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# Spread behavior around board meetings for firms with concentrated insider ownership

Suchi Mishra[a,*], Wei Rowe[b], Arun Prakash[a], Dilip K. Ghosh[c]

[a]*Florida International University, USA*
[b]*University of Nebraska, Omaha, USA*
[c]*Institute of Policy Analysis, USA*

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**Abstract**

For a set of firms with concentrated insider ownership, we find that (a) the bidask spread changes significantly around the board meeting dates, and (b) the actual number of transactions by insiders increases following the board meetings. We also find that there is a statistically significant relationship between spread and the number of insider trades surrounding the board meeting dates. Furthermore, neither an increase in the number of insider transactions nor any significant relationship between insider trading and the spread is observed for the same set of firms around non-board meeting dates.


*Jel classification:* G12; G14

*Keywords:* Spread; Board meeting; Insider trading; Market microstructure

Bagehot (1971), Glosten and Milgrom (1985), and Copeland and Galai (1988) use information-based models and find that some investors seem to be better informed about the intrinsic value of the security than the specialists. Demsetz (1986) points out that insider ownership boosts the profit potential from insider trading. Given the above and the costs associated with information-based trades, the specialist may widen the bid–ask spread when faced with informed traders. Hence, one primary component of the specialist's bid–ask spread will be adverse selection cost (Kyle, 1985; Glosten, 1987;

*Corresponding author. Tel.: +1 305 348 4282.
*E-mail addresses:* mishras@fiu.edu (S. Mishra), wrowe@mail.unomaha.edu (W. Rowe), prakasha@fiu.edu (A. Prakash), dghosh4@msn.com (D.K. Ghosh).

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Copeland and Galai, 1988; Glosten and Harris, 1988; Stoll, 1989). Therefore, spread, in addition to being an important measure of liquidity, may also be considered an indicator of informed trading. Along these lines, Benveniste et al. (1992) and Garfinkel and Nimalendran (2003) report that trader anonymity is significantly reduced in the New York Stock Exchange (NYSE) owing to the presence of floor traders.

According to Garfinkel and Nimalendran (2003, p. 592) that in the NYSE's specialist system, nearly 65% of the trading volume is channeled through floor brokers, who deal repeatedly with the same specialist. They argue that:

> In particular, brokers who inform the specialist that the desired trade is possibly informed will receive ex-post benefits in their dealings with the specialist. These benefits could include the willingness by the specialist to fill the remainder of the broker orders that are only partially filled through limit orders. Moreover, brokers who do not inform the specialist of information trades will experience ex-post sanctions from the specialist.

Thus, in essence, Garfinkel and Nimalendran (2003) suggest that there appears to be an invisible interactive signaling of information unmistakably impounded by the specialist through widening the spread.

Chiang and Venkatesh (1988) examine whether insider ownership triggers informed trading, thereby leading to widening of the spread. They argue that the extent of insider holding can be viewed as one convenient measure of dealer assessment of information asymmetry. Their hypothesis is that the existence of a positive correlation between spreads (net of holding costs and the firm size effect) and insider holding implies that dealers perceive a positive relationship between insider ownership and information asymmetry. They find that insider ownership has significant and positive explanatory power for the cross-sectional difference in bid–ask spread.

Chung and Charoenwong (1998) examine the effect of insider trades on spreads quoted by specialists in NYSE and AMEX-listed stocks. Their hypothesis is that the specialists will widen their spread when corporate insiders trade, presumably because the insiders are trading on private information. They find a significant cross-sectional association between spread and insider trading. Thus, Chiang and Venkatesh (1988) show the cross-sectional link between spread and insider ownership, whereas Chung and Charoenwong (1998) empirically show that widening of spread can happen following transactions by insiders.

Corporate bylaws specify regular board meetings, which typically occur monthly or quarterly. Board meeting dates are important not only because of the decisions made, but also because of the sensitive information collected in preparation for board meetings (Vafeas, 1999). Current SEC disclosure rules only require companies to disclose the frequencies of their annual board meetings (in proxy statements filed with the SEC) but not the actual meeting dates.

In this paper, we use the association between bid–ask spread and insider ownership to study the information asymmetry and hence informed trading, if any, around board of director meetings. Our research examines if board meetings are ordinary routine events or important informational events that deserve more attention from regulators and investors. If insider holding is a good measure of the dealer's assessment of information asymmetry, as suggested in Chiang and Venkatesh (1988), specialists would consider insiders with concentrated ownership to have more incentive to act on the information obtained from board meetings. As a result, insider trading from this group may have more significant

effects on the spread than the insider trades with insignificant ownership. Therefore, our study focuses on firms with concentrated insider ownership. We consider that a firm has concentrated insider ownership when the voting shares held by directors and officers exceed 10% or more of its total shares outstanding.

The critical issue in research involving board of director meetings is the availability of the actual dates of board meetings. Obtaining those dates is a difficult task because only the frequency, not the actual dates, of a company's board meetings is available in its proxy statements.[1] On the other hand, corporate insiders are supposed to report their trades within ten days following the last day of the month in which trading occurs, and the SEC publishes these transactions in its monthly *Official Summary of Insider Transactions*. In this context, the period surrounding the board of director meetings is a "black box." If there is an insider trading, the transaction will not be reported until at least a week after the meeting. The exact dates of meetings are not public knowledge ex ante. Thus, it would be interesting to see if, and how much, the change in spread occurs following the board meetings in firms with concentrated insider ownership.[2]

Our study contributes to the existing literature in the following ways: (1) we believe that this is the first attempt to empirically test the effect of board meetings on bid–ask spread for firms with concentrated insider ownership; (2) it connects the market microstructure literature with the standard corporate finance literature and provides important insights on the triangular relation among board meetings, insider trading, and bid–ask spread; and (3) the empirical evidence from this study has important policy implications to regulators, shareholders, and investors in designing more transparent systems in corporate governance and in monitoring insider trading.

Employing the customized data of board meeting dates collected through direct contacts with the firms with concentrated insider ownership, we examine the spread behavior using event study procedures. As boards of directors' meeting dates are not public knowledge, there is a possibility that corporate insiders utilize this information advantage over non-insiders to make transactions after board meetings. We find significant spread changes after the board meetings, suggesting trading by informed investors. In order to isolate the effect of board meetings, we further examine spread around non-board meeting days for the same set of firms.[3] We find the spread shows no significant changes surrounding these non-event (non-board meeting) days, which further supports our hypothesis.

Consistent with our spread results, we find significant increases in insider trading activities on the days the spread widens. As a robustness check, we also investigate—and find—a significant cross-sectional association between spread and the number of insider trades. For comparison and as an additional test, we examine the number of insider transactions, as well as the cross-sectional association between spread and number of insider transactions for the same set of firms at non-board meeting dates. Here, we do not

[1]We are fully aware of Tobin's (1970) famous citation of "Post hoc ergo propter hoc" on Milton Friedman and Anna Schwarz's (*Monetary History of the United States*, 1867–1960) associational link between one event and the other and calling it a fallacy in inductive logic. Here we establish the cause-effect relationship based on the same results under the same circumstances repeatedly and under the scrutiny of statistical theory.

[2]We must mention the hardship of obtaining this dataset, as many firms simply refused to disclose the board meeting dates on the pretext of non-public information. Such behavior may be a general trend for all firms or it may be because these firms have substantial insider ownership.

[3]We also checked the Wall Street Journal Index to ensure that there were no other major corporate events around these non-meeting dates.

find any significant cross-sectional association between spread and insider transaction numbers. This confirms our research hypothesis that the informed trading is a critical element in the widening of spread following board meetings.

Our empirical evidence suggests that a specialist is able to perceive the presence of informed trading surrounding the board meeting dates. This is consistent with the findings of Garfinkel and Nimalendran (2003) about the significantly lower trader anonymity in the NYSE markets due to the presence of floor brokers. The specialists may have ex ante information about the occurrence of board meetings through the floor brokers.

The remainder of this paper is structured as follows. In the next section, we describe the data collection process. This is followed by a discussion of the method and empirical results. The final section of the paper provides the summary and conclusions.

## 1. Data source and procurement of a workable sample

Since the firms are not required by law to report the exact meeting dates and given the recent investigation by authorities on the non-ethical behavior of various firms, we knew it was going to be an uphill task to obtain a workable amount of data. Because of the recent exposure of the Enron and World Com scandals and the strong media attention on corporate governance, companies are very sensitive about any subject related to their board of directors. Some companies asked us if we were trying to find a relationship between the board of director meetings and scandals and declared that their companies were not the types we were looking for.

The difficulty in obtaining the data can be discerned from the following description of data collection steps.

*Step* 1: The Value Line Investment Survey covers about 1,700 publicly-traded companies. We used the 2000 book and identify all companies that are listed on the NYSE and whose officers and directors have more than a 10% or more voting share of a company's stock. We do not consider non-director or non-officer beneficiary owners of 10% or more in the company as insiders in our study because we do not have reason to suspect this group possesses additional information from board meetings. A total of 235 companies (15%) meet our sample selection criteria; of these 235 companies, we eliminated 20 companies that were acquired, filed for bankruptcy, or delisted during our study period.

Value Line has four updates each year. We surveyed the January–March cycle and double-checked our data for the April–June cycle, July–September cycle, and October–December cycle to ensure that we have covered all companies.

*Step* 2: We visited each company's website, obtained its email address for contact information, and sent an email requesting the company's board meeting dates for calendar year 2000. If we did not hear from the company within two weeks, we made follow-up phone calls to the company's corporate communications department or its investor relations department to request the meeting dates.[4] The overall success rate using the above two survey approaches is about the same (19%).

The survey process proves to be the main hurdle in collecting data. Many companies did not want to participate in the survey. The major reason given by those non-participating companies is that the SEC does not require that board of director meeting dates be

[4]The original letter to the firms requesting their board meeting dates is available from the authors.

reported to the public. Companies consider board meeting dates to be private information. Other reasons given by companies for not providing the data are:

- company has a policy of not participating in survey studies;
- security concerns—there may be a pattern in the dates across different years; or
- some were willing to participate initially, but declined after they were told by legal counsel not to respond.

After numerous emails and phone contacts, which spanned a six-month period, we were able to obtain 209 board meeting dates for 40 companies. Thus, the response rate is 19%.[5]

Following Venkatesh and Chiang (1986), we checked the Wall Street Journal Index and eliminated those board meeting dates around which there is an announcement associated with either merger and acquisitions or dividend and earning announcements. We wanted to make sure that our results reflected the change in spreads, if any, solely due to board meetings, not any influence or contamination by other informational corporate events.

In order to further isolate the effects of board meetings on bid–ask spread, we also collected the dates when there are neither board meetings nor other major corporate events for the same firms in our sample. When we picked the non-board meeting dates, we made sure that there was at least a calendar month gap between board meeting dates and non-board meeting dates so that the estimation period for the board meeting dates does not coincide with the estimation period for the non-board meeting control sample dates.

*Step* 3: We obtained bid and ask (closing) quotes from the trade and quote (TAQ) database for the relevant dates.

Of the 209 dates collected, 43 dates were dropped either because of missing TAQ data or contaminating announcements happening on those dates. Thus the final dataset contained 166 board of director meeting dates for 40 companies with concentrated insider ownership of 10% or more.

Tables 1(A) and (B) present, respectively, market capitalization and sales revenue of the sample firms. The 40 sample firms have a good representation of different industries, spanning 29 different industries. The mean market capitalization (sales) for the firms in our sample is \$5,687 (\$3,800) million.

Table 2 provides the ownership structure and board characteristics for the firms in our sample. The average board size is 10, and the mean ownership by directors and officers is 24.5%. On average, 22.4% of the board members are insiders (executives of the companies). In 70% of the sample firms, the chief executive officer also serves as the chairman of the board (CEO duality). Table 3 provides the descriptive statistics of the board meetings and the meeting frequencies by months. On average, our sample firms held 4.2 board meetings in year 2000, with a minimum of two meetings and a maximum of eight meetings. The dates of board meetings are spread fairly evenly across different

[5]Because we used survey data, there may be a non-response bias. To test for such bias, we randomly selected 30 non-responding firms and compared them with the full sample of responding firms. Our *t*-tests suggest that these two groups are not significantly different in asset sizes and insider ownerships. These tests are available from the authors upon request.

Table 1
(A) Market capitalization of sample firms (in millions of dollars); (B) sales revenue of sample firms (in million of dollars).

This table provides market capitalization of sample firms arranged in descending order. The sample of 40 firms represents 29 industries with an average market capitalization of $5,687 million.

| Sample firms | Industry classification | Market capitalization ($million) |
|---|---|---|
| (A) | | |
| 1 | Computer hardware | $128,000 |
| 2 | Industrial machinery | $16,600 |
| 3 | Broadcasting and cable TV | $10,800 |
| 4 | Aerospace and defense | $10,600 |
| 5 | Printed circuit boards | $10,400 |
| 6 | Hotel management | $8,100 |
| 7 | Home improvement retail | $3,900 |
| 8 | CMP processing, data prep svc | $3,700 |
| 9 | Department stores | $3,600 |
| 10 | Apparel, accessories and luxury goods | $3,400 |
| 11 | Food retail | $2,300 |
| 12 | Paper packaging | $2,100 |
| 13 | Packaged foods and meats | $2,100 |
| 14 | Health care equipment | $1,900 |
| 15 | Brewers | $1,800 |
| 16 | Advertising | $1,800 |
| 17 | Diversified commercial services | $1,600 |
| 18 | Diversified chemicals | $1,500 |
| 19 | Personal products | $1,300 |
| 20 | Publishing | $1,200 |
| 21 | Specialty chemicals | $1,000 |
| 22 | Specialty chemicals | $925 |
| 23 | Insurance products | $920 |
| 24 | Specialty chemicals | $825 |
| 25 | Electrical components and equipment | $802 |
| 26 | Gas utilities | $800 |
| 27 | Electrical components and equipment | $650 |
| 28 | Apparel, accessories and luxury goods | $650 |
| 29 | Home health care services | $625 |
| 30 | Industrial machinery | $625 |
| 31 | Food retail | $500 |
| 32 | Employment services | $475 |
| 33 | Trading companies and distribution | $350 |
| 34 | Industrial machinery | $325 |
| 35 | Property and casualty insurance | $325 |
| 36 | Real estate investment trust | $250 |
| 37 | Apparel retail | $225 |
| 38 | House wares and specialties | $225 |
| 39 | Specialty chemicals | $150 |
| 40 | Apparel, accessories and luxury goods | $150 |
| | Average | $5,687 |

(B)
This table provides sales revenue of sample firms arranged in descending order. The sample of 40 firms represents 29 industries with an average market sales of $3,800 million.

| Sample firms | Industry classification | Sales ($million) |
|---|---|---|
| 1 | Computer hardware | $48,600 |

Table 1 (*continued*)

| Sample firms | Industry classification | Market capitalization ($million) |
|---|---|---|
| 2 | Food retail | $14,050 |
| 3 | Industrial machinery | $10,000 |
| 4 | Aerospace and defense | $10,000 |
| 5 | Hotel management | $9,890 |
| 6 | Packaged foods and meats | $7,650 |
| 7 | Apparel, accessories and luxury goods | $5,600 |
| 8 | Department stores | $5,575 |
| 9 | Home improvement retail | $5,330 |
| 10 | Printed circuit boards | $3,500 |
| 11 | Paper packaging | $2,875 |
| 12 | Food retail | $2,720 |
| 13 | Personal products | $2,200 |
| 14 | Employment services | $2,150 |
| 15 | Brewers | $2,125 |
| 16 | Health care equipment | $2,100 |
| 17 | Diversified chemicals | $1,825 |
| 18 | Trading companies and distribution | $1,585 |
| 19 | CMP processing, data prep svc | $1,330 |
| 20 | Apparel, accessories and luxury goods | $1,250 |
| 21 | Home health care services | $1,020 |
| 22 | Advertising | $930 |
| 23 | Specialty chemicals | $910 |
| 24 | Publishing | $865 |
| 25 | Specialty chemicals | $805 |
| 26 | Broadcasting and cable TV | $800 |
| 27 | Gas utilities | $770 |
| 28 | Industrial machinery | $690 |
| 29 | Insurance products | $655 |
| 30 | Electrical components and equipment | $625 |
| 31 | Specialty chemicals | $540 |
| 32 | Apparel, accessories and luxury goods | $530 |
| 33 | Diversified commercial services | $507 |
| 34 | Industrial machinery | $465 |
| 35 | Electrical components and equipment | $418 |
| 36 | Apparel retail | $395 |
| 37 | Specialty chemicals | $270 |
| 38 | Property and casualty insurance | $230 |
| 39 | House wares and specialties | $120 |
| 40 | Real estate investment trust | $100 |
| | Average | $3,800 |

months with May as the peak meeting month (14.5%) and January and December as the nadir (0%) for board meetings.[6]

[6]To ensure that the participating firms provide accurate information on the number of board meetings, we check the consistency between the number of meetings disclosed in the firms' annual proxy statements and the number of meeting dates provided by the firms themselves. For the few cases in which these two numbers are not the same, we believe that the discrepancies come from the different treatment by the firms of teleconferences or videoconferences for proxy fillings with the SEC and answering our surveys.

Table 2
Insider ownership and board characteristics.

This table provides the ownership structure and board characteristics for the firms in our sample. The average ownership by directors and officers is 24.5%. The average board size is 10. On average, 22.4% of the board members are insiders (executives of the companies). In 70% of the sample, duality is present.

| Sample firms | Industry classification | Directors and officers ownership (%) | Board size | Insiders on board (%) | CEO duality |
|---|---|---|---|---|---|
| 1 | Insurance products | 10.7 | 12 | 25.0 | Yes |
| 2 | Electrical components and equipment | 14.6 | 8 | 37.5 | Yes |
| 3 | Specialty chemicals | 21.1 | 9 | 44.4 | Yes |
| 4 | Personal products | 15.0 | 11 | 36.4 | No |
| 5 | Trading companies and distribution | 10.3 | 10 | 10.0 | Yes |
| 6 | Home health care services | 24.6 | 7 | 14.3 | No |
| 7 | Electrical components and equipment | 19.8 | 10 | 20.0 | Yes |
| 8 | Industrial machinery | 11.0 | 8 | 25.0 | No |
| 9 | Apparel retail | 70.0 | 9 | 33.3 | Yes |
| 10 | Diversified chemicals | 10.6 | 14 | 14.3 | Yes |
| 11 | Specialty chemicals | 17.3 | 11 | 9.1 | Yes |
| 12 | Publishing | 84.4 | 7 | 14.3 | Yes |
| 13 | Brewers | 35.9 | 8 | 50.0 | No |
| 14 | Diversified commercial services | 19.7 | 12 | 16.7 | Yes |
| 15 | CMP processing, data prep svc | 11.4 | 8 | 37.5 | No |
| 16 | Aerospace and defense | 10.0 | 10 | 10.0 | Yes |
| 17 | Industrial machinery | 17.0 | 11 | 9.1 | Yes |
| 18 | Advertising | 37.3 | 10 | 30.0 | Yes |
| 19 | Computer hardware | 18.6 | 9 | 22.2 | No |
| 20 | Health care equipment | 28.1 | 14 | 21.4 | No |
| 21 | Industrial machinery | 13.5 | 10 | 10.0 | Yes |
| 22 | Printed circuit boards | 29.8 | 7 | 28.6 | No |
| 23 | Specialty chemicals | 22.9 | 6 | 16.7 | Yes |
| 24 | Marriott international inc | 19.0 | 10 | 20.0 | Yes |
| 25 | House wares and specialties | 29.0 | 6 | 33.3 | Yes |
| 26 | Department stores | 34.8 | 9 | 22.2 | No |
| 27 | Real estate investment trust | 15.3 | 9 | 22.2 | Yes |
| 28 | Specialty chemicals | 15.1 | 10 | 10.0 | Yes |
| 29 | Property and casualty insurance | 22.0 | 10 | 10.0 | No |
| 30 | Food retail | 11.3 | 12 | 8.3 | No |
| 31 | Apparel, accessories and luxury goods | 25.0 | 10 | 10.0 | Yes |
| 32 | Home improvement retail | 16.6 | 11 | 18.2 | Yes |
| 33 | Paper packaging | 11.5 | 14 | 7.1 | Yes |
| 34 | Gas utilities | 31.5 | 11 | 18.2 | Yes |
| 35 | Packaged foods and meats | 49.0 | 15 | 26.7 | Yes |
| 36 | Apparel, accessories and luxury goods | 45.0 | 6 | 33.3 | Yes |
| 37 | Broadcasting and cable TV | 18.5 | 10 | 20.0 | Yes |
| 38 | Apparel, accessories and luxury goods | 20.6 | 8 | 25.0 | Yes |
| 39 | Employment services | 46.1 | 9 | 55.6 | Yes |
| 40 | Food retail | 14.8 | 10 | 20.0 | No |
| | Average | 24.5 | 10 | 22.4 | 70% Yes |

Table 3
Descriptive statistics and frequency of the board meetings.
This table presents the descriptive statistics of the board meetings and the meeting frequencies by months. On average, our sample firms hold 4.2 board meetings in year 2000, with a minimum of two and a maximum of eight meetings. The dates of board meetings spread fairly evenly across different months with May as the peak meeting month (14.5%) and January and December as the nadir (0%) for board meetings.

| Mean | Minimum | Maximum | Sum | Std. deviation |
|---|---|---|---|---|
| *Panel A. Number of board meetings* | | | | |
| 4.2 | 2 | 8 | 166 | 1.4 |
| Months of board meetings | | | | Occurrence frequency (%) |
| *Panel B. Frequency of the board meetings* | | | | |
| January | | | | 0.0 |
| February | | | | 8.4 |
| March | | | | 7.8 |
| April | | | | 10.2 |
| May | | | | 14.5 |
| June | | | | 6.6 |
| July | | | | 12.7 |
| August | | | | 11.5 |
| September | | | | 6.0 |
| October | | | | 13.3 |
| November | | | | 9.0 |
| December | | | | 0.0 |

*Step* 4: If there is a strong support for our hypothesis of informed trading surrounding the board meeting dates, there should be significant presence of insider transactions surrounding the event dates. To examine this aspect of our hypothesis, we obtained the insider trading filings around the board meeting dates from the SEC's Form 4, which details a company's insider trades or loans. We obtained the data from the Thomson Financial Insider Trading Monitor database. For our non-event day control sample, we followed the same procedure to collect the relevant data.

## 2. Methodology and empirical results

For the event study, we follow the procedure proposed by Chung and Charoenwong (1998) and assume a simple stochastic process for the intertemporal behavior of spreads. That is, we assume that the spread during time $t$ is the sum of two serially uncorrelated random stochastic terms, namely, $\mu_i$ the ex ante expected spread measured from the estimation period and $\varepsilon_{it}$ representing the abnormal component of spread assumed to be serially uncorrelated. Thus:

$$\text{SPREAD}_{i,t} = \mu_i + \varepsilon_{it}, \tag{1}$$

with wide sense stationarity assumptions $\text{E}(\varepsilon_{it}) = 0$ and $\text{COV}(\varepsilon_{it},\varepsilon_{it-1}) = 0$ for all $i$ and $t$.

For each firm, we use a spread of 15 days before and 15 days after the board meeting date. Our estimation period is $t = -15$ to $-6$ and 6 to 15 with $t = 0$ as the day of the event. The event period is a total of ten days surrounding the event, i.e., $t = -5$ to 5. The abnormal component of spread around the board meeting date is measured by subtracting

Table 4
Average abnormal spread, cumulative average spread, and $Z$-statistics for the board meeting sample.

This table presents the average spread $AAS_t = \sum_i SAS_{it}/N$ where $SAS_{it}$ is the standardized abnormal spread of stock $i$ on day $t$ and $N$ is the number of securities on that particular event day, the cumulative average spread $CAS_t = \sum_t AAS_t$ where $\sum_t$ stands for summation over $t = v$ through $\tau$, and the $Z$-statistics $(AAS_t/(1/\sqrt{N})$ or $AAS_t \cdot \sqrt{N})$ for the board meeting sample. These values are presented for the whole event period (i.e., $t = -5$ to 5). The $Z$-statistics are significant at 5% level of significance for days −4 (four days before the meeting date) and one, two, and three days after the board meeting.

| Days relative to board meeting dates | Average abnormal spread | Cumulative average spread | $Z = AAS^*\text{sqrt}(N)$ |
|---|---|---|---|
| −5 | 0.0274 | 0.0274 | 0.3494 |
| −4 | −0.2094 | −0.1821 | −2.6737*** |
| −3 | 0.0574 | −0.1246 | 0.7333 |
| −2 | −0.0766 | −0.2012 | −0.9774 |
| −1 | −0.0453 | −0.2465 | −0.5786 |
| 0 | 0.0142 | −0.2323 | 0.1814 |
| 1 | 0.1580 | −0.0743 | 2.0173** |
| 2 | 0.1551 | 0.0808 | 1.9798** |
| 3 | 0.1625 | 0.2433 | 2.0742** |
| 4 | 0.1266 | 0.3699 | 1.6165 |
| 5 | 0.0108 | 0.3807 | 0.1384 |

*Significant at the 10% level (two-tailed test).
**Significant at the 5% level (two-tailed test).
***Significant at the 1% level (two-tailed test).

an estimate of $\mu_i$ from the spread on and around the event day. The spread measure used here is relative spread defined as follows:

$$SP_{it} = \frac{AP_{it} - BP_{it}}{(1/2)(AP_{it} + BP_{it})}, \tag{2}$$

where $AP_{it}$ and $BP_{it}$ are, respectively, the ask and bid prices of stock $i$ at time $t$.

The standardized abnormal spread of stock $i$ on day $t$ is computed as

$$SAS_i = \frac{(spread - \bar{x}_i)}{s_i} \quad \text{for each } t, \tag{3}$$

where $s_i$ and $\bar{x}_i$ are, respectively, the sample standard deviation and the sample mean of spread of stock $i$ in the estimation period. The average abnormal spread on day $t$ is calculated by averaging the standardized abnormal spread across all securities, i.e., $AAS_t = \sum_i SAS_{it}/N$, where $N$ is the number of securities on that particular event day.

Following the conventional event study methodology, we compute cumulative average spreads (CAS) by summing the average abnormal spread across time. Thus, $CAS_\tau = \sum_\tau AAS_t$. Since $SAS_{it}$ is standardized, it will have a probability distribution with mean 0 and variance 1. Obviously, the statistic $Z$ defined as $AAS_t/(1/\sqrt{N})$ or $AAS_t \cdot \sqrt{N}$ will asymptotically be a standard normal variate.

Table 4 presents the average spread, the cumulative average spreads, and the $Z$-statistics. These values are presented for the whole event period (i.e., $t = -5$ to 5). Fig. 1 graphs the CASs against the event time. We find that our obtained average abnormal spreads (AASs) are significant on each day from day 1 to 3 at the 5% level of significance, but statistically

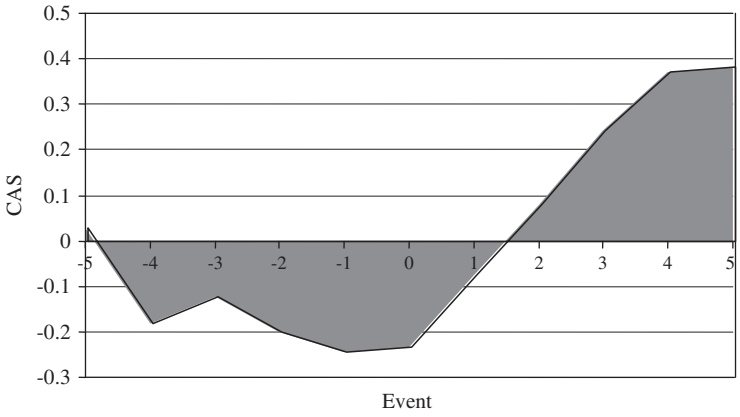


Fig. 1. Graphical presentation of the cumulative average spread. This graph depicts the behavior of the cumulative average spreads (CAS) before and after the event date ($CAS_\tau = \sum_t AAS_t$ where $\sum_t$ stands for summation over $t = v$ through $\tau$ and $AAS_t = \sum_i SAS_{it}/N$, where $SAS_{it}$ is the standardized abnormal spread of stock $i$ on day $t$ and $N$ is the number of securities on that particular event day).

insignificant on the event day (day 0). Thus, following the event day (that is, from day 1 to 3) there seems to be a statistically significant element of informed trading that is reflected in the spread variable.[7]

Prior to a board meeting, we can expect that information may be collected by managers to inform and facilitate the discussion among the directors. Nevertheless, given that significant decisions would have to be approved by the board, we can expect that such information would not be used prior to the meeting. Conversely, given that decisions have been made during a board meeting, managers have useful inside information, which in turn gives rise to the increased spread in the days after a board meeting. This explains why we observe increased spreads following—but not before—a board meeting.

We also note that, in each of the five days following a board meeting, the spreads are positive, and they are statistically significant in each of the first three days (days +1 to +3) as well. In contrast, in the five days before a board meeting, the spreads are positive on two days and negative on three days; except for day −4, none of the spreads are statistically significant. We believe that the statistical significance of the day −4 is anomalous, and similar to the anomalous results found in some other event studies.[8]

To check the robustness of our findings, we look at the basic statistics for the cross-sectional standardized spreads from day −5 through day +5. In order to examine whether there is a significant spread difference before and after board meetings, we conduct two-independent samples *t*-test on the average abnormal spreads five days before and after the event day 0. The results show that under the assumption of equal variance (since null-hypothesis of equality of variances is not rejected), the mean difference between the "before" event group and "after" event group is −0.172, which is statistically significant

[7]Note that from day +5 onward, the standardized spread starts to revert to the pre-event levels.

[8]See, for example, Chung and Charoenwong (1998). They report a statistically significant spread on the event day then non significant spreads on the following two days, followed by an abnormally high and statistically significant spread on the third day (Table 4, Panel A, p. 11).

Table 5
Descriptive statistics for the standardized spreads and two-sample $t$-test for the board meeting sample.

This table provides the basic descriptive statistics of the spread (Panel A) and the results of the two-sample $t$-test with day −4 spread included (Panel B) and without day −4 spread (Panel C).

| Variable | Mean | Median | Std dev | Minimum | Maximum | 25th percentile | 75th percentile | $N$ |
|---|---|---|---|---|---|---|---|---|
| *Panel A. Summary statistics* | | | | | | | | |
| Date −5 | 0.027 | −0.043 | 1.032 | −2.201 | 4.028 | −0.722 | 0.689 | 163 |
| Date −4 | −0.209 | −0.407 | 0.873 | −2.411 | 2.336 | −0.846 | 0.486 | 163 |
| Date −3 | 0.057 | −0.042 | 1.019 | −3.722 | 2.937 | −0.685 | 0.656 | 163 |
| Date −2 | −0.076 | −0.057 | 0.989 | −3.720 | 3.735 | −0.826 | 0.543 | 163 |
| Date −1 | −0.045 | −0.142 | 1.097 | −3.723 | 5.481 | −0.779 | 0.508 | 163 |
| Date 0 | 0.014 | −0.203 | 1.224 | −3.720 | 5.744 | −0.749 | 0.577 | 163 |
| Date 1 | 0.158 | −0.071 | 1.319 | −3.721 | 6.088 | −0.702 | 0.701 | 163 |
| Date 2 | 0.155 | −0.211 | 1.388 | −3.723 | 9.243 | −0.702 | 0.641 | 163 |
| Date 3 | 0.162 | 0.101 | 1.228 | −2.635 | 7.440 | −0.728 | 0.832 | 163 |
| Date 4 | 0.127 | −0.062 | 1.215 | −1.761 | 6.087 | −0.724 | 0.773 | 163 |
| Date 5 | 0.011 | −0.281 | 1.233 | −1.987 | 5.370 | −0.773 | 0.615 | 163 |

| *Panel B. Independent samples t-test* | | | | |
|---|---|---|---|---|
| Levene's test for equality of variances | | $F$ | p-value | |
| | | 0.820 | 0.392 | |
| Independent samples $t$-test for equality of means | | | (equal variances assumed) | |
| Mean difference | Std. error difference | | $t$ | $p$-value |
| −0.172 | 0.055 | | −3.143** | 0.014 |

| *Panel C. Independent samples t-test without −4 day spread* | | | | |
|---|---|---|---|---|
| Levene's test for equality of variances | | $F$ | $p$-value | |
| | | 0.092 | 0.770 | |
| Independent samples $t$-test for equality of means | | | (equal variances assumed) | |
| Mean difference | Std. error difference | | $t$ | $p$-value |
| −0.132 | 0.042 | | −3.117** | 0.017 |

*Note*: The results obtained above (Panels B and C) show that the unknown population variances of the two populations (before the board meeting versus after the board meeting) are equal because the Levine's test of the equality of variance have $p$-values of 0.392 (with −4 day included) and 0.770 (with −4 excluded), respectively. The mean differences between the "before" and "after" event groups in both panels are negative and significantly different at the 5% level of significance.

**Significant at the 5% level (two-tailed test).

with a $p$-value = 0.014. So our empirical evidence indicates that mean spread after the board meeting is significantly wider than before the board meeting.[9] All the basic statistical measures as well as the results of the $t$-test are presented in Table 5, Panels A and B. In order to make sure that our anomalous finding for day −4 does not influence our inferences, we eliminate the corresponding observation and repeat the two-independent sample $t$-test with remaining values. The $t$-statistic is again found to be significant at the 5% level of significance ($p$-value = 0.017).

To isolate further the effect of board meetings on spread, we compiled a sample of non-board meeting days without any other major corporate events for the same set of firms and

[9]One of the basic assumptions of two-sample $t$-test is that the population variances of the two populations from which the samples are drawn must have equal variances before one can use the standard two-sample $t$-test. We find that this indeed is the case with our sample.

Table 6
Average abnormal spread cumulative average spread, and $Z$-statistics for the non-board meeting control sample.

This table presents the average abnormal spread $AAS_t = \sum_i SAS_{it}/N$ where $SAS_{it}$ is the standardized abnormal spread of stock $i$ on day $t$ and $N$ is the number of securities on that particular event day, the cumulative average spreads $CAS_t = \sum_t AAS_t$, where $\sum_t$ stands for summation over $t = v$ through $\tau$, and the $Z$-statistics ($AAS_t/(1/\sqrt{N})$ *or* $AAS_t \cdot \sqrt{N}$) for the non-board meeting control sample. These values are presented for the whole event period (i.e., $t = -5$ to 5). None of the $Z$-statistics are significant at any level of significance for any day either before or after the non-event.

| Days relative to non-board meeting event dates | Average abnormal spread ($AAS$) | Cumulative average spread ($CAS$) | $Z = AAS$*sqrt($N$) |
|---|---|---|---|
| −5 | −0.192 | −0.192 | −2.239** |
| −4 | −0.046 | −0.238 | −0.542 |
| −3 | −0.072 | −0.311 | −0.845 |
| −2 | 0.052 | −0.258 | 0.613 |
| −1 | −0.022 | −0.280 | −0.261 |
| 0 | −0.116 | −0.396 | −1.352 |
| 1 | 0.073 | −0.323 | 0.858 |
| 2 | 0.011 | −0.312 | 0.130 |
| 3 | −0.065 | −0.377 | −0.769 |
| 4 | 0.079 | −0.298 | 0.928 |
| 5 | −0.002 | −0.301 | −0.032 |

**Significant at the 5% level (two-tailed test).

replicated our event study procedure as well as the two-sample $t$-test on the average abnormal spreads to see if the spread behavior around these dates differed from those around the board meeting dates. The empirical results of the event study for non-board meeting control sample are presented in Table 6. Here, the spread shows no significant change around these non-event dates. Therefore, we conclude that board meetings are significant events and that full disclosure of board meeting dates may increase transparency.

To check the robustness of our findings, we look at the basic statistics for the cross-sectional standardized spreads from day −5 through day +5 for the non-board meeting sample. Using the same empirical procedure employed for constructing Table 5, we find that the mean spreads around non-board meeting dates are not statistically significant with the $p$-value equal to 0.155 when day −4 spread is included and, 0.194 when it is not. These results are reported in Table 7.

Our next task is to look at insider trading activities surrounding board meeting days to determine whether the widening of the spread is due to actual trading by corporate insiders. In our study, we consider directors as well as the officers of the company as insiders. Because the exact dates for board of directors' meetings are not public knowledge, we suspect that the presence of corporate insider trading may be the cause for the specialists widening the spread. Panel A of Table 8 reports our findings for the board meeting sample.

We examine the actual insider transactions filed within five (before and after) trading days of the event. To avoid the possibility of contamination and/or double counting, we maintained a gap of 60 calendar days between two meetings. With these restrictions, we found insider transaction data for 123 events. A total of 83 insider transactions were

Table 7
Descriptive statistics for the standardized spreads and two-sample *t*-test for the non-board meeting sample.

This table provides the basic descriptive statistics of the standardized spreads (Panel A) and the results of the two-sample *t*-test with day −4 spread included (Panel B) and without day −4 spread (Panel C).

| Variable | Mean | Median | Std dev | Minimum | Maximum | 25th percentile | 75th percentile | *N* |
|---|---|---|---|---|---|---|---|---|
| *Panel A. Summary statistics* | | | | | | | | |
| Date −5 | −0.192 | −0.274 | 0.892 | −4.684 | 3.495 | −0.645 | 0.348 | 136 |
| Date −4 | −0.046 | −0.197 | 0.913 | −2.060 | 3.278 | −0.586 | 0.380 | 136 |
| Date −3 | −0.072 | −0.282 | 1.058 | −2.087 | 4.788 | −0.674 | 0.143 | 136 |
| Date −2 | 0.053 | −0.184 | 1.147 | −2.950 | 5.069 | −0.572 | 0.434 | 136 |
| Date −1 | −0.022 | −0.183 | 0.835 | −2.604 | 2.507 | −0.533 | 0.459 | 136 |
| Date 0 | −0.116 | −0.181 | 1.639 | −15.452 | 3.179 | −0.544 | 0.531 | 136 |
| Date 1 | 0.074 | −0.164 | 1.049 | −1.866 | 4.908 | −0.603 | 0.550 | 136 |
| Date 2 | 0.011 | −0.172 | 0.929 | −1.364 | 4.589 | −0.584 | 0.386 | 136 |
| Date 3 | −0.066 | −0.159 | 1.068 | −5.147 | 3.995 | −0.598 | 0.497 | 136 |
| Date 4 | 0.080 | −0.060 | 1.023 | −2.244 | 3.617 | −0.516 | 0.544 | 136 |
| Date 5 | −0.003 | −0.116 | 0.869 | −1.854 | 3.170 | −0.566 | 0.538 | 136 |

| *Panel B. Independent sampels t-test* | | | | |
|---|---|---|---|---|
| Levene's test for equality of variances | | *F* | p-value | |
| | | 0.279 | 0.612 | |
| Independent samples *t*-test for equality of means | | | (equal variances assumed) | |
| Mean difference | Std. error difference | | *t* | *p*-value |
| −0.075 | 0.048 | | −1.572 | 0.155 |

| *Panel C. Independent samples t-test without −4 day spread* | | | | |
|---|---|---|---|---|
| Levene's test for equality of variances | | *F* | p-value | |
| | | 0.895 | 0.376 | |
| Independent samples *t*-test for equality of means | | | (equal variances assumed) | |
| Mean difference | Std. error difference | | *t* | *p*-value |
| −0.078 | 0.054 | | −1.435 | 0.194 |

**Significant at the 5% level (two-tailed test).

*Note*: The results obtained above (Panels B and C) show that the unknown population variances of the two populations are equal because the Levine's test of the equality of variance have *p*-values, respectively, of 0.612 (with −4 day included) and 0.376 (with −4 day excluded). Although the mean differences between the "before" and "after" event groups in both panels are negative, they are not statistically significantly different from 0.

reported within the 10-trading day window: 36.14% occurred before the event and 63.86% occurred after the event. Thus, there is about a 77% increase in insider transactions after board meetings. The increase is significant at the 5.69% level, which coincides with our earlier findings of the widening of spread after board meetings.[10] Our intent is to detect the possibility of informed trading as a cause of widening spreads and to confirm our conjecture that there are indications of a presence of informed trading in the market after

[10]When we focus on the transactions made by the non-insider group (the non-director and non-officer beneficial owners of 10%) within the same 10-trading day window, a different pattern emerges. This non-insider group made only 7% of all trades at the time, in comparison with 93% of all trades made by insiders. This group trades more before the board meetings than after the meetings—69% (18 trades) versus 31% (8 trades), respectively—exactly the opposite pattern from that of the insider group. We have no reason to suspect that this non-insider group has access to the content of board meetings, as they are neither directors nor officers of the companies.

Table 8
Insider trading transaction around board meetings.

This table provides the actual insider trading data count 5 days before and 5 days after the board meeting for the board meeting as well as non-board meeting samples. There is clear evidence that the number of transactions by insiders (directors and officers) significantly increases from 36.14% before the board meeting to 63.86% after the board meeting—a 77% increase. There is no significant increase in insider transactions for the non-board meeting control sample.

| Variable | Before | After | | |
|---|---|---|---|---|
| *Panel A. Board meeting sample* | | | | |
| Number of trades made by insiders | 30 | 53 | *t*-statistic | *p*-value |
| Percentage of insider trades | 36.14% | 63.86% | −1.593** | 0.057** |
| *Panel B. Non-board meeting control sample* | | | | |
| Number of trades made by insiders | 21 | 19 | *t*-statistic | *p*-value |
| Percentage of insider trades | 52.50% | 47.50% | 0.364 | 0.358 |

**Significant at the 5% level (two-tailed test).

the event. In other words, the spread increase may have been induced by the presence of informed insiders trading in the market after the event.

To test the robustness of our findings, we examined insider transaction data around the sample of non-board meeting dates. Panel B of Table 8 reports our findings for the non-board meeting sample. Out of a total of 40 transactions within the 10-trading day window, 21 (52.50%) happened before and 19 (47.50%) happened after the non-event days. We found no significant difference in insider transactions around the control dates for the non-board meeting sample.

We also check for the cross-sectional robustness of our findings. We perform cross-sectional regression of standardized spread on the number of insider transactions, the size of the firms, and ownership structure, for each day in our event frame after the board meeting (i.e., +1 to +5). A significant relation between the variables of interest after the event will show that insider transactions and maybe the ownership structure as well as market capitalization are crucial elements in the widening of the spread. Thus, essentially, we run the following regression:

$$SAS_{it} = \beta_0 + \beta_1(NT_{it}) + \beta_2(OWN_i) + \beta_3(MKTCAP_i) + e_{it} \quad t = 0 \ldots + 5 \tag{4}$$

where $NT_{i,t}$ stands for the number of insider transactions for the firm surrounding the event, $OWN_i$ is the percentage of insider ownership, and $MKTCAP_i$ is the market capitalization for the firm. On day +1 there is a significant cross-sectional relationship between the spread and the number of insider transactions. The *t*-statistic is 2.21 for $\beta_1$, the regression parameter corresponding to number of insider trades, which is significant at the 1% level of significance. The parameters associated with ownership and market capitalization rate are not significant (see Table 9). Therefore, our empirical findings suggest that neither the ownership structure nor the size of the firm have any impact on the spread immediately following the board meeting dates. We also estimate a similar cross-sectional regression (Eq. (4)) for the non-board meeting sample. We do not find any significant cross-sectional association between the number of insider transactions and the standardized spread on event day +1 (Table 10) for the non-board meeting sample. However, in this context we also consider the findings of French and Roll (1986).

Table 9
Cross-sectional regression analysis of spread for board meeting sample for event day +1.
This table reports the results of the regression equation:

$$SAS_{it} = \beta_0 + \beta_1(NT_{it}) + \beta_2(OWN_i) + \beta_3(MKTCAP_i) + e_{it} \quad t = 0 \ldots + 5$$

where $SAS_{it}$ is the standardized abnormal spread of stock $i$ on day $t$, $NT_{i,t}$ stands for the number of insider transactions for the firm surrounding the event, $OWN_i$ is the percentage of insider ownership, and $MKTCAP_i$ is the market capitalization for the firm. On day +1 there is a significant cross-sectional relationship between spread and number of insider transactions (the $t$-statistic is 2.96 for $\beta_1$, controlling for size and ownership).

| Explanatory variables | Estimates of parameters |
|---|---|
| *Dependent variable*: *cross-sectional SAS at day* +1 | |
| Intercept | −0.175 |
| | (0.700) |
| $NT_{it}$ (No. of trade) | 0.093 |
| | (2.960)*** |
| $OWN_i$ (Ownership) | 0.002 |
| | (0.310) |
| $MKTCAP_i$ (Market cap) | −2.93E−06 |
| | (0.630) |
| $F$ value | 2.980** |
| Adjusted $R^2$ | 0.062 |
| $N$ | 94 |

$t$-values are in the parentheses.
***Significance level of 1% for a two-tailed test.
**Significance level of 5% for a two-tailed test.

Table 10
Cross-sectional regression analysis of spread for non-board meeting control sample for event day +1.
This table presents the estimated values of the parameters of the regression equation:

$$SAS_{it} = \beta_0 + \beta_1(NT_{it}) + \beta_2(OWN_i) + \beta_3(MKTCAP_i) + e_{it} \quad t = 0 \ldots + 5$$

where $SAS_{it}$ is the standardized abnormal spread of stock $i$ on day $t$, $NT_{i,t}$ stands for the number of insider transactions for the firm surrounding the event, $OWN_i$ is the percentage of insider ownership, and $MKTCAP_i$ is the market capitalization for the firm. On day +1 there is a no significant cross-sectional relationship between spread and the number of insider transactions (the $t$-statistic is 0.23 for $\beta_1$, controlling for size and ownership).

| Explanatory variables | Estimates of parameters |
|---|---|
| *Dependent variable: cross-sectional SAS at day* +1 | |
| Intercept | 0.3449 |
| | (1.13) |
| $NT_{it}$ (No. of trades) | 0.0128 |
| | (0.23) |
| $OWN_i$ (Ownership) | −0.0038 |
| | (−0.42) |
| $MKTCAP_i$ (Market cap) | −4.55E−06 |
| | (−1.29) |
| $F$ value | 0.58 |
| Adjusted $R^2$ | −0.0103 |
| $N$ | 125 |

$t$-values are in the parentheses.

Table 11
Cross-sectional regression analysis of spread for board meeting sample for event day +1.
This table presents the estimated values of the parameters of the regression equation:

$$SAS_{it} = \beta_0 + \beta_1(NT_{it}) + \beta_2(OWN_i) + \beta_3(MKTCAP_i) + \beta_4(VOLATILITY_t) + e_{it} \quad t = 0 \ldots + 5$$

where $SAS_{it}$ is the standardized abnormal spread of stock $i$ on day $t$, $NT_{i,t}$ stands for the number of insider transactions for the firm surrounding the event, $OWN_i$ is the percentage of insider ownership, and $MKTCAP_i$ is the market capitalization for the firm. $VOLATILITY_i$ is the volatility of stock return on day $t$. On day +1 there is a significant cross-sectional relationship between the spread and the number of insider transactions (the $t$-statistic is 2.21 for $\beta_1$, controlling for size, ownership and volatility).

| Explanatory variables | Estimates of parameters |
|---|---|
| *Dependent variable*: *cross-sectional SAS at day* +1 | |
| Intercept | −0.691 |
| | (−2.160)** |
| $NT_{it}$ (No. of trade) | 0.071 |
| | (2.210)** |
| $OWN_i$ (Ownership) | −0.002 |
| | (−0.230) |
| $MKTCAP_i$ (Market cap) | 0.000 |
| | (−1.130) |
| $VOLATILITY_i$ (Volatility) | 27.354 |
| | (2.490)** |
| $F$ value | 3.910*** |
| Adjusted $R^2$ | 0.115 |
| $N$ | 91 |

$t$-values are in the parentheses.
***Significance level of 1% for a two-tailed test.
**Significance level of 5% for a two-tailed test.

According to French and Roll (1986), volatility is caused by private information, which affects prices when informed investors trade, resulting in widening of the spread by the specialist. Maybe around the board meetings the price volatility is higher. Hence, in the above regression model (Eq. (4)), we introduce volatility as yet another explanatory variable. Even in the presence of the volatility measure, the coefficient on the number of insider transactions remains significant. These results are presented in Table 11. These results confirm our previous findings. That is, the informed trading seems to be the cause of possible widening of the spread—the day after the event (day +1) the relationship is significant, whereas later it dwindles as the widening of the spread erases the benefits of informed trading.[11]

## 3. Conclusion

In this research, we empirically examine whether there is information asymmetry surrounding board of directors' meetings for firms with substantial insider ownership. The empirical results suggest that informed trading does exist surrounding board meeting

[11]The regression results for the other event days such as +2 to +5 can be obtained from the authors upon request.

dates, as inferred from the significant spread changes after the board meeting in the event study results. Also, consistent with our interpretation of the spread result, there are significant increases in insider trading activities on the days the spread widens. Thus the empirical evidence suggests that although exact board meeting dates are unknown to the public, specialists are still able to recognize informed trading by the insiders.[12]

The findings suggest that board meetings are highly informative corporate events that should receive more regulatory attention. Currently, SEC rule requires the ex-post reporting of the total number of board meetings held in the prior year. Our findings indicate that it will be informative if companies were to disclose the board meeting dates in advance.

In this paper, we examined only NYSE firms. Trades in the NYSE are facilitated by specialists. In contrast, trades in the NASDAQ are facilitated by market makers. There is more than one market maker for a particular stock whereas there is only one specialist for a stock. An interesting question for future research would be to examine if the spread pattern surrounding board meeting dates exist for firms trading on non-NYSE markets, such as the NASDAQ, and examine if it is more difficult to detect informed trading in a dealer market (such as the NASDAQ) than in an auction market (such as the NYSE).

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