

The background of the entire page is a grayscale photograph of a modern university building. The building features a prominent glass facade with vertical window columns. In the foreground, there is a paved courtyard with several concrete benches and some trees. The overall scene is bright and clear.

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Are Analyst Recommendations Informative?

by

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Are Analyst Recommendations Informative?

Evidence on the Behavior of Bid-Ask Spreads, Bid and Ask Depths and Trading Volume
Around Public Announcements of Analyst Recommendations¹

by

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Abstract

We investigate the effects of public announcements of analyst recommendations on the bid ask spreads, the corresponding bid and ask depths and on trading volume of the associated stocks. Using a sample of analyst recommendations made on all stocks trading in the NYSE and AMEX over an 18-month period, between 1994 and 1995, we find that public announcements of analyst recommendation changes are accompanied by *no* significant widening of the bid ask spreads over the preannouncement period of 10 days, including the day of the public announcement of analyst recommendations. Both the bid and ask depths, however, increase significantly over the preannouncement period and are significantly higher on announcement day. Consistent with the evidence on depths, both trades and trading volume, including large and small size trades as well as buyer and seller initiated trades, show a significant and symmetrical increase leading up to the announcement day and decline thereafter. In balance, however, the overall increase in volume appears to be dominated by large size trades. In sum, our results are consistent with an increase in market liquidity over the preannouncement period, and appear to cast doubt on the proposition that analyst recommendation changes are informative events.

Are Analyst Recommendations Informative?

Evidence on the Behavior of Bid-Ask Spreads, Bid and Ask Depths and Trading Volume Around Public Announcements of Analyst Recommendations

1. Introduction

Beginning with Cowles (1933), considerable academic attention has been devoted towards understanding the effect of equity buy/sell recommendations by financial analysts on security markets. The studies, for the most part, have attempted to either measure abnormal returns accompanying recommendation changes² or to isolate observable quantities that proxy for the degree of informational asymmetry prevalent in analyst recommendations³. The consensus is summarized by Womack (1996, p.139) who states that "the immediate reactions to recommendation changes appear to be permanent, not quickly mean reverting. This implies that recommendations embody valuable information for which a brokerage firm should be compensated."⁴ Womack appears to suggest that analyst recommendations (and, by extension, recommendation changes) are informed events. And if so, the period immediately preceding the public announcement of analyst recommendations (the preannouncement period) should be associated with increased informational asymmetry between the specialist and the market participants, some of whom may be equipped with advance knowledge about the direction of these recommendation changes. Consequently, the theoretical adverse selection literature predicts (see O'Hara (1995) for an overview) that we should expect to see a widening of the bid-ask spreads (or lower market liquidity) in this preannouncement period as specialists move to protect themselves from an increased risk of

² See, for example, Kim, Lin and Slovin (1997), Womack (1996), Stickel (1995) and Francis and Stoffer (1993).

³ Easley, O'Hara and Paperman (1995), Chung, McNish, Wood and Wyhowski (1995), Brennan and Subrahmanyam (1995), Brennan, Jegadeesh and Swaminathan (1993) and Bhushan (1989).

⁴ Specifically, Womack (1996), using a sample of 1,573 recommendation changes on 822 stocks issued by 14 U.S. brokerage houses between 1989 and 1991, finds significant size adjusted abnormal returns in a three-day window surrounding the recommendation change.

trading against investors with superior private information.

Interestingly, a finding of positive abnormal returns, does not always imply wider spreads (and lower market liquidity). In fact, there appears to be mixed evidence of the spread-abnormal return relationship in the literature. For example, Amihud and Mendelson (1986) hypothesize and empirically document that expected asset returns are increasing in the bid-ask spread. But Brennan, Chordia and Subrahmanyam (1996) report a negative and significant relationship between risk-adjusted stock returns and the bid-ask spread. This conflicting evidence begs the question that if analyst recommendations are informed events, are they accompanied by a widening of the bid-ask spreads? The extant literature provides no answer.

We, therefore, investigate the impact of analyst recommendation changes on market liquidity, measured by the bid-ask spreads, the corresponding bid and ask depths⁵ and volume. We include both the spreads and depths in our analysis because following Harris (1990), it is now widely accepted that a complete characterization of market liquidity encompasses both the bid-ask spread and the corresponding bid and ask depths. When liquidity is defined in these two dimensions, it is entirely conceivable that a reduction in liquidity could occur through a reduction in the bid and/or ask depth even though the bid ask spread itself remains unchanged.

A related question is how should volume react to analyst recommendations and recommendation changes? Arguably, the relationship between volume and spreads (and, by extension, market liquidity) should be driven by whether the increase in volume is dominated by informed or

⁵ Formally, the bid depth denotes the quantity for which the quoted bid price is guaranteed while the ask depth denotes the quantity for which the quoted ask price is guaranteed. For example, a bid and ask quote at \$247/8 and \$25 for 500x1000 shares implies that the bid price is guaranteed for 500 shares (bid depth) and the ask price is guaranteed for 1,000 shares (ask depth).

liquidity trading activity.⁶ Womack (1996) finds that the average (abnormal) volume on the announcement day of recommendations is about 190% (300%) of normal for added-to-buy (added-to-sell) recommendations. But, as discussed later, we go significantly beyond Womack in terms of decomposing volume into trade sizes (large versus small) based on both volume and dollar size of trades, and on the basis of the direction (buy versus sell) of the initiator of a transaction, around public announcements of analyst recommendations.

In sum, our null hypothesis (prior) is that analyst recommendations are informative and that we would expect to see a widening of bid-ask spreads and/or a lowering of the bid and ask depths, and an increase in overall volume, dominated primarily by informed volume (however measured) over the preannouncement period (including the announcement day). To the extent that informed traders use large size trades (see Easley and O'Hara (1987, 1992)), we should see an increase in large size trades over the same period.

To test our hypotheses, we use a sample of 5,863 distinct analyst recommendations over 1,147 stocks trading in the NYSE and AMEX between January 1, 1994 and June 30, 1995, obtained from Zacks Investment Research (Zacks). We merge this data with a matching sample of intra-day transactions and quote data (TAQ) obtained from the New York Stock Exchange which enables us to obtain measures of bid ask spreads, the bid and ask depths, volume and transactions, including trade sizes, associated with analyst recommendation changes.

We define three kinds of bid-ask spreads: the quoted bid-ask spreads, the percentage quoted bid-ask spreads and the effective bid-ask spreads⁷. The corresponding depths and trading volume are in

⁶ Easley and O'Hara (1992) provide a theoretical model where the specialist uses volume as a signal of an information event. The model predicts that a higher volume is correlated with wider spreads. Thus, the implication is that the increase in volume is dominated by informed trading.

⁷ The effective bid ask spread is defined as twice the absolute difference of the transaction price and the midpoint of the prevailing quoted bid ask spread.

numbers of shares, and are observed directly. While the quoted (and percentage) quoted spreads measure the ex ante market liquidity, the effective bid-ask spreads measure ex post market liquidity and are narrower than the former because transactions frequently take place inside the quoted spreads.⁸ Additionally, all trades of at least \$10,000 (500 shares) are classified as large. Otherwise, they are classified as small.⁹

We find that public announcements of analyst recommendation changes are not accompanied by any significant increases in bid ask spreads (and, by extension, in adverse selection) over the preannouncement period. This, despite the documented existence of significant abnormal returns around such events. We do, however, find weak evidence of wider spreads over the preannouncement period in some extreme partitions of the data, designed to isolate information based trading.¹⁰

While spreads show little activity, the corresponding bid and ask depths display a significant increase over the preannouncement period, including announcement day itself. Finally, trades and trading volume (both large and small) also show a significant increase over the same period. This preannouncement surge in volume is evident in all partitions of the sample, although, in balance, the overall increase in volume is dominated by large-size trades (measured in dollars as well as in trade size). Assuming that institutions are likely to use large size trades more frequently than individuals (a view consistent with the findings of Chakravarty (1999)), our results imply a significant institutional activity around public announcements of analyst recommendations.

⁸ Lee (1993) and Peterson and Fialkowski (1994).

⁹ While the dollar classification is motivated by Lee (1993), the trade size classification is motivated by the results of Barclay and Warner (1993) and Chakravarty (1999), who find a positive correlation between medium-size trades (500-9,999 shares) and stock price impact. Our classification, therefore, subsumes this finding.

¹⁰ These partitions have been shown in the extant literature to be associated with abnormal returns and include recommendations made by star (versus non-star) analysts, recommendations made on large (versus small) size firms, recommendations made on firms with high (versus low) institutional holdings, and recommendations made on firms with high (versus low) trading volume.

Overall, our results are consistent with a significant increase in market liquidity over the preannouncement period. Therefore, are analyst recommendations informative? On the surface, the evidence from the spreads and depths appears to suggest that it is not. But one possible explanation of why spreads may not widen over the preannouncement period (even though the recommendation changes may themselves be informed events) could be due to the significant increase in the bid and ask depths, which enables market makers to simply match buyers with sellers. Since the market makers do not personally feel the pressures of increased adverse selection, spreads do not widen. As further evidence of this possibility, we find an almost even split between buyer-initiated and seller-initiated trading volume (and trades) on, and immediately preceding, the announcement day. Some other possible explanations of unchanging spreads and an increase in market liquidity on (or before) the announcement day are discussed in the text.

The rest of the paper is organized as follows. Section 2 discusses the analyst recommendation data and sample characteristics. Section 3 details the various liquidity measures used in the analysis. Section 4 presents our main results on bid ask spreads and bid and ask depths for ± 9 days around the announcement day. Section 5 refines our data further to investigate for adverse selection in various partitions of the data. Section 6 presents the volume evidence around recommendation changes. Section 7 concludes with a discussion of the broader implications of our results.

2. The Analyst Recommendation Data

2.1 Overall Description

Brokerage house buy and sell recommendations are supplied by Zacks Investment Research (Zacks). These recommendations are over an eighteen-month period from January 1, 1994, through June 30, 1995.

Zacks compiles these recommendations from printed brokerage reports received via surface mail and overnight delivery. The company also receives ratings from about 240 member brokerage firms (as of 1997) by fax and electronic downloads on a daily, weekly and monthly basis. Once Zacks receives the brokerage reports, the data is coded in by its research department. Commonly, many brokerage houses issue recommendations using the following five-point scale: 1 = STRONG BUY, 2 = BUY, 3 = HOLD, 4 = SELL, and 5 = STRONG SELL. For brokers that do not follow a five-point scale, Zacks converts the specific recommendations into the five-point scale and enters them in the data set. We simply use Zacks's procedures for standardizing these phrases so that recommendations can be compared across brokerage houses. For each recommendation, the data set also records the identification number of a specific broker making the recommendation, the brokerage house she works for, the last recommendation made by that broker on the same stock as well as the date of the recommendation. With these identifiers, it is possible to construct a time series of recommendations (and, hence, of recommendation changes) of a particular broker on a particular stock.

Note that the date of the recommendation included in our data set is the date as recorded by Zacks. It should be noted that Zacks makes a special effort to ensure the accuracy of such dates. For example, at the end of each weekday, a computer algorithm generates a warning report based on the following guidelines: (1) Any deviation of published report dates on a particular stock from dates of reports received from alternate sources on the same stock; (2) Any first (new) estimate for a specific company; (3) Any new estimate from a broker that never covered a specific company; (4) Directional errors -- if the newly entered estimate is different from the trend in the analyst's previous estimates; and so on. These warning reports are then manually checked by Zacks staffers before the data is made available to its customers. A total of about 100 corrections are made daily. In sum, even though on a real time basis, alternative sources like First Call may be more timely (but not necessarily accurate) with

analyst recommendation data, the ex post accuracy of Zacks data is unparalleled.

Despite their attempt at accurately coding the public release date of an analyst recommendation from its member set of 240 brokerages, it is entirely possible that some of the information contained in the written forecasts (and hence the forecast changes) could be publicly disseminated earlier than the date of their official release. Analysts at brokerage houses hold regular meetings, usually before opening of trade on any day and discuss possible changes in recommendations. Subsequent to the meeting, the analyst writes his official report. It is possible that the information in this report is extrapolated by investors and other media experts attending these briefings. Thus, as with any significant corporate event, there is a likelihood of information leakage prior to its official release. To check for the sensitivity of such occurrences, we conduct every analysis in the paper based on the announcement day as well as over periods of varying lengths around the announcement day. Our results are virtually identical in all of these iterations.

Finally, to avoid introducing confounding effects in the analysis, we delete all recommendations occurring within ± 10 days of earnings announcements.

2.2 *Sample Characteristics*

Table 1 provides summary statistics for the analyst recommendation sample used in the study. We have 5,863 distinct recommendation changes on a scale of 1 (strong buy) to 5 (strong sell) over 1,147 stocks trading in the NYSE and AMEX, over the period January 1, 1994, through June 30, 1995. Of these, 1,027 are recommendations from "star analysts" on the Institutional Investor magazine's All-American Research Team as defined by the October 1994 issue and then updated again from the October 1995 issue. Every year, for its October issue, Institutional Investor asks about 2,000 money managers to evaluate analysts on the basis of the following criteria: stock picking, earnings forecasts, written reports

and overall service. The magazine then tabulates and publishes the results annually. Others (see, for example, Stickel (1992)) have investigated the performance of star analysts and stock price performance.

Among the recommendation changes themselves, 1704 recommendations (30% of the sample) skip a rank (based on the previous recommendation by the same analyst on the same stock), 1,532 recommendations (27% of the sample) are at the extremes with a 1 or a 5. The average number of days between recommendations (by the same analyst) is 103.

3. Spreads, Depths and Volume

The first measure of market liquidity that we employ is the quoted bid-ask spread (see Huang and Stoll (1996) and Bessembinder (1997)), that captures the ex ante transactions costs. We also compute the daily average percentage quoted bid ask spread, where the percentage bid-ask spread is defined as follows:

$$\text{Percentage bid ask spread} = \frac{(Ask - Bid)}{(Ask + Bid)/2} \times 100$$

The percentage spread allows us to compare across stocks of various sizes.

Recognizing that the quoted bid-ask spread may not be a reliable measure of transaction costs when trades are executed inside the quoted spread (Peterson and Fialkowski (1994)), we also measure the effective bid-ask spread as:

$$\text{Effective bid ask spread} = 2 \left| \text{Transaction price} - \frac{(Ask + Bid)}{2} \right|$$

where *Ask* and *Bid* are the *prevailing* ask and bid prices at the point of transaction. The effective spread, which measures the ex post transaction cost, could conceivably dampen the effects we are attempting to investigate. As Peterson and Fialkowski (1994) note, when the quoted spread widens, only about 10-22%

of the increase in quoted spreads appears in the effective spread .

The bid and ask depths (associated with the corresponding bid and ask prices) are taken directly from the TAQ database.

We classify transaction volume into large and small size trades based on both dollar value of transaction and trade size. Specifically, in the first definition of large (versus small) size trades, all trades of at least (below) \$10,000 are classified as large (small). In the second definition, all trades of at least (below) 500 shares are considered large (small). Our trade size classification differs from Barclay and Warner (1993), Chakravarty and McConnell (1997) and Chakravarty (1999), who define trades between 500 and 9,999 shares as medium, trades below 500 as small and trades over 10,000 shares as large. Thus, our definition of large size trades subsumes the large and medium size trades defined by Barclay and Warner (1993) and others. We do this because both Barclay and Warner (1993) and Chakravarty (1999) find evidence that trades of 500-9999 shares are significantly correlated with stock price moves. Thus, by combining all trades above 499 shares in the large size category, we acknowledge the possibility of informed (or strategic) traders using trades of 500 shares or above, based on available empirical evidence.

Finally, recall that all extant theories of market microstructure are based on the initiator of a trade. Hence, the validity of all economic studies, based on such theories, also hinges critically on the accurate classification of trades as buyer or seller initiated. Accordingly, we partition intra-day volume separately into buyer initiated and seller initiated volume using the Lee-Ready (1991) algorithm. Thus, if a trade occurs at the prevailing bid price or anywhere between the bid and the midpoint of the prevailing bid-ask spread,¹¹ it is considered to be a seller-initiated trade. Likewise, if a trade occurs at the prevailing ask price or anywhere between the ask and the midpoint of the prevailing bid-ask spread, it is considered to be a buyer-

¹¹ We use the convention that the prevailing bid-ask spread must be at least five seconds old. Otherwise, the previous quote, assuming that it is at least five seconds old, is used to compute the prevailing spread.

initiated trade. For trades occurring at the prevailing spread midpoint, the tick-test rule is applied to determine the trade initiator. By the tick test rule, a trade is buyer-initiated (seller-initiated) if the price move from the previous transaction price is upwards (downwards).

4. Bid-Ask Spreads and Depths around Event day: Overall Sample

In this section, we provide the central results of the paper. For this purpose, the various measures of bid and ask spreads and the corresponding bid and ask depths are computed as time-weighted daily averages, as in McNish and Wood (1992). Specifically, the reported averages (or medians) for the specific days (in relation to the announcement day) are obtained as follows. First, the daily time-weighted averages of all spread measures as well as the bid and ask depths are calculated over the cross section of the stocks in our sample. The medians (and standard deviations) of these variables are then computed over the cross section of all daily averages for each of the days in relation to the announcement day.

The volume and trade measures are first calculated as simple daily averages over the cross section of the stocks. The medians and standard deviations are then computed over the cross section of stocks for each day.

4.1 Graphical Evidence

Figures 1A through 1E present a graphical view of the daily average bid-ask spreads and the corresponding daily average bid and ask depths, between Days -9 and +9 including the announcement day (Day 0). While the quoted bid-ask spreads (figure 1A) and the effective bid ask spreads (figure 1C) are in dollars, the depths (figures 1D and 1E) are in units of 100 shares or round lots.

The figures show a small fluctuation of daily average quoted bid-ask spreads around 0.19 cents and daily average percentage quoted bid-ask spreads of between 0.76 and 0.77 around announcement

day. Only the daily average effective bid-ask spread shows a relatively significant increase on announcement day by increasing to about 0.147 cents from about 0.117 cents in surrounding periods.

Both the average daily bid depth and the average daily ask depth, however, show a significant increase on announcement day compared to surrounding periods. Specifically, the daily average bid depth increases from about 8,900 shares on Day -9 to about 9,550 shares on Day 0 and then settles to about 9,300 shares on Day +9. Similarly, the daily average ask depth increases from about 9,700 shares on Day -9 to about 10,350 shares on Day 0 and then drops to about 10,100 shares on Day +9.

In sum, the graphical evidence on spreads shows little movement on or before announcement day, although both the bid and ask depths show significant increase leading up to, and including, Day 0. Collectively, there appears to be an increase in liquidity on or before announcement day. We investigate this issue more formally in section 4.2.

4.2 Results

In Table 2, we present the *medians* (and standard deviations) for our three spread measures: the quoted spread, the percentage spread, and the effective spread. Additionally, the *median* bid depth, the *median* ask depth, the *median* number of trades and the *median* trading volume are reported.¹² The cross sectional results in Table 2 are based on all stocks on the day of the public announcements of analyst recommendation (Day 0), including upto 9 days before it (Day -9) and nine days after (Day +9).

Table 2 indicates that the median (standard deviation) of the quoted bid ask spread on Day -9 is 0.1806 (0.074), that on Day 0 is 0.1802 (0.077) and on Day +9 is 0.1797 (0.074) with intermediate values on the remaining days. A pairwise Wilcoxon sign rank test of equality of medians finds that the difference between Day 0 and Day +9 is statistically significant at the 0.01 level. No such difference

¹² A preliminary test of the distributions of the spreads, depths and volume revealed that they are highly non-normally distributed, which necessitated the use of non-parametric tests to distinguish across the various variables across various days around the announcement day. The non-parametric tests employed (Wilcoxon sign rank tests) are tests of medians (instead of means). Hence, in our tables, we present the medians (instead of the means).

obtains for the quoted spread between Day -9 and Day 0. The median percentage spread does not show any statistically significant difference between Day -9, Day 0 and Day +9 and is approximately 0.62%. The median effective spread behaves similarly and displays little variation (around 0.11) on between Day -9 and Day +9. Notice the difference in behavior between daily *average* effective spread and the daily *median* effective spread. While the graphical evidence (figure 1) indicates some widening of the *average* effective spread on announcement day (compared to days -9 and +9), the *median* effective spreads in those days are almost identical.

The depth evidence in Table 2, however, is much more striking. Specifically, the median bid depth on Day 0 is 5500 shares and is significantly greater than the median depth on Day -9 (5100 shares) and on Day +9 (5300 shares). Similarly, the median ask depth shows a significant increase at 6100 shares on Day 0 compared to either Day -9 (5700 shares) or Day +9 (5800 shares). Both the bid and ask depths in the remaining days display intermediate values with respect to their corresponding values on Days -9, 0 and +9. The increases in both bid and ask depths on Day 0 are statistically significant from the corresponding values either on Day -9 or Day +9, at the 0.01 level.

In sum, there appears to be no significant widening of bid ask spreads on or before the announcement date. Both bid and ask depths, as well as the number of transactions and trading volume, however, display a significant increase leading up to the announcement date and decreasing afterwards.

Overall, the results of Table 2 cast doubt as to whether analyst recommendation changes are informative events. If anything, our results suggest that there is an *increase* in market liquidity over the period leading up to, and including, the public announcement of analyst recommendations.

We offer two possible explanations for these empirical findings. First, recommendation changes are inherently uninformative liquidity enhancing events, as demonstrated by our results. The second possibility is that analyst recommendation changes, while informative, do not lead to a decrease in

market liquidity via increasing spreads and/or decreasing depths, because of two counteracting forces. On the one hand, the presence of informed traders could have the effect of widening the bid-ask spreads and reduce the willingness of the market makers to provide depth at the quoted bid and ask prices (lower depths). On the other hand, notice, from the last two rows of Table 2, the significant increase in median trades and trading volume on Day 0 compared to Day -9 and Day +9. This additional volume, that the recommendation change appears to generate, could represent trades by uninformed traders. The presence of these additional uninformed traders (and the profits to be made therefrom) could offset the market makers' losses to informed traders such that spreads do not widen and depths actually increase at the quoted bid and ask prices. Alternatively, the market makers could simply match the buyers with sellers without increasing the magnitude of the spreads. We pursue these volume-related explanations further in section 6.

5. The Bid-Ask Spreads around Event Day: Extreme Partitions of the Data

In this section, we partition the sample firms in several ways to further investigate the robustness of our results of section 4. All our specific partitions are motivated by the extant literature that document significant abnormal returns around similar partitions of the data. The idea is that if there is any significant widening of spreads over the preannouncement period, including the announcement day itself, it should show up in the following extreme partitions of the data.

5.1 *Spreads for stocks with recommendation changes that skip a rank*

Stickel (1995) documents that analyst recommendation changes that skip a rank have a greater price impact, ostensibly because of a larger change in expectations.¹³ Accordingly we examine

¹³ Specifically, Stickel (1995) finds that buy recommendations that skip a rank have a 0.33% effect on price over days -5 to +5 and sell recommendations that skip a rank have a -0.40% effect on price over days -5 to +5.

recommendation changes that end with a strong buy and skip a rank, as well as recommendation changes that end in a strong sell and skip a rank. The former case reflects a change from at least a hold recommendation (ranked as 3) to a strong buy recommendation (ranked as 1). Likewise, the latter case reflects a recommendation change from at least a hold recommendation (ranked as 3) to a strong sell recommendation (ranked as 5). It is evident, that the signal for market expectations in either case is greater than for changes from a buy to a strong buy (rank change from 2 to 1) or for a change from a sell to a strong sell (rank change from 4 to 5). To the extent that recommendation changes skipping a rank have a potentially greater information content (compared to those that do not skip a rank), we should expect to see a decrease in market liquidity vis-à-vis spreads (and/or depths) over the period immediately preceding (and including) the announcement day.

Panel A of Table 3 presents the pre-event (Day 0 - Day -9) and post-event (Day +9 - Day 0) median (and standard deviation) quoted spreads, percentage quoted spreads and effective spreads, associated with extreme recommendation changes. Panel B presents the corresponding results for bid and ask depths. It should be noted that that we have replicated all our results by replacing Day 0, successively, by Day -1, Day -2, and the Event Period (defined alternatively by the sum of Day -2 through Day +2). Our results in all instances remain virtually identical and are not reported.

The results indicate that for recommendation changes to a strong buy (i.e., ending in a 1) and skipping a rank, all (median) spreads appear to decline on or before announcement day and continue declining post announcement. Thus, strong recommendation upgrades do not appear to widen spreads. For recommendation changes ending in a strong sell (i.e., ending in a 5) and skipping a rank, spreads increase (but not statistically significantly) on event day and then decline post-event. The bid depth, on the other hand, increases on event day and then decreases in the post-announcement period. The ask depth remains roughly constant both before and after the announcement day.

In sum, we detect no significant adverse selection effects accompanying extreme changes in analyst recommendations. If anything, there is evidence of increasing market liquidity in the period leading up to (and including) the announcement date.

5.2 *Spreads for recommendations made by star (versus non-star) analysts*

Stickel (1995) argues that the reputation of the analyst making stock recommendations affects the magnitude of the abnormal returns around the public announcement of recommendations. Additionally, those in the list of first and second team All-American analysts are even more influential. Specifically, Stickel finds that buy recommendations by first-team All-American analysts are accompanied by an additional 1.27% cumulative abnormal returns over days -5 to +5 beyond those associated with the remaining analysts.

If returns for the sub-sample of recommendations made by star analysts are indicative of the presence of significant private information in the preannouncement period, we would expect a widening of the spreads (and/or a decrease in the corresponding bid and ask depths) of the corresponding stocks over the same period. To investigate this, we first isolate those recommendation changes in our sample made by the first-team All-American analysts (star analysts) as identified by Institutional Investor magazine (see earlier discussion in section 2.2). Table 3, panel A, presents the pre-event and post-event spread results associated with recommendation changes made by star analysts and non-star analysts. Panel B of table 3 presents the corresponding bid and ask depths.

The results indicate a general increase in the median quoted and percentage quoted bid-ask spreads on Day 0 (relative to Day -9) and then a decline post announcement, although the increase is not statistically significant at the 0.10 level. However, both spreads have a statistically significantly greater median on announcement day (at the 0.01 level) compared to those on Day +9 as evidenced by the negative post-event spreads. The corresponding median spreads associated with recommendations made by non-star analysts show no significant difference between pre-event and post-event periods. The

median effective bid ask spreads, and the bid and ask depths, however, show no significant changes over this period. Substituting Day 0 successively with Days -1, -2, etc., in order to compute the pre and post event spreads, makes no difference to our results.

In summary, we find weak support for wider bid ask spreads on announcement day for stocks associated with recommendations made by star-analysts.

5.3 *Spreads for recommendations made on large (versus small) size firms*

In this section, we investigate whether the market capitalization of the firm on which the recommendation is made has any effect on the spreads (and depths) around announcement day. This investigation is motivated by Bhusan (1989), for example, who argues that large firms are followed by more analysts, which results in greater private information acquisition about them. Contrarily, smaller firms have less analyst coverage and less private information generated on their corporate activities. Thus, if analyst recommendations (and changes therefrom) are informative events, we would expect to see an increase in spreads and/or a decrease in the corresponding bid and ask depths over the period leading up to and including the announcement day, in large firms.

Accordingly, we partition our sample of stocks with recommendation changes on the basis of the market value of the firm's equity as of September 30, 1994 (midway through our sample period). The sample median firm size is then used as a cutoff for small and large size firms. Table 4, panel A, presents the differences in median spreads between the pre-event and post-event periods. We first present the results for the whole sample for reference, and then for those associated with small firms and large firms separately. We also repeat the analysis for the bid and ask depths. We do not report them since they show no significant changes between pre-and post-event periods.

Interestingly, the large-size firms show an increase in the quoted (and percentage quoted) bid-ask spreads on Day 0 (compared to Day -9 and to Day +9). The spread difference between Day +9 and

Day 0 (post event) is statistically significant at the 0.05 level. Recommendations changes for small firms show no (significant) changes in the median quoted spreads across the three dates. The effective spreads show no change between pre-event and post-event periods, for either large or small size firms. Once again, substituting Day 0 with any of the surrounding days of periods, to compute the spread differential pre and post event, makes no material difference to the results.

We, thus, find only weak evidence of wider spreads on announcement day (compared with Day +9) for quoted spreads (and percentage quoted spreads) for large firms in our sample.

5.4 *Spreads for recommendations made on stocks with high (versus low) Institutional ownership*

Badrinath, Kale and Noe (1995) find that the stock price performance of firms with high institutional ownership is a leading indicator of subsequent equity market performance. Under the assumption that institutional holdings can proxy for institutional trading and institutional traders are informed traders (see Chakravarty (1999)), firms with high institutional holdings should display greater informed trading compared to firms with low institutional holdings. Then, if analyst recommendation changes are informative, we would expect to see a decrease in preannouncement market liquidity in high institutionally owned firms.

Accordingly, we obtain the percentage institutional ownership of the stocks in our sample in the third quarter of 1994 (about midway through the sample period) from Compact Disclosure and use the sample median institutional ownership as a cutoff for low and high institutional ownership firms. Panel B of Table 4 presents the (differences in) median spreads across the pre-event and post-event periods. Once again, we present results from the whole sample for reference and those associated with low and high institutional ownership firms.

The results indicate that high institutionally owned firms show an increase in the median percentage quoted bid-ask spreads on announcement day (compared to Day +9), and that this difference

is significant at the 0.10 level. Low institutionally held firms show no (significant) changes in the median quoted spreads over the three dates. The median effective spreads show no change across pre-event and post-event periods for either the high or low institutionally held firms. Also, changing the definition of pre and post events to include any other day or period surrounding Day 0, makes no significant difference to the results.

There is, thus, only weak evidence that spreads widen on announcement day for firms with high institutional ownership.

5.5 *Spreads for recommendations made on stocks with high (versus low) trading volume*

Easley and O'Hara (1992) posit that specialists use trading volume to infer the presence of informed traders, with the probability of informed trading being higher (lower) for stocks with higher (lower) trading volume.

Accordingly, we partition our sample of stocks on the basis of high and low non-event volume. For our purpose, the non-event period is defined as the period between Day -60 and Day -30. If analyst recommendations are informative, we would expect to see a widening of the bid ask spreads and/or a decrease in the bid and ask depths in the period leading up to (and including) the announcement day of recommendation changes associated with firms with high trading volume.

Panel C of Table 4 presents results of the sample partitioned into HIGH and LOW trading volume firms based on the median daily non-event trading volume of the stocks in our sample. HIGH volume firms show an announcement day median quoted bid-ask (and the median percentage quoted bid-ask) spread greater than the median quoted spread on Day +9, with the difference being significant at the 0.01 level. The effective spread, however, shows no statistical distinction between Days -9, 0 and +9. As before, the results are immune to how pre and post event periods are defined.

Thus, we find weak evidence of widening of the bid ask spreads on announcement day for HIGH

volume stocks.

Overall, even in the extreme partitions of the data, where we would expect to find significant adverse selection effects associated with analyst recommendations, we uncover only sporadic (and weak) evidence of an announcement day widening of spreads (none in effective bid ask spreads). There does not appear to be any robust spread effect in the preannouncement period and our basic conclusion of the previous section appears to hold.

6. Volume around Announcement Day

In this section, we investigate the behavior of trading volume around the announcement of analyst recommendations. Notice from table 2 that both the daily median trades and trading volume show a systematic increase starting from Day -9, peaking on Day 0, and then dropping off symmetrically to Day +9. Here, we further decompose transaction volume on the basis of both trade and dollar size, as well as on the (buy/sell) direction of order initiation, to better understand the kind of traders who may be active around analyst recommendation changes. For example, Chakravarty (1999) finds that institutional investors are more likely to use larger size trades than individuals. Hence, a relative preponderance of large size trades around analyst recommendations signifies a possible increase in institutional trading around analyst recommendations. Additionally, the theoretical microstructure literature argues that large size trades are more likely to be informed than small size trades (See Easley and O'Hara (1987)). Thus, if the recommendation changes are informative in nature, we might expect to see more large size trades over the preannouncement period.¹⁴

Figures 2A and 2B provide a glimpse of the *average* volume and the *average* trades,

¹⁴ The intuition is similar to Barclay and Warner (1993) who focus on a sample of tender offer targets over their preannouncement period to investigate informed trading behavior, arguing that some traders may have private information during the preannouncement period.

respectively, on each of Days -9 to +9. Notice the significant spike on announcement day (Day 0) in both figures. This evidence is consistent with the median trades and trading volume numbers provided in table 2 and is provided for comparison with the following volume graphs. All trade and trading volume numbers, in table 2 as well as in figure 2, are statistically distinct at the 0.01 level.

Figures 2C through 2F present similar graphs for LARGE and SMALL trades around announcement day, where LARGE and SMALL are defined in terms of the \$10,000 dollar trade cutoff. The results for the 500- share cutoff are virtually identical and are not reported. The results indicate a significant increase in both LARGE and SMALL trades (and trading volume) on announcement day. However, a comparison of figures 2A, 2C and 2E (and, correspondingly, figures 2B, 2D and 2F) reveal that the overall volume increase on announcement day is almost entirely due to an increase in LARGE trades (and trading volume).

We also investigate the relative activity of buyer versus seller initiated volume around announcement day. Specifically, we examine the relative usage of LARGE and SMALL trades (and trading volume) by trade initiators. Recall that the (buy/sell) direction of each trade initiator is classified according to the Lee-Ready (1991) algorithm.

The results are provided in figures 3A through 3D. Consistent with figure 2, we only present results for trades of at least \$10,000 as LARGE trades. These figures confirm the overall theme of a surge in both LARGE buyer initiated and LARGE seller initiated trades (and trading volume) on announcement day. Interestingly, the graph also reveals a near equal split in the increase in volume, between those from buyers and sellers.

Figures 4A through 4D present the corresponding SMALL (less than \$10,000) buyer initiated and seller initiated trades and trading volume. Once again, the graphs reveal a significant increase in both buyer and seller initiated small size trades (and trading volume) on announcement day.

Additionally, even within SMALL trades, there appears to be an even split between buyer and seller initiated trades (and trading volume).

In sum, Figures 2 - 4 paint a vivid picture of a surge in volume on announcement day. The surge is consistent for large and small size trades, and, within each size category, for both buyer and seller initiated trades. Additionally, buyers and sellers appear to be evenly divided in each trade size category. The increased activity of both large and small size trades appears to imply that both institutions and individuals appear to be trading during the preannouncement period. In balance, however, the increased volume appears to be dominated by large size trades (and volume), and, by extension, institutions.

The announcement day increases in trades and trading volume are also evident in all firm specific and recommendation specific partitions of the data as in section 5 and appear to be a very robust phenomenon. For completeness, we also computed the abnormal volume over Day -9 to +9 using Womack's (1996) approach. We obtain results similar to those reported here and do not report them here.

The evidence of significant increases in volume (and trades), and especially in large size trades, within the context of unchanging spreads over the preannouncement period, contrasts with Lee, Mucklow and Ready (1993) who use a sample of NYSE stocks to show that higher volume is correlated with lower market liquidity around earnings announcements -- a period characterized by elevated information asymmetry.

7. Concluding Discussion

Using a sample of analyst recommendations over an eighteen-month period, between 1994 and 1995, on stocks trading in the NYSE and AMEX, we investigate if such recommendation changes are informative events, by measuring their effect on bid-ask spreads, the bid and ask depths and volume, over the period immediately preceding (and including) the public announcement of the recommendations.

Extant market microstructure theory predicts that if such events are informative, then the preannouncement period should be accompanied by increasing bid ask spreads and/or decreasing bid and ask depths.

The contribution of the current paper lies in attempting to investigate *directly*, through the evidence in spreads, depths, volume, and especially with large and small size trades, the conventional wisdom that analyst recommendation changes are informative events. Studies such as those by Womack (1996) and Stickel (1995) among others, have documented that analyst recommendation changes are accompanied by significant size-adjusted abnormal returns, which have a permanent effect on stock prices. This has lead researchers, including the above authors, to infer that such events are informative.

We find that public announcements of analyst recommendation changes are not accompanied by any significant widening of the bid ask spreads over 19 days surrounding (and inclusive of) the public announcement of analyst recommendations. Both the bid and ask depths, however, increase over the preannouncement period and are significantly higher on announcement day. Overall, these results are consistent with an *increase* in market liquidity around such events.

Consistent with the latter interpretation, we find that there is a significant increase in trading volume on announcement day. The increase in volume is very robust and survives any classification of the data based on institutional ownership, extreme changes in recommendations, firm size, trade size and trading volume.

We find that both large and small size trades (and corresponding trading volume) increase significantly on announcement day, although the total increase in volume on announcement day appears to be dominated by increases in large size trades (and trading volume). Assuming that institutions are more likely to use large size trades than individuals, our results imply a significant increase in institutional trading activity on (and around) announcement day. Following the conclusion in Badrinath

et al. (1995) that institutional investors are smart or informed traders, our volume evidence appears to support informed trading activity over the preannouncement period, even though the spread/depth evidence appears to contract it.

How do we explain our results? The first possibility is that recommendations are not inherently informative events. That would explain the lack of increase in spreads over the preannouncement period but would not explain why, as documented in the literature, significant abnormal returns exist around such events. The second, and more realistic, possibility is that there are adverse selection effects associated with such events, but because of the tremendous increase in volume over the same period, the market makers are able to simply match buyers with sellers and do not take personal trading losses. Since they are unaffected personally, the spreads do not increase. As further evidence of this possibility, we find an almost even split between buyer-initiated and seller-initiated trading trades (and trading volume) over the preannouncement period.

Interestingly, both Cornell and Sirri (1992) and Chakravarty and McConnell (1997) find no evidence of significant increases in bid-ask spread around illegal insider trading, although they too document a significantly increased volume on insider trading days. Both argue that the results could be due to a simultaneous increase in both insider and noise trader volume. If the specialist is able to match the trades of one group with those of the other, he does not bear any added personal risk and spreads do not increase. In the current context, there is a strong likelihood of a similar effect, which precludes the spreads from widening in the preannouncement period of analyst recommendations.

All this, of course, begs the obvious question of why does overall volume increase so significantly around such events? There is evidence that the sales forces of big brokerage houses go to work in drumming up customer business around their respective analysts' recommendations. Irvine (1994), for example, using individual brokerage trades of 17 different brokerage houses around the

corresponding analyst recommendation changes (282 distinct forecasts) in 58 different stocks trading in the Toronto Stock Exchange, finds evidence to suggest that analysts are able to generate some immediate trades for their respective brokerages. He finds a small but significant increase in trade from announcement day through the next seven trading days. Irvine argues that his results are due to the marketing efforts of the brokerage, which may provide a partial explanation of why we find a tremendous increase in volume around the public announcement of analyst recommendations.

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Table 1. Distribution of Analyst Recommendation Specific Variables

	Mean	Maximum	Median	Minimum
No of recommendation changes	5,863			
No of distinct firms	1,147			
Firm Size (in millions of dollars)	7,575	156,132	2,543	28
No of recommendations by Star Analysts	1027			
No. of recommendation changes that skip a rank	1,704			
Proportion of recommendation changes that skip a rank	0.2984			
No. of strong recommendation changes (ending in a 1 or a 5)	1,532			
Proportion of strong recommendation changes (ending in a 1 or a 5)	0.2683			
Institutional Ownership proportion	0.5479	0.9912	0.5657	0.0000
Elapsed days since previous recommendation made by same analyst on same stock	103	252	91	1
Average daily non-event trading volume ('000s)	374,508	3,949,507	224,552	3,156

Table 2. Distribution of Bid Ask Spreads, Bid and Ask Depths, Volume and Transactions around Analyst Recommendations

The medians of each variable along with their standard deviations in parenthesis are provided below. The cross sectional medians are computed as follows. First, the daily time-weighted averages of all spread measures as well as the bid and ask depths are calculated over the cross section of the stocks in our sample. The medians (and standard deviations) reported below are then computed over the cross section of all daily averages for each of the days in relation to the announcement day. The volume and trade measures are first calculated as simple daily averages over the cross section of the stocks. The medians and standard deviations are then computed over this cross section of stocks for each day in relation to the announcement day. Note that the superscript *A denotes that the number, on Day 0, is statistically distinct at the 0.01 level from the corresponding number, on Day -9, using a Wilcoxon sign rank test of equality of the medians. Similarly, superscript *B denotes that the number, on Day +9, is statistically distinct at the 0.01 level from the corresponding number, on Day 0, using a Wilcoxon sign rank test of equality of the medians.

	Day -9	Day -8	Day -7	Day -6	Day -5	Day -2	Day -1	Day 0	Day +1	Day +2	Day +5	Day +6	Day +7	Day +8	Day +9
Quoted Spread	0.1806 (0.0744)	0.1802 (0.0685)	0.1797 (0.0648)	0.1806 (0.0650)	0.1796 (0.0700)	0.1797 (0.0766)	0.1812 (0.0762)	0.1802 (0.0767)	0.1791 (0.0717)	0.1787 (0.0766)	0.1786 (0.0752)	0.1785 (0.0736)	0.1786 (0.0777)	0.1793 (0.0664)	0.1797 (0.0742)
% Quoted Spread	0.6209 (0.5329)	0.6269 (0.5296)	0.6221 (0.5418)	0.6245 (0.5559)	0.6223 (0.5445)	0.6212 (0.5492)	0.6311 (0.5493)	0.6271 (0.5453)	0.6196 (0.5364)	0.6213 (0.5295)	0.6189 (0.5442)	0.6205 (0.5389)	0.6211 (0.5583)	0.6179 (0.5548)	0.6176 (0.5483)
Effective Spread	0.1120 (0.0467)	0.1114 (0.0543)	0.1120 (0.0448)	0.1118 (0.0526)	0.1117 (0.0449)	0.1111 (0.0439)	0.1119 (0.0476)	0.1116 (0.0482)	0.1115 (0.0456)	0.1117 (0.0490)	0.1119 (0.0466)	0.1118 (0.0423)	0.1116 (0.0520)	0.1120 (0.0560)	0.1116 (0.0491)
Bid Depth	51 (112)	52 (111)	52 (110)	52 (113)	53 (111)	53 (112)	53 (117)	55* ^A (118)	55 (117)	54 (117)	53 (117)	53 (116)	52 (120)	53 (120)	53* ^B (120)
Ask Depth	57 (118)	57 (119)	57 (113)	57 (115)	58 (120)	58 (119)	59 (120)	61* ^A (123)	60 (120)	61 (122)	59 (121)	59 (121)	59 (120)	59 (120)	58* ^B (121)
Number of trades	77 (115)	77 (118)	80 (124)	79 (124)	79 (124)	80 (129)	82 (132)	88* ^A (149)	85 (140)	81 (130)	77 (118)	78 (120)	78 (121)	78 (120)	77* ^B (115)
Volume ('000s)	176,500 (517,824)	172,300 (483,933)	185,050 (525,938)	180,650 (509,057)	184,850 (497,565)	180,700 (521,123)	194,100 (575,173)	215,400* ^A (742,032)	200,000 (590,029)	187,700 (522,866)	175,600 (439,824)	179,800 (519,313)	178,800 (510,694)	179,600 (501,141)	178,200* ^B (451,380)

Table 3. Spread changes for Various Classifications of the Recommendation Change Sample

Pre-event implies (Day 0 - Day -9) and Post-event implies (Day +9 - Day 0). The bid and ask depths are in units of 100 shares. The asterisks imply significance at the appropriate level for a Wilcoxon sign rank test of equality of medians between the variable in the current column with the one to its immediate left. Superscript * denotes statistically distinct at the 0.01 level using a Wilcoxon sign rank test of equality of the medians. Superscript ** denotes statistically distinct at the 0.05 level using a Wilcoxon sign rank test of equality of the medians. Superscript *** denotes statistically distinct at the 0.10 level using a Wilcoxon sign rank test of equality of the medians.

Panel A

	Quoted Spread		Percentage Spread		Effective Spread	
	Pre-event	Post-event	Pre-event	Post-event	Pre-event	Post-event
	Median (Std Dev)	Median (Std Dev)	Median (Std Dev)	Median (Std Dev)	Median (Std Dev)	Median (Std Dev)
Change in Spread (for recommendations ending in 1 and skipping a rank)	-0.0013 (0.0331)	-0.0019 (0.0587)	-0.0050 (0.1727)	-0.0114 (0.1554)	-0.0006 (0.0328)	-0.0009 (0.0632)
Change in Spread (for recommendations ending in 5 and skipping rank)	0.0011 (0.0268)	-0.0014 (0.0268)	0.0082 (0.1980)	-0.0026 (0.1362)	-0.0009 (0.0290)	0.0000 (0.0235)
Change in Spread (star analysts)	0.0014 (0.0614)	-0.0018* (0.0732)	0.0044 (0.1718)	-0.0065* (0.1544)	-0.0009 (0.0472)	-0.0006 (0.0416)
Change in Spread (non-star analysts)	-0.0002 (0.0433)	0.0008*** (0.0399)	0.0018 (0.1876)	-0.0045* (0.1831)	-0.0003 (0.0370)	0.0005 (0.0392)

Panel B

	Bid Depth		Ask Depth	
	Pre-event	Post-event	Pre-event	Post-event
	Median (Std Dev)	Median (Std Dev)	Median (Std Dev)	Median (Std Dev)
Change in Depth (for recommendations ending in 1 and skipping a rank)	2 (75)	-4 (71)	0 (0)	0 (0)
Change in Depth (for recommendations ending in 5 and skipping a rank)	3 (76)	-2 (101)	0 (0)	0 (0)
Change in Depth (star analysts)	4 (88)	-2 (87)	0 (0)	0 (0)
Change in Depth (non-star analysts)	2 (85)	-2 (82)	0 (0)	0 (0)

Table 4. Pre Event and Post Event Spread Changes for Various Firm-Specific Classifications

Pre-event is Day 0 - Day -9 and post-event is Day +9 - Day 0. The asterisks imply significance at the appropriate level for a Wilcoxon sign rank test of equality of medians between the variable in the current column with the one to its immediate left. The superscript * denotes statistically distinct at the 0.01 level using a Wilcoxon sign rank test of equality of the medians; ** denotes statistically distinct at the 0.05 level; and *** implies statistically distinct at the 0.10 level.

Panel A: Recommendation change sample sorted by Firm Size (market value of equity)

	Quoted Spread		Percentage Spread		Effective Spread	
	Pre-event	Post-event	Pre-event	Post-event	Pre-event	Post-event
	Median (Std. Dev)	Median (Std. Dev)	Median (Std. Dev)	Median (Std. Dev)	Median (Std. Dev)	Median (Std. Dev)
Change in Spread (full sample)	0.0001 (0.0471)	-0.0010* (0.0477)	0.0023 (0.1848)	-0.0051* (0.1783)	-0.0004 (0.0391)	0.0002 (0.0397)
Change in Spread (SMALL firms)	-0.0003 (0.0455)	0.0000 (0.0491)	-0.0029 (0.3709)	-0.0018 (0.3738)	0.0000 (0.0428)	0.0022 (0.0448)
Change in Spread (LARGE firms)	0.0015 (0.0913)	-0.0009* (0.1039)	-0.0004 (0.0368)	-0.0038** (0.0458)	-0.0008 (0.0424)	0.0006 (0.0502)

Panel B: Recommendation change sample sorted by Institutional Ownership

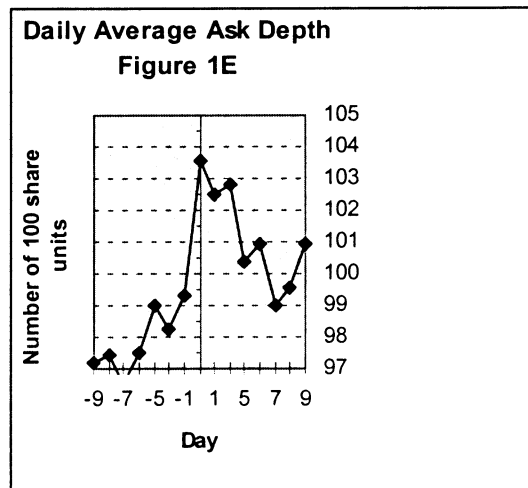
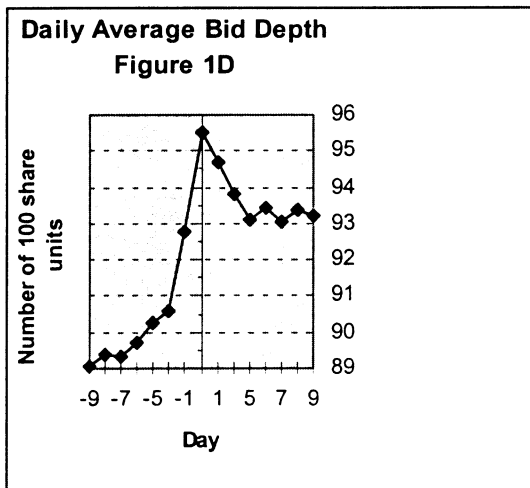
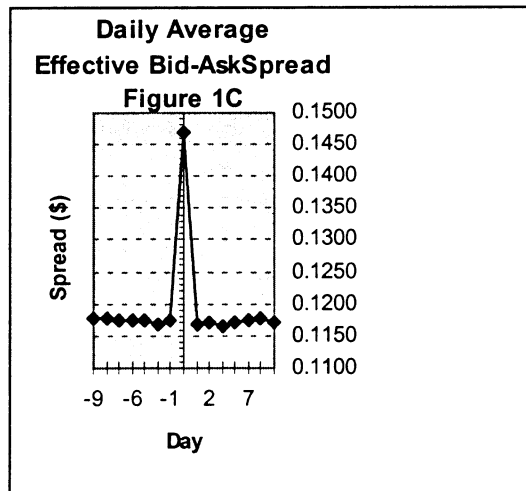
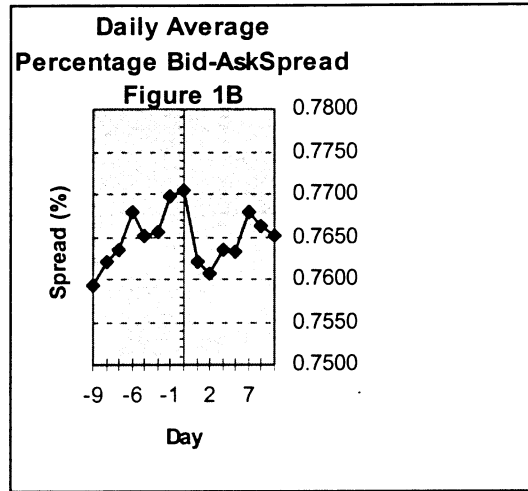
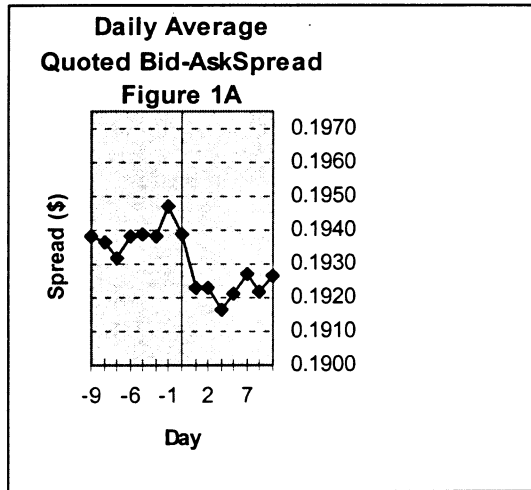
	Quoted Spread		Percentage Spread		Effective Spread	
	Pre-event	Post-event	Pre-event	Post-event	Pre-event	Post-event
	Median (Std. Dev)	Median (Std. Dev)	Median (Std. Dev)	Median (Std. Dev)	Median (Std. Dev)	Median (Std. Dev)
Change in Spread (full sample)	0.0001 (0.0471)	-0.0010 (0.0477)	0.0023 (0.1848)	-0.0051 (0.1783)	-0.0004 (0.0391)	0.0002 (0.0397)
Change in Spread (LOW IO firms)	0.0000 (0.0571)	-0.0004 (0.0527)	0.0000 (0.2407)	-0.0042 (0.2571)	0.0000 (0.0494)	0.0000 (0.0522)
Change in Spread (HIGH IO firms)	-0.0027 (0.0393)	-0.0014 (0.0383)	0.0066 (0.1583)	-0.0067*** (0.1470)	-0.0015 (0.0493)	-0.0008 (0.0509)

Panel C: Recommendation change sample sorted by average daily non-event trading volume

	Quoted Spread		Percentage Spread		Effective Spread	
	Pre-event	Post-event	Pre-event	Post-event	Pre-event	Post-event
	Median (Std. Dev)	Median (Std. Dev)	Median (Std. Dev)	Median (Std. Dev)	Median (Std. Dev)	Median (Std. Dev)
Change in Spread (full sample)	0.0001 (0.0471)	-0.0010 (0.0477)	0.0023 (0.1848)	-0.0051 (0.1783)	-0.0004 (0.0391)	0.0002 (0.0397)
Change in Spread (LOW volume firms)	0.0020 (0.0898)	-0.0009 (0.1030)	0.0050 (0.3337)	-0.0033 (0.3528)	0.0031 (0.0650)	0.0013 (0.0700)
Change in Spread (HIGH volume firms)	0.0008 (0.0117)	-0.0012* (0.0114)	0.0015 (0.0567)	-0.0062* (0.0510)	-0.0004 (0.0141)	0.0008 (0.0130)

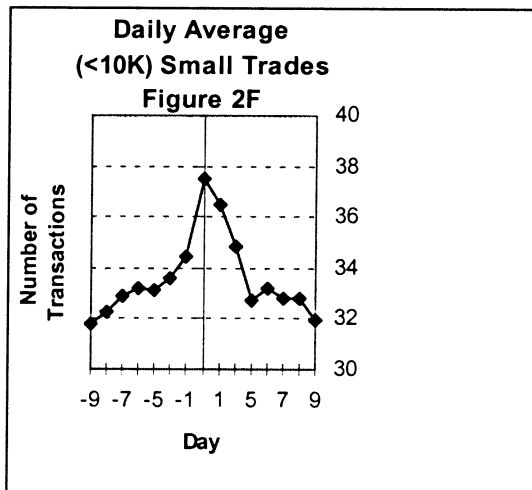
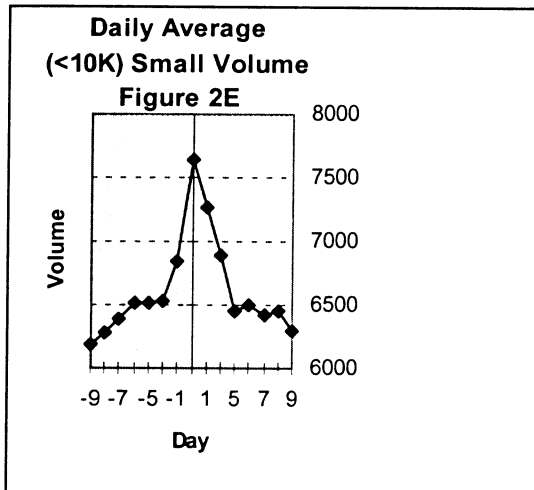
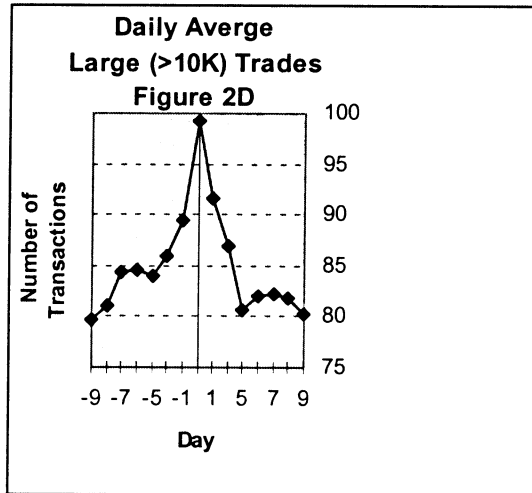
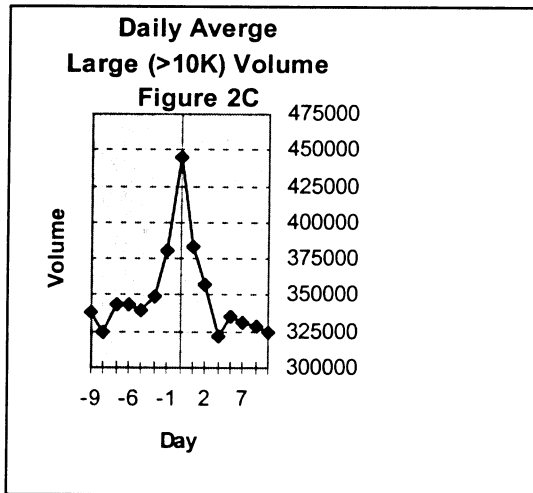
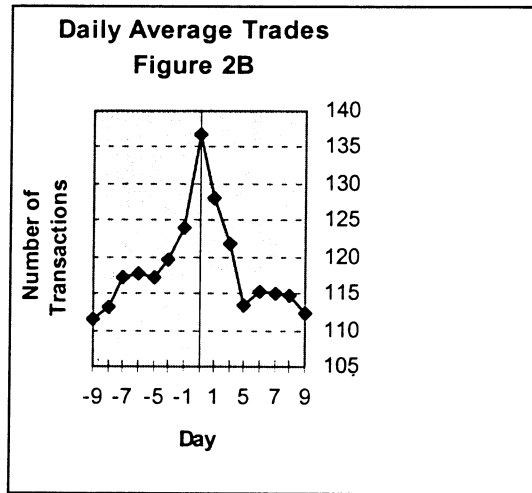
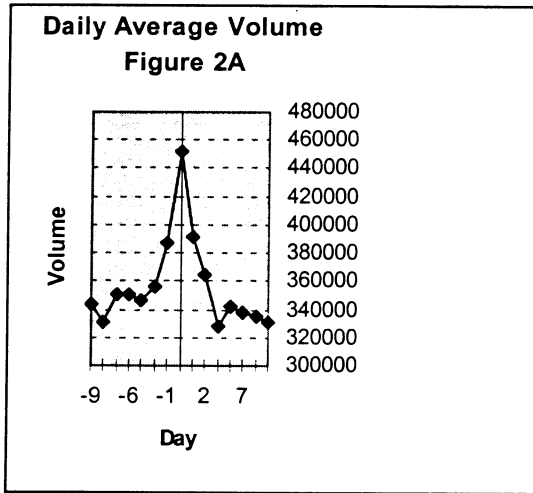
Figures 1A - 1E. Average Spreads and Depths around Event Day

The spreads and depths are daily time-weighted averages over the cross section of the stocks in our sample and are computed over days -9 through +9 relative to the announcement day. The quoted and effective spreads are denominated in dollars, while the depths are denominated in units of 100 shares.



Figures 2A - 2D. Average Volume and Trades Around Event Day

Large (small) volume (and trades) are defined as trades of at least (less than) \$10,000. Daily average volume and trades over the cross section of the stocks in our sample is presented.



Figures 3A - 3D. Average LARGE SIZE Buyer and Seller Initiated Volume around Event Day

Large volume (and trade) is defined as trades of at least \$10,000. Large size trades are further classified into buyer and seller initiated, using the Lee-Ready algorithm. Daily average volume and trades over the cross section of the stocks in our sample is presented.

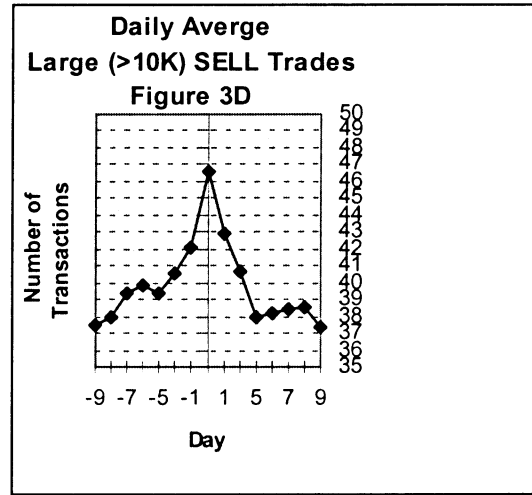
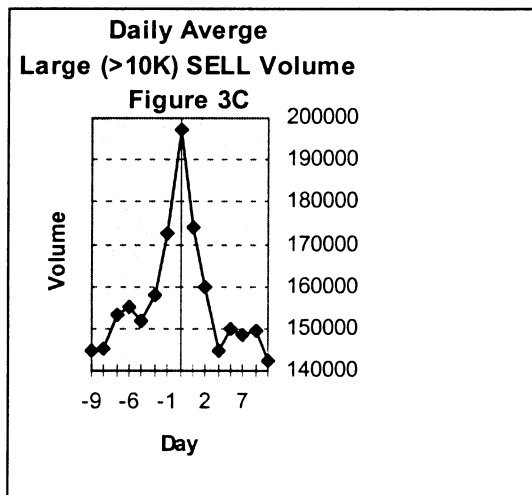
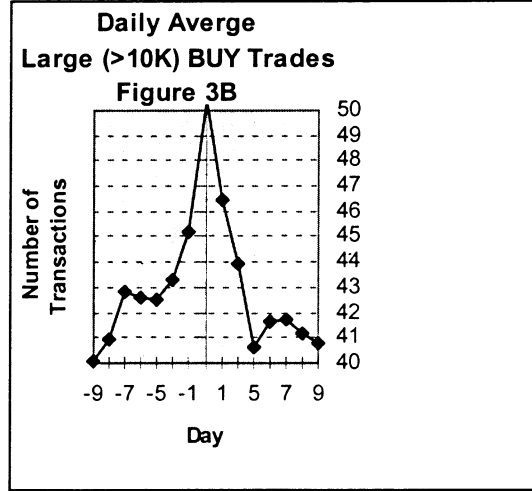
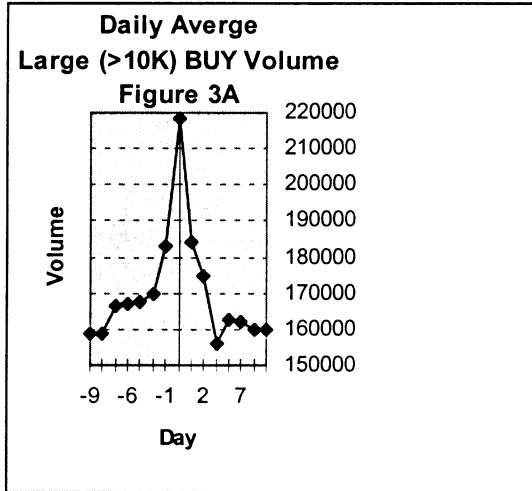
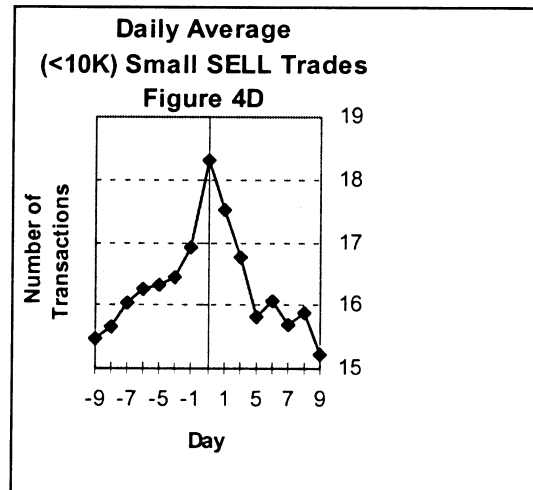
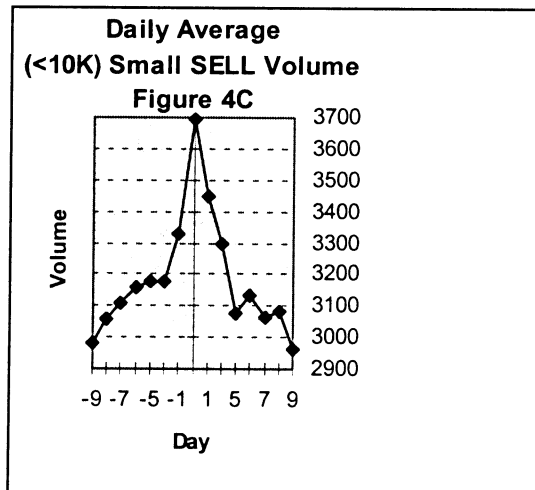
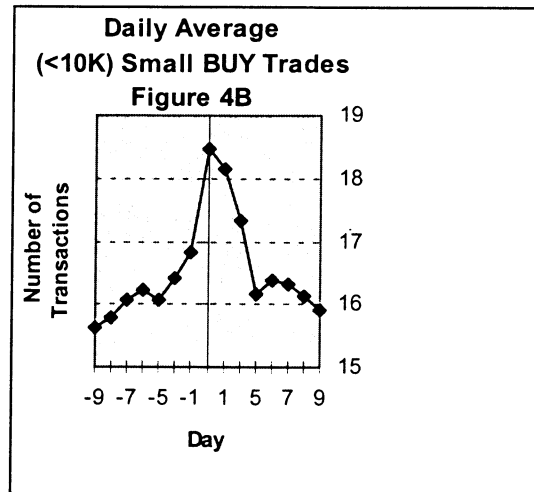
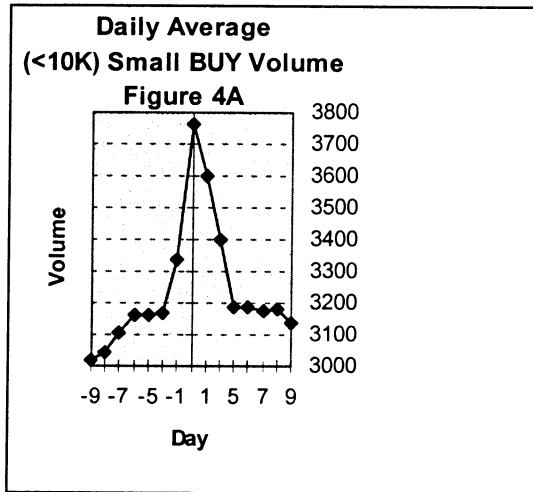


Figure 4A - 4D. Average SMALL SIZE Buyer and Seller Initiated Volume around Event Day

Small volume (and trade) is defined as trades of less than \$10,000. Small size trades are further classified into buyer and seller initiated, using the Lee-Ready algorithm. Daily average volume and trades over the cross section of the stocks in our sample is presented.



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