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## Intraday Stock Price Effects of Ad Hoc Disclosures: The German Case

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The German Case**

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**INTRADAY STOCK PRICE EFFECTS OF AD HOC DISCLOSURES:  
THE GERMAN CASE**

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### Abstract

This paper examines intraday stock price effects and trading activity caused by ad hoc disclosures in Germany. The evidence suggests that the observed stock prices react within 90 minutes after the ad hoc disclosures. Trading volumes take even longer to adjust. We find no evidence for abnormal price reactions or abnormal trading volume before announcements. The bigger the company that announces an ad hoc disclosure, the less severe is the abnormal price effect following the announcement. The number of analysts is negatively correlated to the trading volume effect before the ad hoc disclosure. The higher the trading volume on the last trading day before the announcement, the greater is the price effect after the ad hoc disclosures and the greater the trading volume effect.

Keywords: ad hoc disclosure rules, intraday stock price adjustments, market efficiency

JEL-Classification: G14, K22

## **1 Introduction**

Since early 1995, companies whose shares are traded officially in Germany have been obliged to publish without delay all newly available information which may be of relevance to the price of their stock. This regulation was introduced to prevent insider conflicts caused by asymmetrical information supply. Furthermore, it was believed that a prompt supply of information would increase the amount of information available to the capital market, thus making it easier to perform fair company evaluations.

According to the theory of information efficiency, security prices should immediately reflect all information available to the efficient capital market (Fama, 1970). As positive information and trading cost can be expected, this extreme efficiency hypothesis cannot be held (Fama, 1991). This study focuses on the information content provided by ad hoc disclosures pursuant to section 15 of the German Securities Trading Law (WpHG). Therefore, an event study is performed in order to prove the existence of abnormal returns and abnormal trading activity prior to and after the publication date of the announcements. If abnormal returns and trading volume can be observed, the intraday speed of stock price adjustments should provide evidence regarding the market and information efficiency. Furthermore, anticipation effects or insider trading activity can be proven if significant market effects can be observed prior to the announcement date. Consequently, the period following and prior to the publication, for which significant abnormal returns can be observed, has to be analyzed.

To date, there have been four empirical studies analyzing the German capital market between 1995 and 1997 which concentrate on daily price effects (Nowak, 2001; Oerke, 1999; and Röder, 1999). All of these studies examine the existence of significant abnormal returns before, during and after the announcement date. Their research goal is to prove the existence of insider trading prior to the announcement date, an efficient market reaction on the announcement date and phenomena such as herding after the announcement.

An overview of the results is provided by Nowak (2001). The studies performed by Oerke (1999) and Röder (1999) exhibit methodological problems regarding the calculation of abnormal returns. Their methodology leads to significant results in most cases, even when random price movements are taken (Kaserer and Nowak, 2001).

All of these studies concentrate on long-term price effects, i.e., those which can be observed over several trading days. Short-term intraday price effects, which can be caused by ad hoc disclosures published during trading hours, are considered by Oerke (1999) who analyzes intraday price series between January 1, 1995 and July 1, 1997.

Röder (2000) analyzes intraday price effects caused by ad hoc disclosures for the period 1996–1997. The intraday price data used in this study is limited to one open, close and cash price per day. Consequently, it yields no insights regarding efficient information processing by the capital market. A second study also performed by Röder (2002) analyzes intraday trading volumes caused by ad hoc disclosures in 1998 in the period from 30 minutes prior to the announcement to 60 minutes afterwards. In this study, Röder analyzes the time elapsed until a given number of trades can be observed. Consequently, little is known about the intraday speed of stock price adjustments on the German capital market today.

This paper extends the existing literature in three respects. First of all, new research questions are examined using intraday price series from the Frankfurt stock exchange (XETRA): (1) How large are potential intraday anticipation or insider trading effects before the publication of ad hoc disclosures? (2) How fast does the German capital market react to the arrival of new information in the form of ad hoc disclosures? (3) What are potential determinants of the observed abnormal intraday price and trading activity effects surrounding ad hoc disclosures?

Secondly, the study covers a current observation period between 8/2003 and 8/2004. Consequently, it covers effects caused by the real-time information supply provided by modern information and trading systems. Furthermore, the study takes up an alternative method for cal-

culating abnormal returns first suggested by Carter and Soo (1999). This approach avoids the methodological problems identified in the work of Röder and Oerke (Kaserer and Nowak, 2001).

The evidence suggests that the stock price adjustment process is completed after 10 transactions, or 90 minutes. Besides, we find that, at 90 minutes, the process lasts 30 minutes longer for companies that are not members of an index, since we find no significant abnormal price reaction for the time interval (+61;+90) for the 58 ad hoc disclosures of the index members. We find abnormally high trading volume in the last transaction before the announcement for all ad hoc disclosures and for the 58 disclosures of index members. However, the ex-ante effect on the trading volume seems to be small since we find no evidence of abnormal trading volume in the two time intervals (-120;-61) and (-60;-1) before the ad hoc disclosures. Since the abnormal trading volume in the last transaction is very small in comparison to the transaction at the time of the ad hoc disclosure and the following transactions, we argue that no economically relevant abnormal trading volume occurs. After the announcement, we examine strongly abnormally high trading volumes. The adjustment of trading volume is not completed within the analyzed 16 transactions following ad hoc disclosures for the whole sample and for the sub-sample of index members, nor within the two hours following the ad hoc disclosures. In contrast, the adjustment process seems to end after one hour for the non-members of an index. We also conduct an OLS analysis of determinants of market reactions to ad hoc disclosures. The bigger the company that announces an ad hoc disclosure, the less severe is the abnormal price effect following the announcement. Nevertheless, the number of analysts is negatively related to the ex-ante trading volume effect, but not to the ex-post volume effect. The higher the trading volume on the last trading day before the announcement, the greater the price effect ex-post and the greater the trading volume effect ex-ante and ex-post.

Following this introduction, we give a brief overview of the literature. Section 3 presents the dataset and describes the sample selection process. Section 4 describes our methodological approach. In section 5 we derive several hypotheses, which form the basis for our empirical analysis, presented in section 6. The final section summarizes our findings.

## **2 Review of the literature**

A fast publication of new information having a potential impact on stock price developments is a helpful instrument of communication between management and investors. Furthermore, this instrument hinders the occurrence of insider trading resulting from asymmetric information supply. Section 15 of the German Securities Trading Law (WpHG) defines situations in which companies are obliged to publish ad hoc disclosures in Germany. Already in 2002, the German Federal Financial Supervisory Authority (BaFin) called for prompt disclosure of price relevant information independent of the temporal occurrence. Here the BaFin complained about the fact that nearly 60% of all ad hoc disclosures in 2001 were published between 7am and 9am, i.e., before stock exchange trading hours. This practice can be interpreted as prevention of suspended trading. Furthermore, the management might use the publication of company announcements for its own purposes (Healy and Palepu, 1993): (1) the management has a higher level of information regarding the business strategy and the operational business; (2) the incentives of the management differ from those of the shareholders; (3) accounting rules and supervision are imperfect.

There are several empirical studies analyzing the market and information efficiency level on a daily basis (Aharony and Swary, 1980; Kalay and Lowenstein, 1986; Nowak, 2001; Oerke, 1999; Röder, 1999). With daily data, it is possible to test market efficiency at the daily level only. The intraday speed at which the information is processed into stock prices is not discernable. Since the question of market efficiency is really concerned with the speed at which



relevant information is impounded into stock prices, the question of the degree of efficiency in a certain market can be further refined through the use of intraday data.

Hence, Patell and Wolfson (1984) analyze the intraday speed of stock price reactions to earnings and dividend announcements. They are able to show that most of the detected price reaction occurs within the first 15 minutes after the announcement has been published. Besides, they observe moderately abnormal price reactions in the minus 90 to minus 30 minutes interval before the announcements. Woodruff and Senchak (1988) analyze intraday price reactions caused by unexpected earnings results. They find price reactions occurring up to one hour after the announcements. Barclay and Litzenberger (1988) analyze intraday price reactions caused by announcements of new equity issues. They find an abnormally high trading volume and a negative average return for a period of 15 minutes after the announcement has been published. They also find abnormal price reactions in the minus 75 to minus 50 minutes interval, or in the last four transactions prior to these announcements. Jennings and Starks (1985) divide their sample into earnings announcements with high and low informational content. They find abnormal price reactions in the first 20 transactions following the announcement of earnings forecasts. The price adjustment process for announcements with high informational content takes longer and is observed in the last transaction before the announcement. Converted into time intervals, abnormal price reactions are found in the first eight hours following the announcement (the authors also use data of the trading day following the event day for their analysis). Smith et al. (1997) analyze abnormal trading volume following announcements of takeovers. They find abnormal returns in the first three hours after the announcement and to some extent in the fourth and fifth hours. Lee et al. (1994) examine the development of the traded volume after trading halts. They observe that the price adjustment process takes approximately four hours (eight half-hour intervals) after the restart of trading to incorporate the new information into stock prices.

Aside from price reactions, the trading volume surrounding the announcement is used to gain further insight into the amount of information provided. The existence of increased trading activity is regarded as an indication of whether or not an announcement has any informational content. Most contributions in this field use only daily data (e.g. Bamber, 1986; Beaver, 1986; Morse 1980). However, research has also been carried out on the basis of intraday data. Gisselle et al. (1996) analyze abnormal volume effects for dividend announcements classified as either “good” or “bad” news. They find abnormally high trading volumes in the six (two) hours following a bad (good) dividend announcement. Smith et al. (1997) find that abnormal volumes are traded in the five hours following announcements of takeovers. Lee et al. (1994) observe an abnormal level of trading volume for the 6.5 hours following trading halts.

### **3 Dataset and sample selection**

The event study performed by us focuses on ad hoc disclosures pursuant to section 15 of the German Securities Trading Law (WpHG) published by the Deutsche Gesellschaft für Ad-hoc-Publizität (DGAP). Section 15 defines the situations in which companies are obliged to publish ad hoc disclosures in Germany. The actual publication and distribution is carried out in most cases (98% in 2001) by DGAP on behalf of the companies. As a first step, DGAP sends new company announcements to the stock exchanges and the regulatory authorities in order to comply with legal requirements. Then the ad hoc disclosure is sent to and published via several news services and agencies. In this study, we use a digital news feed provided by DPA-AFX, which contains all ad hoc disclosures published by the DGAP. Each announcement can be identified by a unique timestamp exact to the second. The feed provides the data field's timestamp, news header and news body. By automatically identifying the stock exchange symbol of the company which has published the ad hoc disclosure it is possible to automate the storage and subsequent processing of the corresponding intraday stock price series.

The empirical analysis encompasses the period August 1, 2003 – August 31, 2004. The announcement sample consists of 2,705 ad hoc disclosures. Figure 1 shows the temporal distribution of this dataset. Identical announcements published in different languages are treated as one disclosure. Evidently, most of the ad hoc disclosures are published during the two hours before stock exchanges start trading and are therefore not relevant for our intraday analysis. Companies publishing announcements after their temporal occurrence might wish to prevent possible suspended trading.

The sample adjustment is given in Table 1. We discard ad hoc disclosures published by companies with non-domestic shares since these companies are also subject to other disclosure regulations. If the foreign regulations are stricter than the German regulations, we would expect these ad hoc disclosures to have a different informational content. Confounding events have a significant impact on the calculation of abnormal returns and trading volume, so we eliminate these by identifying companies that have made other ad hoc disclosures in the ten days prior to the ad hoc disclosure of interest. Therefore, we discard all such ad hoc disclosures from the sample. Because we want to observe intraday short-term behavior, we concentrate on ad hoc disclosures published during trading hours. As we want to measure the price reaction surrounding the announcement date, we decide to make inclusion in the dataset conditional on there having been at least five transactions before and 15 transactions after publication of the disclosure. After applying all of these conditions to the sample, the remaining dataset consists of 160 ad hoc disclosures.

Given the ad hoc disclosures published during the observation period, we are able to extract the stock exchange symbol of the corresponding company automatically. Using this symbol, we request the intraday price series and trading volumes of that stock during the ten-day period up to and including the disclosure date. The nine days before the observed event are defined as the comparison period whereas the publication date is defined as the event day. Given

these ten-day price series, we aggregate all price information observed during a period of one minute to one price information using the last price fixing (close) of this period. The trading volumes during this minute are added up to one trading volume information (measured in 1,000 stocks).

We make this aggregation for two reasons. First, we had to reduce the data to be processed to a manageable degree of complexity. Secondly, we want to correct the intraday returns by adjusting for general market effects with a common market index. As the price information of indices is not calculated every second, it was necessary to have consistent timestamps. Therefore, we decide to work with price information exact to the minute, as it is a compromise between manageability and accuracy.

All stock prices and trading volumes were taken from the electronic trading platform XETRA and from the Frankfurt Stock Exchange (floor trading). XETRA is an electronic trading system, operated by the Deutsche Börse Group, which aggregates the buy and sell orders of licensed traders. It covers more than 90% of all share trading in Germany. Nearly 20% of these orders are placed by private investors. Evidently, this weighty customer segment uses the new electronic information and transaction systems.

We use intraday price series and trading volumes from July 22, 2003 (first analyzed ad hoc disclosure date minus nine prior days) to August 31, 2004 in the period between 9am and 8pm or, after November 3, 2003, when XETRA operating hours were shortened, between 9am and 5:30pm. For technical reasons we were able to obtain intraday stock data only for a period of 10 days before an ad hoc disclosure. Therefore, we are restricted to this period.

The descriptive statistics of the 160 ad hoc disclosures are given in Table 2. More than 50% of all ad hoc disclosures were announced by companies with less than EUR 100 million market capitalization at this time. Only 11.2% stem from large caps with more than EUR 5 billion

market capitalization. Therefore, our sample is dominated by small caps. Regarding the number of analysts covering the companies, the picture is similar: 26.1% of the ad hoc disclosures were announced by companies which are not covered by any analyst; 39.2% by companies covered by only 1 to 5 analysts; and less than one quarter by companies covered by more than 15 analysts. Nevertheless, the companies in our sample are traded frequently. Only one quarter of the ad hoc disclosures were made by companies whose stocks exhibit a trading volume of less than 50,000 shares on the day prior to the announcement date.

#### **4 Methodology of the event study**

The calculation of logarithmic returns for a company which published a certain ad hoc disclosure  $i$  at time  $t$  is done using intraday prices  $P$  of the respective company. These returns are calculated for all existing prices (and companies) starting ten days before the day of publication. CDAX returns are calculated accordingly.

To isolate price effects caused by the ad hoc disclosure, we apply a single-index model by using intraday price series of the CDAX Performance Index taken from XETRA for the same period. The CDAX encompasses all domestic companies from the market, so it represents the entire range of the German equity market.

Hence, abnormal returns  $AR_{i,t}$  are calculated by subtracting CDAX returns  $R_{CDAX,t}$  from the stock returns  $R_{i,t}$  for ad hoc disclosure  $i$  at time interval  $t$ .

$$AR_{i,t} = R_{i,t} - R_{CDAX,t} \quad (1)$$

Klein and Rosenfeld (1987) examine the quality of different return-generating models for calculating abnormal returns. They show that the single-index model leads to results analogous to those yielded by market-adjusted returns models.

Unlike event studies of one item, like e.g. short sales (Aitken et al. 1998), where one expects negative stock market reactions, ad hoc disclosures are made after different types of events,

e.g. earnings surprises, new equity issues, or takeovers. For some of these one would expect negative stock returns, and for others positive stock returns. Therefore, we cannot expect a certain general direction of stock returns for all ad hoc disclosures. Because we do not make any ex ante classification into ad hoc disclosures with probably good or probably bad new information, positive and negative stock reactions might neutralize each other.

Hence, we use absolute values of the abnormal returns  $AAR_{i,t}$  to avoid a possible neutralization of returns. However, without any further treatment they cannot be used for any statistical test because rejecting the null hypothesis that “a sum of absolute values is zero” would be possible with the utmost probability. For that reason, an adjustment according to Carter and Soo (1998) has to be made. We therefore calculate the mean of the absolute abnormal returns  $MAAR_i$  for the comparison period of nine days starting ten days prior to the publication date (for time intervals to the minute, which means up to 11 hours \* 60 min \* 9 days = 5,940 prices per company and announcement, depending on the price ticks received from the stock exchanges). Since we only have intraday data for ten days before the ad hoc disclosures we have to deal with the trade-off between estimating  $MAAR_i$  based on more days but with a higher possibility of insider trading and/or anticipation effects or based on fewer days and with a lower probability of insider trading and/or anticipation effects. Since previous non-intraday studies of the German market do not find evidence for abnormal market reactions prior to the publication of ad hoc disclosures, we decide to exclude the day prior to the event day for the calculation of  $MAAR_i$  only:

$$MAAR_i = 1/T \sum_{t=1}^T |AR_{i,t}| \quad (2)$$

where  $T$  indicates the number of transaction prices exact to the minute. The absolute abnormal returns  $|AR_{i,t}|$  of the event day are corrected by these averages. The result is the corrected absolute abnormal return  $CAAR_{i,t}$ :

$$CAAR_{i,t} = |AR_{i,t}| - MAAR_i \quad (3)$$

In comparison to Carter and Soo (1998) our  $CAAR$  can be interpreted easily because we do not standardize equation 3 with the standard deviation of the  $T$  numbers of  $|AR_{i,t}|$ . The  $CAAR$  can be interpreted as the part of the absolute abnormal returns lying above the level that can be observed on average when no ad hoc disclosure is published. In order to test for the existence of significant abnormal returns caused by the published ad hoc disclosures, we compute mean corrected absolute abnormal returns  $m(CAAR_t)$  over the  $I$  number of ad hoc disclosures for the time period  $t$ :

$$m(CAAR_t) = 1/I \sum_{i=1}^I CAAR_{i,t} \quad (4)$$

For different transaction time frames between  $t1$  and  $t2$  we calculate cumulated corrected absolute abnormal returns  $CCAAR_{i,t1,t2}$  for all ad hoc disclosures  $i$ :

$$CCAAR_{i,t1,t2} = \sum_{t=t1}^{t2} CAAR_{i,t} \quad (5)$$

This accumulation is done for two different dimensions. First, we cumulate over a given number of transactions (transaction timeframes  $(t1;t2) = (-5;-1), (0;+1), (+2;+5), (+6;+10), (+11;+15), (0;+10)$ ) and secondly, we cumulate over different timeframes on a minute-by-minute basis (minute-by-minute timeframes  $(t1;t2) = (-120;-61), (-60;-1), (0;+15), (+16;+30), (+31;+60), (+61;+90), (+91;+120)$ ). We have chosen fewer (longer) transaction (minute-by-minute) timeframes prior to the announcement date as we observed fewer transactions prior to the publication date on average.

In addition, we compute mean cumulated corrected absolute abnormal returns  $\mathbf{m}(CCAAR_{t1,t2})$  over the  $I$  number of ad hoc disclosures, which are taken for testing for the existence of significant abnormal returns caused by the published ad hoc disclosures:

$$\mathbf{m}(CCAAR_{t1,t2}) = 1/I \sum_{i=1}^I CCAAR_{i,t1,t2} \quad (6)$$

For calculating abnormal trading volumes we take the corresponding trading volumes  $V_{i,t}$  of the transaction and minute-by-minute timeframes used for the analysis of the price effects. For each announcement and intraday trading volume series, we calculate a mean trading volume per price fixing between ten and two days before the announcement day. As with the price effect we also exclude the day before the event because the trading activity might be affected by anticipation effects.

$$MV_i = 1/T \sum_{t=1}^T V_{i,t} \quad (7)$$

The trading volumes of the event day are corrected by these averages. The result is called abnormal volume  $AV$ .

$$AV_{i,t} = V_{i,t} - MV_i \quad (8)$$

These abnormal volumes are aggregated over all ad hoc disclosures  $i$  to calculate mean abnormal volumes  $\mathbf{m}(AV_t)$ :

$$\mathbf{m}(AV_t) = 1/I \sum_{i=1}^I AV_{i,t} \quad (9)$$

According to the calculation of the cumulated corrected absolute abnormal returns, we calculate cumulated abnormal trading volumes  $CAV$  for different transaction and minute-by-minute timeframes between  $t1$  and  $t2$ :



$$CAV_{i,t1,t2} = \sum_{t=t1}^{t2} AV_{i,t} \quad (10)$$

We also compute mean cumulated abnormal trading volumes  $\mathbf{m}(CAV_{t1,t2})$  over the  $I$  number of ad hoc disclosures, which are taken for testing for the existence of significant abnormal trading volumes caused by the published ad hoc disclosures:

$$\mathbf{m}(CAV_{t1,t2}) = 1/I \sum_{i=1}^I CAV_{i,t1,t2} \quad (11)$$

Given the mean corrected absolute abnormal returns  $\mathbf{m}(CAAR_t)$  and the mean cumulated corrected absolute abnormal returns  $\mathbf{m}(CCAAR_{t1,t2})$  we evaluate the statistical significance of abnormal returns during the event period. In the same manner we evaluate the statistical significance of abnormal trading volumes during the event period for the mean abnormal volumes  $\mathbf{m}(AV_t)$  and the mean cumulated abnormal trading volumes  $\mathbf{m}(CAV_{t1,t2})$ .

The null hypothesis  $H_0 : \mathbf{m}(CAAR_t) = 0$ ,  $H_0 : \mathbf{m}(CCAAR_{t1,t2}) = 0$ ,  $H_0 : \mathbf{m}(AV_t) = 0$ , and  $H_0 : \mathbf{m}(CAV_{t1,t2}) = 0$  are tested with two-sided t-Tests. Since we always have sample sizes larger than 30, the sample means are assumed to be approximately normal distributed.

## 5 Hypotheses

Based on the findings of Nowak (2001), Oerke (1999), and Röder (1999), we formulate a hypothesis regarding the efficiency of the German capital market in responding to the information content provided by ad hoc disclosures published pursuant to section 15 of the German Securities Trading Law. Hence, ex-ante and ex-post reactions of stock prices to ad hoc disclosures are of interest.

*Hypothesis Ia: Stock prices react before the announcement of ad hoc disclosures*

*Hypothesis Ib: Stock prices react after the announcement of ad hoc disclosures*

The reaction of the capital market can also be measured by the trading volume surrounding the ad hoc disclosure (Gosnell et al., 1996; Smith et al., 1997; Lee et al., 1994). In order to prove increased trading activity we formulate a hypothesis regarding the trading volume surrounding the announcements.

*Hypothesis IIa: Ad hoc disclosures cause abnormal trading activity before the announcement of ad hoc disclosures*

*Hypothesis IIb: Ad hoc disclosures cause abnormal trading activity after the announcement of ad hoc disclosures*

Analysis of price effects and trading activity yields valuable evidence regarding information efficiency. While this undoubtedly provides insights into market behavior, it does not detect coherences that might exist between the effects examined by the prior hypotheses and external determinants. Consequently we expect that the extent of price and trading volume effects is affected by company size (measured by index membership and market capitalization), by the number of analysts covering a company, and by the observed trading volume measured by the trading volume of the previous day.

Our hypothesis for the impact of index membership on the magnitude of the price effect is based on the assumption that companies which are included in an index must disclose more information than non-members. Therefore, on a relative basis, ad hoc disclosures by non-members of an index might provide more new information to investors, i.e. the marginal impact of these new pieces of information is greater for non-members than for members of an index.

*Hypothesis IIIa: The price reaction to ad hoc disclosures by non-members of an index is stronger than for index members*

Company size – in this study measured by market capitalization – also matters for the magnitude of stock price reactions. For example, Zeghal (1984) finds that stock price reactions surrounding announcements of financial statements are more pronounced for smaller companies. The importance of size for the estimation of stock returns is also noticeable in the inclusion of the SMB (small minus big) variable in the three-factor model of Fama and French (1995).

*Hypothesis IIIb: The price reaction to ad hoc disclosures by smaller companies is stronger than for larger companies*

We argue that analyst coverage can be interpreted as a further proxy for the information about the company which is available to investors. Therefore, on a relative basis, ad hoc disclosures by companies with low coverage might provide more new information to investors, i.e. the marginal impact of these new pieces of information is greater.

*Hypothesis IIIc: The price reaction to ad hoc disclosures by companies with low analyst coverage is stronger than for companies with wide analyst coverage*

Furthermore, we expect a negative correlation between stock price reactions and observed trading volume as a measure for liquidity. Since liquidity is essential to trade even a large number of stocks without influencing the stock price too much, this is not possible for less liquid stocks. In accordance with results presented by Oerke (1999) we expect stronger price reactions for less liquid stocks.

*Hypothesis IIIId: The price reaction to ad hoc disclosures by companies with low trading volume is stronger than for companies with high trading volume*

To save space we do not report hypotheses that are analogous to hypotheses IIIa to IIIId for the trading volume effect (in the later hypotheses IVa to IVd). We assume that this effect always has the same direction as the effect of the price reaction since large price reactions are normally associated with high volumes.

## 6 Empirical results

We consider hypothesis I by applying an event study approach to price reactions surrounding the announcements of 160 ad hoc disclosures. Thus, we ask whether German corporations' stock prices react to ad hoc disclosures. The results for the transactions are shown in Table 3 and those for time intervals in Table 4. We find no evidence of any abnormal price reactions in the five transactions or the two time intervals (-120;-61) and (-60;-1) before the announcement. This result holds for ad hoc disclosures by both index members and non-members. Hence, we find no evidence for insider trading or anticipation effects. Therefore, our results are not in line with previous research, which find moderate abnormal intraday price reactions before announcements on earnings and dividends (Patell and Wolfson, 1984), before announcements of new equity issues (Barclay and Litzenberger, 1988), and before earnings announcements (Jennings and Starks, 1985). However, these earlier results were found for some of the ex-ante periods and mostly on modest significance levels only. In comparison with the earlier results presented, which are based on US data, our results reflect the soundness of the German capital market.

Second, we examine the ex-post price effect. We find obvious abnormal stock returns in the first 10 transactions after the announcement of ad hoc disclosures, except transaction 7 for all 160 ad hoc disclosures. The event windows (0;+1), (+2;+5), (+6;+10), and (0;+10) all show significant abnormal returns, which are greater than 0 on the 1% significance level. After dividing the sample into index members and non-members, we find that the adjustment process covers more transactions for the index members. For these 58 ad hoc disclosures we also find significant abnormal price reactions for the 12<sup>th</sup> and 15<sup>th</sup> transaction number and also for the event window (+11,+15). Table 4 shows the results for the respective time intervals. The price adjustment process seems to last 90 minutes for the whole sample. The evidence suggests that, at 90 minutes, the process lasts 30 minutes longer for the non-members of an index since

we find no significant abnormal price reaction for the time interval (+61;+90) for the 58 ad hoc disclosures of the index members. The different results with regard to transaction data can be accounted for by the fact that non-members are traded less frequently than index members. However, we accept hypothesis Ib for most of the transactions and time intervals after the ad hoc disclosures. Compared with the results of previous intra-day event studies, our price adjustment processes are slower than the process for earnings and dividend announcements found by Patell and Wolfson (1984), for unexpected earnings releases found by Woodruff and Senchak (1988), and for announcements of new equity issues found by Barclay and Litzenberger (1988). However, the price adjustment processes of our study are still much faster than the eight hours found by Jennings and Starks (1985) for earnings announcements, the five hours following announcements of takeovers found by Smith et al. (1997), and the four hours following trading halts found by Lee et al. (1994).

Next, Table 5 shows the results for the impact of ad hoc disclosures on trading volume with regard to transactions, while Table 6 shows the results according to time intervals. In contrast to the previous analyses of the price effect, we find abnormally high trading volume in the last transaction before the announcement for all ad hoc disclosures and for the 58 disclosures by index members. Therefore, we accept hypothesis IIa for the whole sample and for the subsample of disclosures by index members. No abnormal trading effect is found for the disclosures by non-members of an index. However, the ex-ante effect on trading volume seems to be small, since we find no evidence of abnormal trading volume in the two time intervals (-120;-61) and (-60;-1) before the ad hoc disclosures for any of the three samples. Since the abnormal trading volume in the last transaction (2,935.48) for the whole sample is very small in comparison to the transaction at the time of the ad hoc disclosure and the 10 which follow

(218,261.24), we argue that no economically relevant abnormal trading volume occurs.<sup>‡</sup>

After the announcement, i.e. for the transactions 0 to +15 in Table 5 and for the time intervals (0;+15), (+16;+30), (+31;+60), (+61;+90), (+91;+120) in Table 6, we examine strongly abnormally high trading volumes. For the whole sample, the adjustment of trading volume is not completed within the analyzed 16 transactions<sup>§</sup> following ad hoc disclosures, nor within the two hours following the ad hoc disclosures. We find the same results for the index members. In contrast, the adjustment process seems to end after one hour for the non-members of an index. Hence, we accept hypothesis IIb. In comparison to previous research, we find that the volume adjustment process is faster than the six hours following a bad dividend announcement found by Gosnell et al. (1996), the five hours after the announcement of takeovers found by Smith et al. (1997), and the 6.5 hours after trading halts found by Lee et al. (1994). Since our sample construction is mainly motivated by the desire to measure the price effect surrounding ad hoc disclosures, we are not able to determine the end of the trading volume effect for the whole sample or for the index members.

In addition, we identify several potential determinants that might influence the price effect magnitude and the trading activity surrounding the publication of an announcement. The price effect is measured by the cumulated corrected absolute abnormal return *CCAAR* of ad hoc disclosure *i* over the transactions between *t1* and *t2*:

$$CCAAR_{i,t1,t2} = \mathbf{a} + \mathbf{b}_1 I_i + \mathbf{b}_2 MV_i + \mathbf{b}_3 A_i + \mathbf{b}_4 V_i + \mathbf{e}_i \quad (12)$$

with *I* as a dummy variable, getting a 1 if the company is a member of the DAX, MDAX or

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<sup>‡</sup> Unfortunately, because of the lack of comparable intraday studies of the trading volume effect, we are not able to compare our results with those of previous studies

<sup>§</sup> Since we are not willing to reduce our sample further to analyze more than 16 transactions after the announcement (see Table 2 for the sample adjustments), we are restricted to this number of transactions.

TecDAX at the time of the ad hoc disclosure, and 0 in all other cases. The market capitalization  $MV$  is calculated using the previous closing quote. To minimize the influence of very large companies on results we use the normal logarithm of the market capitalization. The number of analysts  $A$  covering the company on the day prior to the publication date is provided by JCF Group, a provider of equity analytical models and customized software solutions for professional investors. Trading volume  $V$  is calculated as the natural logarithm of the trading volume on the day prior to the publication date and is sourced from Deutsche Börse Group. The random disturbance of ad hoc disclosure  $i$  is given by  $e_i$ .

A second OLS model is used to analyze the trading volume effect that is measured by the cumulated abnormal trading volumes CAV (in 1,000 stocks) of ad hoc disclosure  $i$  over the transactions between  $t1$  and  $t2$ :

$$CAV_{i,t1,t2} = \mathbf{a} + \mathbf{b}_1 I_i + \mathbf{b}_2 MV_i + \mathbf{b}_3 A_i + \mathbf{b}_4 V_i + \mathbf{e}_i \quad (13)$$

In previous studies, a U pattern of stock returns and trading volume has been found (e.g., Harris 1986). In other words, the opening and closing periods of a trading day reveal a higher level of trading activity than other periods. Such intraday patterns generate heteroscedasticity, which distorts statistical results. One approach to deal with the abnormal trading activity, especially in the opening period, is to introduce a dummy variable for the first trading hour (Kalev et al. 2004). Since we restrict our sample to ad hoc disclosures with at least five transactions before and 15 after the announcement, we only have 5 ad hoc disclosures in the first trading hour and 3 in the last trading hour. Hence, the approach of Kalev et al. (2004) is neither necessary nor useful for this study since we have so few events in periods with abnormal trading activity. Nevertheless, we avoid biased statistical results by using heteroscedasticity-consistent White  $t$ -Statistics (White 1980). Besides, we test for multicollinearity by using variance inflation factors (VIF). Since we do not observe  $VIF > 10$  for any parameter esti-

mate, there is no evidence of multicollinearity (Gujarati 1995).

Table 7 shows the results for the OLS analysis of determinants of market reactions to ad hoc disclosures. Membership of an index, i.e., the DAX, MDAX or TecDAX, at the time of the announcement seems to play no role in explaining the price and trading volume effect surrounding ad hoc disclosures. However, the other three variables provide more explanatory power. Market capitalization appears to be important for the ex-post price reaction since the respective parameter coefficient is different from zero at the 5% significance level. The bigger the company announcing an ad hoc disclosure, the less severe is the abnormal price effect following the announcement. Hence, we accept hypothesis IIIb for the 11 transactions after the announcement but not for the five transactions before. Market capitalization seems not to be relevant for explaining the trading volume effect. Therefore, we discard hypothesis IVb. Furthermore, the number of analysts covering a company appears not to enlighten the price effect. The number of analysts is, however, negatively correlated to the ex-ante trading volume effect. Since the parameter estimate for the ex-post effect is not different from 0, hypothesis IVc is only accepted on the 10% significance level for the five transactions before the announcement. For the last determinant, we observe unexpected results. The higher the trading volume on the last trading day before the announcement, the greater the price effect ex-post and the trading volume effect ex-ante and ex-post. Hence, we reject hypothesis IIIId for the ex-post announcement period and hypothesis IVd for both periods.

## **7 Summary**

We have examined intraday stock price effects and trading activity caused by ad hoc disclosures in Germany. The results confirm that after company announcements pursuant to section 15 of the German Securities Trading Law (WpHG) significant abnormal intraday returns and trading volumes are observable.



The evidence suggests that the stock price adjustment process is completed after 10 transactions, or 90 minutes. We also find that, at 90 minutes, the process lasts 30 minutes longer for the non-members of an index, since we find no significant abnormal price reaction for the time interval (+61;+90) for the 58 ad hoc disclosures of the index members. Compared with the results of previous intra-day event studies, our price adjustment processes are slower than the process for earnings and dividend announcements found by Patell and Wolfson (1984), for unexpected earnings releases found by Woodruff and Senchak (1988), and for the announcement of new equity issues found by Barclay and Litzenberger (1988). However, the price adjustment processes of our study are still much faster than the eight hours for earnings announcements found by Jennings and Starks (1985), the five hours following announcements of takeovers found by Smith et al. (1997), and the four hours following trading halts found by Lee et al. (1994). We suggest that this is because ad hoc disclosures contain different types of news, e.g. earnings surprises, new equity issues, or takeovers. Therefore, it is plausible that the price adjustment processes we observe lie between those observed in previous studies, each of which concentrates on one news topic.

We find abnormally high trading volume for the last transaction before the announcement for all ad hoc disclosures and for the 58 disclosures of index members. However, the ex-ante effect on the trading volume seems to be small since we find no evidence of abnormal trading volume during the two time intervals (-120;-61) and (-60;-1) before the ad hoc disclosures. Since the abnormal trading volume in the last transaction is very small in comparison to the transaction at the time of the ad hoc disclosure and the following transactions, we argue that no economically relevant abnormal trading volume occurs. We also find no evidence for any abnormal price reactions in the five transactions or for the two time intervals (-120;-61) and (-60;-1) before the announcement. This result holds for ad hoc disclosures by both index members and non-members. Hence, we find no evidence for insider trading or anticipation effects.

We therefore conclude that post-announcement market reactions should not be confounded by pre-announcement market reactions.

After the announcement, we examine strongly abnormally high trading volumes. The adjustment of trading volume is not completed within the analyzed 16 transactions following ad hoc disclosures for the whole sample and for the sub-sample of index members, nor within the two hours following the ad hoc disclosures. In contrast, the adjustment process seems to end after one hour for the non-members of an index. In comparison to previous research, we find that the volume adjustment process for the non-members of an index is faster than the six hours following a bad dividend announcement found by Gosnell et al. (1996), the five hours after the announcement of takeovers found by Smith et al. (1997), and the 6.5 hours after trading halts found by Lee et al. (1994).

We also conduct an OLS analysis of determinants of market reactions to ad hoc disclosures. Membership of an index, i.e., the DAX, MDAX or TecDAX, at the time of the announcement seems to play no role in explaining the price and trading volume effect surrounding ad hoc disclosures. The bigger the company announcing an ad hoc disclosure, the less severe is the abnormal price effect following the announcement. However, market capitalization seems not to be relevant for explaining the trading volume effect. Furthermore, the number of analysts covering a company appears not to enlighten the price effect. Nevertheless, the number of analysts is negatively correlated to the ex-ante trading volume effect but not to the ex-post volume effect. The higher the trading volume on the last trading day before the announcement, the greater the price effect ex-post and the trading volume effect ex-ante and ex-post.

Table 1. Dataset and sample selection

The master data consists of all ad hoc disclosures published by the Deutsche Gesellschaft für Ad-hoc-Publizität (DGAP) in the period August 1, 2003 – August 31, 2004 for all companies listed on German stock exchanges. We discard ad hoc disclosures published by companies with non-domestic shares since these companies are also subject to other disclosure regulations. We also exclude ad hoc disclosures by companies that made other ad hoc disclosures in the ten trading days prior to the announcement in question, to ensure unbiased estimates of the stock return and trading volume. We discard disclosures which are not published during trading hours, since we want to examine the pre and post-announcement effects of ad hoc disclosures with intraday data. To ensure sufficient liquidity we eliminate ad hoc disclosures with fewer than 5 transactions before and 15 after the announcement.

Reason of revision	Number of Disclosures
Master data	2,705
Elimination of non-domestic stocks	151
Elimination of confounding events	193
Elimination of disclosures not published during trading hours	1,387
Elimination because of insufficient price ticks after the announcement	741
Elimination because of insufficient price ticks before the announcement	73
Remaining dataset size	160

Table 2. Descriptive Analysis

Descriptive statistics are given for 160 ad hoc disclosures published by the Deutsche Gesellschaft für Ad-hoc-Publizität (DGAP) in the period August 1, 2003 – August 31, 2004 for all companies listed on German stock exchanges (see Table 1 for the sample adjustments). Panel I shows the market capitalization of the companies that made the respective ad hoc disclosure, in billions of euros. Panel II presents the number of analysts covering the respective company which published the ad hoc disclosure. The last panel gives the trading volume in 1,000 stocks of the respective company. All measures are given for the trading day before the announcement of the ad hoc disclosure.

Panel I: Market capitalization in EUR billion						
	>0,=0.025	>0.025, =0.05	>0.05, =0.1	>0.1, =1	>1, =5	> 5
Number of ad hoc disclosures	38	26	16	43	19	18
Frequency	23.8%	16.3%	10.0%	26.9%	11.9%	11.3%
Cumulative frequency	23.8%	40.0%	50.0%	76.9%	88.8%	100.0%
Panel II: Number of analysts						
	0	>0,=2	>2, =5	>5, =15	>15, =25	>25
Number of ad hoc disclosures	42	41	22	16	19	20
Frequency	26.3%	25.6%	13.8%	10.0%	11.9%	12.5%
Cumulative frequency	26.3%	51.9%	65.6%	75.6%	87.5%	100.0%
Panel III: Volume of traded stocks in 1,000						
	>0,=10	>10,=50	>50,=100	>100,=1,000	>1,000,=5,000	>5,000
Number of ad hoc disclosures	11	28	34	53	21	13
Frequency	6.9%	17.5%	21.3%	33.1%	13.1%	8.1%
Cumulative frequency	6.9%	24.4%	45.6%	78.8%	91.9%	100.0%

Table 3: Price reactions to ad hoc disclosures according to transactions

This table shows price reactions surrounding ad hoc disclosures by German companies in the period August 1, 2003 – August 31, 2004. We aggregate all price information observed during a period of one minute to one price information using the last price fixing (close) of this period. Transactions are therefore defined to intervals of one minute and notated by  $t$ . Abnormal price reactions are measured by using market adjusted stock returns for five transactions before and 16 transactions after the ad hoc disclosure. The transaction number 0 is defined as having taken place in the minute of the announcement of the ad hoc disclosure or as the next observed transaction. Abnormal price reactions are cumulated over six different event windows between transaction  $t1$  and  $t2$ . Columns 2 and 3 give the results of all 160 ad hoc disclosures. Columns 4 and 5 present results for 58 ad hoc disclosures by companies that were included in the DAX, MDAX or TecDAX at the time of disclosure. Columns 6 and 7 show results for 102 ad hoc disclosures by non-members of an index.

Transaction or window	All disclosures (n = 160)		Disclosures by index members (n = 58)		Disclosures by non-members of an index (n = 102)	
	$\mu(CAAR_t)$ or $\mu(CCAAR_{t1,t2})$ in %	t-Statistic	$\mu(CAAR_t)$ or $\mu(CCAAR_{t1,t2})$ in %	t-Statistic	$\mu(CAAR_t)$ or $\mu(CCAAR_{t1,t2})$ in %	t-Statistic
-5	-0.0805	-0.9644	0.0572	1.0414	-0.1588	-1.2557
-4	0.0095	0.1114	0.0646	0.6498	-0.0218	-0.1799
-3	-0.1295	-1.5823	-0.0011	-0.0270	-0.2025	-1.6106
-2	-0.0303	-0.3531	0.0098	0.2914	-0.0531	-0.3986
-1	-0.0465	-0.5763	0.0151	0.2898	-0.0815	-0.6636
0	2.1357***	3.5539	1.0239***	3.1673	2.7679***	3.0129
+1	1.0272***	4.7820	0.3447***	5.0105	1.4152***	4.3080
+2	0.5953***	3.0521	0.4205***	4.1182	0.6946**	2.3159
+3	0.5204***	3.0088	0.2359***	3.7263	0.6821**	2.5494
+4	0.4785***	2.7697	0.1725**	2.5347	0.6524**	2.4465
+5	0.3016***	2.4687	0.2104***	3.6103	0.3535*	1.8746
+6	0.5964***	2.7673	0.164***	3.0564	0.8423**	2.5199
+7	0.0758	0.7503	0.1341**	2.5396	0.0427	0.2744
+8	0.3439***	2.7329	0.0567	1.3229	0.5072***	2.6140
+9	0.336**	2.2586	0.167***	3.2650	0.4320*	1.8705
+10	0.0747	0.6921	0.0489	0.9478	0.0893	0.5360
+11	0.1441	1.1360	0.0607	1.3831	0.1916	0.9710
+12	0.0228	0.2134	0.0833*	1.8867	-0.0116	-0.0702
+13	0.0964	1.2416	0.0803	1.4211	0.1056	0.8987
+14	0.0158	0.1497	0.0611	1.3924	-0.01	-0.0610
+15	0.0052	0.0559	0.1317**	2.0617	-0.0668	-0.4774
(-5,-1)	-0.2859	-1.0333	0.1457	0.7739	-0.5312	-1.2690
(0,+1)	3.1629***	4.4516	1.3685***	4.2390	4.1832***	3.8504
(+2,+5)	1.8958***	4.3564	1.0394***	4.6799	2.3827***	3.5775
(+6,+10)	1.4268***	3.1415	0.5707***	4.2666	1.9135***	2.7189
(+11,+15)	0.2843	0.8607	0.4171***	3.2031	0.2087	0.4072
(0,+10)	6.4854***	5.4484	2.9786***	5.0507	8.4794***	4.6917

\*\*\* indicates significance on the 1% level; \*\* on the 5% level; \* on the 10% level

Table 4: Price reactions to ad hoc disclosures according to periods in minutes

This table shows price reactions surrounding ad hoc disclosures by German companies in the period August 1, 2003 – August 31, 2004. We aggregate all price information observed during a period of one minute to one price information using the last price fixing (close) of this period. Transactions are therefore defined to intervals of one minute and notated by  $t$ . Abnormal price reactions are measured by using market adjusted stock returns for five transactions before and 16 transactions after the ad hoc disclosure. The transaction number 0 is defined as having taken place in the minute of the announcement of the ad hoc disclosure or as the next transaction. Abnormal price reactions are cumulated over seven different event windows between time period  $t1$  and  $t2$ . Columns 2 and 3 give the results of all 160 ad hoc disclosures. Columns 4 and 5 present results for 58 ad hoc disclosures of companies that were included in the DAX, MDAX or TecDAX at the time of disclosure. Columns 6 and 7 show results for 102 ad hoc disclosures by non-members of an index.

Time win- dows in minutes	All disclosures		Disclosures by index members		Disclosures by non-members of an index	
	Obser- vations	$\mu(CCAAR_{t1,t2})$ in %	Obser- vations	$\mu(CCAAR_{t1,t2})$ in %	Obser- vations	$\mu(CCAAR_{t1,t2})$ in %
(-120;-61)	146	-0.2104	54	0.0952	92	-0.3897
(-60;-1)	149	-0.3699	58	0.0667	91	-0.6482
(0;+15)	144	3.6198***	54	2.9127***	90	4.0441***
(+16;+30)	136	1.1103***	53	0.4099***	83	1.5576***
(+31;+60)	147	1.1810	56	0.4481*	91	1.6319
(+61;+90)	152	1.9709***	58	0.7889	94	2.7003**
(+91;+120)	139	0.0471	56	0.2614	83	-0.0975

\*\*\* indicates significance on the 1% level; \*\* on the 5% level; \* on the 10% level

Table 5: Trading volume reactions to ad hoc disclosures according to transactions

This table shows trading volume reactions surrounding ad hoc disclosures by German companies in the period August 1, 2003 – August 31, 2004. We aggregate all volume information observed during a time frame of one minute and notated by  $t$ . Abnormal volume reactions are measured by using mean adjusted trading volumes for five transactions before and 16 transactions after the ad hoc disclosure. The transaction number 0 is defined as having taken place in the minute of the announcement of the ad hoc disclosure or as the next observed transaction. Abnormal trading volume reactions are cumulated over six different event windows between transaction  $t1$  and  $t2$ . Columns 2 and 3 give the results of all 160 ad hoc disclosures. Columns 4 and 5 present results for 58 ad hoc disclosures of companies that were included in the DAX, MDAX or TecDAX at the time of disclosure. Columns 6 and 7 show results for 102 ad hoc disclosures by non-members of an index.

Transaction or window	All disclosures (n = 160)		Disclosures by index members (n = 58)		Disclosures by non-members of an index (n = 102)	
	$\mu(AV_t)$ or $\mu(CAV_{t1t2})$	t-Statistic	$\mu(AV_t)$ or $\mu(CAV_{t1t2})$	t-Statistic	$\mu(AV_t)$ or $\mu(CAV_{t1t2})$	t-Statistic
-5	1,034.46	0.8891	1,700.00	0.5995	656.01	0.7693
-4	-481.69	-1.2360	-464.19	-0.5898	-491.63	-1.1806
-3	1,941.52	1.5985	4,322.79	1.3627	587.46	1.0276
-2	1,573.39	0.9736	2,372.43	0.6988	1,119.03	0.6818
-1	2,935.48**	2.1456	5,997.35*	1.7592	1,194.41	1.3649
0	38,271.11***	2.8144	88,870.62**	2.4537	9,498.84***	3.2665
+1	28,516.63***	4.0774	68,316.24***	3.8085	5,885.48***	3.7469
+2	33,560.13***	2.9295	86,969.57***	2.8686	3,190.05***	3.6222
+3	21,503.34***	3.9324	52,947.26***	3.7963	3,623.46**	2.5399
+4	18,486.38***	3.8534	48,016.86***	3.9091	1,694.53***	3.6032
+5	12,779.14***	4.0037	34,372.29***	4.2815	500.68	1.2870
+6	14,727.91***	4.2349	37,326.83***	4.2783	1,877.55**	2.2747
+7	15,443.61***	3.7169	40,892.14***	3.8564	972.89	1.4324
+8	12,236.51***	3.1133	31,265.40***	3.0211	1,416.16***	3.0589
+9	13,665.90***	3.7180	34,701.14***	3.6907	1,704.69*	1.9204
+10	9,070.58***	2.7581	24,159.81***	2.7801	490.42	1.0908
+11	9,646.13***	3.4093	25,945.16***	3.5661	378.05	0.7412
+12	7,387.28***	3.2457	20,070.40***	3.4226	175.32	0.3724
+13	9,717.89***	3.4846	21,570.88***	3.5243	2,977.95	1.2370
+14	8,785.85***	3.6557	22,352.14***	3.6337	1,071.69*	1.7670
+15	9,872.65***	3.2654	26,534.41***	3.3826	398.32	0.9704
(-5,-1)	7,006.75	1.6430	13,928.38	1.2731	3,070.92	1.2945
(0,+1)	66,787.74***	3.7716	157,186.86***	3.4184	15,384.32***	3.7932
(+2,+5)	86,328.98***	3.7265	222,305.99***	3.7229	9,008.73***	3.6804
(+6,+10)	65,144.52***	3.9089	168,345.32***	3.9556	6,461.71***	2.9984
(+11,+15)	45,409.80***	3.8783	116,472.99***	3.9420	5,001.33	1.5150
(0,+10)	218,261.24***	4.1103	547,838.17***	4.0433	30,854.76***	4.2659

\*\*\* indicates significance on the 1% level; \*\* on the 5% level; \* on the 10% level

Table 6: Trading volume reactions to ad hoc disclosures according to periods in minutes

This table shows trading volume reactions surrounding ad hoc disclosures by German companies in the period August 1, 2003 – August 31, 2004. We aggregate all volume information observed during a time frame of one minute and notated by  $t$ . Abnormal volume reactions are measured by using mean adjusted trading volumes for five transactions before and 16 transactions after the ad hoc disclosure. The transaction number 0 is defined as having taken place in the minute of the announcement of the ad hoc disclosure or as the next transaction. Abnormal trading volume reactions are cumulated over seven different event windows between time period  $t1$  and  $t2$ . Columns 2 and 3 give the results of all 160 ad hoc disclosures. Columns 4 and 5 present results for 58 ad hoc disclosures of companies that were included in the DAX, MDAX or TecDAX at the time of disclosure. Columns 6 and 7 show results for 102 ad hoc disclosures by non-members of an index.

Time win- dows in minutes	All disclosures		Disclosures by index members		Disclosures by non- members of an index	
	Obser- vations	$\mu(CAV_{t1t2})$	Obser- vations	$\mu(CAV_{t1t2})$	Obser- vations	$\mu(CAV_{t1t2})$
(-120;-61)	146	10,628.90	54	31,002.42	92	-1,329.46
(-60;-1)	149	19,838.03	58	49,608.14	91	863.68
(0;+15)	144	216,637.73***	54	524,882.68***	90	31,690.76***
(+16;+30)	136	77,720.18***	53	181,803.42***	83	11,257.39***
(+31;+60)	147	88,474.42***	56	209,687.84***	91	13,881.55***
(+61;+90)	152	125,060.00***	58	309,100.03***	94	11,503.38
(+91;+120)	139	77,439.48***	56	189,804.82***	83	1,626.72

\*\*\* indicates significance on the 1% level; \*\* on the 5% level; \* on the 10% level



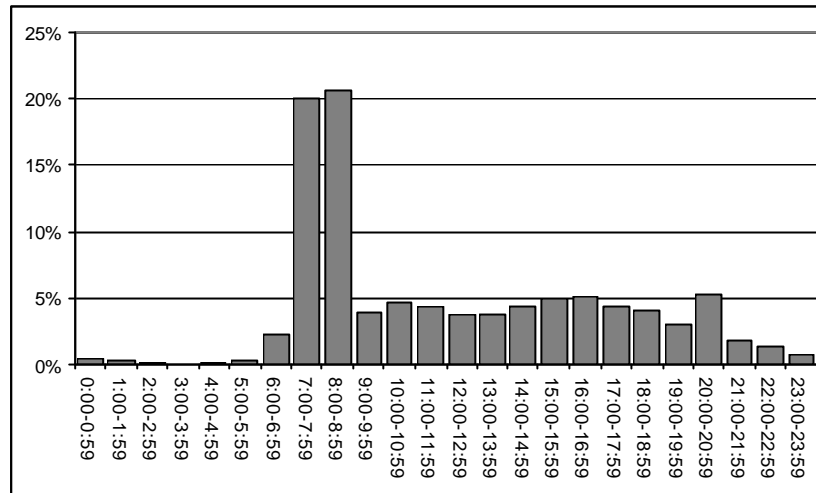
Table 7: Determinants of market reactions to ad hoc disclosures

This table shows results of multivariate OLS analysis of determinants of market reactions to 160 ad hoc disclosures. To avoid the influence of heteroscedasticity on statistical measures we use White adjusted t-Statistics. In Panel I, two regressions are made to analyze the price effect. The dependent variable of the first regression is the cumulated corrected absolute abnormal return *CCAAR* over the five transactions before the announcements. The dependent variable of the second regression in Panel I is the *CCAAR* of the 11 transactions after the announcements. The first independent variable is a dummy for index membership, which takes the value 1 if the company is listed in the DAX, MDAX or TecDAX at the time of the announcement. The second dependent variable is the normal logarithm of the market capitalization, which is calculated using the previous closing quote. The third dependent variable is the number of analysts covering the company on the day prior to the publication date. The fourth dependent variable is the natural logarithm of the trading volume, which is calculated as the trading volume (in stock) on the day prior to the publication date. In Panel II, we conduct two further regressions to analyze the trading volume effect. The dependent variable of the first regression is the cumulative abnormal volume *CAV* in 1,000 stocks of the five transactions before the announcements. The dependent variable of the second regression is the cumulative abnormal volume *CAV* in 1,000 stocks of the 11 transactions after the announcements. Independent variables in Panel II are the same as in Panel I.

Panel I: Price effect				
	<i>CCAAR</i> <sub>-5,-1</sub>		<i>CCAAR</i> <sub>0,+10</sub>	
	Parameter estimate	White adjusted t-Statistics	Parameter estimate	White adjusted t-Statistics
Intercept	0.0213	0.2821	0.5461*	1.8319
Index membership	0.0102	1.3052	-0.0021	-0.0932
Market capitalization	-0.0017	-0.4159	-0.0389**	-2.3180
Number of analysts	0.0001	0.3057	0.0033*	1.6529
Trading volume	0.0002	0.0942	0.0181***	2.5921
Adjusted R <sup>2</sup>	<0		0.1939	
Panel II: Trading volume effect				
	<i>CAV</i> <sub>-5,-1</sub>		<i>CAV</i> <sub>0,+10</sub>	
	Parameter estimate	White adjusted t-Statistics	Parameter estimate	White adjusted t-Statistics
Intercept	-168.4180	-1.6161	-1,532.8560	-1.4086
Index membership	23.0410	1.3884	102.5380	0.6663
Market capitalization	4.4054	1.4324	11.8200	0.3354
Number of analysts	-2.3111*	-1.7918	7.8850	0.5663
Trading volume	8.6792*	1.6881	116.469**	2.2588
Adjusted R <sup>2</sup>	0.1248		0.2820	

\*\*\* indicates significance on the 1% level; \*\* on the 5% level; \* on the 10% level

Figure 1: Temporal distribution of ad hoc disclosure published  
in the period August 1, 2003 to August 31, 2004



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