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ABSTRACT

This study investigates the behavior of the components of the bid-ask spread around earnings announcements. We find that the adverse selection cost component significantly increases surrounding the announcements, while the inventory holding and order processing components significantly decline during the same periods. Our results suggest that the directional change in the total bid-ask spread depends on the relative magnitudes of the changes in these three components. Specifically, the decreases in inventory holding costs and order processing costs imply that earnings announcements may have an insignificant impact on the total bid-ask spread, even when they result in increased information asymmetry.

THE PURPOSE OF THIS STUDY is to investigate the behavior of the three components of the quoted bid-ask spread surrounding earnings announcements. Because these announcements convey price-relevant information and their timing is largely predictable, they allow us to examine the effect of temporary information advantages that informed investors and/or public information processors may have. Further, we are able to provide new insight into the pre- and post-announcement effect of the earnings news on information asymmetry.

Extant market microstructure literature shows that the quoted bid-ask spread is composed of three components: order processing costs, inventory holding costs, and adverse selection costs. The order processing cost component of the spread represents a fee charged by market makers for standing ready to match buy and sell orders (Tinic (1972)). This component also includes compensation for the market maker's time for performing the paper work necessary to consummate the transaction. The inventory holding cost component, modeled in Stoll (1978) and Ho and Stoll (1981), compensates dealers for holding less than fully diversified portfolios. Finally, the adverse selection component (Copeland and Galai (1983) and Glosten and Milgrom (1985)) represents a reward to dealers for taking on the risk of dealing with traders who may possess superior information.

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In contrast to the above theoretical studies, recent empirical research has concentrated on the effect of earnings releases on the behavior of the *total* bid-ask spread. Using daily closing bid-ask prices for 25 National Association of Securities Dealers (NASD) firms, Morse and Ushman (1983) detect no change in the bid-ask spread. Venkatesh and Chiang (1986) find significant changes in the spreads after earnings announcements only in cases when no other material information with regard to the firm was released in the 30-day period prior to the earnings announcements. Patel (1991) documents an increase in spreads after earnings announcements, while Skinner (1991) reports similar results only for announcements that convey large earnings surprises. Finally, using intraday data, Lee, Mucklow, and Ready (1993) offer evidence that the spread substantially widens during the half-hour period containing earnings announcements and remains wider than nonannouncement periods for up to one day. They also document a decrease in the quoted depth in advance of earnings announcements and interpret their finding as evidence of active management of information asymmetry risk by specialists and other liquidity providers.

Surprising as it is, only a few attempts have been made to empirically investigate the behavior of the *components* of the bid-ask spread in general and surrounding earnings releases in particular. Notable exceptions are Stoll (1989), George, Kaul, and Nimalendran (1991), and more recently, Affleck-Graves, Hedge, and Miller (1994). Stoll (1989) constructs estimates of the three components of the bid-ask spread from slope coefficients of regressions of the serial covariance in the percentage price change series on the bid-ask spread.[1] Affleck-Graves, Hedge, and Miller use an extended Stoll methodology and test the impact of two trading mechanisms—agency/auction and competitive dealer—on the components of the bid-ask spread. They find that the order processing component of the spread is lower for exchange-listed stocks that use the agency/auction trading mechanisms. The adverse selection and inventory holding components, however, are generally higher for the agency/auction mechanism. They suggest that the difference in inventory holding costs may be attributed to differences in the characteristics of firms that choose to list on a trading system. Finally, Foster and Viswanathan (1993), using inter- and intraday New York Stock Exchange data, present evidence that the order processing component of the spread has very little intra- and interday variation. The adverse selection component, however, varies within the day and across days. In general they report higher adverse selection costs at times of the day with higher trading volume.

[1] See also George, Kaul, and Nimalendran (1991). They suggest that due to time-varying expected return Stoll's method might result in downward biased measures of the bid-ask spread and its components. They also show that the bias decreases as the differencing interval is reduced and/or the frequency of *simultaneous* measurement of transaction prices and bid/ask quotes is increased. Since half-hour intervals are used in the present study, the potential biases associated with the Stoll method are mitigated. Further, their proposed method has the drawback that it assumes zero inventory holding costs.

In this study, the behavior of the three components of the quoted bid-ask spread before and following earnings announcements is investigated using the method developed by Stoll (1989) and extended by Affleck-Graves, Hedge, and Miller (1994). Our empirical procedure distinguishes this study from other microstructure studies in two ways. First, by comparing the behavior of adverse selection costs (instead of the total quoted spread) during announcement and nonannouncement periods, we can directly infer the impact of earnings announcements on information asymmetry among market participants.[2] Second, by examining changes in inventory holding costs and order processing costs, we are able to provide an explanation for why previous studies document mixed results when investigating the effect of accounting earnings releases on the total bid-ask spread. We find that the adverse selection component of the spread increases significantly surrounding earnings releases, supporting the view that earnings releases increase information asymmetry among market participants (Lee, Mucklow, and Ready (1993) and Kim and Verrecchia (1994)). We also detect decreases in order processing costs and inventory holding costs during the predisclosure and event periods. Our findings imply that the impact of earnings announcements on the total quoted spread depends on the relative magnitudes of the changes in the adverse selection, inventory holding, and order processing components.

The remainder of the article is organized as follows. In Section I, we discuss our hypotheses concerning the impact of earnings announcements on the components of the bid-ask spread. Section II provides the empirical specification and describes the data. Empirical results are discussed in Section III, while Section IV provides summary remarks.

I. Theoretical Background and Development of Hypotheses

The typical information asymmetry model (e.g., Copeland and Galai (1983) and Glosten and Milgrom (1985)) assumes two types of traders: liquidity traders and potential information processors (or informed traders). Informed traders trade because they have private information not currently reflected in prices, while liquidity traders trade for reasons other than superior information. Market makers sustain losses from trading with informed traders and they recover these losses through the bid-ask spread. These models suggest that greater information asymmetry among market participants will lead to wider spreads.[3] If the specialist anticipates a greater probability of facing an informed trader in advance of earning releases, these models predict that the spread, and in particular the adverse selection component of the spread, should *widen*. Similarly, in the model by Easley and O'Hara (1992), the specialist sets the initial spread based on the ex ante probability of facing informed traders. During periods with an unusually

[2] Here we loosely define an earnings announcement period as a four-day window surrounding an earnings release. In the empirical investigation, however, 26 half-hour intervals, i.e., 2 trading days, after (before) an earnings announcement are used as the event (predisclosure) period.

[3] In these models, information asymmetry risk can increase with an increase in either the proportion of informed traders or the precision of their information.

high number of trades, the spread is widened as protection against informed investors. While the model does not decompose the spread, its logical extension is that it is the adverse selection component of the spread which is *widened* before an earnings announcement. This leads to our first hypothesis.

HYPOTHESIS 1. *Before earnings announcements (i.e., predisclosure periods), the adverse selection component of the bid-ask spread increases because of the greater probability of market makers facing an informed trader with advance knowledge of the earnings.*

In Kim and Verrecchia's (1994) model, some informed market participants (e.g., financial analysts, large shareholders, etc.) process public information such as earnings announcements into private information. These information processors have a comparative information advantage over the specialist, since they are able to produce superior assessments of a firm's performance on the basis of earnings announcements. In the words of Kim and Verrecchia (1994, page 44) ". . . earnings announcements prompt market makers to increase the bid-ask spread during a brief window (perhaps one or two days) surrounding their release. This protects market makers against the temporary information advantage held by processors of public information." This leads to our second hypothesis.[4,5]

HYPOTHESIS 2. *Following earnings announcements (i.e., event periods), the adverse selection component of the bid-ask spread increases because of the superior ability of informed traders to assess firms' performance on the basis of the announcements.*

The inventory holding cost component of the bid-ask spread compensates the specialist for sacrificing diversification.[6] Predicting the behavior of this component at the time of earnings announcements is, however, not straightforward. In general, during earnings releases one usually observes higher trading activity *and* higher volatility (e.g., Bamber (1986), Lee (1992), and Lee, Mucklow, and Ready (1993)). Increased volatility exposes a market maker to a greater risk from holding an undiversified portfolio, causing the market maker to *widen* the bid-ask spread. On the other hand, with higher volume the specialist has economies of scale, and hence the bid-ask spread can be *smaller*

[4] Two related articles (Admati and Pfleiderer (1988) and Foster and Viswanathan (1990)) focus on the adverse selection faced by a market maker who uses the order flow to infer the informed trader's beliefs and set prices so that they best represent the true value of the asset. Admati and Pfleiderer's model predicts that trading costs are *low* (i.e., the adverse selection component of bid-ask spread *decreases*) when trading volume is high and prices are more volatile, which is the case when earnings are announced. Foster and Viswanathan predict that the adverse selection component of bid-ask spread *increases* when trading volume is low and prices are more volatile.

[5] We thank the referee for drawing our attention to potential changes in the components of the bid-ask spread during predisclosure periods. For evidence on liquidity shifts before earnings announcements, see Lee, Mucklow, and Ready (1993).

[6] Unlike multiple dealers market (e.g., Nasdaq), specialists on the exchanges are not allowed to diversify their trading operations by offering other financial products and services such as investment banking and retail brokerage. See Affleck-Graves, Hedge, and Miller (1994) for a discussion of this and other issues related to the various trading mechanisms.

in percentage terms (e.g., Copeland and Galai (1983)). Empirical findings based on cross-sectional data are consistent with this prediction. McInish and Wood (1992), for example, show that firms with tighter spreads are generally characterized by higher volume and a greater number of trades. Although they do not attempt to examine inventory holding costs and order processing costs separately, Glosten and Harris (1988) also show that these two transitory components are *inversely* related to trading volume. In what follows, we empirically examine the extent to which the negative effect of increased volume on the inventory holding cost component is offset by the positive effect of volatility on this component in the period surrounding the releases of earnings information.[7]

The order processing cost component also influences the impact of earnings announcements on the total quoted spread. Affleck-Graves, Hedge, and Miller document that average order processing costs represent only 1 percent of the quoted spread for New York Stock Exchange (NYSE)/American Stock Exchange (AMEX) stocks, which is much smaller than Stoll's (1989) estimate of 47 percent for Nasdaq stocks. These two studies, however, use daily data and do not examine the behavior of this component during earnings releases. While the negative relation between trading volume and the two transitory components of the bid-ask spread (Glosten and Harris (1988)) may suggest that the order processing cost component decreases during earnings releases, its behavior remains an open question, and it is empirically addressed below.[8]

II. Empirical Specification, Data Sources, and Definitions of Variables

A. Data sources and sample selection

The sample includes quarterly earnings announcements drawn from the period January 1989 to December 1990. The earning announcement times are obtained from the PR Newswire data base (through DIALOG Information Services, Inc.) where each announcement is time-stamped to the nearest minute. To investigate the impact of earnings releases on the components of the bid-ask spread, three periods are considered: the event, predisclosure, and benchmark periods. The event period comprises 26 half-hour trading intervals, i.e., two trading days, (t = 0, . . . , and 25) where interval 0 includes the PR Newswire earnings announcement time. Similarly, the predisclosure period involves 26 trading intervals just before an earnings announcement (t = -26, . . . , and -1). The three components of the bid-ask spread during the event and predisclosure periods are compared to the components during the

[7] Harris and Raviv (1993) argue that increased volume reflects the lack of concensus among investors and suggest that higher volume is due to the arrival of public limit orders on both sides of the bid-ask spreads. Thus, their model implies that one should observe tighter spreads during earnings announcements.

[8] Similar to Glosten and Harris (1988), Foster and Viswanathan (1993) consider only adverse selection costs and fixed costs of the bid-ask spread. They report that fixed costs have little inter- and intraday variation.

benchmark period, which consists of 26 half-hour intervals beginning two weeks prior to the announcement.[9] Since we use intraday data in this study, an earning announcement is included in the sample only if transaction data for all three periods are available from the Institute for Study of Security Markets (ISSM) NYSE/AMEX tapes. Each trading day in the sample period is segmented into 13 half-hour intervals. Because the NYSE and AMEX are open from 09:30 to 16:00 Eastern Standard Time (EST), each of the event, predisclosure, and benchmark periods includes 26 half-hour intervals representing 2 trading days.

In addition, each announcement in the sample satisfies the following three selection criteria: (1) during the sample period the firm's average stock price is at least \$3, (2) the announcement is made between 09:30 and 16:00 EST (i.e., during trading hours),[10] and (3) each included stock has one or more transactions in at least 21 of the 26 half-hour trading intervals in the event, predisclosure, and benchmark periods. These criteria yield a sample of 506 and 511 firm/quarter earnings announcements for 1989 and 1990, respectively.

Summary statistics are presented in Table I. All values reported in the table are based on half-hour trading intervals. Consistent with previous studies (e.g., Lee, Mucklow, and Ready (1993)), we find that trading volume (measured by the number of shares traded times transaction price), the number of transactions, and volatility increase before and following earnings announcements. Nevertheless, while the mean percentage spread (where the quoted proportional spread is measured by the difference between the latest ask and bid quotes for each half-hour interval divided by the average of these quotes) increases during the event and predisclosure periods, the differences in means are not statistically significant.[11] Note that this result by itself does not necessarily imply that earnings announcements have no significant impact on information asymmetry because the total spread covers adverse selection, inventory holding, and order processing components.

B. Empirical Specification

In estimating the three components of the spread, the Stoll (1990) method utilizes the slope coefficients of the following two regressions:

$$\text{cov}_T = a_0 + a_1 S^2 + u \tag{1}$$

and

$$\text{cov}_Q = b_0 + b_1 S^2 + v \tag{2}$$

[9] The selection of an alternative benchmark period, such as four weeks prior to the announcement, yields similar results.

[10] This restriction ensures us that the PR Newswire stamp relative to the time stamp for ISSM trades is accurate to within 30 minutes, which is the trading interval used in this study. This criterion is also consistent with previous intraday studies (e.g., Lee (1992) and Lee, Mucklow, and Ready (1993)).

[11] We also find that the quoted spread, defined as the ask price minus the bid price, does not significantly change during the event and predisclosure periods.

Table I

Sample Sizes and Descriptive Statistics

The sample consists of 506 and 511 earnings announcements made in 1989 and 1990, respectively. The event period is defined as 26 half-hour trading intervals, $t = 0, \ldots, +25$, (i.e., 2 trading days) where interval 0 contains the announcement time as recorded by PR Newswire. The benchmark period is defined as a 2-trading day period beginning 2 weeks prior to the announcement, while the predisclosure period includes 2 trading days just before the announcement. Price is the average of bid and ask prices. Volume is estimated by the number of shares traded times transaction price. σ is the cross-sectional average of the standard deviation of inter-period returns. The percentage spread is averaged for all 26 intervals in each period, and these averages are averaged across all announcements. No. of Trades is the average number of transactions per half-hour interval. Values in parentheses indicate t-statistics for tests of difference in means.

	Benchmark Period				Predisclosure Period				Event Period				Differences in Means		
	Mean	Std. Dev.	Min.	Max.	Mean	Std. Dev.	Min.	Max.	Mean	Std. Dev.	Min.	Max.	Predisclosure Less Benchmark	Event Less Benchmark	Event Less Predisclosure
Price	38.26	35.38	2.24	622.03	38.08	35.37	2.09	586.86	38.01	35.02	2.18	553.91	−0.18	−0.25	−0.07
													(−0.11)	(−0.16)	(−0.04)
Volume ($\times 10^5$	7.60	17.70	0.04	434.04	8.17	13.89	0.08	224.61	10.28	17.45	0.08	315.72	0.57	2.68	2.11
													(0.80)	(3.44)	(3.02)
σ	0.62	0.74	0.10	20.54	0.64	0.41	0.00	4.66	0.75	1.27	0.14	29.38	0.02	0.13	0.11
													(0.75)	(2.82)	(2.63)
Spread (%)	1.05	0.72	0.17	8.01	1.08	0.78	0.19	8.78	1.09	0.83	0.20	9.23	0.03	0.04	0.01
													(0.90)	(1.16)	(0.28)
No. of Trades	10.66	12.98	1.38	203.62	11.60	12.70	1.69	133.69	13.35	16.33	1.73	215.31	0.94	2.69	1.75
													(1.65)	(4.11)	(2.70)

where S denotes the difference between the ask and bid quotes divided by the average of these quotes (i.e., the quoted proportional spread); cov_T is the serial covariance of transaction price changes; cov_Q is the serial covariance changes in bid (ask) quotes; and u and v are error terms.[12]

Given a_1 and b_1, the probability of a price reversal, π, and the size of a price continuation as a fraction of the spread, ∂, can be calculated from the following two equations:

$$a_1 = \partial^2(1 - 2\pi) - \pi^2(1 - 2\partial), \tag{3}$$

and

$$b_1 = \partial^2(1 - 2\pi). \tag{4}$$

The components of the bid-ask spread are then determined as

$$\text{Adverse Selection Cost} = [1 - 2(\pi - \partial)], \tag{5}$$

$$\text{Inventory Holding Cost} = 2(\pi - 0.5), \tag{6}$$

and

$$\text{Order Processing Cost} = (1 - 2\partial). \tag{7}$$

In addition to providing estimates of the proportional components of the spread, the Stoll method can also be used to obtain the value in cents of each component of the spread per dollar of stock price. Estimates of the costs as well as the proportion may be important because previous studies indicate that the *level* of the spread may differ between announcement and non-announcement periods.[13]

The coefficients a_1 and b_1 are estimated separately for each of the event, predisclosure, and benchmark periods in each year. The final estimates of these coefficients, obtained by averaging the coefficients for 1989 and 1990, are then utilized to calculate π and ∂ in equations (3) and (4). Finally, the three components of the spread are estimated using equations (5) to (7).[14]

Stoll's method does not provide a direct way to test the statistical significance. Thus, we use the bootstrap technique (Efron, 1979 and 1982) to calcu-

[12] Similar to Stoll (1989) and Affleck-Graves, Hedge, and Miller (1994), two estimates of cov_Q (one based on changes in the bid quote between two adjacent intervals and the other based on changes in the ask quote) are obtained for each of the years 1989 and 1990. We, however, use only one estimate of cov_T based on the latest transaction price in each half-hour interval, since we use intraday transaction data while these two studies utilize daily data.

[13] The costs per dollar of price are computed by multiplying each of the proportional components, obtained from equations (1) to (3), by the proportional spread (S).

[14] Both Stoll (1989) and Affleck-Graves, Hedge, and Miller (1994) require each stock in their samples to have at least 3 transactions on at least 15 trading days in each month. To have a reasonably large number of observations in each year, we include every earnings announcement that has at least one transaction in at least 21 half-hour intervals in the benchmark, predisclosure, and event periods.

late the standard errors and other statistics on the components of the bid-ask spread. The idea is to use a Monte-Carlo simulation on a nonparametric estimate of the underlying error distribution. More specifically, equations (1) and (2) are fitted to the data using the ordinary least squares (OLS) procedure and residuals are calculated. Then, the residuals are resampled and an artificial set of residuals is constructed. This is done so that the pattern of the disturbances does not change. Once a set of artificial residuals is obtained, pseudo-data are generated by adding these new residuals to the predicted values of the endogenous variables. Equations (1) and (2) are then refitted to the pseudo-data to obtain new regression coefficients a_1 and b_1. Each of these steps is carried out separately for each of the benchmark, predisclosure, and event periods in each year. These new slope coefficients are averaged for two years and these average values are substituted into equations (3) and (4) to calculate the probability of a price reversal, π, and the size of a price continuation as a fraction of the spread, ∂, which in turn are used to compute the three components of the bid-ask spread, as defined in equations (5) to (7). The entire procedure is repeated 10,000 times for all three periods.[15] The resulting sets of simulated components are then used to compute asymptotic standard errors and t-statistics for these components of the spread.[16]

III. Empirical Results

The estimates of the three components as a proportion of the percentage spread are summarized in Panel A of Table II.[17] The results in the panel indicate that adverse selection costs increase during earnings announcements. This component represents 76.4 (59.5) percent of the quoted proportional spread for the event (predisclosure) period versus 46.6 percent for the benchmark period. The asymptotic t-statistics for the difference in estimates are 19.10 for the event period and 8.15 for the predisclosure period, significant at any conventional level. The results suggest that information asymmetry increases before earnings releases, supporting our first hypothesis. Further, the adverse selection component is significantly higher for the event period than it is for the predisclosure period, consistent with our second hypothesis. This finding implies that earnings announcements may provide information pro-

[15] As discussed in Affleck-Graves, Hedge, and Miller (1994), we also find that the Stoll estimates in the bootstrap simulations can result in negative estimates of the order processing component when the size of a price continuation as a fraction of the spread, ∂, is greater than 0.5. Following their approach, we restrict ∂ to the range (0; 0.5).

[16] We also estimated p-values using the method similar to Affleck-Graves, Hedge, and Miller (1994). According to their method, the p-value for the difference in the adverse selection component, for example, is computed as the number of negative differences divided by 10,000 where each difference is the event period minus the benchmark period. The use of this approach does not alter our conclusion and thus its results are not reported.

[17] Each of our estimates for the benchmark periods generally falls within the range reported in previous studies. For example, our adverse selection cost component of 46.6 percent is higher than 43 percent in Stoll (1989) but lower than 50 percent for the "full sample" and 59 percent for the "matched sample" in Affleck-Graves, Hedge, and Miller (1994).

Table II

Estimated Component of the Bid-Ask Spread

Components of the bid-ask spread (Panel A) are estimated for the benchmark, predisclosure, and event periods using the Stoll (1989) methodology. The event period is defined as 26 half-hour trading intervals, $t = 0, \ldots, +25$, (i.e., 2 trading days) where interval 0 contains the announcement time as recorded by PR Newswire. The benchmark period is defined as a 2-trading day period beginning 2 weeks prior to the announcement, while the predisclosure period includes 2 trading days just before the announcement. Similar to Affleck-Graves, Hedge, and Miller (1994), the cost per dollar of price estimates (Panel B) are obtained by multiplying each component of the spread by the mean percentage spread S. Values in parentheses indicate asymptotic t-statistics where standard errors are obtained from a bootstrap simulation involving 10,000 replications.

	Estimated Components			Changes in Estimated Components		
	Benchmark Period	Predisclosure Period	Event Period	Predisclosure Less Benchmark	Event Less Benchmark	Event Less Predisclosure
Panel A: Proportion of Percentage Spread						
Adverse selection cost	0.466	0.595	0.764	0.129 (8.15)	0.298 (19.10)	0.169 (12.52)
Inventory holding cost	0.326	0.297	0.194	−0.029 (−2.47)	−0.132 (−10.73)	−0.103 (−9.21)
Order processing cost	0.208	0.109	0.042	−0.099 (−7.85)	−0.166 (−12.15)	−0.067 (−5.12)
Panel B: Cost per Dollar of Price (Cents)						
Adverse selection cost	0.489	0.642	0.834	0.153 (9.17)	0.345 (20.90)	0.192 (13.20)
Inventory holding cost	0.342	0.321	0.212	−0.021 (−1.69)	−0.130 (−9.96)	−0.109 (−9.03)
Order processing cost	0.218	0.118	0.046	−0.100 (−7.51)	−0.172 (−11.83)	−0.072 (−5.10)

cessors with a temporary information advantage over market makers and induce increased information asymmetry among market participants, as predicted by Kim and Verrecchia (1994).[18] We also find evidence that the inventory holding component is lower during the event period (19.4 percent) than it is during the benchmark period (32.6 percent). The difference is statistically significant with the asymptotic t-statistic of -10.73. In general, one observes higher trading activity and higher volatility following earnings announcements (see Table I). On the one hand, with higher volume the market maker has economies of scale such that the bid-ask spread can be tighter in percentage terms (e.g., Copeland and Galai (1983)). On the other hand, increased volatility exposes the market maker to greater risk from holding inventory. To offset this, the market maker is most likely to widen the spread. Our results indicate that the former effect dominates over the latter effect during earnings announcements. Although the inventory holding cost component also rises during the predisclosure period, the increase is much smaller than the change

[18] For announcements with analysts' EPS forecast data available from the summary statistics of I/B/E/S History Tape, we repeated the empirical analysis by partitioning the announcements into two groups based on the magnitude of earnings surprise. While the impact of earnings releases on information asymmetry is more pronounced for the announcements that convey large surprises (Kim and Verrecchia (1994)), the directional changes in the components of the bid-ask spread for both groups are similar to the results shown in Table II. We are thankful to I/B/E/S Inc. for providing earnings forecast data.

during the event period. This result is not surprising since trading volume during the event period is significantly higher than during the predisclosure period (see Table I).

Finally, we find that the order processing cost component declines during the event (4.2 percent) and predisclosure (10.9 percent) periods relative to the benchmark period (20.8 percent). Our estimate of the order processing component for the benchmark period lies between the 47 percent observed in Stoll (1989) and the 1 percent in Affleck-Graves, Hedge, and Miller (1994). Nevertheless, this component significantly decreases during the event and predisclosure periods, consistent with Glosten and Harris (1988). During these periods, there is a greater probability that the specialist will face informed traders and/or information processors. Consequently, the specialist's average realized spread (or gross profit) declines, as evident by the decreases in the two transitory components.

Panel B of Table II presents the estimates of the three components of the spread measured in cents per dollar of price. These values are computed by multiplying each of the proportional components, reported in Panel A, by the percentage spread (S). As expected, a comparison of these costs per dollar of price between the benchmark period and the event and predisclosure periods indicates that adverse selection costs increase around earnings announcements, while the other two components of the spread decrease. With regard to the economic magnitude of our results, adverse selection costs for an average stock with the price of \$38.26 during the benchmark period (see Table I) increase by 13.20 cents during the event period while the average realized spread, that is inventory holding costs plus order processing costs, declines by 11.55 cents per round trip transaction. From a specialist's perspective, one may argue that the decrease of this magnitude in the realized spread is economically important although the change in the total spread is negligible.

Overall, Table II shows that the adverse selection component increases around earnings announcements, implying greater information asymmetry among market participants. The release of earnings news is also accompanied by increased trading volume, which in turn reduces transitory components (i.e., inventory holding costs and order processing costs). Thus, the net impact of earnings announcements on the total bid-ask spread depends on which of these two effects is more pronounced. For example, the total spread will increase only if the effect of earnings announcements on information asymmetry dominates the effect on trading volume. When the magnitude of change in the adverse selection component is comparable to the total change in the transitory components, the quoted spread may not change significantly even if earnings announcements indeed increase information asymmetry. Thus, our results may help in explaining the contradictory results reported in previous studies that examine the effect of earnings releases on the behavior of the total bid-ask spread (e.g., Morse and Ushman (1983), Venkatesh and Chiang (1986), Skinner (1991), Patel (1991), and Lee, Mucklow, and Ready (1993)).

IV. Conclusion

This study investigates the behavior of the components of the bid-ask spread around the announcement of earnings news by advancing two hypotheses. Consistent with the theoretical work in the extant literature (e.g., Glosten and Milgrom (1985)), we hypothesize that the period prior to an earnings announcement is characterized by greater information asymmetry among market participants and thus increased adverse selection costs. We also propose that, following earnings announcements, the adverse selection cost component increases due to the presence of information processors who have superior ability to assess firms' performance on the basis of the announcements (Kim and Verrecchia (1994)). In addition, we examine changes in the inventory holding cost and order processing cost components before and following earnings announcements. To test our hypotheses, we use the Stoll (1989) framework to estimate the adverse selection, inventory holding, and order processing components of the quoted spread for the benchmark, predisclosure, and event periods. Our empirical results are strongly supportive of the two hypotheses.

With regard to the impact of earnings announcements on information asymmetry, we find that adverse selection costs increase significantly before and following the announcements. This result can be interpreted as evidence of increased information asymmetry. Moreover, the inventory holding component of the bid-ask spread is lower for the event and predisclosure periods than it is for the benchmark period, suggesting that a market maker's risk of holding excessive inventory decreases around the release of public information due to increased trading activity. Finally, we show that order processing costs also decline significantly during periods surrounding earnings releases.

Previous empirical evidence regarding the effect of earnings announcements on information asymmetry has been mixed (e.g., Morse and Ushman (1983) and Skinner (1991)). These studies interpret the change in the total spread as the evidence of increased information asymmetry. In contrast, we examine the changes in the three components of the quoted spread. Because of lower inventory holding and order processing components, the change in the quoted bid-ask spread will be less pronounced, although earnings releases result in increased information asymmetry among market participants. In this sense, our findings suggest that the total spread used in previous studies may not be an accurate measure of information asymmetry.

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