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Market Liquidity around Quarterly Earnings Announcements

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Market Liquidity around Quarterly Earnings Announcements:

Evidence from Japan

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Abstracts

In Japan there has recently been a rapid increase in the number of firms disclosing quarterly earnings. I investigate the information asymmetry and market liquidity around the quarterly earnings announcements, by focusing on the bid-ask spreads and quoted depths. Prior theoretical research has indicated that information asymmetry is exacerbated and market liquidity is reduced just before and at the point of public information disclosure, and that information asymmetry is improved and market liquidity is enhanced by disclosing public information. Using the transaction data of 121 firms that have implemented quarterly earnings reporting during 2001, I find that there are significant decreases in daily bid-ask spreads and slight increases in daily depths during the period just after the release of the quarterly earnings, which are consistent with the prediction based on prior theoretical studies. However, I do not find strong evidence that the spreads are wider and the depths lower during the pre-announcement and announcement periods.

Key Words: Quarterly Earnings Announcements; Information Asymmetry; Market Liquidity; Bid-Ask Spread; Quoted Depth

Data Availability: The data used in this study are publicly available from the sources indicated in the text.

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1. Introduction

In Japan there has recently been a rapid increase in the number of firms disclosing quarterly earnings, mainly because in November 1999 the Tokyo Stock Exchange (TSE) organized a new section named Mothers, in which small, newly-established companies could raise funds, and imposed a rule requiring that listed firms in this section report their earnings quarterly. Many firms listed in the other sections also began voluntarily to release quarterly earnings, so that investors could obtain information on their performance in a more timely matter.[1] Furthermore, on June 27, 2002, the TSE announced that all of the listed firms would be obligated to make quarterly reporting for the fiscal years beginning after April 1, 2003.[2] The purpose of this study is to examine the effectiveness of quarterly financial reporting, which has rapidly been becoming pervasive in the Japanese stock market.

In the United States, quarterly earnings reporting has a forty-year history, since the American Stock Exchange (ASE) first required listed firms to issue quarterly reports in 1962. For example, Morse (1981) find that the most significant stock price changes and excess trading volume occur the day prior to and the day of the quarterly earnings announcements in the Wall Street Journal. McNichols and Manegold (1983) indicate that there is a significant reduction in the marginal

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[1] Based on the survey of TSE (2001), 139 Japanese firms released financial reports for the first quarter of the fiscal year ending in March 2002. Among these firms, 98 were ones listed on the TSE, 36 on the over-the-counter market, and 5 on the other stock markets. It was also reported in the Nihon Keizai Shimbun on September 9, 2002 that another 140 firms listed on the TSE newly disclosed financial reports for the first quarter of the fiscal year ending in March 2003.

[2] To be more precise, the TSE announced a plan that first mandates listed firms to concisely disclose each quarter's general conditions such as sales revenues, order backlogs, and increases or decreases of assets and liabilities for the fiscal years beginning after April 1, 2003, and subsequently to file the quarterly condensed financial statements for the fiscal years beginning after April 1, 2004.

information content of annual earnings announcements following the introduction of quarterly reporting. Landsman and Maydew (2002) find evidence of an increase in the informativeness of quarterly earnings announcements over the past three decades, as measured by both abnormal trading volume and abnormal return volatility.

Up to now, Japanese firms, in principle, have reported their earnings semi-annually. Several firms, which have adopted U.S. GAAP for their consolidated financial statements, have only voluntarily released quarterly earnings. Therefore, there has been little research that analyzed the information content of quarterly earnings in the Japanese stock market. Otogawa (1999) examine the stock price reaction to quarterly earnings announcements using 95 firm-quarter observations during the period from 1987 to 1997.

In this study, I investigate the information asymmetry and market liquidity around quarterly earnings announcements, measured by the percentage bid-ask spreads and quoted depths. Prior theoretical research has indicated that information asymmetry is exacerbated and market liquidity is reduced just before and at the point of public information disclosure, and that information asymmetry is improved and market liquidity is enhanced by disclosing public information. Using the transaction data of 121 TSE firms that have implemented quarterly earnings reporting during 2001, I find that there are significant decreases in daily bid-ask spreads and slight increases in daily depths during the period just after the quarterly earnings are released, which are consistent with the prediction based on the theoretical studies. However, I do not find strong evidence that the spreads are wider and depths lower during the pre-announcement and announcement periods.

The remainder of the paper is organized as follows: in Section 2, I briefly survey earlier studies and describe my hypotheses. In Section 3, I explain the sample selection, data, and research methodology. In Section 4, I present the empirical results, and Section 5 contains the conclusion.

2. Review of Prior Research and Research Hypotheses

2-1. Financial Reporting and Information Asymmetry

There has been some theoretical research conducted on how earnings announcements affect information asymmetry.[3] Assuming that costless public information is a perfect substitute for costly private information concerning the return on a risky asset, Verrecchia (1982) shows that increasing publicly available information decreases the amount of private information traders acquire on their own. Diamond (1985) also demonstrates that releasing public information reduces the incentives for the production of private information by traders, and that risk sharing is improved because the public information makes traders' beliefs more homogeneous and decreases the magnitude of the speculative positions which informed traders take. One can think of the earnings information that a company discloses as an example of publicly available information for investors trading its stocks. Therefore, these analytical models lead to the following hypothesis:[4]

H_1: Information asymmetry in the stock market is improved during the post-announcement period after a firm releases earnings.

Kim and Verrecchia (1994) show that if investors have a different ability to process earnings announcements, some traders capable of making informed judgments from public sources enjoy a temporary information advantage. Their model suggests information asymmetry at the date when an earnings number is released, as follows:

H_2: Information asymmetry in the stock market is exacerbated during the announcement period during which a firm releases earnings.

Demski and Feltham (1994) demonstrate that there are some traders who are motivated to privately acquire costly information in order to speculate on the forthcoming public disclosure under a certain condition. In the settings where traders with short-term investment horizons are allowed to

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3 See Callahan, Lee, and Yohn (1997) for a more comprehensive literature survey.

4 Within the context of two complementary private signals, Lundholm (1991) indicates that as the public information becomes more precise, fewer traders become informed, but the information gap between informed and uninformed traders increases.

trade on their private information prior to a public disclosure, McNichols and Trueman (1994) show that public disclosure stimulates investment in private information acquisition, and that an increase in either the probability or the precision of a public disclosure gives informed traders an incentive to increase the precision of their private information. Thus, these theoretical models, which predict that some traders' private information search prior to the public disclosure exists, lead to the following hypothesis:

H_3: Information asymmetry in the stock market is exacerbated during the pre-announcement period just before a firm releases earnings.

I test the three hypotheses on information asymmetry surrounding the earnings announcement described above using data on Japanese firms that have initiated quarterly earnings reporting.

2-2. Information Asymmetry and Liquidity in the Stock Market

In the New York Stock Exchange (NYSE), exchange-designated specialists have affirmative obligations to provide continuous liquidity to the market. Specialists offer simultaneous quotes to both buy and sell. Glosten and Milgrom (1985) demonstrate that a specialist sets a higher ask price and a lower bid price when the fraction of informed traders increases or their information becomes better. That is, the bid-ask spread, defined as the difference between the ask price and bid price, is thought to measure the extent of information asymmetry among the market participants.

The trading mechanism on the TSE differs substantially from the one on the NYSE.[5] The primary differences between the two systems are the absence of a designated liquidity-provider such as specialists or market makers in the TSE.[6] Within continuous double auction trading called the

[5] See Lehmann and Modest (1994), and Hamao and Hasbrouck (1995) for the market micro-structure of the TSE.

[6] It is anecdotally argued that the self-trading department of stockbrokerage firm acts as a market-maker in the TSE.

Zaraba, traders may submit limit orders or market orders.[7] All liquidity is supplied by traders who submit limit orders. The highest limit order to buy becomes the best bid price, and the lowest limit order to sell becomes the best ask price. Therefore, the bid-ask spread, in this study, is defined as the difference between the best ask price and the best bid price of all limit orders.

The market order to buy (sell) that arrives at the exchange is successively matched to the best ask (bid) limit order, and the trade is executed if the price change from the last trade satisfies prescribed conditions set by the TSE, and if the depth at the quote is sufficient.[8] Virtually all trades occurring under the Zaraba mechanism are the result of market orders hitting limit orders or limit orders crossing. Because market orders almost never cross, there are virtually no trades between the bid and ask prices. Therefore, I do not compute the effective spread, which is defined as the difference between the transaction price and the mid-point of the bid and ask quotes, but instead use the quoted spread.

Prior research suggests that the bid-ask spread set by a specialist is comprised of the transaction costs of processing orders, and the costs of holding a less than fully diversified portfolio, as well as expected losses due to dealing with informed traders. On the TSE, stockbrokerage firms charge a commission for the provision of trading services, and order processing costs are unlikely to be recovered by the bid-ask spreads. Because all traders are able to post limit orders, no one should be forced to maintain an excess inventory position. Leuz and Verrecchia (2000), which investigate German firms included in the DAX 100 stock index, suggest that other spread components unrelated

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[7] TSE trading takes place in two different trading sessions. The morning session, called the Zemba, begins at 9:00 A.M. and ends at 11:00 A.M., while the afternoon session, called the Goba, begins at 0:30 P.M. and ends at 3:00 P.M. Trade at the beginning of each session is initiated through a single-price auction called the Itayose. After that, trades occur under the Zaraba mechanism until the session closes, at which orders are also executed through the Itayose mechanism. Lehmann and Modest (1994) report that 65 to 70 percent of total trading volume occurs under the Zaraba mechanism for all firms regardless of their size decile.

[8] If the price change exceeds maximums mandated by TSE, trading is temporarily halted to advertise the need for additional liquidity and smooth quote adjustments between transactions.

to information asymmetry are presumably less important in an order-driven market. As the TSE is an order-driven market, I don't attempt to partition the total quoted spread into these components.

Lee, Mucklow, and Ready (1993) point out that if the specialist believes the probability that some traders possess superior information has increased, he could protect himself not only by increasing the bid-ask spread, but also by decreasing the number of shares available to trade at each quoted price. Therefore, I also focus on the quoted depth, which is measured as the number of shares quoted at the best ask price plus the number of shares quoted at the best bid price, to comprehensively understand information asymmetry in the stock market.

Furthermore, in the context of narrowing spread and increasing depth, traders can buy or sell large numbers of shares that they want at low transaction costs. In contrast, in the context of widening spread and decreasing depth, traders cannot buy or sell even small numbers of shares at the given transaction costs. Bid-ask spread and quoted depth serve together as the proxy for market liquidity. Because of this, I investigate the changes in information asymmetry and market liquidity around the quarterly earnings announcement using data on quoted spreads and depths.

2-3. Bid-Ask Spreads and Depths around the Earnings Announcements

Many researches have examined bid-ask spreads and depths around informational events such as earnings announcements.[9] For example, Morse and Ushman (1983) investigate bid-ask spreads over 21 days surrounding quarterly earnings announcements of 25 over-the-counter (OTC) firms between 1973 and 1976. They find no significant changes in bid-ask spreads around earnings announcements. Venkatesh and Chiang (1986), using a random sample of 75 NYSE listed firms, examine bid-ask

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[9] See Callahan, Lee, and Yohn (1997) for a more comprehensive literature survey. As the literature that focus on the relation between other information events and bid-ask spreads, Conrad and Niden (1992) and Jennings (1994) examine the behavior in spreads around takeover announcements, while Barclay and Smith (1988), Singh, Zaman, and Krishnamurti (1994), Wiggins (1994), and Miller and McConnell (1995) investigate open market stock repurchases.

spreads just before earnings and dividend announcements. They find significant increases in bid-ask spreads only before the second announcement that is preceded by another announcement in the prior thirty days. Lee, Mucklow, and Ready (1993) use intraday quotes data of 230 NYSE firms to analyze both bid-ask spreads and depths at the time of quarterly earnings announcements. They show that bid-ask spreads widen, and depths drop, in advance of quarterly earnings announcements, and the sharpest increases in bid-ask spreads occur in the half hour during which the earnings announcements are made. Coller and Yohn (1997) investigate the relationship between management earnings forecasts and bid-ask spreads. They report that forecasting firms have significantly larger spreads than matched non-forecasting firms during the period prior to the release of the management forecast, and that the spreads of forecasting firms temporarily increase in the day of and the day after the management forecast. In addition, they report that there are no significant differences in spreads between forecasting firms and non-forecasting firms during the nine days after the management forecast. Affleck-Graves, Callahan, and Chipalkatti (2002) examine the bid-ask spreads around quarterly earnings announcements for 247 NASDAQ firms. They find a significant increase in the adverse selection component of the bid-ask spread on the day and the day before quarterly earnings announcements for firms with less predictable earnings, but no changes for firms with more predictable earnings.

There have also been several studies analyzing non-U.S. stock markets. Leuz and Verrecchia (2000) investigate German firms included in the DAX 100 stock index, and show that firms switching to international reporting standards (IAS or U.S. GAAP) have significantly smaller spreads than the firms following the German reporting standards. Acker, Stalker, and Tonks (2002) use a sample of 195 U.K. firms on the London Stock Exchange (LSE) over the period from 1986 to 1994. They find that the bid-ask spreads start to decrease 15 days before the earnings announcements, and remain at relatively narrow levels for up to 90 days after the announcements. In this study, I examine changes in the quoted spread and depth around the quarterly earnings announcement, using a sample of the Japanese firms listed on the TSE.

3. Research Design

3-1. Sample and Data

I use the Nikkei Telecom 21 (similar to the Dow Jones News Retrieval Service in the U.S.) to identify whether a firm have implemented quarterly financial reporting, and when the quarterly earnings numbers were published in the Nihon Keizai Shimbun (the most popular Japanese financial newspaper). Among more than 2,000 firms that were listed on the TSE during 2001, 121 firms released quarterly earnings. This results in an initial sample of 484 firm-quarter observations. But because some firms introduced quarterly earnings reporting in the middle of 2001, there are 18 observations that quarterly earnings announcement date are missing. I obtain the necessary data for this study from the Nikkei Tick by Tick Data provided by the Nikkei Quick Information Technology Co., Ltd.[10] I also eliminate 81 observations that don't have sufficient market data over the estimation period due to thin transactions. Therefore, the final sample consists of 385 quarterly earnings announcements.

Panel A of table 1 presents the sample distribution based on the Nikkei two-digit industrial codes. More than 70% of the firms that have disclosed quarterly earnings are in the service, stockbrokerage,

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[10] The Nikkei Tick by Tick Data is basically the same database as one provided by the University of Memphis's Institute for the Study of Security Markets (ISSM). It reports all trades and quotes originating from TSE or other stock exchanges. For each trade, it records time stamped to the nearest minute, price, volume, and transaction codes. For each quote, it records time stamp, code indicating bid or ask quotes, best bid or ask prices, number of shares quoted at either price, and quote codes. Because my data have a coarser time stamp than ones on the ISSM tape, which has time stamp to the nearest second, there are a number of trades and quotes in the same time. Since they are numbered serially in the broadcasted order, I process the data in accordance with their serial numbers. Then there are some types of quotes on the TSE. By excluding a warning quote (*chui kehai*) and a special quote (*tokubetsu kehai*) that are issued when no quote is available or when the required price change to execute a single market order would exceed the maximum allowable price variation, I use only regular quotes (*ippan kehai*), which are constituted by limit orders some trader has submitted, to compute the daily spread and depth.

trading, or electrical equipment industries. Panel B indicates a sample distribution by the market section. I exclude more observations on the Second and Mothers sections than on the First section, because the stocks on the former sections are much less actively traded than the stocks on the latter section.

Table 1

3-2. Abnormal Spread and Depth Measures

To test the changes in information asymmetry and market liquidity around the quarterly earnings announcements, I compute the abnormal spread and depth using a standard event study methodology. First, at each quarterly earnings announcement date, I separately estimate the following equations (1) and (2) using Ordinary Least Squares (OLS). Equation (1) is the model with the bid-ask spread, and equation (2) is the model with the quoted depth, as the dependent variable. The parameter estimates are derived using the data from day -150 to day -11 (i.e., the estimation period), where day 0 is the quarterly earnings announcement date. Because I require that market data for at least 100 days are available for estimating each model, 81 firm-quarters are excluded from the final sample, as mentioned above.

$$\ln(SPREAD_{i,t}) = \alpha_0 + \alpha_1 \ln(TRANS_{i,t}) + \alpha_2 \ln(PRICE_{i,t}) + \alpha_3 \ln(VAR_{i,t}) + \alpha_4 \ln(MVAR_{i,t}) + \varepsilon_{i,t} \quad (1)$$

$$\ln(DEPTH_{i,t}) = \beta_0 + \beta_1 \ln(TRANS_{i,t}) + \beta_2 \ln(PRICE_{i,t}) + \beta_3 \ln(VAR_{i,t}) + \beta_4 \ln(MVAR_{i,t}) + \mu_{i,t} \quad (2)$$

$SPREAD_{i,t}$ is the daily average of percentage bid-ask spreads for firm *i* on day *t*. I measure the percentage spread as the difference between the bid and ask prices in effect at the time of the transaction deflated by the midpoint of the bid and ask prices.[11] $DEPTH_{i,t}$ is the daily average of the quoted depths for firm *i* on day *t*. I define the quote depth as the number of shares quoted at the ask price plus the number of shares quoted at the bid price in effect at the time of the transaction divided by its round lot.[12] $TRANS_{i,t}$ is the daily number of transactions for firm *i* on day *t*. $PRICE_{i,t}$ is the closing price for firm *i* on day *t*. $VAR_{i,t}$ is the proxy of volatility, measured as one plus the squared percentage change in the closing price for firm *i* from day *t-1* to day *t*. $MVAR_{i,t}$ is the proxy of market-wide volatility, calculated as one plus the squared percentage change in a popular market index, Tokyo Stock Price Index (TOPIX), for firm *i* from day *t-1* to day *t*. These independent variables, TRANS, PRICE, VAR, and MVAR, are suggested to be the determinants of the bid-ask spreads by many prior researches.[13] But as there are few studies on depths, it is not very clear how they vary among firms and over times. In this study, both the bid-ask spread and depth are considered to be the measures of information asymmetry and market liquidity. I choose the same independent variables in the depth model as in the spread model. All variables are log-transformed.

Next, on each trading day in the event period (i.e., day -10 to day +10), I calculate the expected spread and depth based on the estimated regression coefficients of equations (1) and (2), respectively. The difference between the actual spread (depth) on each day in the event period and the expected value computed in this manner is an estimate of the abnormal spread (depth). Under hypothesis H_1, I expect that the abnormal spread is significantly negative, and that the abnormal depth is significantly positive during the post-announcement period. Under hypotheses H_2 and H_3, I predict that the abnormal spread is significantly positive, and that the abnormal depth is significantly negative during

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[11] I eliminate the opening and closing transactions of each trading session executed through a single-price auction. Because stocks of Japanese firms generally have par value of ¥50, ¥500, or ¥50,000, I use the percentage spread, not the amount spread, which is the difference between bid and ask prices, to keep cross-sectional comparability.
[12] The reason is because there are various round lots of 1,000, 100, or 1 shares in Japan. I use the depth deflated by its round lot, to facilitate the cross-section comparison.
[13] For example, see Callahan, Lee, and Yohn (1997, p.52, table 1).

the announcement and pre-announcement periods. To infer statistical significance, I compute three test statistics. The first is the t-statistic, computed using the cross-sectional standard deviation on each event day. The second t-statistic is defined using the standard deviation estimated from the time-series of average abnormal measures over the estimation period (Brown and Warner, 1985, p.7). These parametric tests are for the null hypothesis in which the mean is zero. In contrast, the third is the z-statistic based on the non-parametric binominal sign test for the null hypothesis in which the median is zero.

4. Empirical Results

4-1. Descriptive Statistics

Table 2 reports the descriptive statistics for some characteristics of 121 firms in the initial sample that have released their earnings quarterly. For reference, I also provide descriptive statistics for another 1,882 firms that have not implemented quarterly financial reporting. For each firm, all variables are the average value of at maximum 246 trading days during the period from January to December 2001. While the non-quarterly reporting firms have a mean (median) daily percentage spread of 1.48 (1.06) %, the quarterly reporting firms have a mean (median) spread of 1.23 (0.73) %. The difference in mean (median) spreads across the two groups is significant with p = 0.0485 (p = 0.0021) using a two-tailed t-test (Mann-Whitney-Wilcoxon test). The mean (median) quoted depth of the quarterly reporting firms are 24.1915 (12.4708) round lots, which are marginally higher than one of the non-quarterly reporting firms at the significant level of 0.1218, using a Mann-Whitney-Wilcoxon test. The quarterly reporting firms are also larger in size, are traded more actively, and have a more volatile stock price, than the non-quarterly reporting firms.

Table 2

It is not completely clear to me how these characteristics of sample firms affect the empirical results on information asymmetry and market liquidity around the quarterly earnings announcements. However, Lang and Lundholm (1993) indicate that the disclosure practices of larger firm are evaluated more highly by financial analysts. Because quarterly reporting firms always take up positive attitudes toward information disclosure, for reasons inclusive of the size factor, they might keep information asymmetry among the market participants at a lower level, so that they have their stocks traded more actively, at smaller bid-ask spreads, and with marginally higher quoted depths, over time than the non-quarterly reporting firms.[14] If so, the following results are potentially biased against finding significant changes in spread and depth around the quarterly earnings announcement date.

4-2. Bid-Ask Spreads

In this section, I examine the three hypotheses about information asymmetry and market liquidity around the quarterly earnings announcements by focusing on the bid-ask spreads. Because prior studies suggest numerous determinants of the bid-ask spread, I first estimate equation (1) to control the effect of such determinants.[15] Table 3 provides the descriptive statistics for the estimation results of the spread model. Generally, the coefficient on TRANS is significantly negative, suggesting that the more actively stocks are traded, the lower the bid-ask spreads are. PRICE also has a significantly negative coefficient, that is, lower-priced stocks have higher spreads. The positive coefficients on VAR and MVAR indicate that higher individual stock's and market-wide volatilities are associated with wider spreads. The only coefficient on VAR is significant. These results are basically consistent with prior research. The model has a moderate explanatory power; the mean (median) adjusted R^2 is

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[14] The positive relationship between disclosure quality and market liquidity is demonstrated by Welker (1995), Healy, Hutton, and Palepu (1999), and Heflin, Shaw, and Wild (2001).

[15] Excluding the market-wide volatility (MVAR) from equation (1) does not materially alter the results reported below.

0.2258 (0.1723).

Table 3

Next, on each trading day in the event period, I compute the abnormal spread, defined as the difference between the actual percentage spread and the expected one based on the estimated coefficients of equation (1). Panel A of table 4 presents the behavior in an abnormal spread around 385 quarterly earnings announcement dates that are released by 121 firms listed on the TSE during 2001. During the period just after releasing the quarterly earnings, especially from day +2 to day +10, both the mean and median abnormal spreads are significantly negative. These results vigorously support hypothesis H_1 that information asymmetry among the market participants is improved by public disclosure of earnings information. However, over the other period from day -10 to day +1, the abnormal spreads are also negative, and statistically significant in most days. These findings provide no support for hypotheses H_2 and H_3 that private information search and excellent information processing by some traders deteriorate information asymmetry and market liquidity during the pre-announcement and announcement periods.

Table 4

Because up to now Japanese firms have been mandated to release their earnings semi-annually, the earnings information newly disclosed by introducing quarterly financial reporting is only the information from the first and third quarters. Because of this, I divide the sample into two groups in order to conduct the above-mentioned analysis repeatedly. Panel B reports the results for the sub-sample consisting of 183 firm-quarters that announce earnings in first or third quarters. During the post-announcement period, the mean abnormal spreads are negative, but statistically significant only from day +7 on forward. The median spreads are significantly negative in most days. During the pre-announcement and announcement periods, they are also significantly negative in some days. Panel C provides the result for the sub-sample of 202 observations, including only second quarter (semi-annual) or fourth quarter (annual) earnings announcements, which have been the prevailing reporting system in Japan for many years. The mean and median abnormal spreads are consistently negative and mostly significant at the conventional level. These results from both sub-samples are basically the same as the results from the full sample, and support hypothesis H_1, but not hypotheses H_2 and H_3.

4-3. Quoted Depths

In this section, I focus on the quoted depths to examine the hypotheses about information asymmetry and market liquidity around the quarterly earnings announcements. First, I estimate equation (2), which has the same independent variables as the above spread model.[16] Table 5 reports the descriptive statistics for the estimation results of the depth model. Generally, the coefficient on TRANS is significantly positive, showing that more actively traded stocks have larger quoted depths. But PRICE, VAR, and MVAR have insignificant coefficients. As suggested by the mean (median) adjusted R^2 of 0.1599 (0.1239), the depth model has rather less explanatory power than the spread model.

Table 5

Next, on each trading day in the event period, I compute the abnormal depth, defined as the difference between the actual quoted depth and the expected one based on the estimated coefficients

[16] Excluding the market-wide volatility (MVAR) from equation (2) does not materially alter the results reported below.

of equation (2). Panel A of table 6 presents the behavior in abnormal depth around 385 quarterly earnings announcement dates that are released by 121 firms listed on the TSE during 2001. The result is not as clear as the result obtained with the bid-ask spreads. During the period just after announcing quarterly earnings, the mean abnormal depth is positive, and statistically significant only in day +2. The median depths are not statistically significant. These results just weakly support hypothesis H_1, which predicts that accounting disclosure alleviates information asymmetry among the market participants. Positive abnormal depths during the announcement period, from day -1 to day +1, provide no support for hypothesis H_2 that information asymmetry in the market is exacerbated by the traders' differential information processing abilities. During the pre-announcement period, the mean abnormal depths are not significantly different from zero. The median depths are significantly negative in days -10. These findings provide just little support for hypothesis H_3 that private information searches by some traders deteriorate information asymmetry and market liquidity during the pre-announcement period.

Table 6

Next, I divide the sample into two groups to conduct the analysis mentioned above repeatedly. Panel B reports the results for the sub-sample consisting of 183 firm-quarters that announce earnings in first or third quarters. In days +6 and +8, the mean abnormal depths are significantly positive, which are consistent with the prediction of hypothesis H_1. In days -10 and -3, the median depths are significantly negative, supporting hypothesis H_3. Panel C provides the results for the sub-sample of 202 observations including only second quarter (semi-annual) or fourth quarter (annual) earnings announcements. The positive mean depth in days 0 and +2, and the negative median depth in day -4 are only statistically significant. These results are not very consistent with the hypothesized changes in information asymmetry and market liquidity around the quarterly earnings announcements.

5. Concluding Remarks

In Japan, there has recently been a rapid increase in the number of firms releasing their earnings quarterly. The TSE decided that all of the listed firms would be mandated to implement quarterly financial reporting after April 2003. I investigate from the viewpoint of the ex ante equity or equality of opportunity in the capital markets suggested by Lev (1988). I first derive three hypotheses on the changes in information asymmetry and market liquidity around the earnings announcement date based on prior theoretical studies, and then use bid-ask spreads and quoted depths to test them.

During the period just after releasing quarterly earnings, the bid-ask spreads decrease significantly, and the quoted depths increase slightly, which are consistent with the prediction that information asymmetry among the market participants is improved by the public disclosure of accounting information. During the announcement period, the findings that there are significant decreases in bid-ask spreads and moderate increases in quoted depths contradict the hypothesis that excellent information processing by some traders deteriorates information asymmetry and market liquidity. Over the period just before an earnings announcement, I find that the spreads lower significantly, and that the depths decrease somewhat. The former finding provides no support for the hypothesis that information asymmetry and market liquidity are exacerbated by some traders' private information search activities, but the latter provides very weak support for it.

Significant decreases in bid-ask spreads over the pre-announcement and announcement periods are not consistent with the findings of Lee, Mucklow, and Ready (1993) for the U.S. stock market, but are consistent with the findings of Acker, Stalker, and Tonks (2002) for the U.K. market. The reason why spreads are reduced significantly before quarterly earnings are announced in the Japanese stock market is an open question that needs to be resolved in the future.

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Table 1

Sample Distribution

	Firms	%	Observations	%
Panel A: By Industry				
Foods	1	0.83	4	1.04
Chemicals	2	1.65	8	2.08
Rubber	1	0.83	4	1.04
Ceramics	2	1.65	8	2.08
Machinery	4	3.31	15	3.90
Electrical Equipment	17	14.05	59	15.32
Automobile	3	2.48	8	2.08
Precision Machinery	4	3.31	13	3.38
Other Manufacturing	1	0.83	4	1.04
Trading	18	14.88	54	14.03
Retail	3	2.48	12	3.12
Stockbrokerage	19	15.70	75	19.48
Other Finance	5	4.13	14	3.64
Real Estate	1	0.83	2	0.52
Air Transportation	1	0.83	4	1.04
Communications	3	2.48	6	1.56
Service	36	29.75	95	24.68
Total	121	100.00	385	100.00
Panel B: By Market Section				
First Section	73	60.33	276	71.69
Second Section	27	22.31	61	15.84
Mothers Section	21	17.36	48	12.47
Total	121	100.00	385	100.00

Table 2

Characteristics of Quarterly Reporting Firms

Variable	Mean	Median	Std. Dev.	t-statistic	z-statistic
Panel A. Quarterly Reporting Firms					
SPREAD	0.0123	0.0073	0.0120	-1.9742	-3.0759
DEPTH	24.1915	12.4708	43.7991	-0.3650	1.5474
MVE	435.4	46.2	1027.2	4.1505	4.3539
TRANS	183.8	56.5	283.1	7.1013	5.1142
ABSRET	0.0271	0.0244	0.0098	7.2489	6.2664
Panel B. Non-Quarterly Reporting Firms					
SPREAD	0.0148	0.0106	0.0132		
DEPTH	29.6523	9.5857	164.1556		
MVE	150.1	22.3	710.0		
TRANS	81.1	25.2	141.9		
ABSRET	0.0218	0.0205	0.0077		

Quarterly reporting firms are 121 firms in the initial sample that have listed on the TSE during 2001, and that have released their earnings quarterly. Non-quarterly reporting firms are another 1,882 firms that have listed on the TSE during 2001, but that have not implemented quarterly financial reporting.

Variable definitions: SPREAD is the daily average of percentage bid-ask spreads, measured as the difference between the bid and ask prices in effect at the time of the transaction divided by the midpoint of the bid and ask prices. DEPTH is the daily average of quoted depths, defined as the number of shares quoted at the ask price plus the number of shares quoted at the bid price in effect at the time of the transaction divided by its round lot. MVE is the market value of equity, computed as the closing price multiplied by the number of shares issued (in billion yen). TRANS is the daily number of transactions. ABSRET is the absolute percentage change in closing price from the previous day. For each firm, all variables are the mean value over at maximum 246 trading days from January to December 2001.

The t-statistic is based on the parametric t-test for the null hypothesis that the means of the two groups are the same. The z-statistic is based on the non-parametric Mann-Whitney-Wilcoxon test for the null hypothesis that the medians of the two groups are the same.

Table 3

Descriptive Statistics for Ordinary Least Squares Estimation of the Spread Model

$\ln(SPREAD_{i,t}) = \alpha_0 + \alpha_1 \ln(TRANS_{i,t}) + \alpha_2 \ln(PRICE_{i,t}) + \alpha_3 \ln(VAR_{i,t}) + \alpha_4 \ln(MVAR_{i,t}) + \varepsilon_{i,t}$

	N	Mean	Std. Dev.	Q1	Median	Q3
Observations	385	136.3013	8.3287	138	140	140
a_0	385	-1.7235	6.3250	-4.1906	-1.3029	1.3383
t-statistic	385	-1.2795	3.5878	-2.9340	-0.8028	0.7405
a_1	385	-0.1489	0.1306	-0.2382	-0.1400	-0.0604
t-statistic	385	-2.5084	2.1250	-3.8638	-2.4311	-1.1048
a_2	385	-0.4045	0.8342	-0.8254	-0.4586	0.0124
t-statistic	385	-3.2393	8.7571	-4.4450	-2.0988	0.0510
a_3	385	40.9019	62.8509	9.7487	25.1344	51.7616
t-statistic	385	2.0493	1.3708	1.1570	1.9716	2.8999
a_4	385	36.1541	119.5377	-17.7342	35.1246	94.4244
t-statistic	385	0.5556	1.1907	-0.2473	0.5460	1.3337
adj. R^2	385	0.2258	0.1839	0.1040	0.1723	0.2916
F-statistic	385	32.7826	208.1063	4.9221	8.0453	15.0229

For each of 385 firm-quarters, the spread model is estimated using the data of at least 100 days over the estimation period from day -150 to day -11, where day 0 is the quarterly earnings announcement date.

Variable definitions: $SPREAD_{i,t}$ is the daily average of percentage bid-ask spreads for firm i on day t, measured as the difference between the bid and ask prices in effect at the time of the transaction divided by the midpoint of the bid and ask prices. $TRANS_{i,t}$ is the daily number of transactions for firm i on day t. $PRICE_{i,t}$ is the closing price for firm i on day t. $VAR_{i,t}$ is the proxy of volatility, measured as one plus the squared percentage change in closing price for firm i from day t-1 to day t. $MVAR_{i,t}$ is the proxy of market-wide volatility, calculated as one plus the squared percentage change in a market index, Tokyo Stock Price Index (TOPIX) for firm i from day t-1 to day t. All variables are log-transformed. a_0, a_1, a_2, a_3, and a_4 denote estimated coefficients α_0, α_1, α_2, α_3, and α_4, respectively.

Q1 and Q3 are the first and third quartiles of the distribution, respectively.

Table 4

The Behavior in Abnormal Spread around the Quarterly Earnings Announcement Date

Event Day	N	Mean	Median	Std. Dev.	Positive	Negative	t1-statistic	t2-statistic	z-statistic
Panel A: Full Sample									
-10	372	-0.0558	-0.0187	0.3613	170	202	-2.9777	-2.0328	-1.6073
-9	378	-0.0297	-0.0356	0.4264	161	217	-1.3541	-1.0822	-2.8289
-8	378	-0.0696	-0.0613	0.3842	147	231	-3.5198	-2.5350	-4.2691
-7	372	-0.0212	-0.0470	0.3989	159	213	-1.0243	-0.7720	-2.7479
-6	375	-0.0666	-0.0551	0.3831	156	219	-3.3664	-2.4268	-3.2017
-5	373	-0.0647	-0.0479	0.4121	152	221	-3.0300	-2.3562	-3.5209
-4	373	-0.0599	-0.0456	0.3937	154	219	-2.9376	-2.1825	-3.3138
-3	374	-0.0591	-0.0540	0.4468	156	218	-2.5562	-2.1523	-3.1542
-2	374	-0.0778	-0.0687	0.3384	139	235	-4.4458	-2.8347	-4.9123
-1	380	-0.0220	-0.0258	0.4083	171	209	-1.0492	-0.8008	-1.8981
0	372	-0.0769	-0.0646	0.4037	145	227	-3.6748	-2.8027	-4.1997
1	375	-0.0456	-0.0437	0.3987	156	219	-2.2129	-1.6603	-3.2017
2	375	-0.0544	-0.0727	0.3691	141	234	-2.8554	-1.9835	-4.7509
3	374	-0.0665	-0.0692	0.3738	141	233	-3.4383	-2.4222	-4.7055
4	375	-0.0662	-0.0605	0.3888	142	233	-3.2958	-2.4112	-4.6476
5	380	-0.0575	-0.0559	0.3915	152	228	-2.8653	-2.0970	-3.8474
6	375	-0.0659	-0.0701	0.3995	143	232	-3.1953	-2.4020	-4.5443
7	375	-0.0884	-0.0830	0.4018	136	239	-4.2602	-3.2211	-5.2673
8	375	-0.1020	-0.1034	0.4096	129	246	-4.8214	-3.7169	-5.9902
9	375	-0.0930	-0.0926	0.4579	142	233	-3.9351	-3.3906	-4.6476
10	380	-0.0926	-0.0764	0.3958	148	232	-4.5628	-3.3759	-4.2578
Panel B: First or Third Quarter Earnings Announcements									
-10	178	-0.0563	-0.0165	0.3542	81	97	-2.1218	-1.7451	-1.1243
-9	181	0.0020	-0.0109	0.4374	88	93	0.0619	0.0623	-0.2973
-8	181	0.0026	-0.0378	0.3856	78	103	0.0896	0.0796	-1.7839
-7	175	0.0050	-0.0548	0.3682	72	103	0.1804	0.1556	-2.2678
-6	178	-0.0522	-0.0517	0.3923	76	102	-1.7765	-1.6182	-1.8738
-5	178	-0.0785	-0.0504	0.4350	72	106	-2.4083	-2.4327	-2.4735
-4	176	-0.0231	-0.0254	0.4249	79	97	-0.7199	-0.7143	-1.2814
-3	178	-0.0355	-0.0571	0.4325	76	102	-1.0942	-1.0990	-1.8738
-2	179	-0.0646	-0.0512	0.3512	76	103	-2.4608	-2.0014	-1.9433
-1	181	-0.0054	-0.0257	0.4299	81	100	-0.1679	-0.1663	-1.3379
0	172	-0.0576	-0.0392	0.4372	75	97	-1.7278	-1.7846	-1.6012
1	178	-0.0333	-0.0258	0.4293	81	97	-1.0336	-1.0304	-1.1243
2	178	-0.0217	-0.0398	0.3774	75	103	-0.7671	-0.6722	-2.0237
3	176	-0.0296	-0.0604	0.3815	69	107	-1.0302	-0.9178	-2.7890
4	180	-0.0434	-0.0337	0.4260	79	101	-1.3662	-1.3438	-1.5652
5	181	-0.0256	-0.0459	0.3838	81	100	-0.8958	-0.7916	-1.3379
6	180	-0.0372	-0.0563	0.4011	75	105	-1.2438	-1.1521	-2.1615
7	177	-0.0972	-0.0689	0.4247	69	108	-3.0452	-3.0115	-2.8563
8	180	-0.1083	-0.1153	0.4284	64	116	-3.3912	-3.3544	-3.8013
9	177	-0.0859	-0.1002	0.4153	70	107	-2.7516	-2.6612	-2.7059
10	180	-0.0903	-0.0411	0.4142	78	102	-2.9247	-2.7976	-1.7143

Table 4 - *continued*

Event Day	N	Mean	Median	Std. Dev.	Positive	Negative	t1-statistic	t2-statistic	z-statistic
Panel C: Second or Fourth Quarter Earnings Announcements									
-10	194	-0.0553	-0.0297	0.3686	89	105	-2.0886	-1.6922	-1.0769
-9	197	-0.0588	-0.0655	0.4150	73	124	-1.9897	-1.8009	-3.5624
-8	197	-0.1358	-0.0971	0.3718	69	128	-5.1278	-4.1582	-4.1323
-7	197	-0.0445	-0.0397	0.4239	87	110	-1.4722	-1.3611	-1.5674
-6	197	-0.0796	-0.0577	0.3751	80	117	-2.9775	-2.4357	-2.5649
-5	195	-0.0520	-0.0411	0.3908	80	115	-1.8582	-1.5918	-2.4348
-4	197	-0.0928	-0.0600	0.3615	75	122	-3.6024	-2.8406	-3.2774
-3	196	-0.0805	-0.0501	0.4595	80	116	-2.4523	-2.4637	-2.5000
-2	195	-0.0899	-0.0953	0.3265	63	132	-3.8440	-2.7517	-4.8696
-1	199	-0.0371	-0.0260	0.3880	90	109	-1.3481	-1.1350	-1.2760
0	200	-0.0935	-0.0930	0.3727	70	130	-3.5485	-2.8625	-4.1719
1	197	-0.0567	-0.0690	0.3696	75	122	-2.1522	-1.7348	-3.2774
2	197	-0.0840	-0.1026	0.3599	66	131	-3.2759	-2.5715	-4.5598
3	198	-0.0992	-0.0824	0.3647	72	126	-3.8276	-3.0371	-3.7665
4	195	-0.0872	-0.1024	0.3507	63	132	-3.4718	-2.6693	-4.8696
5	199	-0.0866	-0.0690	0.3971	71	128	-3.0778	-2.6523	-3.9697
6	195	-0.0924	-0.0994	0.3971	68	127	-3.2504	-2.8294	-4.1535
7	198	-0.0805	-0.0890	0.3810	67	131	-2.9729	-2.4644	-4.4772
8	195	-0.0962	-0.0858	0.3926	65	130	-3.4215	-2.9447	-4.5831
9	198	-0.0994	-0.0716	0.4937	72	126	-2.8335	-3.0435	-3.7665
10	200	-0.0947	-0.0912	0.3794	70	130	-3.5313	-2.9001	-4.1719

In panel A, the full sample consists of 385 firm-quarters that have listed on the TSE during 2001, and that released quarterly earnings. The sample of panel B is composed of 183 firm-quarters that announced first or third quarter earnings. The sample of panel C is made up of 202 firm-quarters that announced second quarter (semi-annual) or fourth quarter (annual) earnings.

The abnormal spread is defined as the difference between the actual percentage spread and the expected spread. The actual spread is the daily average of the percentage bid-ask spreads, defined as the difference between the ask and bid prices in effect at the time of the transaction deflated by the midpoint of the bid and ask prices. The expected spread is based on the estimated coefficients of the log-linear equation (1) (see table 3 for detailed model description and estimation specifications). At each firm-quarter, I separately estimate equation (1) for the data of at least 100 days over the estimation period (day -150 to day -11) using Ordinary Least Squares. I use equation (1) to estimate the expected spread on each trading day in the event period (day -10 to day +10) inclusive of the quarterly earnings announcement date.

Event Day represents the trading day relative to the quarterly earnings announcement.

The two t-statistics are based on the parametric t-test for the null hypothesis that the mean abnormal spread is zero. The first t-statistic is computed using the cross-sectional standard deviation on each event day. The second t-statistic is defined using the standard deviation of the average abnormal spread estimated over the estimation period. The z-statistic is based on the non-parametric binominal sign test for the null hypothesis that the median abnormal spread is zero.

Table 5

Descriptive Statistics for Ordinary Least Squares Estimation of the Depth Model

$\ln(DEPTH_{i,t}) = \beta_0 + \beta_1 \ln(TRANS_{i,t}) + \beta_2 \ln(PRICE_{i,t}) + \beta_3 \ln(VAR_{i,t}) + \beta_4 \ln(MVAR_{i,t}) + \mu_{i,t}$

	N	Mean	Std. Dev.	Q1	Median	Q3
Observations	385	136.3013	8.3287	138	140	140
b_0	385	0.2153	8.2239	-2.0709	1.2875	3.9385
t-statistic	385	0.8015	3.3317	-0.8936	0.6453	2.4701
b_1	385	0.2672	0.2244	0.1366	0.2285	0.3477
t-statistic	385	3.4680	2.3220	1.9813	3.2231	4.6309
b_2	385	0.1444	1.0630	-0.3258	0.0004	0.4597
t-statistic	385	-0.0380	3.2252	-1.6386	0.0014	1.6057
b_3	385	-19.8842	43.5145	-29.8215	-9.9695	1.5645
t-statistic	385	-0.5851	1.2740	-1.4383	-0.6590	0.1641
b_4	385	-5.3010	130.3567	-77.3678	-5.3225	64.9890
t-statistic	385	-0.0484	1.1119	-0.7680	-0.0680	0.6221
adj. R^2	385	0.1599	0.1459	0.0553	0.1239	0.2321
F-statistic	385	9.4349	12.3055	2.9741	5.8764	10.9611

For each of 385 firm-quarters, the depth model is estimated using the data of at least 100 days over the estimation period from day -150 to day -11, where day 0 is the quarterly earnings announcement date.

Variable definitions: $DEPTH_{i,t}$ is the daily average of quoted depths for firm i on day t, measured as the number of shares quoted at the ask price plus the number of shares quoted at the bid price in effect at the time of the transaction divided by its round lot. $TRANS_{i,t}$ is the daily number of transactions for firm i on day t. $PRICE_{i,t}$ is the closing price for firm i on day t. $VAR_{i,t}$ is the proxy of volatility, measured as one plus the squared percentage change in closing price for firm i from day t-1 to day t. $MVAR_{i,t}$ is the proxy of market-wide volatility, calculated as one plus the squared percentage change in a market index, Tokyo Stock Price Index (TOPIX) for firm i from day t-1 to day t. All variables are log-transformed. b_0, b_1, b_2, b_3, and b_4 denote estimated coefficients β_0, β_1, β_2, β_3, and β_4, respectively.

Q1 and Q3 are the first and third quartiles of the distribution, respectively.

Table 6

The Behavior in Abnormal Depth around the Quarterly Earnings Announcement Date

Event Day	N	Mean	Median	Std. Dev.	Positive	Negative	t1-statistic	t2-statistic	z-statistic
Panel A: Full Sample									
-10	372	-0.0224	-0.0535	0.4343	155	217	-0.9930	-0.9035	-3.1627
-9	378	-0.0072	-0.0250	0.4556	176	202	-0.3052	-0.2889	-1.2859
-8	378	0.0316	-0.0052	0.4156	188	190	1.4786	1.2773	-0.0514
-7	372	-0.0121	-0.0611	0.4589	169	203	-0.5067	-0.4871	-1.7110
-6	375	0.0132	-0.0412	0.4487	169	206	0.5708	0.5344	-1.8590
-5	373	-0.0158	-0.0149	0.4455	182	191	-0.6845	-0.6380	-0.4142
-4	373	-0.0102	-0.0264	0.4687	175	198	-0.4210	-0.4128	-1.1391
-3	374	-0.0107	-0.0500	0.4661	169	205	-0.4438	-0.4322	-1.8098
-2	374	0.0409	-0.0141	0.4664	181	193	1.6971	1.6540	-0.5688
-1	380	0.0150	-0.0265	0.4859	185	195	0.6006	0.6049	-0.4617
0	372	0.0760	0.0311	0.5603	193	179	2.6165	3.0716	0.6740
1	375	0.0556	0.0160	0.5018	191	184	2.1453	2.2461	0.3098
2	375	0.0519	0.0079	0.4880	192	183	2.0583	2.0958	0.4131
3	374	0.0185	-0.0229	0.4868	184	190	0.7364	0.7491	-0.2585
4	375	0.0270	-0.0163	0.5132	180	195	1.0191	1.0913	-0.7230
5	380	0.0225	-0.0280	0.4965	178	202	0.8832	0.9090	-1.1799
6	375	0.0352	-0.0225	0.5065	178	197	1.3464	1.4230	-0.9295
7	375	0.0408	0.0121	0.5182	194	181	1.5263	1.6503	0.6197
8	375	0.0418	0.0021	0.4808	188	187	1.6830	1.6886	0.0000
9	375	0.0002	-0.0222	0.4912	179	196	0.0066	0.0068	-0.8262
10	380	0.0185	-0.0084	0.5019	184	196	0.7167	0.7457	-0.5643
Panel B: First or Third Quarter Earnings Announcements									
-10	178	-0.0504	-0.0722	0.4284	64	114	-1.5696	-1.5798	-3.6727
-9	181	-0.0075	-0.0382	0.4527	79	102	-0.2240	-0.2363	-1.6352
-8	181	0.0424	0.0027	0.4303	92	89	1.3267	1.3301	0.1487
-7	175	0.0185	-0.0709	0.4981	80	95	0.4920	0.5807	-1.0583
-6	178	0.0287	-0.0168	0.4484	83	95	0.8539	0.8997	-0.8245
-5	178	-0.0228	-0.0524	0.4968	76	102	-0.6133	-0.7160	-1.8738
-4	176	0.0156	0.0205	0.4911	91	85	0.4226	0.4904	0.3769
-3	178	-0.0372	-0.0832	0.4731	73	105	-1.0491	-1.1662	-2.3235
-2	179	0.0441	-0.0159	0.4318	85	94	1.3666	1.3826	-0.5979
-1	181	0.0235	-0.0530	0.5085	86	95	0.6216	0.7366	-0.5946
0	172	0.0722	0.0005	0.6332	86	86	1.4955	2.2634	-0.0762
1	178	0.0697	-0.0012	0.5605	89	89	1.6602	2.1865	-0.0750
2	178	0.0173	-0.0320	0.5297	83	95	0.4348	0.5411	-0.8245
3	176	0.0078	-0.0791	0.5001	80	96	0.2072	0.2448	-1.1307
4	180	-0.0075	-0.0551	0.5330	77	103	-0.1878	-0.2339	-1.8634
5	181	0.0006	-0.0587	0.5260	78	103	0.0143	0.0175	-1.7839
6	180	0.0876	-0.0227	0.5560	87	93	2.1133	2.7452	-0.3727
7	177	0.0540	0.0164	0.5470	93	84	1.3123	1.6913	0.6013
8	180	0.0810	0.0155	0.5127	94	86	2.1198	2.5392	0.5217
9	177	0.0302	-0.0222	0.5255	86	91	0.7647	0.9467	-0.3007
10	180	0.0331	0.0097	0.5568	92	88	0.7982	1.0385	0.2236

Table 6 - *continued*

Event Day	N	Mean	Median	Std. Dev.	Positive	Negative	t1-statistic	t2-statistic	z-statistic
Panel C: Second or Fourth Quarter Earnings Announcements									
-10	194	0.0034	-0.0226	0.4392	91	103	0.1068	0.1069	-0.7898
-9	197	-0.0068	-0.0088	0.4593	97	100	-0.2076	-0.2156	-0.1425
-8	197	0.0217	-0.0088	0.4026	96	101	0.7554	0.6877	-0.2850
-7	197	-0.0392	-0.0562	0.4204	89	108	-1.3093	-1.2448	-1.2824
-6	197	-0.0008	-0.0625	0.4497	86	111	-0.0236	-0.0240	-1.7099
-5	195	-0.0094	0.0190	0.3941	106	89	-0.3315	-0.2969	1.1458
-4	197	-0.0333	-0.0423	0.4479	84	113	-1.0442	-1.0575	-1.9949
-3	196	0.0134	-0.0103	0.4596	96	100	0.4074	0.4245	-0.2143
-2	195	0.0380	-0.0055	0.4972	96	99	1.0678	1.2067	-0.1432
-1	199	0.0072	-0.0129	0.4656	99	100	0.2186	0.2290	0.0000
0	200	0.0793	0.0516	0.4907	107	93	2.2851	2.5166	0.9192
1	197	0.0428	0.0242	0.4431	102	95	1.3553	1.3580	0.4275
2	197	0.0831	0.0549	0.4461	109	88	2.6159	2.6384	1.4249
3	198	0.0281	0.0263	0.4758	104	94	0.8303	0.8910	0.6396
4	195	0.0588	0.0440	0.4934	103	92	1.6649	1.8669	0.7161
5	199	0.0424	0.0035	0.4685	100	99	1.2780	1.3471	0.0000
6	195	-0.0131	-0.0175	0.4521	91	104	-0.4050	-0.4162	-0.8593
7	198	0.0291	0.0062	0.4921	101	97	0.8326	0.9242	0.2132
8	195	0.0056	-0.0154	0.4477	94	101	0.1744	0.1775	-0.4297
9	198	-0.0267	-0.0238	0.4581	93	105	-0.8195	-0.8468	-0.7817
10	200	0.0052	-0.0262	0.4478	92	108	0.1658	0.1666	-1.0607

In panel A, the full sample consists of 385 firm-quarters that have listed on the TSE during 2001, and that released quarterly earnings. The sample of panel B is composed of 183 firm-quarters that announced first or third quarter earnings. The sample of panel C is made up of 202 firm-quarters that announced second quarter (semi-annual) or fourth quarter (annual) earnings.

The abnormal depth is defined as the difference between the actual quoted depth and the expected depth. The actual depth is the daily average of the quoted depths, defined as the number of shares quoted at the ask price plus the number of shares quoted at the bid price in effect at the time of the transaction divided by its round lot. The expected depth is based on the estimated coefficients of the log-linear equation (2) (see table 5 for detailed model description and estimation specifications). At each firm-quarter, I separately estimate equation (2) for the data of at least 100 days over the estimation period (day -150 to day -11) using Ordinary Least Squares. I use equation (2) to estimate the expected depth on each trading day in the event period (day -10 to day +10) inclusive of the quarterly earnings announcement date.

Event Day represents the trading day relative to the quarterly earnings announcement.

The two t-statistics are based on the parametric t-test for the null hypothesis that the mean abnormal depth is zero. The first t-statistic is computed using the cross-sectional standard deviation on each event day. The second t-statistic is defined using the standard deviation of the average abnormal depth estimated over the estimation period. The z-statistic is based on the non-parametric binominal sign test for the null hypothesis that the median abnormal depth is zero.

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