

Media Reporting and Business Cycles

Empirical Evidence based on Sectoral News Data ^{*}

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Abstract

Recent literature suggests that news shocks might be an important driver of business cycles. In this paper, we use a direct measure of news tone derived from media reports in a VAR model with survey data on business expectations and the business situation for the German manufacturing sector to examine if innovations in the tone of reporting correlates with changes in expectations. We find that innovations in news reporting affect business expectations, even conditioning on the current business situation and current industrial production. The dynamics of the empirical model confirm theoretical predictions that news innovations affect real variables, such as productions, via changes in expectations. Looking at a more disaggregate sectors within manufacturing, we find that news about the general economy are at least as important for business expectations within a sector as sector-specific news. This finding is consistent with the existence of information complementarities across sectors.

JEL classification: E32, D82.

Keywords: Media reporting, news-driven business cycles, sectoral information complementarities.

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1 Introduction

The role of news as a driving force for business cycles has already been noted by Pigou (1927) and received renewed interest in recent years (see Beaudry and Portier, 2013, for a survey). In these models, favourable news about future demand causes increased activity because firms invest more to make their goods available once higher demand materializes, and because agents increase consumption as they feel richer. If many agents rely on the same news source, such as media reports, for example, their behaviour becomes coordinated, which means that news can generate business cycle fluctuations.

Empirical evidence suggests that news about future productivity is an important driver of macroeconomic fluctuations. There are two approaches to identify news shocks. The first is an indirect approach, which treats news as unobserved. Beaudry and Portier (2006), for example, exploit the fact that stock prices are a fast-moving variables, which readily incorporate information about future fundamentals immediately. They examine the joint behaviour of total factor productivity (TFP) and stock prices. Looking at the correlation between the innovations that drive long-run movements in TFP and the innovation that is contemporaneously orthogonal to TFP, they find that these two are highly collinear. This suggests that news about future TFP is incorporated into expectations prior to the realisation of the change in TFP.¹

The second approach is a direct approach, which treats news as ex-post observable. Here, researchers use documents of past announcements of events, which are likely to have an impact on future productivity (see, for example, Brückner and Pappa, 2013).

Our paper is related to the second approach. One main underlying assumption in the models reviewed above is that firms receive news and adjust their expectations accordingly, even before an increase in output or productivity can be observed.² Therefore, news can be a driver of business cycles. In this paper, in a first step, we examine the transmission of news via media and examine how media reporting and coverage may influence firm's expectations. To do so, we employ a direct measure of news represented by a time series of a news indicator, that quantifies the content and intensity of news reports published by the most important newspapers, magazines and TV daily news in Germany. Firm's expectations and their assessment of the current business situation is measured by survey indicators from the German Ifo Institute. We document two regularities in the data. First, we show in a VAR-representation, that news Granger-causes the assessment of firms

¹Additional approaches to identify news shocks includes Barsky and Sims (2011) or Kurmann and Sims (2017).

²The causal link between changes in expectations and output is documented in Grisse (2009), also using the German Ifo data.

about the current and future state of their business. Based on VAR estimates, where the innovation in the news variable represents news shocks, we find that news has a economically important effect on expectations. This effect of news on expectations is, on impact, larger than the effect on current assessment. This finding is robust to including contemporaneous measures of industrial production data, suggesting that the information captured in the news variable influences expectations and provides information about the future that goes beyond the information included in measures of the current situation.

In a second step, we examine differences across sectors in the response to sector-specific news and macroeconomic news. We find that in most sectors, news about the macroeconomy has on average a larger impact on sectoral business assessments than sector-specific news. This finding would suggest that some sectors overreact to macroeconomic news and lends support to the information-complementarities hypothesis put forward in Veldkamp and Wolfers (2007). If obtaining information on the driving forces behind output is costly, it is optimal for media to report more on macroeconomic news, which is relevant for all sectors, than producing sector-specific news, which is only relevant for a share of firms in the economy. This mechanism amplifies the effects of common shocks relative to sectoral shocks. If firms do not find it optimal to invest in obtaining sector-specific information, firms will base their decisions on mostly macroeconomic news that can be directly obtained from the media.

The remainder of this paper is organized as follows. Section 2 discusses the data, while Section 3 presents our model and the estimation approach. Section 4 reports our empirical results. The final section concludes.

2 Data

Our analysis requires two types of data. On the one hand, we need data on expectations and perceptions to monitor the current and expected state of the economy and the individual firms. For this purpose we employ survey data as published by the Ifo Institute for Economic Research. On the other hand, we need data that capture the information that is disseminated at a certain point in time and relevant for firms in planning their future. For this, we utilize information contained in news magazines, newspapers and TV news broadcasts. This media data is kindly provided by Mediatenor, a media research institute. All measures are available at both the macroeconomic and the sector-specific level.

Data on the business climate. Each month, the Ifo institute sends a survey to approximately 7,000 firms in the sectors industry, construction and (retail and wholesale) trade all over Germany (Nerb, 2004). In general, this so-called Ifo Business Tendency Survey intends to capture the firms' appraisals of the business situation and their expectations about short-term developments. For instance, it asks firms to judge their current business situation and their business expectations for the upcoming six months.³

Firms are invited to answer most of the questions on a three-category scale: 'good/better', 'satisfactorily/same' or 'bad/worse'. When aggregating, the replies are weighted according to the importance of each firm and its industry. The percentage shares of the positive and negative responses to each question are balanced (ignoring the answer 'satisfactorily'). In this way each qualitative question is converted into a single Ifo indicator.

The well-known Ifo business climate indicator combines two questions: the assessment of the current business situation and the business expectations for the next six months.⁴ We will use the same two questions—labelled *Ifo Situation* and *Ifo Expectations* in the remainder of this paper—individually to see whether news reports in the media affect the way in which firms assess the current business situation and whether these news reports change their expectations about future developments of the business climate of their own product line.⁵ In our analysis, we concentrate upon the manufacturing sector, which takes up by far the largest part of the Ifo Business Tendency Survey.⁶

Data on media reports. The media data captures the number of statements regarding the economic development on a daily frequency since 1999. These statements cover both the German economy as such as well as on specific sectors individually. According to the standard of so-called media content analysis, Mediatenor captures news which are at least five lines long in case of printed media or last at least five seconds in the case of television reports. We rely

³For more detailed information, we refer to Oppenländer (1997) or Sturm and Wollmerhäuser (2004). See Theil (1955) or Strigel (1990) for an earlier appraisal.

⁴To be precise, it is the geometric mean of the indicators derived from the balances to the question: 'We judge our current business situation for product group XY to be good, satisfactorily, or bad', and the question: 'With respect to the business cycle, our business situation for product group XY is expected to be somewhat better, more or less the same, or somewhat worse in the next six months.' Note that both questions refer to the 'business climate' of the firm and do not explicitly ask for developments in profits, or production. How the term 'business climate' should be interpreted is left open to the individual firms. Nevertheless, it is generally acknowledged that these qualitative results give a good indication of how actual industrial production evolves over the time.

⁵Hence, rather than focusing on the forecasting ability of Ifo Business Tendency Survey indicators, as is often done in literature (see, e.g. Fritsche and Stephan, 2002 and Hüfner and Schröder, 2002), this paper uses these indicators as direct measures for firms' sentiment and assessments of their own future development.

⁶We blend out retail and wholesale trade and the construction sector. The main reason is that we do not have data from Mediatenor on news reports covering these sectors.

on news reports stemming from 26 newspapers, weekly magazines and TV broadcasts.⁷ Overall, our dataset consists of 109,023 statements on the aggregate economy and 218,192 sector-specific statements on the six sectors employed in our analysis. Besides the number of reports, Mediatenor captures its content. Trained coders identify whether each report contains a positive message for the industry or the macroeconomy or whether there is rather bad news attached to it. Inter-coder reliability test guarantee that coding the same article twice leads to an identical outcome.⁸ To allow comparison with the Ifo indicator, we focus on the balance between the share of positive and the share of negative news. The classification used in the media data allows us to focus on developments of six sectors: Chemistry, Electrics, Cars, Machinery, Food and Textiles. The appearance of these sectors in the media relative to the amount of news on the macroeconomy is shown in Figure 1. It shows that some sectors are more often mentioned in the media than others. Furthermore, relative to each individual sector the amount of news on macroeconomic developments is substantially larger. Whereas there is basically twice as much reporting on the macroeconomy as compared to the automobile and electricity sectors, it is even tenfold the amount of news on the textile industry.

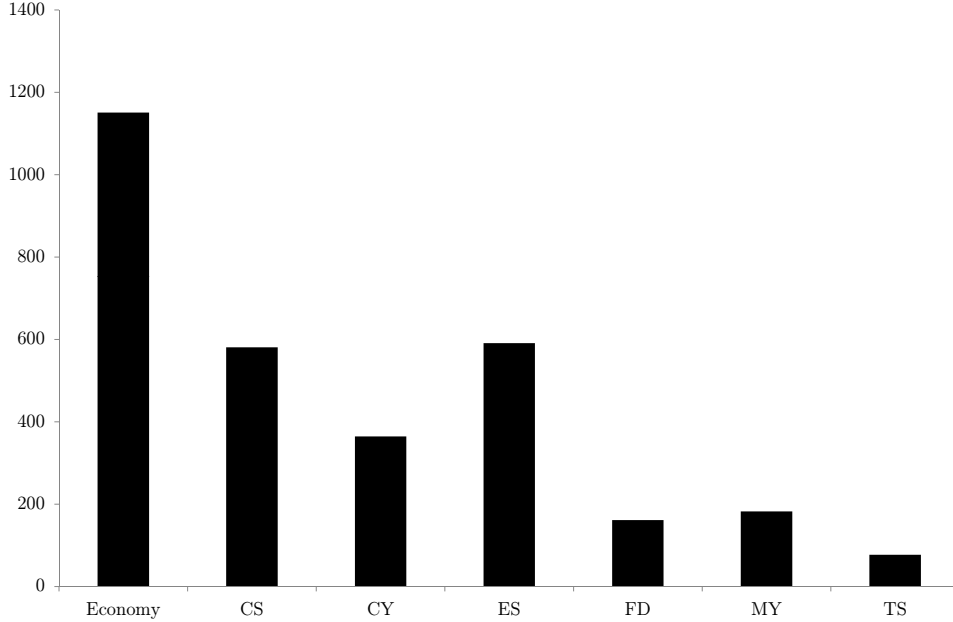
This implies that, if we would ignore the quality of these reports, it should be easier to obtain detailed information on the performance of the macroeconomy relative to information on developments of individual sectors. One obvious reason is that there are several institution and research departments providing information on the current and future outlook of the economy. Another reason is the above-mentioned scarcity of data at the sectoral level. Finally, macroeconomic news is likely to contain more forward-looking information than sector-specific news, which makes it more valuable in the planning process of the firm.

Concerning our media data we want to stress that our measure of macroeconomic news is *not* the average or aggregate of the sector-specific news items, but instead contains the assessment of news focusing on the German economy as a whole. Moreover, the manufacturing industry accounts for less than 25% of German GDP and our six sectors are only part of that. Consequently, the information contained in our sector-specific variable relative to our news measure on the economy as a whole basically does not overlap.

⁷The following news sources are analysed: Daily press: Frankfurter Allgemeine Zeitung, Welt, Süddeutsche Zeitung, Frankfurter Rundschau, Tageszeitung, Bild, Neue Züricher Zeitung, Berliner, Volksstimmer, Sächsische, Westdeutsche Allgemeine Zeitung, Kölner Stadt-Anzeiger, Rheinischer Merkur; daily TV-News: ARD Tagesschau, Tagesthemen, ZDF Heute, Heute Journal, RTL Aktuell, SAT.1 18:30, ProSieben Nachrichten; Weekly Press: Spiegel, Focus, Die Woche, Wochenpost, Welt am Sonntag, Bild am Sonntag, Die Zeit.

⁸For more information on media content analysis see also Holsti (1969).

Figure 1: Average number of reports per month on the macroeconomy and the individual sectors

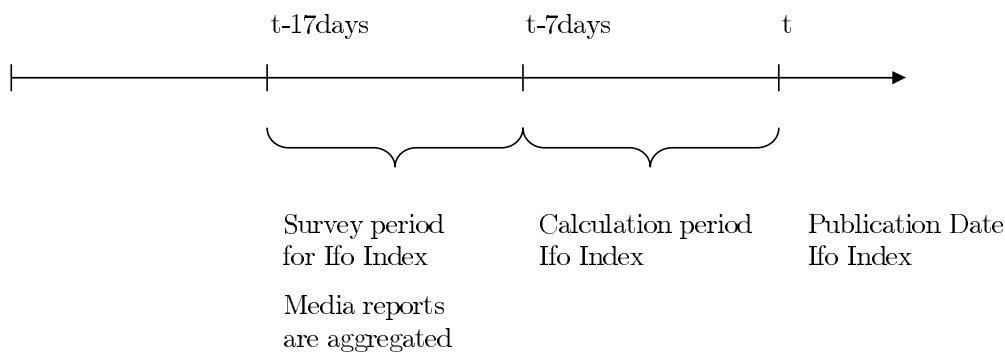


Sector codes: Cars (CS), Chemistry (CY), Electrics (ES), Food (FD), Machinery (MY) and Textiles (TS). News on the macroeconomy and news regarding sector-specific performance are mutually exclusive.

Figure 2 visualizes the construction of the media indicator with respect to its aggregation in time. Usually the Ifo Business Climate Indicator is made public at the end of each month (i.e. between the 18th and the 24th of a month). Since it takes several days for the Ifo institute to construct it, we assume the firms have already submitted the questionnaire a week before. For the same ten days during which firms fill out the Ifo Business Tendency Survey, we accumulate the media reports and construct our media indicators. Hence, we assume that survey participants are especially affected to news transmitted during the period in which they fill out the forms.⁹ Because the Ifo Business Climate Indicator is made public one week later, by construction there cannot be any contemporaneous impact running from the publication of this indicator to our constructed news indicator. This fact also has direct implication for our estimation approach which will be explained in the following section. Hence, our media indicators refer to news item published during the same period the Ifo survey is carried out. However, as the results of the survey are unknown

⁹As a robustness check, we also construct media indicators using data covering the full month. However, this does not alter the results qualitatively.

Figure 2: Timeline of the Construction of the Media Indices and the Ifo Index



t denotes the publication date of the Ifo Index.

to the public at that time, because those are published with a delay of about one week, it is clear that the Ifo Business Climate indicator itself is not included in the contemporaneous media data.

In Tables 1 and 2, we present summary statistics of our main variables. Table 1 offers the individual time series characteristics, while Table 2 refers to the stacked series covering the six sectors used in the panel VAR analysis. By construction, each variable can at most fluctuate between -100 and 100, where positive values indicate on balance more positive than negative assessments and vice versa.¹⁰ Media reporting on the macroeconomy has, with an average value of -23.7, a negative bias, i.e. overall a rather pessimistic tone. In contrast, media reports on sector-specific developments do not reveal such a pattern and seem to on average report in a more neutral fashion. This result is particularly interesting as our six sectors are industrial sectors which, relative to the service sector, have hardly contributed to GDP growth during this period. Looking at both the extreme values and the standard deviations, all series face similar degrees of volatility.

Figure 3 visualizes the movement of the Ifo Situation indicator in comparison to our macroeconomic news measure and the average of the six sector-specific news measures. The three series are positively correlated. The macroeconomic media indicator seems to be somewhat more volatile than the sector-average news indicator. Moreover, both indicators show a low degree of persistence in comparison to the Ifo Situation indicator for the manufacturing sector. This is as expected;

¹⁰Although our variables are bounded there is little merit in applying the log-odds transformation, as the mass of observations is concentrated and more than two standard deviations away from the bounds.

Table 1: Summary Statistics – Individual Sectors and the Economy

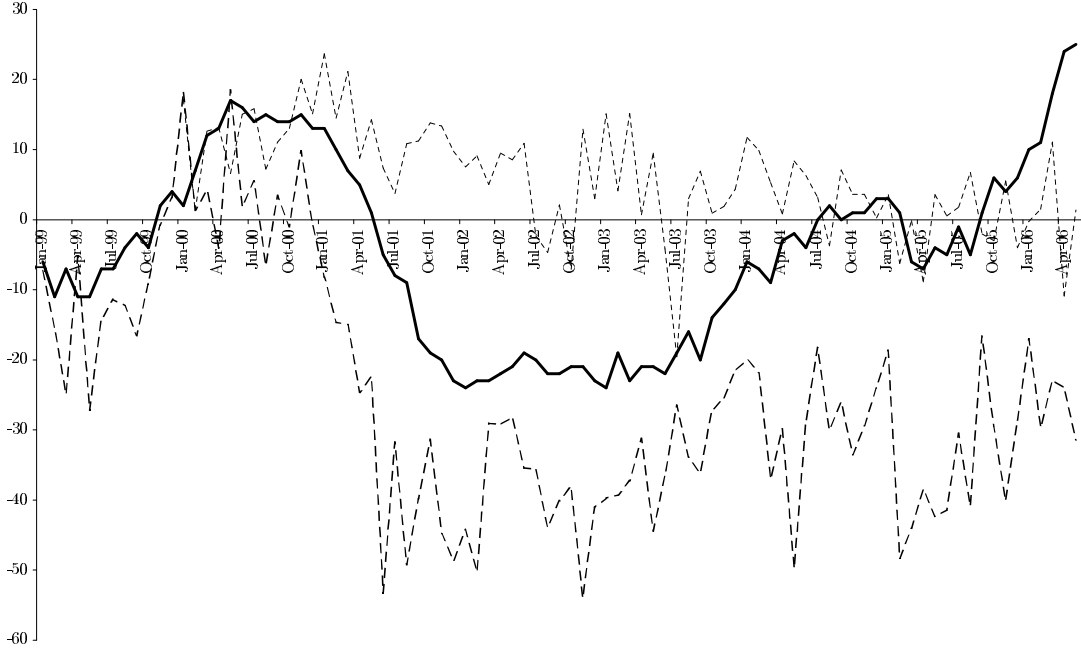
Variable	Mean	Std. Dev.	Min.	Max.	Observations
News Economy (n^{mac})	-23.7	18.1	-64.2	21.0	103
News Cars	6.1	11.1	-27.3	30.5	89
News Chemistry	6.9	12.2	-28.1	34.8	89
News Electronics	5.6	11.4	-23.5	33.6	89
News Food	-1.0	15.4	-53.3	27.0	89
News Machinery	4.9	14.8	-55.1	33.3	89
News Textiles	15.3	17.8	-20.0	66.7	89
Ifo Situation Manufacturing Sector	-2.2	13.9	-24.0	28.0	103
Ifo Expectations Manufacturing Sector	3.3	11.5	-31.0	24.0	103
Ifo Situation Cars	16.3	15.0	-10.0	47.0	103
Ifo Situation Chemistry	9.9	15.1	-18.0	47.0	103
Ifo Situation Electronics	-3.4	18.8	-35.0	32.0	103
Ifo Situation Food	-9.2	7.2	-29.0	9.0	103
Ifo Situation Machinery	1.7	17.3	-30.0	45.0	103
Ifo Situation Textiles	-23.0	14.7	-48.0	6.0	103
Ifo Expectations Cars	7.0	19.6	-35.0	58.0	103
Ifo Expectations Chemistry	10.4	13.7	-26.0	35.0	103
Ifo Expectations Electronics	6.4	15.5	-35.0	38.0	103
Ifo Expectations Food	-2.6	8.0	-29.0	17.0	103
Ifo Expectations Machinery	4.1	13.7	-33.0	27.0	103
Ifo Expectations Textiles	-6.3	12.3	-40.0	16.0	103

Table 2: Summary Statistics – Panel of six sectors

Variable	Mean	Std. Dev.	Min.	Max.	Observations
News Economy (n^{mac})	-23.7	18.1	-64.2	21.0	618
News Sector (n_t^{sec})	6.3	14.7	-55.1	66.7	534
Ifo Situation (i^s)	-1.3	19.8	-48.0	47.0	618
Ifo Expectations (i^e)	3.2	15.3	-40.0	58.0	618

activities at the firm level in general do not change very rapidly whereas news items react quickly to sometimes even small changes in the economic environment.

Figure 3: Media Indices and the Ifo Situation Indicator

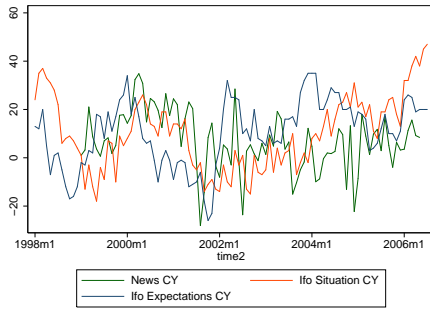


Solid line: Ifo Situation indicator; dashed thick line: media indicator for the macroeconomy (News Economy); dashed thin line: average of the sector-specific media indicators (News Sector).

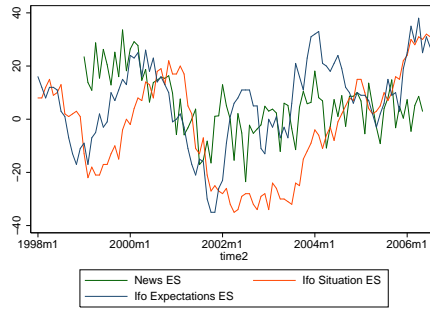
In Figure 4 we show the three time series for each sector. There is no common pattern across these sectors. For some, like for instance cars and electronics, business cycles can be recognized, whereas for others, like food, no systematic movement over time appears to exist.

Table 3 contains the correlation coefficients of our variables, where again the sector-specific media indicators are averaged across the six sectors. Several observations can be made. First, the average of sector-specific news reports and economy-wide news has a correlation coefficient of about 0.5. As the industrial sector is a relevant part of the total economy a positive correlation is expected. However, as economy-wide news is not simply the average of sector-specific news, the correlation is indeed well below 1. Second, the news measure of the aggregate economy shows a substantially stronger correlation with the aggregate sector-specific Ifo indexes than the sector-specific news measure. This indicates that companies might be more influenced by economy-wide news than by sector-specific news. Third, most news seems to be related to the present economic

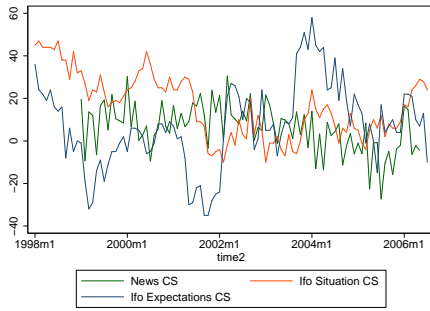
Figure 4: Sector-specific news and the Ifo indicators



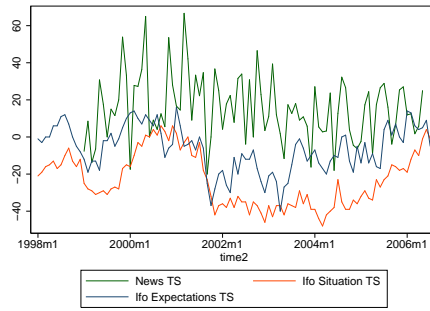
(a) Chemistry



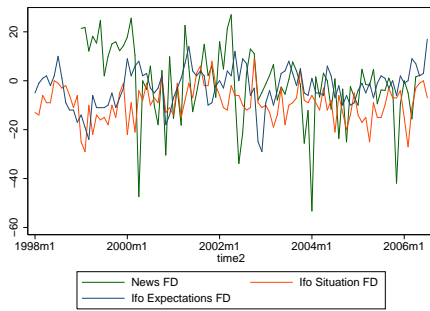
(b) Electronics



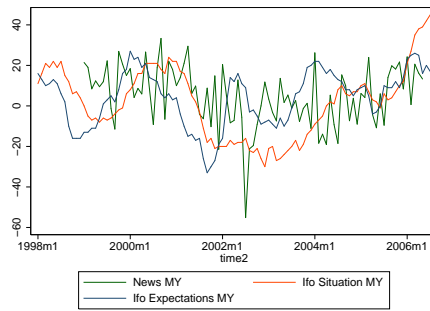
(c) Cars



(d) Textiles



(e) Food



(f) Machinery

situation as both the economy-wide news measure and the sector-specific news measure are more strongly correlated with Ifo Situation indicator than the Ifo Expectations indicator. Finally, given the differences in correlation coefficients with Ifo Expectations, there appears to be more forward-looking information contained in the macroeconomic news than in sector-specific news. This might raise the value of macroeconomic news for firms.

Table 3: Correlation Table

Correlations-Observations	News Economy	News Sector	Ifo Situation	Ifo Expectations
News Economy	1.000	89	103	103
News Sector	0.487	1.000	89	89
Ifo Situation	0.502	0.182	1.000	103
Ifo Expectations	0.185	0.003	0.410	1.000

The lower triangular shows the pairwise correlation coefficients while the upper triangular contains the number of observations.

3 Model and Estimation Approach

To derive our empirical setup, we first sketch a simple model explaining how firms form their expectations.¹¹ Let Ω^i represent the information set for firm i . This information set is decomposed into two subsets of information: information from the macroeconomy (*mac*) as well as sector-specific information (*sec*):

$$\Omega^i = \Omega_{mac}^i \cup \Omega_{sec}^i. \quad (1)$$

The information firm i has on the macroeconomy and on its own sector is a subset of the entire information available for, respectively the macroeconomy Ω_{mac} and the sector Ω_{sec} :

$$\Omega_{mac}^i \subset \Omega_{mac}, \quad (2)$$

$$\Omega_{sec}^i \subset \Omega_{sec}. \quad (3)$$

Firm decisions are based upon information they have regarding their own current situation and their own expectations thereof for the future. We assume that the information gathered by the firm is at least partly collected and distributed via the media. That kind of information is provided at very low costs and is often at a more economy-wide level. For example, publicly- or privately-funded research institutes carrying out macroeconomic research regularly publish analyses and forecasts. These are often taken up by the media and via that channel made public. Therefore, it

¹¹A more sophisticated model is provided by Veldkamp and Wolfers (2007).

is straightforward and not very costly for a firm to inform itself regarding aggregate developments via the media. Information regarding its own sector is often less readily available via the media and other channels and thereby relatively more costly to acquire. As described in the introduction, this is the main feature of the model of strategic information complementarities.

Of course, certain industry groups are organised as such that they do collect and share useful information. However, it is first of all not clear how much of that information is actually on the current state of that sector, i.e. is not backward-looking and perhaps not already covered in one way or the other by the media. Especially, sector-specific information is scarce and can basically only be inferred from backward-looking industrial production and trade data or contemporaneous business tendency survey results.¹² As a matter of fact, business tendency survey institutes, like the Ifo institute, use organisations that represent industry groups to keep their panel of participants representative and offer their results in return. The implicit value of the survey results for these organisations indicates the scarcity of other information at the sector level. By using such the Ifo indicators we do capture that kind of information.

Furthermore, as compared to macroeconomic information, there is, by a simply size-effect, relatively less demand for sector-specific information. This implies that there are lower incentives for both research institutes and the media to generate such specific information. At same time, the specialised knowledge and the lower availability and quality of the required data make it also more costly to produce such information.¹³ Hence, there are lower incentives and higher costs for statistical agencies, research institutes and the media to generate sector-specific information.

Finally, if we consider that information is non-rival in consumption and has marginal cost of replication, then the sector-specific information set is unlikely to be fully revealed. We label the observable part Ω_o :

$$\Omega_{sec} = \Omega_o \cup \Omega_u. \quad (4)$$

The unobservable part, Ω_u , has to be derived from other sources. As the economy-wide outlook also contains information for each sector ($\Omega_{mac} \cap \Omega_u$), a firm might, for instance, use the available media information on macroeconomic developments to ‘guestimate’ the sector-specific unobservable part. In that case, this implies

$$\Omega_{sec}^i = \Omega_o^i \cup \Omega_{mac}^i. \quad (5)$$

¹²Both industrial production and trade data have a publication lag of about two months.

¹³These costs become even more severe, if we think of generating this information on a high frequency, e.g. on a monthly basis.

Thus, a firm i forms its future output decision based on its own information set about sector-specific and macroeconomic productivity shocks:

$$E_t(y_{t+1}^i) = \alpha E_t(y_{t+1}^i | \Omega_{mac}^i) + \beta E_t(y_{t+1}^i | \Omega_{sec}^i) \quad (6)$$

$$\Leftrightarrow E_t(y_{t+1}^i) = \tilde{\alpha} E_t(y_{t+1}^i | \Omega_{mac}^i) + \tilde{\beta} E_t(y_{t+1}^i | \Omega_o^i). \quad (7)$$

To sum up, both sector-specific as well as macroeconomic information are important for making output decisions at the firm level. Although it might be argued that the ‘true’ sector-specific information is more important for a firm’s production plan, this information is costly to obtain and the observable part might be incomplete, imprecise or simply too costly to be ordered every month.¹⁴ To the contrary economy-wide information is provided (almost) freely as several research institutes provide accurate and reliable forecasts for future output and inflation. Their forecasts are subject to an intensive debate and thus catered by various media agencies. This implies that a firm’s production decision will in practice rest largely upon aggregate information provided by the media. The more important this information channel is, the larger the effect of economy-wide media information will be on production plans of firms.¹⁵

We employ so-called Granger causality analysis to investigate the importance of media information on the assessment of current and expected business. In that way, we provide evidence with respect to the information complementarities hypothesis.

To make our main hypothesis testable, we restate it to the following: The balance between positive and negative news is said to ‘Granger cause’ the assessment of the business climate and/or business expectations, if the time-series prediction of the Ifo indicators from their own past can be improved by adding lags of news balances to the equation. We analyze Granger causality in a VAR to overcome simultaneity problems.

Using our four variables of interest—Mediatenor news balances concerning sector news (n_t^{sec}) and news addressing the stance of the macroeconomy (n_t^{mac}), the Ifo Situation indicator (i_t^s) and the Ifo Expectations indicator (i_t^e)—gives the following VAR(p) model:

¹⁴One could argue that sector-specific news are provided via informal channels, like discussions with other companies, etc. The drawback of this channel is, however, the reliability of this information and to which extent it may be readily and timely available.

¹⁵See also Veldkamp and Wolfers (2007) for a formal model.

$$\begin{pmatrix} n_t^{mac} \\ n_t^{sec} \\ i_t^e \\ i_t^s \end{pmatrix} = \begin{bmatrix} a_{10} \\ a_{20} \\ a_{30} \\ a_{40} \end{bmatrix} + \begin{bmatrix} A_{11}(L) & A_{12}(L) & A_{13}(L) & A_{14}(L) \\ A_{21}(L) & A_{22}(L) & A_{23}(L) & A_{24}(L) \\ A_{31}(L) & A_{32}(L) & A_{33}(L) & A_{34}(L) \\ A_{41}(L) & A_{42}(L) & A_{43}(L) & A_{44}(L) \end{bmatrix} \begin{pmatrix} n_{t-1}^{mac} \\ n_{t-1}^{sec} \\ i_{t-1}^e \\ i_{t-1}^s \end{pmatrix} + \begin{pmatrix} e_{1t} \\ e_{2t} \\ e_{3t} \\ e_{4t} \end{pmatrix}, \quad (8)$$

where, for $j, k = 1, \dots, 4$, a_{j0} are the constants, A_{jk} are polynomials of order p in the lag operator L , and e_{jt} are independent and identically distributed disturbance terms such that the covariance matrix $\Sigma = E(e_{jt}e_{kt})$ is not necessarily zero for $j \neq k$. For now, we just use an average of sector-specific news for n^{sec} . Below, we extend our analysis and estimate the VAR for each sector.

The Granger-causality testing procedure does not generally give us an estimate of the sign of the overall effect. In order to test whether there exists a positive or negative effect of one variable on another, we apply the neutrality test, in which we calculate the sum of the lagged values of an explanatory variable and test whether it significantly differs from zero (Zarnowitz, 1992, pp. 365–379).

Hence, in this setting the analysis of a Granger-causal relation from news balances on the assessment of the (future) business climate boils down to testing whether each of the coefficients of the lag polynomials $A_{jk}(L) = A_{jk}^1, \dots, A_{jk}^p$, specifically A_{31} and A_{41} , (A_{32} and A_{42}) in equation (8) differ from zero. If furthermore the sum of these elements is significantly different from zero, we know that news does have a long-run impact on the two Ifo indicators. We apply likelihood ratio tests to carry out these test, i.e. we estimate both the constrained and unconstrained systems. We also use likelihood ratio tests to determine the optimal lag length (p) of the system.

As an identification of the structural shocks in the system, we use the Choleski factorization. In our case the ordering is largely predetermined by the construction of the media variables—as depicted in Figure 2—and the reference in time of the two Ifo survey questions. By construction, we cannot have a contemporary feedback effect from the two Ifo indicators on media as the media coverage of these indicators has been excluded. With respect to the two Ifo indicators, we assume that the Situation indicator can have a contemporaneous effect on the Ifo Expectations, but not vice versa. Because the Ifo Situation indicator reflects the current actual situation, this appears to be a plausible assumption. Only with respect to the macroeconomic and the sector-specific media indicators, it is less obvious what ordering is theoretically more plausible. We opt to restrict the contemporaneous effect of macroeconomic news on sector-specific news to be negligible.¹⁶ Hence,

¹⁶None of the qualitative conclusions depend upon this assumption, or in general upon the ordering chosen. Results are available upon request.

the ordering from most exogenous to most endogenous is the two Ifo indicators—Ifo Situation and Ifo Expectations—followed by the two media variables—sector-specific and macroeconomic news. Related to the literature on identifying news shocks, the residual in the news-variable equations can be related to a structural news shock, that is, an innovation in the news variable, which is not related to past news or past changes in the Ifo indicator. Even though our identification technique is much simpler as for example in Barsky and Sims (2011) or Kurmann and Sims (2017), we include a measurement of observed information flows, which can be observed before a survey period, and we measure news and expectations on relatively high frequency (monthly), the identification assumptions should be reliable.

To give an indication of statistical reliability, we report the impulse responses along with a 95% bootstrapped confidence interval, using a computational procedure developed by Giannini (1992), which is based on asymptotic Gaussian approximations of the distribution of the responses.

So far, the sectoral news impact is related to the sectoral expectation and situation assesment with one identical estimated coefficient for each sector. To extend the VAR to a sectoral VAR, which allows for different coefficients for each sector, we use a panel data framework, in which the constants in Equation (8) are replaced by sector dummies. We basically estimate a VAR for each sector, thus we do not allow for dynamic interdependencies across sectors. We focus on manufacturing, which is usually driving the business cycle, and use data for six of its sectors.

4 Empirical results

Table 4 reports the statistics of the Granger causality and Neutrality tests.¹⁷ There is clear evidence that Ifo Expectations subsequently cause changes in the Ifo Situation indicator and not vice versa. This is as expected and reveals that the answers collected by the Ifo institute are genuine. Furthermore, we observe that macroeconomic news has a significant impact on both the Ifo Situation and Ifo Expectations whereas sector-specific news does not cause these Ifo indicators in a significant way. These results correspond with the model predictions. Media directly affects the current perception on the economy but is also used to digest information on future developments. Furthermore, firms use macroeconomic information to infer the future path of the economy. In addition, as the neutrality test is rejected, the effect of macroeconomic news on Ifo Expectations appears of a rather short-term nature. While this analysis provides us with information concerning the significance and the direction of the impact of one variable on another,

¹⁷We opt for the Likelihood-Ratio test. However, the conducted Wald-tests lead qualitatively to identical results.

Table 4: Neutrality and Granger Causality Tests

Variable \ Equation	Ifo Situation		Ifo Expectations		News Sector		News Economy	
	Neutrality	Granger	Neutrality	Granger	Neutrality	Granger	Neutrality	Granger
Ifo Situation	0.000 (567.73)	0.000 (580.94)	0.393 (0.72)	0.748 (3.47)	0.454 (0.56)	0.332 (6.88)	0.004 (8.10)	0.0139 (15.97)
Ifo Expectation	0.000 (29.28)	0.000 (42.81)	0.000 (375.10)	0.000 (462.32)	0.115 (2.29)	0.060 (12.07)	0.782 (0.07)	0.005 (18.31)
Sector-specific News	0.539 (0.36)	0.124 (9.99)	0.958 (0.00)	0.228 (8.14)	0.000 (28.88)	0.000 (37.98)	0.008 (6.69)	0.105 (10.48)
Economy-wide News	0.005 (7.73)	0.000 (24.73)	0.816 (0.05)	0.000 (23.46)	0.031 (4.66)	0.374 (6.44)	0.000 (471.07)	0.000 (496.53)

The reported test statistics are based on Likelihood-Ratio tests. Six lags of each endogenous variable are selected and included in each equation ($p = 6$). Columns labeled 'Neutrality' show p-values of tests on the significance of the sum of the coefficients. Columns labeled 'Granger' report p-values for tests on joint significance. The associated χ^2 statistics are shown in parentheses. The results are based on 498 observations.

it does not answer how a shock evolves over time. To get a clearer picture, we therefore calculate the implied impulse-response functions.

Figure 5 shows that a one standard deviation shock in Ifo Expectations will with some delay have a clear and significant impact on the actual business assessment by firms, i.e. the Ifo Situation indicator.¹⁸ The maximum impact is reached after about six months, the time horizon over which firms are asked to assess future developments. This implies that firms, on average, give coherent answers, and are able to quite accurately describe their economic standing six months in advance.

Furthermore, we can confirm that media indeed shapes the opinion and assessment of the current and future business situation; media affects both the Ifo Expectations as well as the Ifo Situation indicator. Overall, however, a shock in macroeconomic news exhibits a stronger impact on the Ifo indicators than sector-specific news. This affirms the importance of information complementarities. Companies rely on macroeconomic data in order to infer sector-specific information.

It is generally found that the Ifo indicators capture real movements in the economy quite well (see Nierhaus and Sturm, 2007). This suggests that information transmission via the media has indeed an impact on the real economy and thereby drives business cycles and amplifies sector comovement. Other evidence supporting the view that news is highly relevant for economic outcomes is provided by Mora and Schulstad (2007). They find that the information agents have about current GNP, i.e. first releases on these, have a larger impact on their own actions than the true ex-post figures of GNP.¹⁹

In view of the heterogeneous character of the manufacturing sector, we estimate our model for each sector separately. For the sake of brevity, Figure 6 only shows the impulse-response functions of one standard deviation news shocks on the two Ifo indicators for each of the six sectors.²⁰

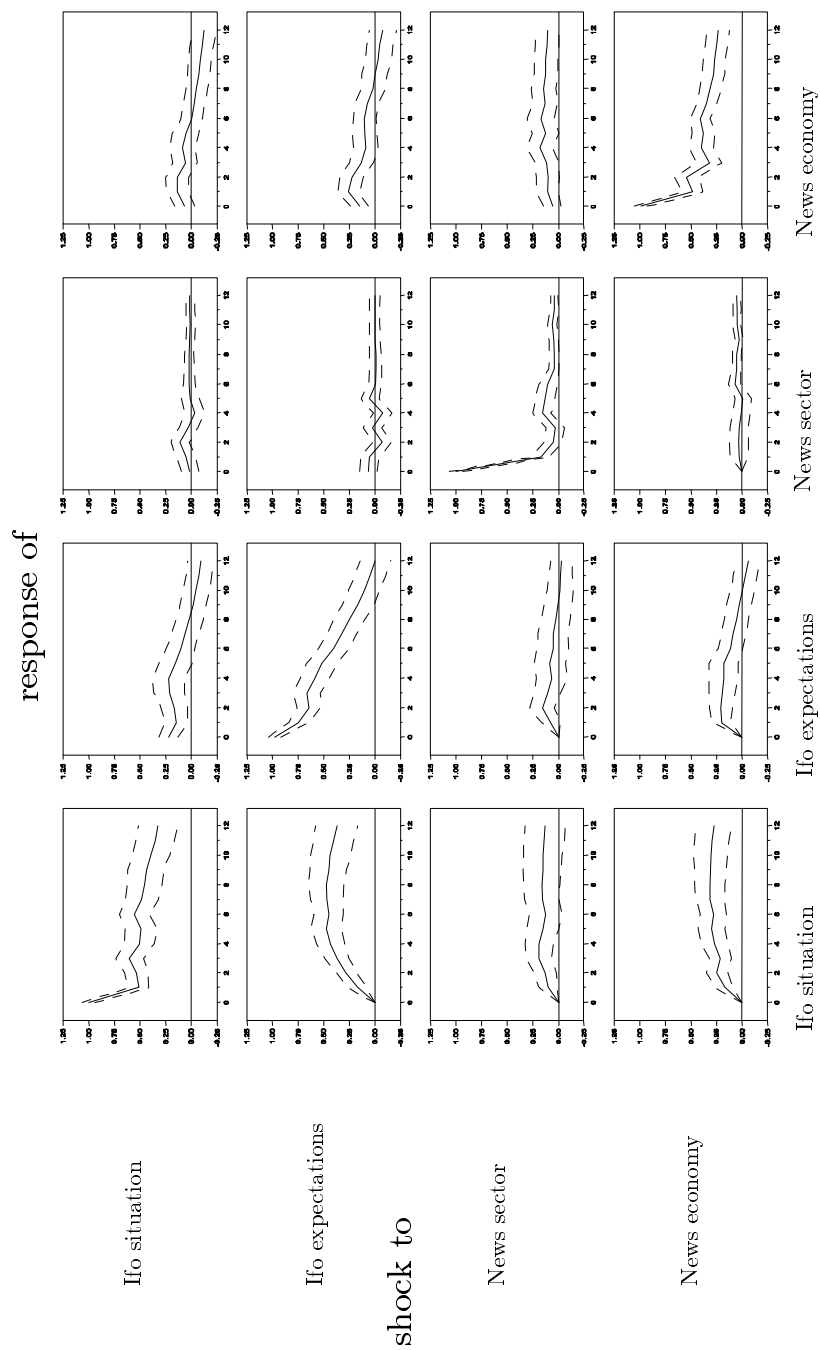
While on average there is compelling evidence in favor of our proposition that macroeconomic information has a strong impact, there is some degree of heterogeneity in the responses across sectors. For instance, the food sector is neither influenced by macroeconomic nor sector-specific news. On the other hand, sectors like textiles, chemistry, cars and machinery exhibit a clear pattern that matches our ex-ante considerations and the general picture which emerged from Figure 5.

¹⁸The impulse-response functions are scaled by the standard deviation of the response variable and each shock equals one standard deviation of the impulse variable.

¹⁹The authors study the degree to which expectations affect the evolution of the economy. They find that once GNP first releases are taken into account, the true (revised) value of GNP growth at time t has no predictive power in explaining future growth rates at any time. Thus, all the predictive power lies in the unexpected part of the announcements, and not in the true level of growth.

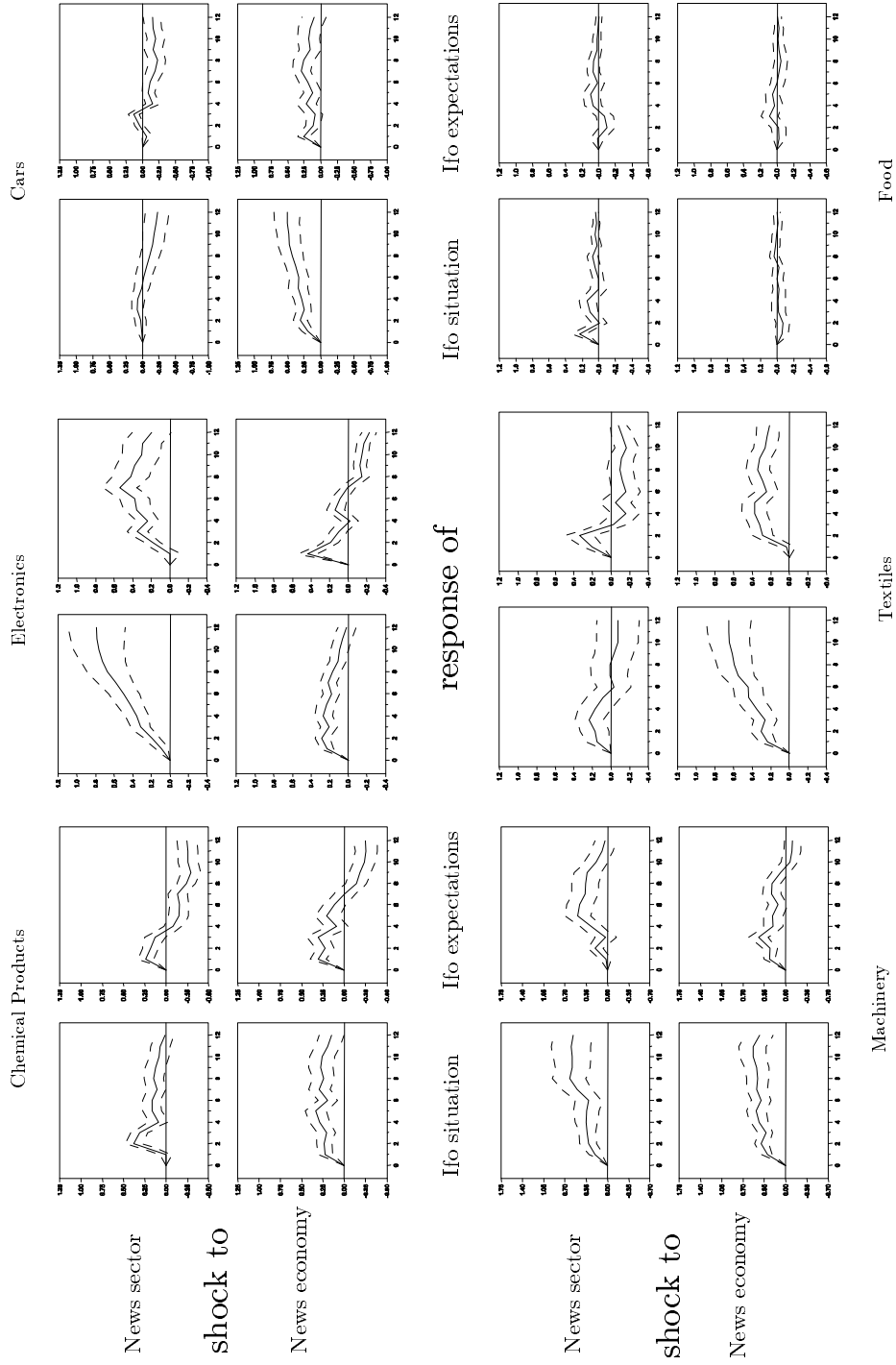
²⁰That is, we concentrate on the A_{31} , A_{41} , A_{32} and A_{42} polynomials in equation (8). The full set of results is available on request.

Figure 5: Panel VAR



The impulse-response functions are plotted together with their 95% bootstrapped confidence intervals based on Giannini (1992).

Figure 6: Sector Specific VARs



The impulse-response functions are plotted together with their 95% bootstrapped confidence intervals based on Giannini (1992).

The different impact across sectors can be explained by different needs for sector-specific information. That would be consistent with the Veldkamp-Wolfers model. Firms make rational choices when deciding between buying sector-specific information (for a relatively high price) or obtaining only macroeconomic information (for a relatively low price). If a firm in a given sector knows that sectoral productivity developments are closely related to macroeconomic productivity developments, the loss of making decisions based on macroeconomic information is relatively small. The reverse holds when sector-specific productivity developments are less synchronized with those of the rest of the economy. Hence, the loss of making decisions based on macroeconomic information is higher, the higher the difference between macroeconomic and sector-specific productivity developments. Furthermore, if the volatility of productivity growth is high, then there are higher costs associated with a mismatch between the actual and the optimal output decision. Hence, if this loss outweighs the costs firms face for acquiring sector-specific information, it is rational for them to obtain this relatively costly information.

This is consistent with the results presented. For instance, the necessity of the food industry to base their decision on external information is low as food consumption patterns are usually quite stable over time and productivity growth in this sector is in general low.²¹ Hence, the incentive to react to news concerning in particular macroeconomic developments is much lower than in other sectors.²² Furthermore, we find support that sectors underlying rapid productivity growth and low correlation with the macro economy have more incentives to gather sector-specific information. For instance, for electronics, with an average TFP growth of six percent and the lowest correlation of sector productivity with macroeconomic productivity, we observe that a shock in sector-specific information has a more pronounced impact than in macroeconomic news. The other sectors react more strongly to macroeconomic news.

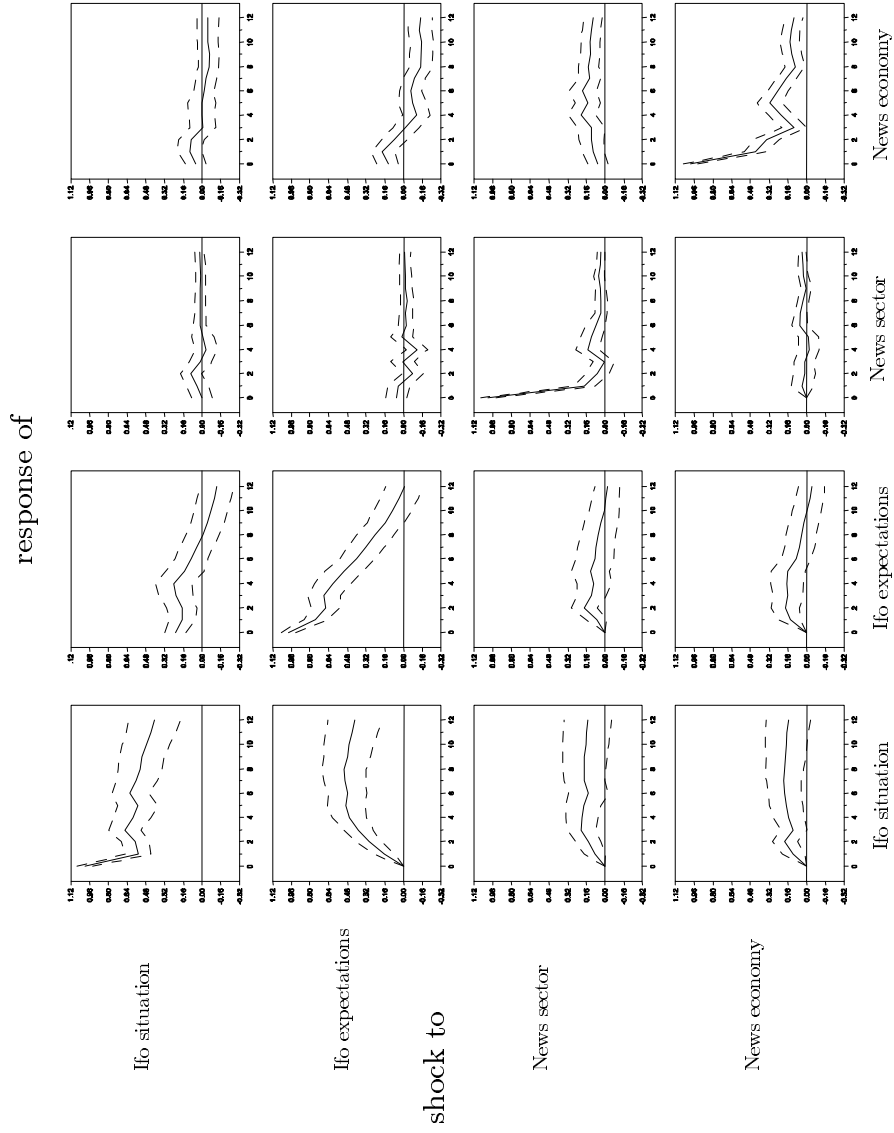
Finally, we present a robustness check for our results. Although we have included the Ifo Situation indicator in our set-up, we might only be capturing actual shocks which are consequently reported in the media. In order to further remove the effect of current real economic events reported in the media we instrument the media indicators by official industrial production data. Put differently, in a first stage the media indicators are regressed on both macroeconomic and sector-specific (ex-post) industrial production growth.²³ The resulting residual we now interpret

²¹TFP growth in the food sector is basically zero. The average unweighted TFP growth across all sectors is about one percent.

²²This is underlined by the low degree of volatility in this sector relative to the other sectors in our sample. See Table 1.

²³Besides the contemporaneous values we include up to three lags of macroeconomic and sector-specific industrial production growth.

Figure 7: Two-Step VAR



The impulse-response functions are plotted together with their 95% bootstrapped confidence intervals based on Giannini (1992). Variables 'News Sector' and 'News economy' are being instrumented by industrial production.

as news movements which are not backed up by actual real developments. Within the VAR framework, we now replace the original news indicators by these newly constructed variables. As Figure 7 reveals hardly any changes emerge. Hence, information as distributed by the media still appears to affect the firms' assessments of current and future developments.

5 Conclusions

Using German survey data from the Ifo institute as well as a rich dataset on economic news in the media, we find that media reporting affects firms' perceptions and expectations. This suggests that news contribute to the business cycle because they have an impact on expectations. Even though we do not directly identify news shocks, changes in the intensity of media reporting are arguably correlated with news shocks. Our results therefore relate to theoretical models where news shocks are an important component of business cycles.

Looking at sectoral responses to news about the aggregate economy and news about a specific sector, we find that the intensity of reporting on macroeconomic developments has as much impact on firm's assessment of their situation as the intensity of media reporting on a firm's sectoral development. This result supports the existence strategic complementarity in information acquisition across sectors as for instance developed by Veldkamp and Wolfers (2007). Furthermore, we observe that there is significant heterogeneity across sectors. For some industries might be more crucial to have up-to-date and sector-specific information than for others. For instance, industries relying on large and possibly irreversible investments, facing greater volatility or stronger competition, might be willing to invest more in sector-specific information.

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