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ECB vs Bundesbank: Diverging tones and policy effectiveness

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ECB vs Bundesbank: Diverging Tones and Policy Effectiveness*

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June 9, 2018

Abstract

The present paper studies the consequences of conflicting narratives for the transmission of monetary policy shocks. We focus on conflict between the presidents of the ECB and the Bundesbank, the main protagonists of monetary policy in the euro area, who often disagreed on policy over the past two decades. This conflict received much attention on financial markets. We use over 900 speeches of both institutions' presidents since 1999 and quantify the tone conveyed in speeches and the divergence of tone among both presidents. We find (i) a drop towards more negative tone in 2009 for both institutions and (ii) a large divergence of tone after 2009. The ECB communication becomes persistently more optimistic and less uncertain than the Bundesbank's after 2009, and this gap widens after the SMP, OMT and APP announcements. We show that long-term interest rates respond less strongly to a monetary policy shock if ECB-Bundesbank communication is more cacophonous than on average, in which case the ECB loses its ability to drive the slope of the yield curve. The weaker transmission under high divergence reflects a muted adjustment of the expectations component of long-term rates.

Keywords: Central bank communication, diverging tones, speeches, text analysis, monetary transmission

JEL classification: E52, E43, E32

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ECB Press Conference, 6. Sept. 2012:

Question: “My question regards the vote today. Was it unanimous and, if not, what does it mean? Thank you.”

Draghi: “Well, it was not unanimous. There was one dissenting view. We do not disclose the details of our work. It is up to you to guess.”¹

1 Introduction

Communication by central banks is carefully crafted in order to avoid unwanted volatility of financial markets.² In his introductory statements to the post-meeting press conference, the president of the European Central Bank (ECB) is cautious not to generate market jitters. This is because communication matters, even more so since the euro area economy as well as many other economies are stuck at the zero lower bound (ZLB) of nominal interest rates. At the ZLB, the management of market expectations about future policy through central bank communication, known as forward guidance, becomes even more important (Coenen et al., 2017).

It is against this backdrop that the long and persistent conflict between the presidents of the ECB and the Bundesbank is striking. The president of the Bundesbank, the German central bank, sits on the ECB’s Governing Council and, if the rotation system allows, has a vote on policy decisions. During the past two decades, the Bundesbank’s presidents have been the most vocal critique of ECB policy. This is particularly important as Germany is the largest economy in the euro area. Hence, the ECB faced fundamental opposition from within the Eurosystem. In a world in which every piece of information originating from the central bank is closely monitored, the coexistence of different narratives on the same policy should not be innocuous for the overall effectiveness of monetary policy.

Of course, the discussion about monetary policy and the dynamics of coalition building and dissenting views in the Governing Council are more complex than the Bundesbank-ECB dichotomy. In particular, the debate involves many other members of the Governing Council representing member countries’ central banks and also Executive Board members. However, the Bundesbank-ECB conflict, which ultimately reflects different views on the institutional framework of the euro area, is certainly receiving the largest resonance in the media.³ Much of the conflict has

¹See <https://www.ecb.europa.eu/press/pressconf/2012/html/is120906.en.html>.

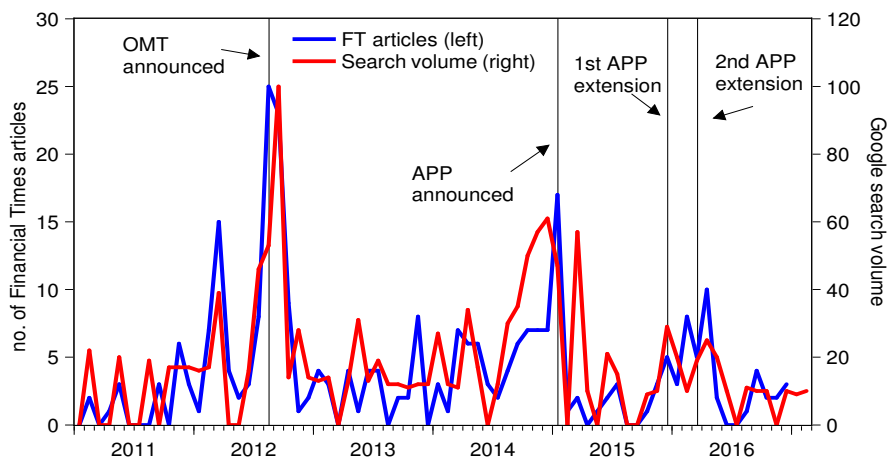
²See Blinder et al. (2008) for a survey on the developments of central bank communication and transparency over the past two decades.

³See Brunnermeier, James and Landau (2016) for an excellent account.

not been contained to meetings of the Governing Council, for which only anecdotal evidence is available. Rather, the public could witness the conflict unfolding. In the *Financial Times*, Münchau (2012) interprets a Weidmann speech as casting "Draghi in the role of the modern-day Mephisto". In the *New York Times*, Irwin (2014) argues that the "future of Europe" depends on the "dysfunctional relationship" between both presidents.

As shown in Figure (1), the conflict between both institutions during the Weidmann-Draghi tenure received much attention by central bank observers.⁴ The number of articles in the *Financial Times* containing the names of both President Draghi and President Weidmann peaks around important policy announcements since 2011, such as the announcement of the OMT program (Outright Monetary Transactions) following Draghi's "whatever-it-takes" speech or the introduction of the Asset Purchase Programme (APP). Likewise, the attention received on *Google* increases sharply around these events.

Figure 1: Media attention to ECB-Bundesbank conflict



Notes: The blue line is the number of articles mentioning "Draghi" and "Weidmann" in the *Financial Times*. The red line is the *Google* search volume for "Draghi Weidmann". The search volume is indexed to 100 for the month with the highest volume.

The Draghi-Weidmann conflict received attention across the entire euro area. Figure (9) plots the number of hits in the *Nexis* database, i.e. newspaper articles, press releases and others, containing "Draghi" and "Weidmann" in the most important euro area languages. The strong increase in attention around the aforementioned policy announcements cannot only be found in English-speaking media read by financial professionals, but also across all other languages.

⁴We do not have similar data for the Weber-Trichet or Welteke-Duisenberg tenure.

This paper studies the consequences of the ECB-Bundesbank conflict for the transmission process of monetary policy. The immediate challenge is to operationalize the notion of conflict between both institutions and to quantify the extent to which the presidents disagree in their communication of policy. Since the results of votes on the Governing Council remain opaque, we cannot use information on formal or informal dissent in meetings (Riboni and Ruge-Murcia, 2014). Other central banks, most notably the Fed's Federal Open Market Committee (FOMC) or the Bank of England's Monetary Policy Committee publish this kind of information.

Instead, this paper uses text analysis of speeches delivered by the presidents of both central banks to quantify the tone of each statement. The concept of tone refers to the number of positive and negative words in a given speech and is often used in the literature on monetary policy communication and financial markets (Schmeling and Wagner, 2017 and Neuhierl and Weber, 2016) and investor sentiment (Tetlock, 2007, Bannier et al., 2018). We use more than 900 speeches of the ECB and Bundesbank presidents since 1999 and apply specialized dictionaries to associate a speech with a sentiment score. We employ the Loughran and McDonald (2011) word list, which is by now standard in the literature, for the ECB speeches which are available in English. For the speeches of the Bundesbank president given in German, we use the Bannier et al. (2017, 2018) word list, which has been assembled specifically to analyze financial texts. This list is the German-speaking equivalent to the Loughran-McDonald word list.

Despite the frequent use of tone or sentiment analysis of financial communication, respectively, the precise nature of tone remains vague. However, for our purpose we do not rely on tone as such, but on the gap between the tone expressed in speeches of the presidents of both institutions in a given month. Hence, we construct a measure of disagreement in terms of tone. The resulting series of disagreement varies strongly over the sample period. We find that the tone expressed in speeches of both institutions fell into the negative terrain at the time of the global financial crisis. This means that speeches contained more negative than positive words. This level shift in tone is accompanied by a second finding. We discover large and persistent gaps between the tone expressed by the ECB president and the Bundesbank president. With the outbreak of the European debt crisis in 2010, the Bundesbank presidents Weber and Weidmann became more negative in the sentiment conveyed in their speeches than ECB presidents Trichet and Draghi, respectively. This gap widens after the announcement of the Securities Markets Programme (SMP) as well as the OMT and APP announcements. Overall, the sentiment gap provides a plausible indicator of ECB-Bundesbank disagreement.

In the next step, we use local projections (Jordà, 2005), a time-series model of the transmission process, to let the monetary policy shock interact with the extent to disagreement between the ECB and the Bundesbank. Monetary policy is allowed to effect interest rates more or less strongly under disagreement. The dependent variable is the Overnight Index Swap (OIS) rate for different maturities, which is the safe euro area interest rate that should closely reflect monetary policy. Importantly, OIS rates are not affected by sovereign risk premia or flight-to-quality premia such as bond yields from the periphery of the euro area and German Bund yields, respectively. The OIS rate can, like other nominal interest rates, be decomposed into the average expected short-rate over the maturity (expectations component) and an excess return (term premium). For each maturity, we also use the subcomponents of OIS rates in our analysis.⁵

We find that long-term interest rates respond less strongly to a given monetary policy shock if the divergence of tone is large, i.e. if the cacophony of voices from the ECB and the Bundesbank becomes too disturbing. This finding lends support to Alan Blinder's (2007, p. 114) famous dictum: "A central bank that speaks with a cacophony of voices may, in effect, have no voice at all".

The loss of effectiveness is mostly due to the weaker response of the expectations component of long-term rates, not the adjustment of the term premium. We also distinguish easing and tightening shocks along the lines of Tenreyro and Thwaites (2016). In line with our expectations, we find that the loss of policy effectiveness is largest if the ECB eases monetary conditions at a time of strong disagreement. This might explain the perception of policy ineffectiveness at the height of the euro area debt crisis, where the Bundesbank fiercely opposed unconventional measures adopted by the ECB. The results are robust with respect to several modifications of the model and bear important policy implications, which we will discuss below. The results can be rationalized in a simplistic textbook model of the expectations hypothesis of the term structure. Suppose strong internal disagreement implies that a given policy measure will be revoked sooner than expected, that is, the perceived persistence of policy shock falls. For a wide range of maturity combinations we show that the response of the yield spread should indeed be smaller if the perception of policy persistence declines.

This paper is related to several strands of the literature. First, a large field of the literature uses sentiment analysis to quantify the information content of central bank speeches derived using specialized dictionaries such as the Loughran-McDonald word

⁵This data is taken from Geiger and Schupp (2018).

list.⁶ In most of these papers, the focus is on how the tone of communication affect asset prices (e.g. Hubert and Labondance, 2017; Schmeling and Wagner, 2017; Neuhierl and Weber; 2016). In our paper, we do not study the effect of tone as such, but the interaction of tone with a monetary policy shock. Hubert and Labondance (2017) classify the sentiment of FOMC communication and provide empirical evidence on the effects of unexpected changes in the sentiment of policymakers on the term structure of interest rate expectations.⁷ Schmeling and Wagner (2017) show that the tone of central bank communication affects asset prices even after controlling for fundamentals and policy actions. The effect is mostly transmitted through an adjustment of risk premia. The authors also use the Loughran and McDonald (2011) word list for their analysis. In a similar vein, Neuhierl and Weber (2016) provide evidence for the explanatory power of the tone conveyed in speeches of the FOMC chair for the slope of the term structure of US interest rates.

A second strand studies the loss in policy effectiveness under disagreement. Ricco et al. (2016) show that the transmission of fiscal policy weakens when forecasters disagree. Hoffmann and Hürtgen (2016) and Falck et al. (2017) provide evidence in favor of a loss in the effectiveness of monetary policy in the presence of forecast disagreement. Both papers study the disagreement of forecasters about future policy. In our paper, in contrast, the focus is on disagreement among policymakers themselves.

Four papers are very closely related to our project. Results provided by Ehrmann and Fratzscher (2013) suggest that more consistent communication of members of monetary policy committees improves markets' ability to predict future interest rates. The dispersion of communication across committee members explains a substantial part of the prediction error. The work of Detmers (2016) addresses forward guidance announcements of the Fed. She finds that high disagreement of policymakers' interest rate projections leads to stronger responses of interest rates to macroeconomic news announcements. This is consistent with the view that forward guidance becomes less credible. Madeira and Madeira (2015) estimate the response of stock prices to FOMC announcements and distinguish between unanimous policy decisions and policy decisions accompanied by dissenting votes of FOMC members. As a result, equity markets rise in the first case and fall in the latter. Lastly, Andrade et al. (2017) present a New Keynesian model with heterogeneous agents, who

⁶An alternative to dictionary-based approaches to text mining are methods from computational linguistics. Hansen and McMahon (2016) use a Latent Dirichlet Allocation-approach to split FOMC communication into different topics. They show that changes in the frequencies of selected topics have effects on financial markets.

⁷Gertler and Horvath (2018) provide high-frequency evidence for the effect of speeches by members of the ECB's Governing Council on financial markets.

interpret policy differently. The authors argue that monetary policy, in particular forward guidance at the zero lower bound, becomes less effective if the ambiguity of policy signals increases.

The remainder of this paper is organized as follows: section two introduces our data set and explains how we derive a measure of the different narratives of Bundesbank and ECB presidents. In section three, we explain our baseline model, whose results are shown in section four. In order to facilitate the interpretation of our findings, section five sketches a toy model about the term structure of interest rates. Sections six and seven address the role of tightening and easing shocks and different levels of uncertainty conveyed in central bank speeches. A summary of the main results and conclusions for monetary policy are given in section eight. An appendix contains additional information on the analysis of the speeches.

2 Inferring diverging tones from speeches

In this section, we illustrate how we measure the tone of speeches by the Bundesbank and the ECB president, respectively. Naturally, tone is a diffuse concept, in particular when applied to the complex world of central banking. While several papers use measures of tone to describe the communication among stock market investors or financial analysts, where optimism and pessimism could be pinned down to sentiment about future performance, optimism and pessimism do not have a natural meaning in the realm of central banking. Our objective is not to interpret the level of tone of each speech, but to quantify the sentiment difference between ECB and Bundesbank communication. Hence, even if tone is an elusive concept, the relative tone of the ECB compared to the Bundesbank might still be informative.

2.1 ECB and Bundesbank speeches

The data set consists of all speeches delivered by the presidents of the ECB and the Bundesbank, respectively, since 1999. This amounts to 907 speeches, 558 of which were given by the ECB presidents and 349 by the presidents of the Bundesbank. These speeches cover a range of topics from monetary policy to financial stability and the institutional design of the euro area. Since financial stability is intertwined with central banking and the future of the euro area, not least since the financial crisis, we use speeches on all available topics.

As a matter of fact, giving a speech is not the only format of central bank communication. For the ECB president, the primary communication device is the introductory statement to the press conference after the meeting of the Governing

Council, in which the ECB president explains the policy decision. However, there is no similar format available for the Bundesbank president. Therefore, we focus on a communication format which is available to both institutions' presidents.

Since speeches by other members of the Executive Boards of both institutions, compared to speeches by the presidents, receive far less attention by financial markets and the media, we restrict the analysis to the respective presidents' speeches. In this paper, we use speeches from the ECB and the Bundesbank only. The primary reason for this is that the presidents of both institutions are the main protagonists in the Governing Council and lead the debate about monetary policy in the euro area. The second reason is that presidents of other important banks of the Eurosystem, among them the Banque de France and the Banca d'Italia, give fewer speeches and, in particular in the early years of the euro, gave speeches in their local language, for which we do not have a sentiment dictionary available.

The online appendix shows the number of speeches per months with a 12-month moving average. These moving averages show that both presidents increased their communication activities in crisis times with the ECB president starting to give more speeches in 2007 and the Bundesbank president raising the number of speeches after the outbreak of the European debt crisis in 2010.

2.2 Measuring the tone of speeches

Quantifying the content of a text relies on concepts such as "tone" and "sentiment".⁸ While there is no natural meaning of a positive or negative tone in the context of central banking, it is important to stress that we do not want to over-interpret the measure of tone. Rather, we want to calculate the differences in tone between the speeches of the ECB presidents and the Bundesbank presidents.

To quantify the sentiment of each speech, we rely on a textual analysis based on specialized dictionaries. Before we can draw on these dictionaries, a few preparatory steps are needed: First, uploading the text files to **RAPIDMINER STUDIO**. Second, splitting text into tokens, i.e. words, by eliminating punctuation and converting all to small caps. Third, eliminating stop words. Fourth, computing how often each word appeared in each text. Fifth, using **STATA** to count the number of positive and negative words as well as the total number of words in a speech.

The speeches given by the ECB presidents are available in English. For these

⁸Topic modelling by means of a Latent Dirichlet Allocation approach is often used to measure the extent to which the central banks refers to certain concepts, such as inflation and unemployment. It is less useful in our context as we ultimately aim to quantify the cacophony expressed in speeches.

speeches, the Loughran and McDonald (2011) dictionary is our primary tool.⁹ It consists of a selection of words which convey a positive or negative sentiment in financial applications. In section seven, we also use the list of words which express uncertainty. The speeches delivered by the presidents of the Bundesbank are available in German. We draw on the Bannier et al. (2018) dictionary of German words, calibrated to financial applications.¹⁰ This dictionary is a German adaption of the Loughran-McDonald word list.

For each central bank $i = ECB, BuBa$, we construct two alternative measures of tone, which are bounded between -1 and +1,

$$Tone_{1,t}^i = \frac{\#pos_t^i - \#neg_t^i}{\#pos_t^i + \#neg_t^i}$$

and

$$Tone_{2,t}^i = \frac{\#pos_t^i - \#neg_t^i}{\#total_t^i},$$

where $\#pos_t$ and $\#neg_t$ is the number of positive and negative words, respectively, and $\#total_t$ is the total number of words in each speech. In the first measure, tone is scaled by the clarity of tone measure, i.e. the sum of positive and negative words. A higher number reflects a more positive tone conveyed by a given speech. For $Tone_t^i = 0$, the sentiment stance is neutral. The first measure of tone, $Tone_{1,t}^i$ normalizes the difference between positive and negative sentiment by the number of words identified by the dictionaries, while the second, $Tone_{2,t}^i$ use the total number of words in the denominator. Across institutions, the tone measures are positively correlated. The correlation is 0.29 for $Tone_{1,t}^{ECB}$ and $Tone_{1,t}^{BuBa}$ and 0.31 for the institution-specific $Tone_{2,t}^i$ measures.

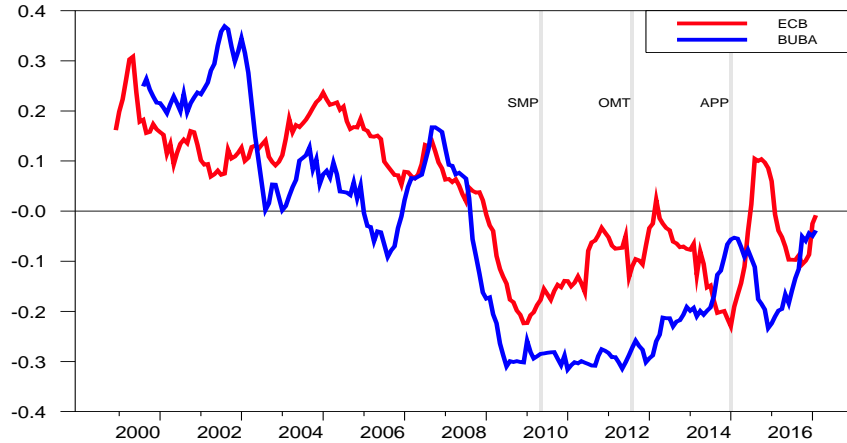
The 20 most frequently identified words, which express either a positive or a negative sentiment, are listed in the online appendix. We also list the 20 most frequently used words which reflect uncertainty, which we will exploit below. We provide this list separately for ECB and Bundesbank speeches, suggesting that both institutions draw on broadly similar words.

After classifying the sentiment score of each speech, we aggregate the information to a monthly series. If there is more than one speech per month, we use the average sentiment score across speeches. In months without a speech, typically in August, we maintain the sentiment level conveyed by the previous speech, i.e. for August we use the July score. The assumption is that if the president had wanted to convey an

⁹For this dictionary, see https://www3.nd.edu/~mcdonald/Word_Lists.html.

¹⁰This dictionary is available here: https://www.uni-giessen.de/fbz/fb02/forschung/research-clusters/bsfa/textual_analysis.

Figure 2: Tone conveyed in presidents' speeches



Notes: $Tone_{1,t}^i$ series for $i = ECB, BuBa$. The shaded areas indicate the SMP, OMT and APP programs, respectively.

adjusted sentiment, he would have given another speech. Finally, since the resulting series of tone are very erratic, we use a 12-month moving average of the tone for each central bank. This prevents that a single speech, possibly on a specialized topic, drags the tone series too much into the positive or negative terrain and should also limit the impact of a month without a speech.

We construct a measure of sentiment divergence from the tone series. Our baseline measure is the absolute difference of tone between the ECB and the Bundesbank, i.e.

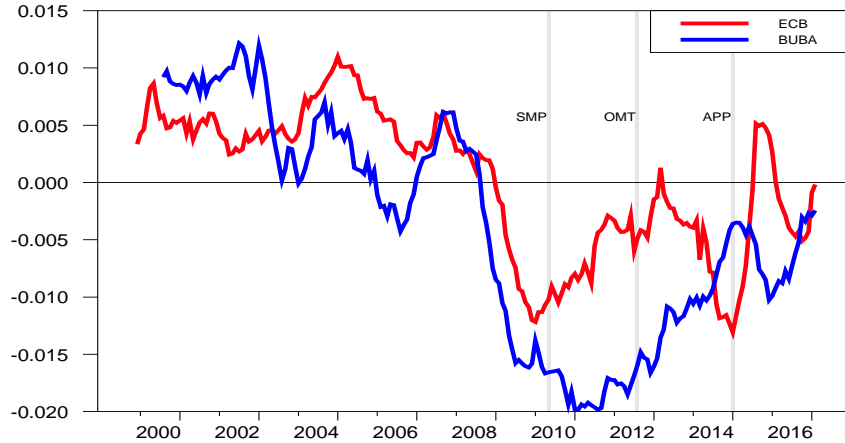
$$div_t = |Tone_{j,t}^{ECB} - Tone_{j,t}^{BuBa}|.$$

for $j = 1, 2$. We remain agnostic about the sign of the sentiment gap, i.e. we do not distinguish between the ECB or the Bundesbank being more optimistic. The assumption is that it is the extent of disagreement among senior policy makers as such, that impacts policy transmission, not whether one institution or the other is more optimistic or pessimistic.¹¹

Since we use two different dictionaries, an English one for the ECB speeches and a German one for the Bundesbank speeches, we need to check the consistency of both dictionaries. We want to avoid that the tone of a speech is biased only because it

¹¹Azzimonti (2018) uses information from newspaper articles to construct an index of partisanship in U.S. politics. She shows that partisan disagreement reduces private investment. Few papers so far study the gap between two (financial) sentiment proxies. Baker et al. (2012) look at the gap between global and local sentiment and its role for stock market comovement. Cookson and Niessner (2016) construct a disagreement measure based on the sentiment expressed in a social network of investors. Dzielinski and Hasseltoft (2015) interpret disagreement as the dispersion in the tone of firm-specific news.

Figure 3: Tone conveyed in presidents' speeches



Notes: $Tone_{2,t}^i$ series for $i = ECB, BuBa$. The shaded areas indicate the SMP, OMT and APP programs, respectively.

is evaluated according to one or the other dictionary. Consider the word "crisis" ("Krise"), which ranks at the top of the list of negative words used by both institutions. In English, the expression "financial crisis" is reflected in the word count of the word "crisis", while the German word "Finanzkrise" is a separate entry in the list. Such differences in counting could potentially bias the tone measure. For that reason we cross-check the consistency of the dictionaries based on the 54 Bundesbank speeches, for which an official English translation is available. We calculate the tone score for these speeches using both dictionaries. The correlation between the tone based on the Loughran-McDonald dictionary and based on the Bannier et al. (2018) dictionary is 0.78. Although scores across both languages are not perfectly correlated, we are confident that the German speeches do not bias the overall tone of Bundesbank communication. The online appendix to this paper contains additional information on the comparison of the two dictionaries in all four dimensions, i.e. the number of positive and negative words, the measure of tone and the measure of uncertainty.

2.3 ECB vs Bundesbank

The series of tone for the Bundesbank and the ECB are shown in Figures (2) and (3). We find that both measures vary strongly over the sample period. Three key observations stand out. First, there was a level shift in tone corresponding to the global financial crisis in 2008/9. Before 2009, both institutions' tone was positive, i.e. speeches contained more positive than negative words. After 2009, tone is negative, i.e. the negative words dominate. Second, before the financial crisis, there

was no systematic sentiment gap between the respective presidents.¹² It is striking, though, that after 2004 when Axel Weber became president of the Bundesbank, his communication became more negative than that of his ECB counterpart. Third, the relative tone of both institutions changed after 2009. Since 2009, with a short break in 2014, the Bundesbank’s communication is more negative than the ECB’s. A large sentiment gap opens up, which widens with the outbreak of the European debt crisis.

The graphs also highlight three important policy announcements, namely the adoption of the Securities Markets Programme (SMP) in 2010, the Outright Monetary Transactions (OMT) in 2012 and the Asset Purchase Programme (APP) in 2015. In the aftermath of each announcement, the sentiment gap widens.

It is conceivable that a fraction of the divergence of tone between Bundesbank and ECB is due to the different cyclical positions of the euro area and the Germany economy.¹³ Although the Bundesbank president, in his capacity as a member of the ECB’s Governing Council, should formulate policy based on euro area aggregates, his views could be affected by less-than-perfectly synchronized business cycles. We control for cyclical differences by regressing the disagreement measure on the differences between inflation and unemployment in the euro area and the German economy, that is,

$$div_t = \beta_0 + \beta_1 (\pi_t^{EA.exDE} - \pi_t^{DE}) + \beta_2 (u_t^{EA.exDE} - u_t^{DE}) + \varepsilon_t \quad (1)$$

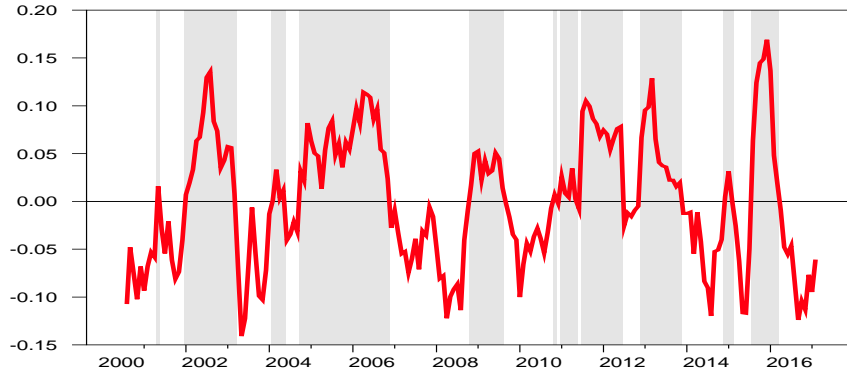
where $\pi_t^{EA.exDE}$ and $u_t^{EA.exDE}$ are inflation and unemployment in a hypothetical euro area which excludes Germany, where π_t^{DE} and u_t^{DE} are the German counterparts for inflation and unemployment.¹⁴ The R^2 of this simple regression, see Table (1), suggests that we can explain between 13% and 25% of the variation in sentiment in terms of diverging cycles. Divergence increases significantly if the gap widens between euro area inflation and German inflation. If unemployment in the hypothetical euro area exceeds unemployment in Germany, divergence intensifies. In the following, we use the unexplained part of this regression as our measure of divergence. It should be emphasized that all our results survive if we do not control our measure disagreement for differences in the business cycles. In fact, the state-dependence of the policy shock slightly increases in this case.

¹²Jansen and de Haan (2006) use pre-crisis data to show that while initially contradicting, statements by ECB officials became more in line later.

¹³Hayo and Neuenkirch (2013) and Bennani and Neuenkirch (2017) find a home bias in speeches of central bankers. They seem to adjust the tone of their speeches according to the cyclical conditions in their constituency.

¹⁴The hypothetical euro area series are constructed using the annual GDP weights, which are available on the ECB’s website.

Figure 4: Divergence of tone between Bundesbank and ECB



Notes: Divergence measured as the absolute difference of ECB and Bundesbank tone based on $Tone_{1,t}^i$, controlled for cyclical differences between Germany and the rest of the euro area. In shaded episodes, divergence is above the sample mean.

Our baseline measure of tone divergence, the absolute difference between the two tone-measures controlled for cyclical differences in inflation and output, ε_t , is shown in Figure (4). The graph shows that divergence exhibits strong fluctuations since 1999 and peaked in 2002, 2006 and after 2012, at the height of the euro area debt crisis. Episodes with above-average disagreement are shown in the graph as shaded areas. We will use these episodes below to separate a high- from a low-disagreement state.¹⁵

Table (2) reports the average tone and divergence over the tenure of each president and the overlapping tenures of Presidents Welteke (Bundesbank) and Duisenberg (ECB), Weber (Bundesbank) and Trichet (ECB) and Weidmann (Bundesbank) and Draghi (ECB), respectively. For each subsequent ECB and Bundesbank president, the tone of speeches becomes more pessimistic. The disagreement between both institutions peaks under the current Weidmann-Draghi conflict (for $Tone_{1,t}$) or the Weber-Trichet tenure (for $Tone_{2,t}$).

Overall, the results illustrate how different the communication of monetary policy has been among the leading protagonists of policy making. In the following, we assess whether the sentiment gap affected the way monetary policy is transmitted to long-term interest rates.

¹⁵Divergence based on $Tone_{2,t}$ is not shown to save space. The resulting dynamics of disagreement are very similar to that obtained from $Tone_{1,t}$.

3 Model

Our aim is to assess the extent to which divergence among policymakers impairs the transmission of policy impulses to long-term interest rates. Since long-term rates determine the refinancing conditions for households and firms, the transmission to the yield curve is the core of the transmission mechanism to the rest of the economy. We use local projections (Jordà, 2005) as a very flexible framework to estimate the impact of policy conditional on disagreement. In its most basic form, the model explains a dependent variable y_t measured h periods ahead by a constant α_h , a monetary policy shock at time t , ε_t , and a set of q lags of control variables, \mathbf{x}_t ,

$$y_{t+h} = \alpha_h + \beta_h \varepsilon_t + \delta_h' \sum_{s=1}^q \mathbf{x}_{t-s} + u_{t+h}. \quad (2)$$

Plotting β_h as a function of $h = 0, \dots, 12$ provides us with an impulse response function. We follow Jordà (2005) and apply a Newey-West correction to our estimation errors. The maximum lag for the Newey-West correction is set to $h+1$. The Newey-West corrected errors are used to construct confidence bands around our estimates. Local projections of this form are frequently used in the recent macroeconomic literature. This is due to their flexibility to encompass all sorts of non-linear and asymmetric adjustment, as it will become clear below.

It remains to choose the variables and the monetary policy shock, respectively. The dependent variable is the euro area Overnight Index Swap (OIS) rate of maturity n for $n = 1, 2, 5, 10$ years, taken from Geiger and Schupp (2018). The OIS rate corresponds to the risk-free euro area interest rate, which is not affected by either credit risk or a flight-to-safety premium such as German Bund yields. Hence, our results are not driven by the euro area debt crisis or sovereign spreads, respectively. Likewise, our results are not driven by the safe-heaven status of German yields. Geiger and Schupp (2018) also provide us with the components of each OIS rate at maturity n , that is, the expectations component and the estimated term premium. For the overall OIS rate and the two subcomponents, we estimate the model separately for each maturity n .

The vector of control variables contains the euro area inflation rate, measured as the year-on-year change of the HICP in percentage points, the unemployment rate and the (log) CISS index of systemic financial stress. We include one lag of each control variable. Following Ramey (2016), we also include one lag of the monetary policy shock in the vector of controls.

In contrast to vector autoregressive models, in which we can simultaneously identify policy shocks and estimate their impact on the macroeconomy, using local projec-

tions requires us to identify policy surprises prior to estimation. We use a measure of policy shocks which is model free and purely measured by market reactions. In particular, we use the change in Euribor Futures at each meeting day of the Governing Council plus a few special days on which important policy measures were announced, i.e. the announcement of the two tranches of the Securities Markets Programme (SMP) on October 5, 2010 and July 8, 2011, as well as President Draghi’s ”Whatever-it-takes”-speech on July 26, 2012.

At time t , the Futures incorporate all information about expected future monetary policy. The change at the meeting day should reflect the new information emerged from the meeting of the Governing Council. The assumption is that on meeting days of the Governing Council, Futures change only as a results of new information about future monetary policy. Since we do not have intraday Futures data available, with which we could narrow the observation window to the announcement and the subsequent press conference, the daily change seems to be a reasonable approximation to the true policy surprise. We take the surprise series from Hafemann and Tillmann (2018), where we show that the change in Futures prices does indeed contain new information about monetary policy.¹⁶ We plot the surprise series in Figure (15). Given that the shock is available since January 2002, our estimation sample is 2002:1 to 2017:2.

Thus far the model does not yet distinguish between episodes of high and low disagreement among policymakers. In order to condition the effect of shocks on the extent of divergence, we use an indicator variable, I_t , which equals one if the divergence of tone is above the sample mean and zero otherwise,

$$I_t = \begin{cases} 1 & \text{if } \widetilde{div}_t > 0 \\ 0 & \text{otherwise,} \end{cases} \quad (3)$$

where \widetilde{div}_t is the demeaned divergence measure, i.e. the demeaned residual from regressing div_t on relative inflation and relative unemployment rates, measured in standard deviations.¹⁷ The idea is that markets and the public are used to some sort of average disagreement. If the relative tones diverges from this historical average, however, they adjust their assessment of future policy and, as a consequence, price assets differently. The model can now be generalized to

$$y_{t+h} = \alpha_h + I_t \beta_h^{high} \varepsilon_t + (1 - I_t) \beta_h^{low} \varepsilon_t + (\delta_h)' \sum_{s=1}^q \mathbf{x}_{t-s} + u_{t+h}. \quad (4)$$

¹⁶We use the Euribor Future that is the 12th next to deliver at any point in time, so that the delivery month is roughly two years ahead.

¹⁷The results remain unchanged when we use disagreement in $t - 1$ to separate the states.

The estimated β_h^{high} reflects the impact in the high-divergence state while β_h^{low} is the dynamic multiplier in the low-divergence state.¹⁸ It is important to recognize that we do not need to assume that the system remains in the high- or low-divergence state throughout the entire adjustment. It is enough to be in either state at the moment of the policy shock.

4 Results

The resulting impulse response functions for OIS rates and their components are shown in Figures (5), (6) and (7). All figures show the response to a 100bp policy shock. Due to the symmetry of the model, the response to a policy easing can be obtained by flipping the impulse response function on the horizontal axis.

Yields of all maturity, see Figures (5), increase after the policy tightening. On impact, the response is strongest at the short end of the yield curve.¹⁹ Most importantly, the extent of divergence between the Bundesbank and the ECB communication matters. If divergence, at the time of the shock, is below its long-run average, the responses are given by the black, dotted line. For divergence above the sample mean, the response is given by the green, dotted line. Both lines are surrounded by 90% confidence bands. In the high divergence state, the response is much weaker than in the low divergence state. This is the main result of this paper. Put differently, the central bank loses a large part of its ability to drive long rates if the opposition to its policy measures is fierce. Under high divergence, the response quickly reverts back to zero, while under low divergence the policymaker is able to affect yields for quite some time. For maturities of 5- or 10-years, respectively, the difference between both states disappears.

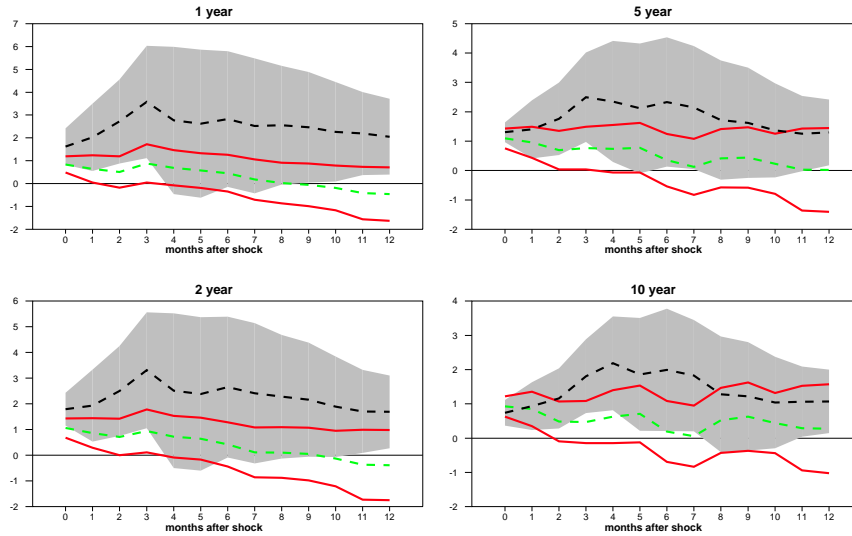
One advantage of the data set on OIS rates is that we can also use the expectations component and the estimated term premium for each maturity. Figure (6) shows the response of the expectations components to the shock, again conditional on being in a high- or low-divergence state at the time the shock occurs. The state-dependence is slightly stronger than for the OIS yields. Again, policy loses its ability to drive-up yields through a policy tightening if divergence is high. Hence, our findings are primarily driven by the adjustment of expectations about future policy rates rather than the change of term premia after the policy surprise.

Figure (7) reports the responses of the estimated term premia for each maturity. In

¹⁸In this model, only the β_h coefficient is allowed to be state-dependent. We can also allow the constant and the coefficient vector on the control variables to switch across states. The results, however, do not differ from those derived from the model presented here.

¹⁹We will elaborate on the responses across the maturity spectrum below.

Figure 5: Response of OIS yields



Notes: The black (green), dashed line is the response if divergence is low (high). The confidence bands are constructed using 1.65 standard errors.

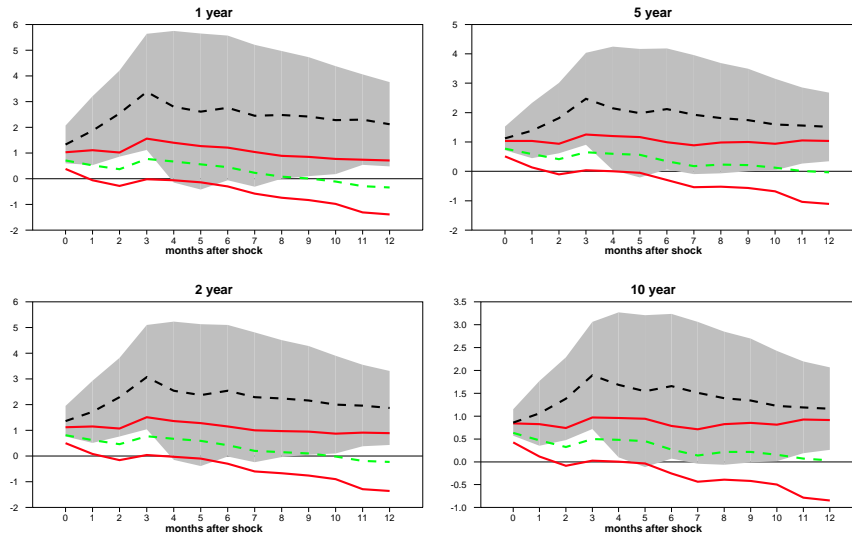
contrast to the responses of overall yields and the expectations components, we do not find systematic differences across high- and low-divergence states. Term premia at the short end of the yield curve increase after a policy tightening, while premia at the 10-year maturity do not respond significantly. Hence, the state-dependent responses of OIS rates stem almost entirely from the adjustment of the expectations component.

Whether or not the impulse response are statistically significant across the high- and low-divergence states can best be evaluated based on a t -statistic. Figure (8) plots the t -statistic for the null hypothesis $\beta_h^{high} = \beta_h^{low}$ for each h and for the three dependent variables. We find the impulse responses to be significantly different for the expectations components two and three months after the shock and, to a lesser extent, the OIS yield. Differences in the responses of the term premium, however, are statistically significant on impact only at the very short end of the maturity spectrum.

Alternative distinction of states

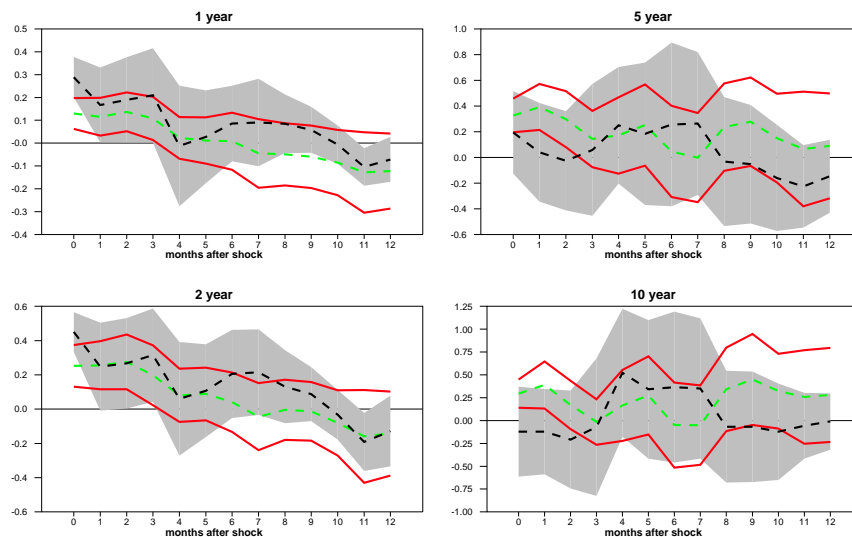
Since much of the ECB-Bundesbank divergence of tone occurred during and after the European debt crisis, it could be argued that the weaker transmission reflects the crisis-state, not a high-divergence state. In this case our indicator variable, which separates a high- from a low-divergence state, simply picks up the pre- and post-crisis distinction. To rule out such an alternative interpretation of our findings,

Figure 6: Response of OIS expectations components



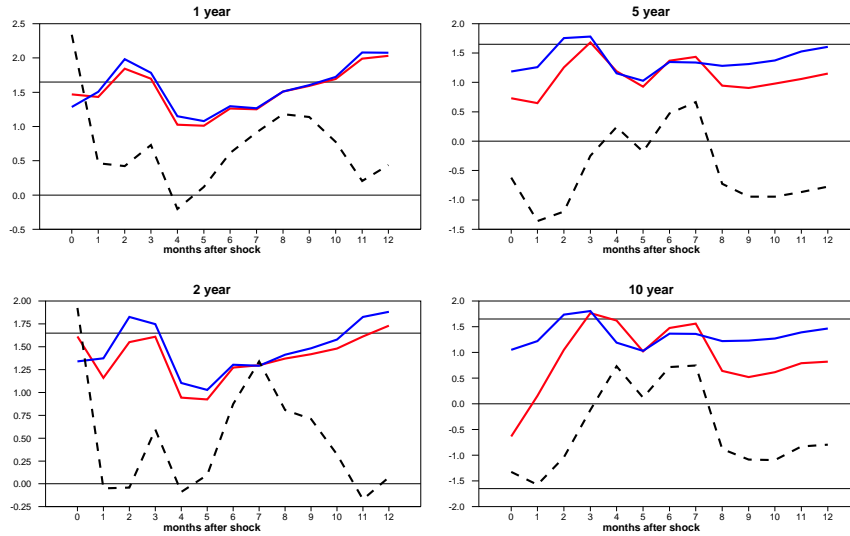
Notes: The black (green), dashed line is the response if divergence is low (high). The confidence bands are constructed using 1.65 standard errors.

Figure 7: Response of OIS term premia



Notes: The black (green), dashed line is the response if divergence is low (high). The confidence bands are constructed using 1.65 standard errors.

Figure 8: Testing for significant differences across states



Notes: The graph shows the t -statistics for each maturity for the null hypothesis of equal responses of OIS yields (red), expectations components (blue) and term premia (black, dashed) in the high- and low-disagreement state. The horizontal lines are the ± 1.65 critical values.

we replace I_t by

$$I_t^{crisis} = \begin{cases} 1 & \text{if } t > 2010 : 1 \\ 0 & \text{otherwise,} \end{cases}$$

which separates the period after the outbreak of the European debt crisis from the pre-crisis period. All other elements of the model remain unchanged. Figure (16) plots the resulting impulse response functions. We find no significant difference in the responses across the pre- and post-crisis state. Hence, we conclude that the weaker transmission in states of strongly diverging narratives is not a mere reflection of the post-2010 crisis episode in Europe.

Alternatively, two states could be separated based on the notion of a high- and low-volatility state, respectively. We use the sub-component of the CISS index, the ECB's measures of systemic stress in the financial system, that describes realized bond market volatility to distinguish a regime with above-average and below-average bond market volatility and to define I_t^{vola} appropriately. Figure (17) depicts the resulting impulse responses. As for the pre- and post-2010 separation of regimes, the interest rate responses do not differ significantly across states. Hence, the shift in transmission of policy shocks found in this section is not due to systematic shifts in bond market volatility.

Is diverging tone among policymakers reflecting a broader notion of policy uncer-

tainty perceived by financial markets? To find out, we replace the demeaned divergence measure by an index of economic policy uncertainty for the euro area. This index is constructed using the Baker et al. (2016) newspaper-based uncertainty indicators for Germany, France, Spain and Italy. After weighting each country according to the ECB's GDP weights, we obtain an index for the euro area. However, we do not find significant differences in the responses of yields in states of high and low policy uncertainty.

Finally, we differentiate regimes based on the tone level expressed in ECB speeches or, alternatively, the average tone level of the Bundesbank and the ECB. An optimistic regime, in which the tone is above the sample average, is distinguished from a pessimistic regime. The results do not yield significant impulse responses for states of pessimism and optimism of the ECB alone or the respective states for the average tone of the ECB and the Bundesbank. These results are not shown in this paper.

Alternative series of shocks

Our baseline monetary policy shock is defined as the change in Euribor Futures on meeting days of the Governing Council. A common criticism points to weaknesses of this measure. The first is the fact that the Futures market in the euro area is relatively thin, at least when compared to the Fed funds Futures market, such that the change in liquidity premia could potentially affect the measurement of the surprise component of policy changes. The second caveat is the presence of the zero lower bound, which might also be expected to bind in the future, such that the change in Futures cannot reflect the full extent of easing shocks. To address both concerns, we also use the change in two-year German Bund yields on Governing Council days as a measure of the policy surprise.²⁰ The two-year Bund is much more liquid, and its yield is less affected by the zero lower bound. The results, which are not shown here in order to save space, are indistinguishable from our baseline findings.

Distribution of shocks

To close this section, we want to rule out that the state-dependence of the policy transmission is due to the shock distribution being different across the high- and low-divergence states. Figure (18) plots the Kernel density for the monetary policy shock in the two states, i.e. for high and low disagreement. Indeed, the distribution looks very similar in both states. Although the means of both distributions differ slightly, formal tests of equality of the mean and the variance of both distributions, respectively, fail to reject the null hypothesis of equal moments. Hence, our results

²⁰This series is also taken from Hafemann and Tillmann (2018).

are not driven by systematic differences in shock sizes or variances across states. Larger divergence between the ECB and the Bundesbank communication does not seem to result in systematically larger or smaller policy shocks.

Controlling for the level of tone

The baseline model presented before employs the extent of divergence between the ECB and the Bundesbank as an indicator of two alternative states. We do not include the level of tone in the vector of control variables. It could be argued, however, that the tone of the ECB communication is an important driver of interest rates which affects markets on non-meeting days. For this reason we now present results from an alternative model in which we include the contemporaneous ECB tone and the extent of divergence as additional control variables. Figure (19) depicts the resulting impulse response functions. Since we do not find marked differences compared to the baseline model specification, we conclude that the level of tone does not add much information beyond what is already included in the controls.

The role of negations

A dictionary-based text analysis, such as the one adopted in this paper, counts the number of positive and negative words, respectively. It is unable to take account of the context in which these words appear. In particular, the method is unable to distinguish the mere appearance of positive word from the negation of a positive word. The number of positive words increases if the word "progress" is found or if "no progress" is detected. In the following, we want to minimize the risk that negations of positive words bias our measures of tone. To accomplish that, we follow Schmeling and Wagner (2017) and calculate an alternative measure of tone based on the number of negative words only. The idea is that negations of negative words are much less common than negations of positive words. We calculate

$$Tone_{neg,t}^i = 1 - \frac{\#neg_t^i}{\#total_t^i}$$

for each central bank i . The higher $Tone_{neg,t}^i$, the more positive is the tone expressed in a given speech. Figure (10) shows this tone-measure for the ECB and the Bundesbank. All previous findings remain unaffected by the modification of the calculation of tone. We still find the level-shift in 2008 and the tone-gap since 2010. Figure (11) presents the impulse responses of OIS yields in the high- and low-disagreement states when we calculate divergence as the absolute difference of $Tone_{neg,t}^i$ for the ECB and the Bundesbank. We still find that monetary policy shocks are more effective in the low-divergence state. Hence, our baseline result

does not seem to be strongly affected by the problem of counting negated positive words and unambiguously positive.

5 A simple mechanism

In this section, we sketch a simple mechanism that delivers results which are consistent with our evidence. We draw on a textbook description of the Expectations Hypothesis of the term structure of interest rates and combine it with an exogenous process for the short rate.

Let i_t^n be the yield on an n period bond with $n > m > 1$. The Expectations Hypothesis holds, i.e. the term premium is absent

$$i_t^n = \frac{1}{n} E_t \sum_{i=0}^{n-1} i_{t+i}.$$

The three-months (shadow) short rate controlled by the central bank follows an AR(1) process, $i_t = \rho i_{t-1} + \varepsilon_t$, with $0 < \rho < 1$. The autoregressive coefficient ρ is the perceived persistence of the shock. For the ease of exposition, we disregard the zero lower bound on nominal interest rates. The three-month rate constitutes the short end of the yield curve, such that the time interval is one quarter. The monetary policy shock is ε_t , which has a mean of zero. Before period t , the short-rate is zero.

Using the formula for a finite geometric series, the slope of the term structure, i.e. the difference between yields on n - and m -period bonds can be written as

$$i_t^n - i_t^m = \frac{\frac{1}{n}(1 - \rho^n) - \frac{1}{m}(1 - \rho^m)}{1 - \rho} \varepsilon_t \quad (5)$$

which is, for all values of n and ρ , a negative function of the shock. A tightening shock raises short rates more than long rates, such that the yield curve becomes flatter. Figure (20) plots the response of the yield spread to a monetary policy shock of $\varepsilon_t = 1$ as a function of ρ and n for $m = 4$. Hence, the lower end of the spread is the one year-rate, which is consistent with our data set.

Our simple assumption is that disagreement among policymakers about future policy makes a reversal of the policy measure more likely. Without the pressure from dissenting policymakers, a policy would remain in place for a longer period of time. Put differently, under strong disagreement a monetary policy shock should be perceived as less persistent, i.e. ρ should be smaller.

Figure (20) shows that for an intermediate degree of shock persistence, a lower perceived ρ makes policy less able to flatten the yield curve. Hence, we should expect that if ECB-Bundesbank dissent is virulent, monetary policy shocks lose their ability to flatten the yield curve.

According to our working hypothesis, stronger internal opposition should lead to a smaller perceived persistence. This should, for a large region of the parameter space, translate into a smaller response of the spread between long and short rates to a monetary policy shock.

To contrast this prediction with the data, we re-estimate our baseline model and use the slope of the term structure as our dependent variable. We use three alternative slopes with the one-year OIS rate as the short-end, i.e. the differences between 10-year and 1-year, 5-year and 1-year as well as 2-year and 1-year rates. To remain consistent with the simple mechanism sketched before, we use the expectations components of yields only in order to avoid the results being obscured by movements in the term premium.

Figure (21) shows the resulting impulse response functions for the first measure of tone. For all pairs of maturities, we find large and significant differences across both divergence states. If policymakers' tone diverges less than on average, a policy tightening flattens the yield curve. Yields at short maturities rise more than yields on long maturities, such that the term structure becomes flatter. The slope between the longest and shortest maturity responds strongest. If divergence at the time of the shock is larger than on average, however, the central bank is no longer able to determine the slope of the yield curve. We can again confirm that strong disagreement harms the effectiveness of monetary policy. This is consistent with the implication of the illustrative model presented before.

It should be noted that our measure of divergence is not correlated with a deterioration of future macroeconomic fundamentals. If disagreement leads forecasters to revise their forecasts downwards, this could be another channel through which disagreement impacts interest rate expectations. We use revisions of the mean inflation forecast from the ECB's Survey of Professional Forecasters (SPF). The correlations between the revision at time t of inflation expectations one year ahead or the next calendar year, respectively, as well as disagreement at t are below $|0.05|$.

6 Tightening vs easing

While the previous results suggest that monetary policy becomes less effective under strong disagreement, we now want to dissect this finding into smaller bits. In light

of the European debt crisis, it seems likely that the Bundesbank-ECB dissent was particularly large at times of expansionary policies and smaller at times of tightening steps. Hence, our results could be dependent on the sign of the policy surprise. In order to shed light on this, we first need to modify our baseline model to allow the transmission to be asymmetric across policy directions.

We distinguish contractionary, $\max[\varepsilon_t, 0]$, and expansionary policy shocks, $\min[\varepsilon_t, 0]$, along the lines of Tenreyro and Thwaites (2016). We then modify the model and let the coefficient β_h be different according to the sign of the shock. The coefficient β_h^+ (β_h^-) reflects the impact of a tightening (easing) shock.

In a slight deviation from the model used before, we do not distinguish between a high- and low-disagreement regime. The notation would become too clumsy since we would need to distinguish four cases, the two states and the two signs of the shock. Instead, we let the monetary policy shock interact with the extent of disagreement, such that the model becomes

$$y_{t+h} = \alpha_h + \beta_h^+ \max[\varepsilon_t, 0] + \gamma_h^+ \left(\max[\varepsilon_t, 0] \times \widetilde{dis}_t \right) + \beta_h^- \min[\varepsilon_t, 0] + \gamma_h^- \left(\min[\varepsilon_t, 0] \times \widetilde{dis}_t \right) + \delta'_h \sum_{s=1}^q \mathbf{x}_{t-s} + u_{t+h}. \quad (6)$$

The coefficients on the interaction term with disagreement, γ_h , depend on the sign of the shock. The total response to a tightening policy shock is

$$\frac{\partial y_{t+h}}{\partial \varepsilon_t} = \beta_h^+ + \gamma_h^+ \times \widetilde{dis}_t, \quad (7)$$

and equivalently for an easing shock. In this model, β represents the unconditional effect of the shock whereas γ is the effect conditional on the size of disagreement. The responses are asymmetric across the sign of the shock if $\beta_h^+ \neq \beta_h^-$ or $\gamma_h^+ \neq \gamma_h^-$. In order to simplify the interpretation, we plot β_h^+ , $-\beta_h^-$, $-\gamma_h^+$ as well as $-\gamma_h^-$ for disagreement being one standard deviation *below* the sample average and two standard deviations *above* the sample mean.

To save space, Figure (22) reports the results for the two-year maturity only.²¹ The figure shows the adjustment of the OIS rate, the expectations component and the term premium following a tightening and an easing shock, respectively. The results support our notion that the weaker transmission stems from the easing side of policy actions. For a tightening shock the unconditional response and the responses conditional on high and low disagreement lie inside the shaded area, the confidence band around the unconditional response. Hence, the patterns of adjustment are not

²¹Results for other maturities are available upon request.

statistically different. The transmission of tightening shocks is not affected by the degree of disagreement. For easing shocks, however, we find that for disagreement being two standard deviations above the mean the response of the expectations component is much weaker. Since the response of the term premium is unaffected, this translates into a weaker response of yields.

7 Differences in uncertainty expressed by the Bundesbank and the ECB

The two dictionaries, which were previously used to quantify the sentiment conveyed in each speech, also contain lists of words expressing uncertainty. The notion of uncertainty is broad one, which does not necessarily correspond to the notion of economic uncertainty, forecast uncertainty or policy uncertainty. However, while we believe that the level of uncertainty transmitted through speeches is less informative, the difference in uncertainty between the two presidents could be a valuable piece of information for market participants.

For each central bank i , we draw on the uncertainty word lists offered by Loughran and McDonald (2011) and Bannier et al. (2018) and also construct a measures of uncertainty reflected in speeches as

$$Uncertainty_t^i = \frac{\#uncertain_t^i}{\#total_t^i}$$

for $i = ECB, BuBa$, where $\#uncertain_t^i$ is the number of words expressing uncertainty, with the divergence of uncertainty across institutions given by

$$div_t^{unc} = |Uncertainty_t^{ECB} - Uncertainty_t^{BuBa}|.$$

As before, we use a 12-month average of each measure of uncertainty in order to prevent outlier speeches to be too influential. Figure (12) shows the uncertainty reflected in Bundesbank and ECB speeches. We find that uncertainty increased strongly between 2004 and 2007. This is remarkable, as it supports the view that central banks were increasingly concerned with the build-up of risks in the economy before 2008. For both institutions, uncertainty peaks in 2008/9 at the height of the global financial crisis. Interestingly, since the appointment of Axel Weber as president of the Bundesbank in 2004, the Bundesbank communication reflects more uncertainty than the ECB communication. This gap in uncertainty became highly persistent after 2009. Figure (13) depicts the resulting measure of the difference in uncertainty. This difference reaches a maximum in 2012, around the announcement

of the OMT program and the public controversy associated with it. Overall, the pattern of disagreement in terms of uncertainty is not unlike the disagreement in terms of sentiment studied before.

Table (2) reports the level of uncertainty expressed in the speeches of each president and the mean uncertainty differential between the Bundesbank and the ECB. All subsequent Bundesbank presidents expressed a higher level of uncertainty, while each subsequent ECB president communicates a lower level of uncertainty. The uncertainty gap, therefore, reaches a maximum in the Draghi-Weidmann period.

After controlling for cyclical differences between Germany and the rest of the euro area, we use the demeaned uncertainty gap to separate two states, a high and a low uncertainty differential, and estimate the state-dependent local projections.²² Figure (23) shows the resulting responses of OIS rates in the two uncertainty states. The strongest effect occurs at the short end of the yield curve. Rates with a maturity of one year increase less after a policy tightening if the economy is in a state with a very different expression of uncertainty in the speeches of both institutions' presidents. The long end of the maturity spectrum, however, remains unaffected by the extent of disagreement. Figures (24) and (25) reveal that a relatively small part of the state-dependency stems from the response of the expectations components across the four maturities. The response of the term premium, in contrast to the case of sentiment disagreement, explains the largest part of the weaker response of OIS rates under high disagreement. At the short end, the positive response of the term premium is much weaker if uncertainty is perceived unevenly across the two central banks. For the response of the term premium at the long end, however, we do not find a significant state-dependent effect of policy.

In order to understand the gap in uncertainty between both institutions, we contrast it with a measure of subjective interest rate uncertainty provided by Istrefi and Mouabbi (2017). These authors use interest rate forecasts from Consensus Economics to construct an index of interest rate uncertainty related to long-term interest rates over a horizon of 12 months.

Figure (14) plots our uncertainty gap against their series of interest rate uncertainty for German, French and Italian long-term interest rates. We find that our series captures well the evolution of interest rate uncertainty related to German yields before the euro crisis. After 2010, we observe a much closer comovement with uncertainty about French and Italian yields. This is consistent with the notion of a safe-heaven status of German Bunds, which weakens the connection between

²²See Tillmann (2018) for an analysis of how uncertainty about Fed policy affects the yield-curve response to shocks.

uncertainty expressed by policymakers and the uncertainty of forecasters. The main take-away is that the gap between uncertainty expressed in speeches moves in line with interest rate uncertainty. This is a cross-check of the plausibility of our series. Whether a differential view on uncertainty across the ECB and the Bundesbank is driving interest rate uncertainty, is subject of future research.

8 Conclusions

The president of the Bundesbank, the German central bank, is a member of the ECB's Governing Council. For most of the past two decades since the early days of the euro area, the presidents of the ECB and the Bundesbank were the main protagonists of monetary policy making in the euro area. At the same time, however, both presidents often and persistently disagreed about the future course of monetary policy. The presidents of the largest and most important central bank of the Eurosystem communicated their concerns at important junctions of European monetary policy. Given how carefully central bank communication is crafted, such a vehement dissent should have effects on how monetary policy is transmitted to households and markets. This is the subject of this paper.

Based on speeches delivered by the presidents of the ECB and the Bundesbank, we calculated the gap between the institutions in terms of either the sentiment conveyed in these speeches or the extent of uncertainty reflected in them. In a further step, we showed that the transmission of a monetary policy shock to the long-term safe euro area interest rate is much weaker if the sentiment or uncertainty gap, respectively, is large. Hence, the ECB-Bundesbank conflict weakened the effectiveness of monetary policy.

The paper offers a new channel through which monetary policy making by committees rather than single decision makers affects outcomes. While the literature discusses costs and benefits of committee decisions in terms of the quality of the decisions, the speed of the decision making and all sorts of political economy considerations associated with intra-committee dynamics, we showed that the cacophony of views might harm the effectiveness of policy. In this context, we should also mention a caveat of the analysis presented here: while purely empirical, we do not make any normative judgment about the quality of monetary policy. It is conceivable that because of the cacophony of views and the disagreement inside the Governing Council, the resulting policy improves (see, among others, Gerlach-Kristen, 2006). This could be the case if the debate about policy brings new arguments on the table or helps balancing extreme views in the committee. Our analysis can only highlight

the empirical consequences of disagreement for a *given* monetary policy shock. Our first implication of the analysis is that different narratives of the same policy harm the effectiveness of this very policy. Hence, if a maximum impact of policy should be achieved, the divergence of views should be minimized. We also showed that the extent of divergence increases in the divergence of unemployment between the euro area and Germany. The current, broad-based recovery of the euro area should therefore reduce policy disagreement, align the tones of ECB and Bundesbank communication and ultimately strengthen the transmission of policy. Finally, the current low-interest rate environment implies that the zero lower bound could become binding again in the future, thus making unconventional monetary policy more likely. A key element of this is central bank communication about the likely future path of policy rates. Different narratives about policy could make such forward guidance ineffective.

It is likely that the ECB-Bundesbank conflict cannot be solved by improving the communication or voting procedures in the Governing Council.²³ Ultimately, it is a symptom of the deeper controversy about the future of the euro area and, hence, is likely to remain for the time being.

²³Blinder (2018) suggests to address the cacophony problem by giving a formal voice to the majority and the minority positions on the committee.

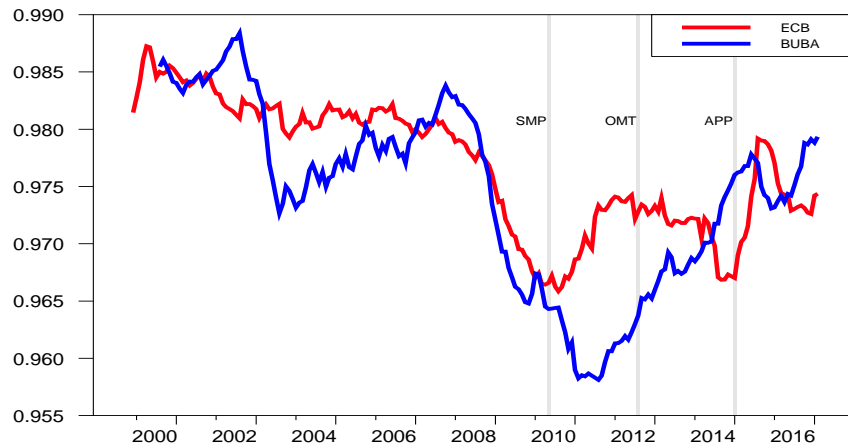
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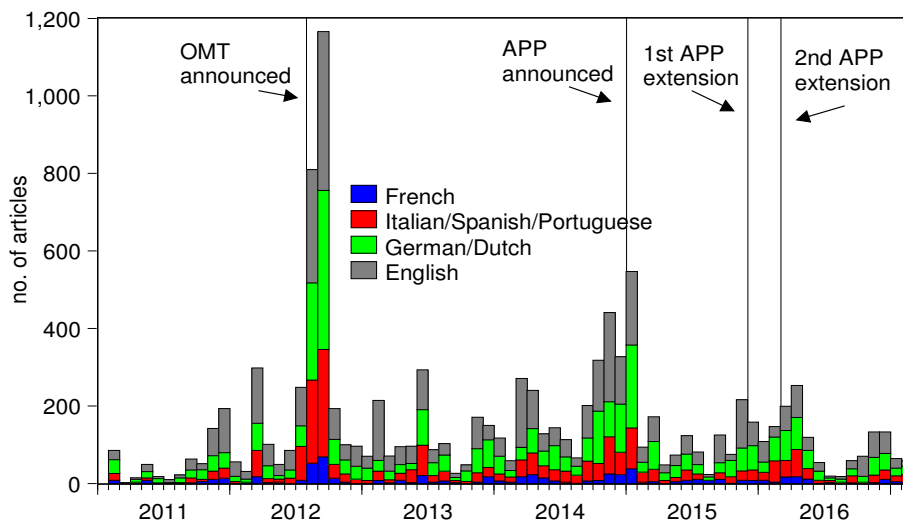
Figure 10: Tone (measured by negative words) conveyed in presidents' speeches



Notes: $Tone_{neg,t}^i$ series for $i = ECB, BuBa$. The shaded areas indicate the SMP, OMT and APP programs, respectively.

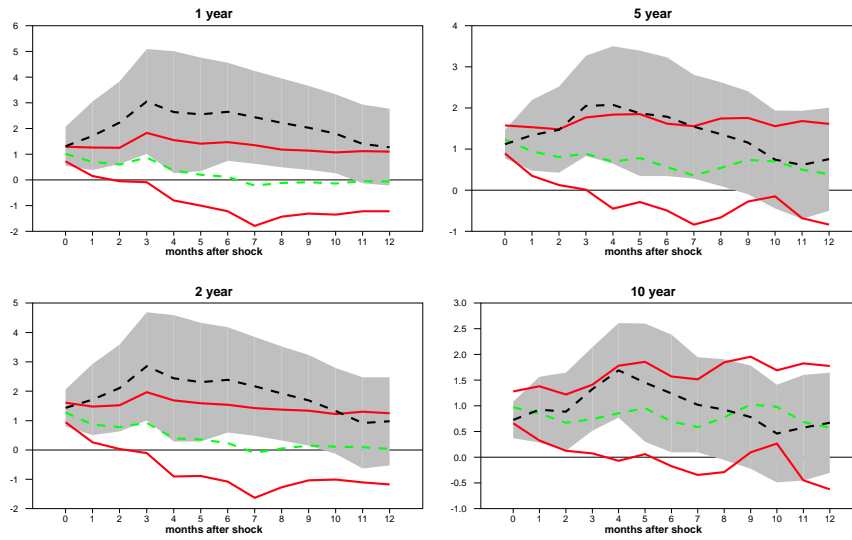
Appendix: Figures

Figure 9: Media attention to ECB-Bundesbank conflict across euro area countries



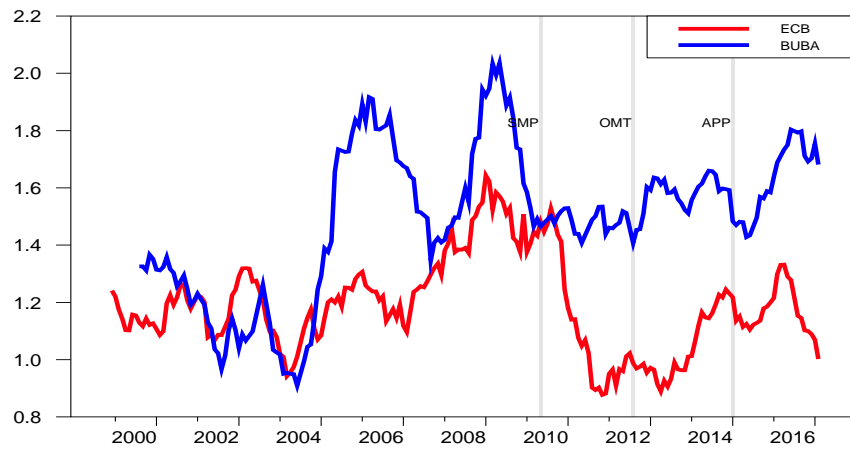
Notes: Number of articles in *Nexis* database mentioning "Draghi" and "Weidmann" in several euro area languages.

Figure 11: Response of OIS yields when tone is measured by negative words



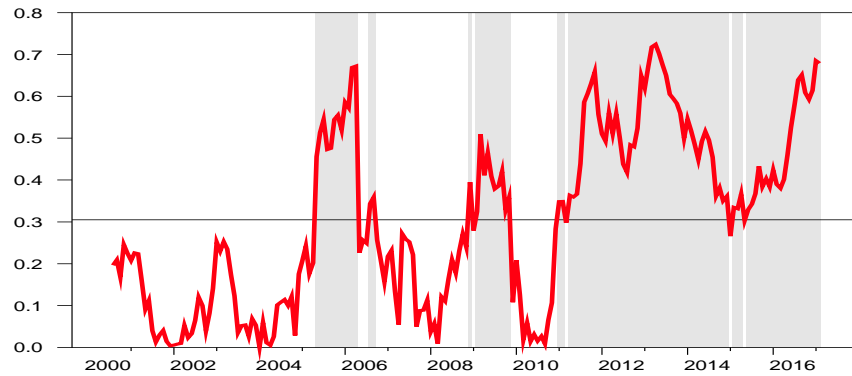
Notes: The black (green), dashed line is the response if divergence is low (high). The confidence bands are constructed using 1.65 standard errors.

Figure 12: Uncertainty reflected in presidents' speeches



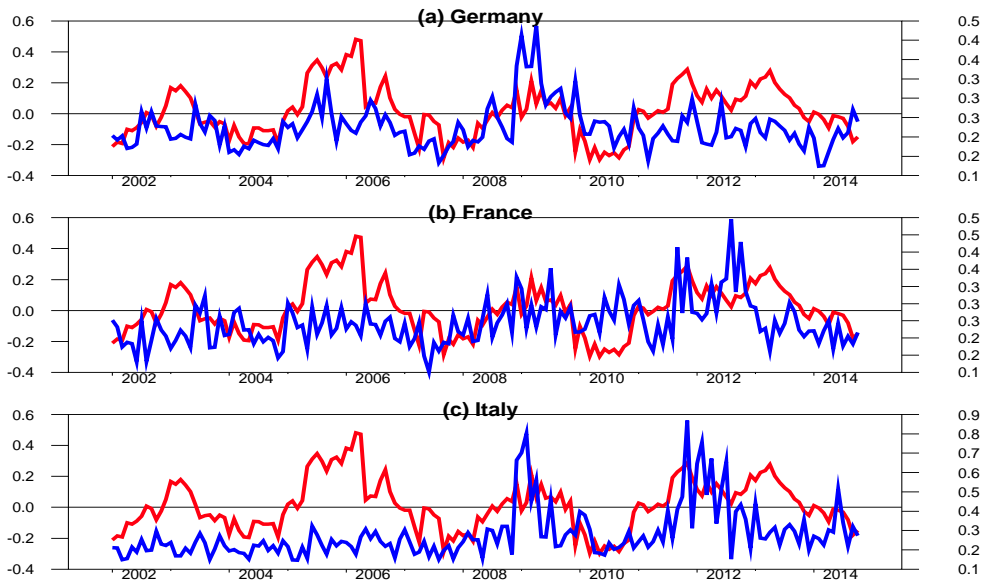
Notes: $Uncertainty_t^i$ series for $i = ECB, BuBa$. The shaded areas indicate the SMP, OMT and APP announcements.

Figure 13: Divergence in the communication of uncertainty between Bundesbank and ECB



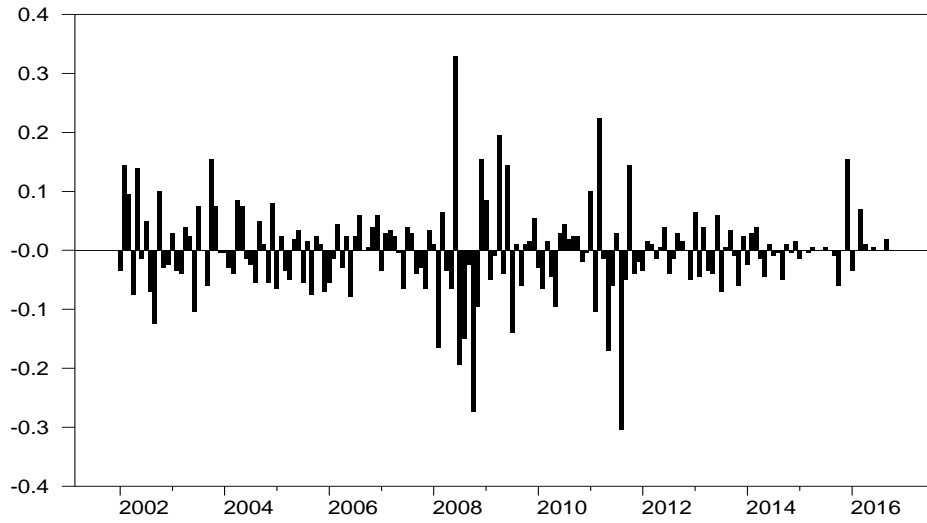
Notes: Divergence measured as absolute difference of ECB and Bundesbank uncertainty expressed in speeches. In shaded episodes, divergence is above the sample mean.

Figure 14: Uncertainty divergence against subjective interest rate uncertainty



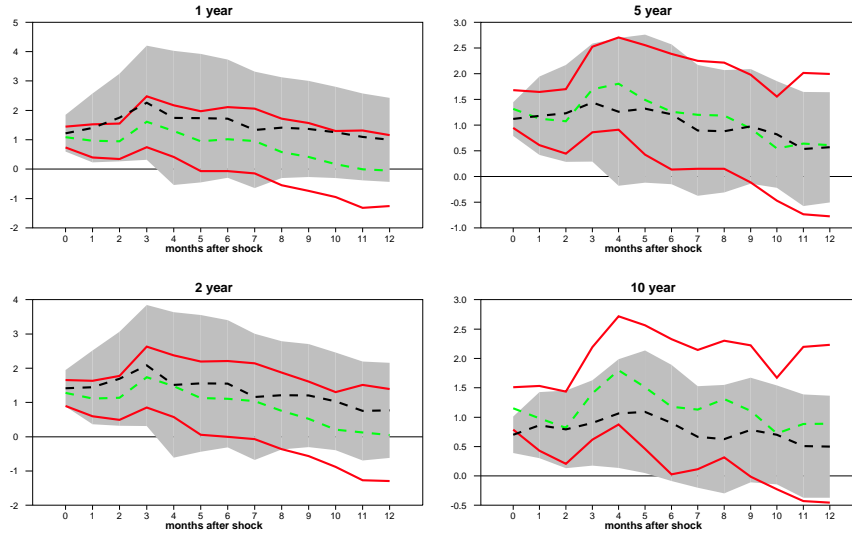
Notes: Divergence of uncertainty (red line, left scale) against uncertainty about 10-year interest rates over a 12-month horizon (right scale) for (a) Germany, (b) France and (c) Italy. The data on interest rate uncertainty is taken from Istrefi and Mouabbi (2017).

Figure 15: Monetary policy shock



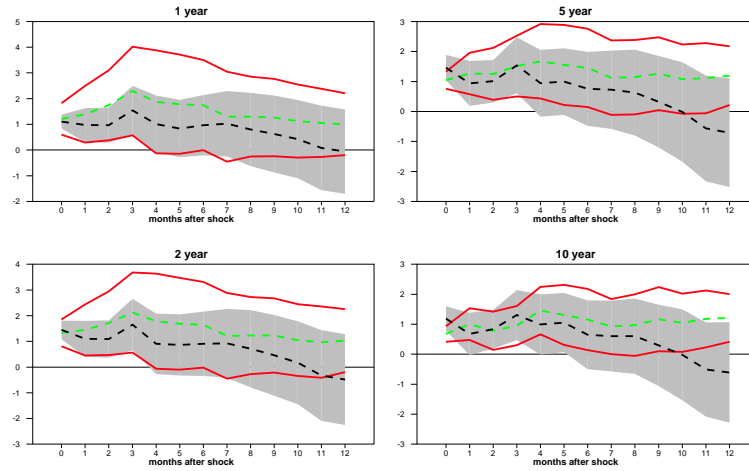
Notes: Change in Euribor Futures (in percentage points) on meeting days of the ECB's Governing Council and three selected non-meeting events. Details are given in the text. The series is taken from Hafemann and Tillmann (2018).

Figure 16: Response of OIS yields before and after 2010



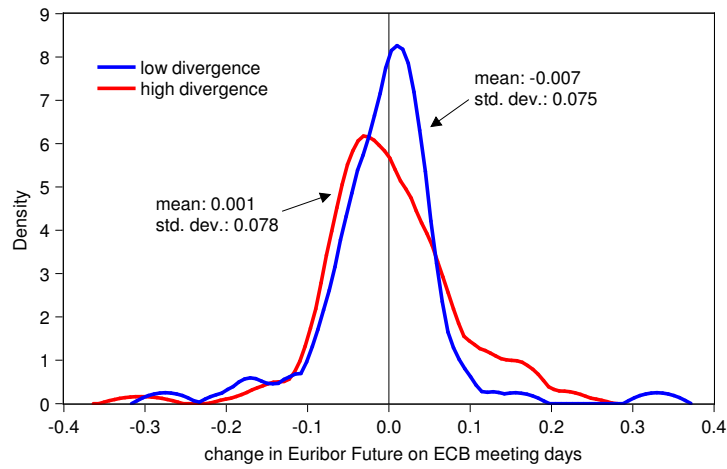
Notes: The black (green), dashed line is the response before (during) the European debt crisis starting in 2010. The confidence bands are constructed using 1.65 standard errors.

Figure 17: Response of OIS yields in high- and low-volatility states



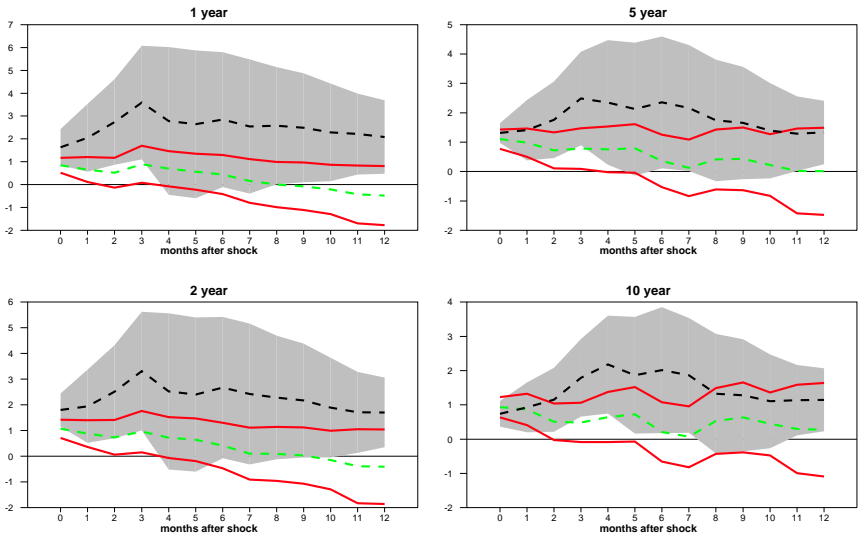
Notes: The black (green), dashed line is the response in the low (high) volatility state. Volatility is measured by the demeaned and standardized bond market volatility component of the ECB's CISS index. The confidence bands are constructed using 1.65 standard errors.

Figure 18: Distribution of monetary policy shocks across states



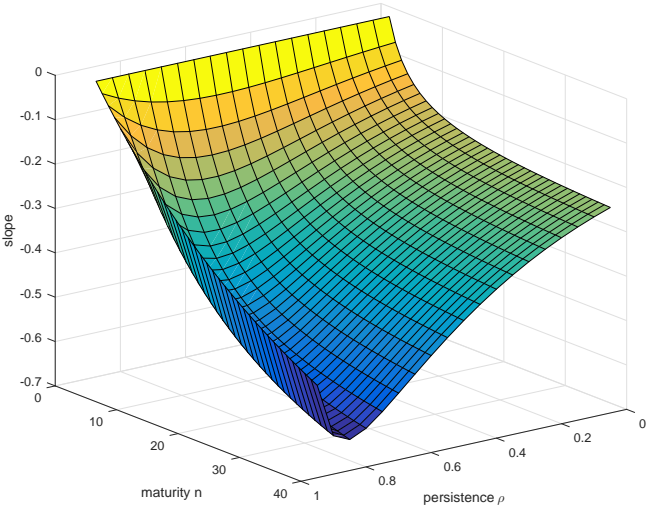
Notes: Estimated Kernel density of the policy shock in the high- and low-divergence states, which are identified based on the $Tone_{1,t}^i$ measure.

Figure 19: Response of OIS yields with ECB tone as a control variable



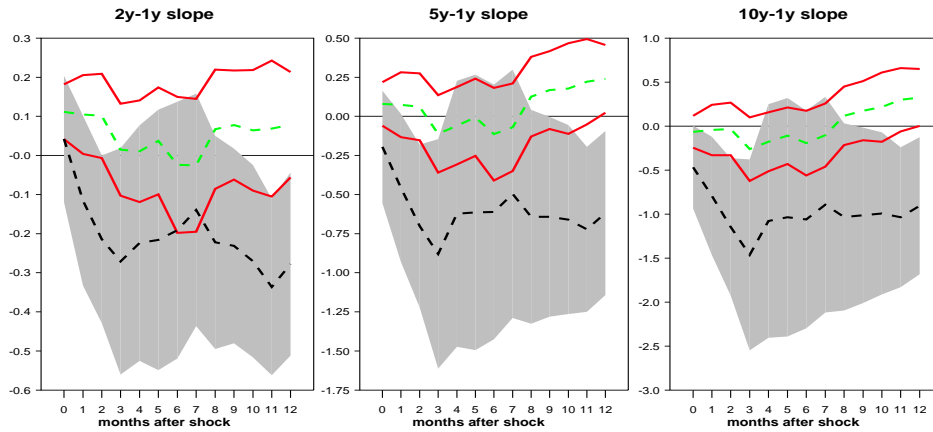
Notes: The black (green), dashed line is the response if divergence is low (high) obtained from a model in which we control for the the tone of ECB speeches and the level of ECB-Bundesbank divergence. The confidence bands are constructed using 1.65 standard errors.

Figure 20: Term structure slope as a function of the perceived shock persistence



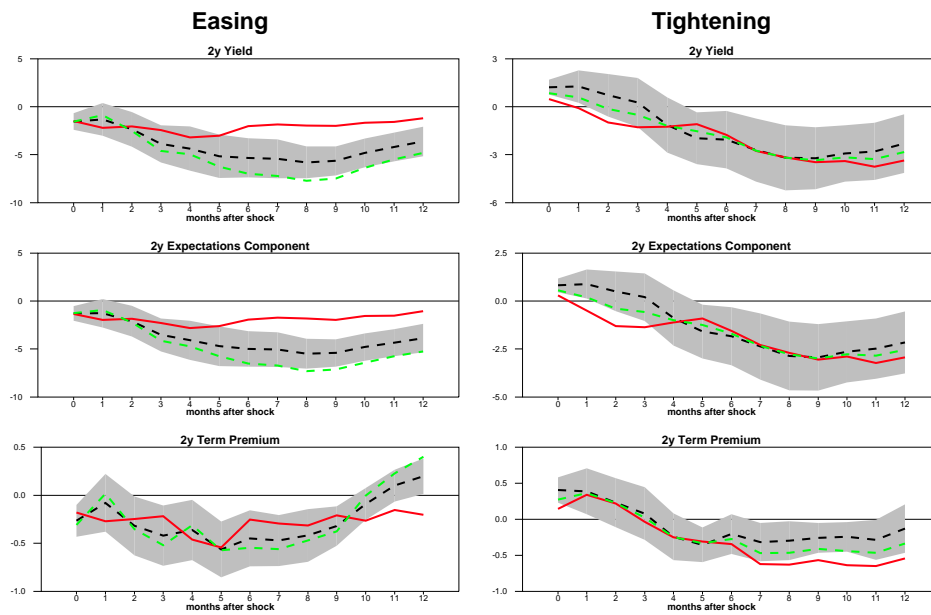
Notes: Spread between yield on an n -period and m -period bond, for $n > m$, as a function of the policy shock. We set $m = 4$.

Figure 21: Response of the yield curve slope of expectations components



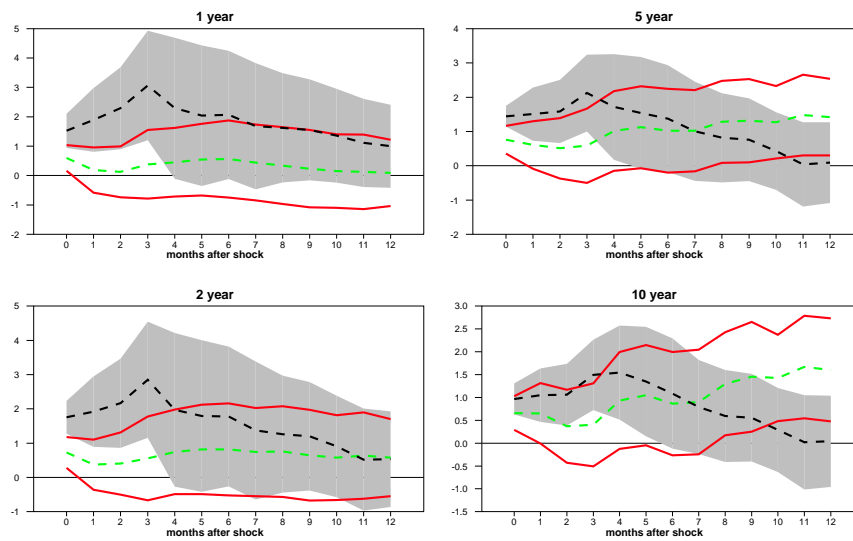
Notes: The black (green), dashed line is the response of the slope of the yield curve if divergence is low (high). The confidence band is constructed using 1.65 standard errors.

Figure 22: Response to easing and tightening shocks



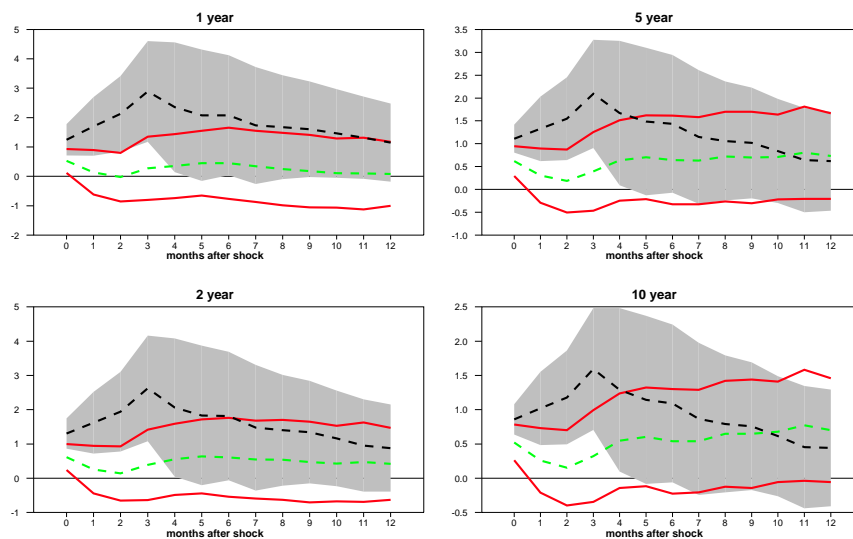
Notes: The black, dashed line is the unconditional response to a monetary policy shock with a 90% confidence band. The green, dashed (red, solid) line reflects the response for divergence one standard deviations below (above) its mean. The dependent variables have a maturity of two years.

Figure 23: Response of OIS yields for a high and low uncertainty divergence



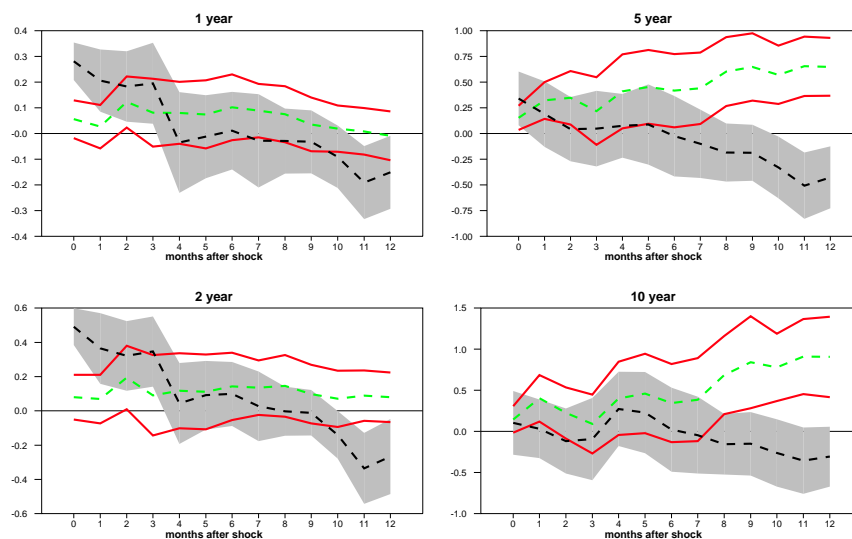
Notes: The black (green), dashed line is the response if the uncertainty divergence is low (high). The confidence bands are constructed using 1.65 standard errors.

Figure 24: Response of OIS expectations components for a high and low uncertainty divergence



Notes: The black (green), dashed line is the response if the uncertainty divergence is low (high). The confidence bands are constructed using 1.65 standard errors.

Figure 25: Response of OIS term premia for a high and low uncertainty divergence



Notes: The black (green), dotted line is the response if uncertainty divergence is low (high). The confidence bands are constructed using 1.65 standard errors.

Appendix: Tables

Table 1: Controlling the measure of divergence for cyclical differences

| | $div_{1,t}$ | $div_{2,t}$ | div_t^{unc} |
|--------------------------------|---------------------|----------------------|----------------------|
| const | 0.095*** (0.008) | 0.004*** (0.000) | 0.294*** (0.019) |
| $\pi_t^{EA.exDE} - \pi_t^{DE}$ | 0.041*** (0.009) | 0.002*** (0.000) | -0.109*** (0.021) |
| $u_t^{EA.exDE} - u_t^{DE}$ | 0.007*** (0.001) | 0.0006*** (0.000) | 0.019*** (0.003) |
| R^2 | 0.137 | 0.253 | 0.440 |

Notes: Standard errors in parentheses. A 1% significance level is indicated by ***. $\pi_t^{EA.exDE}$ and $u_t^{EA.exDE}$ represent inflation and unemployment in a hypothetical euro area that excludes Germany. π_t^{DE} and u_t^{DE} are inflation and unemployment in Germany.

Table 2: Tone and divergence for each president's term in office

| | $Tone_{1,t}$ | $Tone_{2,t} (\times 100)$ | unc_{it} |
|----------------------------------|--------------|---------------------------|-------------------|
| ECB | | | |
| President Duisenberg (1998-2003) | 0.141 | 0.469 | 1.179 |
| President Trichet (2003-2011) | 0.031 | 0.071 | 1.268 |
| President Draghi (2011-) | -0.070 | -0.386 | 1.081 |
| Bundesbank | | | |
| President Welteke (1999-2004) | 0.203 | 0.734 | 1.169 |
| President Weber (2004-2011) | -0.069 | -0.416 | 1.542 |
| President Weidmann (2011-) | -0.197 | -1.078 | 1.575 |
| | $div_{1,t}$ | $div_{2,t} (\times 100)$ | $div_{1,t}^{unc}$ |
| overlapping presidency | | | |
| Duisenberg-Welteke | -0.017 | -0.157 | -0.044 |
| Trichet-Weber | 0.002 | 0.055 | -0.001 |
| Draghi-Weidmann | 0.004 | -0.022 | 0.027 |

Notes: The table reports average measures of tone and (demeaned) divergence, respectively, over the tenure of each president. The measures of divergence have been controlled for cyclical differences between Germany and the rest of the euro area.

ECB vs Bundesbank: Diverging Tones and Policy Effectiveness

Online Appendix

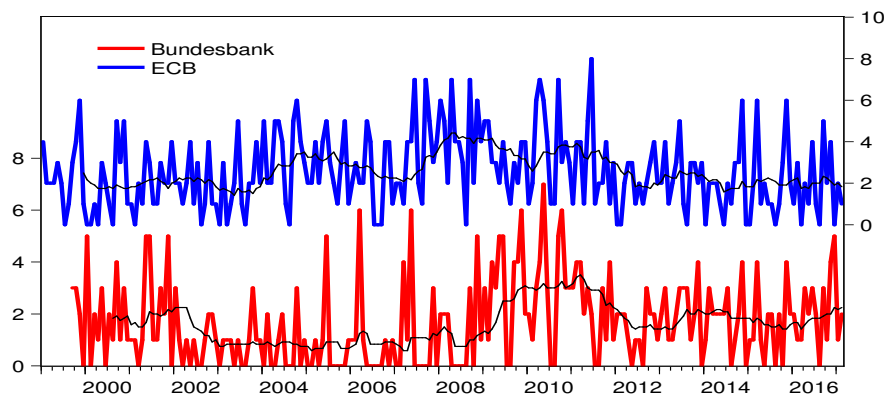
June 9, 2018

This appendix contains additional material which is not meant for publication in the journal. The additional material covers additional information on the analysis of the speeches given by the Bundesbank and ECB presidents, respectively.

1 The number and length of speeches

Figure (1) shows the number of speeches per months with a 12-month moving average. While the ECB president gave more speeches in the beginning of the sample, both institutions presidents' gave a similar number of speeches in the years of the global financial crisis and the euro crisis, respectively. The moving averages show that both presidents increased their communication activities in crisis times. The ECB president increased the number of speeches in mid-2007 at the outbreak of the sub-prime crisis in the US. The Bundesbank presidents raises their communication activities with the outbreak of the European debt crisis in 2010.

Figure 1: Number of speeches per month



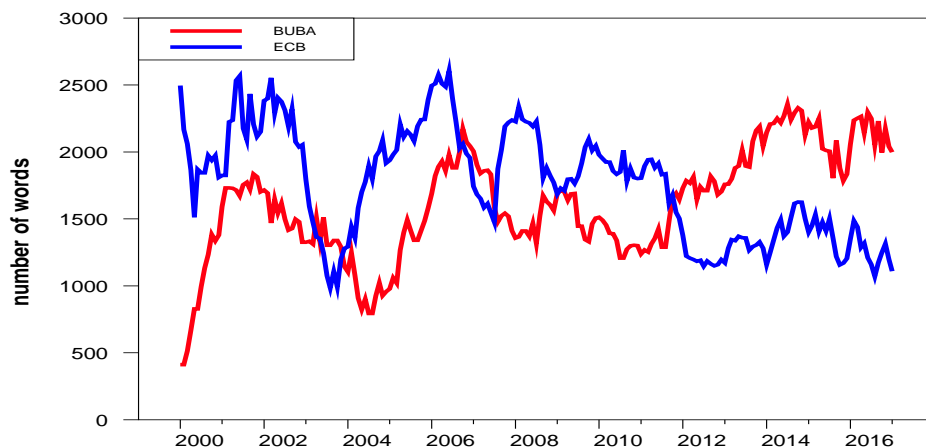
Notes: The figure plots the number of speeches for each central bank delivered in a given month. The black lines are the 12-months moving averages for each institution.

Our measures of tone presented in the main text control for the number of words of each speech identified as reflecting a positive or a negative sentiment or the total

number of words. Hence, both measures should be robust to differences in the lengths of speeches. Nevertheless, the length of speeches is interesting as such as it might reflect the desire of the institution to communicate with the public.

Figure (2) plots the average number of words of the speeches delivered in a given month for each institution. We do not find systematic difference in the level of words across institutions. Hence, systematic differences in the text lengths across different languages do not play a role. However, we find that since the outbreak of the euro crisis, the Bundesbank talks more to the public than the ECB. Whether there is a general tendency to talk more if disagreement is high or the tone of the communication becomes more extreme, is a question for future research.

Figure 2: Number of words per speech



Notes: The figure plots the average of number of words in the speeches of a given months for the Bundesbank (red line) and the ECB (blue line). We plot the 12-months moving average for each institution.

2 Most frequent words

The speeches delivered by the president of the ECB are available in English. We apply the Loughran and McDonald (2011) dictionary for the analysis of the tone conveyed in these speeches. For the Bundesbank, the speeches given by its president are available in German. For these speeches, we use the Banner et al. (2018) dictionary, which is an adoption of the Loughran-McDonald dictionary to German, for these speeches.

Tables (1) and (2) report the 20 words from the Loughran and McDonald (2011) and Banner et al. (2018) dictionary most often found in the English and German speeches, respectively. The table also reports the number on how often each word is mentioned.

Table 1: Most frequent English words expressing tone and uncertainty

| positive words ECB | negative words ECB | uncertainty words ECB |
|-----------------------|-----------------------|--------------------------|
| stability (6376) | crisis (2234) | risk (2090) |
| progress (6933) | challenges (1000) | risks (1551) |
| effective (724) | against (705) | could (1501) |
| better (679) | question (672) | possible (874) |
| great (616) | unemployment (658) | might (566) |
| transparency (593) | imbalances (567) | uncertainty (503) |
| stable (554) | crucial (477) | believe (431) |
| able (527) | difficult (460) | almost (399) |
| positive (511) | stress (406) | volatility (336) |
| success (490) | challenge (396) | seems (275) |
| greater (446) | concerns (353) | perhaps (244) |
| successful (431) | concerned (340) | somewhat (212) |
| improve (429) | volatility (336) | sometimes (196) |
| achieve (426) | decline (317) | suggests (184) |
| benefit (417) | negative (313) | suggest /175) |
| efficient (410) | excessive (311) | possibility (159) |
| achieved (407) | problems (310) | doubt (153) |
| smooth (353) | questions (296) | probably (153) |
| stronger (352) | problem (255) | appear (143) |
| enhance (349) | crises (252) | depends (143) |

Notes: The table reports the 20 most frequently found words in the (English) ECB speeches expressing positive or negative tone and uncertainty, respectively. The word search is based on the Loughran-McDonald (2011) dictionary. The number in brackets is the number of appearances across all speeches of a given institution.

Table 2: Most frequent German words expressing tone and uncertainty

| positive words Bundesbank | negative words Bundesbank | uncertainty words Bundesbank |
|------------------------------|------------------------------|---------------------------------|
| stabilität (536) | krise (1259) | kann (1450) |
| stärker (312) | finanzkrise (484) | risiken (815) |
| großen (258) | herausforderungen (276) | könnte (433) |
| besser (247) | gefahr (266) | etwa (406) |
| stärken (229) | probleme (247) | dürfte (320) |
| dauerhaft (192) | gegen (238) | etwas (314) |
| erreichen (187) | rückgang (195) | gefahr (266) |
| erfolg (183) | sorgen (183) | risiko (264) |
| erreicht (183) | verhindern (182) | möglich (234) |
| transparenz (157) | arbeitslosigkeit (163) | unsicherheit (206) |
| häufig (155) | problem (161) | könnten (197) |
| freue (154) | ungleichgewichte (160) | möglichkeit (152) |
| verbessert (152) | druck (158) | vielleicht (142) |
| möglichkeit (152) | herausforderung (143) | zweifel (142) |
| stärkung (151) | zweifel (142) | erwartungen (139) |
| stabiles (145) | verluste (136) | scheint (130) |
| verbessern (144) | staatsschuldenkrise (132) | dürften (116) |
| stabile (144) | fehlentwicklungen (129) | mögliche (108) |
| aufschwung (138) | gegenteil (112) | gläubiger (106) |
| verstärkt (136) | defizite (112) | verschiedenen (104) |

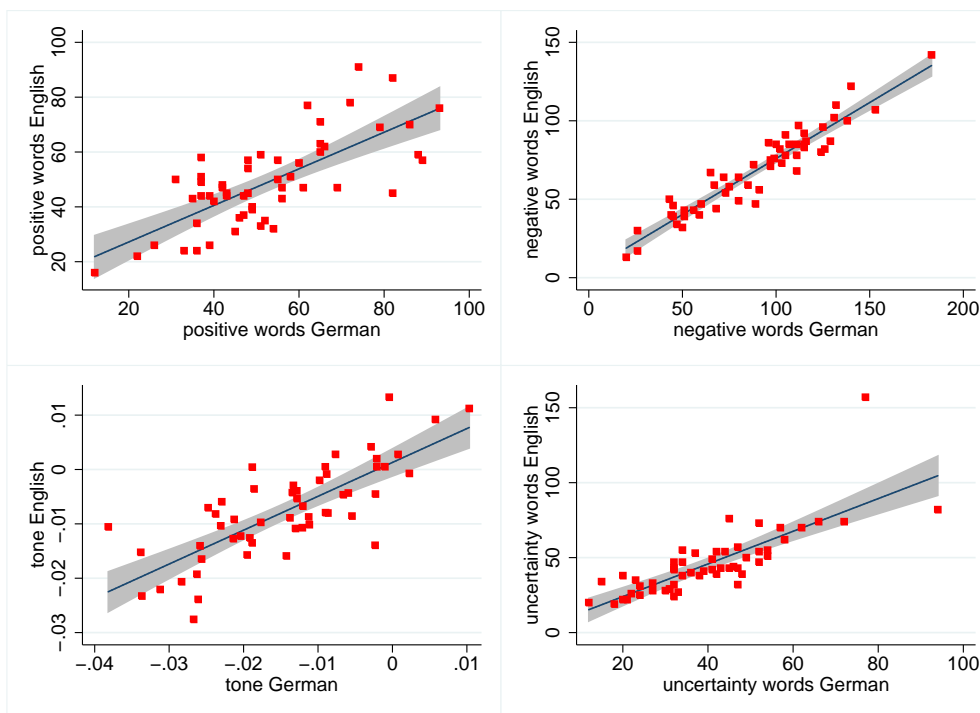
Notes: The table reports the 20 most frequently found words in the (German) Bundesbank speeches expressing positive or negative tone and uncertainty, respectively. The word search is based on the Bannier, Paul and Walter (2018) dictionary. The number in brackets is the number of appearances across all speeches of a given institution’s president.

3 Comparing the English and German dictionaries

We need to rule out that differences in tone across the speeches of the presidents of both institutions are solely driven by differences between the English and German language. For that purpose, we use the 54 speeches of the Bundesbank president available in the German original and official Bundesbank translation into English. For each of these speeches, we apply the Loughran-McDonald dictionary to the English translation and the Bannier et al. dictionary to the German original. If the resulting sentiment scores are highly correlated, we could conclude that the use of different languages and other corresponding dictionaries does not bias our findings. Figure (3) presents scatter plots for the number of positive and negative words, the sentiment score and the uncertainty score for the same speeches in alternative languages. We find that the number of positive and negative words, the overall tone of the speeches and the extent of uncertainty expressed in these speeches are indeed highly correlated. The correlations are 0.95 for the number of negative words, 0.73

for the number of positive words, 0.78 for the tone measure across languages and 0.79 for the number of words expressing uncertainty.

Figure 3: Comparing identical speeches in different languages

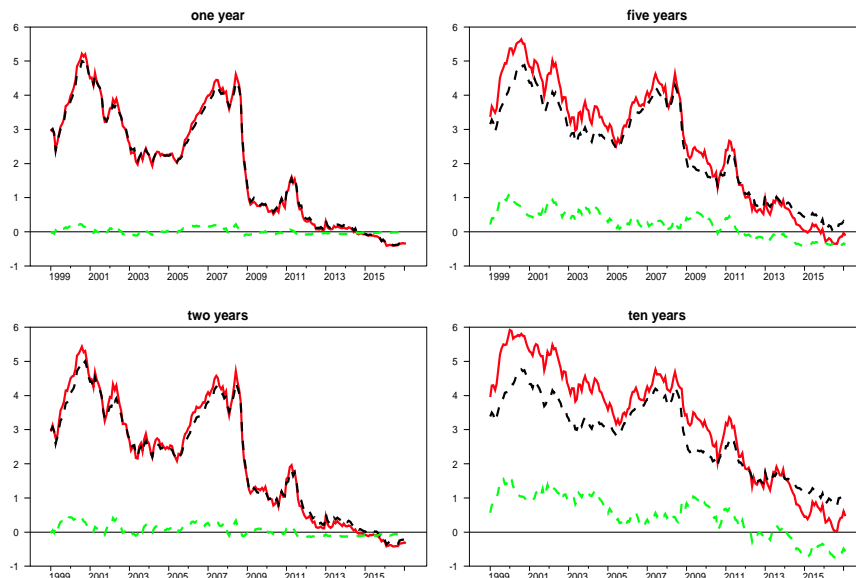


Notes: Each dot reflects one of the 54 speeches in German, given by the Bundesbank president, for which an official Bundesbank translation into English is available. The same speech is analyzed using the Loughran-McDonald (English, vertical axis) and Bannier et al. (German, horizontal axis) dictionary.

4 Euro area OIS rates

In the paper, the dependent variables are OIS (Overnight Index Swap) rates for the euro area. We use the OIS rate for different maturities as well as the estimated expectations component and the implicit term premium from Geiger and Schupp (2018). The data is shown in Figure (4).

Figure 4: OIS rates, expectations components and term premium estimates



Notes: The series are taken from Geiger and Schupp (2018). The red line is the OIS rate for maturity n , the black line is the expectations component and the green line is the term premium. All series are measured in percentage points.

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