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# Mirror or Molder? A Study of Media Coverage, Stock Prices, and Trading Volumes in Germany

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*This article investigates the short-term relationship between media coverage, stock prices, and trading volumes of eight listed German companies. A content analysis of news reports about the selected companies and a secondary analysis of the daily changes in closing prices and the trading volumes of these companies were combined in a time-series design. After ARIMA-modeling each of them, the results suggest that media coverage rather reflects than shapes the development at stock exchanges from a short-term perspective (2 months). There were almost no hints for a widespread media effect, that is, an impact on so many investors that it will result in a measurable change in stock prices or trading volumes. Finally, theoretical and methodological consequences for exploring widespread media effects are discussed.*

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## Literature review

Stock prices or even the price level of the market in general sometimes deviate from fundamentally justified values. This creates the so-called bubbles, which might burst in the end. In 2000, the so-called dot.com bubble actually did burst and the accounts of many (private) investors lost horrendous amounts of money. A more recent stock market landslide was caused by the crisis of the global financial system in autumn 2008. Such processes raise the question, whether media coverage has an impact on stock markets. This article does not explore the media impact on individual investors' decisions (microperspective) but the *widespread impact* of media coverage on closing prices (CPs) and trading volumes of selected shares (macroperspective). Theories from finance and communication science will be joined for an integrative view on the role of mass media in stock markets. The empirical study compares

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different types of media, companies, and stocks. Yet, it does not explore what moves stock markets altogether but applies the *perspective of an investor*. We start from the question if the benefit promised by financial Web sites and other media was really kept. In other words, is there any chance for (small) investors to make profit from media information?

**Efficient capital markets and behavioral finance**

Classic pricing models (e.g., Muth, 1961) are based on the concept of a *homo oeconomicus*, whose decisions take all relevant information into account. As all investors act like that, new information about listed companies should lead to a homogeneous reaction among all investors. This assumption is one of the main premises of the *efficient market hypothesis* (e.g., Fama, 1965, 1970; Grossmann & Stiglitz, 1980). According to Fama (1970), "a market in which prices always 'fully reflect' available information is called 'efficient'" (p. 383). Yet, a (stock) market is only efficient in relation to a particular subset of information (Fama, 1970, p. 388). Most empirical support was provided for the semistrong form of efficiency: Relying on publicly available (media) information will not result in above-average profits because such information is already included in stock prices at the time of (media) publication. Only new information will lead to an immediate price adjustment. For investors aspiring short-term profits, media news comes too late. The random walk hypothesis (e.g., Fama, 1965; Kendall, 1953) is the mathematical form of the efficient market hypothesis, because the changes in stock prices follow a random walk. This means that the change in stock prices from one trading day to the next does not show any systematic pattern (e.g., a trend) but is simply random.

*Behavioral finance* (e.g., Barberis & Thaler, 2003; Shiller, 2003) meets a large number of cases in which stock prices or the market as a whole deviated from a fundamentally justified level. As Shiller noted, "[r]esearchers had seen too many [of such] anomalies" (p. 90). According to behavioral finance, these anomalies stem from the fact that investors do not decide in a fully rational manner and do not constitute a homogenous group as proposed by efficient market hypothesis: (a) On the microlevel, information processing and decision making of individual investors are considered. Anomalies of information processing include, for instance, availability heuristics, representativeness heuristics, or anchoring (e.g., Kahneman & Tversky, 1972; Tversky & Kahneman, 1974). Anomalies of decision making comprehend, for example, risk aversion or the endowment effect (e.g., Kahneman, Knetsch, & Thaler, 1991). Most studies refer to prospect theory (e.g., Kahneman & Tversky, 1979) which tells us, for example, that information about "losses loom[s] larger than [information about comparable] gains" (Kahneman & Tversky, 1979, p. 279). (b) On the mesolevel, anomalies in terms of social psychology are considered (e.g., Adler & Adler, 1984). Here, positive feedback trading is discussed the most: Especially, inexperienced small investors can easily be affected by market tendencies and often follow stock or market trends (e.g., Shleifer & Summers, 1990). (c) On the macrolevel, anomalies like "bubbles" or rapidly growing prices ending in mean reversals are studied. Micro- or mesolevel anomalies receive evidence from psychological experiments, whereas market anomalies are supported by studies about winner–loser effects (e.g., Barberis, Shleifer, & Vishny, 1998; De Bondt & Thaler, 1985). Winner–loser effect studies distinguish past share price performances into winners and losers and compare their performances for future periods.

Evidence from finance studies (e.g., Chan, 2003; Chen & Siems, 2004; Niederhoffer, 1971; Patell & Wolfson, 1984) can be summarized like this: Most studies examine the effects of investment recommendations (published in media) or the impact of company news reports on stocks. Price changes often occur immediately or 1 day after information has been published. Sometimes, the market reacts stronger on negative and sometimes on positive information. Analyst recommendations, especially about small caps, can lead to abnormal returns, which usually diminish within few days. Finance studies, however, share some deficits: Many of them just focus on one type of information exclusively and a lot of them are case studies calculating correlations which do not allow for causal interpretation. Most importantly, these studies seldom consider specific characteristics of media coverage.

### Effects of media coverage about the economy on public's evaluations

On one hand, communication science has examined the effects of news coverage about economic aspects in terms of agenda setting (e.g., Behr & Iyengar, 1985; Hagen, 2005; Wu, Stevenson, Chen, & Güner, 2002). On the other hand, several studies have explored the effects of media coverage about the economy (e.g., recession news) on public's evaluations or attitudes. Blood and Phillips (1995) explored the complex relationships between economic news data, the state of the economy, public opinion of the state of the economy, and the presidential popularity. The authors also provide an overview of different types of (media) effects—for instance, the "effect of unfavorable economic news reports on the economy, the so-called 'media malady'" (p. 3) or the Katonian hypothesis claiming "that changes in consumer sentiment can serve as a leading indicator of future economic activity" (p. 5). According to Hagen (2007, p. 531), the "vast majority of studies investigating the influence of the media on consumer confidence do so in the context of an analysis of economic models of voting behavior." This brief review (for details see Gavin & Sanders, 1998; Hagen, 2005, 2007) should be sufficient, because we are interested in specific media effects on stock markets.

### Effects of media coverage about stocks and companies on stock prices and trading volumes

The rather few studies exploring the media influence on stock markets either focus on media sources (e.g., Lasorsa & Reese, 1987), lack empirical evidence (e.g., Warner & Molotch, 1993), or argue theoretically for the most part (e.g., Schuster, 2004). Thus, the effects of media coverage about stocks on the macrolevel are still an empirical black box. We do not explore the media impact on individual investors on the micro-level but the media impact on stock prices and trading volumes on the macrolevel. Media reports are an important source, especially for small investors searching for information about companies, industries, or stocks. Professional investors, however, receive such information earlier and from other sources. But news reports can serve as a seismograph for professionals who try to anticipate small investors' behavior as well as market reactions. Such an anticipation-driven decision can be explained as a third-person effect (e.g., Davison, 1983; Paul, Salwen, & Dupagne, 2000). Furthermore, agenda-setting and framing (e.g., D. Scheufele, 2000) are relevant in this context: By framing a company in a certain way, for instance by reporting mismanagement continuously, media can predetermine decisions, because small investors rely on such media information. Additionally, aspects, such as an announced downsizing, can be portrayed either negatively—the company is in a "bad situation"—or positively—the downsizing signals a "new beginning." If professional investors suspect many small investors to be influenced by media, they might bet on the trend and therefore even strengthen it—as previously proposed by Davison. The effects of analyst recommendations published in media can be explained by the anchoring heuristics or the concept of opinion leaders (e.g., Snow & Parker, 1984).

### The micro–macro difficulty

Media effects on individual investors can be explained by psychology and communication science. However, financial considerations about anomalies on the meso- and macrolevel have to be taken into account, if we want to explain how investors' decisions affect stock prices and trading volumes. Explaining such cross-level linkages theoretically may be a solvable problem, but modeling them empirically is quite a challenge (cf. Scheufele, 2008). In more general terms, Pan and McLeod (1991) also concluded that "[c]ross-level linkages are clearly the area where empirical sciences encounter the most difficulties" (p. 149).

Turning back to the problem in terms of media and stock markets, four aspects are crucial (cf. Scheufele & Haas, 2008a): (a) Stock prices represent the aggregate of the decisions made by all investors trading this share. But investors differ in many ways, for instance, in risk aversion, response rates, or information sources available. Professional investors usually draw on other sources than inexperienced small investors who rather rely on media. Besides, professionals have more options in decision making due to their endowment and their professional or institutional status. Conversely, most private investors in Germany do not have the opportunity "to go short," for instance. Thus, when analyzing changes in stock prices or trading volumes, we cannot tell which investor contributed how much and in which way to these changes on the macrolevel. (b) This problem gets even worse because the group of investors trading a share can change rapidly. Therefore, the set of relevant investors and the role of media coverage differ from one point of time to another. (c) The fact that no significant stock price changes may occur does not disprove media effects, however. In such cases, media coverage affects only a short number of small investors. As they hold only a few of all stocks, their decisions do not result in a widespread reaction on the macrolevel. Besides, many small investors may have been infected, but professional investors trading a significantly larger number of shares thwart these effects. Thus, macrolevel media effects cannot be detected from the start. (d) Sociopsychological processes at stock markets are difficult to measure and can only be estimated in terms of their "results," such as a significant price change. Surveying investors or carrying out experiments in a simulated market setting does not model the processes at stock markets appropriately. These methods meet the micro- and mesolevel, but the macrolevel remains a black box. Conversely, macro analyses such as winner–loser effect studies meet the micro- and mesolevel only in theoretical but not in empirical terms. Taking all these considerations into account, a macroanalysis should be most adequate to study the *widespread impact* of news coverage on stock prices and trading volumes. This term stands for a process, in which news reports have an impact on so many investors in such a way that a significant correlation between stock prices or trading volumes and media coverage about the company can be measured in a time-series design.

## Research questions

The study presented here applied a strategy known from finance (e.g., Akhigbe, Larson, & Madura, 2002; De Bondt & Thaler, 1985; Shleifer & Summers, 1990). This contrasting strategy takes the concept of middle-range theories seriously by going beyond studies limited to a single company or a microlevel media effect: (a) Starting from finance literature, we defined specific conditions under which media impact should be more likely or less likely. (b) As part of a time-series design, we compared the correlation patterns between media coverage and stock prices or trading volumes for all previously defined conditions. Media effects are, for instance, more likely to occur, if one can expect a sufficient number of small investors among all investors relevant for a given stock, because small investors usually rely on media. But as mentioned before, a small investor infection can even be enforced by professional investors. At first, we compared stocks of different types of companies: Blue chips can be characterized by a higher market capitalization and usually a higher market turnover than small caps. For instance, during April 2005, DaimlerChrysler (DCX) shares amounting to €5 billion were traded, whereas it was only €6 million with Evotec. Besides, blue chips more often become subject of news reports (Table 1). Thus, small investors are more likely to get into contact with reports about blue chips. Of course, a high amount of stocks in the free float is a necessary condition here. However, the market turnover of blue chips is very large, and the orders by small investors will hardly have a measurable effect on stock prices or trading volumes. In contrast, if national media cover small caps, these reports should be quite salient for investors. Based on these considerations we ask the following:

**RQ1:** Do cross-lagged correlations between media coverage and stock prices or trading volumes differ for blue chips and small caps?

Second, we focused on characteristics of media coverage. Cumulative and consonant reporting is more salient for (small) investors than selective reporting. Besides,

**Table 1** Company Sample of Secondary Analysis

| Company | Industry | Market Capitalization[a] | Market Turnover[b] | Presence | | |
|---|---|---|---|---|---|---|
| | | | | Web[c] | TV[c] | Papers[c] |
| DaimlerChrysler | Automobile | 33.980 | 5.408 | 477 | 37 | 97 |
| Infineon | Technology | 5.500 | 1.388 | 302 | 22 | 64 |
| Lufthansa | Transport | 4.598 | 783 | 238 | 19 | 39 |
| Mobilcom | Telecom | 1.152 | 148 | 195 | 3 | 51 |
| Solarworld | Industry | 917 | 163 | 60 | 2 | 8 |
| EM.TV | Media | 399 | 76 | 40 | 5 | 12 |
| Evotec | Pharma | 183 | 6 | 46 | 1 | 6 |
| Consumer Electronics | Industry | 25 | 2 | 12 | — | — |

[a]Total of stocks multiplied by stock price at June 1, 2005, in € millions. [b]Total turnover in April 2005 at German stock exchanges including computer-based XETRA trading in € million. [c]Total of newspaper and Web site articles or TV reports covering the company (July and August 2005).

the valence of media coverage plays an important role. For instance, a newspaper article reporting an increasing number of customers has a positive valence. Based on these considerations we ask the following:

> **RQ2:** Do cross-lagged correlations between media coverage and stock prices or trading volumes differ according to the amount and the valence of coverage?

Finally, we distinguished types of mass media: Financial Web sites, daily newspapers, and stock market TV shows differ in terms of actuality and audiences. Web sites are more up-to-date than other media from an investor's point of view. And their audience is probably more "professional" than TV viewers or newspaper readers. Based on this consideration we ask the following:

> **RQ3:** Do cross-lagged correlations between media coverage and stock prices or trading volumes differ according to the type of media which reports on the company or stock?

## Method

There are several options for studying media effects on stock markets. Yet, none of them can entirely model the complex relations between micro-, meso-, and macro-level. (a) An investor survey examines media effects on individual investors. This, however, makes conclusions about stock prices and trading volumes impossible. The same holds true for experiments that argue with simulated markets (e.g., Andreassen & Kraus, 1990). (b) Secondary analyses of investors' trading records (e.g., Barber & Odean, 2005) meet real market situations but do not consider investors whose transactions had not been recorded. (c) Secondary analyses of market data meet the macrolevel by contrasting prices or returns of various types of stocks (e.g., Akhigbe et al., 2002). Here, all processes below the macrolevel—for example, investors' risk aversion or media use—remain an empirical black box. Yet, this is the price one has to pay for reaching the macrolevel empirically.

As we are interested in the widespread media impact on shares, we chose the fourth option. As mentioned already, the term "widespread impact" gives expression to a process in which media coverage has an impact on so many investors in such a way that it can be measured at the macrolevel of prices and volumes and therewith in a correlation with media coverage. We combined a primary analysis of print, television, and online coverage about eight listed German companies with a secondary analysis of CPs and trading volumes of these companies at German stock exchanges. The companies represent different industries and stock exchange indices and can be classified into groups according to characteristic values such as market turnover, frequency of coverage, and so on (Table 1).

**Stock measures**

The secondary analysis focused on CPs and trading volumes of the companies' stocks in July and August 2005. This period comprises 44 trading days, which makes a time-series of 44 data points. In the case of stock prices, the relative change in the CP compared with the previous trading day was calculated for each trading day. Furthermore, the relative change in the reference index for the company (e.g., Deutscher Aktien Index [DAX]) was then subtracted from this value. The entire algorithm can be exemplified by CP of DCX and the DAX: $y_t = [(\mathrm{CP\ DCX}_t - \mathrm{CP\ DCX}_{t-1})/\mathrm{CP\ DCX}_{t-1} - (\mathrm{DAX}_t - \mathrm{DAX}_{t-1})/\mathrm{DAX}_{t-1}]{*}100$. This algorithm served for adjusting stock prices to the general development of the economy or to market moods. For instance, a decrease in the prime rate can cause a general increase in stock markets. But some stocks even under- or outperform the whole market, which might be due to media coverage about these companies. In the case of trading volumes, the sum of all shares traded in Germany—including trading floors as well as the computer-based trading system *XETRA*—was calculated for each trading day (Table 2).

**Media and reports sample**

The primary analysis relied on news reports published in print media, on television, and on Web sites between July 1 and August 31, 2005. We selected the daily newspapers *Frankfurter Allgemeine Zeitung* and *Sueddeutsche Zeitung* which are among Germany's four national quality papers. Moreover, Germany's most frequently visited financial Web sites *Onvista* and *Finanztreff* were selected. Additionally, we analyzed two of Germany's leading stock market TV shows. The sample included all reports containing either the name of the company, its products, or affiliated industries in headlines or moderation. With daily newspapers, only articles from the economic or the stock market pages were selected. Of course, the media also provide information about the economy in general by telling recipients about the economical "climate" or about parameters such as gross domestic product, unemployment, or inflation rates

**Table 2** Secondary Analysis Measures by Companies

| | Closing Price[a] | | Change Closing Price[b] | | Trading Volume[c] | |
|---|---|---|---|---|---|---|
| Company | Mean | *SD* | Mean | *SD* | Mean | *SD* |
| DCX | 38.48 | 3.51 | 0.39 | 1.37 | 8.386.156 | 9.469.975 |
| IFX | 8.00 | 0.28 | −0.15 | 1.41 | 9.736.101 | 4.966.994 |
| LHA | 10.61 | 0.34 | 0.03 | 0.84 | 4.171.686 | 2.955.045 |
| MOB | 19.93 | 0.91 | 0.12 | 1.45 | 442.122 | 436.200 |
| SOW | 83.21 | 5.42 | 0.35 | 1.77 | 114.923 | 75.896 |
| EMTV | 5.57 | 0.39 | −0.31 | 2.82 | 763.510 | 585.145 |
| EVT | 2.81 | 0.09 | −0.29 | 1.61 | 129.893 | 88.865 |
| CE | 1.08 | 0.14 | −0.12 | 5.13 | 239.029 | 218.248 |

*Note:* DCX = DaimlerChrysler; IFX = Infineon; LHA = Lufthansa; MOB = Mobilcom; SOW = Solarworld; EMTV = EM.TV; EVT = Evotec; CE = Consumer Electronics.
[a]Closing price XETRA trading. [b]Percentage of the index-adjusted changes in closing prices, compared with the previous trading day. [c]Sum of all stocks traded at the stock exchanges at Frankfurt, Munich, and Stuttgart as well computer-based trading on XETRA.

(cf. Hagen, 2007). But especially TV and Web site coverage supply people focusing on stock markets with rather specific information about companies and stocks and quite often suggest a direct benefit from their stock recommendations. And the audience, especially small investors, are themselves interested in company-related information.

**Content analysis procedure**

The single report was the unit of analysis. A maximum of five companies was coded for each report. For each company, a maximum of five issues was coded, including one valence measure per issue. Finally, the coders registered if a buy, hold, or sell recommendation was mentioned by analysts. In total, 15 student coders analyzed the articles from newspapers and Web sites as well as the TV reports. Of course, this is a rather brief description of a more complex hierarchical coding system. Reliability values and information about measures derived from the categories are therefore presented in the Appendix.

Newspaper and Web site articles from weekends were generally assigned to the next trading day, which was mostly Monday. But we had to take into account that Web site articles are published continuously, whereas CPs of XETRA trading are noted by 5:30 p.m. (CET). Thus, all Web site articles published after 5:30 p.m. were assigned to the next trading day. All in all, only 12% of all relevant articles were published on a weekend or after 5:30. We created two types of media time-series: The first one represents the quantity of media coverage per trading day. For instance, the time-series *Overall newspaper presence of DCX* represents the daily total of mentions of DCX in newspaper articles. The second type stands for the quality of coverage. For instance, *Overall TV valence of DCX* expresses the daily differences between issues with a positive and a negative valence. We focus on three characteristics of media

**Table 3** Frequency of Selected Characteristics of Media Coverage

| | Overall Media Presence | | | Overall Media Valence | | | Valence of Stock Values | | |
|---|---|---|---|---|---|---|---|---|---|
| Company | Web | Papers | TV | Web | Papers | TV | Web | Papers | TV |
| DCX | 98 | 68 | 45 | 86 | 50 | 36 | 82 | 30 | 39 |
| IFX | 82 | 59 | 32 | 68 | 50 | 25 | 64 | 23 | 25 |
| LHA | 80 | 50 | 30 | 64 | 36 | 30 | 39 | 9[a] | 25 |
| MOB | 61 | 34 | 5[a] | 45 | 27 | —[a] | 30 | 16 | —[a] |
| SOW | 43 | 18 | 5[a] | 41 | 16 | 2[a] | 32 | 16 | 2[a] |
| EMTV | 43 | 16 | 9[a] | 20 | 7[a] | 7[a] | 16 | 5[a] | 7[a] |
| EVT | 30 | 9[a] | 2[a] | 20 | 5[a] | —[a] | 18 | 5[a] | —[a] |
| CE | 16 | —[a] | —[a] | 16 | —[a] | —[a] | 2[a] | —[a] | —[a] |

*Note:* Web sites covered DCX at 98% of all trading days (43 of all 44 trading days). DCX = DaimlerChrysler; IFX = Infineon; LHA = Lufthansa; MOB = Mobilcom; SOW = Solarworld; EMTV = EM.TV; EVT = Evotec; CE = Consumer Electronics.
[a]No time-series was created because the characteristic did appear in media coverage at less than 15% of all 44 trading days.

coverage: the overall media presence, the overall media valence, and the valence of stock values (Appendix, Table A2). Several of the 72 possible time-series had only a few values different from zero. To minimize an alpha error, we abstained from creating time-series, if less than 15% of all data points had values different from zero. Taking this into account, we created 47 time-series (Table 3).

**Data analyses**

Data analyses included descriptive and time-series analyses. Time-series strategies focus on the dynamics of correlations (cf. Box, Jenkins, & Reinsel, 1994; McCleary & Hay, 1980). We estimated cross-lagged correlations between media coverage and stock prices or trading volumes, respectively. Basically, two steps of time-series analysis can be distinguished: (a) In the first step, each media time-series and each time-series of trading volumes was adjusted by ARIMA (Autoregressive Integrated Moving Average) modeling separately. The differences between the original time-series and its ARIMA model are called residuals and were used for analysis. Like with ordinary least squares regression, these residuals should not be auto-correlated. If the residuals are not auto-correlated, time-series analysis speaks of *White Noise*. This modeling technique called *prewhitening* was necessary to avoid spurious correlations. The CP time-series had already been adjusted to the index, as outlined above, and afforded no further ARIMA modeling. (b) In the next step, cross-correlations between each adjusted media time-series and each adjusted stock series were calculated: We correlated time-series both synchronously (lag 0) and asynchronously (lags ±5 trading days). The coefficient expresses the strength of correlation, whereas the lags offer an insight into dynamics: Correlations at positive (negative) lags indicate that changes in media coverage proceeded (succeeded) shifts in stock prices or trading volumes. The prewhitening technique is known to be a strong test, because it rather under- than overestimates cross-correlations. One might suggest vector auto-regression models instead (cf. Blood & Phillips, 1995; Enders, 2003). Yet, we did choose prewhitening for a strong theoretical reason: Our argument of a widespread media effect afforded a strong test. Here, the prewhitening strategy seemed to be the best choice. Otherwise, we may have found statistical hints for macroeffects, even though they actually never occurred, which would be an alpha error. Of course, this problem would vanish, if the aforementioned *micro–macro difficulty* did not exist: If one could get an empirical insight into all processes beyond macrolevel as well, one could assess which correlations on the macrolevel can be treated as an evidence for widespread media effects. But this was impossible. Finally, we are fully aware of the fact that the prewhitening strategy may increase the beta error.

We cannot present all ARIMA models in detail but give some impressions of the overall pattern: (a) In total, 24 of 47 media time-series were White Noise and did not afford further modeling (random walk). This related to two thirds of the print coverage time-series and to most of the media time-series referring to small caps. (b) In total, 13 media time-series were best represented by moving average models (mostly one parameter). This related especially to the Web site coverage. (c) Eight time-series included a trend, which was best represented by autoregressive models (mostly one parameter). (d) The trading volume time-series were modeled the same way, with three of them already being White Noise. The criteria for the best models were root mean squared error (RSME), Bayesian information criterion (BIC), and Akaike information criterion (AIC), as well as the standard of a parsimonious model.

## Results

### Descriptive analysis

We start with exemplary descriptive results to illustrate our strategy. Figure 1 shows the overall presence of DCX in all analyzed media as well as the adjusted change in CPs. With an increasing stock price, media coverage increased accordingly. This becomes especially obvious with the withdrawal of the company's former CEO, announced on July 25, 2005. Investors seemed to interpret this new information as a sign for a new beginning after the failure of the fusion with Chrysler. This led to an immediate and significant increase in prices as well as in news reports. The Web sites and TV shows reported about the event on the very same day. The newspapers followed the next morning. Soon after this climax, stock prices and media coverage declined again.

Before we discuss cross-correlation patterns from a meta-perspective, we have to explain how cross-correlations were interpreted—again using DCX as an example. Table 4 presents the cross-correlations between Web site reports about the company and the DAX-adjusted price change. Overall, correlation patterns are almost identical, regardless of media characteristics. Significant and positive correlations occurred at lag −1 and lag 0. Thus, an increase (decrease) in Web site reports about

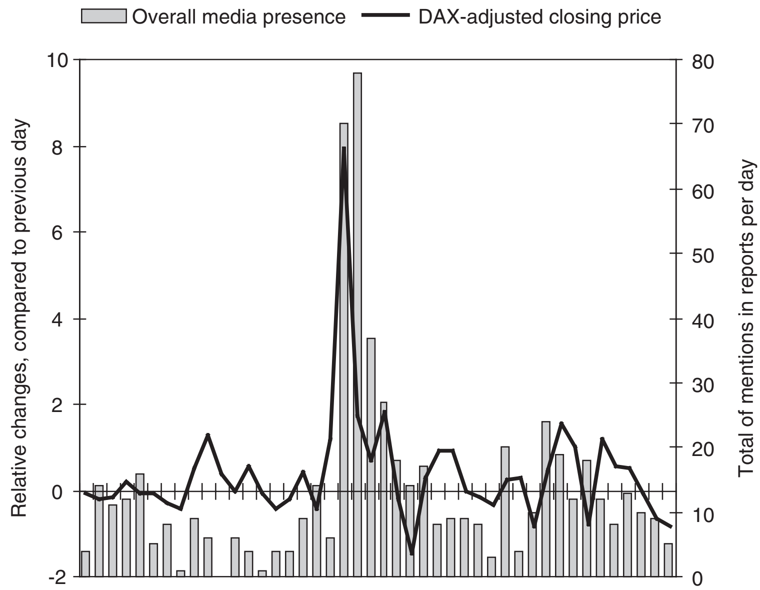


**Figure 1** Overall media presence and Deutscher Aktien Index (DAX)-adjusted change in closing prices for DaimlerChrysler (DCX) shares in July and August 2005 (44 trading days). *Stock time-series:* DAX-adjusted change in closing prices of DCX shares. *Overall media presence:* Total of DCX mentions in reports of newspapers, Web sites, and stock market TV shows.

**Table 4** Cross-Lagged Correlations Between Media Coverage (Series Residuals After ARIMA Modeling) and DAX-Adjusted Change in Closing Prices of DCX Shares as an Example

| | Lags | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | −5 | −4 | −3 | −2 | −1 | 0 | +1 | +2 | +3 | +4 | +5 |
| Overall media presence | *−.05* | *−.03* | *−.01* | *+.07* | +.44* | +.67* | *+.12* | *+.10* | *+.09* | *−.20* | *−.11* |
| Overall media valence | *−.21* | *+.06* | *−.02* | *+.15* | +.52* | +.69* | *+.04* | *+.00* | *−.02* | *−.19* | *−.15* |
| Media valence of stock values | *−.09* | *+.04* | *+.03* | *−.09* | +.56* | +.67* | *−.01* | *+.00* | *+.05* | *−.20* | *−.14* |
| Analysts' recommendations | *−.11* | *−.04* | *+.00* | *−.12* | +.70* | +.38* | *−.05* | *+.18* | *−.02* | *−.23* | *−.01* |

*Note:* Correlations at positive lags indicate that the media time-series was the lead variable for the stock time-series. Correlations at negative lags indicate the reverse. Nonsignificant correlations are in italics. DAX = Deutscher Aktien Index; DCX = DaimlerChrysler.
*$p < .05$.

DCX as well as a more positive (negative) valence of these reports corresponded to an increasing (decreasing) price of DCX shares (lag 0). Correlations at lag −1 suggest that price changes were covered by financial Web sites even the next day. Analysts did not react to the price changes until the next day. Buy (sell) recommendations were published by Web sites as recently as 1 day after an increase (decrease) in prices had occurred (lag −1: +.70). An immediate analysts' reaction seemed to have been much weaker (lag 0: +.38).

This case is also a good example for the logic of interpreting correlation patterns (Tables 5 and 6): We not only distinguish between significant correlations at lag 0, at negative and positive lags, but also add two further "conditions" to strengthen the causal argument: Significant correlations at lag 0 do not allow for any causal interpretation. But if there is a high correlation at lag 0 and a lower correlation at a positive lag, one can at least assume a multiplier effect of media coverage. Conversely, the pattern of a simultaneous correlation at lag −1 and at lag 0 clearly suggests that the media just mirror what happened at stock exchanges on the day of publishing and the day before—like in the case outlined above.

**Cross-correlation patterns**

Following our research questions, we examined cross-lagged correlation patterns from a meta-perspective and counted the amount of positive or negative correlations between media coverage and trading volumes (Table 5) as well as price changes (Table 6) for negative and positive lags and for lag 0. (a) All in all, there were 36 positive and 2 negative correlations between media coverage and trading volumes as well as 39 positive correlations and 1 negative correlation for stock prices. The negative correlations are not presented. The overall pattern of positive correlations suggests that an increase (decrease) in prices or volumes was accompanied by an increase (decrease) in media coverage and to more positive (negative) reports. Thus, there was not only a more favorable coverage but also a higher degree of media resonance for "winning" than for "losing" stocks. (b) A clear majority of correlations occurred at negative lags and/or at lag 0 (29 of 36 correlations in Table 5 and 27 of 39 correlations in Table 6). Thus, there was almost no evidence for a widespread media effect. Even the pattern of correlations occurring both at positive lags and at lag 0 suggesting a multiplier effect of coverage was rather seldom (6 of 36 and 2 of 39 correlations). Media effects on a significant number of small investors may have occurred though. But they surely did not reach the macrolevel and probably had been thwarted by professional investors' behavior before reaching the "surface" of the macrolevel.

RQ1 asked for differences between blue chips and small caps. All selected companies listed in the DAX (DCX, Infineon, and Lufthansa [LHA]) are blue chips. Consumer Electronics and Evotec are small caps, whereas EM.TV, Mobilcom, and Solarworld are bigger small caps according to market capitalization and market turnover. (a) First, we considered correlations between media coverage and trading volumes (Table 5). For blue chips, 15 of 20 correlations occurred at negative lags and/or at lag 0. Only five correlations appeared both at lag 0 and at positive lags. For bigger small caps, almost all correlations occurred at negative lags and/or lag 0. The total of significant correlations was considerably lower for small caps, which was

**Table 5** Total of Correlations Between Media Coverage and Trading Volumes

| Total of Significant Positive Crossed-Lagged Correlations | Negative Lags | Negative Lags and Lag 0 | Lag 0 | Lag 0 and Positive Lags | Positive Lags | Total of Correlations | Total of Time-Series |
|---|---|---|---|---|---|---|---|
| Total | 12 | 8 | 9 | 6 | 1 | 36[a] | 47 |
| Characteristics of media coverage | | | | | | | |
| Overall media presence | 4 | 3 | 5 | 2 | 1 | 15 | 17 |
| Overall media valence | 4 | 1 | 3 | 3 | — | 11 | 16 |
| Media valence of stock values | 4 | 4 | 1 | 1 | — | 10 | 14 |
| Companies | | | | | | | |
| Blue chips[b] | 8 | 5 | 2 | 5 | — | 20 | 26 |
| Bigger small caps[b] | 4 | 3 | 4 | — | 1 | 12 | 16 |
| Small caps[b] | — | — | 3 | 1 | — | 4 | 5 |
| Amount of coverage | | | | | | | |
| Extensive coverage[c] | 10 | 7 | 4 | 5 | — | 26 | 32 |
| Selective coverage[c] | 2 | 1 | 5 | 1 | 1 | 10 | 15 |
| Types of media | | | | | | | |
| Web sites | — | 5 | 9 | 2 | 1 | 17 | 23 |
| TV | 5 | 1 | — | 2 | — | 8 | 9 |
| Newspapers | 7 | 2 | — | 2 | — | 11 | 15 |

*Note:* DCX = DaimlerChrysler; IFX = Infineon; LHA = Lufthansa; EMTV = EM.TV; MOB = Mobilcom; SOW = Solarworld; CE = Consumer Electronics; EVT = Evotec.

[a]Only two correlations were negative, 36 correlations were positive. Thus, the negative correlations are not considered any further. [b]Blue chips: DCX, IFX, LHA; bigger small caps: EMTV, MOB, SOW; small caps: CE, EVT. [c]Extensive coverage: DCX, IFX, LHA, MOB; selective coverage: CE, EMTV, EVT, SOW.

**Table 6** Total of Correlations Between Media Coverage and Change in Closing Prices

| Total of Significant Positive Crossed-Lagged Correlations | Negative Lags | Negative Lags and Lag 0 | Lag 0 | Lag 0 and Positive Lags | Positive Lags | Total of Correlations | Total of Time-Series |
|---|---|---|---|---|---|---|---|
| Total | 10 | 13 | 14 | 2 | — | 39[a] | 47 |
| Characteristics of media coverage | | | | | | | |
| Overall media presence | 3 | 5 | 2 | — | — | 10 | 17 |
| Overall media valence | 3 | 7 | 5 | — | — | 15 | 16 |
| Media valence of stock values | 4 | 1 | 7 | 2 | — | 14 | 14 |
| Companies | | | | | | | |
| Blue chips[b] | 6 | 7 | 7 | 1 | — | 21 | 26 |
| Bigger small caps[b] | 4 | 5 | 5 | 1 | — | 15 | 16 |
| Small caps[b] | — | 1 | 2 | — | — | 3 | 5 |
| Amount of coverage | | | | | | | |
| Extensive coverage[c] | 7 | 9 | 9 | 2 | — | 27 | 32 |
| Selective coverage[c] | 3 | 4 | 5 | — | — | 12 | 15 |
| Types of media | | | | | | | |
| Web sites | — | 8 | 9 | 1 | — | 18 | 23 |
| TV | — | 2 | 5 | 1 | — | 8 | 9 |
| Newspapers | 10 | 3 | — | — | — | 13 | 15 |

*Note:* DCX = DaimlerChrysler; IFX = Infineon; LHA = Lufthansa; EMTV = EM.TV; MOB = Mobilcom; SOW = Solarworld; CE = Consumer Electronics; EVT = Evotec.

[a]Only one correlation was negative, 39 correlations were positive. Thus, the negative correlation is not considered any further. [b]Blue chips: DCX, IFX, LHA; bigger small caps: EMTV, MOB, SOW; small caps: CE, EVT. [c]Extensive coverage: DCX, IFX, LHA, MOB; selective coverage: CE, EMTV, EVT, SOW.

certainly due to the fact that there were only a few media time-series. All in all, media coverage seemed to mirror the development at stock markets both for blue chips and small caps. (b) Next, we considered correlations between media and stock prices (Table 6). As the patterns are quite the same for prices and volumes, we abstain from this distinction for further purposes.

RQ2 asked for differences in correlations according to different characteristics of media coverage. Again, it makes almost no difference if we considered the quantity or the quality of media coverage: A higher (lower) trading volume as well as an increase (decrease) in stock prices on the same or the previous day was accompanied by more and rather favorable media reports. There were some but rather few correlations both at lag 0 and at positive lags. In all these cases, the correlation at lag 0 was higher than the correlation at the positive lag. This may be seen as a weak indication for a multiplier effect of extensive media coverage. Nevertheless, this finding is not incisive enough.

RQ3 focused on differences in correlation patterns according to the type of media. As Web sites are more up-to-date than other media, widespread media effects on stocks were more likely than for newspapers and television. In fact, the majority of correlations between Web sites and stock prices (or volumes) either appeared at lag 0 only or at both negative lags and at lag 0. For Web sites, two interpretations are equally conceivable for correlations at lag 0: Web sites either reflected the market situation or online reports had an effect on a significant number of investors, whose decisions became manifest on the macrolevel on the day of publication. The second interpretation is not that unlikely, because online traders rely, among other sources, on online information. Such investors trade immediately and should be quite numerous among small investors. Besides, Web sites publish throughout the day whereby even reports from the afternoon hours can influence investors. TV shows in Germany, however, are broadcast in the evening hours after German stock exchanges have closed. And newspaper articles are not published until the next morning. But again, only 3 of all 17 correlations between online coverage and trading volumes occurred either at positive lags or both at positive lags and at lag 0 (Table 5). According to our results, newspaper information seemed to be old news from an investor's point of view. With television, it was a bit different: Evening TV reports seemed to mirror the price development or the trading volume of this or of the previous trading day—reflected by the fact that most correlations occurred at negative lags only or both at negative lags and lag 0. Only 2 of 8 significant correlations between TV coverage and trading volume occurred both at positive lags and lag 0, which is a rather weak indicator for a multiplier effect of television.

We examined cross-correlations for several other characteristics of media coverage and found a similar pattern. Furthermore, this pattern was even robust for LHA, which is a company with all shares in the free float and a high amount of private investors, who are likely to rely on media information. Summarizing, all results taken together rather disprove the assumption of a widespread media impact on stocks.

## Discussion

The study presented here tried to answer the question whether media have an impact on stock markets (macrolevel). According to theoretical and methodical considerations, we decided to combine a secondary analysis of stock market data with a content analysis of media coverage and applied a time-series strategy. At first sight, the results support the semistrong form of the market efficiency hypothesis, claiming that investors relying on publicly available information make no profit at stock markets (cf. Fama, 1970). The cross-correlation patterns rarely support the idea of strong and widespread media effects. Yet, this could partly be due to the design as well the secondary data available; we will come back to this.

Comparing companies, characteristics of media coverage, and types of media revealed only minor differences. Media reported much more about blue chips than about small caps. The amount of coverage also affects the total of media time-series which can be created. This fact explains to some extent, why we found more correlations between media coverage and stocks for blue chips than for small caps. Quantity or quality of coverage makes no difference. Besides, there is clear evidence that newspaper coverage rather reflects than shapes stock market reality. With regard to Web sites, however, causality remains an open question. Online coverage may reflect the stock markets. But it is also likely to affect online traders, who immediately trade after reading online reports. If this relates to companies with many shares in the free float and much variability in the stock development, there may be some chance in measuring widespread effects for Web sites. Yet, investors would trade immediately, and the macroeffect would thus appear on the same day. Relying on daily measures of prices and trading volumes makes it almost impossible to detect such effects. However, better data were not available. Finally, the fact that we found almost no negative correlation is another indicator for the argument that media rather mirror than shape what happens at stock markets.

### The micro–macro difficulty

Our study does not allow any direct conclusions about media effects on individual investors (microlevel). In fact, we know nothing about the individual investor's media use or his risk aversion or endowment. Finding correlations between media coverage and stock prices or trading volumes at positive lags can merely be taken as a hint, certainly not as a proof for widespread media effects on the macrolevel. Conversely, the fact that such correlations do not occur does not disprove media effects. Maybe only a few investors were influenced by the media reports. This would make it impossible to measure any effect on the macrolevel. Or media effects on small investors may have been thwarted by professionals.

Why is it so difficult to isolate media effects on stocks (cf. Scheufele & Haas, 2008b)? (a) Actually, stocks cannot be analyzed without considering reference measures such as a stock market index. We tried to model this aspect by adjusting the stock prices to the relevant index (e.g., DAX). But many shares are also part of a portfolio. Thus, trading shares of one company cannot be treated independently from trading shares of other companies in the same portfolio. (b) Moreover, professional investors have more means and options than small investors. Which investor decides what and when for what reason can be discussed theoretically but cannot be separated empirically. Apart from that, alternative designs and methods face the same problem with regard to the macrolevel. (c) Besides, media effects on small investors and on professional investors can neutralize each other: If professionals try to anticipate small investors' behavior, they will rely on media information as a seismograph (third-person effect). If media publish favorable reports about a company, small investors will chase the trend and keep buying, whereas professionals already anticipate the mean reversal and start selling. In such a case, media effects on small investors *as well as* media effects on professionals remain undetected, because there is no strong trend then. All in all, it is quite difficult to analyze investors' behavior in real situations, because it heavily depends on strategic considerations and psychological aspects. Of course, it would be easier to conduct a traditional third-person effect study or to explore other media effects on investors in an experimental setting. Yet, such strategies limit themselves to a single case or a single aspect and, therefore, do not meet the standard of a middle-range theory.

**Study limitations**

Our study did not find much of an evidence for widespread media effects. Whether media effects on small investors had been thwarted by profession investors was discussed theoretically but could not be examined empirically. After all, time-series based on hours or minutes would have been necessary to answer the causality question appropriately. In this case, however, we would have had to abstain from analyzing newspapers and TV shows. And we would have faced the problem of too many data points with a measure of zero especially for small caps, which would have foiled any time-series design from the start.

The period from July 1 to August 31, 2005, was a period of consolidation at stock exchanges with no sharp trends or mean reversals occurring, for example, in the DAX. Furthermore, 2 months was not enough for analyzing investors' long-term trading strategies. However, results for a second period from January to August 2000 are quite the same (cf. Scheufele & Haas, 2008a,b). The burst of the "dot.com bubble" in February 2000 marked the beginning of a long and continuous decline at international stock markets. Unfortunately, neither TV recordings nor Web site reports were available any more from that period. Besides, we chose single stocks to compare media effects for companies of various industries or markets. As the results were quite the same, the question arises if media have the potential to affect the *market mood* and drive an existing trend, rather than affect the performance of single shares.

There are three reasons why we neither examined the market mood nor the media coverage about the economy in general: (a) First, media's portrayal of the general economical climate can have a stronger or weaker impact on investors, depending on the economical situation. As the financial crisis became visible to a broader public in 2008, the trust in the financial system deteriorated rapidly among investors, media, and the public. From an investor's point of view, this was such a severe crisis that it probably affected his or her decisions concerning *any* stock. The situation in 2005 was quite different. Stock markets in Germany and around the world were in a period of consolidation after the sharp fall of prices in 2000. Thus, macroeconomic media information in 2005 may have influenced investors' decisions on some stocks to some extent but certainly not like in 2008. Empirical evidence for this argument was recently presented by Funke and Matsuda (2006, p. 208). Poitras (2004, p. 549), however, cannot even find a "significant evidence that the marginal effects of [macroeconomic] announcements vary with the state of the economy." (b) Poitras' (2004) evidence for marginal effects of macroeconomic information on stock prices is consistent with results from several other studies (e.g., Jain, 1988; Mitchell & Mulherin, 1994). Pearce and Roley (1985) state that only real surprises such as "money announcement surprises have a[n . . .] effect on stock prices" (p. 66). Yet, media reports about such surprises are no surprise any more when being published. Thus, even if we would have examined the media coverage about the general economical climate, we would have very likely obtained similar results. (c) Finally, the impact of macroeconomic media coverage was not the initial point of our study. We started from the question if the benefit promised by financial Web sites and other media is really kept. Especially, television and financial Web sites supply investors not only with company-specific information but also promise a direct benefit from their recommendations. Therefore, we applied the perspective of an investor. Small investors are much more likely to buy and sell stocks than, for example, index-based securities. They select and read reports about these companies and stocks. Even more so in times after market anomalies like in 2000, because investors still lack their former trust in the market and the economy and, therefore, should rather focus on companies appearing to be "healthy." The media's portrayal of the global economical climate will also play a role. But this impact—as mentioned above—does not only depend on the economical situation but rather influences the stock market as a whole and less the development of single stocks.

## Conclusion

We found strong correlations between media coverage about listed German companies and the development of stock prices and trading volumes. Alternative methods such as surveying investors or experiments cannot measure such correlations. But still, the lack of evidence for a widespread media impact on stocks could also be because of the rather short-term period. Future research should compare times of bull and bear markets, boom and recession periods (cf. Funke & Matsuda, 2006), and also consider other stock markets (e.g., the New York Stock Exchange or Asian stock exchanges). Our study focused on short-term effects of media coverage about companies on the stock market. The role of macroeconomic news in this context, however, can only be studied from a long-term perspective (also cf. Chaudri & Smiles, 2004).

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## Appendix

### Intercoder reliability and content analysis measures

Although Krippendorff's (1978) α is a much more popular and usually recommended measure, we relied on Holsti (1969) for good reason. Of course, there are several programs available to calculate different reliability measures, but usually they cannot cope with hierarchical data sets. Our data set comprised three levels of coding: reports, companies mentioned, and issues mentioned with companies. Thus, we had to calculate reliability measures by hand. Calculating Krippendorff's α with paper and pencil would have been exceedingly tedious. The Holsti coefficient was easier to handle in this respect. Yet, the Holsti measure neither accounts for agreement between coders occurring by chance nor for an agreement between coders in not coding a category. We controlled for both: First, we only considered cases of coding a category and ignored all noncoding cases (Code 0). Second, we listed the total of values for

**Table A1** Intercoder Reliability of the Core Categories on Different Levels of the Coding Hierarchy

| Hierarchy Level | Category | Total of Category Values | Reliability According to Holsti (1969) | | |
|---|---|---|---|---|---|
| | | | Papers | Web | TV |
| Report | Company | 8 nominal categories | .92 | .92 | .85 |
| Company | Issues (a maximum of five per company) | 11 nominal categories | .79 | .82 | .78 |
| | Valence (one per issue) | Ratio scale +1/0/−1 | .85 | .86 | .83 |
| | Analyst recommendation (one per company) | Ratio scale +1/0/−1 (buy, hold, sell) | .84 | .95 | .77 |

*Note:* On the level of reports, coders' agreement in coding companies was at 92% for newspapers. This agreement served as the starting point for the reliability measure on the next coding level: For the companies coded identically before, coders' agreement in coding issues was at 79%. This value, however, is *conditional* to the coding of companies. The "overall" reliability value for issues can be obtained by multiplying both values .92 and .79 (= 73%).

**Table A2** Description of Content Analysis Measures

| Measure | Description | Calculation for Each Company per Trading Day |
|---|---|---|
| Overall media presence | Up to five issues could be coded for each company mentioned in a report | Total of mentions |
| Overall media valence | For each issue, the valence in terms of a positive or negative industry- or company-related aspects was coded; ratio scale: +1/0/−1 | Difference between issues with positive and with negative valence |
| Media valence of stock values | Media portrayal of stock values; ratio scale: +1/0/−1 | Difference between mentions of positive and negative stock values |
| Tenor of analysts' recommendations | Direction of recommendations (buy, hold, sell); ratio scale: +1/0/−1 | Difference between recommendations to buy and to sell |

each category (Table A1). With a larger amount of values, the probability of two coders measuring the same value by chance is lower than for categories with few values. All 15 coders and the authors of this article—in the role of a master coder—took part in the reliability test which was based on a total of 21 reports from all types of media covering 36 companies. Thus, on the relevant level of companies, our test even exceeded the recommended number of at least 30 units for reliability tests. Reliability was calculated by pairs, that is, between each coder and the master coder. The reliability values for each category are a mean of all pairs. The reliability test was conducted after a six-session coder training (with each session lasting for 3 to 4 hours). After the reliability test, the codebook was modified in terms of the valence category in minor details and another training session especially referring to the valence category was held. Note that all values beyond company level are *conditional reliabilities* (Table A1).