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A growing body of literature analyses the impact of news on companies' equity prices. We add to this literature by showing that the transmission of news to prices goes through a combination of changing earnings expectations and risk premia. First, we disentangle sectoral equity prices into components of expected future earnings and equity risk premia. Then, we evaluate how these react to general and sector-specific sentiment shocks constructed from Reuters news articles. We find that price changes for especially the financial sector are mainly driven by changes in equity risk premia, while changes in earnings expectations play a comparatively larger role for other sectors.

Resumé
Det er i litteraturen velkendt, at nyheder har en direkte effekt på virksomheders aktiepriser. Vi bidrager til denne litteratur ved at vise, at transmissionen af nyheder til priser går igennem en kombination af ændrede forventninger til fremtidig indtjening og ændret risikopræmie. Først deler vi aktieprisen i to dele bestående af forventet fremtidig indtjening og en risikopræmie. Dernæst analyserer vi, hvordan disse to dele reagerer ved stød til et generelt nyhedssentiment og ved stød til et sentiment baseret på sektorspecifikke nyheder. Vi finder, at prisændringer for specielt finansielle virksomheder sker på baggrund af ændringer i risikopræmien, hvorimod ændringer i forventet fremtidig indtjening er forholdsvist vigtigere for ikke-finansielle virksomheder.

Key words
Financial markets.

JEL classification
G10; G12; G14.

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Abstract

A growing body of literature analyses the impact of news on companies' equity prices. We add to this literature by showing that the transmission of news to prices goes through a combination of changing earnings expectations and risk premia. First, we disentangle sectoral equity prices into components of expected future earnings and equity risk premia. Then, we evaluate how these react to general and sector-specific sentiment shocks constructed from Reuters news articles. We find that price changes for especially the financial sector are mainly driven by changes in equity risk premia, while changes in earnings expectations play a comparatively larger role for other sectors.

JEL classification: G10, G12, G14.

Keywords: Text analysis, news sentiment, stock returns, equity risk premia, Dividend Discount Models.

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Non-technical summary

Our paper examines the link between news sentiment measures and stock prices, expected future earnings and forward-looking equity risk premia across a number of sectors. It is well established in the literature that news-based sentiment measures capture important information for the price setting in equity markets. We expand on this literature by analyzing the underlying reasons for the found price changes. As stock prices are functions of expected future earnings as well as the required excess return compared to a risk-free bond, the so-called equity risk premium, a sentiment effect could go through either of those channels, or both. On the one hand, prices may increase in response to good news, as these make investors revise their earnings expectations upwards. On the other hand, the price reaction could also be due to the fact that investors now believe that the riskiness of the stock has been reduced, and hence demand a lower equity risk premium (ERP), also leading to higher prices.

We find that changes in sentiment have a clear effect on stock prices for the ten MSCI sectors examined. For most sectors the price reaction stems from a combination of changes in expected earnings and risk premia. However, as also supported in the literature, we find that the impact of sentiment changes differs across sectors, with e.g. the financial sector, characterized by hard-to-estimate cash flows and a very distinct risk profile, showing a higher degree of price change due to changes in the risk premium, while there is no change in the earnings expectations.

Moreover, by splitting the sentiment measure into an economy-wide and a pure sector-specific sentiment, we find that the economy-wide sentiment affects the stock prices of all sectors, but that the pure sector-specific sentiment is only significant for a few sectors, most notably the financial sector. A potential explanation for the later finding is that financial companies are particularly prone to a large degree of similarity of assets across firms, so that bad news about one or more financial companies spreads to other firms within the sector, affecting their stock prices.

We thus confirm and elaborate on the idea that news sentiment has heterogeneous effects on the stock market, that prices react due to a change in earnings expectations and risk premia, and in particular that financial companies are affected differently than other sectors.

1 Introduction

An expanding literature finds that news-based sentiment measures capture important information for the price setting in equity markets (notable examples are Tetlock et al. [25], Tetlock [24]). While this literature establishes a rather robust connection between news sentiment and various stock price indices as well as individual stock returns, the more fundamental driving force behind this relationship is less explored.

As stock prices are functions of expected future earnings as well as the required excess return compared to a risk-free bond, the so-called equity risk premium, the sentiment effect could go through either of those channels, or both. On the one hand, prices may increase in response to good news, as these make investors revise their earnings expectations upwards. On the other hand, the price reaction could also be due to investors now believing that the riskiness of the stock has been reduced, and hence demand a lower equity risk premium (ERP), also leading to a higher stock price.

A very simplified exercise illustrates the potential for sentiment to move equity prices through earnings expectations and ERP. In general, one might expect that the general sentiment measure capturing information across all companies might have forecast properties for GDP as such. Indeed, when sentiment falls we find that the expected growth rate of the economy decreases, see Figure 1. The relation is significant on a 99 percent confidence level. As a low sentiment score is directly linked to lower expected growth, the potential for finding a similar link between sentiment and earnings expectations should be straightforward as firms' earnings are highly dependent on the performance of the overall economy. The lower expected future growth might also translate into higher required risk compensation. Notice that this intuition works within a range of models e.g. the consumption CAPM: When sentiment falls, the expected growth rate of the economy decreases, implying lower income for consumers, who in turn will require a higher compensation for investing their income instead of consuming it. That is, investors require higher equity risk premia.

A few studies have suggested that the impact of sentiment might be different across sectors. For example, Baker and Wurgler [2] show that stocks that are hard to arbitrage and difficult to value, are affected more by investor sentiment. In addition, Morgan [20] shows that risks associated with investing in banks and insurance companies are particularly difficult to establish, because

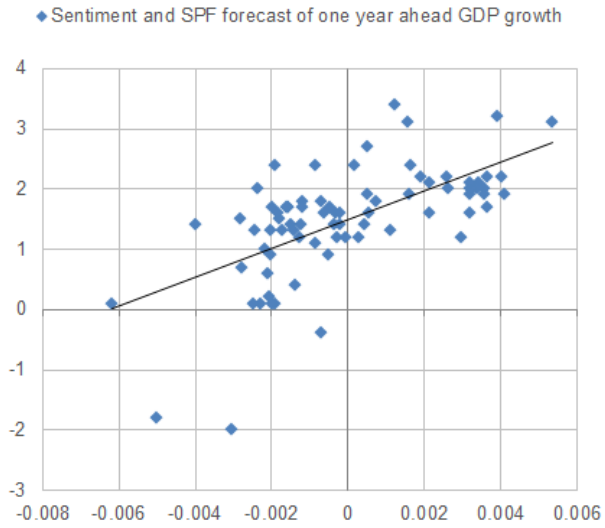


Figure 1: The horizontal axis depicts the quarter-to-quarter change in our general sentiment measure, while the vertical axis depicts the quarter-to-quarter change in the Survey of Professional Forecasters (SPF) forecast of euro area GDP growth one year ahead.

of their inherent uncertainty, both in terms of perceived risk and understanding of the cash flow.

This suggests that the financial sector may be affected differently by the news flow, and in particular that the risk compensation might be different. If the future earnings and the riskiness of a financial company are hard to determine, one could imagine the adjustment to go (partly) through the required return. That is, bad news would make investors more cautious and uncertain about the future, leading them to discount future expectations higher. This would imply a higher equity risk premium (ERP) and hence a lower equity price.

We investigate this hypothesis by estimating the effect of news sentiment on sectoral stock price indices as well as the underlying components; expected future returns and equity risk premia. We find that equity prices in general react to sentiment shocks as earnings expectations and equity risk premia change. However, financials are only affected by sentiment through equity risk premia, and to a much larger and more significant extent than any other sector, supporting our proposed hypothesis.

Moreover, by splitting the sentiment measure into economy-wide and pure sector sentiments, we find that the economy-wide sentiment affects the stock prices of all sectors, but that the pure sector sentiments are only significant for a few sectors, most notably the financial sector. A potential explanation is that financial companies are particularly prone to a large degree of

similarity of assets across firms as well as reputational effects, so that bad news about one or more financial companies spreads to other firms in the sector and affects their stock prices.

Hence, we contribute to the burgeoning literature on the relationship between news sentiment and the stock market by digging a bit deeper into the question of the fundamental drivers behind the relationship. We confirm and elaborate on the idea that news sentiment has heterogeneous effects on the stock market, and in particular that financial companies are affected differently than other sectors.

The paper is organized as follows: after a quick discussion of related literature in Section 2, helping to identify our contributions, the sentiment and ERP estimates are introduced in Section 3, impulse response estimates from a VAR are presented in Section 4 and a sensitivity analysis is conducted in Section 5. Finally, Section 6 concludes.

2 Related literature

It is well established in the literature that the news flow contains important information for financial markets with a robust link between different measures of news sentiment and changes in individual stock prices and earnings (Boudoukh et al. [4]) as well as index returns (Tetlock [23], Tetlock et al. [25], Dougal et al. [8], Chen et al. [6]).

The effects are mostly found to be relatively short-lived (Tetlock et al. [25], Loughran and McDonald [18]) although Heston and Sinha [16], Sinha [21] and Uhl [26] find longer-lasting effects when aggregating sentiment to a weekly or monthly frequency implying a higher information content in the aggregated sentiment. Further, Chan [5], Groß-Klußmann and Hautsch [15] and Heston and Sinha [16] find a reaction asymmetry to good and bad news, with the later finding that positive news predicts positive returns for one week, whereas negative news predicts negative returns for as long as a quarter. That is, bad news seems to be somewhat sticky, possibly reflecting investors' aversion towards downside risks.

Consequently, one could expect periods with a lot of bad news, e.g. during recessions, to be times where sentiment measures can significantly predict stock returns, and Smales [22] does indeed find that stock prices react stronger to sentiment changes during crisis periods than in other periods. Going one step further, Garcia [11] can actually only find a significant relation

during recessions with non-recession estimates being insignificant. Finally, Griffith et al. [14] use a sentiment measure to show that fear has a lasting effect on market returns and conditional volatility. Accordingly, one must be extra careful when estimating reactions based on data containing crisis periods such as the financial crisis.

Finally, it is worth noting that although the impact on stock prices of positive and negative news is relatively straightforward and intuitive, it is less clear what impact neutral news should have. Heston and Sinha [16] find a news publication effect; neutral news leads to higher stock prices, suggesting a positive effect of the mere publication of firm-specific news.

All of these papers have a clear focus on examining the relation between sentiment measures and stock returns. Hence, we contribute to this literature by digging a bit deeper into the question of the fundamental drivers behind the relationship.

3 Estimating equity risk premia and sentiment

This section presents the estimation method of the ERP and the sentiment. All estimates are weekly to ensure a sufficient number of articles for each sector and to match the frequency of analysts' forecasts of earnings growth for the applied sector indices.

3.1 The ERP measure

The ERP is defined as the expected extra return required by investors for holding the risky stock instead of a risk-free asset. The finance literature offers a range of models to estimate this unobservable component, among them is the class of dividend discount models (DDM). These models equate the stock price to the present value of all future expected dividends discounted by the risk-free rate and the ERP. That is, observing a stock price along with risk-free rates and expectations of future profits, it is a simple matter to reverse the logic within a given DDM to find the ERP. Our main reason for applying this type of model is that the use of current prices and expectations of future profits implies a **forward-looking** ERP which is crucial when linking it to the news sentiment.

In practice, we use the model of Geis et al. [12], which combines different earnings growth rates, the risk-free curve and a combination of dividends and buybacks to estimate the ERP. In this

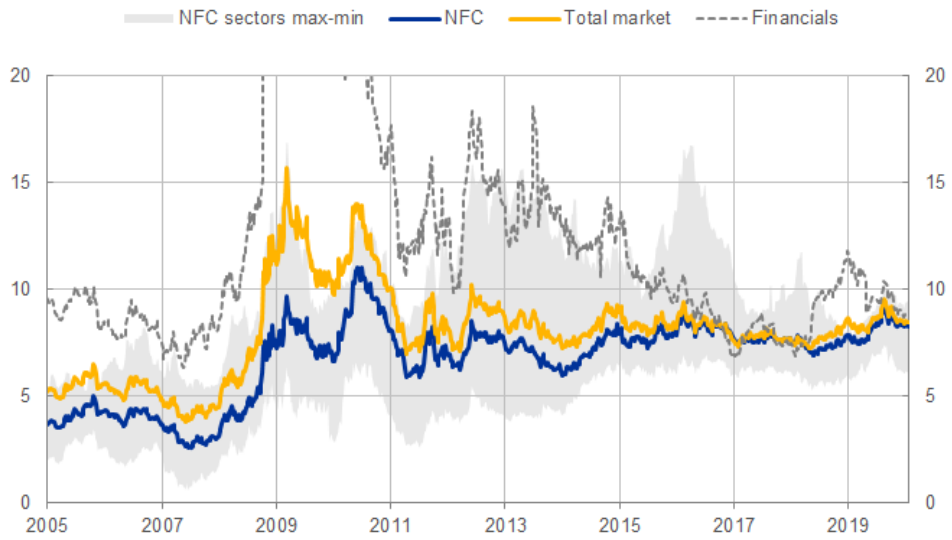


Figure 2: ERP in percentages per annum for the total market, financial and Non-Financial Corporations (NFC) indices as estimated with the procedure outlined in section 3.1. The shaded area depicts the min-max range of ERP estimates for the nine NFC sectors.

model, the equity price at time t is given by

$$
\begin{aligned}
P_t = & \frac{D_{t-1,1}(1+g_{t,1})}{(1+r^f_{t,1}+erp_t)^1} + \sum_{h=2}^{5} \frac{D_{t-1,h}(1+g_{t,2})}{(1+r^f_{t,h}+erp_t)^h} \\
& + \sum_{h=6}^{10} \frac{D_{t-1,h}\big(1+g_{t,2}-(g_{t,2}-g_{t,3})\frac{h-5}{5}\big)}{(1+r^f_{t,h}+erp_t)^h} \\
& + \sum_{h=11}^{\infty} \frac{D_{t-1,h}(1+g_{t,3})}{(1+r^f_{t,15}+erp_t)^h}
\end{aligned}
$$

where the last sum is geometric and a closed-form solution can be found. Each fraction corresponds to the current value (time t) of expected payouts at future time h.

The price at time t, P_t, is the sum of the market capitalization of all firms within a given sector. Likewise, the latest payout, $D_{t-1,1}$, consists of all dividends and buybacks across firms in the specific sector. As payouts are expected to grow at rates $g_{t,i}$, future payouts are calculated using the expected payout from the previous period and this period's expected growth rate, i.e. the expected payout at future time point h is given by

$$D_{t-1,h} = D_{t-1,h-1} \cdot (1+g_{t,h}),$$

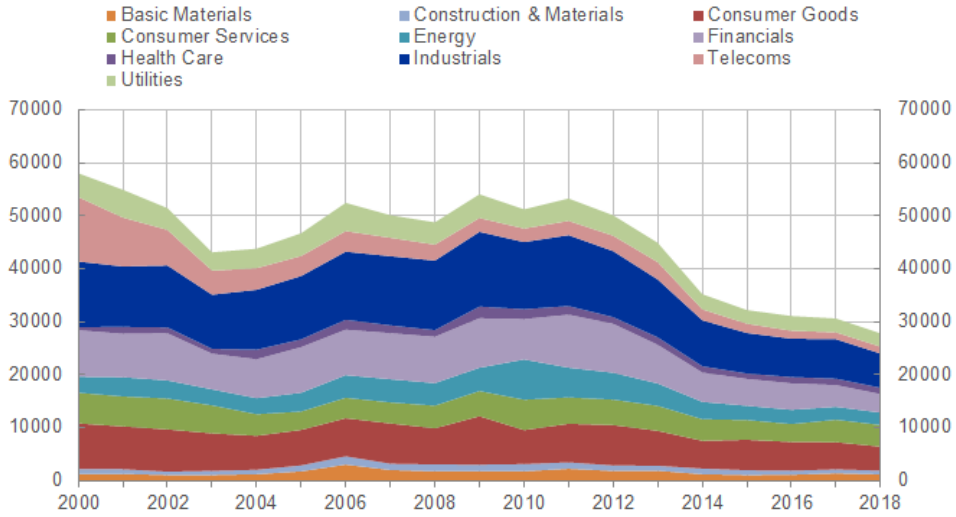
where $g_{t,h}$ is the growth rate for period h as expected at time t. For the growth rates, $g_{t,i},\ i = 1, 2, 3$, we use the expected 12-month forward earnings growth rate, the expected 3-5-year earnings growth rate (both at index level from Institutional Brokers Estimate System, IBES) and the expected 10-year nominal growth rate of the Eurozone economy (from Consensus Economics). Price, dividends and buybacks are all extracted from Thomson Reuters DataStream.

We apply the model to estimate the ERP for 10 different EuroStoxx sectors: *Consumer Goods*, *Consumer Services*, *Energy*, *Health Care*, *Industrial*, *Basic Materials*, *Construction and Materials*, *Telecommunication*, *Utilities* and *Financials*.

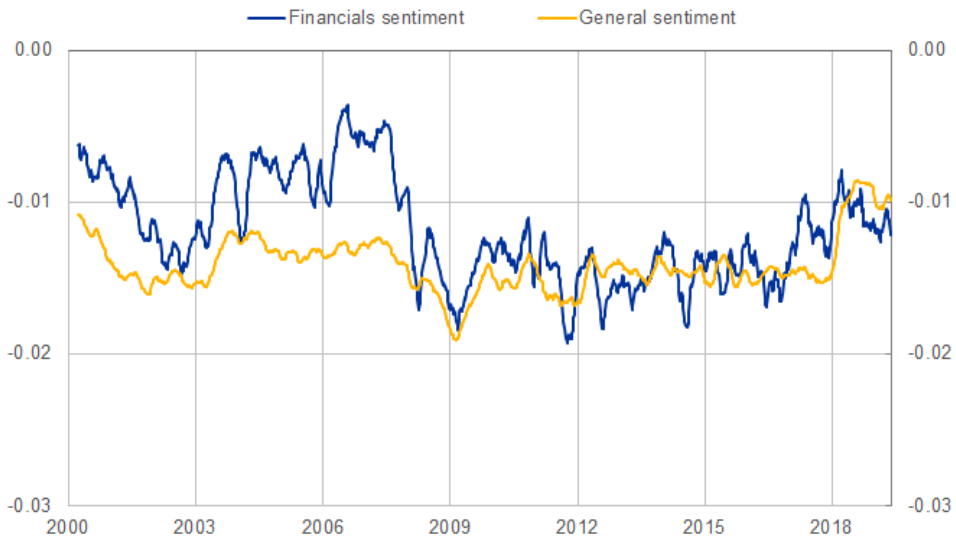
As shown in Figure 2, the sector ERPs show significant differences over the period 2005-2019. The financial crisis and the sovereign debt crisis are associated with large movements in the total market and financial sector ERP. Moreover, the period covered shows some large divergences between the sector ERPs.

The dynamics of the total market ERP from the outlined DDM are very similar to those of estimates from other well established models such as the Gordon Growth model (Gordon [13]), the H-model (Fuller and Hsia [10]), a Goldman Sachs estimate (Wright et al. [27]) or the so-called Fed spread (Bekaert and Engstrom [3]) as illustrated in Figure 8 in the Appendix. Although the levels differ somewhat, it is clear that all the models peak around the time of the financial crisis and again during the sovereign debt crisis. That is, investors required a relative high return for investing in equity during these episodes. This finding is even stronger when using short-term ERPs as in e.g. Martin [19] or Kilic and Shaliastovich [17], although also the shorter-term ERPs typically converge towards the more classic long-term measures of the ERP as the horizon is increased.

Further, a level change is observable across these models when comparing the pre-financial crisis period to the post-sovereign debt crisis period. The level change is well-known in the literature, e.g. Duarte and Rosa [9] find it across a range of models, and has several potential explanations ranging from a change in risk aversion to secular stagnation (see Daly [7] and Autrup and Hensch [1]).



(a) Yearly number of articles split by sector as used in the sentiment estimation.



(b) General sentiment and a sentiment specific for the financial sector. 3-month moving average.

Figure 3: Sentiment and article count.

3.2 The sentiment measure

Our news data consists of articles from Thompson Reuters News Archive, covering the period between 2000 and 2018. To measure sentiment, we use a dictionary-based approach, developed in Loughran and McDonald [18], which is particularly suitable for texts related to financial issues. According to this method, the sentiment of an article is given by the difference between the number of predefined 'positive' and 'negative' words, normalized by the total number of words in the article.

Reuters data comes with metadata containing subject tags that identify the topic of an article and any company that is mentioned in the article. Using these tags we identify around 860,000 articles about companies in the 10 different EuroStoxx sectors mentioned above, from which we construct sector-specific sentiments. As evident in Figure 3a, the number of articles is decreasing over the period with relatively few articles for the Basic Materials, Construction & Materials and Health Care sectors.

Figure 3b shows the general sentiment as well as the sentiment in news stories covering EuroStoxx financial companies. They show a high degree of comovement, however, with long periods of deviation. One noticeable example is the lead-up to the financial crisis in 2007, where the general sentiment is largely stable, but the financial sentiment has a positive trend. Although plummeting together during the financial crisis, the financial sentiment has, unlike the general sentiment, been very slow to recover to pre-crisis levels.

In addition to a relatively low number of news articles for certain sectors, the number of firms and basic statistics also warrant some attention with possible implications for the interpretation of our results. Table 1 presents some statistics on the ERP and the sentiment. A few things are worth noting. First, the number of firms in the Construction & Materials, Energy and Telecommunication sectors is relatively low, implying that estimates of ERP and sentiment should be taken with a grain of salt. The Construction & Materials sentiment has a slightly higher standard deviation, and the same applies to the Energy ERP. This gives an indication that later results for these sectors might be a bit too overly dependent on a few firms. Another noticeable feature is the very high standard deviation of the Financial sector ERP. This is, however, to a large part, due to the financial crisis, and excluding the crisis brings the standard deviation in line with the other sectors.

Table 1: Estimate statistics of sector ERP and sentiment

		ERP		Sentiment			Pure sentiment
Sector	# firms	avg.	std. dev.	avg.	std. dev	Corr.	std. dev.
Basic Materials	23	6.7	2.3	-8.3	6.2	0.2	6.1
Construction & Materials	12	6.3	3.0	-6.9	7.1	0.2	7.1
Consumer Goods	41	5.5	1.9	-9.4	4.4	0.2	4.4
Consumer Services	28	6.2	2.2	-9.5	4.4	0.3	4.4
Energy	11	9.9	5.6	-11.3	4.7	0.3	4.4
Financials	65	13.7	6.9	-11.8	4.7	0.4	4.5
Health Care	25	5.0	1.7	-8.8	6.5	0.1	6.5
Industrials	59	5.5	2.0	-11.6	4.0	0.5	3.7
Telecommunication	11	9.5	3.1	-8.0	4.2	0.2	4.3
Utilities	22	7.8	3.2	-9.9	4.4	0.2	4.3

[a] For each sector (row) the table provides in column (2) the number of firms used for estimating the sector ERP and sentiment, (3) the average sector ERP, (4) the standard deviation of the sector ERP, (5) the average sector sentiment, (6) the standard deviation of the sector sentiment, (7) the correlation between the sector sentiment and the general sentiment, and (8) the standard deviation of the pure sector sentiment, i.e. following the normalization procedure that is used to eliminate any correlation with the general sentiment.

It is only natural that our sector sentiments correlate with the general sentiment as also evident from the correlation coefficients in column 6 of Table 1. Therefore we introduce a pure sector sentiment calculated as the residual of a projection of the sector sentiment on the general sentiment. This ensures a clear distinction in our VAR specification between the general and sector sentiment measures, while leaving the information content and standard deviation of the sector sentiments largely unchanged.

4 Interaction between sentiment and stock prices

To investigate the impact of sentiment on equities, we employ a BVAR and a Cholesky factorization with the ordering: general sentiment, pure sector sentiment and price/earnings expectations/ERP. The ordering goes from general to specific to ensure an intuitive explanation of variation.

The sentiment is, as such, estimated on a weekly basis; however, taking the weekly changes does not necessarily yield an intuitive change series. Take a small example: The sentiment has until now been fluctuating closely around zero. Due to significant negative news, the sentiment drops. The following week brings more bad news, however, with a comparably lower impact on the sentiment. This would imply a positive week-to-week change although things are still historically bad. Therefore we use sentiment differences from the average in the VAR estimations, although using simple differences or differences from a 3-month moving average does not materially change the conclusions (unreported). Hence, we define a sentiment shock as a change in sentiment relative to the average. Further, we allow for up to four lags in the VAR to reflect that both bad and good news might be slightly sticky.

Table 2: Estimate significance of general and sector sentiment gauged from 65% IRF uncertainty bands

	Price		Earnings		ERP	
Sector	Gen.	Sec.	Gen.	Sec.	Gen.	Sec.
Basic Materials	✓	✓	✓		✓	
Construction and Materials	✓		✓	✓	✓	
Consumer Goods	✓		✓	✓	✓	
Consumer Services	✓		✓		✓	
Energy	✓		✓			✓
Financials	✓	✓			✓	✓
Health Care	✓	✓			✓	
Industrials	✓	✓	✓	✓	✓	
Telecommunication	✓		✓		✓	✓
Utilities	✓				✓	

[a] For each sector (row) a tick indicates a significant impulse response. Columns (2) and (3) give the impulse of the price following a general sentiment and pure sector sentiment shock, respectively. Likewise columns (4) and (5) give the response of earnings, and columns (6) and (7) the response of the ERP, following a general sentiment and pure sector sentiment shock, respectively.

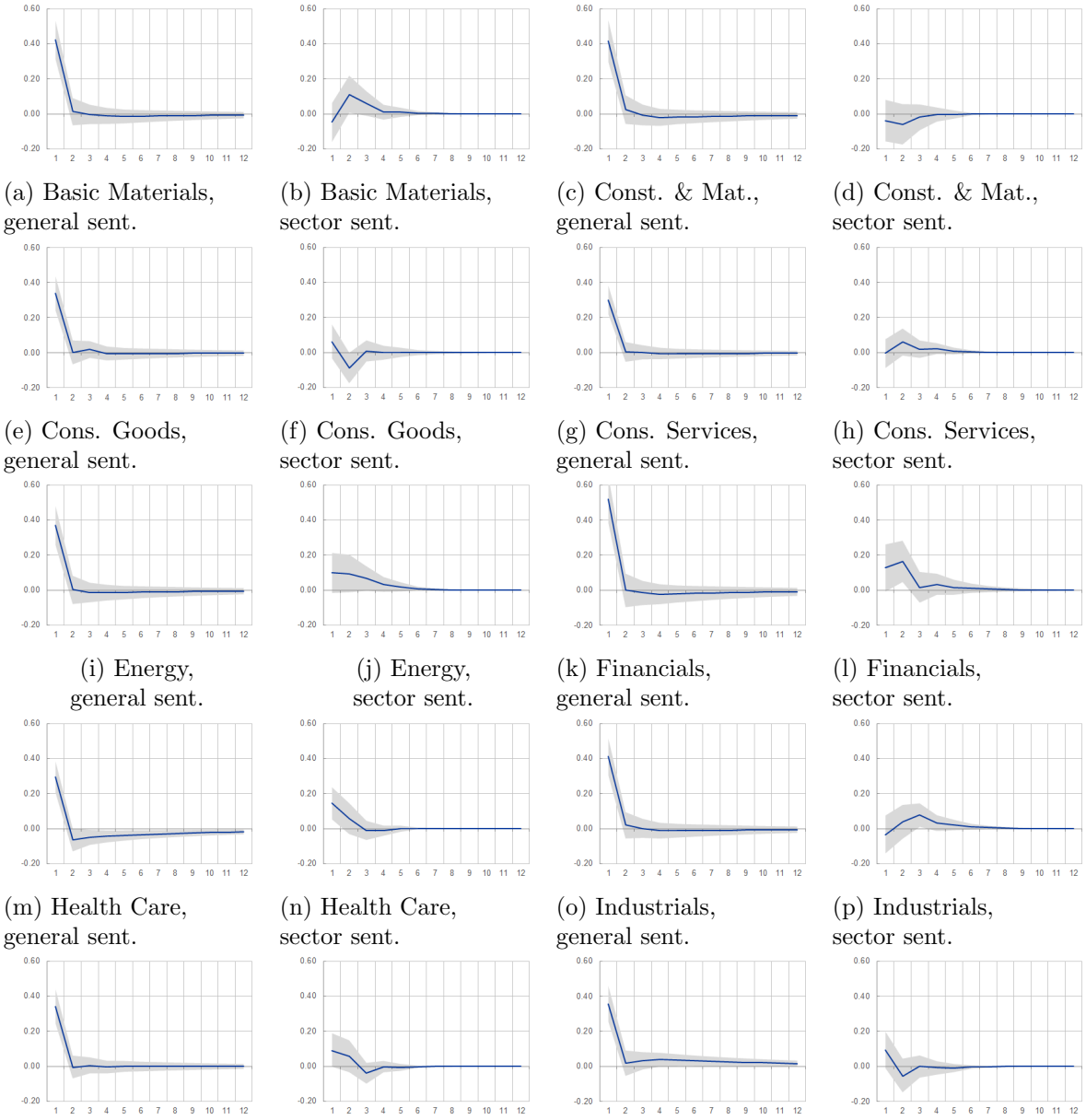
In the following subsection we present results for changes in price, earnings expectations and ERP. In general, we find that all sectors' prices react to news shocks at the overall level, see Table 2. Further, most sectors' earnings expectations and ERP also react to general sentiment shocks. The pure sector sentiment seems to be important for only a few specific sectors.

4.1 Sentiment and stock prices

The first step is to determine the effect of sentiment shocks on stock prices. A positive shock has the interpretation of better than average news, and we expect prices to increase accordingly.

A general sentiment shock can be expected to have a higher price effect than sector-specific sentiment shocks for the simple reason that the actual future performance of a firm might not depend as much on the sector as on the performance of the overall economy. For example, bad news about one machine manufacturer might only have limited effects on other machine manufacturers, as their customer base is outside their own sector. However, as the customers are heavily impacted by the performance of the overall economy, any change in the general sentiment can be expected to have a large impact on all machine manufacturers. As reported in Figure 4, a positive shock to the general sentiment leads to a significant equity price increase of around 0.35-0.4 percent in the following week – with a somewhat higher impact of around 0.5 percent for financials. Overall, the impact of the pure sector sentiment is very limited and/or insignificant, however, with the exceptions of the financial and health care sectors. This might be due to the complex and distinct business model of companies in the financial and healthcare sectors, with the latter being dominated by medico firms. More specifically, in the case of the healthcare industry, a sector-specific effect could be due to e.g. sector news on acceptance of new medicines or treatments. For the financial sector, the finding could be due to a high degree of similarity of assets and the possible presence of reputational effects, where bad news about one company may affect the stock prices of other companies within the sector.

Hence, while all sectors react relatively strongly to a general sentiment shock, only some sectors, most notably the financial and health care sectors, react to the pure sector shock. In the following we attempt to answer the more fundamental – but so far unanswered – question of what the underlying driver of the price reaction found is. It seems reasonable that news can affect the future outlook and risk perception of companies. Accordingly, a change in either expected future earnings or the equity risk premium – or both – are the main candidates to underlie the equity price movements.



(a) Basic Materials, general sent. (b) Basic Materials, sector sent. (c) Const. & Mat., general sent. (d) Const. & Mat., sector sent.

(e) Cons. Goods, general sent. (f) Cons. Goods, sector sent. (g) Cons. Services, general sent. (h) Cons. Services, sector sent.

(i) Energy, general sent. (j) Energy, sector sent. (k) Financials, general sent. (l) Financials, sector sent.

(m) Health Care, general sent. (n) Health Care, sector sent. (o) Industrials, general sent. (p) Industrials, sector sent.

(q) Telecom., general sent. (r) Telecom., sector sent. (s) Utilities, general sent. (t) Utilities, sector sent.

Figure 4: Standardized impulse response functions of the sector price to shocks from the general and the pure sector sentiment. Grey area marks the uncertainty region.

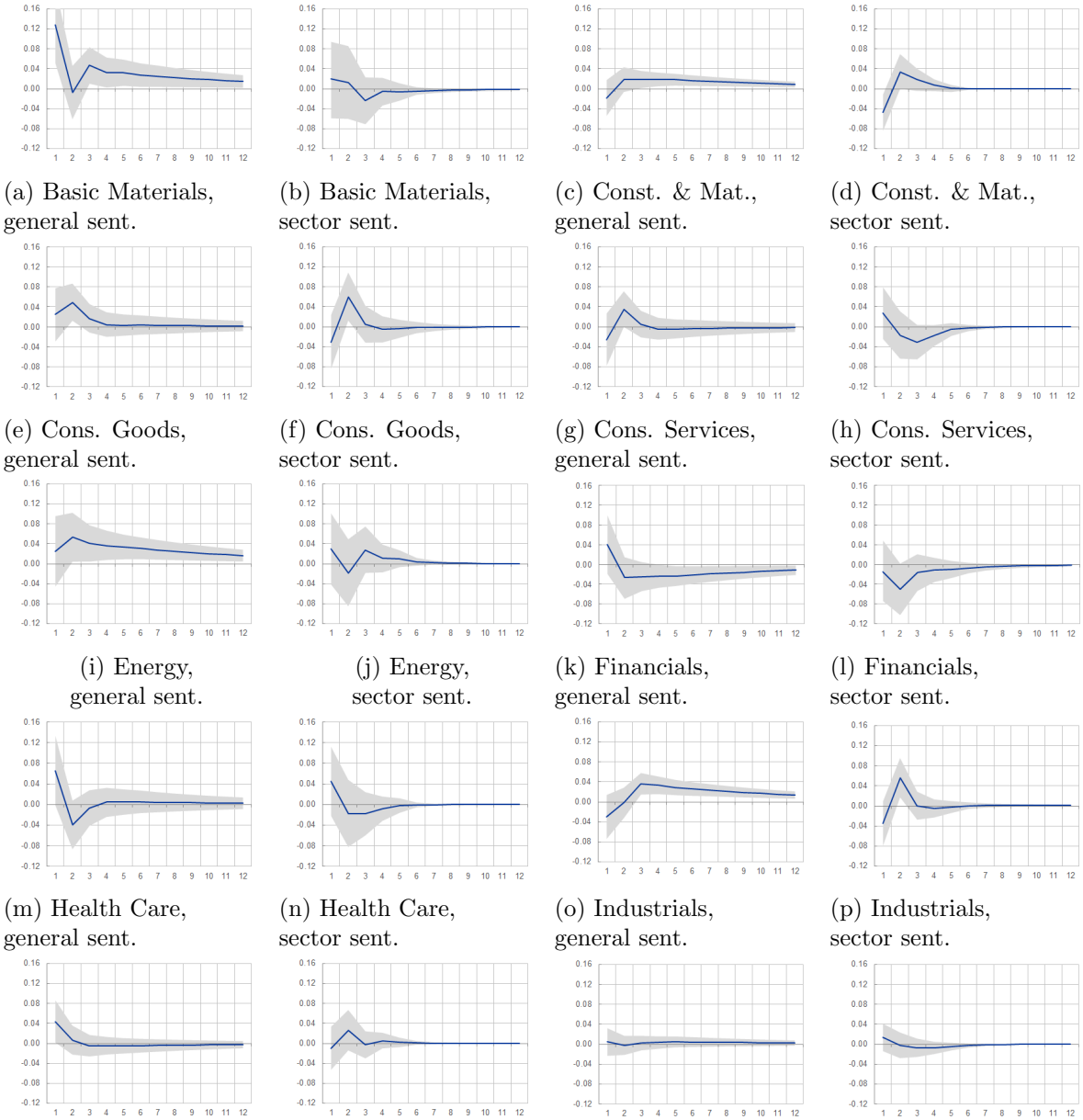
4.2 Sentiment and expected future earnings

Good and bad news, reflected in positive and negative sentiment shocks, respectively, should in theory be informative on the economic outlook and therefore each firm's earnings outlook, at least over short horizons. To more formally investigate this, we replace the change in price with

the change in expected 12-month forward earnings growth in the BVAR. Results are shown in Figure 5.

Across most sectors, the expected future earnings growth increases following a positive general sentiment shock. Some sectors, particularly the industrial and consumer goods sectors, are also affected by the sector specific sentiment.

We also note that while the price reaction of the financial sector was sizable, the change in earnings expectations is insignificant for both types of sentiment shocks. A possible explanation is that changes to the financial sector's cash flows are relatively hard to estimate as they depend on the funding structure, customer portfolio etc. If this is indeed the case, one would expect the positive price reaction to come from a reduction of the equity risk premium.



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(k) Financials, general sent.
(l) Financials, sector sent.
(m) Health Care, general sent.
(n) Health Care, sector sent.
(o) Industrials, general sent.
(p) Industrials, sector sent.
(q) Telecom., general sent.
(r) Telecom., sector sent.
(s) Utilities, general sent.
(t) Utilities, sector sent.

Figure 5: Standardized impulse response functions of the sector 12-month forward expected earnings growth to shocks from the general and the pure sector sentiment. Grey area marks the uncertainty region.

4.3 Sentiment and the ERP

The other potential candidate for driving the price change is the equity risk compensation. Good news might lead to a lower perception of risk, resulting in a lower ERP, and therefore a higher equity price. It must of course be noted that this can happen in parallel with a change

in earnings expectations. Figure 6 illustrates the results when repeating the exercise with the change in the ERP.

Most sectors respond to a positive general sentiment shock with a lower ERP. This supports the argument that firms are mainly exposed to the general market sentiment, i.e. it is the overall mood on the market rather than the sector mood that determines the price. Combined with the results from the previous section, this would suggest that most sectors respond to a positive sentiment shock by an increase in expected earnings and a simultaneous decrease in the ERP.

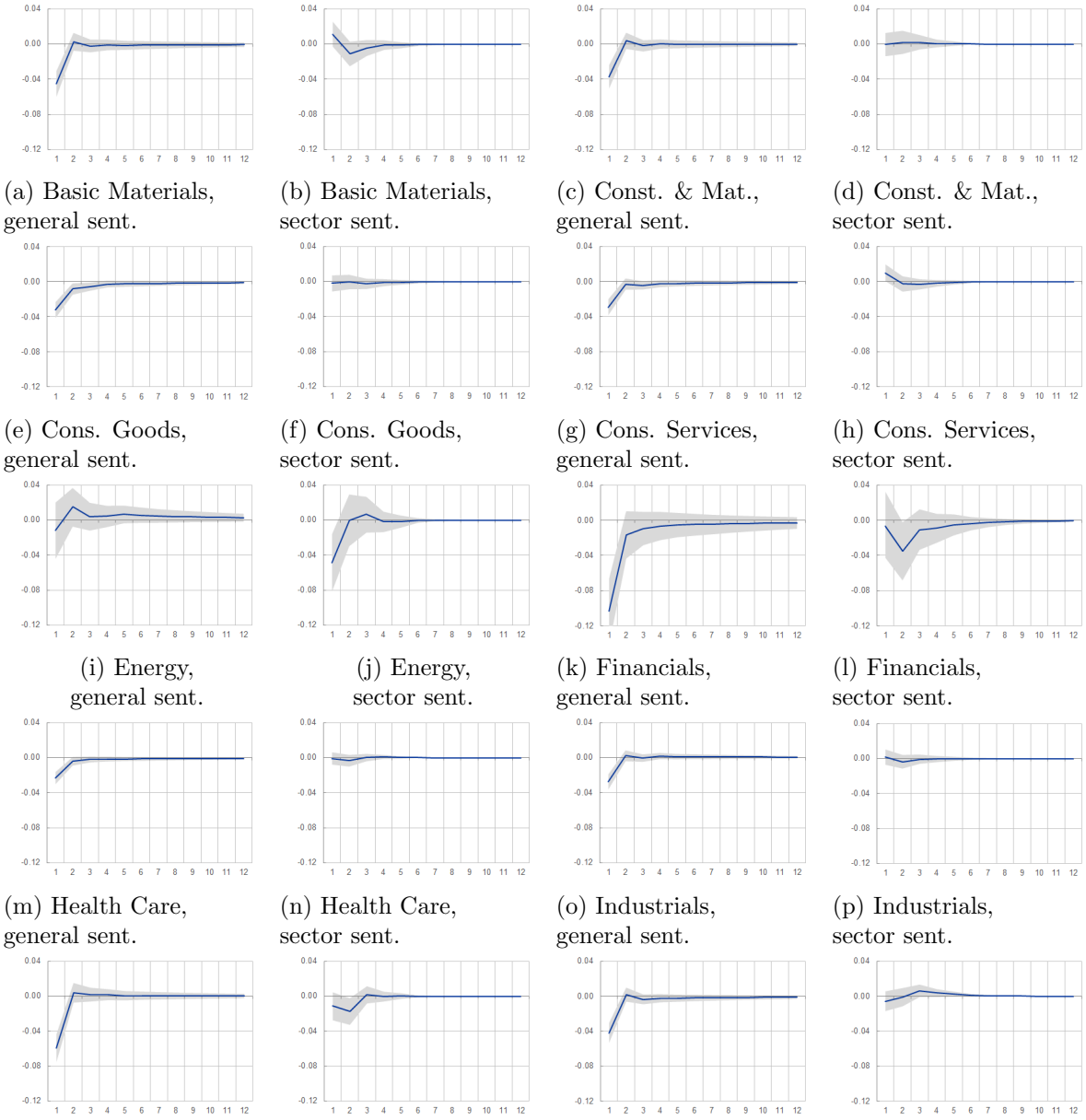
Again, we find that the financial sector stands out. The standardized reaction is at least double the size of the other sectors. As argued earlier, this is in line with the literature finding that the assets and risks of financials are difficult to evaluate for market participants. For most industries, it is (in theory) relatively straightforward to estimate an event's impact on earnings, and indeed we find this to be the case following sentiment shocks for most industries. However, for financials it is very difficult to estimate an event's impact on the cash flow – both due to the earnings coming from a portfolio of different assets and due to the more uncertain risk profile. Accordingly, market participants instead change their required risk compensation, leaving the expected earnings relatively unchanged.

The pure sector sentiments are only (marginally) significant for the financial and energy sectors. For the energy sector, this likely reflects a high sensitivity towards news on oil, while the reaction of financials might very well stem from the large similarity in assets across firms.

4.4 Summary

This section presented several novel findings. First, through a combination of changed earnings expectations and risk premia, the general sentiment affects prices across sectors. However, financial companies stand out, since the effect of sentiment on stock prices only goes through a change in ERP, and this effect is much larger than for the other sectors. This is well in line with the hypothesis that financials are difficult to evaluate, leading the sentiment to affect prices via the ERP rather than earnings expectations. An examination of the IRFs of the financial sector reveals that they are significant at a higher level than the other sectors, see Figure 7.

Second, pure sector-specific sentiments are only relevant for some sectors. This is especially true for the financial sector, where a potential explanation could be that financial companies



(a) Basic Materials, general sent. (b) Basic Materials, sector sent. (c) Const. & Mat., general sent. (d) Const. & Mat., sector sent.

(e) Cons. Goods, general sent. (f) Cons. Goods, sector sent. (g) Cons. Services, general sent. (h) Cons. Services, sector sent.

(i) Energy, general sent. (j) Energy, sector sent. (k) Financials, general sent. (l) Financials, sector sent.

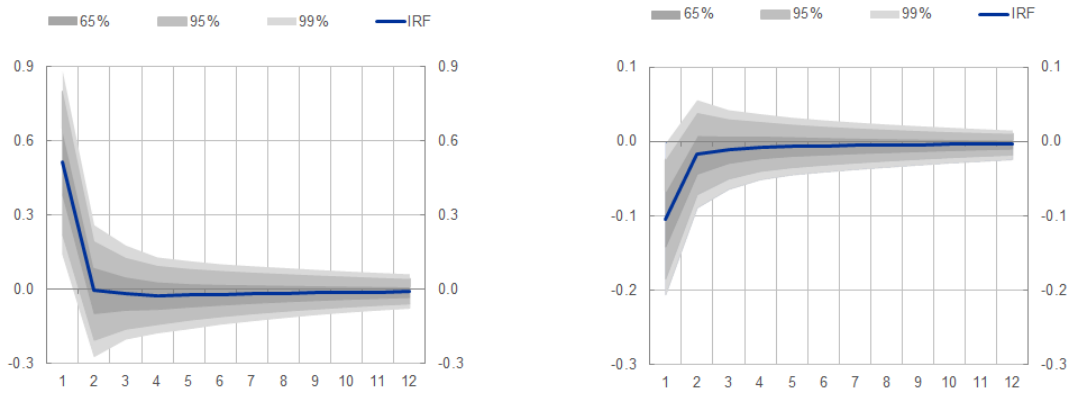
(m) Health Care, general sent. (n) Health Care, sector sent. (o) Industrials, general sent. (p) Industrials, sector sent.

(q) Telecom., general sent. (r) Telecom., sector sent. (s) Utilities, general sent. (t) Utilities, sector sent.

Figure 6: Standardized impulse response functions of the sector ERP to shocks from the general and the pure sector sentiment. Grey area marks the uncertainty region.

have very similar assets, and that they, due to their complex business model, are particularly vulnerable to reputational effects. Hence, bad news about one or more financial companies, reflected in the sector-level sentiment, affects the whole sector.

The major finding is that the news flow does not only affect prices through expectations of future earnings but also through the risk perception. This highlights that not only does news



(a) Price of financials

(b) ERP of financials

Figure 7: Standardized impulse response functions of the financial sector price and ERP to shocks from the general sentiment. Grey areas mark the 65%, 95% and 99% uncertainty regions.

bring information about current and future profitability but also information important for the perception of risk. Additionally, we have shown that certain sectors are more exposed to changes in risk perception than others.

5 Sensitivity analysis

The above findings may depend on a number of applied assumptions. In unreported results we have tried using two alternative shock series with simple differences and differences from a 3-month moving average of the sentiment. As this qualitatively yielded the same results, we instead focus on three other aspects that might change the results. First, we change the ordering in the VAR. Then we exclude the financial crisis from the sample. Finally, we change the number of lags allowed in the VAR.

Including other controls, such as industrial production and GDP, is not part of our sensitivity analysis as this gives certain endogeneity problems as the sentiment measures are partially based on news articles on these. Accordingly, our focus is to show that the results are not model driven.

5.1 Changing the VAR order

In the main section, the general sentiment was placed before the pure sector sentiment in the VAR, implying that most of the variance is ascribed to the general sentiment. To check that

most of the variation is indeed explained by the general sentiment rather than the pure sector sentiment, we reverse the order in the VAR: pure sector sentiment, general sentiment and ERP. Table 3 in the Appendix reports the results for the impulse response of the price, earnings expectations and the ERP with a focus on weeks 1 and 2 due to a lack of significance in later periods.

The change in ordering has little impact on the reaction of the price to the two types of sentiment shocks, where reactions to general sentiment shocks remain the largest component. The same conclusion applies for the impulse responses of the ERP, whereas earnings expectations seem to become slightly less significant. That is, the conclusions in Section 4 are largely unchanged.

5.2 Excluding the financial crisis

During the financial crisis, there is a large drop in the general sentiment and in many of the sector sentiments. To check that results are not excessively driven by this event, we exclude the time around the financial crisis. Specifically, we redo all estimates for the period 2011w1-2019w22. Impulse responses of the stock prices are mostly insignificant before the financial crisis (unreported results), however, becoming quite large, significant and in-line with the previously presented results for the post-crisis period as shown in Table 4 in the Appendix. Similar findings apply for the ERP and earnings expectations. Most important for this robustness check is that the conclusions remain unchanged for the financial sector.

5.3 Number of lags in the VAR

The main results use a VAR allowing for up to four lags. This is, however, quite a lot of lags considering the nature of the data and the results. Therefore, Table 5 in the Appendix reports the estimates with only one lag. Results are fairly similar to the results in Figures 4-6.

We conclude that the results are largely robust to changes in the ordering and number of lags, however, somewhat dependent on the time period used to estimate the VAR with the post-financial crisis estimates being slightly stronger. The finding that the impact on the ERP of financials is stronger than for other sectors is preserved throughout these different specifications.

6 Conclusion

Through the lens of a VAR, we evaluate the influence of sentiment measures, constructed from Reuters articles, on stock prices, earnings expectations and forward-looking equity risk premia, across different sectors.

We find that stock prices across sectors react significantly to shocks in the general sentiment, while only some sectors, most notably the financial sector, show significant reactions to the pure sector sentiments. For financials, the relatively strong effect of the pure sector sentiment could be due to a high degree of similarity of assets and the possible presence of reputational effects, where bad news about one company may affect the stock prices of other companies within the sector.

Going one step further, we find that good news affects prices via a significant increase in the expected future earnings for most sectors, combined with a reduction in the risk compensation required by equity investors. Again, financials constitute a special case, as their price reaction seems solely driven by a change in the equity risk premium. We hypothesize that this could be due to the cash flows of financials being harder to estimate which is why investors change the required risk compensation while leaving the earnings expectations unchanged. Furthermore, the magnitude of the ERP reaction is around twice that of the other sectors, and both price and ERP changes are highly significant.

Sensitivity analysis reveals that the findings are robust to different definitions of sentiment shocks, the ordering and lag number in the VAR as well as exclusion of the large fluctuations during the financial crisis.

A Additional figures

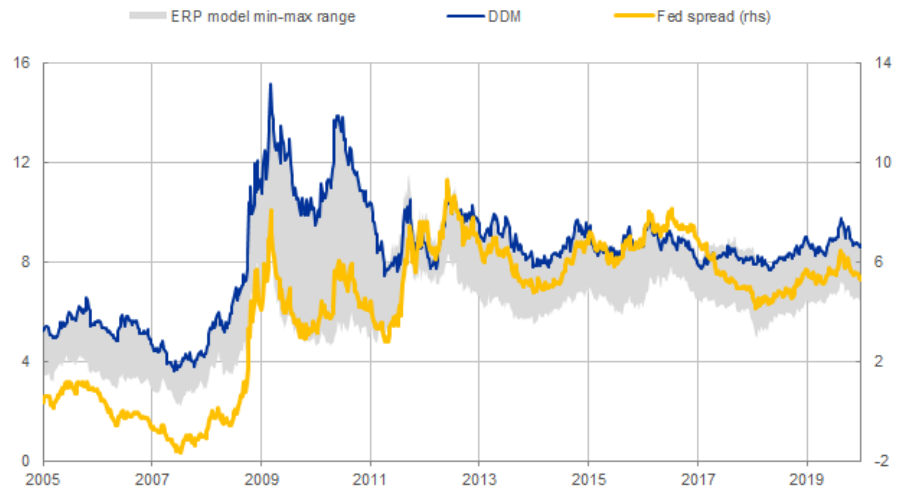


Figure 8: Estimates of the euro area equity risk premium in percentages per annum. The grey area shows the spread of estimates when applying the Gordon Growth model, the H-model, a Goldman Sachs estimate and the DDM outlined in this paper. The right-hand axis shows the Fed spread.

B Additional tables

Table 3: Standardized Impulse Response Function with reversed order of the sentiment measures.

Sector	*Sentiment*	*Response of Price*		*Response of Exp. earn.*		*Response of ERP*	
		week 1	*week 2*	*week 1*	*week 2*	*week 1*	*week 2*
Basic Materials	sector	−0.071	0.113*	0.012	0.013	0.013	−0.011
	general	0.418*	0.018	0.126*	−0.005	−0.045*	0.002
Const. and Mat.	sector	−0.047	−0.059	−0.048*	0.034	0.001	0.002
	general	0.411*	0.026	−0.020	0.020	−0.037*	0.004
Consumer Goods	sector	0.081	−0.087	−0.030	0.064*	−0.004	−0.001
	general	0.338*	0.007	0.026	0.047∗	−0.032*	−0.008*
Consumer Services	sector	−0.001	0.060	0.026	−0.018	0.009	−0.003
	general	0.301*	0.001	−0.026	0.035	−0.029*	−0.003
Energy	sector	0.089	0.091	0.028	−0.021	−0.048*	−0.001
	general	0.372*	0.003	0.028	0.053*	−0.013	0.015
Financials	sector	0.070	0.166*	−0.018	−0.048	0.006	−0.033*
	general	0.526*	0.014	0.039	−0.032	−0.104*	−0.019
Health Care	sector	0.166*	0.051	0.049	−0.020	−0.002	−0.004
	general	0.282*	−0.067*	0.061	−0.039	−0.023*	−0.004
Industrials	sector	−0.037	0.038	−0.035	0.057*	0.002	−0.003*
	general	0.407*	0.020	−0.031	−0.002	−0.027*	0.002
Telecommunication	sector	0.096	0.058	−0.010	0.026	−0.011	−0.018*
	general	0.344*	−0.004	0.045*	0.007	−0.060*	0.004
Utilities	sector	0.091	−0.054	0.014	−0.003	−0.005	−0.001
	general	0.360*	0.017	0.004	−0.002	−0.042*	0.002

[a] For each sector (row) the table gives the impulse response of the price (columns 3 and 4), earnings expectations (columns 5 and 6) and ERP (columns 7 and 8) in weeks 1 and 2 following a shock to the sentiment type provided in column 2. * indicates a significant response.

Table 4: Standardized Impulse Response Function for the post-crisis period.

Sector	*Sentiment*	*Response of Price*		*Response of Exp. earn.*		*Response of ERP*	
		week 1	*week 2*	*week 1*	*week 2*	*week 1*	*week 2*
Basic Materials	general	0.484*	−0.014	0.001	0.018	−0.041*	0.004
	sector	0.030	0.110	0.021	0.055*	0.001	−0.013*
Const. and Mat.	general	0.446*	−0.025	−0.046	0.011	−0.054*	0.008
	sector	−0.052	−0.031	−0.076*	0.046	0.010	0.011
Consumer Goods	general	0.354*	0.011	0.093*	0.034*	−0.022*	−0.002
	sector	−0.004	−0.093	−0.033	0.061*	−0.002	0.001
Consumer Services	general	0.292*	0.004	0.002	0.016	−0.031*	0.001
	sector	0.090	0.103*	0.023	0.000	0.011	−0.002
Energy	general	0.411*	−0.005	0.033	0.058	−0.010	0.024
	sector	0.151*	0.140*	0.059	−0.091	−0.094*	−0.006
Financials	general	0.531*	−0.002	−0.018	−0.047	−0.081*	0.000
	sector	0.037	0.158*	0.040	−0.034	0.045*	−0.032*
Health Care	general	0.345*	−0.045	0.016	0.007	−0.022*	−0.001
	sector	0.094	0.096	0.054*	−0.019	0.007	−0.003
Industrials	general	0.420*	−0.006	−0.022	0.011	−0.028*	0.003
	sector	−0.103	0.047	0.014	0.030	−0.002	−0.006
Telecommunication	general	0.357*	0.054	0.067*	−0.002	−0.073*	−0.002
	sector	0.114	0.094	−0.014	0.046	−0.010	−0.036*
Utilities	general	0.387*	−0.007	0.018	−0.017	−0.047*	0.004
	sector	0.050	−0.007	0.034	0.005	−0.001	−0.005

[a] For each sector (row) the table gives the impulse response of the price (columns 3 and 4), earnings expectations (columns 5 and 6) and ERP (columns 7 and 8) in weeks 1 and 2 following a shock to the sentiment type provided in column 2. * indicates a significant response.

Table 5: Standardized Impulse Response Function with one lag.

Sector	*Sentiment*	*Response of Price*		*Response of Exp. earn.*		*Response of ERP*	
		week 1	*week 2*	*week 1*	*week 2*	*week 1*	*week 2*
Basic Materials	general	0.417*	0.002	0.130*	0.034	−0.046*	−0.001
	sector	−0.043	0.117*	0.015	0.011	0.011	−0.011
Const. and Mat.	general	0.406*	0.003	−0.017	0.024*	−0.037*	0.001
	sector	−0.040	−0.060	−0.046	0.035	0.000	0.002
Consumer Goods	general	0.330*	−0.004	0.019	0.021	−0.032*	−0.006*
	sector	0.071	−0.062	−0.035	0.046	−0.003	−0.002
Consumer Services	general	0.297*	−0.001	−0.029	0.002	−0.030*	−0.004
	sector	0.005	0.069	0.026	−0.024	0.009	−0.004
Energy	general	0.359*	−0.015	0.001*	0.001*	−0.013	0.009
	sector	0.100	0.106*	0.001*	0.000	−0.052*	0.002
Financials	general	0.510*	−0.014	0.044	−0.030*	−0.105*	−0.011
	sector	0.115	0.141*	−0.012	−0.044	−0.001	−0.032*
Health Care	general	0.290*	−0.071*	0.074*	−0.003	−0.023*	−0.002
	sector	0.153*	0.054	0.039	−0.022	−0.001	−0.003
Industrials	general	0.405*	0.009	−0.027	0.030*	−0.028*	0.003
	sector	−0.021	0.068	−0.037	0.041*	0.002	−0.003
Telecommunication	general	0.342*	−0.009	0.043*	−0.001	−0.060*	0.003
	sector	0.092	0.052	−0.011	0.024	−0.001	−0.016*
Utilities	general	0.363*	0.097	0.006	0.004	−0.043*	−0.003
	sector	0.038	−0.043	0.012	−0.007	−0.005	0.002

[a] For each sector (row) the table gives the impulse response of the price (columns 3 and 4), earnings expectations (columns 5 and 6) and ERP (columns 7 and 8) in weeks 1 and 2 following a shock to the sentiment type provided in column 2. * indicates a significant response.

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