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Implications of Dividend Announcements for Stock Prices and Trading Volume of DAX Companies

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1. Introduction

Dividend policy has been intensively discussed in financial research ever since Modigliani and Miller (1961) suggested that dividend payout was irrelevant for a firm's value. The respective literature has concentrated on two major questions: i) Why do companies pay dividends at all, and is there an optimal dividend policy? ii) Do announcements of changing payouts affect investor behavior and what is the information content of such announcements?

The former question has been investigated in numerous, predominantly theoretical models (see (Allen – Michaely, 2003) for an excellent overview), while the latter is mainly empirical. This investigation follows this second question by analyzing market reactions to dividend announcements on the German stock market. In contrast to most other studies on this issue we do not concentrate solely on price reactions, but also investigate trading volume. This gives us a broader perspective of how investors react to news on dividends. While stock price reactions measure the average revision in investors' expectations, trading volume mirrors differential belief revisions. This implies that even if stock prices do not react to public announcements, trading volume may rise, indicating that the announcements convey new information to the market. On the other hand, significant price effects accompanied by no excess trading volume indicate that (for whatever reason) an event does not cause investors to adapt their expectations.

This paper examines the implications of public corporate dividend news by means of event-study methodology using data from the German stock market, namely the companies included in the DAX. We assess the market

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impacts of these announcements by measuring abnormal returns, the variability of returns and abnormal trading volume. Thereby we infer the information content of a company's dividend policy. The investigation differs substantially from two earlier studies on dividend announcement effects on the German stock market by Amihud and Murgia (1997) and Gerke, Oerke and Sentner (1997). The main differences concern: definition of event (dividend announcement); investigation of volatility and trading volume reactions; implementation of recent methodology; and the use of recent data.

The remainder of the paper is organized as follows: Section 2 provides a short overview of the literature on the causes for a dividend announcement effect. In Section 3 we give an insight into the methodology for determining excess returns and trading volume. In section 4 we present our data and report empirical results. Section 5 concludes the paper.

2. Prior Research

Several explanations of why information on a company's payout policy affects investors' behavior have been discussed in the literature, the most relevant being market imperfections due to tax reasons and asymmetric information, incomplete contracts (agency costs) and behavioral reasons. Tax considerations have been among the oldest arguments for a dividend effect. Individual investors typically face a tax disadvantage with respect to dividend payouts, therefore preferring low dividend paying companies. On the other hand, institutional investors (e.g. pension funds) often pay no taxes at all on dividend earnings, implying that their portfolio choice will emphasize companies that announce higher than average dividends. Allen, Bernardo and Welch (2000) suggest that the substantial increase in the proportion of institutional investors over the past 20 years has raised the demand for high dividend paying stocks.

An alternative explanation rests upon the *cash flow signaling hypothesis* developed in theoretical models by Bhattacharya (1979), John and Williams (1985) and Miller and Rock (1985). According to this hypothesis managers possess superior information about a firm's current and/or future cash flows than other market participants. By announcing changing dividends, managers convey this information to the market. The resulting reactions of stock prices therefore reflect the average change in investors' expectations in response to this inside-firm information (see (Dyl – Weigand, 1998), (Best – Best, 2001) or (Nissim – Ziv, 2001) for recent results on this hypothesis).

Another body of research on dividend-announcement effects deals with agency theory. The *free cash flow hypothesis,* formulated by Jensen (1986), states that managers facing substantial free cash flows might either invest these below the cost of capital or increase dividends. The latter policy protects the firm from over-investing and leads to agency cost reductions and consequently to an increase in stock prices. Employing *Tobin's Q* ratio as a proxy for the over-investment problem, Lang and Litzenberger (1989) find empirical support for this hypothesis.

Finally, behavioral finance models imply that most investors prefer regular, high dividend payouts to capital gains. Therefore, an increase in dividend payment can attract potential investors and cause a rise in equity

prices (see (Barberis – Thaler, 2003) for a comprehensive overview of this literature).

Most empirical analyses find evidence that points to a positive relationship between dividend announcements and stock-price movements: increasing (decreasing) dividends cause stock prices to move in the same direction. A detailed overview of these empirical studies is provided by Frankfurter and Wood (2002). For the German stock market, two earlier contributions on dividend announcement effects by Amihud and Murgia and Gerke, Oerke and Sentner were published in 1997. Their results are mostly in line with those from other markets; however, neither study pays any attention to the effects of dividend announcements on trading volume or return volatility. This is probably due to the present absence of a consistent theory with respect to trading volume.

In his survey paper, Karpoff (1986) stresses that the increase in trading volume caused by public announcements may either be a consequence of different interpretations of the news by investors, or market participants' interpretations are identical, but they start from diverse prior beliefs. Kim and Verrechia (1991) assume that investors are diversely informed and typically differ in terms of the precision of their private prior information. Consequently, their responses to the announced news differ and this leads to an increase in trading volume (the paper by Brockman and Chung (2000) provides detailed empirical results on that issue). Abnormal trading volume, in conjunction with price reactions, may also be caused by noise-traders who revise their portfolios on the basis of recent price changes rather than new information.

3. Abnormal Return and Abnormal Volume Methodology

We start our investigations by defining the dividend process as a martingale, i.e. we assume investors to expect future dividends to be unchanged:

$$E\,[D_{i,y}] = D_{i,y-1} \tag{1}$$

where $E\,[D_{i,y}]$ stands for the expected dividend of company i for year y and $D_{i,y-1}$ is last year's dividend. A dividend announcement is considered to be a positive surprise for market participants if $D^{a}_{i,y} > E[D_{i,y}]$, neutral if $D^{a}_{i,y} = E[D_{i,y}]$ and a negative event if $D^{a}_{i,y} < E[D_{i,y}]$, where $D^{a}_{i,y}$ denotes the announced dividend of company i for year y.

Our assumption about the dividend process has its origin in the *reluctance-to-change dividends hypothesis*, which states that companies are typically averse to changing dividends unless substantial changes in the economic situation of the firm appear to make it necessary. This assumption is highly relevant in our study since we define an event as the very first statement on upcoming dividends, and this can take place several months before the dividend is fixed. Managers are thus cautious and tend to formulate their projections on the basis of last year's dividend.

For each observed dividend announcement we define an event window and a pre-event window (estimation window). The former comprises five trading days, namely the announcement date ($t = 0$) plus the two days be-

fore ($t = -2$, $t = -1$) and the two days after the announcement date ($t = +1$, $t = +2$), while the pre-event window covers the 50 trading days prior to the event window. For each day of the event window, we compute the abnormal return *AR* as the difference between the actual ex-post return and the security's normal return that is expected in the absence of the event. Formally, for each announcement of the analyzed companies we compute:

$$AR_{i,t} = R_{i,t} - E\left[R_{i,t} \mid X_i\right] \tag{2}$$

where $R_{i,t}$ stands for the actual continuously compounded return of firm i on date t in the event window and $E\left[R_{i,t} \mid X_i\right]$ denotes the predicted return conditional on the information set X_i, where $X_i = (R_{i,-52}, \ldots, R_{i,-3})$. To estimate risk-adjusted expected stock returns, we apply the market model with an AR(1) term in the mean equation and GARCH(1,1) error term. Formally, we use the following representation for the return generating process:

$$R_{i,t} = \alpha_i + \phi_i R_{i,t-1} + \beta_i R_{m,t} + \varepsilon_{i,t}, \quad \varepsilon_{i,t} \sim (0,\ \sigma_{i,t}^2) \tag{3}$$

$$\sigma_{i,t}^2 = \omega_i + \gamma_i \varepsilon_{i,t-1}^2 + \delta_i \sigma_{i,t-1}^2 \tag{4}$$

In equation (3), $R_{m,t}$ denotes the continuously compounded return of the DAX on day t, and is taken as a proxy for the market return.

Corresponding to equation (1), we divide our sample of dividend announcements into three clusters, one comprising dividend increases, one for dividend decreases and one for constant dividends. For each cluster, we compute average abnormal returns across sampled firms for event day t as:

$$\overline{AR_t} = N^{-1} \sum_{i=1}^{N} AR_{i,t} \tag{5}$$

where N stands for the number of events in a cluster.

The sample standard deviation of $\overline{AR_t}$ for the pre-event window is calculated from the time-series of mean abnormal returns for each cluster as:

$$\hat{\sigma}[\overline{AR_t}] = \left[\frac{1}{49} \sum_{t=-52}^{-3} \left(\overline{AR_t} - \overline{\overline{AR}}\right)^2\right]^{1/2} \tag{6}$$

where the subtrahend in parentheses denotes the average of (5) over the pre-event window.

Note that the statistic defined in (6) can be called a cross sectional-time series standard deviation.

Finally, we wish to test the null hypothesis that the mean abnormal return on event day t is equal to zero. Our test statistic is the ratio of mean cross-sectional abnormal return and the standard deviation given by (6):

$$t_{stat} = \frac{\overline{AR_t}}{\hat{\sigma}[\overline{AR_t}]} \tag{7}$$

Assuming that the $\overline{AR_t}$ are i.i.d. and normal, statistic (7) has a Student-t distribution under the null hypothesis with $(N - 1)$ degrees of freedom.

In order to examine whether dividend announcements lead to a change in trading activities, we analyze trading volume using a method proposed in Beneish and Gardner (1995). Abnormal trading volume on event day t is measured by use of the market adjusted volume ratio, $VR_{i,t}$, given by:

$$VR_{i,t} = \frac{V_{i,t}}{V_{m,t}} \cdot \frac{\overline{V_m}}{\overline{V_i}} \tag{8}$$

In (8), $V_{i,t}$ stands for the i-th company's number of shares traded and $V_{m,t}$ is the aggregated trading volume in the DAX. $\overline{V_i}$ and $\overline{V_m}$ denote the averages of $V_{i,t}$ and $V_{m,t}$, respectively, over the pre-event window. If dividend announcements induce no excess volume, the expected value of $VR_{i,t}$ is 1. Consequently, we define event-induced trading volume as the difference between actual $VR_{i,t}$ and 1.

4. Empirical Results

4.1 Description of Data

Our sample consists of 30 companies listed on the German stock market. The companies were selected on the basis of their being members of the German DAX, the blue chip index of Deutsche Börse, in April 2004. The investigation covers the period from January 1992 to April 2004, although not all firms were included in the index for the whole period. An appendix at the end of the paper comprises a list of all companies included in the sample as well as their period of quotation and the number and direction of announced dividend changes. Daily closing prices as well as trading volumes for these firms are derived from Reuters.

We define the announcement date as the day of the very first official statement on dividends by the executive board of the firm analyzed, as identified in the Factiva database. This definition differs from other studies but is equivalent to that in Gurgul, Mestel and Schleicher (2003). In most cases, this first announcement is made several months before the end of the fiscal year and does not provide information on the exact level of dividends but only on the expected direction of dividend changes (increase/constancy/decrease). On the basis of these criteria, we were thus able to extract 280 relevant dividend announcements from the several thousand included in the Factiva databases.

4.2 Stock Return Reactions

The t-statistic given by (7) assumes the abnormal stock returns to follow a normal distribution and to be serially uncorrelated. To make sure that the latter assumption holds true we employ the Ljung-Box Q test statistic with Q denoting the maximum lag being considered. When choosing Q equal to 15, it turns out that autocorrelation is present in less than 6 % of the sampled events. To test for normality we apply the Lilliefors test, detecting non-normality in approximately one out of five cases. As far as the mean

TABLE 1 Average Daily Abnormal Returns for the Event Window in Three Clusters

Event period day *t*	Dividend increases Sample size: 140		Constant dividends Sample size: 109		Dividend decreases Sample size: 31	
	$\overline{AR}$ (%)	*t*-stat	$\overline{AR}$ (%)	*t*-stat	$\overline{AR}$ (%)	*t*-stat
–2	–0.078	–0.546	–0.004	–0.024	–0.203	–0.727
–1	0.078	0.548	0.123	0.755	–0.297	–1.066
0	0.417*	2.940	–0.068	–0.421	–1.542*	–5.533
+1	–0.024	–0.168	–0.154	–0.947	–0.326	–1.171
+2	0.024	0.169	0.097	0.596	–0.064	–0.231
Σ	0.418*	2.942	–0.007	–0.041	–2.432*	–8.729

Note: * significant at the 1% level

abnormal return series (equation (5)) is concerned, there is no reason to reject the hypothesis of normality at the 5% significance level.

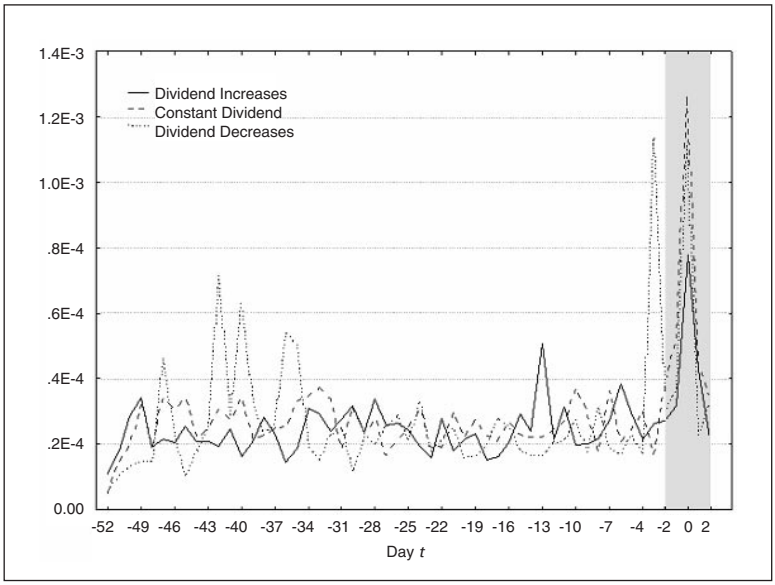
Our results for abnormal stock returns over the event window for each cluster are summarized in *Table 1*. For 140 announced dividend increases the average abnormal return on the immediate announcement day is +0.42 % (significant at the 1% level). This result confirms the findings of other studies in the sense that dividend increases are interpreted as positive signals by investors. We also find that for all other days over the event window, average abnormal returns are not significantly different from zero. This means that on the one hand, news of increasing dividend payouts is incorporated into stock prices very quickly, and on the other hand, is in fact new information to the market (no significant abnormal returns prior to the announcement).

In the case of constant dividends (sample size: 109), the average abnormal returns are not statistically different from zero on any day of the event window. However, one must not conclude from this (as do e.g. Gerke, Oerke and Sentner (1997)) that the announcement of unchanged dividends conveys no relevant information to the market. It needs to be remembered that prices reflect only one part of market reactions to news.

In the cluster of announced dividend decreases (sample size of only 31), we find a statistically significant average abnormal daily return of –1.54 % on day $t = 0$. This result corroborates empirical findings for other markets that cuts in dividend payments are bad news to investors and have a negative impact on stock prices. Average *AR* turns out to be negative on each event-window day with cumulated abnormal returns of –2.43 %. As a further point of interest, our results also indicate that an announced dividend cut causes a much stronger price reaction in absolute terms compared to the average abnormal returns induced by increasing dividends. This confirms the more general observation on financial markets that bad news has a greater impact on stock returns than good news. Kahnemann and Tversky (1979) argue in terms of their prospect theory that this effect stems from the fact that people are more sensitive to losses than to gains, a feature known as *loss aversion*.

Apart from the average reactions of stock returns, we were also interested in the extent of return changes within the three clusters. *Figure 1* shows

FIGURE 1 Cross-Sectional Variances of Excess (Abnormal) Returns for Three Clusters over the Pre-Event and Event Window



the cross-sectional variances of abnormal returns for the three clusters from $t = -52$ to $t = +2$ relative to the announcement date. It is noticeable that for all clusters, variance increases over the event window. Surprisingly, cross--sectional variance on day $t = 0$ is highest for the cluster of announced constant dividends, implying that the price reactions to these announcements differ greatly across this cluster. For dividend decreases, variance rises sharply immediately before the announcement. This might be taken as an indication that several investors have inside information at their disposal.

4.3 Trading Volume Reactions

To supplement our results on the dividend announcement effect for the DAX market segment, *Table 2* reports our findings of cross sectional averages of the market-adjusted volume ratio *VR* for each cluster. As for the time series of abnormal stock returns, we began the testing with checking whether or not the abnormal volume series exhibit non-normality as well as autocorrelation. The Ljung-Box Q statistic ($Q = 15$) is statistically significant at the 5% level in half of the firms included in our sample. In contrast, the mean abnormal volume series are close to normality.

We find strong support for the hypothesis that news on dividends conveys new and valuable information to the market, since for each day over the event period abnormal trading volume is positive and in most cases significant. Looking at the cluster of dividend increases, we find significant abnormal trading volume over a four-day period, starting one day before

TABLE 2 Average Daily Market Adjusted Volume Ratio for the Event Window in Three Clusters

Event period day *t*	Dividend increases Sample size: 140		Constant dividends Sample size: 109		Dividend decreases Sample size: 31	
	$\overline{VR}$	*t*-stat	$\overline{VR}$	*t*-stat	$\overline{VR}$	*t*-stat
–2	0.054	1.327	0.148*	3.411	0.134	1.497
–1	0.110*	2.717	0.150*	3.459	0.198**	2.212
0	0.618*	15.294	0.702*	16.144	1.110*	12.405
+1	0.427*	10.573	0.410*	9.422	0.401*	4.487
+2	0.180*	4.459	0.192*	4.419	0.186**	2.079
Σ	1.390*	15.370	1.602*	16.452	2.029*	10.143

Notes: * significant at the 1% level
** significant at the 5% level

the announcement. The observed abnormal trading volume after $t = 0$ indicates that information-related portfolio revisions also arise with a time-lag. Since we find that stock prices increase significantly when dividend raises are announced, trading volume after $t = 0$ may also rise due to the presence of noise-traders who do not trade on news but only on prior price signals (feedback trading).

In the cluster of constant dividends, we find abnormal trading volume to be significant over the whole event window, indicating that investors revise their beliefs even in the case of an announcement of unchanged dividends. We interpret this increase in trading volume, despite the absence of any price reaction, as an indicator that investors' revisions of beliefs due to an announcement of unchanged dividends are very heterogeneous (see (Kandel – Pearson, 1995) for a theoretical explanation of investors' heterogeneous interpretations of public news). This is also supported by the fact that stock return volatility in this cluster increases sharply on day $t = 0$ (see section 4.1).

Finally, considering the cluster of announced dividend decreases, we find significant positive abnormal trading volume on the same days as in the case of dividend increases. In conjunction with our results on price reactions, this means that announced decreases in expected dividend payouts, on average, induce investors to negatively revise their expectations. We find *AV* on the announcement day is highest in this cluster, implying again that investors react more strongly to bad news than to good news.

5. Conclusions

It is widely accepted in financial literature that dividend announcements have several attractive aspects as an information-transmission mechanism. Our empirical examination for the German DAX segment strongly supports the hypothesis that announcements of upcoming dividend payouts have a significant impact on investors' behavior. In line with existing empirical literature, we find that dividend increases induce a significant positive reaction in stock prices, whereas announced dividend decreases lead to a significant fall in stock prices. Constant dividends leave stock prices unaltered.

However, market reactions within each cluster of dividend changes differ greatly since cross-sectional variance generally increases sharply on the announcement day.

When looking at trading volume, we find statistically significant positive abnormal volume around dividend announcements in all clusters, indicating that any form of dividend announcement conveys new and valuable information to the market. Since investors are diversely informed and differ in the precision of their private prior information, they respond differently to new information, which leads to an increase in trading volume. Observed price reactions reflect the average change in investors' beliefs so that heterogeneity at the individual level is lost in the aggregate. A good example for this is the fact that we observe no significant price reaction, but an increase in trading volume in the case of announced constant dividends.

Overall, our results illustrate that for the revelation of stock-market reactions to firm-specific news, trading volume contains precious information in excess of that manifested in stock prices. Volume data should thus constitute an important component in event studies.

APPENDIX
Companies Included in the Sample and the Number of Announced Dividend Changes

Firm name	Dividend increases	Constant dividend	Dividend decreases	Total
Adidas-Salomon	2	4	0	6
Allianz	1	0	0	1
Altana	7	6	0	13
BASF	8	2	2	12
Bayer	7	5	2	14
Bay. Hypo- und Vereinsbank	6	7	0	13
BMW	3	5	3	11
Commerzbank	1	0	0	1
Continental	2	0	0	2
DaimlerChrysler	5	6	0	11
Deutsche Bank	5	4	3	12
Deutsche Börse	3	0	1	4
Deutsche Lufthansa	1	5	2	8
Deutsche Post	4	0	0	4
Deutsche Telekom	5	0	0	5
E.ON	8	5	1	14
Fresenius Medical Care	3	8	1	12
Henkel	7	3	2	12
Linde	7	3	2	12
MAN	6	3	4	13
Metro	1	7	1	9
Münchener Rück	4	5	1	10
RWE	8	5	0	13
SAP	7	3	0	10
Schering	8	3	1	12
Siemens	6	6	0	12
ThyssenKrupp	5	3	4	12
TUI	3	9	0	12
Volkswagen	7	2	1	10
Total	**140**	**109**	**31**	**280**

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SUMMARY

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This paper deals with market reactions to dividend announcements on the German stock market. The authors' study is based on a model of *expected dividends* with regard to the *reluctance-to-change-dividends hypothesis*. State-of-the-art models are used to detect price and volume reactions to dividend news. Empirical results provide evidence that announced dividend changes convey new information to the market. On average, stock prices move in the same direction as dividends. One can observe an increase in stock-return volatility in anticipation of expected news. For the entire sample, the authors find that trading volumes exhibit significant increases around dividend announcement dates. This supports the hypothesis that dividend change in either direction causes an increase in investors' propensity to revise their portfolios.