SFB 649 Discussion Paper 2007-011

Media Coverage and Macroeconomic Information Processing

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This research was supported by the Deutsche Forschungsgemeinschaft through the SFB 649 "Economic Risk".

http://sfb649.wiwi.hu-berlin.de
ISSN 1860-5664

SFB 649, Humboldt-Universität zu Berlin
Spandauer Straße 1, D-10178 Berlin

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This draft, March 2007

Comments Welcome

Abstract

This paper investigates how media coverage influences macroeconomic information processing at the bond market. I provide evidence that a high media coverage of an economic topic increases investor attention prior to the release of the corresponding economic indicator: High media coverage of the business cycle leads to a stronger market reaction to the release of gross domestic product, industrial production and IFO business index than low media coverage. High media coverage of the price level increases the market reaction to the release of producer and consumer price index than low media coverage. High media coverage of unemployment leads to a stronger market reaction to the release of the unemployment rate than low media coverage.

JEL-Classification Codes: G23, E44, G14

Keywords: Media Coverage, Information Processing, Economic Indicators

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Media Coverage and Macroeconomic Information Processing

Abstract

This paper investigates how media coverage influences macroeconomic information processing at the bond market. I provide evidence that a high media coverage of an economic topic increases investor attention prior to the release of the corresponding economic indicator: High media coverage of the business cycle leads to a stronger market reaction to the release of gross domestic product, industrial production and IFO business index than low media coverage. High media coverage of the price level increases the market reaction to the release of producer and consumer price index than low media coverage. High media coverage of unemployment leads to a stronger market reaction to the release of the unemployment rate than low media coverage.

1 Introduction

This paper examines how the news media impacts information processing of economic indicators at financial markets. A large body of research suggests that financial markets significantly react to the release of macroeconomic news (see, e.g., Fleming and Remolona (1999), Balduzzi, Elton, and Green (2001) and Boyd, Hu, and Jahannathan (2005)). Furthermore, several papers show that the strength of the market reaction is not constant over time. McQueen and Roley (1993) provide evidence that the price reaction at the stock market to the release of an economic indicator depends on the business cycle and Hautsch and Hess (2007) show that the market reaction is stronger if the precision of the released information is high. In this paper, I examine an additional factor that might determine the strength of the market reaction to the release of an economic indicator. I argue that the strength of the market reaction also depends on the attention investors pay to the release of this indicator. Since attention is a scarce cognitive resource (see, e.g., Kahnemann (1973)), investors are not able to react to the same extent to every piece of information that hits the market. Accordingly, the price reaction to new information will be low if investor attention to this information is low (see, e.g., Peng and Xiong (2004)). One driver of investor attention is the news media (see, e.g., Mitchell and Mulherin (1994), Shiller (2000) and Huberman and Regev (2001)).

The paper is based on the idea that investor attention is driven by media coverage. Mitchell and Mulherin (1994) provide evidence that the number of news announcements and trading activity at financial markets are directly related. Furthermore, Huberman and Regev (2001) show that information is not incorporated into asset prices if investors do not pay attention to the information release: A New York Time's article containing information that had already been released five months earlier caused a daily stock return of more than 300%. This indicates that the media plays a crucial role in creating investor attention towards specific events. However, the media does not only drive investor attention but also has an influence on how the information is interpreted. Tetlock (2007) shows that high

media pessimism leads to downward pressure on market prices. It is therefore difficult to distinguish the impact of the information content of a news report from the impact of simply a large number of articles on investor attention.[1]

The problem of separating the influence of the intensity of media coverage on investor attention from the influence of the information content can be solved if the impact of media coverage on investor attention is transferred to the setting of macroeconomic information processing. Macroeconomic releases always contain the same information, for instance the unemployment rate, only the magnitude of the numbers differ and even this difference is quantifiable. Thus, an increased media coverage on the economic situation a specific economic indicator represents prior to this indicator's release should increase investor attention to the release of this indicator. For instance, a large number of newspaper articles on unemployment should increase investors' attention to the release of the most recent unemployment rate. If a large amount of investors pays attention to the release, the market reaction should be stronger.

I investigate the impact of media coverage on investor attention and information processing with high frequency data from the German bund futures market over a time period from 1993 to 2005. The results show that the price reaction to the release of a German economic indicator is stronger if media coverage on a related economic topic was high prior to the release of the indicator. I investigate the impact of media coverage on three different economic topics and the market reaction to the release of the corresponding economic indicators. First, I show that a high media coverage on the business cycle leads to a stronger market reaction to the release of the gross domestic product, industrial production and IFO business climate index.[2] Second, a high media coverage on the price level leads to a stronger market reaction to the release of the consumer price index and the producer price index.

[1] For instance, Inderfurth, Fabrycky, and Cohen (2005) show that media coverage after the 2004 Tsunami was extremely high and donations increased sharply. However, it is unclear if donations rose because more people than usual paid attention to the event or because this event was perceived as especially bad.

[2] The IFO business climate index is one of the most important leading indicators for the German business cycle. It is based on a survey among 7,000 companies.

Third, a high media coverage on unemployment leads to a stronger market reaction to the release of the unemployment rate.

One important implication of these results is that the market power of the media might be underestimated and that the media has a systematic impact on financial markets. The media is able to drive investor attention and might thereby cause sentiment drifts at financial markets simply by selectively reporting on certain economic issues. Given that the media seems to be a major source for investors' knowledge of the market (see, e.g., Parker (1997)), it is important to be aware of its ability to influence information processing especially because media reports can be severly biased (see, e.g., Gentzkow and Shapiro (2005)).

The paper contributes to several strands of the literature. First, it contributes to the literature on information processing of macroeconomic indicators (see, e.g., Fleming and Remolona (1999), Balduzzi, Elton, and Green (2001) and Funke and Matsuda (2006)) by providing evidence that the German bund futures market significantly reacts to the release of several economic indicators. Second, it extends the literature on the relation between limited attention and asset prices (see, e.g., Peng and Xiong (2004)) by showing that an increased investor attention towards the release of economic indicators leads to a stronger price reaction at the bond market. Third, it contributes to the literature on the impact of the news media on market participants' perception and information processing (see, e.g., Mitchell and Mulherin (1994), Fair (2002), and Tetlock (2007)) by providing evidence that the news media plays a crucial role in driving investor attention towards specific macroeconomic indicators.

The paper proceeds as follows. Section 2 contains a description of the data used in the empirical analysis. Section 3 contains the empirical results and Section 4 concludes.

2 Data and Methodology

To analyze the impact of investor attention on macroeconomic information processing, media coverage on different economic topics is collected and used as a proxy for investor attention. Specifically, media coverage of unemployment, the price level and the business cycle is investigated because there are several macroeconomic indicators that can be directly linked to these topics. First, media coverage of unemployment can be directly linked to an increased investor attention to the release of the most recent unemployment rate. Second, media coverage of the price level can be linked to investor attention to the release of economic indicators like the producer price index or the consumer price index. Finally, media coverage of the business cycle is linked to economic indicators reflecting overall economic activity like the gross domestic product and industrial production. The use of these three broad economic topics ensures that an increased media coverage of these topics increases investor attention to the respective economic indicator that is released. Specifically, if the media coverage of unemployment is large, it is likely that investors pay more attention to the release of the next unemployment figure.

I use the two most influential German daily newspapers covering economic stories in Germany, i.e. the Handelsblatt and the Frankfurter Allgemeine Zeitung, to count the number of articles on "recession", "inflation" and "unemployment" as proxies for media coverage of the business cycle, price level and unemployment, respectively.[3] Handelsblatt is the most important economic newspaper with a print run of 142,043 newspapers and reaches more than 500,000 readers. Frankfurter Allgemeine Zeitung is a nationwide newspaper with a print run of 362,579 newspapers and reaches approximately 910,000 readers. The use of the largest newspapers with relevant articles on the economic topics I investigate allows to measure a systematic impact of media coverage on a large number of investors. Figure 1 illustrates how the proxies for media coverage of the economic topics are computed.

[3]Since the impact of media coverage on information processing of German economic indicators is investigated, I use the German words for recession, inflation and unemployment, i.e. "Rezession", "Inflation" and "Arbeitslosigkeit", respectively.

— Please insert FIGURE 1 approximately here —

To avoid endogeneity problems the computation of media coverage for a specific economic indicator starts seven days after the last announcement has been released. It is likely that some newspaper stories are written in response to a macroeconomic announcement. To ensure that my results are not driven by such endogenous news reporting, I therefore exclude the first seven days after a macroeconomic announcement. Then, the number of articles covering the economic topic in the newspaper are collected including the last day before the announcement is released. For example, I compute the number of articles on unemployment appearing in any newspaper article of "Handelsblatt" and "Frankfurter Allgemeine Zeitung" from seven days after the last unemployment figure has been released to one day before the next unemployment figure is released. Finally, I sum up the numbers from both newspapers and construct a dummy variable, $MediaD_{j,t}$, for topic j (with j= recession, inflation or unemployment) in month t that is one if the number of articles on a specific economic topic is larger than the median number of articles over the sample period, and zero otherwise:

$$MediaD_{j,t} = \begin{cases} 1 & Words > Median(Words) \\ 0 & Words \leq Median(Words) \end{cases} . \tag{1}$$

Table 1 presents summary statistics of the proxies for media coverage.

— Please insert TABLE 1 approximately here —

Media coverage of all three economic topics largely varies over time. The minimum number of newspaper articles on recession is 20 articles and the maximum number is 1,026 articles. The variation of newspaper articles on unemployment is also large from a minimum of 65 articles to a maximum of 1,035 articles. Media coverage of unemployment shows a

slightly smaller variation ranging from 56 articles to 808 articles. The large variation in media coverage of these articles is a first hint that investor attention towards the economic indicators might significantly differ over the sample period.

To analyze the market impact of the economic indicators, I use high frequency data of the German bund futures market. This is one of the most liquid bond markets in the world. I calculate returns for 2 minute intervals within an event window of 30 minutes before the release of the economic indicator up to 60 minutes after the release.

The release of an economic indicator usually leads to an immediate price reaction at financial markets if it is not entirely anticipated. Market participants incorporate the unexpected news component and prices adjust according to the interpretation of the news by the market participants. As a proxy for the market's expectation concerning the development of the economic indicators, I use analysts' forecasts from Money Market Services, (MMS, Informa Global Markets) obtained from the U.S. Bureau of Labor Statistics.[4] Analysts' forecasts are available for six different German macroeconomic indicators: gross domestic product, industrial production, IFO business climate index, producer price index, consumer price index and unemployment rate. The price indices, the unemployment rate, and industrial production are published monthly and the gross domestic product is published quarterly by the Federal Statistical Office Germany. The IFO business climate index is published monthly by the IFO institute. It is a survey-based sentiment indicator and provides information on market participants' expectation with respect to future economic conditions. A higher than expected value of the IFO business climate index indicates increasing economic activity (see, e.g., Huefner and Schroeder (2002)).

I compute the surprise component of each announcement i in month t, $Srp_{i,t}$, as the difference between the released value of the indicator, $A_{i,t}$, and the forecasted value of this announcement, $F_{i,t}$. To make all indicators comparable, the surprise component is normalized by dividing over the standard deviation of the announced indicator, $Std(A_i)$:

[4]Each Friday, MMS polls analysts' forecasts of several economic indicators to be released in the following week. Survey responses are received over a 3 to 4-hour period every Friday morning via fax or phone.

$$S_{i,t}^{resc} = \frac{A_{i,t} - F_{i,t}}{Std(A_i)}. \tag{2}$$

Table 1 contains summary statistics for the six German economic indicators used in this study.

— Please insert TABLE 2 approximately here —

The unemployment rate is distributed between a minimum value of 9.2% and a maximum value of 12.0% within our sample period. Analysts' forecasts are available from 1998 on, thus I analyze the impact of media coverage on information processing of the unemployment rate between 1998 and 2005. For the producer price index (PPI) and the consumer price index (CPI), analysts' forecasts start in 1993 and in 2001, i.e. the producer price index sample period is 1993 to 2005 and the consumer price index sample period is from 2001 to 2005. Within the sample period, these indicators are distributed between a minimum value of -2.3 (-0.4) for PPI (CPI) and a maximum value of 5.0 (0.50). Analysts' Forecasts with respect to the gross domestic product and industrial production also start in 1997 and thereby define the start of the sample period for these indicators. Both indicators are investigated from 1997 to 2005. They are distributed between a minimum of -0.2 (2.3) for GDP (industrial production) and a maximum of 0.9 (5.0).

To validate that the different proxies for media coverage do not measure the same background variable, e.g. some business cycle variable, I calculate correlations between the proxies for different sample periods where the economic indicators are investigated. Results are given in Table 3:

— Please insert TABLE 3 approximately here —

Results show that the correlation between the different proxies for media coverage are generally low. The highest correlation can be observed between unemployment and infla-

tion with a correlation coefficient of -0.48 while correlations between the other proxies are low ranging between -0.22 and 0.31. Overall, if media coverage on one of the three topics investigated is high, this does not mean that media coverage on the other two topics is also high. Thus, a strong price reaction to the release of an economic indicator can be attributed to a high media coverage on the related economic topic with some reliability.

3 Results

The empirical analysis starts with the question whether the German bund futures market reacts to the release of the economic indicators investigated in this study. After the price reaction to the release of the indicators has been examined for this base case, I split up the sample into subsamples of high and low media coverage prior to the release of the indicators.

I expect the following price reactions after the release of the indicators: First, a higher than expected unemployment rate signals a weaker consumer demand and a lower price pressure. Thus, a negative impact on interest rates and a positive impact on bund futures prices is expected. Second, a higher than expected index value of the gross domestic product, industrial production and IFO business climate index signals a stronger than expected economic activity. This hints at an increasing price pressure. Therefore, it leads to an upward pressure on the interest rate and eventually a negative price reaction at the bund futures market. Thus, the coefficients measuring the price impact of these indicators at the bond market are expected to be negative. The same reasoning also holds for the indicators on the changes in price levels, i.e. the producer price index and the consumer price index. If these indicators are larger than expected, consumer demand is stronger and price pressure increases. This again leads to an upward pressure on interest rates and a negative price reaction at the bund futures market is expected.

Overall, the sign of the price reaction after the release of these indicators is clearly predictable since only one component, i.e. the interest rate, will react to the release of

macroeconomic information at the bond market. Therefore, impact factors like the business cycle that are relevant for the stock market (see, e.g., Boyd, Hu, and Jahannathan (2005)) do not influence the results for the bond market.

3.1 The Price Impact of Macroeconomic Indicators

I investigate the price change at the German bund futures market within the first two minutes after one of the economic indicators has been released based on the following equation:

$$R_{\tau,t} = \alpha + \beta_1 \cdot S_{i,t}^{resc} \cdot D_1 + \varepsilon_{\tau,t}. \tag{3}$$

Specifically, I relate returns at the bund futures market, $R_{\tau,t}$, measured by two minute intervals τ with $\tau = -30... + 60$ on day t to the rescaled surprise component of economic indicator i on day t, $S_{i,t}^{resc}$. The surprise component is multiplied with a dummy variable, D_1, that is one for the first two minutes after the economic indicator has been released, and zero otherwise.

Ederington and Lee (1993) and Balduzzi, Elton, and Green (2001) show that market volatility significantly increases around macroeconomic announcements. To account for these volatility patterns around the release of the economic indicators I alternatively estimate the following GARCH(1,1) model:

$$\begin{aligned} R_{\tau,t} &= \alpha + \beta_1 \cdot S_{i,t}^{resc} \cdot D_1 + \varepsilon_{\tau,t} \\ \varepsilon_{\tau,t} &= \mu_{\tau,t}\sigma_{\tau,t} \\ \sigma_{\tau,t}^2 &= \omega + \alpha\varepsilon_{\tau-1}^2 \end{aligned} \tag{4}$$

The mean equation again contains the rescaled surprise component of the announcement, $S_{i,t}^{resc}$. It is interacted with a dummy variable, D_1, indicating the first two minutes after the release. The variance equation accounts for changes in volatility around the announcements. Results are reported in Table 4:

— Please insert TABLE 4 approximately here —

Results for both model specifications show that the German bund futures market significantly reacts to the release of the economic indicators investigated in this study. In Panel A results for the OLS estimation are given. They show a significant price reaction at the German bund futures market two minutes after the release of unemployment rate, producer prices, gross domestic product and IFO business climate index. The price reaction is not significant after the release of industrial production and consumer price index.

All coefficients have the expected sign: A higher than expected unemployment leads to a significantly positive price reaction at the German bund futures market (Column 1) while gross domestic product (Column 2), IFO business index (Column 4) and producer price index (Column 5) are significantly negative related to prices at the German bund futures market.[5]

Results from the GARCH model in Panel B lead to similar results. Again, the coefficients indicating the market impact of the six economic indicators have the expected sign. While unemployment is significantly positive related to prices at the German bund futures market (Column 1), the price indicators as well as the indicators on economic activity are significantly negative related to prices at the German bund futures market (Columns 2–6). The strongest price reaction occurs after the release of the unemployment figures which is consistent with earlier findings from Hautsch and Hess (2007). The magnitude of the coefficients also remains stable. One exception is the price impact of industrial production

[5]Since the gross domestic product is released quarterly, the number of observations is comparably small for this indicator.

(Column 3) and the consumer price index (Column 6) estimated with a GARCH(1,1) model in Panel B. These coefficients are now also statistically significant.

3.2 Impact of Media Coverage on Information Processing

Overall, the indicators investigated in this study have a significant price impact on the German bund futures market. However, the magnitude of the price reaction might differ depending on the attention market participants pay to the release of the respective indicator. One proxy to measure how much attention market participants pay to a specific release is the media coverage of related economic topics. For example, a high media coverage of unemployment prior to the release of the unemployment rate might lead investors to (willingly or unwillingly) pay more attention to the release of the unemployment rate. An increased investor attention to an economic release might then result in a stronger price reaction.

To investigate the impact of investor attention proxied by media coverage with respect to an economic topic, I use a dummy approach to distinguish between high and low media coverage prior to the release of an economic indicator. Specifically, I estimate the following regression:

$$R_{\tau,t} = \alpha + \beta_1 \cdot S_{i,t}^{resc} \cdot D_1 \cdot MediaD_{j,t}^{high} + \beta_2 \cdot S_{i,t}^{resc} \cdot D_1 \cdot MediaD_{j,t}^{low} + \varepsilon_{\tau,t}. \qquad (5)$$

Again, returns at the bund futures market, $R_{\tau,t}$, within the two minute intervals, τ with $\tau = -30... + 60$, on day t are related to the rescaled surprise component of the announced indicator i on day t, $S_{i,t}^{resc}$. The surprise component is multiplied by a dummy variable, D_1, that is one for the first two minutes after the release, and zero otherwise. Furthermore, the rescaled surprise component is interacted with a dummy variable that indicates the degree of media coverage as defined in Model (1). $MediaD_{j,t}^{high}$ is one if media coverage on an economic topic (with j=unemployment, inflation or recession) is larger than the median

over the sample period, and zero otherwise.[6] $MediaD_{j,t}^{low}$ is one if the number of words on an economic topic (with j=unemployment, inflation or recession) is below or equal the median over the sample period, and zero otherwise. Alternatively, I again estimate a GARCH (1,1) model based on the following equation:

$$\begin{aligned} R_{\tau,t} &= \alpha + \beta_1 \cdot S_{i,t}^{resc} \cdot D_1 \cdot MediaD_{j,t}^{high} + \beta_2 \cdot S_{i,t}^{resc} \cdot D_1 \cdot MediaD_{j,t}^{low} + \varepsilon_{\tau,t} \\ \varepsilon_{\tau,t} &= \mu_{\tau,t}\sigma_{\tau,t} \\ \sigma_{\tau,t}^2 &= \omega + \alpha\varepsilon_{\tau-1}^2. \end{aligned} \tag{6}$$

If a strong media coverage leads to increased investor attention to the release of the related economic indicator, the interaction of surprise component with the dummy variable indicating high media coverage should be significantly larger than the interaction of surprise component with the dummy variable indicating low media coverage.

Media Coverage of the Business Cycle

I start with the investigation of how a high media coverage of the business cycle influences information processing of economic indicators that reflect economic activity. Economic indicators that provide evidence about the overall production level are (among others) the gross domestic product (GDP) and industrial production. Another indicator, that is closely related to economic activity is the IFO Business Climate survey (see, e.g., Huefner and Schroeder (2002)). This indicator reflects market participants' expectations towards the six-months development of the economy and their evaluation of the current economic situation.

Since these indicators allow investors to collect more information on economic activity, I expect that a high media coverage on the business cycle enhances investors' attention to the release of these indicators, i.e. investors will pay attention to the release of these indicators

[6]The median is chosen as a cut-off to ensure equal distribution of high and low media coverage. Alternatively, the mean is used as a cut-off. Results (not reported) remain similar. All results can be obtained from the author upon request.

after a high media coverage directed their attention to economic activity. Specifically, the more articles on recession are published in the two most influential German newspapers, the stronger should be the price reaction to the release of GDP, industrial production and IFO business index at the bund futures market. I use articles on recession as a proxy for media coverage on the business cycle since the word recession doesn't allow much interpretation and is unambiguously related to the economic indicators investigated. Results for the impact of media coverage on information processing of gross domestic product, industrial production and IFO business index are reported in Table 5:

— Please insert TABLE 5 approximately here —

Panel A of Table 5 shows that high media coverage of the business cylce in the two most relevant German newspapers leads to a stronger price reaction to the release of economic indicators that are related to economic activity, i.e. GDP (Column 1), industrial production (Column 2) and IFO business climate index (Column 3) than low media coverage of the business cycle. The coefficient indicating the price reaction to the release of gross domestic product after a high media coverage on the business cycle is almost three times as large as the coefficient indicating the price reaction after a low media coverage of the business cycle (Column 1). The same pattern can be observed for industrial production (Column 2). While a high media coverage of the business cycle prior to the release of industrial production leads to a significantly negative impact of this indicator on the bond market, the price reaction to the release of industrial production after a low media coverage is not statistically significant. Finally, a high media coverage of the business cycle also increases investors' attention towards the release of the IFO business climate index (Column 3). The coefficient indicating the price reaction to the IFO index is four times larger after a high media coverage of the business cycle than after a low media coverage of the business cycle, respectively.

The results do not depend on the model specification. The GARCH(1,1) approach estimated in Panel B leads to similar results. The coefficients indicating the price impact of an economic indicator are larger if media coverage on related economic topics was high during the three weeks before the announcement is released.

Overall, high media coverage of the business cycle clearly increases investors' attention towards the next release of economic indicators that reflect economic activity. Thus, media coverage is positively related to the magnitude of the price reaction to the release of economic indicators at the German bund futures market. If media coverage is low, the price reaction to the release of gross domestic product and industrial production within the first two minutes after the release is not significant anymore. This finding indicates that investor attention plays a crucial role in information processing at financial markets.

Media Coverage of the Price Level

I now investigate whether high media coverage of the price level has an impact on information processing of economic indicators that measure past price changes at the end of the production process and thereby provide information on inflation. Common measures of past price changes are the monthly producer price index as well as the monthly consumer price index. Thus, I analyze the market impact of these indicators depending on media coverage of price levels. If a large number of articles on inflation drive investors' attention towards the release of these indicators, they will react to information provided by price indices. Results are reported in Table 6:

— Please insert TABLE 6 approximately here —

The price reaction to the release of inflation-linked economic indicators like the producer price index (Column 1) and the consumer price index (Column 2) is stronger if media coverage of the price level is high. The price reaction to the release of the producer price index is twice as large if media coverage of inflation was high prior to the release. This is result is less pronounced but still holds for the consumer price index. Again, the price reaction to

the release of the indicators is not statistically significant after a low media coverage of the price level. The only exception is the significant price reaction to the consumer price index after a low media coverage of inflation estimated with a GARCH(1,1) model (Panel B).

Overall, a high salience of inflation-linked topics due to increased media coverage measured by the number of articles on inflation causes investors to pay attention to the release of economic indicators that contain information about inflation.

Media Coverage of Unemployment

Finally, I investigate whether high media coverage of "unemployment" is related to the price impact of the unemployment rate at the German bund futures market. If investor attention is driven towards unemployment topics, they should pay more attention to the release of the unemployment rate. This should be reflected in a stronger market impact of the unemployment rate when media coverage is high. As a proxy for media coverage of unemployment, I compute the number of articles on unemployment in the two German newspapers as described in Section 2. Again, an OLS specification as well as a GARCH(1,1) specification are estimated. Results are reported in Table 7:

— Please insert TABLE 7 approximately here —

The price reaction to the release of the current unemployment rate is larger if media coverage of unemployment is high. The price reaction to the release of the unemployment rate after a low media coverage is smaller but still leads to a significant price reaction on the German bund futures market. This is not surprising since the unemployment figure is one of the most closely watched economic indicators that usually causes the strongest price reactions at bond markets (see, e.g., Fleming and Remolona (1999), Boyd, Hu, and Jahannathan (2005) and Hautsch and Hess (2007)).

Overall, the results support the view that a high media coverage leads to increased investor attention to the release of economic indicators that are related to the topic covered

by the news media. This increased attention then leads to a stronger price reaction at the German bund futures market to the release of the respective indicator. Of course, one could argue that an increased media coverage just reflects large movements with respect to the economic indicators, i.e. high media coverage on unemployment might be caused by information on increasing unemployment in advance of the released indicator. However, market participants then should expect a higher unemployment which would lead to a smaller surprise and therefore a smaller market reaction. I observe a stronger market reaction after high media coverage which is consistent with the idea that the media simply increases investor attention towards the release of the respective economic indicator.

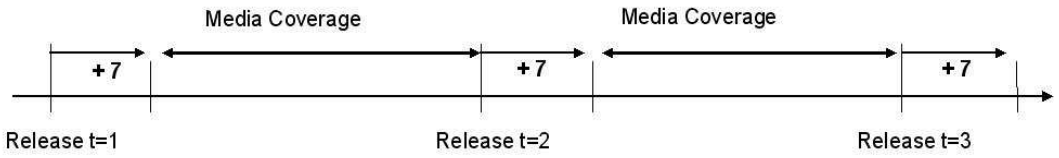
4 Conclusion

My results suggest that media coverage has a significant impact on macroeconomic information processing on financial markets. The price impact of several economic indicators at the German bund futures market is stronger if media coverage of related economic topics is high. Specifically, the results show that a high media coverage of the business cycle leads to a stronger price reaction to the release of indicators on economic activity like the gross domestic product, industrial production and the IFO business climate. Furthermore, a high media coverage of the price level leads to a stronger price reaction to the release of inflation-linked indicators like the producer price index and the consumer price index. Finally, the market reaction to unemployment news is stronger if media coverage of unemployment is high prior to the release of the unemployment rate.

This finding is in line with theories on limited investor attention, where market participants are unable to equally process all information they obtain. A high media coverage can increase the salience and perceived relevance of specific economic indicators and thereby lead to stronger price reactions after the indicator has been released.

These findings have important implications for the dynamics of information processing at financial markets. The amount of information that is publicly reported does not only affect stock markets (see, e.g, Mitchell and Mulherin (1994)) but also affects bond markets. Media coverage directs investors' attention to specific economic topics and thereby determines the strength of the price reaction to the release of an economic indicator. Although the impact of media coverage on information processing is rather implicit, this paper provides new evidence on the ability of the news media to influence investors' attention and their reaction to macroeconomic announcements by increasing the number of articles that are released on a related economic topic.

Figure 1: Computation of Media Coverage Proxies



Notes: This figure shows the time frame for the calculation of proxies for media coverage. The number of articles on "unemployment", "inflation" and "recession" that are published in Handelsblatt and Frankfurter Allgemeine Zeitung from seven days after the last macroeconomic announcement to one day before the release of the next macroeconomic indicator are counted.

Table 1: Summary Statistics of Media Proxies

	Mean	Median	Minimum	Maximum	Standard Dev.
Recession	106.20	70.00	20.00	1026.00	107.59
Unemployment	229.89	181.00	65.00	1035.00	159.83
Inflation	154.01	120.00	56.00	808.00	108.49

Notes: This table presents summary statistics for media coverage proxies. The number of articles on "unemployment", "inflation" and "recession" that are published in Handelsblatt and Frankfurter Allgemeine Zeitung are counted and mean, median, minimum and maximum value as well as standard deviation of the media proxies are calculated.

Table 2: Summary Statistics of Economic Indicators

	Mean	Median	Minimum	Maximum	Standard Dev.
Unemployment Rate	10.34	10.50	9.20	12.00	0.75
Producer Price Index	1.32	1.25	−2.30	5.00	1.90
Consumer Price Index	0.09	0.15	−0.40	0.50	0.31
Gross Domestic Product	0.23	0.20	−0.20	0.90	0.32
Industrial Production	0.73	0.95	2.30	5.00	1.85
IFO Business Climate Index	94.25	95.10	84.70	102.10	4.19

Notes: This table presents summary statistics of all macroeconomic indicators used in this study. Mean, median, minimum and maximum value as well as standard deviation of the indicators are calculated.

Table 3: Correlations

Panel A: Unemployment Rate	Recession	Inflation	Unemployment
Recession	1.00		
Inflation	−0.20	1.00	
Unemployment	0.06	0.25	1.00
Panel B: Gross Domestic Product	Recession	Inflation	Unemployment
Recession	1.00		
Inflation	−0.22	1.00	
Unemployment	−0.05	0.28	1.00
Panel C: Industrial Production	Recession	Inflation	Unemployment
Recession	1.00		
Inflation	−0.09	1.00	
Unemployment	0.10	0.27	1.00
Panel D: IFO Business Climate Index	Recession	Inflation	Unemployment
Recession	1.00		
Inflation	−0.14	1.00	
Unemployment	0.07	0.25	1.00
Panel E: Producer Price Index	Recession	Inflation	Unemployment
Recession	1.00		
Inflation	−0.19	1.00	
Unemployment	−0.03	0.29	1.00
Panel F: Consumer Price Index	Recession	Inflation	Unemployment
Recession	1.00		
Inflation	−0.48	1.00	
Unemployment	−0.18	0.31	1.00

Notes: This table presents correlations between the words used to calculate a proxy for media coverage. The number of articles on "unemployment", "inflation" and "recession" is counted from Handelsblatt and Frankfurter Allgemeine Zeitung every three weeks before a macroeconomic indicator is released. Correlations are given for every indicator (Panel A-F) used in this study.

Table 4: Price Impact of Macroeconomic Announcements

Panel A: OLS						
	Unemployment	GDP	IP	IFO	PPI	CPI
Intercept	0.0077	−0.0624	−0.0103	−0.2391	−0.0003	0.0048
$S_{i,t}^{resc} \cdot D_1$	12.6344***	−2.0744**	−1.8185	−5.0938***	−3.8345***	−6.9060
R^2	1.90%	0.59%	0.28%	0.98%	0.47%	0.59%
observations	1,407	397	1,477	10,080	1,396	822
Panel B: Garch(1,1)						
	Unemployment	GDP	IP	IFO	PPI	CPI
Mean Equation						
Intercept	0.0010	−0.0007	−0.0272	0.0179	0.0313	0.0279
$S_{i,t}^{resc} \cdot D_1$	11.1448***	−3.3616**	−1.8875***	−4.3919***	−4.1574***	−6.1495***
Variance Equation						
Intercept	0.0745	0.3280	0.0623	0.1208***	0.1867	0.2705***
σ_{t-1}^2	0.8627***	0.7829***	0.8840***	0.8501***	0.8878***	0.6906***
ε_{t-1}^2	0.1147***	0.1461***	0.0932***	0.0932***	0.0576***	0.2202***
R^2	1.89%	0.25%	0.25%	0.95%	0.43%	0.57%
observations	1,407	397	1,477	10,080	1,396	822

Panel A of this table shows regression results of the following equation: $R_{\tau,t} = \alpha + \beta_1 \cdot S_{i,t}^{resc} \cdot D_1 + \varepsilon_{\tau,t}$. The price change within two-minute intervals at the bund futures market, $R_{\tau,t}$, is related to the rescaled surprise component, $S_{i,t}^{resc}$, of announcement i on day t. The surprise component is interacted with a dummy variable, D_1, which is one for the first two minutes after the release of indicator i, and zero otherwise. Panel B of this table shows regression results of the same mean equation but estimated with a Garch(1,1) model. The regressions are estimated with Newey-West autocorrelation and heteroskedasticity constant standard errors. Significance levels are indicated as follows: *** 1% significance, ** 5% significance and * 10% significance.

Table 5: Media Coverage of the Business Cycle

Panel A: OLS			
	GDP	Industrial Production	IFO Business Climate
Intercept	-0.0549	-0.0108	-0.0028
$S_{i,t}^{resc} \cdot D_1 \cdot Media_{Recession}^{high}$	-3.4110^{***}	-1.2030^{***}	-9.2483^{***}
$S_{i,t}^{resc} \cdot D_1 \cdot Media_{Recession}^{low}$	0.5070	-0.3108	-3.7081^{**}
R^2	1.07%	0.39%	0.12%
observations	397	1,477	10,080
Panel B: Garch(1,1)			
Mean Equation	GDP	Industrial Production	IFO Business Climate
Intercept	0.0027	-0.0278	-0.0165
$S_{i,t}^{resc} \cdot D_1 \cdot Media_{Recession}^{high}$	-4.8355^{***}	-0.9198^{*}	-8.5601^{***}
$S_{i,t}^{resc} \cdot D_1 \cdot Media_{Recession}^{low}$	-2.2255	-0.1766	-2.8805^{***}
Variance Equation			
Intercept	0.3327^{***}	0.0617^{***}	-0.1208
σ_{t-1}^2	0.7752^{***}	0.8845^{***}	0.8487^{***}
ε_{t-1}^2	0.1534^{***}	0.0929^{***}	0.0944^{***}
R^2	0.41%	0.35%	1.16%
observations	397	1,477	10,080

Panel A of this table shows regression results of the following equation: $R_{\tau,t} = \alpha + \beta_1 \cdot S_{i,t}^{resc} \cdot D_1 \cdot MediaD_{recession,t}^{high} + \beta_2 \cdot S_{i,t}^{resc} \cdot D_1 \cdot MediaD_{recession,t}^{low} + \varepsilon_{\tau,t}$. The price change within two-minute intervals at the bund futures market, $R_{\tau,t}$, is related to the rescaled surprise component, $S_{i,t}^{resc}$, of announcement i on day t. The surprise component is interacted with a dummy variable, D_1, which is one for the first two minutes after the release of indicator i, and zero otherwise. Furthermore it is interacted with a dummy variable, $MediaD_{recession,t}$ that is one if media coverage on recession is larger than the median, and zero otherwise. Panel B of this table shows regression results of the same mean equation but estimated with a Garch(1,1) model. The regressions are estimated with Newey-West autocorrelation and heteroskedasticity constant standard errors. Significance levels are indicated as follows: *** 1% significance, ** 5% significance and * 10% significance.

Table 6: Media Coverage of the Price Level

Panel A: OLS		
	Producer Price Index	Consumer Price Index
Intercept	0.0006	0.0043
$S_{i,t}^{resc} \cdot D_1 \cdot Media_{Inflation}^{high}$	-4.4368^{***}	-1.9334^{*}
$S_{i,t}^{resc} \cdot D_1 \cdot Media_{Inflation}^{low}$	-2.8172	-1.6131
R^2	0.48%	0.59%
observations	1,396	822
Panel B: Garch(1,1)		
Mean Equation	Producer Price Index	Consumer Price Index
Intercept	-0.0162	0.0280
$S_{i,t}^{resc} \cdot D_1 \cdot Media_{Inflation}^{high}$	-4.9540^{***}	-1.9518^{***}
$S_{i,t}^{resc} \cdot D_1 \cdot Media_{Inflation}^{low}$	-2.8629	-1.6738^{***}
Variance Equation		
Intercept	0.5379^{***}	0.2726^{***}
σ_{t-1}^2	0.5942^{***}	0.6896^{***}
ε_{t-1}^2	0.0218^{***}	0.2201^{***}
R^2	0.47%	0.57%
observations	1,396	822

Panel A of this table shows regression results of the following equation: $R_{\tau,t} = \alpha + \beta_1 \cdot S_{i,t}^{resc} \cdot D_1 \cdot MediaD_{inflation,t}^{high} + \beta_2 \cdot S_{i,t}^{resc} \cdot D_1 \cdot MediaD_{inflation,t}^{low} + \varepsilon_{\tau,t}$. The price change within two-minute intervals at the bund futures market, $R_{\tau,t}$, is related to the rescaled surprise component, $S_{i,t}^{resc}$, of announcement i on day t. The surprise component is interacted with a dummy variable, D_1, which is one for the first two minutes after the release of indicator i, and zero otherwise. Furthermore it is interacted with a dummy variable, $MediaD_{inflation,t}$ that is one if media coverage on inflation is larger than the median, and zero otherwise. Panel B of this table shows regression results of the same mean equation but estimated with a Garch(1,1) model. The regressions are estimated with Newey-West autocorrelation and heteroskedasticity constant standard errors. Significance levels are indicated as follows: *** 1% significance, ** 5% significance and * 10% significance.

Table 7: Media Coverage of Unemployment

Panel A: OLS	
	Unemployment Rate
Intercept	0.0077
$S_{i,t}^{resc} \cdot D_1 \cdot Media_{Unemployment}^{high}$	14.5865^{***}
$S_{i,t}^{resc} \cdot D_1 \cdot Media_{Unemployment}^{low}$	10.8136^{***}
R^2	1.94%
observations	1,407
Panel B: Garch(1,1)	
Mean Equation	Unemployment Rate
Intercept	0.0104
$S_{i,t}^{resc} \cdot D_1 \cdot Media_{Unemployment}^{high}$	13.3308^{***}
$S_{i,t}^{resc} \cdot D_1 \cdot Media_{Unemployment}^{low}$	8.9274^{***}
Variance Equation	
Intercept	0.0742^{***}
σ_{t-1}^2	0.8632^{***}
ε_{t-1}^2	0.1142^{***}
R^2	1.91%
observations	1,407

Panel A of this table shows regression results of the following equation: $R_{\tau,t} = \alpha + \beta_1 \cdot S_{i,t}^{resc} \cdot D_1 \cdot MediaD_{unemployment,t}^{high} + \beta_2 \cdot S_{i,t}^{resc} \cdot D_1 \cdot MediaD_{unemployment,t}^{low} + \varepsilon_{\tau,t}$. The price change within two-minute intervals at the bund futures market, $R_{\tau,t}$, is related to the rescaled surprise component, $S_{i,t}^{resc}$, of announcement i on day t. The surprise component is interacted with a dummy variable, D_1, which is one for the first two minutes after the release of indicator i, and zero otherwise. Furthermore it is interacted with a dummy variable, $MediaD_{unemployment,t}$ that is one if media coverage on unemployment is larger than the median, and zero otherwise. Panel B of this table shows regression results of the same mean equation but estimated with a Garch(1,1) model. The regressions are estimated with Newey-West autocorrelation and heteroskedasticity constant standard errors. Significance levels are indicated as follows: *** 1% significance, ** 5% significance and * 10% significance.

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This research was supported by the Deutsche Forschungsgemeinschaft through the SFB 649 "Economic Risk".