t$ is an indicator; $day-2_{i,t}$, $day-1_{i,t}$, $day+1_{i,t}$, $day+2_{i,t}$ are announcement window day indicators.

* Significance at the 10% level

** Significance at the 5% level

*** Significance at the 1% level

Figure 1

Representative distribution of daily summary informativeness measures

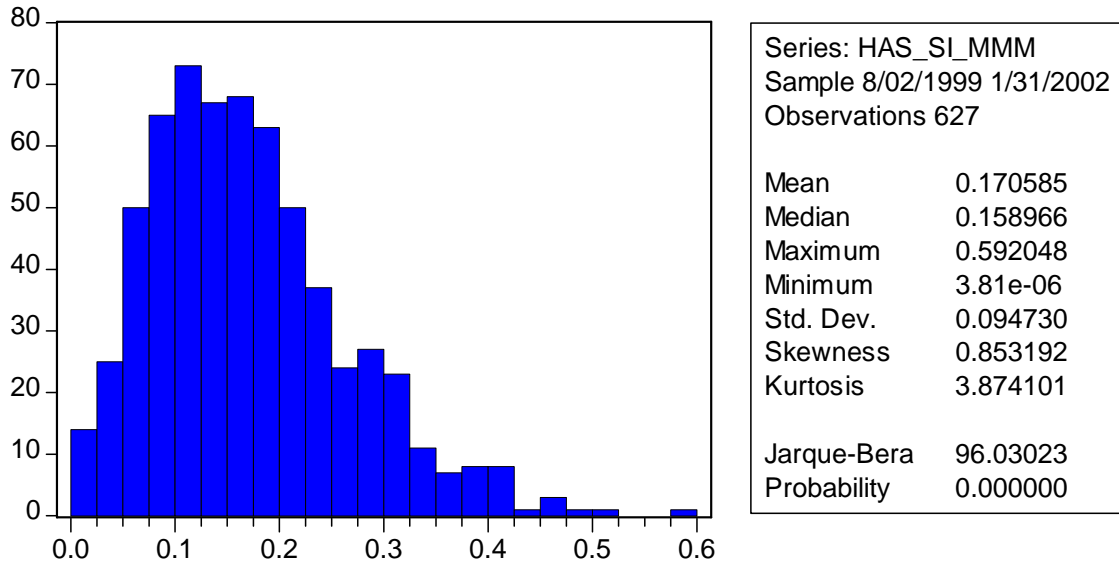


Figure 2

Representative time series plot of summary informativeness

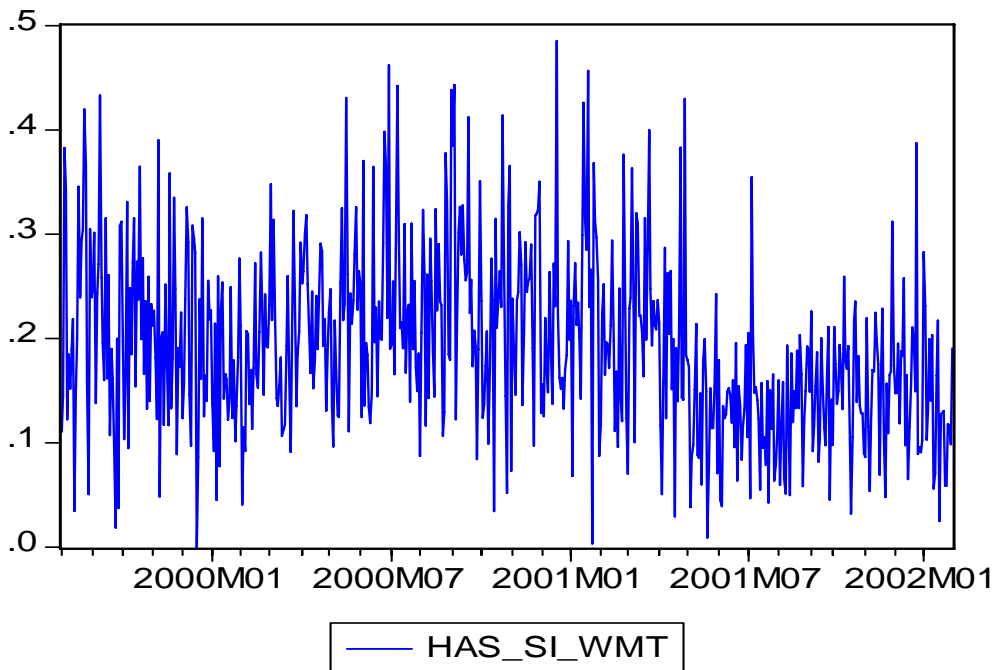


Figure 3

Representative distribution of average daily relative depth measures

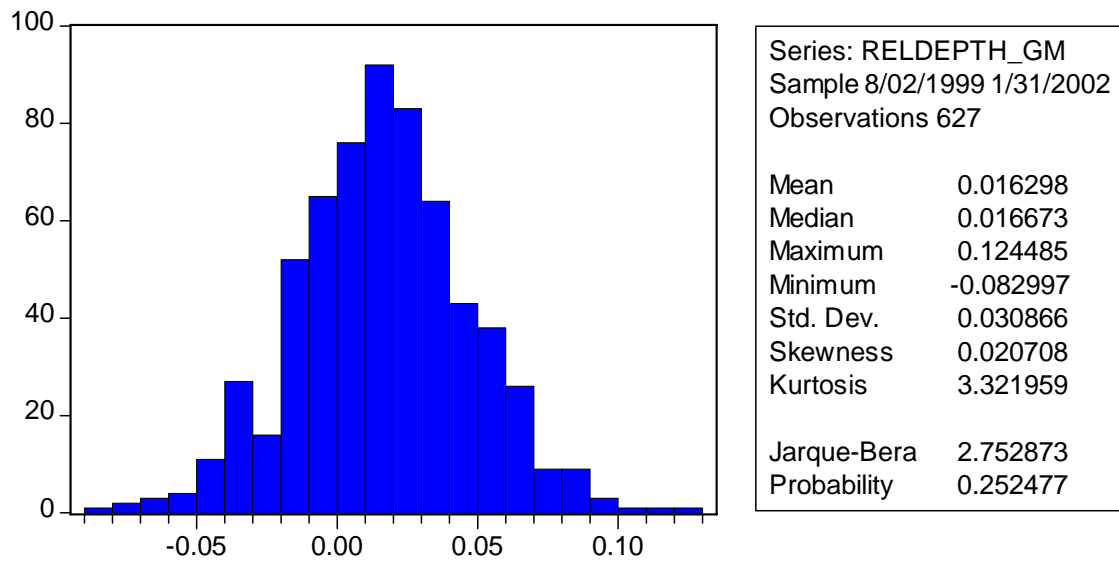


Figure 4

Representative time series plot of average daily relative depth measures

