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JEL Classification: G10, G12, E43, E44, E52, E58

Keywords: monetary policy shocks, central bank communication, Asset Pricing, textual analysis

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"*As had been suggested by Mr Praet in his introduction, nuances in the communication could convey a more positive tone on the state of the euro area economy, while signalling less urgency for further monetary policy action.*", ECB Monetary Policy Account, April 6^{th}, 2017

1 Introduction

A key question in economics and finance is how monetary policy impacts financial markets and the real economy. In addressing this question, a standard approach is to assess monetary policy shocks based on high-frequency market price reactions around central bank announcements. To give these shocks an economic interpretation, researchers use economic theory to (indirectly) infer what type of news may have plausibly moved asset prices in the direction observed. In this paper, we propose to identify the sources of such monetary policy shocks directly from the contents of central banks' verbal communication.

Put differently, our objective is to decipher monetary policy shocks by directly connecting what markets *hear* to what the central bank *says*. Since such an analysis requires central bank announcements to be accompanied by rich verbal communication, we focus on euro market reactions to announcements by the European Central Bank (ECB). To assess market responses, we construct three sets of shock measures established in the literature, based on either high-frequency changes in interest rates, the entire term structure, or the joint response in interest rates and stock prices. To gauge news communicated by the central bank, we use textual analysis to measure the ECB's stance towards the different topics addressed in its communication. Our results show that all shock measures are significantly related to the ECB changing its stance, either on the topic 'rate guidance', 'economic activity', or 'financial & monetary conditions'. Additionally, our analysis of other asset classes shows that currency markets also respond to news about 'financial & monetary conditions' and that sovereign yield spreads between core and peripheral countries are driven by the ECB changing its assessment of 'fiscal policy'.

The announcements of the European Central Bank (ECB) are particularly well-suited for our analysis, because the ECB has employed a consistent communication strategy from its very inception in 1999. This allows us to study a much longer sample period, spanning very different economic conditions, than what would be possible for any other major central bank. Moreover, the ECB's communication strategy allows us to cleanly separate the market reaction to the latest policy decision from the reaction to the ECB's verbal communication, because the policy decision is released 45 minutes before the press conference, in which details on the underlying rationale are provided (e.g. Ehrmann and Fratzscher, 2009). The recently established Euro Area Monetary Policy event-study Database (EA-MPD) allows for a consistent construction of different types of monetary policy shocks from asset price data (see Altavilla et al., 2019). We use these data to construct a broad range of price-based shocks, organized in three groups: Shocks

based on changes in (single) interest rates, shocks based on information from the whole yield curve (e.g., Altavilla et al., 2019; Leombroni et al., 2021; Swanson, 2021), and shocks based on the joint dynamics of interest rates and other stock returns (e.g., Cieslak and Schrimpf, 2019; Jarociński and Karadi, 2020). All shocks are estimated over the same sample period and are based on identical high-frequency timing conventions.

To decipher these shocks, we first examine transcripts of the ECB President's press conference statements to extract the ECB's stance towards five topics: 'rate guidance', 'economic activity', 'inflation', 'financial & monetary conditions', and 'fiscal policy'. To measure topic-specific stance, we use dictionary-based measures of central bank tone (similar to, e.g., Schmeling and Wagner, 2019) and content analysis to capture whether the ECB indicates policy easing or tightening (similar to, e.g., Hansen and McMahon, 2016). Our goal is to capture nuances in the communication of the ECB, such as the ones suggested by the quote presented above at the beginning of the paper.

In a second step, to assess the economic drivers of monetary policy shocks, we regress the twelve shock measures on changes in the ECB's topic stances. To ensure that changes in topic-specific stance revealed during the ECB's press conferences can be interpreted as news, i.e., as surprises conditional on the information available to market participants prior to press conferences, we include a comprehensive set of control variables. Specifically, we control for market responses associated with the release of the policy decision (45 minutes before the start of the press conference), announcements of unconventional policy actions, current economic and financial market conditions as well as economic projections, and ECB communication prior to the press conference, which includes topic-level stances estimated from speeches given by ECB Executive Board members.

Our results show that financial markets react to news about three topics: 'rate guidance', 'economic activity' and 'financial & monetary conditions'. However, not all shock measures reflect all news equally. Starting with shock measures based on a single interest rate, we find that these are generally neither sufficient for capturing all information released in a statement, nor for pinning down a specific type of news. In particular, while changes in short-term rates represent the most popular price-based proxy for monetary policy news in the literature, this type of shock fails to cleanly separate news about the central bank's reaction function from news about other aspects of monetary policy. More specifically, we find that short-term rates (3-month) react to communication about 'rate guidance', medium-term rates (2-year) react to both 'rate guidance' and 'economic activity', and long-term rates (10-year) are most sensitive to news about 'financial & monetary conditions'.

Our findings for shocks based on the full term structure of interest rates are consistent with these results. In particular, we find that term structure factors driven by the short end of the yield curve are associated with changes in the 'rate guidance'-stance, the medium-term factor with 'economic activity',

and the long-term factor with 'financial & monetary conditions'. These economic drivers align well with the respective 'timing', forward guidance', and 'quantitative easing' interpretations proposed by Altavilla et al. (2019).

The price-based shock measures estimated from the joint movements of interest rates and stock markets allow for the cleanest identification of relevant topics. Using the approach of Jarociński and Karadi (2020), we find that 'policy' shocks are associated with changes in the 'rate guidance'-stance whereas 'information' shocks are driven by news about 'economic activity'. Similarly, we find that the 'monetary' and 'growth' shocks of Cieslak and Schrimpf (2019) are related to stance changes about 'rate guidance' and 'economic activity', respectively. Moreover, we find that their measure for 'risk premium' shocks is significantly related to news about 'financial & monetary conditions', which suggests that news about the health of financial intermediaries matters for market prices in a manner that is consistent with the intermediary asset pricing literature (e.g., He and Krishnamurthy, 2013; Adrian et al., 2014; He et al., 2017).

Our findings provide a novel angle for the interpretation of monetary policy shocks. First, and most generally, we show that monetary policy shocks are directly related to news communicated by central banks. Second, the economic linkages between text-based news and price-based shocks provide an empirical validation for the interpretations typically given to monetary policy shocks. In this respect, we find that the taxonomy of shocks proposed by Cieslak and Schrimpf (2019), which are based on short-term rates, long-term rates, and stock returns, most clearly differentiate between central bank news about distinct topics.

Finally, we show that ECB stance changes also matter for market prices in other asset classes. We provide evidence that changes in euro exchange rates (USD, GBP, and JPY) are significantly related to news about 'financial & monetary conditions' communicated by the ECB. Specifically, we find that the euro appreciates when the ECB's topic stance becomes unexpectedly positive, which appears consistent with recent research on the role of intermediaries in currency markets (e.g., Gabaix and Maggiori, 2015; Mueller et al., 2017). Moreover, we find that differential responses of sovereign bonds in core and periphery countries to ECB announcements (e.g., Leombroni et al., 2021) are related to the ECB's stance towards 'fiscal policy'.

Our results also provide new insights for the literature on central bank communication (see, e.g. Woodford, 2005; Blinder et al., 2008). While the optimal level of communication is debated, recent theoretical work by Cieslak et al. (2020) argues that limiting the discussion to a (relatively) narrow and possibly changing set of topics may be beneficial for policy communication. In line with this rationale, we find that markets do not react equally strong to all the topics addressed by the ECB and that the importance of topics changes over time. For example, we find that markets responded to the ECB

changing its stance towards 'fiscal policy' during the sovereign debt crisis, but hardly before or afterwards. Indeed, the ECB has recently dropped its communication about 'fiscal policy' in July 2021. In addition, our results suggest that using one or the other topic to explain the very same policy decision may lead to different yield curve reactions, thereby directly affecting the transmission of monetary policy.

Related Literature. Our paper contributes to the growing literature on central bank communication, e.g. Ehrmann and Fratzscher (2007); Blinder et al. (2008); Ehrmann and Fratzscher (2009); Ehrmann and Talmi (2019). More specifically, our results relate to the literature on monetary policy shocks, e.g. Romer and Romer (2004); Gürkaynak et al. (2005); Altavilla et al. (2019); Swanson (2021); Leombroni et al. (2021). As outlined above, most of the recent literature in this stream indirectly infers the content of central bank announcements from observable asset price reactions. A contribution of our paper is to link shocks from the earlier literature to the actual wording of the central bank, thereby providing evidence on underlying economic drivers. Moreover, we address the literature on central bank information effects, e.g. Romer and Romer (2000); Campbell et al. (2012); Melosi (2017); Nakamura and Steinsson (2018), who argue that such effects are likely to play a substantial role for the transmission of monetary policy. Miranda-Agrippino and Ricco (2018); Cieslak and Schrimpf (2019); Jarociński and Karadi (2020); Andrade and Ferroni (2021); Leombroni et al. (2021) propose different approaches to separately measuring such 'information' shocks (general economic news beyond information on the future path of monetary policy) alongside 'policy' shocks (surprises about the central bank's reaction function). Cieslak and Pang (2021) extend these structural identification approaches to the general asset pricing literature.

Contrary to the studies cited above, and in particular with a view to the Fed, some papers have recently also questioned the existence of 'information' shocks ('Fed information effects'). Bauer and Swanson (2020) attribute the Fed information effect to a reaction of both, the Fed and the private sector, to public economic news. Hoesch et al. (2020) present evidence that the importance of the Fed information effect may have diminished over recent years. At the same time, however, Lunsford (2020) leverages the use of economic forward guidance in FOMC statements from 2000 to 2003 to provide evidence consistent with information effects. For the ECB, our findings provide direct evidence for 'information' shocks, from a novel angle that explicitly relies on the central bank's communication.

Another related stream of the literature examines particular features of central bank communication in more detail. Important studies include Hansen and McMahon (2016) and Hansen et al. (2018, 2019) who demonstrate the usefulness of working with textual data and discuss the differential effects of forward and economic guidance on financial markets and the real economy. Schmeling and Wagner (2019) find that the ECB's tone in the press conference tone matters for euro area equity prices, market volatility, and credit spreads. For the Fed, Cieslak et al. (2021) use the FOMC meetings' structure to distinguish

different sources of uncertainty that policymakers face in their decision making process. Gómez-Cram and Grotteria (2022) document a high positive correlation between asset price changes associated with policy statement releases and press conferences. They attribute this finding to forward guidance and clarification conveyed by information newly added to the policy statement. Aruoba and Drechsel (2022) use economic and text data to predict federal fund rate changes and interpret the residuals as monetary policy shocks. Our paper provides insights beyond these studies by relating asset price movements to a set of different types of central bank news, which account for the multifaceted nature of central bank communication. This allows us to systematically validate the interpretation given to a broad range of price-based monetary policy shock measures widely used in the literature. While this paper focuses on asset price responses to news communicated by central banks, our topic-specific central bank stance measures can also be used in other applications to study the impact of monetary policy announcements.

The remainder of this paper proceeds as follows. Section 2 provides an overview of different shock measures proposed in the literature that we decipher in this paper. Section 3 describes how we derive measures of topic-specific stance directly from the transcripts of ECB statements, while Section 4 connects these measures to the price-based shocks. Section 5 provides results for asset classes beyond those used in the construction of the standard monetary policy shocks measures. Section 6 concludes.

2 Price-based measures of monetary policy shocks

A standard approach to assessing the news contained in central bank announcements is to interpret observable market price reactions. The underlying assumption is that market reactions during a sufficiently small time window around an announcement are entirely due to the announcement and in particular only due to information not previously known to market participants. Using these market responses, researchers infer what type of news is economically plausible to have moved asset prices in the direction observed.

In this section, we describe how we construct price-based high-frequency shocks for the euro area, which we subsequently aim to 'decipher' in Section 4 by directly connecting them to the communication of the ECB. We construct three sets of shocks, which we either identify from a single interest rate, the full term structure of interest rates, or the joint dynamics of interest rates and stocks, respectively.

The first set of shocks is in the spirit of the earliest and most widely adopted price-based measures of monetary policy shocks, which draw on a risk-free interest rate at the short end of the yield curve (e.g. Kuttner, 2001; Cochrane and Piazzesi, 2002). Based on the notion that unexpected changes in short-term rates should capture all relevant news released by the central bank, such shock measures are either derived from a single interest rate or the first principal component of interest rates with maturities

up to one or two years (e.g., Gertler and Karadi, 2015; Hanson and Stein, 2015). For the second set of shocks, we build on research emphasizing that central bank announcements do not only affect short-term interest rates but the entire term structure (e.g., Gürkaynak et al., 2005; Altavilla et al., 2019; Swanson, 2021). Finally, our third set of shocks is motivated by the literature which explores the possibility that central bank announcements are not necessarily confined to news about policy actions but also contain news about the general state of the economy (e.g. Romer and Romer, 2000; Campbell et al., 2012; Melosi, 2017; Nakamura and Steinsson, 2018; Miranda-Agrippino and Ricco, 2018; Cieslak and Schrimpf, 2019; Jarociński and Karadi, 2020; Andrade and Ferroni, 2021). To disentangle these different types of news, recent research proposes to examine the joint market reactions of interest rates and other assets, such as stocks or inflation-linked instruments.

2.1 Construction of ECB communication shocks

Since our aim is to 'decipher' monetary policy shocks as measured in the literature, we focus on market reactions to central bank announcements accompanied by rich verbal communication. The announcements of the European Central Bank are particularly well-suited for such an analysis, because the ECB has employed a consistent communication strategy from its very inception. Moreover, the recently established Euro Area Monetary Policy event-study Database (EA-MPD) allows for a consistent construction of all types of monetary policy shocks from high-frequency interest rate and asset price data. Our sample covers 196 ECB press conferences from January 2002 to July 2020.

The ECB's Governing Council convenes eight times per year[1] to decide on monetary policy in the euro area. After the meeting, the ECB announces its policy decision to the public through a press release at 13:45 CET. At 14:30, i.e. 45 minutes later, the President and Vice-President hold a press conference to further elucidate the monetary policy decision. This press conference starts with a pre-scripted introductory statement read by the President, followed by a Q&A session with journalists. Previous research has exploited the staggered timing of this communication strategy, i.e. the press release and the subsequent press conference, in combination with high-frequency data to distinguish market surprises related to the policy decision itself from surprises related to the ECB's press conference communication (e.g., Ehrmann and Fratzscher, 2009; Cieslak and Schrimpf, 2019; Altavilla et al., 2019; Leombroni et al., 2021; Kerssenfischer, 2019).

To construct a consistent set of communication shock measures, we use data from the EA-MPD, developed and maintained by Altavilla et al. (2019). For a wide range of assets, the EA-MPD quantifies the market response to the ECB press conference as the yield change or return of an asset from its median quote during the time window 14:15–14:25 to the median quote in the window 15:40–15:50. To

[1] Before 2015, the Governing Council met (almost) every month.

construct shock measures in accordance with the literature, we require data for overnight index swap rates with maturities ranging from one month up to ten years and for the Eurostoxx 50 stock market index. Additionally, we will use the market responses to the press release, computed as the yield change or return of an asset from the median quote during the time window 13:25–13:35 to the median quote in the window 14:00–14:10, as control variables.

In what follows, we describe the intuition for and outline the construction of the monetary policy shock measures that we compute based on EA-MPD interest rate and equity data. Table 1 presents an overview by providing the reference papers, reporting the assets used and summarizing the interpretation of the shock measures. For technical details, see Appendix A.

[Table 1 about here]

First, we follow the common approach of measuring monetary policy shocks from high-frequency changes in short-term interest rates. In line with the literature, we consider the OIS 3-month rate as well as the OIS 2-year rate, which researchers have increasingly used more recently to avoid interest rate inertia of shorter maturities during prolonged periods at the effective lower bound (e.g., Kerssenfischer, 2019). Additionally, we also compute shocks based on 10-year rates to complement the term structure analysis below. A common interpretation of such shocks, as summarized in Table 1, is that an unexpected increase in the interest rate reflects hawkish news and thus tighter monetary policy than expected, and vice versa.

Second, we construct shock measures based on information about the full term structure of interest rates. As a parsimonious measure for shocks to the entire yield curve, we estimate an 'interest rate' factor as in Leombroni et al. (2021), that is, we use the first principal component of interest rate changes across all maturities. To allow for potentially heterogeneous responses across different segments of the yield curve, we follow the PCA approach of Altavilla et al. (2019), which rotates the first three principal components of interest rate changes into the following factors: 'timing', 'forward guidance (FG)', and 'quantitative easing (QE)'. The interpretation provided by Altavilla et al. (2019) suggests that the 'timing'-factor captures information relevant for the short run, the 'FG'-factor for monetary policy over the medium-term, and the 'QE'-factor contains information only relevant for long-term yields. For more details on the construction of the yield curve shocks, see Appendix A.1.

Finally, in order to account for potentially different types of information released during central bank announcements, we estimate shocks from the joint market reactions of interest rates and stock prices. The objective is to distinguish between 'policy' shocks, i.e., news about the central bank's reaction function, and 'information' shocks, i.e., unexpected changes in asset prices due to other types of news contained in ECB announcements, such as news about expected economic activity. For this purpose, we estimate two

sets of shocks, following Jarociński and Karadi (2020) and Cieslak and Schrimpf (2019), respectively. We summarize the identification procedures below and provide technical details in Appendix A.2.

Jarociński and Karadi (2020) use the co-movement of interest rates and equity returns to identify 'policy' and 'information' shocks based on the following rationale. On the one hand, news about the central bank reaction function should lead to a negative co-movement of interest rates and stocks, because unexpectedly higher rates should depress asset valuations through stronger discounting of future cash flows. On the other hand, news about the general state of the economy can lead to a positive co-movement; that is, the asset price impact of tighter expected future monetary policy due to an unexpectedly positive economic outlook might be more than outweighed by the simultaneous increase in expected cash flows. To estimate 'policy' and 'information' shocks, we implement the structural framework proposed by Jarociński and Karadi (2020), which imposes the corresponding sign restrictions on the co-movement between interest rates and stocks, using changes in the OIS 2-year rate and returns on the Eurostoxx 50. A positive 'policy' shock can be interpreted as hawkish monetary policy news, whereas a positive 'information' shock represents positive news about the overall economy.

In a similar vein, Cieslak and Schrimpf (2019) also propose to exploit the co-movement between stocks and interest rates for the identification of different shock dimensions, but they additionally distinguish between short-term and long-term rates. This procedure allows to identify news related to monetary policy, economic growth, and risk premia. In their framework, a positive 'monetary' shock corresponds to higher interest rates, but lower equity prices. A positive 'growth' shock leads to higher rates as well as higher equity prices. Hence, the interpretations of the 'monetary' and 'growth' shocks are very similar to those of Jarociński and Karadi (2020) for their 'policy' and 'information' shocks. Additionally, Cieslak and Schrimpf (2019) introduce a 'risk premium' shock. A positive shock is identified through lower (risk-free) rates and lower equity prices, as well as the additional identification criterion that a 'risk premium' shock moves long-term rates more than short rates; by contrast, 'monetary shocks' and 'growth shocks' have a stronger impact on short maturities. Empirically, we implement the structural estimation using changes in the OIS 2-year and 10-year rates as well as the returns on the Eurostoxx 50.

In total, our sample of central bank communication shocks comprises twelve shock measures, which are all estimated from market price reactions during the ECB press conference window as recorded in the EA-MPD. All shocks are estimated over the same sample period and using an identical high-frequency timing, which allows for a direct comparison and facilitates the interpretation once we decipher the shocks using ECB communication transcripts. Table 2 presents summary statistics and the pairwise correlations of the communication shock measures, which show that there is a high degree of correlation for several shocks measures. This is not too surprising, because all shocks are, at least to some degree, based on yield changes. Hence, the high correlations of some shocks suggest that these reflect similar information

and are likely driven by the same type of news. At the same time, the low correlations between some of the shocks, e.g., 'timing' and 'risk premium', suggest that these are driven by different types of news.

[Table 2 about here]

In the following sections, we investigate which news drive different types of monetary policy shocks using the actual wording of central bank communication. We empirically show that the signs and magnitudes of the shocks are significantly related to the ECB's stance on different topics covered in its communication.

3 Measuring the ECB's topic-specific stance

Having captured what markets *hear*, based on policy communication shocks measured from high-frequency asset price movements, we now turn to measuring what the ECB actually *says*. In its press conference statements, the ECB addresses several distinct topics with potentially different economic implications, and we use textual analysis to separately measure the ECB's stance towards 'monetary policy tools', 'economic activity', 'inflation', 'financial & monetary conditions' and 'fiscal policy'. Ultimately, this will allow us to connect price-based shock measures to the ECB's communication and thereby shed light on the underlying economics of monetary policy shocks.

3.1 ECB press conference topics

At the outset, it is instructive to lay out the typical structure of ECB press conference statements during our sample period.[2] The statement first reiterates the latest policy decision together with a brief summary of the underlying rationale. Next, the ECB elaborates on her view on economic developments, with particular emphasis on the euro area economy and risks to the economic outlook. This assessment is followed by the ECB's analysis of inflation developments. The most recent inflation flash estimate is announced, together with a discussion of important drivers and risks. Afterwards, the ECB discusses financial and monetary developments. Before the global financial crisis, the focus was mainly on money supply growth, while during and after the financial crisis, a more detailed analysis of bank lending emerged as an additional component.[3] Subsequently, a short summary "cross-checks" the economic and monetary developments with a view to their implications for inflation and the stance of monetary policy. Finally, the president concludes with a statement on fiscal policy and structural reforms, which typically highlights the need for structural reforms or balanced fiscal budgets. In addition, every three months, the

[2] For changes in the ECB's communication strategy during our sample period, see Appendix B.

[3] For this reason, the ECB initially labelled this section of the introductory statement 'monetary analysis'. Only in summer 2021, the section name was formally changed to 'financial and monetary conditions'.

introductory statement also incorporates forecasts for inflation and GDP growth from the Eurosystem's macroeconomic projections, with the structure of the statement remaining unchanged.

The contents covered by ECB statements suggest themselves to be categorized into five topics, which we label as 'monetary policy tools', 'economic activity', 'inflation', 'financial & monetary conditions' and 'fiscal policy'. To measure the ECB's stance towards each of these topics, we need to isolate the respective remarks. To assign ECB remarks to one of the five topics, we rely on the statements' coherent paragraph structure[4]. Each topic starts with a new paragraph, with the transition to the next topic being explicitly indicated. For example, following the introduction, the in-depth discussion of the economic outlook is introduced with a new paragraph, which opens with a sentence like '*Let me now explain our assessment in greater detail, starting with the economic analysis.*' Likewise, the transition to the discussion of other topics is clearly indicated by a new paragraph, usually starting with phrases like '*Turning to price developments*', '*Turning to the monetary analysis*', or '*Turning to fiscal policies*'. While each topic addressed by the ECB in this fashion may comprise more than one paragraph, all paragraphs belonging to the same topic generally occur in direct succession.

Mindful of this communication structure, the assignment of paragraphs to the four topics 'economic activity', 'inflation', 'financial & monetary conditions', and 'fiscal policy' is straightforward. For the topic 'monetary policy tools', we consider the introductory and summary paragraphs of the statements. While these paragraphs do not contain any additional information for the other four topics, compared to the more detailed remarks in the topic-specific paragraphs, the ECB uses the beginning and/or the end of the press conference to explicitly refer to the current or future path of monetary policy. Whenever this is the case, we tag these paragraphs as 'monetary policy tools'. Otherwise, we discard them due to the repetitive or irrelevant nature of their contents, as we also do with occasional other communication unrelated to monetary policy, e.g. on the issuance of new banknotes.

[Table 3 about here]

Table 3 provides summary statistics on the ECB's coverage of different topics in its press conference statements. On average, an ECB statement comprises 830 words, net of stop words.[5] The averages for each of the five topics identified above range from 130 to 158 words, whereas the residual paragraphs (introduction, summary, unclassified) aggregate to an average of 100 words. Relatively speaking, 88% of

[4] In a robustness analysis, we let the text data speak for itself and model topics via Latent Dirichlet Allocation (LDA) in combination with human verification. LDA is also applied in related research in monetary economics, for instance, by Hansen and McMahon (2016) and Hansen et al. (2018). All the results that we report in the rest of the paper remain very similar – if anything they get even slightly stronger. This is the case, because the coherent communication structure chosen by the ECB is almost fully recognized by the algorithm. Therefore, there is no need to apply LDA to identify topics from the ECB press conference statements, but we use these technique later when we model (less coherent) inter-meeting communication from speeches of ECB officials.

[5] It is common practice in textual analysis to exclude stop words, i.e. words that frequently occur without adding information, such as 'a' or 'the'.

the statements can be directly associated with the five topics 'monetary policy tools', 'economic activity', 'inflation', 'financial & monetary conditions' and 'fiscal policy', with average proportions of each topic ranging from 16% and 19%.

[Figure 1 about here]

In addition, Figure 1 shows time series of word counts for the the five topics covered in ECB press conferences. The extent of overall and topic-specific communication exhibits substantial variation over time. In particular, a common feature across all topics is that their discussion lengthens during difficult times, such as the global financial crisis, the European sovereign debt crisis, or the onset of the Covid19-pandemic at the end of our sample. At the topic-level, several features are interesting to note. For instance, 'inflation' saw an increase in coverage during the global financial crisis and the European debt crisis, but then decreased to a steady level. The coverage of 'financial & monetary conditions' has also markedly increased with the onset of the global financial crisis; subsequently, the topic coverage has remained at an elevated but decreasing level until another sharp increase in 2020. The discussion of 'monetary policy tools' has considerably lengthened over time, which reflects the introduction of complex monetary policy tools requiring more detailed explanations during our sample.

3.2 Measuring the ECB's topic-specific stance

In our analysis that 'deciphers' monetary policy shocks, we are interested in whether price-based shocks are related to news about the ECB's stance towards the topics covered in its press conference statements.

For the topics 'economic activity', 'inflation', 'financial & monetary conditions' and 'fiscal policy', we assess ECB stance by the communication *tone* the ECB uses in association with these topics. Similar to other papers that quantify central bank tone, e.g. Schmeling and Wagner (2019), we use the financial dictionary of Loughran and McDonald (2011) to identify negative words. Using all paragraphs assigned to topic i in press conference t, we measure the ECB's topic-specific tone τ as

$$\tau_{i,t} = 1 - \frac{\#\text{ negative words in topic } i \text{ at press conference } t}{\#\text{ words in topic } i \text{ at press conference } t}. \tag{1}$$

To provide some intuition for our tone-based topic stance measures, Table IA.1 in the Internet Appendix reports the most frequent bigrams containing at least one tone-word. For 'economic activity' the most frequently used bigrams relate to comments on global imbalances, corrections thereof and weaker-than-expected economic growth. The 'inflation' stance covers discussions of downside risks to inflation such as weaker-than-expected growth or the crucial role of social partners for wage negotiations and

the associated impact on inflation. The tone on 'financial & monetary conditions' picks up discussions about weak loan dynamics, their lagged relationship with the business cycle or, more generally, financial turmoil, which confirms that we indeed measure the ECB's stance towards bank lending and financial conditions. Finally, the stance on 'fiscal policy' is mainly driven by discussions of excessive deficits, fiscal imbalances and structural unemployment.

To assess news about the ECB's stance towards these topics, we compute changes in the topic-specific tone from the preceding press conference at time $t-1$ to the current press conference at time t, that is

$$\Delta\tau_{i,t} = \tau_{i,t} - \tau_{i,t-1}. \tag{2}$$

Finally, we use the discussions on 'monetary policy tools' to assess the ECB's 'rate guidance' by applying a manual classification similar to Hansen and McMahon (2016); unconventional policy actions will be accounted for in the control variables, as we discuss in the next section. To indicate possible future policy action, the Governing Council uses subtle changes in language that an algorithm is unlikely to detect. In many instances, such changes only affect a single sentence in the statement and a human observer has a clear edge in interpreting such nuances. For example, to indicate heightened probability of future policy action, the ECB would often change formulations stating that policy makers would 'monitor closely' certain risks to 'we will remain vigilant', to 'strong vigilance is warranted' or to 'strong vigilance is of the essence'. Following the content analysis guidelines established by Holsti (1969), we distinguish introductory statements with indications of tighter monetary policy (+1), no indications regarding future monetary policy (0), or monetary easing (−1), that is

$$\Delta\tau_{i,t} = \Delta \textit{Rate Guidance}_t = \begin{cases} +1 & \text{if indication of future rate hike} \\ 0 & \text{if no indication} \\ -1 & \text{if indication of future rate cute} \end{cases} \tag{3}$$

We provide examples for our coding of $\Delta\tau$ for 'rate guidance' in Appendix C and report the most frequently used bigrams in Table IA.1 in the Internet Appendix.

Figure 2 visualizes the evolution of the ECB's topic-specific stances over our sample period from January 2002 to July 2020. For the four tone-based stance measures we plot their levels, which align well with important events in the euro area.[6] For instance, 'economic activity' reaches its lowest point during the recession accompanying the great financial crisis; the stance towards 'financial & monetary conditions' drops substantially in the aftermath of the financial crisis and at the onset of European sovereign debt crisis. For 'rate guidance', the plot illustrates when ECB stance indicates policy easing or tightening.

[6] Additionally, Figure IA.1 in the Internet Appendix plots the time series of tone changes.

[Figure 2 about here]

Table 4 reports summary statistics for changes in topics-specific stances as well as their pairwise correlations. The changes in stance on 'economic activity' and 'inflation' exhibit the highest correlation (0.26). 'Economic activity' and 'fiscal policy' are also somewhat positively correlated (0.16). Correlations among other topic-specific stance changes are even lower. The summary statistics also show, in line with the time series plots above, that changes in topic-specific stance vary substantially, with minimum and maximum values that are up to 5 standard deviations away from the mean.

[Table 4 about here]

In the next section, we relate changes in these measures of topic-specific ECB stance to the price-based monetary policy shocks constructed in Section 2.

4 Deciphering monetary policy shocks

To 'decipher' measures of monetary policy shocks, we now connect what markets *hear* to what the ECB *says* by relating the market response measures described in Section 2 to the text-based measures developed in Section 3. More specifically, we regress the price-based shock measures on changes in the ECB's stance towards the topics discussed in its press conferences, controlling for information available prior to the press conference that market participants may use to anticipate changes in ECB stance.

Our sample covers 196 ECB press conferences from January 2002 to July 2020. For each press conference at time t, we have twelve shock measures (S_t) and the changes in stance for five topics as compared to the previous press conference ($\Delta\tau_{i,t}$). We run separate regressions for each monetary policy shock S of the form

$$S_t = \alpha + \sum_i \beta_i \Delta\tau_{i,t} + \sum_j \gamma_j C_{j,t} + \epsilon_t. \tag{4}$$

We include a comprehensive set of control variables ($C_{j,t}$) to ensure that changes in topic-specific stance revealed during the ECB's press conferences can be interpreted as news, i.e. as surprises conditional on the information available to market participants prior to press conferences; for details on the construction of these variables, see Appendix D. First, we include press release shocks, that is the same market response measure as S_t, but measured over the time-window around the press release. This control variable accounts for the possibility that the policy decision announced 45 minutes prior to the press conference impacts market participants' expectations about what they will hear during the press conference. Second, we control for unconventional monetary policy (UMP) announcements. Third, we account for the possibility that the market impact of the ECB's stance on inflation might depend on the current inflation

environment by including a dummy variable indicating whether inflation is currently above or below target and an interaction term with the ECB's stance on 'inflation'. Fourth, we control for ECB communication from the previous press conference and between meetings. Following standard NLP techniques, we measure the inter-meeting topic-level stance from over 2,000 speeches given by ECB Executive Board members and control for changes in inter-meeting stance. Additionally, we control for the topic-specific stance changes revealed in the previous press conference. Fifth, to capture changes in general economic and financial market conditions, we include the stock market return (EURO STOXX 50), changes in market volatility (VSTOXX volatility index), and changes in the two-year German sovereign bond yield over the inter-meeting period. Sixth, we explicitly control for numerical GDP and inflation forecasts released during the press conference to ensure that the ECB's verbal assessment of economic conditions indeed carries additional information beyond these data releases.

Following the structure of Section 2, we now present the results for three sets of shocks, identified from single interest rates, the full term structure of interest rates, and the joint dynamics of interest rates and stocks.

4.1 Interest rate shocks

We start with our findings for shocks that are based on interest rate changes, using either changes in the OIS 3-month, 2-year, or 10-year rate. Table 5 presents results from regressing these shock measures on changes in the ECB's topic-specific stances for a baseline specification that only includes the changes in ECB topic stances and our most comprehensive specification, which includes all the control variables discussed above.[7]

[Table 5 about here]

The results for the two specifications with and without controls are very similar, both quantitatively and economically. We find that interest rate shocks are significantly related to ECB stance changes with respect to three topics: 'rate guidance', 'economic activity' and 'financial & monetary conditions'. Each of these topics appears to impact a different segment of the yield curve. 'Rate guidance' is mainly reflected in movements at the short end of the yield curve, with significant estimates for the three-month and two-year maturities. The impact of changes in the 'economic activity' stance materializes further out on the yield curve, in particular for the two-year maturity, whereas the level of significance for the ten-year coefficient depends on whether we include control variables in the regression. The stance change on 'financial & monetary conditions' is picked up by the long end of the yield curve, but not reflected in shorter maturities.

[7] Additional tables, which include coefficient estimates for all control variables are provided in the Internet Appendix in Tables IA.5, IA.6, and IA.7.

These text-based results therefore confirm the common notion that movements in short-term rates reflect news about the future path of interest rates and our estimates suggest that these effects are economically large: An unexpected hawkish change to 'rate guidance', i.e., a value of this variable equal to one, is associated with a shock of one basis point in the OIS 3-month rate. To put this into perspective, a change of one basis point corresponds to approximately 90% of the average absolute change of three-month rates during ECB press conferences. In addition, our results suggest that other news communicated by the ECB in its press conferences matter for interest rates as well. The stance on 'economic activity' is particularly relevant for the two-year interest rate, such that a one-standard deviation increase, i.e., the ECB's tone becoming more positive, is associated with a rate increase of 0.812 basis points, which is approximately one third of the average absolute change of two-year rates in our sample. Finally, a one-standard deviation more positive stance on 'financial & monetary conditions' is associated with a 0.522 basis point shock to the ten-year rate, which again corresponds to around a quarter of its sample average absolute change. Hence, our results suggest that news about the health of banks' balance sheets and their ability to keep markets and the economy afloat affect the long end of the yield curve, similar to unconventional policy actions.

Our findings show that unexpected changes in interest rates can be directly related to changes in the ECB's stance towards important policy and economic topics. The stance changes revealed during the ECB's press conference, relative to its stance taken in the preceding press conference, matter for interest rates after controlling for a large set of economic and financial variables as well as the ECB's communication in previous and between press conferences. Hence, the interest rate effects we measure should reflect actual news about 'rate guidance', 'economic activity', and 'financial & monetary conditions'. The differential topic-responses of interest rates with different maturities suggests that the multifaceted communication of the ECB cannot be comprehensively assessed by shocks based on a single interest rate. In other words, shocks based on a single rate do not isolate news about a specific topic in the ECB's communication but reflect news about multiple topics.[8]

In what follows, we show that more involved shock measures, either based on the full term structure of interest rates or on the co-movement between interest rates and stock markets, are more suitable to gauge the information communicated by the ECB.

4.2 Shocks based on the term structure of interest rates

To study how the ECB's stance towards the topics discussed in its press conferences moves the term structure of interest rates, we construct the monetary policy shock measures proposed by Leombroni et al.

[8] In the Internet Appendix, we illustrate how the coefficients on changes in topic-specific stance evolve over the full term-structure of OIS rates in Figure IA.2.

(2021) and by Altavilla et al. (2019), as described in Section 2 above. Table 6 presents regression results for the main coefficients of interest, whereas more detailed results, which include coefficient estimates for all control variables, are again delegated to the Internet Appendix; see Tables IA.8 to IA.11.

[Table 6 about here]

The 'interest rate' (IR) shock measure following Leombroni et al. (2021, LVVW) is defined as the first principal component of interest rate changes across all maturities during the ECB's press conference. We find that IR shocks are significantly related to changes in the ECB's stance towards 'rate guidance' and 'economic activity'; in the specification without control variables the coefficient on 'financial & monetary conditions' is marginally significant as well. These results suggest that news about the ECB's 'rate guidance' and 'economic activity' communicated during the press conferences move the yield curve: positive IR shocks are associated with hawkish policy news and/or a more positive view on the economy. Conversely, however, this implies that from merely observing an IR shock it is unclear whether it reflects news about monetary policy, the economy, or both.

To study whether further dissecting the term structure allows for a tighter connection to text-based topic news, we use the yield curve factors proposed by Altavilla et al. (2019, ABGMR): 'timing', 'forward guidance (FG)', and 'quantitative easing (QE)'.

The interpretation of ABGMR is that 'timing' captures information relevant in the short-run until the next policy meeting that is reflected in short-term rates. Our regression results confirm this intuition by showing that 'timing'-shocks are significantly related to changes in the ECB's stance on 'rate guidance', which captures nuances in central bank communication indicating near-future rate decisions. For the other topics, we only find a moderately significant correlation with 'financial & monetary conditions'.

Shocks to the 'FG'-factor, which ABGMR interpret to reflect medium-term interest rate expectations, are related to changes in the 'economic activity' stance. Albeit slightly less pronounced than for other relations, statistical significance consistently holds across the baseline and the specification with comprehensive controls. This suggests that the ECB's assessment of the economic outlook is an important determinant of market participants' medium-term interest rate expectations such that a more positive view of the economy may be interpreted as a signal for future policy tightening and induce higher rates in the center of the yield curve. In the specification with control variables, which include the ECB's numerical forecasts, in addition, also 'rate guidance' turns marginally significant.

The 'QE'-factor, which picks up movements in long-term yields and is constructed to have minimum variance in the pre-crisis period, is significantly related to the ECB's stance on 'financial & monetary conditions'. This link appears intuitive, because quantitative easing in the euro area includes asset purchases in order to increase liquidity and to facilitate bank lending, which has been shown to impact

the long end of the yield curve (e.g., Krishnamurthy and Vissing-Jorgensen, 2011; Krishnamurthy et al., 2018). From this angle, higher long-term yields may be the result of market participants interpreting news about improved lending and financial market conditions as a signal for a reduced likelihood for QE or other unconventional policies in the future.

Overall, the results in Table 6 confirm our findings from Section 4.1 that different types of verbal news revealed during ECB press conferences have distinct effects on interest rates with different maturities. Specifically, we show that a systematic approach to decomposing yield curve movements, as suggested by Altavilla et al. (2019) and Swanson (2021), allows to directly connect the behaviour of the term structure to text-based news on 'rate guidance', 'economic activity' and 'financial & monetary conditions' and that their proposed shocks reflect distinct topics in the ECB's communication.

4.3 Shocks based on the co-movement of interest rates and stocks

More recently, several papers have suggested to measure shocks related to central bank announcements from the joint market reactions of interest rates and stock prices. Below, we present results using the 'policy' and 'information' shocks proposed by Jarociński and Karadi (2020) as well as the 'monetary', 'growth', and 'risk premium' shocks suggested by Cieslak and Schrimpf (2019).[9]

According to Jarociński and Karadi (2020, JK), 'policy' shocks that capture information relevant for future monetary policy in a narrow sense can be identified via negative co-movement of yields and equity returns. By contrast, 'information' shocks due to news about the general economic outlook should be reflected in a positive co-movement of interest rates and stock markets. The results in Table 7 show that these interpretations of the JK shocks are fully supported by our text-based stance measures. 'Policy' shocks are driven by unexpected news regarding the monetary policy stance (as measured from the topic 'rate guidance'), which implies that hawkish news are accompanied by a positive shock. 'Information' shocks are significantly related to changes in the ECB's stance on 'economic activity', such that a surprisingly more positive view of the ECB on the economy is associated with a positive 'information' shock. Our results suggest that the JK approach indeed allows for a concise distinction between news on monetary policy and news on the economy, as judged by the topic-specific stance changes that we estimate from the ECB transcripts.

[Table 7 about here]

The approach suggested by Cieslak and Schrimpf (2019, CS) also exploits the co-movement between stocks and interest rates, but by additionally distinguishing between short-term and long-term rates they can measure three types of shocks. As discussed in Section 2.1, their 'monetary' and 'growth' shocks are

[9] For detailed regression results reporting the coefficient estimates of all control variables, see Tables IA.12 to IA.16.

(empirically) very similar to the JK 'policy' and 'information' shocks. Thus, in line with our JK-shock results reported above, Table 8 shows that the CS 'monetary' shock is significantly related to a change in the 'rate guidance' topic stance whereas the 'growth' shock is significantly related to news on 'economic activity'. The CS 'risk premium' shock provides a new dimension, which we find to be significantly associated with 'financial & monetary conditions'. The relation is such that a more positive tone on the topic of 'financial & monetary conditions' is associated with a more negative risk premium shock (i.e. lower risk premia). This finding seems in line with results from the intermediary asset pricing literature that focuses on financial institutions and their risk taking capacity as determinants of asset prices (e.g., Adrian et al., 2014; He et al., 2017). Moreover, the risk premium shock of CS is quite similar in this respect to the QE shock of Altavilla et al. (2019) discussed above and both shocks seem to capture the same type of information.[10]

[Table 8 about here]

Overall, we find that the ECB's stances on 'rate guidance', 'economic activity' and 'financial & monetary conditions' not only intuitively relate to single interest rate movements or reactions of the whole yield curve, but also to joint reactions of equity prices and interest rates. 'Policy' or 'monetary' shocks identified through negative co-movement of yields and equity returns are typically considered as information about the monetary policy reaction function in the literature, whereas 'information' or 'growth' shocks relate to news about economic activity. Our results based directly on the ECB's communication about these topics confirm these interpretations.

4.4 ECB topic-specific stances and monetary policy shocks

Our findings show that measures of monetary policy shocks, based on either high-frequency market reactions in interest rates, the entire term structure, or the joint response in interest rates and stock prices, are significantly related to ECB news on the topics 'rate guidance', 'economic activity', and 'financial & monetary conditions'. Below we discuss how these linkages are economically intuitive, provide a text-based validation for shock interpretations suggested in the literature, and allow to study the transmission channel more deeply. We also discuss that markets do not appear to directly respond to the ECB changing its stance towards 'inflation' and 'fiscal policy', which we will explore further in in the next section.

First, we find that the ECB changing its stance on 'rate guidance' is associated with significant changes in short-term OIS rates, the 'timing' factor of Altavilla et al. (2019, ABGMR), the 'policy' shock identified by Jarociński and Karadi (2020, JK), and the 'monetary' shock of Cieslak and Schrimpf (2019, CS).

[10] This is also evident from the strong (negative) correlation between the 'QE' factor and the 'risk premium' shock presented in Table 2.

Second, we show that JK 'information' shocks and CS 'growth' shocks are significantly related to 'economic activity' news communicated by the ECB. The positive relation we find is consistent with the economic rationale underlying the identification procedures that an unexpectedly positive outlook on the economy should be associated with higher (short- to medium-term) interest rates and stock prices. There also is a positive link for the ABGMR 'FG' factor (which captures medium-term rates) but this relation is statistically weaker, presumably because it does not condition on stock market information.

Third, we find that the ECB's communication about 'financial & monetary conditions' matters for monetary policy shocks, for which the identification involves long-term interest rates. On the one hand, we find that the ten-year OIS rate and the ABGMR 'QE' factor are positively related to changes in topic stance. This link appears intuitive, because quantitative easing in the euro area includes asset purchases in order to increase liquidity and to facilitate bank lending, which has been shown to impact the long end of the yield curve (e.g., Krishnamurthy and Vissing-Jorgensen, 2011; Krishnamurthy et al., 2018). On the other hand, we find that the link to CS 'risk premium' shocks, which additionally incorporate stock market information, is negative. That is, good news about 'financial & monetary conditions' are associated with lower risk premia and, as a consequence, higher long-term risk-free rates and stock prices. Taken together, these findings suggest that the ECB unexpectedly changing its stance towards 'financial & monetary conditions' may affect market prices through a channel involving financial intermediaries. Through the lens of the intermediary asset pricing literature (e.g., He and Krishnamurthy, 2013; Adrian et al., 2014; He et al., 2017), market participants may interpret the ECB communicating bad news about financing conditions as a signal for a lowered intermediary capacity to bear risk, which in turn increases risk premia.[11] We explore this channel further in the next section, where we show that ECB communication about 'financial and monetary conditions' also matters for currency markets.

Interestingly, our findings suggest that monetary policy shocks are not significantly related to changes in the ECB's stance towards 'inflation'. Our results are based on an analysis which accounts for the possibility that inflation stance may depend on inflation being above or below the target; as outlined in Section 4, our specification includes a dummy for inflation being below two percent and an interaction with the change in inflation stance, which we never find to be significantly different from zero. Moreover, we neither find a significant relation between market responses and inflation stance changes when using daily data on inflation linked swaps (similar to Andrade and Ferroni, 2021), nor when repeating the analysis with an alternative stance measure based on a human assessment of the inflation discussion in the press conference. However, it is worth noting that we find changes in inflation stance to be related to some of the interest rate shock measures in univariate settings which do not include changes in other

[11] Additional results suggest that the link between stance changes and market responses becomes more pronounced, the larger the stance changes are, as we show in Figure IA.3 in the Appendix.

topics stances. That is, in our sample period, news about inflation appear to have had less of a direct market impact than news about other topics communicated by the ECB, which themselves are conditional on the ECB's inflation assessment.

Moreover, we do not find that monetary policy shocks are significantly related to changes in the topic stance for 'fiscal policy'. Given the ECB's recurring expression of concern about fiscal imbalances and deficits, it may be surprising that markets do not appear to react to related news. To study this in more detail, the next section provides evidence that changes in the ECB's stance towards fiscal policy have distinct effects on sovereign bond prices in core and periphery countries of the euro area.

5 Price responses in sovereign bond and currency markets

This section explores how our text-based measures of ECB stance relate to price reactions in other asset classes beyond those used to construct the monetary policy shock measures discussed above. We show that sovereign yields respond to the ECB changing its stance towards 'fiscal policy', and exchange rates to news 'financial & monetary conditions'. Summary statistics for sovereign yield spreads and foreign exchange rate returns can be found in Table IA.17 in the Internet Appendix.

5.1 Core-periphery sovereign yield spreads

Several studies show that ECB announcements can have differential effects on the yields of sovereign bonds issued by core and peripheral countries of the euro area (see, e.g., Altavilla et al., 2016; Falagiarda and Reitz, 2015; De Santis and Holm-Hadulla, 2020). More specifically, Leombroni et al. (2021) find that the communication shocks they estimate are positively associated with the yield spread between peripheral and core countries during the European sovereign debt crisis. Motivated by this evidence, we now study whether we can directly relate price responses in sovereign bond markets to the ECB changing its stance using our text-based measures.

Using the EA-MPD data for German, Italian and Spanish sovereign bonds, we compute the 5-year and 10-year yield spreads for Spain (ES) and Italy (IT) versus Germany (DE). Table 9 presents the results of regressing yield spread changes during the ECB press conference on changes in ECB stance, using our most comprehensive set of control variables. We find that high-frequency changes in the sovereign yield spreads exhibit a significantly negative relation to the ECB changing its stance towards 'fiscal policy'. That is, our results provide direct evidence that the ES-DE and IT-DE yield spreads drop when the ECB communicates a more optimistic assessment of public finances in the euro area.

[Table 9 about here]

Figure 3 illustrates the link between the ECB's 'fiscal policy' stance and sovereign yield spreads over time, using rolling windows of 60 press conferences. We find that unexpected changes in the ECB's stance move core-periphery spreads only after the onset of the financial crisis. This effect intensifies during the European sovereign debt crisis and gradually abates afterwards. In particular during that crisis period, unexpectedly positive communication about 'fiscal policy' in the euro area narrowed the core-periphery spread substantially.

[Figure 3 about here]

5.2 Exchange Rates

A related stream of the literature studies the role of monetary policy actions and announcements for currency markets. While early empirical research, such as Eichenbaum and Evans (1995) and Faust and Rogers (2003), focuses on the relevance of monetary policy shocks for deviations from uncovered interest rate parity and exchange rate overshooting, more recent work is interested in the role of financial intermediaries, see, e.g. Bruno and Shin (2015), Mueller et al. (2017), and Ferrari et al. (2021). In most of these papers, the theoretical foundation for the role of intermediaries in currency markets is the model of Gabaix and Maggiori (2015) in which financiers intermediate currencies and bear risks resulting form international imbalances.

The EA-MPD provides high-frequency price information during the ECB's press conference for the EUR/USD, EUR/GBP and EUR/JPY exchange rates, all quoted in foreign currency per EUR. Table 10 presents the results of regressing currency returns during the ECB press conference on changes in ECB stance, using our most comprehensive set of control variables. We consistently find that a more positive stance on 'financial & monetary conditions' is associated with an appreciation of the Euro against all three foreign currencies.

These findings provide further evidence that markets pay particularly close attention to the ECB unexpectedly changing its stance towards 'financial & monetary conditions'. More specifically, our results suggest that news communicated by the ECB matters for markets in a way that is consistent with the notion of intermediary asset pricing.

[Table 10 about here]

6 Conclusion

This paper shows that financial market responses to central bank announcements can be directly linked to verbal news communicated by the central bank. We establish this finding by relating high-frequency

asset price movements in euro area markets to text-based measures of the ECB's stance towards the topics discussed in its press conferences.

We start by constructing three sets of monetary policy shock measures established in the literature, based on either high-frequency market reactions in interest rates, the entire term structure, or the joint response in interest rates and stock prices. While the literature uses economic theory to (indirectly) infer what type of news should move asset prices in the direction observed, we directly show that all shock measures are related to the ECB changing its stance on the topics 'rate guidance', 'economic activity', or 'financial & monetary conditions'. The differential responses of the different shocks to these topics allow us to provide a text-based validation for shock interpretations suggested by the literature.

Using the term structure of interest rates, we find that shocks to the short end of the yield curve are associated with changes in the ECB's 'rate guidance'-stance, the medium term with 'economic activity', and the long end with 'financial & monetary conditions'. These text-based economic drivers align well with the term structure factor interpretations offered by Altavilla et al. (2019). Our text-based results also provide support for the economic intuition underlying monetary policy shocks identified from the joint movements of interest rates and stock markets. Using the approach of Jarociński and Karadi (2020), we find that their 'policy' shocks are associated with changes in the ECB's 'rate guidance'-stance whereas 'information' shocks are driven by news about 'economic activity'. Similarly, the 'monetary' and 'growth' shocks of Cieslak and Schrimpf (2019) are related to stance changes about 'rate guidance' and 'economic activity', respectively. Additionally, we show that their measure for 'risk premium' shocks is significantly related to news about 'financial & monetary conditions'. This suggests that news about financing conditions matter for asset prices in a manner consistent with intermediary asset pricing theory (e.g., He and Krishnamurthy, 2013; Adrian et al., 2014; He et al., 2017).

Moreover, we find that ECB stance changes also matter for market prices in other asset classes. We find that the euro appreciates (relative to USD, GBP, and JPY) when the ECB's topic stance towards 'financial & monetary conditions' becomes unexpectedly positive and that the differential response of sovereign bonds in core and periphery countries to ECB announcements is related to the ECB's stance towards 'fiscal policy'.

Beyond providing economic interpretations for market responses to central bank announcements, our findings should also be relevant for the optimal design of monetary policy communication. For instance, the trade-offs associated with the level of policy communication, i.e., too much as compared to too little communication, are debated among academics and policymakers alike. Our findings suggest that market participants indeed do not react (equally strong) to all the topics addressed by the ECB. In addition, different topics move different asset prices. As a result, using one or the other topic to explain the very same policy decision may lead to different implications for the yield curve, thereby directly affecting the

transmission of monetary policy.

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Appendix

A Details on the measurement of monetary policy shocks

This appendix presents technical details related to the identification of monetary policy shocks from the term structure of interest rates as well as from the co-movement of interest rates and stocks, as discussed in Section 2.1 of the main paper.

A.1 Shocks based on the term structure of interest rates

In order to construct the 'interest rate' shock of Leombroni et al. (2021) we perform principal component analysis (PCA) on a matrix that contains the high frequency reactions of our interest rate universe during the press conference. More formally, let X be a 196×7 matrix, where each row corresponds to a press conference and each column to an OIS maturity. First, we demean each row and then we apply PCA to X

$$P = XW \tag{A.1}$$

where P is a 196×7 matrix containing the principal components in each column and W is a 7×7 matrix where the i-th column contains the loadings of the yields on the i-th principal component. We then extract the first principal component, i.e. the first column of P, and scale it to load with a factor of one on the two-year OIS movement. We repeat this exercise for the high frequency rate changes during the press release in order to construct the press release control variable.

For replicating the 'timing', 'forward guidance' and 'quantitative easing' factors of Altavilla et al. (2019) we again gather all press conference reactions of OIS rates in a matrix X. We then perform PCA as in equation A.1 and extract the first, second and third columns of P, i.e. the first three principal components. Afterwards, we rotate them such that the second and third factors are orthogonal to the OIS 1M and the third factor has a minimal variance prior to August 2008.

More formally, let F be a 196×3 matrix that contains the first three columns of P, i.e. the first three principal components. Let Λ consist of the first three rows of W^T, recall that $W^T = W^{-1}$, thus Λ is a 3×7 matrix and each row i now contains the loadings of the yields on the i-th principal component. That means we rewrite A.1 as

$$X = F\Lambda \tag{A.2}$$

We need to find an orthonormal rotation matrix U with $UU' = I$

$$X = \underbrace{FU}_{F^R}\underbrace{U'\Lambda}_{\Lambda^R} \tag{A.3}$$

and then the rotated factors F^R are given by $F^R = FU$. U has to be orthonormal, thus, its columns have unit length

$$u_{1j}^2 + u_{2j}^2 + u_{3j}^2 = 1 \; for \; j = 1, 2, 3 \tag{A.4}$$

and columns are orthogonal to each other

$$\begin{aligned} u_{11} * u_{12} + u_{21} * u_{22} + u_{31} * u_{32} = 0 \\ u_{11} * u_{13} + u_{21} * u_{23} + u_{31} * u_{33} = 0 \\ u_{12} * u_{13} + u_{22} * u_{23} + u_{32} * u_{33} = 0 \end{aligned} \tag{A.5}$$

Additionally, we want the second and third rotated factor to be orthogonal to the OIS 1M

$$\begin{aligned} u_{12} * \lambda_{11} + u_{22} * \lambda_{21} + u_{32} * \lambda_{31} = 0 \\ u_{13} * \lambda_{11} + u_{23} * \lambda_{21} + u_{33} * \lambda_{31} = 0 \end{aligned} \tag{A.6}$$

Given constraints in equations A.3, A.5 and A.6 we then solve the following optimization problem, which ensures that the third factor has minimum variance in the pre-crisis period

$$\arg\min_{u_{ij}} \frac{1}{T} \sum_{t=1}^{T} \sum_{j=1}^{3} f_{tj} u_{j3} \tag{A.7}$$

where $t = 1, \ldots, T$ are the time points between January 2002 and August 2008. We then scale the rotated factors such that the 'timing' factors loads with one on the six-month OIS, the 'forward guidance' factor loads with one on the two-year OIS and the 'quantitative easing' factor loads with one on the ten-year OIS.

We repeat this analysis with the yield curve movements during press conferences to obtain a corresponding press release window control variable, but only consider the rotated first principal component, thereby following Altavilla et al. (2019).

A.2 Shocks identified from the co-movement of interest rates and stocks

The main framework of monetary policy shocks based on co-movement of assets is as following: it is assumed that the observed high frequency shocks Δy_t are driven by a structural shock u_t

$$\Delta y_t = A^{-1} u_t \tag{A.8}$$

where $y_t \sim WN(0, \Sigma)$ and $u_t \sim WN(0, I)$.

Δy_t are the observed high frequency market reactions, i.e. the changes of yields and stock returns. u_t are

orthogonal structural shocks that the researcher would like to back out, i.e., the 'policy' and 'information' respectively 'monetary', 'growth' and 'risk premium' shocks. The matrix A^{-1} is not unique, rather there exists a whole set of possible candidates. However, for a set of specific shocks the researcher knows the sign restrictions of A's entries.

'Policy' and 'information' shocks The y_t vector contains changes in the 2-year interest rate (Δi_t) and stock market returns (r_t). As Jarociński and Karadi (2020) we assume that (i) a 'policy' shock (u_t^{Policy}) impacts interest rates and stock valuations with opposite signs and (ii) an 'information' shock ($u_t^{Information}$) moves interest rates and stock valuations in the same direction. Under these assumptions, the we can write equation (A.8) as

$$\underbrace{\begin{pmatrix} \Delta i_t \\ r_t \end{pmatrix}}_{\Delta y_t} = \underbrace{\begin{pmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{pmatrix}}_{A^{-1}} \underbrace{\begin{pmatrix} u_t^{Policy} \\ u_t^{Information} \end{pmatrix}}_{u_t}, \; u_t \sim N(0, I) \tag{A.9}$$

with the sign restrictions $a_{11} > 0$, $a_{12} > 0$, $a_{21} < 0$ and $a_{22} > 0$ on the entries of A^{-1}.

'Monetary', 'growth' and 'risk premium' shocks The y_t vector contains changes in the 2-year interest rate (Δi_t^{2Y}), changes in the 10-year interest rate (Δi_t^{10Y}) and stock market returns (r_t). As Cieslak and Schrimpf (2019) we assume that

- a 'monetary' shock ($u_t^{Monetary}$) impacts interest rates and stock valuations with opposite signs and impacts the two-year rate more than the 10Y rate
- a 'growth' shock (u_t^{Growth}) moves interest rates and stock valuations in the same direction and impacts the two-year rate more than the 10Y rate
- a 'risk premium' (u_t^{RP}) shock moves interest rates and stock valuations in the same direction and impacts the ten-year rate more than the two-year rate

Thus, we can write equation (A.8) as

$$\underbrace{\begin{pmatrix} \Delta i_t^{2Y} \\ \Delta i_t^{10Y} \\ r_t \end{pmatrix}}_{\Delta y_t} = \underbrace{\begin{pmatrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \\ a_{31} & a_{32} & a_{33} \end{pmatrix}}_{A^{-1}} \underbrace{\begin{pmatrix} u_t^{Growth} \\ u_t^{Monetary} \\ u_t^{RP} \end{pmatrix}}_{u_t}, \; u_t \sim N(0, I) \tag{A.10}$$

with the sign restrictions $a_{i1} > 0$ for $i = 1, 2, 3$, $a_{i2} > 0$ for $i = 1, 2$ and $a_{32} < 0$, $a_{i3} < 0$ for $i = 1, 2, 3$, $|a_{13}| < |a_{23}|$, $|a_{11}| > |a_{21}|$, $|a_{12}| > |a_{13}|$ and $|a_{22}| < |a_{23}|$.

Generating A Hence, the task boils down to generating a set of suitable matrices which entries have the sign derived by theory. In order to back out A^{-1} we first decompose the covariance matrix Σ with a Cholesky Decomposition s.t. $\Sigma = CC'$ where C is a lower triangular matrix. Furthermore, let Q be an orthogonal matrix $QQ' = Q'Q = I$. Then

$$\Delta y_t = \underbrace{CQ}_{A^{-1}} u_t \tag{A.11}$$

ensures that Δy_t retains its covariance structure, while u_t has unit variance. Q is the so called rotation matrix.

In order to find a suitable set of rotation matrices we follow the procedure outlined by Rubio-Ramirez et al. (2010):

- First, we randomly generate a matrix X with independent standard normally distributed entries and apply a QR decomposition $X = QR$ (the entries in the diagonal of R have to be positive).
- Second, we generate a candidate matrix for A^{-1} by $A^{-1} = CQ$ and check whether the sign restrictions are met. If so we keep the matrix as an candidate for A^{-1}. We repeat the procedure until we have obtained 2000 candidate for A^{-1}.
- Finally, we apply the median target of Fry and Pagan (2011): we choose the matrix A^{-1}, which entries minimize the distance to the median of the set of candidate matrices. Hence, we ensure that the chosen matrix lies within the set of generated candidates.

B Changes in the communication of ECB policy decisions

Since June 9^{th}, 1998, the ECB holds regular press conferences to elaborate on its policy decisions. All press conferences can be found at ECB's website. Our sample covers 196 press conferences between January 2002 and July 2020, that is, all press conferences except for one unscheduled press conference on 2nd of August 2007.

The chronological structure of topics outlined in Section 3.1 was first adopted for the press conference on May 8^{th}, 2003. Before May 8^{th}, 2003, the topics discussed were the same, but 'financial & monetary conditions' were discussed before 'economic activity' and 'inflation', i.e. only the *ordering* of topics within the press conference changed. See the following press briefing and presentation for more information on this change. Furthermore, the ECB includes quarterly announcements of macroeconomic projections in the introductory statements since June 2004. Before, the ECB published the Eurosystem staff projections only biannually (June and December) in the Monthly Bulletin. In June 2004 the ECB

announced that it would also publish the ECB staff projections from then on (March and September) in the Monthly Bulletin. In addition, they started to make them public in the press conference. The change of communication was announced in this press conference.

In 2015, the Governing council changed the frequency of policy meetings – and therefore also subsequent press conferences – to 8 times a year. Before, they held a press conferences (almost) every month. Since February 2015, the ECB also releases the Monetary Policy Accounts, which provide additional insights regarding the considerations and the deliberative process within the ECB Governing Council underlying policy decisions. You can find them here. Since March 10^{th}, 2016, the press release also contains all monetary policy decisions – previously, it only contained the interest rate decision and unconventional monetary policy instruments were announced during the press conference.

C Examples for stance changes in 'rate guidance'

As described in Section 3.2 in the paper, we use content analysis to assess the change in the ECB's stance for 'rate guidance', i.e. Δ*Rate Guidance*. More specifically, we identify (and code) indications of tighter monetary policy (+1), no indications regarding future monetary policy (0), or monetary easing (−1). Below, we provide an example for an indication of monetary easing and an example for an indication of monetary tightening.

- On 11^{th} November 2002 the first paragraph stating the monetary policy decision included explicitly that the Governing Council discussed rate cuts today:

  > "*In view of the high uncertainty on future growth, and its implication for medium-term inflationary developments, the* ***Governing Council has discussed extensively the arguments for and against a cut in the key ECB interest rates****. The view has prevailed to keep interest rates unchanged.*"

- On 4^{th} May 2006 the ECB changed the following sentence of the paragraph stating their policy decision from:

  > "*We will continue to* ***monitor very closely*** *all developments to ensure that risks to price stability over the medium term do not materialise.*"

  to

  > "*Against this background, the Governing Council will exercise* ***strong vigilance*** *in order to ensure that risks to price stability over the medium term do not materialise.*"

D Deciphering monetary policy shocks: Control variables

This section details the construction of the control variables used in the regressions presented in Section 4 in the paper. Table IA.2 in the Internet Appendix presents summary statistics.

Press Release Shocks All press release shocks are calculated similar to their press conference pedants, however, they are based on the asset price changes during the press release.

UMP Announcements The introductory statement included announcements of unconventional monetary policy instruments until 10^{th} March, 2016 and also forward guidance relating to the future use of UMP instruments thereafter. On 2^{nd} October 2013 the ECB changed the last sentence of the 'monetary policy tools' paragraph from

> "*We will remain particularly attentive to the implications that these developments may have for the stance of monetary policy.*"

to

> "*With regard to money market conditions, we will remain particularly attentive to developments which may have implications for the stance of monetary policy* ***and are ready to consider all available instruments***."

Therefore, we manually code two additional dummy variables 'asset purchase programs' and 'non-app unconventional monetary policy'. They capture the change from the last press conference to the next in terms of formulations that give insights into the ECB's policy intentions. We then summarize 'asset purchase programs' and 'non-app unconventional monetary policy' to one category called 'unconventional monetary policy' by taking the sum of both dummy variables and recoding them accordingly:[12]

$$\Delta UMP = \begin{cases} 1 & \text{if } APP + NON\ APP\ UMP > 0 \\ -1 & \text{if } APP + NON\ APP\ UMP < 0 \\ 0 & otherwise \end{cases} \tag{D.12}$$

ΔUMP then serves as a control variable and is added together with the press release shock to our empirical specifications.

State Dependence of Inflation We account for a possible state dependent effect of the inflation stance. It could be that a positive inflation stance has a distinctively different effect when inflation is

[12]The dummy variables are coded as following: -1 indicates an easing while 1 indicates a tightening, 0 indicates no change. Moreover, we choose to code a renewal of LTROs as no change to UMP and only count the introduction of LTRO with a longer maturity as an easing.

below the target compared to inflation above the target. We, therefore, take the vintage flash estimate from the Real Time Database available at the ECB's Statistical Data Warehouse. For a press conference in month t we use the flash estimate from month $t-1$ and create a dummy variable that takes the value 1 when the announced inflation estimate was below 2%. The variable, called *Inflation* $<$ *2%*, is then interacted with the inflation tone.

Past communication In order to control for the auto-correlation of changes in communication, we include lagged changes in stance of 'economic activity', 'inflation', 'financial & monetary conditions' and 'fiscal policy'. The appropriate control variable 'rate guidance' is the press release shock since any new information on policy measures is announced during the press release.

Financial Market Conditions Changes of financial market conditions are based on the return of the EUROSTOXX 50, the change of the VSTOXX, and the change of the two-year German yield between press conferences. All data is obtained from Thomson Reuters Eikon.

Numerical Forecasts We consider changes in one-year-ahead GDP and inflation forecasts from macroeconomic projections announced during press conferences. In December, we consider the change from the previous 1Y forecast to the December 1Y forecast. For the first macroeconomic projections of the new year, we compute the difference between the 1Y forecast and the previous projections' two-year forecast. Since macroeconomic projections prior to 2004 were not released as part of the introductory statement, changes are set to 0 for this period.

Inter-meeting Communication It could be the case that the ECB provides information about her updated stance during speeches that take place between press conferences. Therefore, we utilize a rich data set of ECB's executive board members speeches in order to account for communication between press conferences. This data set includes 2403 speeches starting from 2^{nd} June 1997 to 13^{th} July 2020. Given the large number of texts, we draw on a standard machine learning technique called LDA (Blei et al., 2003) in order identify topics (see subsection D.1 for a short overview of this method) . Our goal is to extract topics that are closely related to the topics discussed in the ECB's introductory statement and measure the ECB's stance on this topics between press conferences.

First of all we identify multi-word expressions in the ECB's speech corpus. For example, consider the multi-word expression 'price stability'. While it is clear to a human reader that this particular word combination has a distinct meaning and that both 'price' and 'stability' can separately co-occur with other words in different contexts, the standard LDA does not take this into account. In order to better identify multi-word expressions we merge the press conferences corpus with the executive board members'

speeches of executive board members. The augmentation of the text data set substantially improves the precision in finding multi-word expression frequently used by central bankers. We automatically remove certain parts of these speeches such as the introductory paragraph, paragraphs that start with 'Chart', 'Source', 'Slides' or 'Note' as well the references of speeches. We also run a language detection algorithm and remove speeches that are not identified as English. Furthermore, we convert all words from American to British English. In addition, we drop all speeches and press conferences that have less than 500 words.

We then use the `R`-package `quanteda` developed by Benoit et al. (2018) together with the `R`-wrapper `spacyr` for the Python package `spacy` to POS-tag words and lemmatize them. Part-of-speech-tagging (POS-tagging) means that words are assigned a part of speech – e.g. verb, noun, pronoun, adverb or adjective. Lemmatization determines the root of each word e.g. the noun 'policies' will be altered to 'policy'. For a more detailed explanation of both concepts we refer to Jurafsky and Martin (2020). Part-of-speech-tagging increases the ability to find multi-word expression, while lemmatization is a form of information reduction. Different word forms are unified to a common root which increases the frequency of this word and, thus, helps the clustering of topics. We set the POS-tag for each lemma to the most common POS-tag in the data and unify pronoun POS-tags to noun POS-tags. We then remove all stop words (except for 'of'), numbers and punctuation. Afterwards, we search for all nouns that are connected through 'of' and manually verify whether these are multi-word expression. For example, 'cost of funding' is recast to 'funding cost'. Subsequently, we remove all remaining incidences of the stop word 'of' from our text. In order to build multi-word expressions we only keep words that have been POS-tagged as nouns and adjectives.

We start identifying multi-word expression with 5-grams and move downwards to 2-gram multi-word expressions. For this purpose we use a method readily implemented in quanteda.[13] However, this unsupervised method is purely based on statistical measures. Therefore, we manually check each proposed multi-word expression and decide whether it is a true multi-word expression. After each n-gram we compound all identified multi-word expressions. Overall, we detect 2321 multi-word expressions. Finally, we only keep nouns and multi-word expressions, remove all POS-tags and replace abbreviations with lemmatized versions of the full expression (e.g. SMP is replaced with security_market_programme). Hence, we are left with a corpus that consists of paragraphs with nouns and multi–word expression from ECB speeches and press conferences. We split the corpus into a speeches and press conference corpus and continue to work with the former.

Subsequently, we impose the condition that the minimum occurrence of words has to be above the 75% quantile and that a word is allowed to appear only in 4% of the paragraphs. Afterwards, we fit

[13] We refer to the reference manual of the quanteda R-package for a detailed explanation of statistical procedure. The function is called 'textstat_collocation'.

a topic model with $K = 40$, reweigh the top terms and label the topics. Reweighing means that we normalize the posterior probability of a word given a topic by its posterior distribution over all topics. Hence, words that have high probability of occurring in several topics will be down weighted and, thus, the interpretation of topics for a human reader should become easier (see Table IA.3 for the top 30 keywords of the matched topics). We then match the topics of the speeches to the press conference topics (see Table IA.4 for the exact matching of topics).

Afterwards we use the top 30 keywords of each of these topics and impose that a paragraph belongs to the topic with the majority of keyword counts. If two keywords have the same count, the algorithm classifies the paragraph belonging to both topics. In order to measure the topic specific stance of the ECB in the inter-meeting speeches, we again use the dictionary based method outlined in Section 3. Therefore, we aggregate the word counts of all paragraphs belonging to a specific topic i in the *inter-press conference* time window, i.e., the time between two subsequent press conferences, and calculate the topic-specific tone $\tau_{i,t}^{IPC}$ as

$$\tau_{i,t}^{IPC} = 1 - \frac{\#\text{ negative words in topic } i \text{ between press conferences at time } t \text{ and } t-1}{\#\text{ words in topic } i \text{ between press conferences at time } t \text{ and } t-1}. \tag{D.13}$$

Finally, for a press conference at t we calculate the change in the inter-press conference time window, $\Delta\tau_{i,t}^{IPC}$, as the differences of the inter-meeting tone in the time window before the press conference at t and the inter-meeting tone in the window before the press conference at $t-1$.

D.1 Latent Dirichlet Allocation

The intuition behind a LDA is that words that frequently co-occur in a document belong to the same topic. The researcher a priori has to specify the number of topics K she expects in the text. Consider a corpus of D documents on K different topics, where each document d consists of n_d individual words from a common vocabulary of V possible terms.[14] The data generating process for our corpus of text data can then be written in the following way:

1. Choose $\theta_d \sim Dir(\alpha)$ where $d \in \{1, \ldots, D\}$ and θ_d a K-dimensional vector of probabilities
2. Choose $\phi_k \sim Dir(\beta)$ where $k \in \{1, \ldots, K\}$ and ϕ_k a V-dimensional vector of probabilities
3. For each word w_{di}, $i \in \{1, \ldots, n_d\}$ in document d:
   - draw a topic $z_{di} \sim$ multinomial(θ_d)
   - draw a word $w_{di} \sim$ multinomial$(\phi_{k=z_{di}})$

[14] Individual words in our application include multi-word expressions and documents correspond to paragraphs in our corpus. For a more detailed treatment of LDA we refer to Blei et al. (2003).

Table 1: Overview of price-based measures of monetary policy shocks

This table provides an overview of all monetary policy shock measures considered in our empirical analysis. The table is divided intro three broad categories: 'interest rate', 'term structure' and 'joint interest rate and equity' shocks. The main difference between these categories are the assets used for the construction of shocks. The first column contains the source and the name of the monetary policy shocks. The second column lists the assets and identification assumptions on which the shocks are based. The last column summarizes how a positive shock is interpreted. For shocks based on a single rate no direct source is provided, since a broad range of authors use these types of shocks (except for the OIS 10Y rate, which is not a common single-rate-based measure, but provided as a point of reference for other results presented in this paper).

Market-based shock measure	Identification	Shock ↑
Interest rate shocks		
3M	change in the 3M OIS rate	rates ↑
2Y	change in the 2Y OIS rate	rates ↑
10Y	change in the 10Y OIS rate	rates ↑
Term structure shocks		
Leombroni et al. (2021)	PCA of yield changes: 1M to 10Y	
Interest rate factor (IR)	1^{st} PC	yield level ↑
Altavilla et al. (2019)	PCA of yield changes: 1M to 10Y	
Timing factor (TIM)	1^{st} PC, rotated	short-term rates ↑
Forward guidance factor (FG)	2^{nd} PC, rotated, $\perp$1M	medium-term rates ↑
Quantitative easing factor (QE)	3^{rd} PC, rotated, $\perp$1M	long-term rates ↑
Joint interest rate and equity shocks		
Jarociński and Karadi (2020)	structural shocks: 2Y, ESX50	
Policy shock (POL)	2Y ↑, ESX50 ↓	hawkish news
Information shock (INF)	2Y ↑, ESX50 ↑	good economic news
Cieslak and Schrimpf (2019)	structural shocks: 2Y, 10Y, ESX50	
Monetary shock (MON)	2Y ↑↑, 10Y ↑ , ESX50 ↓	hawkish news
Growth shock (GRO)	2Y ↑↑, 10Y ↑ , ESX50 ↑	good economic news
Risk Premium shock (RP)	2Y ↓ , 10Y ↓↓, ESX50 ↓	risk premium ↑

Table 2: Summary statistics for ECB communication shocks

This table presents descriptive statistics and pairwise correlations for monetary policy shocks during the ECB press conference window. All shocks are based on high-frequency market data available from the Euro Area Monetary Policy event-study Database (EA-MPD), see Altavilla et al. (2019). We measure interest rate shocks as changes in overnight index swap rates with maturities of three months (OIS 3M), two years (OIS 2Y) and ten years (OIS 10Y). To assess shocks to the term structure of interest rates, we construct the 'interest rate' (IR) factor of Leombroni et al. (2021) and the three term structure factors 'timing', 'forward guidance' (FG), and 'quantitative easing' (QE) proposed by Altavilla et al. (2019). To gauge the joint responses of interest rates and stock markets (i.e., the Eurostoxx 50), we construct 'policy' and 'information' shocks as suggested by Jarociński and Karadi (2020) as well as the 'monetary', 'growth', and 'risk premium' shocks proposed by Cieslak and Schrimpf (2019). Panel A reports the pairwise shock correlations. Panel B reports descriptive statistics and the unit in which shocks are measured, i.e. we indicate whether shocks are measured in basis points (bps) or standardized (std). Our sample covers 196 ECB press conferences from January 2002 to July 2020.

	Interest rate shocks			Term structure shocks				Joint interest rate and equity shocks				
	3M	2Y	10Y	IR	TIM	FG	QE	POL	INF	MON	GRO	RP
Panel A. Pairwise shock correlations												
OIS 3M	1											
OIS 2Y	0.76	1										
OIS 10Y	0.46	0.74	1									
IR	0.80	0.98	0.79	1								
Timing	0.93	0.55	0.32	0.62	1							
FG	0.30	0.83	0.58	0.76	0.00	1						
QE	0.01	0.10	0.73	0.22	-0.00	0.00	1					
Policy	0.55	0.77	0.55	0.76	0.39	0.67	0.06	1				
Information	0.57	0.71	0.54	0.70	0.43	0.55	0.09	0.10	1			
Monetary	0.45	0.65	0.53	0.65	0.30	0.57	0.14	0.98	-0.06	1		
Growth	0.66	0.77	0.32	0.72	0.50	0.62	-0.27	0.26	0.91	0.07	1	
Risk Premium	-0.12	-0.31	-0.84	-0.39	-0.08	-0.20	-0.91	-0.03	-0.44	-0.04	-0.06	1
Panel B. Summary statistics												
Mean	-0.10	-0.25	-0.06	0	0	0	0	0	0	0	0	0
Median	0.00	-0.16	-0.07	0	0.15	0.09	-0.03	-0.04	0.04	-0.07	0.07	0.03
SD	2.02	4.22	2.75	4.16	2.26	3.48	2.01	1	1	1	1	1
Min	-10.60	-22.50	-8.74	-18.04	-12.19	-25.45	-7.71	-5.33	-3.87	-4.72	-4.75	-2.78
Max	10.80	19.40	8.75	20.55	10.79	10.25	6.26	3.77	3.11	4.06	3.8	4.38
Mean Absolute Change	1.10	2.62	2.04	2.62	1.30	2.15	1.42	0.68	0.70	0.70	0.67	0.73
Unit	bps	bps	bps	bps	bps	bps	bps	std	std	std	std	std

Table 3: Summary statistics for ECB introductory statements

This table presents summary statistics for the text length of ECB press conference statements ('introductory statement') after removing stop words. The left part of the table displays total word counts, while the right part presents summary statistic as a fraction of total words per press conference. The first row presents summary statistics for the whole introductory statement. The next five rows contain summary statistics for our five topics of interest, as outlined in Section 3.1. The last three rows present summary statistics for the residual topics.

	Word Count					% of Press Conference				
	Mean	Median	SD	Min	Max	Mean	Median	SD	Min	Max
Press conference	829.96	788.50	178.98	482.00	1,388.00					
Monetary Policy Tools	154.93	150.50	82.18	27.00	484.00	18.48	17.15	8.63	4.67	42.27
Economic Activity	157.65	153.00	40.87	79.00	289.00	19.25	19.06	4.18	9.44	36.29
Inflation	130.14	122.00	47.98	44.00	325.00	15.86	14.73	5.19	6.26	31.94
Financial & Monetary Cond.	144.15	143.50	53.27	42.00	289.00	17.21	17.18	4.93	5.87	34.48
Fiscal Policy	142.90	138.00	47.58	60.00	280.00	17.64	16.87	6.05	5.62	34.21
Introduction	34.49	21.50	34.47	0.00	293.00	4.25	2.86	4.29	0.00	41.44
Summary	55.83	33.00	43.97	0.00	160.00	6.20	4.47	4.10	0.00	16.00
Unclassified	9.86	3.00	28.48	0.00	307.00	1.12	0.39	2.62	0.00	22.12

Table 4: Summary Statistics for changes in the ECB's topic-specific stance

This table presents summary statistics and pairwise correlations for changes in the ECB's topic-specific stance. Changes in stance on 'economic activity', 'inflation', 'financial & monetary conditions' and 'fiscal policy' are based on equations (1) and (2) and are additionally standardized. 'Rate guidance' is a hand-coded variable that can take values $\in \{-1, 0, 1\}$. All stance measures cover ECB press conferences from January 2002 to July 2020. Panel A reports the pairwise correlations of changes in topic-specific stance. Panel B reports descriptive statistics and the unit in which changes are measured, i.e. standardized (std) or values $\in \{-1, 0, 1\}$.

	Δ RG	Δ EA	Δ INF	Δ FMC	Δ FP
Panel A. Pairwise correlations					
Δ Rate Guidance (RG)	1				
Δ Economic Activity (EA)	0.04	1			
Δ Inflation (INF)	-0.05	0.26	1		
Δ Financial & Monetary Cond. (FMC)	0.10	-0.08	0.06	1	
Δ Fiscal Policy (FP)	-0.10	0.16	-0.03	-0.13	1
Panel B. Summary statistics					
Mean	0.05	0.00	0.00	0.00	0.00
Median	0.00	-0.12	-0.10	0.01	0.01
SD	0.46	1.00	1.00	1.00	1.00
Min	-1.00	-4.40	-3.33	-3.23	-2.93
Max	1.00	3.45	5.48	3.80	2.77
Unit	$\in \{-1, 0, 1\}$	std	std	std	std

Table 5: Results from regressing interest rate shocks on changes in the ECB's topic-specific stance

The dependent variables are changes in the OIS 3M, OIS 2Y and OIS 10Y rates (measured in bps) over the ECB press conference event window. Coefficient estimates for the changes in topic-specific measures of stance correspond to the regression model in equation (4). The left part of the table presents estimations without controls, the right part contains results for the estimation with all control variables. 'Economic activity, 'inflation, 'financial & monetary conditions' and 'fiscal policy' measure changes in topic-specific stance from the last press conference to the current (scaled to unit variance). The topic-specific stance is measured as the ECB's tone on topic i at press conference t, i.e. $\tau_{i,t} = 1 - \frac{\text{\# negative words in topic } i \text{ at press conference } t}{\text{\# words in topic } i \text{ at press conference } t}$. For the manually coded 'rate guidance', 1 (-1) indicates a tighter (looser) policy stance. Reported standard errors are corrected for heteroscedasticity based on White (1980).

	Baseline			With Controls		
$\Delta Stance$	OIS 3M	OIS 2Y	OIS 10Y	OIS 3M	OIS 2Y	OIS 10Y
Rate Guidance	1.096***	1.601**	0.307	0.932***	1.475**	0.277
	(0.350)	(0.704)	(0.356)	(0.297)	(0.634)	(0.400)
Economic Activity	0.198	0.673**	0.519**	0.213	0.812**	0.423
	(0.125)	(0.296)	(0.224)	(0.142)	(0.351)	(0.267)
Inflation	0.050	0.064	0.156	0.014	0.183	0.243
	(0.100)	(0.243)	(0.197)	(0.197)	(0.537)	(0.322)
Financial & Monetary Cond.	0.240	0.407	0.584***	0.228	0.290	0.522**
	(0.152)	(0.311)	(0.207)	(0.148)	(0.330)	(0.226)
Fiscal Policy	0.043	−0.043	0.164	0.100	0.158	0.217
	(0.140)	(0.264)	(0.193)	(0.165)	(0.347)	(0.219)
Press Release Shock & UMP				✔	✔	✔
Inflation Interaction				✔	✔	✔
Prev. Stance & inter-PC Comm.				✔	✔	✔
Financial Market Cond.				✔	✔	✔
Macroeconomic Projections				✔	✔	✔
Observations	196	196	196	196	196	196
Adjusted R^2	0.067	0.045	0.069	0.008	0.009	0.013
Note:						*p<0.1; **p<0.05; ***p<0.01

Table 6: Results from regressing term structure shocks on changes in the ECB's topic-specific stance

The dependent variables are changes in the 'interest rate', 'timing', 'forward guidance' and 'quantitative easing' factor (measured in bps) over the ECB press conference event window. The 'interest rate' factor by Leombroni et al. (2021, LVVW) is denoted by 'IR'. The 'timing', 'forward guidance' and 'quantitative easing' factors by Altavilla et al. (2019, ABGMR) are denoted by 'Timing', 'FG' and 'QE'. The initials of the respective original authors are provided in parentheses. Coefficient estimates for changes in topic-specific measures of stance correspond to the regression model in equation (4). The left part of the table presents estimations without controls, the right part presents results for estimations with the most comprehensive set of control variables. 'Economic activity, 'inflation, 'financial & monetary conditions' and 'fiscal policy' measure changes in topic-specific stance from the last press conference to the current (scaled to unit variance). The topic-specific stance is measured as the ECB's tone on topic i at press conference t, i.e. $\tau_{i,t} = 1 - \frac{\#\text{ negative words in topic } i \text{ at press conference } t}{\#\text{ words in topic } i \text{ at press conference } t}$. For 'rate guidance', which is manually coded, 1 (-1) indicates a tighter (looser) policy stance. Reported standard errors are corrected for heteroscedasticity based on White (1980).

	Baseline				With Controls			
$\Delta Stance$	IR (LVVW)	Timing (ABGMR)	FG (ABGMR)	QE (ABGMR)	IR (LVVW)	Timing (ABGMR)	FG (ABGMR)	QE (ABGMR)
Rate Guidance	1.783**	1.162***	0.688	−0.355	1.691***	0.925***	0.977*	−0.337
	(0.726)	(0.377)	(0.541)	(0.219)	(0.651)	(0.344)	(0.571)	(0.277)
Economic Activity	0.647**	0.088	0.487*	0.240	0.657**	0.139	0.535*	0.029
	(0.287)	(0.142)	(0.249)	(0.166)	(0.333)	(0.167)	(0.322)	(0.189)
Inflation	0.107	0.086	−0.072	0.166	0.179	−0.040	0.131	0.228
	(0.228)	(0.115)	(0.217)	(0.159)	(0.489)	(0.200)	(0.462)	(0.197)
Financial & Monetary Cond.	0.506*	0.330*	−0.058	0.409**	0.385	0.337*	−0.230	0.419***
	(0.303)	(0.183)	(0.281)	(0.159)	(0.327)	(0.175)	(0.294)	(0.158)
Fiscal Policy	0.043	0.064	−0.123	0.185	0.209	0.097	0.001	0.146
	(0.266)	(0.152)	(0.194)	(0.151)	(0.343)	(0.182)	(0.295)	(0.160)
Press Release Shock & UMP					✔	✔	✔	✔
Inflation Interaction					✔	✔	✔	✔
Prev. Stance & inter-PC Comm.					✔	✔	✔	✔
Financial Market Cond.					✔	✔	✔	✔
Macroeconomic Projections					✔	✔	✔	✔
Observations	196	196	196	196	196	196	196	196
Adjusted R^2	0.059	0.061	0.003	0.053	0.026	0.010	0.019	0.041
Note:								*p<0.1; **p<0.05; ***p<0.01

Table 7: Results from regressing 'policy' and 'information' shocks on changes in the ECB's topic-specific stance

The dependent variables are changes in the 'policy' and 'information' shocks introduced by Jarociński and Karadi (2020, JK), measured over the ECB press conference event window. The shocks are scaled to unit variance. Coefficient estimates for the changes in topic-specific measures of stance correspond to the regression model in equation (4). The left part of the table presents estimations without controls, the right part presents results for estimations with the most comprehensive set of control variables. 'Economic activity, 'inflation, 'financial & monetary conditions' and 'fiscal policy' measure changes in topic-specific stance from the last press conference to the current (scaled to unit variance). The topic-specific stance is measured as the ECB's tone on topic i at press conference t, i.e. $\tau_{i,t} = 1 - \frac{\#\text{ negative words in topic } i \text{ at press conference } t}{\#\text{ words in topic } i \text{ at press conference } t}$. For 'rate guidance', which is manually coded, 1 (-1) indicates a tighter (looser) policy stance. Reported standard errors are corrected for heteroscedasticity based on White (1980).

	Baseline		With Controls	
	Policy	Information	Policy	Information
$\Delta Stance$	(JK)	(JK)	(JK)	(JK)
Rate Guidance	0.319**	0.240*	0.372**	0.137
	(0.157)	(0.142)	(0.154)	(0.146)
Economic Activity	0.054	0.189***	0.063	0.231***
	(0.073)	(0.070)	(0.086)	(0.081)
Inflation	−0.010	0.035	0.001	0.081
	(0.065)	(0.072)	(0.114)	(0.112)
Financial & Monetary Cond.	0.040	0.106	0.012	0.092
	(0.074)	(0.073)	(0.079)	(0.077)
Fiscal Policy	−0.072	0.063	−0.055	0.112
	(0.077)	(0.075)	(0.083)	(0.070)
Press Release Shock & UMP			✔	✔
Inflation Interaction			✔	✔
Prev. Stance & inter-PC Comm.			✔	✔
Financial Market Cond.			✔	✔
Macroeconomic Projections			✔	✔
Observations	196	196	196	196
Adjusted R^2	0.008	0.044	-0.016	0.032
Note:				*p<0.1; **p<0.05; ***p<0.01

Table 8: Results from regressing 'monetary', 'growth' and 'risk premium' shocks on changes in the ECB's topic-specific stance

The dependent variables are changes in the 'monetary', 'growth' and 'risk premium' shocks introduced by Cieslak and Schrimpf (2019, CS), measured over the ECB press conference event window. The shocks are scaled to unit variance. Coefficient estimates for the changes in topic-specific measures of stance correspond to the regression model in equation (4). The left part of the table presents estimations without controls, the right part presents results for estimations with the most comprehensive set of control variables. 'Economic activity, 'inflation, 'financial & monetary conditions' and 'fiscal policy' measure changes in topic-specific stance from the last press conference to the current (scaled to unit variance). The topic-specific stance is measured as the ECB's tone on topic i at press conference t, i.e. $\tau_{i,t} = 1 - \frac{\#\text{ negative words in topic } i \text{ at press conference } t}{\#\text{ words in topic } i \text{ at press conference } t}$. For 'rate guidance', which is manually coded, 1 (-1) indicates a tighter (looser) policy stance. Reported standard errors are corrected for heteroscedasticity based on White (1980).

	Baseline			With Controls		
	Monetary	Growth	Risk Premium	Monetary	Growth	Risk Premium
$\Delta Stance$	(CS)	(CS)	(CS)	(CS)	(CS)	(CS)
Rate Guidance	0.256*	0.362**	0.119	0.327**	0.271*	0.155
	(0.149)	(0.148)	(0.099)	(0.152)	(0.142)	(0.135)
Economic Activity	0.032	0.140*	−0.175**	0.030	0.221***	−0.106
	(0.076)	(0.072)	(0.075)	(0.090)	(0.086)	(0.090)
Inflation	−0.010	0.004	−0.075	−0.005	0.041	−0.105
	(0.069)	(0.068)	(0.081)	(0.107)	(0.113)	(0.104)
Financial & Monetary Cond.	0.042	0.024	−0.233***	0.016	0.006	−0.227***
	(0.074)	(0.075)	(0.073)	(0.080)	(0.075)	(0.080)
Fiscal Policy	−0.073	0.008	−0.115	−0.065	0.067	−0.118
	(0.078)	(0.059)	(0.087)	(0.080)	(0.069)	(0.077)
Press Release Shock & UMP				✔	✔	✔
Inflation Interaction				✔	✔	✔
Prev. Stance & inter-PC Comm.				✔	✔	✔
Financial Market Cond.				✔	✔	✔
Macroeconomic Projections				✔	✔	✔
Observations	196	196	196	196	196	196
Adjusted R^2	-0.001	0.025	0.083	-0.022	0.024	0.048
Note:						*p<0.1; **p<0.05; ***p<0.01

Table 9: Sovereign yield spreads

The dependent variables are changes in the yield spread of Spanish and German 5 (or 10) year government bonds and changes in the yield spread of Italian and German 5-year (or 10-year) government bonds, measured over the ECB press conference event window.. A positive change in the core periphery spread represents a wider spread between core and periphery yields. Exchange rate increases are interpreted as an appreciation of the dollar. Coefficient estimates for the changes in topic-specific measures of stance correspond to the regression model in equation (4). 'Economic activity, 'inflation, 'financial & monetary conditions' and 'fiscal policy' measure changes in topic-specific stance from the last press conference to the current (scaled to unit variance). The topic-specific stance is measured as the ECB's tone on topic i at press conference t, i.e. $\tau_{i,t} = 1 - \frac{\#\text{ negative words in topic } i \text{ at press conference } t}{\#\text{ words in topic } i \text{ at press conference } t}$. For 'rate guidance', which is manually coded, 1 (-1) indicates a tighter (looser) policy stance. Reported standard errors are corrected for heteroscedasticity based on White (1980).

	Core Periphery Spread			
$\Delta Stance$	ES-DE 5Y	IT-DE 5Y	ES-DE 10Y	IT-DE 10Y
Rate Guidance	−0.100	−0.046	0.235	0.188
	(0.622)	(0.783)	(0.526)	(0.584)
Economic Activity	−0.288	−0.316	−0.083	−0.305
	(0.269)	(0.361)	(0.256)	(0.329)
Inflation	−0.482	−0.694	−0.569	−0.602
	(0.362)	(0.478)	(0.391)	(0.441)
Financial & Monetary Cond.	−0.278	−0.487	−0.398	−0.560
	(0.304)	(0.421)	(0.320)	(0.405)
Fiscal Policy	−0.622**	−0.821**	−0.704**	−0.806**
	(0.305)	(0.414)	(0.341)	(0.409)
Press Release Shock & UMP	✔	✔	✔	✔
Inflation Interaction	✔	✔	✔	✔
Prev. Stance & inter-PC Comm.	✔	✔	✔	✔
Financial Market Cond.	✔	✔	✔	✔
Macroeconomic Projections	✔	✔	✔	✔
Observations	196	196	196	196
Adjusted R^2	0.018	0.063	0.026	0.112
Note:				*p<0.1; **p<0.05; ***p<0.01

Table 10: Exchange rates

The dependent variables are Euro/USD, Euro/GBP and Euro/JPY exchange rates returns, measured over the ECB press conference event window. A positive return is interpreted as an appreciation of the Euro. Coefficient estimates for the changes in topic-specific measures of stance correspond to the regression model in equation (4). 'Economic activity, 'inflation, 'financial & monetary conditions' and 'fiscal policy' measure changes in topic-specific stance from the last press conference to the current (scaled to unit variance). The topic-specific stance is measured as the ECB's tone on topic i at press conference t, i.e. $\tau_{i,t} = 1 - \frac{\#\text{ negative words in topic } i \text{ at press conference } t}{\#\text{ words in topic } i \text{ at press conference } t}$. For 'rate guidance', which is manually coded, 1 (-1) indicates a tighter (looser) policy stance. Reported standard errors are corrected for heteroscedasticity based on White (1980).

	Exchange Rates		
$\Delta Stance$	EUR/USD	EUR/GBP	EUR/JPY
Rate Guidance	0.075	0.054	−0.028
	(0.061)	(0.049)	(0.059)
Economic Activity	0.014	0.013	0.063
	(0.042)	(0.028)	(0.045)
Inflation	−0.035	−0.032	−0.066
	(0.038)	(0.031)	(0.041)
Financial & Monetary Cond.	0.054*	0.059***	0.069**
	(0.030)	(0.022)	(0.032)
Fiscal Policy	0.003	−0.001	0.020
	(0.038)	(0.027)	(0.039)
Press Release Shock & UMP	✔	✔	✔
Inflation Interaction	✔	✔	✔
Prev. Stance & inter-PC Comm.	✔	✔	✔
Financial Market Cond.	✔	✔	✔
Macroeconomic Projections	✔	✔	✔
Observations	196	196	196
Adjusted R^2	0.029	0.070	0.090
Note:			*p<0.1; **p<0.05; ***p<0.01

Figure 1: ECB's topic coverage over the sample

This figure presents the ECB's coverage of different topics in introductory statements between 2002 and July 2020. Each panel corresponds to one topic as outlined section 3.1. Coverage is measured as the total number of words devoted to each topic per introductory statement, disregarding stop words.

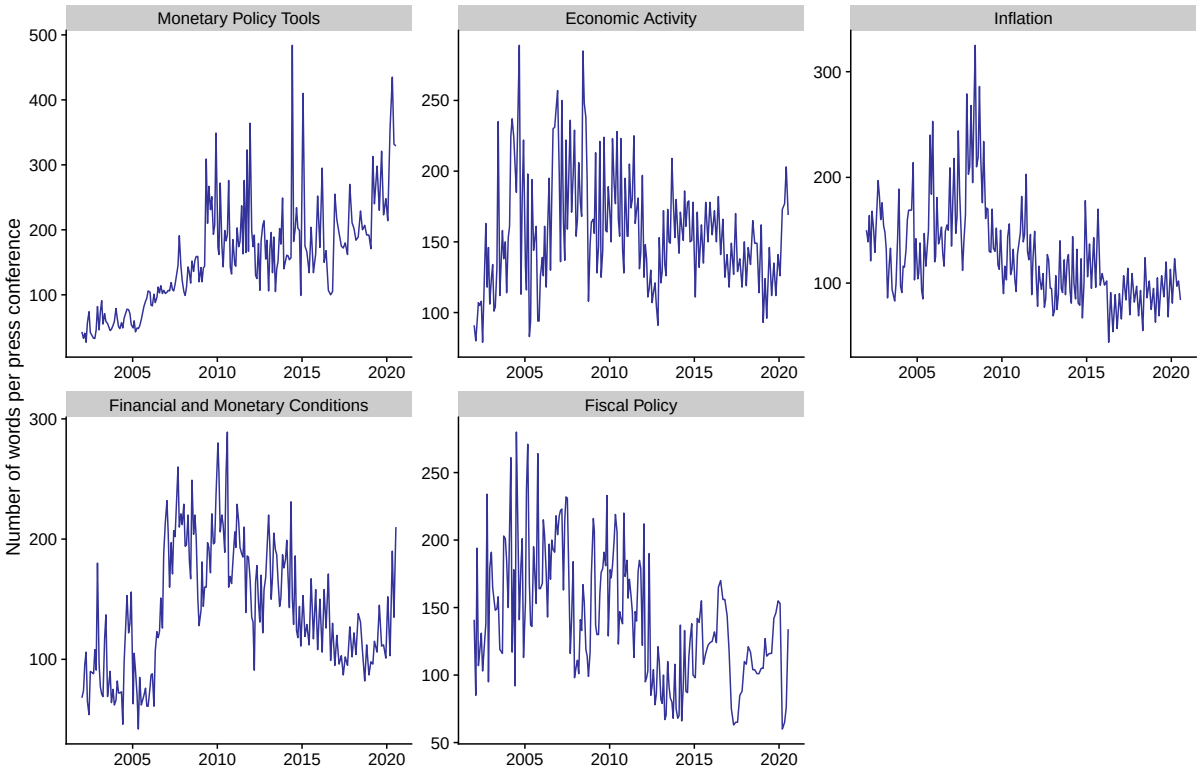


Figure 2: ECB's topic specific stance over the sample

This figure presents the ECB's topic-specific stances in introductory statements from 2002 until July 2020. Each panel represents a specific topic as outlined Section 3.1. The stance on topic i at time t is defined as $\tau_{i,t} = 1 - \frac{\#\text{ negative words in topic } i \text{ at press conference } t}{\#\text{ words in topic } i \text{ at press conference } t}$. 'Rate Guidance' corresponds to hand-coded changes and can therefore take values in $\{-1, 0, 1\}$. See Section 3.2 for details on the stance measurement.

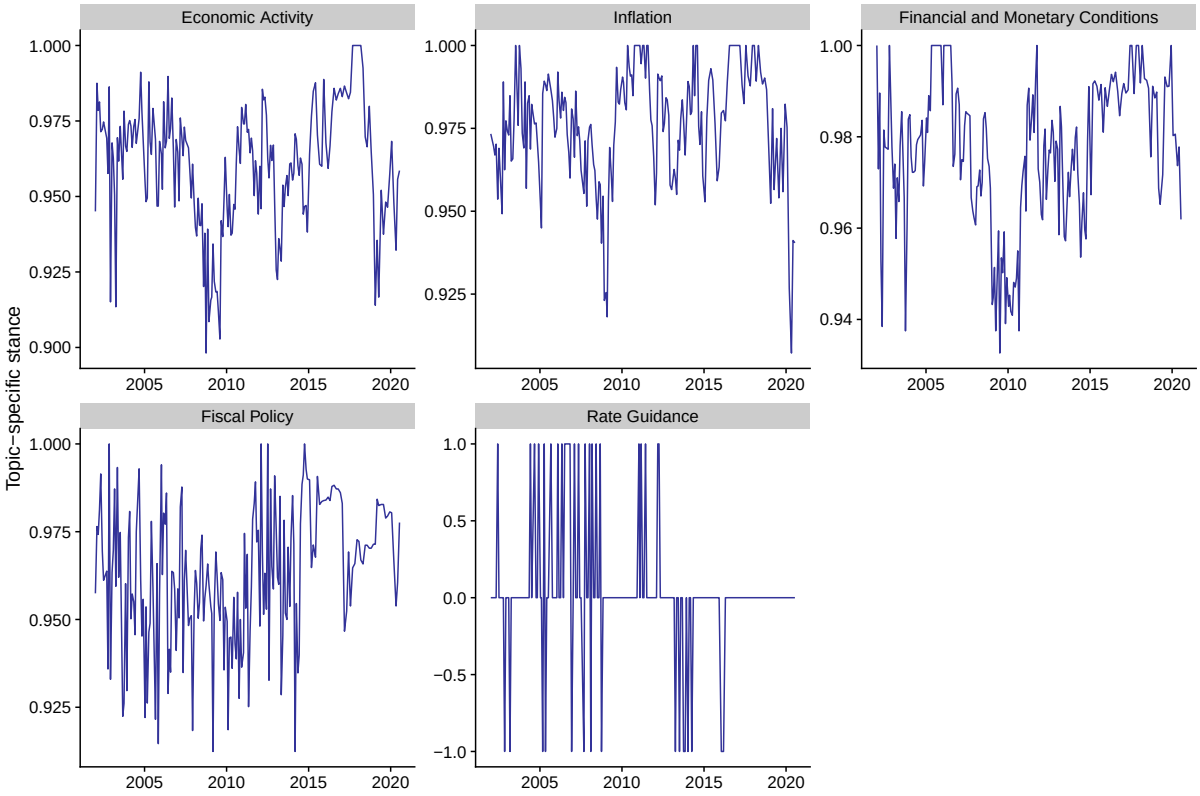
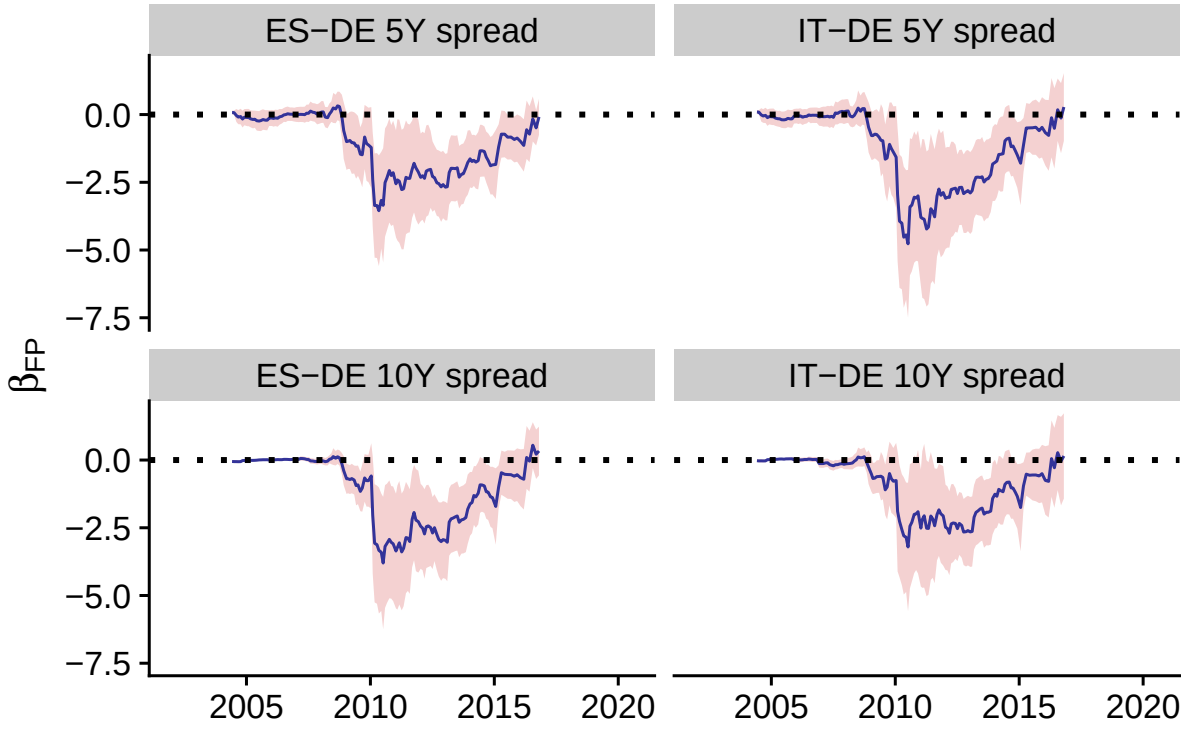


Figure 3: Time varying impact of 'fiscal policy' on core periphery spreads

This figure reports rolling regression estimates of the coefficient corresponding to 'fiscal policy' centered at a window of 60 press conferences. The dependent variables are changes in the Spanish-German respectively the Italian-German 5-year (or 10-year) sovereign bond yield spread. Coefficient estimates for the change in stance on 'fiscal policy' correspond to the regression model in equation (4), including the most comprehensive set of controls. Blue lines represent point estimates, the red shaded area indicates 95% confidence intervals. The stance on the topic 'fiscal policy' at time t is defined as $\tau_{FP,t} = 1 - \frac{\text{\# negative words in topic 'fiscal policy' at press conference } t}{\text{\# words in topic 'fiscal policy' at press conference } t}$. Standard errors are corrected for heteroscedasticity based on White (1980).



Internet Appendix for

Deciphering Monetary Policy Shocks

(not for publication)

Table IA.1: Tone Words in each Topic (Bigrams)

This table exhibits the most frequent bi-grams containing at least one tone-word, separately for each topic except for rate guidance. Rate guidance is a hand-classified variable, with each classification in deviation from zero justified by the authors in a detailed comment on what changed relative to the previous press conference. Accordingly, for rate guidance, the table shows the most frequent bi-grams occurring in these comments.

Rate.Guidance	Economic.Activity	Inflation	Financial.and.Monetary.Conditions	Fiscal.Policy
strong vigilance (10)	global imbalances (86)	weaker expected (22)	lagged relationship (33)	structural unemployment (49)
vigilance essence (5)	correction global (38)	crucial social (17)	reflect lagged (29)	fiscal imbalances (38)
close monitoring (5)	disorderly correction (36)	parties concerned (16)	address challenge (20)	excessive deficit (30)
timely manner (4)	possibility disorderly (35)	therefore crucial (16)	weak loan (15)	excessive deficits (24)
vigilance warranted (4)	weaker expected (27)	level unemployment (12)	financial turmoil (14)	unemployment boost (24)
continued vigilance (3)	disorderly developments (25)	impact weaker (12)	challenge remains (13)	reducing vulnerabilities (21)
monitoring strong (3)	concerns remain (18)	stemming weaker (12)	stressed countries (13)	vulnerabilities implementation (21)
progressive withdrawl (3)	sheet restructuring (18)	revised downwards (11)	negative annual (12)	deficit debt (15)
stands ready (2)	expected dampened (17)	utilisation tightening (11)	challenge banks (11)	deficit procedure (15)
monitor carefully (2)	sluggish pace (17)	tightening labour (11)	remained weak (11)	macroeconomic imbalances (12)
monitor closely (2)	insufficient implementation (16)	concerned meet (10)	weak annual (11)	speed restructuring (11)
vigilance vigilance (2)	continue dampened (15)	likely decline (10)	market volatility (10)	appropriate restructuring (11)
upside risks (2)	downside concerns (14)	decline coming (10)	markets declines (10)	government deficit (11)
price stability (2)	market volatility (14)	weaker growth (9)	declines resilience (10)	losses competitiveness (11)
withdrawl warranted (2)	possible disorderly (14)	countries concerned (8)	remained negative (9)	external deficits (11)
essence acting (2)	stronger protracted (13)	short-term volatility (8)	tightening credit (8)	unemployment low (11)
firm timely (2)	negative feedback (13)	spiral detrimental (8)	challenge necessary (8)	deficit procedures (10)
accomodative stance (2)	high unemployment (13)	detrimental employment (8)	number stressed (8)	correction excessive (10)
present lower (2)	lie downside (13)	concerned governing (8)	persistent upward (8)	restructuring banking (9)
lower levels (2)	protectionism vulnerabilities (13)	ongoing sluggish (8)	downward impact (7)	high unemployment (9)

Table IA.2: Summary statistics for control variables

The table presents summary statistics for all control variables used in the paper. OIS 3M, OIS 2Y and OIS 10Y denote the rate changes of the overnight index swap with maturities of 3 months, 2 years and 10 years. The 'interest rate' factor is based on Leombroni et al. (2021). The 'timing', 'forward guidance' and 'quantitative easing' factors were introduced by Altavilla et al. (2019). The 'policy' and 'information' shocks are based on Jarociński and Karadi (2020). The 'monetary', 'growth' and 'risk premium' shocks were introduced by Cieslak and Schrimpf (2019). The letters in the parentheses correspond to the initials of the shocks' original authors. PR indicates that shocks are measured during the press release. UMP is a hand-coded variable that can takes values in $\{-1, 0, 1\}$, where 1 means (an indication of) an unexpected unconventional monetary tightening, -1 an easing and 0 no change. 'Inter-PC' denotes that the change in stance is measured based on ECB board members' speeches between introductory statements. Inflation below 2% is based on the most recent flash estimate of HICP inflation in the euro area and takes the value 1 if inflation is below 2%. $R_{EuroStoxx\ 50}$ is the return of the Eurostoxx 50, Δ Vstoxx is the change of the Vstoxx and Δ German 2Y yield is the change of the 2 year yield between two press conferences. Δ real GDP projection and Δ inflation projection are the changes in one-year-ahead GDP and inflation forecasts from macroeconomic projections announced during press conferences.

	Mean	Median	SD	Min	Max
OIS 3M PR	0.25	0.00	2.07	-9.40	13.85
OIS 2Y PR	0.11	0.02	1.59	-8.25	8.40
OIS 10Y PR	-0.08	-0.05	1.25	-5.90	5.40
IR (LVVW) PR	-0.00	-0.15	1.38	-7.52	9.05
Timing (ABGMR) PR	-0.00	-0.20	1.75	-9.20	10.74
POLICY (JK) PR	0.00	-0.05	1.00	-4.30	6.36
INFO (JK) PR	-0.00	0.03	1.00	-3.31	7.50
Monetary (CS) PR	-0.00	-0.03	1.00	-4.52	5.97
Growth (CS) PR	0.00	-0.05	1.00	-4.18	7.91
Risk Premium (CS) PR	-0.00	-0.02	1.00	-4.41	3.84
UMP	-0.12	0.00	0.34	-1.00	1.00
Δ UMP (inter-PC)	-0.00	0.00	0.01	-0.06	0.06
Δ Bank Funding (inter-PC)	-0.00	0.00	0.01	-0.03	0.03
Δ Economic Activity (inter-PC)	-0.00	0.00	0.02	-0.12	0.13
Δ Inflation (inter-PC)	-0.00	0.00	0.01	-0.05	0.05
Δ Monetary Developments (inter-PC)	-0.00	0.00	0.01	-0.07	0.06
Δ Bank Lending (inter-PC)	-0.00	0.00	0.01	-0.04	0.04
Δ Structural Reforms (inter-PC)	-0.00	0.00	0.02	-0.12	0.11
Δ Fiscal Discipline (inter-PC)	-0.00	0.00	0.01	-0.03	0.03
Inflation below 2%	0.53	1.00	0.50	0.00	1.00
$R_{EuroStoxx\ 50}$	0.14	0.86	4.82	-19.65	18.58
Δ Vstoxx	0.04	-0.49	6.14	-40.80	40.60
Δ German 2Y yield	-0.02	-0.00	0.19	-0.79	0.63
Δ Real GDP Projection	-0.02	0.00	0.35	-1.70	3.90
Δ Inflation Projection	-0.01	0.00	0.17	-1.20	0.50

Table IA.3: Top LDA keywords for the ECBs' speeches corpus

The table presents top keywords for relevant topics obtained by applying Latent Dirichlet Allocation (LDA) to the corpus of speeches by ECB executive board members from 1997–2020. Each column corresponds to a topic, where the column header contains the topic name. Topic names are chosen by researchers. The words below the column header are the top 30 keywords allocated to each topic by the LDA. Underscores indicate multi-word expressions.

Unconventional Monetary Policy	Bank Funding	Economic Activity	Inflation	Bank Lending	Monetary Developments	Fiscal Discipline	Structural Reforms
asset_purchase_programme	money_market	recovery	inflation_rate	loan	monetary_analysis	fiscal_policy	structural_reform
asset_purchase	long_term_refinancing_operation	domestic_demand	hicp	non_financial_corporation	reference_value	growth_pact	labour_market
net_asset	main_refinancing_operation	favourable_financing_condition	oil	sme	mthree	public_finance	unemployment_rate
monetary_accommodation	operational_framework	disposable_income	consumer_price	bank_loan	monetary_development	deficit	labour_market_reform
term_premia	inter_bank_market	macroeconomic_projection	energy_price	credit_condition	monetary_growth	public_debt	product_market
net_purchase	maintenance_period	gdp_growth	second_round_effect	bank_lending	first_pillar	debt_ratio	employment_rate
inflation_path	reserve_requirement	economic_activity	energy	bank_lending_survey	money_growth	automatic_stabiliser	market_flexibility
duration	tender	private_consumption	commodity_price	medium_sized_enterprise	inflation_target	fiscal_position	lisbon_agenda
pandemic_emergency_purchase_programme	liquidity_provision	growth_outlook	oil_price	bank_lending_rate	broad_money	fiscal_rule	reform_process
inflation_convergence	allotment	economic_outlook	food_price	loan_sale	monetary_expansion	fiscal_consolidation	participation_rate
unconventional_measure	eonia	foreign_demand	flash_estimate	house_purchase	mone	excessive_deficit_procedure	labour_mobility
side_effect	money_market_rate	corporate_profitability	indirect_tax	credit_supply	monetary_pillar	fiscal_deficit	labour_market_policy
term_premium	central_bank_liquidity	consumer_confidence	food	nfc	mthree_growth	debt_level	employment_protection_legislation
principal_payment	tender_procedure	industrial_production	price_index	credit_flow	monetary_phenomenon	debt_to_gdp_ratio	wageflexibility
public_sector_purchase_programme	overnight_rate	external_demand	measurement_bias	non_financial_sector_balancesheet	money_demand	government_deficit	mobility
duration_risk	inter_bank_money_market	export_growth	producer_price	loan_dynamic	portfolio_shift	sgp	labour_force_participation
negative_interest_rate	refinancing_operation	growth_momentum	price_pressure	lending_condition	inflation_forecast	budget	unemployment
security_purchase	marginal_lending_facility	business_efficiency	price_setting	funding_condition	second_pillar	fiscal_imbalance	labour_demand
term_structure	euribor	economic_sentiment	core_inflation	enterprise	monetary_target	fiscal_framework	wage_policy
reinvestment	main_refinancin_grate	upturn	unprocessed_food	borrowing_condition	credit_growth	fiscal_adjustment	good_market
pandemic	open_market_operation	geopolitical_factor	headline_inflation	credit_demand	overnight_deposit	budget_deficit	part_time
negative_territory	corridor	containment	positive_inflation	lending_rate	inflation_targeting	fiscal_sustainability	job
qe	deposit_facility	geopolitical_tension	negative_inflation	loan_demand	money_supply	expenditure	labour_market_rigidity
dfr	non_standard_measure	industrial_confidence	consumer_price_inflation	bank_lending_channel	monetary_data	stability_programme	bottle_neck
inflation_outlook	excess_reserve	business_investment	price_change	bank_financing	inflationary_risk	balanced_budget	lisbon_strategy
unconventional_monetary_policy	separation_principle	business_confidence	service_price	corporate_sector_purchase_programme	two_pillar_approach	public_expenditure	youth_unemployment
rate_expectation	liquidity_operation	up_swing	cpi	non_financial_private_sector	financial_indicator	fiscal_development	market_regulation
rate_path	minimum_bidrate	sentiment	oil_price_shock	bank_funding	money	fiscal_stimulus	economic_reform
policy_rate	mro_rate	survey_indicator	service_price_inflation	loan_growth	monetary_dynamic	fiscal_space	wage_settlement
easing_package	fix_rate_full_allotment	economic_recovery	consumer_price_index	external_financing	monetary_liquidity	fiscal_discipline	bargaining

Table IA.4: Topic mapping between PC topics and inter-press conference topics

This table presents the mapping between press conference and inter-press conference topics. The first column contains the name of the press conference topic, while the second column contains the names of the corresponding inter-press conference topics. For example, as a counterpart to the change in stance on 'financial & monetary conditions' we use the inter-press conference changes in stance on the two topics 'bank lending' and 'monetary developments' as control variables.

PC Topic	**Inter-PC Topic**
Monetary Policy Tools	Unconventional Monetary Policy, Bank Funding
Economic Activity	Economic Activity
Inflation	Inflation
Financial & Monetary Conditions	Bank Lending, Monetary Developments
Fiscal Policy	Structural Reforms, Fiscal Discipline

Table IA.5: Detailed regression results OIS 3M

This table presents detailed regression results, where in each column control variables are progressively added. The dependent variable is the change in the 3M overnight index swap rate. Coefficient estimates for the topic-specific measures of stance correspond to the regression model in equation 4. 'Economic activity', 'inflation', 'financial & monetary conditions' and 'fiscal policy' are scaled to unit variance. For 'rate guidance', 1 (-1) indicates a tighter (looser) policy stance. Reported standard errors are corrected for heteroscedasticity based on White (1980).

Δ Stance	OIS 3M					
Rate Guidance	1.074***	1.117***	1.129***	1.050***	0.941***	0.932***
	(0.356)	(0.346)	(0.369)	(0.372)	(0.310)	(0.297)
Economic Activity	0.177	0.183	0.158	0.187	0.210	0.213
	(0.130)	(0.133)	(0.146)	(0.145)	(0.144)	(0.142)
Inflation	0.047	0.159	0.027	0.011	0.011	0.014
	(0.101)	(0.119)	(0.190)	(0.197)	(0.193)	(0.197)
Financial & Monetary Cond.	0.232	0.231	0.246*	0.260*	0.230	0.228
	(0.149)	(0.149)	(0.142)	(0.147)	(0.147)	(0.148)
Fiscal Policy	0.057	0.068	0.088	0.101	0.097	0.100
	(0.137)	(0.136)	(0.161)	(0.160)	(0.167)	(0.165)
UMP	0.353	0.407	0.450	0.515	0.448	0.465
	(0.485)	(0.496)	(0.496)	(0.501)	(0.457)	(0.461)
Press Release Shock	0.034	0.029	0.035	0.020	0.050	0.052
	(0.065)	(0.068)	(0.056)	(0.069)	(0.083)	(0.084)
Inflation below 2%		0.210	0.416	0.341	0.465	0.472
		(0.274)	(0.402)	(0.430)	(0.444)	(0.442)
Inflation × below 2%		−0.239	−0.117	−0.135	−0.118	−0.105
		(0.192)	(0.230)	(0.242)	(0.236)	(0.248)
Economic Activity (lag)			−11.023	−12.155	−13.792	−13.786
			(8.560)	(8.362)	(8.905)	(8.883)
Inflation below 2% (lag)			−0.218	−0.169	−0.286	−0.267
			(0.395)	(0.427)	(0.419)	(0.419)
Inflation (lag)			−21.184	−22.451	−26.043	−26.194
			(17.355)	(17.601)	(18.708)	(18.626)
Inflation (lag) × below 2% (lag)			21.904	21.259	29.470	28.933
			(20.013)	(20.767)	(23.195)	(22.936)
Fiscal Policy (lag)			0.120	0.514	0.869	0.990
			(6.596)	(6.647)	(6.494)	(6.535)
Financial & Monetary Cond. (lag)			1.360	1.380	−0.134	−0.383
			(10.781)	(11.049)	(11.226)	(11.178)
UMP (inter-PC)				5.451	4.176	4.231
				(10.142)	(9.839)	(9.543)
Bank Funding (inter-PC)				6.801	6.034	6.782
				(13.938)	(13.900)	(13.973)
Economic Activity (inter-PC)				4.641	4.009	3.624
				(5.326)	(5.639)	(5.619)
Inflation (inter-PC)				−11.922	−10.798	−10.230
				(18.522)	(18.773)	(18.636)
Inflation (inter-PC) × below 2%				8.552	10.835	11.189
				(20.428)	(20.690)	(20.752)
Monetary Developments (inter-PC)				1.484	1.626	1.718
				(10.658)	(11.377)	(11.409)
Bank Lending (inter-PC)				14.386	10.744	10.074
				(16.453)	(16.827)	(17.293)
Structural Reforms (inter-PC)				−1.130	1.384	1.269
				(8.451)	(8.541)	(8.768)
Fiscal Discipline (inter-PC)				5.090	6.658	5.786
				(15.525)	(15.826)	(15.631)
$R_{Eurostoxx\ 50}$					−0.032	−0.028
					(0.053)	(0.057)
Δ VSTOXX					−0.031	−0.029
					(0.036)	(0.037)
Δ GER 2Y Yield					1.483	1.496
					(1.646)	(1.646)
Δ Real GDP Projection						−0.194
						(0.308)
Δ Inflation Projection						0.177
						(0.889)
Constant	−0.115	−0.215	−0.218	−0.188	−0.172	−0.187
	(0.135)	(0.213)	(0.221)	(0.216)	(0.220)	(0.216)
Observations	196	196	196	196	196	196
Adjusted R^2	0.062	0.058	0.050	0.014	0.019	0.008
Note:						*p<0.1; **p<0.05; ***p<0.01

Table IA.6: Detailed regression results OIS 2Y

This table presents detailed regression results, where in each column control variables are progressively added. The dependent variable is the change in the two-year overnight index swap rate. Coefficient estimates for the topic-specific measures of stance correspond to the regression model in equation 4. 'Economic activity', 'inflation', 'financial & monetary conditions' and 'fiscal policy' are scaled to unit variance. For 'rate guidance', 1 (-1) indicates a tighter (looser) policy stance. Reported standard errors are corrected for heteroscedasticity based on White (1980).

Δ Stance	OIS 2Y					
Rate Guidance	1.571**	1.716**	1.668**	1.656**	1.389**	1.475**
	(0.719)	(0.712)	(0.726)	(0.734)	(0.654)	(0.634)
Economic Activity	0.635**	0.645**	0.595*	0.668*	0.729**	0.812**
	(0.302)	(0.307)	(0.359)	(0.344)	(0.355)	(0.351)
Inflation	0.065	0.354	0.034	0.091	0.120	0.183
	(0.246)	(0.346)	(0.491)	(0.502)	(0.533)	(0.537)
Financial & Monetary Cond.	0.402	0.394	0.333	0.343	0.300	0.290
	(0.314)	(0.313)	(0.315)	(0.328)	(0.331)	(0.330)
Fiscal Policy	−0.028	0.003	0.079	0.137	0.123	0.158
	(0.259)	(0.254)	(0.308)	(0.319)	(0.346)	(0.347)
UMP	0.324	0.472	0.739	0.766	0.701	0.733
	(0.854)	(0.860)	(0.850)	(0.882)	(0.809)	(0.811)
Press Release Shock	0.139	0.132	0.133	0.053	0.113	0.071
	(0.202)	(0.203)	(0.200)	(0.214)	(0.235)	(0.231)
Inflation below 2%		0.646	−0.354	−0.251	−0.122	−0.217
		(0.588)	(0.861)	(0.846)	(0.791)	(0.793)
Inflation × below 2%		−0.614	−0.352	−0.448	−0.458	−0.469
		(0.427)	(0.504)	(0.536)	(0.545)	(0.547)
Economic Activity (lag)			−24.746	−24.977	−27.461	−27.571
			(16.356)	(16.473)	(17.958)	(17.370)
Inflation below 2% (lag)			1.333	1.214	0.988	1.078
			(0.870)	(0.849)	(0.790)	(0.795)
Inflation (lag)			−40.972	−41.139	−47.517	−50.094
			(34.707)	(35.144)	(38.460)	(39.056)
Inflation (lag) × below 2% (lag)			24.097	29.796	39.783	37.932
			(37.753)	(39.613)	(44.222)	(44.508)
Fiscal Policy (lag)			−2.499	−2.803	−2.035	−2.014
			(13.498)	(13.897)	(13.822)	(14.009)
Financial & Monetary Cond. (lag)			−36.934	−36.524	−39.930	−44.819*
			(25.452)	(25.970)	(26.270)	(26.185)
UMP (inter-PC)				−6.194	−8.445	−4.598
				(17.395)	(17.092)	(16.165)
Bank Funding (inter-PC)				8.568	5.785	10.061
				(25.399)	(24.757)	(24.560)
Economic Activity (inter-PC)				13.800	12.769	12.488
				(11.526)	(12.141)	(11.875)
Inflation (inter-PC)				−14.178	−14.138	−9.101
				(37.151)	(39.077)	(39.220)
Inflation (inter-PC) × below 2%				29.155	32.907	26.206
				(43.177)	(44.323)	(44.202)
Monetary Developments (inter-PC)				−13.681	−13.164	−11.941
				(20.795)	(21.696)	(21.776)
Bank Lending (inter-PC)				2.516	−4.354	−2.025
				(30.884)	(32.036)	(33.122)
Structural Reforms (inter-PC)				8.868	13.688	9.841
				(15.000)	(15.981)	(15.916)
Fiscal Discipline (inter-PC)				18.865	18.677	17.817
				(32.488)	(32.102)	(31.659)
$R_{Eurostoxx\ 50}$					0.021	0.073
					(0.128)	(0.136)
Δ VSTOXX					−0.014	0.021
					(0.066)	(0.065)
Δ GER 2Y Yield					2.669	2.739
					(2.954)	(2.936)
Δ Real GDP Projection						−1.131
						(0.781)
Δ Inflation Projection						−1.429
						(1.979)
Constant	−0.298	−0.613	−0.763	−0.750	−0.657	−0.679
	(0.296)	(0.512)	(0.513)	(0.516)	(0.499)	(0.499)
Observations	196	196	196	196	196	196
Adjusted R^2	0.038	0.039	0.046	0.008	0.010	0.009
Note:						*p<0.1; **p<0.05; ***p<0.01

Table IA.7: Detailed regression results OIS 10Y

This table presents detailed regression results, where in each column control variables are progressively added. The dependent variable is the change in the 10Y overnight index swap rate. Coefficient estimates for the topic-specific measures of stance correspond to the regression model in equation 4. 'Economic activity', 'inflation', 'financial & monetary conditions' and 'fiscal policy' are scaled to unit variance. For 'rate guidance', 1 (-1) indicates a tighter (looser) policy stance. Reported standard errors are corrected for heteroscedasticity based on White (1980).

Δ Stance	OIS 10Y					
Rate Guidance	0.312	0.427	0.449	0.420	0.335	0.277
	(0.362)	(0.373)	(0.386)	(0.410)	(0.395)	(0.400)
Economic Activity	0.511**	0.505**	0.401	0.413	0.436*	0.423
	(0.236)	(0.237)	(0.273)	(0.254)	(0.257)	(0.267)
Inflation	0.149	0.263	0.249	0.244	0.255	0.243
	(0.197)	(0.280)	(0.305)	(0.314)	(0.323)	(0.322)
Financial & Monetary Cond.	0.580***	0.572***	0.534**	0.538**	0.523**	0.522**
	(0.207)	(0.206)	(0.215)	(0.223)	(0.225)	(0.226)
Fiscal Policy	0.170	0.189	0.278	0.224	0.218	0.217
	(0.198)	(0.196)	(0.206)	(0.208)	(0.218)	(0.219)
UMP	0.202	0.286	0.429	0.442	0.410	0.444
	(0.674)	(0.649)	(0.637)	(0.601)	(0.575)	(0.584)
Press Release Shock	−0.137	−0.127	−0.129	−0.151	−0.153	−0.137
	(0.194)	(0.192)	(0.186)	(0.179)	(0.179)	(0.186)
Inflation below 2%		0.481	−0.276	−0.224	−0.168	−0.117
		(0.372)	(0.612)	(0.624)	(0.620)	(0.631)
Inflation × below 2%		−0.244	−0.157	−0.136	−0.139	−0.109
		(0.381)	(0.392)	(0.411)	(0.410)	(0.412)
Economic Activity (lag)			−19.526	−18.034	−18.925	−18.938
			(12.728)	(12.779)	(13.506)	(13.480)
Inflation below 2% (lag)			1.032	1.005	0.927	0.951
			(0.642)	(0.649)	(0.650)	(0.654)
Inflation (lag)			4.083	6.843	5.102	5.644
			(19.930)	(19.135)	(19.954)	(19.757)
Inflation (lag) × below 2% (lag)			7.257	6.016	9.778	8.867
			(24.567)	(25.432)	(28.759)	(28.432)
Fiscal Policy (lag)			5.924	3.878	4.077	4.451
			(8.289)	(8.553)	(8.554)	(8.525)
Financial & Monetary Cond. (lag)			−19.264	−20.052	−21.330	−20.294
			(18.297)	(18.759)	(18.919)	(18.992)
UMP (inter-PC)				−17.579	−18.689*	−20.083*
				(11.386)	(11.098)	(11.500)
Bank Funding (inter-PC)				−4.024	−5.079	−4.732
				(21.553)	(21.653)	(21.826)
Economic Activity (inter-PC)				−6.476	−6.455	−7.104
				(11.325)	(11.461)	(11.348)
Inflation (inter-PC)				−3.319	−3.467	−4.253
				(25.663)	(25.948)	(25.840)
Inflation (inter-PC) × below 2%				12.064	13.667	17.416
				(33.667)	(33.615)	(33.717)
Monetary Developments (inter-PC)				5.825	6.049	5.741
				(12.355)	(12.531)	(12.536)
Bank Lending (inter-PC)				4.220	1.998	−0.224
				(16.984)	(17.146)	(17.723)
Structural Reforms (inter-PC)				3.105	5.202	6.494
				(12.349)	(12.054)	(12.433)
Fiscal Discipline (inter-PC)				23.756	24.181	22.176
				(21.746)	(21.806)	(22.139)
$R_{Eurostoxx\ 50}$					0.001	−0.008
					(0.075)	(0.087)
Δ VSTOXX					−0.010	−0.016
					(0.050)	(0.058)
Δ GER 2Y Yield					0.853	0.850
					(1.370)	(1.348)
Δ Real GDP Projection						−0.124
						(0.450)
Δ Inflation Projection						0.937
						(1.216)
Constant	−0.060	−0.302	−0.430	−0.442	−0.416	−0.444
	(0.184)	(0.283)	(0.282)	(0.279)	(0.279)	(0.278)
Observations	196	196	196	196	196	196
Adjusted R^2	0.064	0.063	0.063	0.034	0.022	0.013
Note:						*p<0.1; **p<0.05; ***p<0.01

Table IA.8: Detailed regression results 'interest rate' shock

This table presents detailed regression results, where in each column control variables are progressively added. The dependent variable is the 'interest rate' shock of Leombroni et al. (2021). Coefficient estimates for the topic-specific measures of stance correspond to the regression model in equation 4. 'Economic activity', 'inflation', 'financial & monetary conditions' and 'fiscal policy' are scaled to unit variance. For 'rate guidance', 1 (-1) indicates a tighter (looser) policy stance. Reported standard errors are corrected for heteroscedasticity based on White (1980).

Δ Stance	IR (LVVW)					
Rate Guidance	1.828**	1.996***	1.985***	1.937**	1.673**	1.691***
	(0.743)	(0.739)	(0.757)	(0.766)	(0.674)	(0.651)
Economic Activity	0.565*	0.566*	0.493	0.548*	0.608*	0.657**
	(0.294)	(0.301)	(0.341)	(0.329)	(0.333)	(0.333)
Inflation	0.122	0.372	0.090	0.110	0.143	0.179
	(0.235)	(0.312)	(0.445)	(0.458)	(0.480)	(0.489)
Financial & Monetary Cond.	0.471	0.461	0.421	0.450	0.392	0.385
	(0.308)	(0.307)	(0.311)	(0.320)	(0.326)	(0.327)
Fiscal Policy	0.059	0.090	0.201	0.210	0.183	0.209
	(0.262)	(0.257)	(0.309)	(0.321)	(0.344)	(0.343)
UMP	0.522	0.668	0.910	0.918	0.818	0.870
	(0.854)	(0.852)	(0.855)	(0.879)	(0.791)	(0.793)
Press Release Shock	0.291	0.288	0.268	0.229	0.335	0.316
	(0.202)	(0.216)	(0.209)	(0.232)	(0.255)	(0.256)
Inflation below 2%		0.723	−0.139	−0.117	0.089	0.044
		(0.576)	(0.817)	(0.818)	(0.795)	(0.800)
Inflation × below 2%		−0.533	−0.283	−0.356	−0.348	−0.334
		(0.425)	(0.497)	(0.520)	(0.519)	(0.531)
Economic Activity (lag)			−28.145*	−28.165*	−30.787*	−30.881*
			(15.446)	(15.562)	(17.066)	(16.854)
Inflation below 2% (lag)			1.178	1.124	0.831	0.922
			(0.829)	(0.823)	(0.776)	(0.780)
Inflation (lag)			−35.717	−35.695	−42.792	−44.405
			(34.020)	(34.088)	(36.959)	(37.188)
Inflation (lag) × below 2% (lag)			26.637	29.098	42.540	40.336
			(36.839)	(38.469)	(43.529)	(43.385)
Fiscal Policy (lag)			2.076	0.716	1.569	1.848
			(13.239)	(13.506)	(13.386)	(13.510)
Financial & Monetary Cond. (lag)			−27.329	−27.584	−31.570	−34.406
			(24.861)	(25.457)	(25.836)	(25.705)
UMP (inter-PC)				−3.062	−5.527	−3.444
				(18.390)	(17.979)	(17.547)
Bank Funding (inter-PC)				9.264	6.258	9.870
				(26.089)	(25.498)	(25.470)
Economic Activity (inter-PC)				4.075	2.152	1.349
				(11.157)	(11.602)	(11.422)
Inflation (inter-PC)				−8.357	−7.709	−3.954
				(36.674)	(38.467)	(38.716)
Inflation (inter-PC) × below 2%				23.495	28.010	25.057
				(42.591)	(43.668)	(43.897)
Monetary Developments (inter-PC)				−6.798	−5.784	−5.098
				(19.743)	(20.766)	(20.785)
Bank Lending (inter-PC)				8.007	−0.830	−0.831
				(31.270)	(32.379)	(33.636)
Structural Reforms (inter-PC)				3.992	9.762	7.628
				(16.268)	(16.115)	(16.323)
Fiscal Discipline (inter-PC)				24.823	26.014	23.571
				(31.465)	(31.390)	(31.023)
$R_{Eurostoxx\ 50}$					0.013	0.046
					(0.118)	(0.129)
Δ VSTOXX					−0.029	−0.008
					(0.065)	(0.069)
Δ GER 2Y Yield					3.009	3.061
					(2.941)	(2.924)
Δ Real GDP Projection						−0.937
						(0.703)
Δ Inflation Projection						−0.382
						(1.840)
Constant	−0.023	−0.382	−0.529	−0.513	−0.417	−0.455
	(0.280)	(0.480)	(0.483)	(0.483)	(0.474)	(0.473)
Observations	196	196	196	196	196	196
Adjusted R^2	0.060	0.062	0.063	0.023	0.031	0.026
Note:						*p<0.1; **p<0.05; ***p<0.01

Table IA.9: Detailed regression results 'timing' factor

This table presents detailed regression results, where in each column control variables are progressively added. The dependent variable is the 'timing' factor of Altavilla et al. (2019). Coefficient estimates for the topic-specific measures of stance correspond to the regression model in equation 4. 'Economic activity', 'inflation', 'financial & monetary conditions' and 'fiscal policy' are scaled to unit variance. For 'rate guidance', 1 (-1) indicates a tighter (looser) policy stance. Reported standard errors are corrected for heteroscedasticity based on White (1980).

Δ Stance	Timing (ABGMR)					
Rate Guidance	1.121***	1.123***	1.142***	1.038**	0.931***	0.925***
	(0.390)	(0.388)	(0.415)	(0.412)	(0.352)	(0.344)
Economic Activity	0.075	0.083	0.073	0.107	0.131	0.139
	(0.150)	(0.153)	(0.170)	(0.171)	(0.169)	(0.167)
Inflation	0.077	0.150	0.012	−0.039	−0.045	−0.040
	(0.118)	(0.131)	(0.201)	(0.204)	(0.196)	(0.200)
Financial & Monetary Cond.	0.327*	0.329*	0.353**	0.372**	0.339*	0.337*
	(0.180)	(0.181)	(0.171)	(0.177)	(0.175)	(0.175)
Fiscal Policy	0.080	0.085	0.103	0.090	0.092	0.097
	(0.147)	(0.146)	(0.176)	(0.177)	(0.184)	(0.182)
UMP	0.411	0.437	0.450	0.518	0.436	0.456
	(0.579)	(0.590)	(0.596)	(0.598)	(0.555)	(0.563)
Press Release Shock	0.010	0.006	0.018	0.022	0.048	0.048
	(0.092)	(0.094)	(0.078)	(0.091)	(0.106)	(0.106)
Inflation below 2%		0.042	0.531	0.395	0.542	0.545
		(0.316)	(0.456)	(0.482)	(0.509)	(0.509)
Inflation × below 2%		−0.156	−0.037	−0.004	0.014	0.026
		(0.223)	(0.255)	(0.266)	(0.261)	(0.273)
Economic Activity (lag)			−9.430	−9.664	−11.603	−11.600
			(10.211)	(9.875)	(10.339)	(10.294)
Inflation below 2% (lag)			−0.575	−0.456	−0.558	−0.532
			(0.454)	(0.482)	(0.475)	(0.478)
Inflation (lag)			−24.220	−26.164	−30.152	−30.433
			(19.517)	(19.438)	(20.033)	(20.018)
Inflation (lag) × below 2% (lag)			23.883	22.167	32.518	31.841
			(22.936)	(23.557)	(25.945)	(25.723)
Fiscal Policy (lag)			0.478	1.509	1.894	2.027
			(7.581)	(7.535)	(7.297)	(7.322)
Financial & Monetary Cond. (lag)			6.230	6.163	4.677	4.205
			(12.688)	(12.943)	(13.175)	(13.128)
UMP (inter-PC)				6.248	4.715	4.947
				(12.084)	(11.840)	(11.586)
Bank Funding (inter-PC)				11.728	11.314	12.298
				(14.329)	(14.373)	(14.404)
Economic Activity (inter-PC)				−2.645	−3.043	−3.461
				(5.711)	(6.044)	(6.045)
Inflation (inter-PC)				−19.763	−18.016	−17.184
				(19.769)	(19.603)	(19.441)
Inflation (inter-PC) × below 2%				4.136	6.945	7.013
				(23.487)	(23.528)	(23.521)
Monetary Developments (inter-PC)				9.189	9.221	9.366
				(11.230)	(11.995)	(12.031)
Bank Lending (inter-PC)				17.947	14.470	13.873
				(17.666)	(18.108)	(18.516)
Structural Reforms (inter-PC)				−3.178	−0.157	−0.442
				(9.532)	(9.896)	(10.196)
Fiscal Discipline (inter-PC)				−1.006	1.302	0.299
				(16.857)	(17.028)	(16.966)
$R_{Eurostoxx\ 50}$					−0.064	−0.058
					(0.056)	(0.059)
Δ VSTOXX					−0.049	−0.045
					(0.039)	(0.041)
Δ GER 2Y Yield					1.598	1.614
					(1.717)	(1.714)
Δ Real GDP Projection						−0.255
						(0.355)
Δ Inflation Projection						0.125
						(0.943)
Constant	−0.003	−0.019	0.011	0.036	0.044	0.028
	(0.148)	(0.228)	(0.239)	(0.231)	(0.230)	(0.227)
Observations	196	196	196	196	196	196
Adjusted R^2	0.055	0.046	0.042	0.015	0.021	0.010
Note:						*p<0.1; **p<0.05; ***p<0.01

Table IA.10: Detailed Regression Results 'forward guidance' factor

This table presents detailed regression results, where in each column control variables are progressively added. The dependent variable is the 'forward guidance' factor of Altavilla et al. (2019). Coefficient estimates for the topic-specific measures of stance correspond to the regression model in equation 4. 'Economic activity', 'inflation', 'financial & monetary conditions' and 'fiscal policy' are scaled to unit variance. For 'rate guidance', 1 (-1) indicates a tighter (looser) policy stance. Reported standard errors are corrected for heteroscedasticity based on White (1980).

Δ Stance	FG (ABGMR)					
Rate Guidance	0.907	1.061*	0.982*	1.060*	0.898	0.977*
	(0.576)	(0.611)	(0.597)	(0.591)	(0.573)	(0.571)
Economic Activity	0.399	0.391	0.379	0.412	0.459	0.535*
	(0.268)	(0.270)	(0.339)	(0.317)	(0.327)	(0.322)
Inflation	−0.025	0.124	−0.070	0.028	0.071	0.131
	(0.218)	(0.312)	(0.418)	(0.417)	(0.461)	(0.462)
Financial & Monetary Cond.	−0.111	−0.123	−0.201	−0.191	−0.225	−0.230
	(0.288)	(0.289)	(0.284)	(0.294)	(0.294)	(0.294)
Fiscal Policy	−0.150	−0.126	−0.064	0.005	−0.036	0.001
	(0.196)	(0.196)	(0.249)	(0.259)	(0.295)	(0.295)
UMP	−0.103	0.004	0.235	0.171	0.148	0.177
	(0.521)	(0.507)	(0.514)	(0.523)	(0.500)	(0.503)
Press Release Shock	0.302*	0.304*	0.266	0.232	0.298	0.275
	(0.159)	(0.167)	(0.165)	(0.180)	(0.189)	(0.188)
Inflation below 2%		0.626	−0.783	−0.609	−0.534	−0.653
		(0.531)	(0.884)	(0.840)	(0.772)	(0.771)
Inflation × below 2%		−0.320	−0.185	−0.337	−0.340	−0.366
		(0.347)	(0.401)	(0.426)	(0.446)	(0.439)
Economic Activity (lag)			−13.057	−13.370	−13.889	−14.095
			(14.841)	(14.517)	(15.043)	(14.374)
Inflation below 2% (lag)			1.792**	1.587**	1.358*	1.444**
			(0.855)	(0.788)	(0.732)	(0.733)
Inflation (lag)			−19.247	−18.632	−22.205	−24.906
			(25.896)	(25.391)	(28.088)	(28.109)
Inflation (lag) × below 2% (lag)			0.657	7.736	11.304	9.520
			(27.742)	(27.298)	(29.906)	(30.546)
Fiscal Policy (lag)			−2.559	−4.334	−3.983	−3.922
			(11.150)	(11.344)	(11.366)	(11.466)
Financial & Monetary Cond. (lag)			−40.462*	−40.077*	−43.527**	−47.802**
			(21.220)	(21.222)	(21.236)	(21.395)
UMP (inter-PC)				−2.873	−4.041	0.125
				(15.358)	(15.651)	(15.181)
Bank Funding (inter-PC)				0.263	−2.914	1.036
				(20.249)	(19.408)	(19.176)
Economic Activity (inter-PC)				13.833	12.179	11.925
				(10.003)	(10.310)	(10.101)
Inflation (inter-PC)				11.169	8.724	14.116
				(25.903)	(27.912)	(28.050)
Inflation (inter-PC) × below 2%				21.914	25.147	17.177
				(35.325)	(35.936)	(36.381)
Monetary Developments (inter-PC)				−23.470	−21.997	−21.087
				(15.021)	(14.850)	(14.895)
Bank Lending (inter-PC)				−15.983	−21.833	−19.115
				(23.229)	(24.844)	(25.559)
Structural Reforms (inter-PC)				8.824	11.922	7.896
				(11.583)	(12.855)	(12.928)
Fiscal Discipline (inter-PC)				23.261	22.857	21.813
				(24.547)	(23.463)	(22.962)
$R_{Eurostoxx\ 50}$					0.094	0.143
					(0.109)	(0.116)
Δ VSTOXX					0.030	0.062
					(0.050)	(0.048)
Δ GER 2Y Yield					1.644	1.701
					(1.923)	(1.908)
Δ Real GDP Projection						−0.974*
						(0.575)
Δ Inflation Projection						−1.557
						(1.516)
Constant	−0.054	−0.370	−0.535	−0.538	−0.440	−0.449
	(0.263)	(0.463)	(0.456)	(0.461)	(0.433)	(0.436)
Observations	196	196	196	196	196	196
Adjusted R^2	0.015	0.015	0.030	0.011	0.018	0.019
Note:						*p<0.1; **p<0.05; ***p<0.01

Table IA.11: Detailed Regression Results 'quantitative easing' factor

This table presents detailed regression results, where in each column control variables are progressively added. The dependent variable is the 'quantitative easing' factor of Altavilla et al. (2019). Coefficient estimates for the topic-specific measures of stance correspond to the regression model in equation 4. 'Economic activity', 'inflation', 'financial & monetary conditions' and 'fiscal policy' are scaled to unit variance. For 'rate guidance', 1 (-1) indicates a tighter (looser) policy stance. Reported standard errors are corrected for heteroscedasticity based on White (1980).

Δ Stance	QE (ABGMR)					
Rate Guidance	−0.408*	−0.325	−0.265	−0.269	−0.231	−0.337
	(0.230)	(0.250)	(0.268)	(0.261)	(0.263)	(0.277)
Economic Activity	0.241	0.231	0.136	0.105	0.095	0.029
	(0.170)	(0.172)	(0.197)	(0.181)	(0.185)	(0.189)
Inflation	0.155	0.184	0.303	0.275	0.281	0.228
	(0.153)	(0.223)	(0.233)	(0.231)	(0.234)	(0.197)
Financial & Monetary Cond.	0.412***	0.405***	0.409***	0.411**	0.419***	0.419***
	(0.156)	(0.156)	(0.158)	(0.160)	(0.160)	(0.158)
Fiscal Policy	0.200	0.210	0.276*	0.180	0.174	0.146
	(0.156)	(0.157)	(0.165)	(0.150)	(0.157)	(0.160)
UMP	0.305	0.345	0.367	0.340	0.350	0.368
	(0.601)	(0.591)	(0.574)	(0.509)	(0.485)	(0.499)
Press Release Shock	−0.026	−0.023	−0.027	−0.001	−0.004	0.024
	(0.098)	(0.099)	(0.095)	(0.096)	(0.097)	(0.094)
Inflation below 2%		0.312	0.060	0.098	0.078	0.219
		(0.287)	(0.407)	(0.417)	(0.421)	(0.453)
Inflation × below 2%		−0.063	−0.077	−0.017	−0.020	0.041
		(0.320)	(0.315)	(0.324)	(0.328)	(0.308)
Economic Activity (lag)			−11.173	−9.588	−9.027	−8.786
			(10.642)	(10.987)	(11.305)	(10.361)
Inflation below 2% (lag)			0.372	0.372	0.386	0.355
			(0.401)	(0.404)	(0.414)	(0.426)
Inflation (lag)			20.458*	23.888**	25.502**	27.823**
			(11.582)	(11.072)	(11.684)	(11.399)
Inflation (lag) × below 2% (lag)			1.733	−2.236	−4.209	−3.960
			(16.784)	(17.131)	(19.133)	(18.917)
Fiscal Policy (lag)			8.255	5.873	5.837	6.118
			(6.007)	(6.194)	(6.143)	(6.143)
Financial & Monetary Cond. (lag)			2.445	1.358	1.773	5.378
			(11.813)	(12.343)	(12.440)	(12.862)
UMP (inter-PC)				−15.657*	−15.251	−19.360**
				(9.292)	(9.306)	(9.028)
Bank Funding (inter-PC)				−9.130	−8.979	−10.876
				(14.732)	(14.732)	(15.311)
Economic Activity (inter-PC)				−14.712	−14.793	−15.599
				(10.798)	(10.925)	(10.565)
Inflation (inter-PC)				6.921	7.135	3.206
				(17.656)	(16.999)	(15.164)
Inflation (inter-PC) × below 2%				2.000	0.762	9.964
				(24.371)	(24.029)	(22.686)
Monetary Developments (inter-PC)				11.252	11.379	10.731
				(9.145)	(9.141)	(9.350)
Bank Lending (inter-PC)				3.284	3.567	−1.073
				(10.941)	(11.026)	(11.816)
Structural Reforms (inter-PC)				−1.443	−1.512	2.300
				(9.716)	(9.899)	(9.935)
Fiscal Discipline (inter-PC)				17.054	16.726	15.284
				(16.345)	(16.045)	(16.186)
$R_{Eurostoxx\ 50}$					0.011	−0.028
					(0.061)	(0.061)
Δ VSTOXX					0.001	−0.026
					(0.046)	(0.042)
Δ GER 2Y Yield					−0.547	−0.571
					(0.822)	(0.789)
Δ Real GDP Projection						0.435
						(0.359)
Δ Inflation Projection						2.090*
						(1.224)
Constant	0.054	−0.107	−0.169	−0.188	−0.197	−0.229
	(0.133)	(0.186)	(0.186)	(0.181)	(0.173)	(0.172)
Observations	196	196	196	196	196	196
Adjusted R^2	0.046	0.042	0.045	0.037	0.022	0.041
Note:						*p<0.1; **p<0.05; ***p<0.01

Table IA.12: Detailed regression results 'policy' shock

This table presents detailed regression results, where in each column control variables are progressively added. The dependent variable is the 'policy' shock of Jarociński and Karadi (2020). Coefficient estimates for the topic-specific measures of stance correspond to the regression model in equation 4. 'Economic activity', 'inflation', 'financial & monetary conditions' and 'fiscal policy' are scaled to unit variance. For 'rate guidance', 1 (-1) indicates a tighter (looser) policy stance. Reported standard errors are corrected for heteroscedasticity based on White (1980).

Δ Stance	Policy (JK)					
Rate Guidance	0.318*	0.359**	0.356**	0.368**	0.346**	0.372**
	(0.163)	(0.166)	(0.167)	(0.169)	(0.157)	(0.154)
Economic Activity	0.049	0.046	0.042	0.046	0.048	0.063
	(0.072)	(0.072)	(0.090)	(0.085)	(0.086)	(0.086)
Inflation	−0.007	0.032	−0.037	−0.035	−0.010	0.001
	(0.064)	(0.067)	(0.097)	(0.100)	(0.110)	(0.114)
Financial & Monetary Cond.	0.039	0.036	0.032	0.010	0.013	0.012
	(0.074)	(0.074)	(0.076)	(0.080)	(0.079)	(0.079)
Fiscal Policy	−0.072	−0.066	−0.047	−0.043	−0.060	−0.055
	(0.082)	(0.083)	(0.087)	(0.077)	(0.083)	(0.083)
UMP	0.012	0.041	0.085	0.124	0.137	0.135
	(0.302)	(0.308)	(0.307)	(0.299)	(0.281)	(0.280)
Press Release Shock	0.034	0.037	0.025	−0.023	0.013	0.003
	(0.106)	(0.103)	(0.099)	(0.095)	(0.099)	(0.098)
Inflation below 2%		0.169	0.035	0.068	0.045	0.018
		(0.147)	(0.155)	(0.155)	(0.158)	(0.161)
Inflation × below 2%		−0.083	−0.038	−0.047	−0.055	−0.066
		(0.112)	(0.124)	(0.126)	(0.126)	(0.129)
Economic Activity (lag)			−4.230	−4.070	−3.746	−3.714
			(4.706)	(4.467)	(4.793)	(4.745)
Inflation below 2% (lag)			0.178	0.148	0.106	0.112
			(0.146)	(0.140)	(0.147)	(0.152)
Inflation (lag)			−9.292	−9.197	−8.203	−8.820
			(7.537)	(7.603)	(8.940)	(9.002)
Inflation (lag) × below 2% (lag)			3.910	6.624	4.400	4.322
			(8.933)	(10.144)	(11.143)	(11.146)
Fiscal Policy (lag)			−0.135	−0.973	−0.920	−0.973
			(3.164)	(3.172)	(3.178)	(3.200)
Financial & Monetary Cond. (lag)			−3.496	−3.856	−4.269	−5.143
			(5.971)	(6.035)	(6.062)	(6.116)
UMP (inter-PC)				−5.566	−5.375	−4.473
				(4.327)	(4.244)	(4.269)
Bank Funding (inter-PC)				−2.739	−3.199	−2.824
				(8.075)	(7.672)	(7.649)
Economic Activity (inter-PC)				3.613	3.197	3.253
				(6.465)	(5.947)	(5.872)
Inflation (inter-PC)				3.986	3.029	3.926
				(8.635)	(9.213)	(9.336)
Inflation (inter-PC) × below 2%				6.088	5.762	3.837
				(11.503)	(12.112)	(12.479)
Monetary Developments (inter-PC)				2.540	2.998	3.202
				(5.847)	(5.757)	(5.779)
Bank Lending (inter-PC)				−0.596	−1.823	−0.928
				(6.452)	(6.558)	(6.812)
Structural Reforms (inter-PC)				5.335	5.828	4.981
				(4.083)	(4.182)	(4.215)
Fiscal Discipline (inter-PC)				10.503	8.887	9.314
				(8.602)	(8.106)	(8.158)
$R_{Eurostoxx\ 50}$					0.055*	0.064*
					(0.032)	(0.036)
Δ VSTOXX					0.021	0.027
					(0.017)	(0.019)
Δ GER 2Y Yield					−0.099	−0.096
					(0.640)	(0.648)
Δ Real GDP Projection						−0.117
						(0.165)
Δ Inflation Projection						−0.428
						(0.435)
Constant	−0.013	−0.098	−0.118	−0.116	−0.089	−0.083
	(0.070)	(0.116)	(0.117)	(0.116)	(0.112)	(0.112)
Observations	196	196	196	196	196	196
Adjusted R^2	-0.001	-0.003	-0.014	-0.026	-0.009	-0.016
Note:						*p<0.1; **p<0.05; ***p<0.01

Table IA.13: Detailed regression results 'information' shock

This table presents detailed regression results, where in each column control variables are progressively added. The dependent variable is the 'information shock' of Jarociński and Karadi (2020). Coefficient estimates for the topic-specific measures of stance correspond to the regression model in equation 4. 'Economic activity', 'inflation', 'financial & monetary conditions' and 'fiscal policy' are scaled to unit variance. For 'rate guidance', 1 (-1) indicates a tighter (looser) policy stance. Reported standard errors are corrected for heteroscedasticity based on White (1980).

Δ Stance	Information (JK)					
Rate Guidance	0.231	0.245*	0.227	0.207	0.130	0.137
	(0.144)	(0.144)	(0.149)	(0.153)	(0.146)	(0.146)
Economic Activity	0.188***	0.191***	0.173**	0.200**	0.216***	0.231***
	(0.070)	(0.072)	(0.080)	(0.081)	(0.080)	(0.081)
Inflation	0.036	0.095	0.063	0.080	0.070	0.081
	(0.071)	(0.093)	(0.121)	(0.121)	(0.117)	(0.112)
Financial & Monetary Cond.	0.105	0.105	0.088	0.114	0.094	0.092
	(0.072)	(0.072)	(0.073)	(0.078)	(0.077)	(0.077)
Fiscal Policy	0.064	0.069	0.070	0.094	0.104	0.112
	(0.076)	(0.075)	(0.078)	(0.070)	(0.069)	(0.070)
UMP	0.069	0.095	0.143	0.127	0.074	0.091
	(0.303)	(0.300)	(0.299)	(0.278)	(0.251)	(0.256)
Press Release Shock	−0.033	−0.033	−0.034	−0.047	−0.074	−0.072
	(0.062)	(0.063)	(0.065)	(0.065)	(0.064)	(0.066)
Inflation below 2%		0.076	−0.147	−0.149	−0.067	−0.079
		(0.146)	(0.249)	(0.247)	(0.242)	(0.241)
Inflation × below 2%		−0.124	−0.080	−0.112	−0.099	−0.094
		(0.145)	(0.163)	(0.162)	(0.155)	(0.152)
Economic Activity (lag)			−4.922	−5.031	−6.720	−6.712
			(4.672)	(4.665)	(4.749)	(4.612)
Inflation below 2% (lag)			0.297	0.282	0.253	0.280
			(0.259)	(0.250)	(0.243)	(0.239)
Inflation (lag)			−3.378	−4.085	−6.762	−7.345
			(7.116)	(7.445)	(7.046)	(7.034)
Inflation (lag) × below 2% (lag)			4.658	4.082	10.607	9.956
			(9.523)	(10.527)	(10.272)	(10.303)
Fiscal Policy (lag)			−1.076	−0.123	−0.001	0.101
			(3.177)	(3.199)	(3.085)	(3.104)
Financial & Monetary Cond. (lag)			−10.136*	−9.519*	−10.222*	−11.081*
			(5.800)	(5.699)	(5.707)	(5.679)
UMP (inter-PC)				3.097	1.884	2.604
				(4.249)	(4.164)	(3.864)
Bank Funding (inter-PC)				6.264	6.644	7.788
				(6.697)	(6.263)	(6.296)
Economic Activity (inter-PC)				1.966	2.408	2.026
				(6.724)	(6.337)	(6.379)
Inflation (inter-PC)				−10.697	−10.265	−8.983
				(8.476)	(8.028)	(7.704)
Inflation (inter-PC) × below 2%				5.493	8.328	7.331
				(13.468)	(13.724)	(13.661)
Monetary Developments (inter-PC)				−7.743	−8.082*	−7.852
				(4.716)	(4.736)	(4.803)
Bank Lending (inter-PC)				1.799	0.665	0.567
				(6.888)	(6.865)	(6.986)
Structural Reforms (inter-PC)				−1.859	−0.616	−1.346
				(4.931)	(4.247)	(4.184)
Fiscal Discipline (inter-PC)				−4.328	−3.271	−4.030
				(7.325)	(6.731)	(6.753)
$R_{Eurostoxx\ 50}$					−0.051**	−0.041
					(0.026)	(0.026)
Δ VSTOXX					−0.025	−0.019
					(0.021)	(0.020)
Δ GER 2Y Yield					1.166**	1.183**
					(0.542)	(0.530)
Δ Real GDP Projection						−0.294
						(0.189)
Δ Inflation Projection						−0.111
						(0.602)
Constant	−0.002	−0.037	−0.071	−0.066	−0.069	−0.081
	(0.067)	(0.105)	(0.103)	(0.102)	(0.099)	(0.100)
Observations	196	196	196	196	196	196
Adjusted R^2	0.036	0.031	0.026	-0.001	0.034	0.032
Note:						*p<0.1; **p<0.05; ***p<0.01

Table IA.14: Detailed regression results 'monetary' shock

This table presents detailed regression results, where in each column control variables are progressively added. The dependent variable is the 'monetary' shock of Cieslak and Schrimpf (2019). Coefficient estimates for the topic-specific measures of stance correspond to the regression model in equation 4. 'Economic activity', 'inflation', 'financial & monetary conditions' and 'fiscal policy' are scaled to unit variance. For 'rate guidance', 1 (-1) indicates a tighter (looser) policy stance. Reported standard errors are corrected for heteroscedasticity based on White (1980).

Δ Stance	Monetary (CS)					
Rate Guidance	0.256*	0.296*	0.299*	0.312*	0.307**	0.327**
	(0.152)	(0.157)	(0.159)	(0.162)	(0.154)	(0.152)
Economic Activity	0.031	0.027	0.022	0.020	0.020	0.030
	(0.076)	(0.076)	(0.092)	(0.087)	(0.088)	(0.090)
Inflation	−0.009	0.021	−0.037	−0.039	−0.012	−0.005
	(0.068)	(0.069)	(0.093)	(0.096)	(0.104)	(0.107)
Financial & Monetary Cond.	0.042	0.038	0.036	0.009	0.016	0.016
	(0.075)	(0.074)	(0.077)	(0.080)	(0.080)	(0.080)
Fiscal Policy	−0.073	−0.068	−0.046	−0.049	−0.068	−0.065
	(0.084)	(0.086)	(0.087)	(0.075)	(0.081)	(0.080)
UMP	0.002	0.027	0.065	0.108	0.130	0.126
	(0.333)	(0.338)	(0.337)	(0.324)	(0.305)	(0.306)
Press Release Shock	0.009	0.014	0.004	−0.047	−0.020	−0.026
	(0.118)	(0.116)	(0.111)	(0.100)	(0.104)	(0.103)
Inflation below 2%		0.163	0.053	0.089	0.051	0.031
		(0.148)	(0.153)	(0.155)	(0.162)	(0.165)
Inflation × below 2%		−0.064	−0.028	−0.027	−0.038	−0.047
		(0.125)	(0.135)	(0.135)	(0.133)	(0.135)
Economic Activity (lag)			−3.759	−3.476	−2.857	−2.834
			(4.941)	(4.670)	(4.939)	(4.932)
Inflation below 2% (lag)			0.147	0.118	0.085	0.086
			(0.149)	(0.143)	(0.155)	(0.158)
Inflation (lag)			−7.697	−7.343	−5.762	−6.189
			(6.862)	(6.948)	(8.232)	(8.268)
Inflation (lag) × below 2% (lag)			2.892	5.478	2.029	2.068
			(8.955)	(10.384)	(11.201)	(11.179)
Fiscal Policy (lag)			0.429	−0.671	−0.657	−0.714
			(3.160)	(3.144)	(3.140)	(3.153)
Financial & Monetary Cond. (lag)			−1.961	−2.483	−2.752	−3.337
			(6.054)	(6.072)	(6.112)	(6.185)
UMP (inter-PC)				−6.930	−6.603	−5.941
				(4.385)	(4.258)	(4.335)
Bank Funding (inter-PC)				−4.504	−5.032	−4.857
				(8.721)	(8.244)	(8.241)
Economic Activity (inter-PC)				2.695	2.331	2.408
				(7.073)	(6.449)	(6.406)
Inflation (inter-PC)				5.807	4.597	5.191
				(8.725)	(9.150)	(9.232)
Inflation (inter-PC) × below 2%				5.150	4.505	3.031
				(12.470)	(13.086)	(13.526)
Monetary Developments (inter-PC)				4.443	4.933	5.070
				(5.976)	(5.812)	(5.846)
Bank Lending (inter-PC)				−0.694	−1.535	−0.807
				(6.064)	(6.105)	(6.322)
Structural Reforms (inter-PC)				5.748	6.036	5.423
				(4.320)	(4.266)	(4.356)
Fiscal Discipline (inter-PC)				12.192	10.477	10.908
				(8.806)	(8.174)	(8.288)
$R_{Eurostoxx\ 50}$					0.063**	0.069*
					(0.031)	(0.036)
Δ VSTOXX					0.025	0.029
					(0.019)	(0.022)
Δ GER 2Y Yield					−0.331	−0.331
					(0.589)	(0.597)
Δ Real GDP Projection						−0.055
						(0.166)
Δ Inflation Projection						−0.336
						(0.474)
Constant	−0.011	−0.095	−0.111	−0.109	−0.084	−0.078
	(0.070)	(0.111)	(0.112)	(0.110)	(0.106)	(0.105)
Observations	196	196	196	196	196	196
Adjusted R^2	-0.012	-0.015	-0.033	-0.036	-0.013	-0.022
Note:						*p<0.1; **p<0.05; ***p<0.01

Table IA.15: Detailed regression results 'growth' shock

This table presents detailed regression results, where in each column control variables are progressively added. The dependent variable is the 'growth' shock of Cieslak and Schrimpf (2019). Coefficient estimates for the topic-specific measures of stance correspond to the regression model in equation 4. 'Economic activity', 'inflation', 'financial & monetary conditions' and 'fiscal policy' are scaled to unit variance. For 'rate guidance', 1 (-1) indicates a tighter (looser) policy stance. Reported standard errors are corrected for heteroscedasticity based on White (1980).

Δ Stance	Growth (CS)					
Rate Guidance	0.352**	0.362**	0.334**	0.321**	0.241*	0.271*
	(0.152)	(0.151)	(0.155)	(0.157)	(0.144)	(0.142)
Economic Activity	0.141**	0.147**	0.145*	0.174**	0.194**	0.221***
	(0.072)	(0.073)	(0.085)	(0.083)	(0.085)	(0.086)
Inflation	0.005	0.069	0.0004	0.025	0.019	0.041
	(0.066)	(0.097)	(0.128)	(0.123)	(0.122)	(0.113)
Financial & Monetary Cond.	0.024	0.024	0.009	0.028	0.010	0.006
	(0.075)	(0.075)	(0.074)	(0.075)	(0.075)	(0.075)
Fiscal Policy	0.009	0.013	0.006	0.045	0.054	0.067
	(0.057)	(0.056)	(0.067)	(0.066)	(0.068)	(0.069)
UMP	0.043	0.067	0.119	0.115	0.075	0.087
	(0.294)	(0.294)	(0.290)	(0.279)	(0.248)	(0.255)
Press Release Shock	−0.027	−0.030	−0.015	−0.041	−0.054	−0.060
	(0.074)	(0.075)	(0.074)	(0.079)	(0.077)	(0.071)
Inflation below 2%		0.060	−0.106	−0.099	−0.031	−0.066
		(0.139)	(0.216)	(0.212)	(0.200)	(0.200)
Inflation × below 2%		−0.135	−0.082	−0.124	−0.118	−0.123
		(0.131)	(0.147)	(0.150)	(0.148)	(0.141)
Economic Activity (lag)			−3.410	−3.925	−5.339	−5.397
			(4.626)	(4.552)	(4.714)	(4.402)
Inflation below 2% (lag)			0.211	0.188	0.150	0.181
			(0.221)	(0.216)	(0.199)	(0.197)
Inflation (lag)			−9.388	−10.389	−13.126*	−14.118*
			(7.381)	(7.658)	(7.890)	(7.889)
Inflation (lag) × below 2% (lag)			5.628	6.441	11.864	11.315
			(9.186)	(9.865)	(10.244)	(10.346)
Fiscal Policy (lag)			−2.570	−1.436	−1.262	−1.210
			(3.279)	(3.346)	(3.254)	(3.291)
Financial & Monetary Cond. (lag)			−9.903*	−9.048*	−9.855*	−11.414**
			(5.441)	(5.465)	(5.559)	(5.566)
UMP (inter-PC)				4.537	3.378	4.939
				(4.642)	(4.534)	(3.724)
Bank Funding (inter-PC)				6.478	6.311	7.970
				(6.618)	(6.237)	(6.433)
Economic Activity (inter-PC)				5.345	5.666	5.367
				(4.143)	(3.941)	(4.032)
Inflation (inter-PC)				−9.974	−9.944	−7.956
				(8.995)	(8.583)	(7.607)
Inflation (inter-PC) × below 2%				6.499	9.123	6.504
				(12.865)	(13.037)	(12.276)
Monetary Developments (inter-PC)				−8.957*	−9.240*	−8.861*
				(4.758)	(4.909)	(5.030)
Bank Lending (inter-PC)				0.984	−0.142	0.594
				(6.789)	(6.950)	(7.190)
Structural Reforms (inter-PC)				−0.311	0.931	−0.558
				(4.003)	(4.054)	(3.809)
Fiscal Discipline (inter-PC)				−4.700	−3.791	−4.294
				(8.017)	(7.584)	(7.418)
$R_{Eurostoxx\ 50}$					−0.036	−0.018
					(0.031)	(0.030)
Δ VSTOXX					−0.017	−0.006
					(0.021)	(0.018)
Δ GER 2Y Yield					1.091*	1.122*
					(0.619)	(0.606)
Δ Real GDP Projection						−0.384*
						(0.209)
Δ Inflation Projection						−0.520
						(0.669)
Constant	−0.011	−0.037	−0.056	−0.051	−0.044	−0.051
	(0.066)	(0.108)	(0.107)	(0.106)	(0.098)	(0.100)
Observations	196	196	196	196	196	196
Adjusted R^2	0.015	0.010	0.011	-0.010	0.014	0.024
Note:						*p<0.1; **p<0.05; ***p<0.01

Table IA.16: Detailed regression results 'risk premium' shock

This table presents detailed regression results, where in each column control variables are progressively added. The dependent variable is the 'risk premium' shock of Cieslak and Schrimpf (2019).. Coefficient estimates for the topic-specific measures of stance correspond to the regression model in equation 4. 'Economic activity', 'inflation', 'financial & monetary conditions' and 'fiscal policy' are scaled to unit variance. For 'rate guidance', 1 (-1) indicates a tighter (looser) policy stance. Reported standard errors are corrected for heteroscedasticity based on White (1980).

Δ Stance	Risk Premium (CS)					
Rate Guidance	0.120	0.092	0.071	0.092	0.106	0.155
	(0.103)	(0.113)	(0.122)	(0.128)	(0.129)	(0.135)
Economic Activity	−0.167**	−0.165**	−0.118	−0.122	−0.125	−0.106
	(0.077)	(0.077)	(0.092)	(0.087)	(0.087)	(0.090)
Inflation	−0.075	−0.090	−0.137	−0.128	−0.122	−0.105
	(0.081)	(0.104)	(0.108)	(0.109)	(0.110)	(0.104)
Financial & Monetary Cond.	−0.230***	−0.228***	−0.217***	−0.232***	−0.226***	−0.227***
	(0.072)	(0.072)	(0.074)	(0.081)	(0.080)	(0.080)
Fiscal Policy	−0.117	−0.121	−0.151*	−0.119	−0.124	−0.118
	(0.090)	(0.091)	(0.086)	(0.075)	(0.076)	(0.077)
UMP	−0.085	−0.100	−0.127	−0.106	−0.087	−0.103
	(0.307)	(0.303)	(0.294)	(0.254)	(0.248)	(0.250)
Press Release Shock	−0.049	−0.048	−0.062	−0.060	−0.059	−0.048
	(0.093)	(0.093)	(0.090)	(0.083)	(0.086)	(0.085)
Inflation below 2%		−0.111	0.124	0.126	0.095	0.047
		(0.145)	(0.231)	(0.233)	(0.240)	(0.252)
Inflation × below 2%		0.032	0.026	0.012	0.008	−0.012
		(0.161)	(0.163)	(0.162)	(0.160)	(0.158)
Economic Activity (lag)			5.753	5.019	5.495	5.477
			(4.915)	(4.989)	(5.113)	(4.939)
Inflation below 2% (lag)			−0.324	−0.333	−0.329	−0.329
			(0.237)	(0.236)	(0.244)	(0.248)
Inflation (lag)			−9.356	−10.390	−9.612	−10.406*
			(6.413)	(6.333)	(6.225)	(6.107)
Inflation (lag) × below 2% (lag)			−0.003	2.423	0.051	0.396
			(8.917)	(9.244)	(9.902)	(9.759)
Fiscal Policy (lag)			−3.241	−2.713	−2.784	−2.988
			(2.826)	(2.943)	(2.925)	(2.880)
Financial & Monetary Cond. (lag)			4.216	4.642	4.707	3.408
			(6.143)	(6.339)	(6.279)	(6.347)
UMP (inter-PC)				5.015	5.319	6.949
				(3.997)	(4.062)	(4.247)
Bank Funding (inter-PC)				0.816	0.635	1.240
				(6.545)	(6.699)	(6.895)
Economic Activity (inter-PC)				6.322	6.255	6.443
				(6.891)	(6.670)	(6.567)
Inflation (inter-PC)				2.063	1.427	2.932
				(8.390)	(8.283)	(7.858)
Inflation (inter-PC) × below 2%				−0.632	−1.128	−4.731
				(12.344)	(12.345)	(12.096)
Monetary Developments (inter-PC)				−2.462	−2.311	−1.946
				(4.297)	(4.290)	(4.271)
Bank Lending (inter-PC)				−2.046	−1.729	−0.104
				(5.640)	(5.320)	(5.558)
Structural Reforms (inter-PC)				1.989	1.521	−0.005
				(5.613)	(5.194)	(5.125)
Fiscal Discipline (inter-PC)				−4.505	−5.139	−4.209
				(7.263)	(7.282)	(7.374)
$R_{Eurostoxx\ 50}$					0.026	0.039
					(0.026)	(0.030)
Δ VSTOXX					0.015	0.024
					(0.021)	(0.022)
Δ GER 2Y Yield					−0.281	−0.262
					(0.372)	(0.364)
Δ Real GDP Projection						−0.094
						(0.144)
Δ Inflation Projection						−0.807*
						(0.451)
Constant	−0.016	0.041	0.084	0.089	0.096	0.111
	(0.065)	(0.095)	(0.093)	(0.092)	(0.092)	(0.092)
Observations	196	196	196	196	196	196
Adjusted R^2	0.077	0.070	0.076	0.052	0.043	0.048
Note:						*p<0.1; **p<0.05; ***p<0.01

Table IA.17: Summary statistics for sovereign yield spreads and FX returns

This table presents summary statistics for sovereign yield spreads as well as exchange rate returns during the ECB press conference window. ES-DE 5Y and ES-DE 10Y are changes in the yield spread of Spanish and German 5-year (or 10-year) government bonds. IT-DE 5Y and IT-DE 10Y are the changes in yield spread of Italian and German 5-year (or 10-year) government bonds. A positive change in the core periphery spread represents a wider spread between core and periphery yields. Euro/USD, Euro/GBP and Euro/JPY are exchange rates returns. A positive return is interpreted as an appreciation of the Euro.

	Mean	Median	SD	Min	Max
ES-DE 5Y	-0.06	-0.05	3.94	-12.90	28.30
IT-DE 5Y	0.31	0.00	5.48	-14.85	37.15
ES-DE 10Y	0.20	0.00	4.12	-9.40	39.50
IT-DE 10Y	0.46	-0.05	5.24	-10.80	46.55
EUR/USD	-0.01	-0.03	0.43	-1.33	1.68
EUR/GBP	0.01	0.00	0.32	-0.91	1.23
EUR/JPY	-0.00	-0.01	0.44	-1.30	1.33

Figure IA.1: Change in ECB's topic specific stance over the sample

This figure presents changes in the ECB's topic-specific stance in introductory statements from 2002 until July 2020. Each panel corresponds to one topic as outlined section 3.1. The stance on topic i at time t is defined as $\tau_{i,t} = 1 - \frac{\#\text{ negative words in topic } i \text{ at press conference } t}{\#\text{ words in topic } i \text{ at press conference } t}$. Thus, the change in stance is defined as $\Delta\tau_{i,t} = tone^i_t - tone^i_{t-1}$. All four changes in stance visualized below are standardized. For a visualization of changes to 'Rate Guidance', which is a hand-classified variable in $\{-1, 0, 1\}$, see Figure 2.

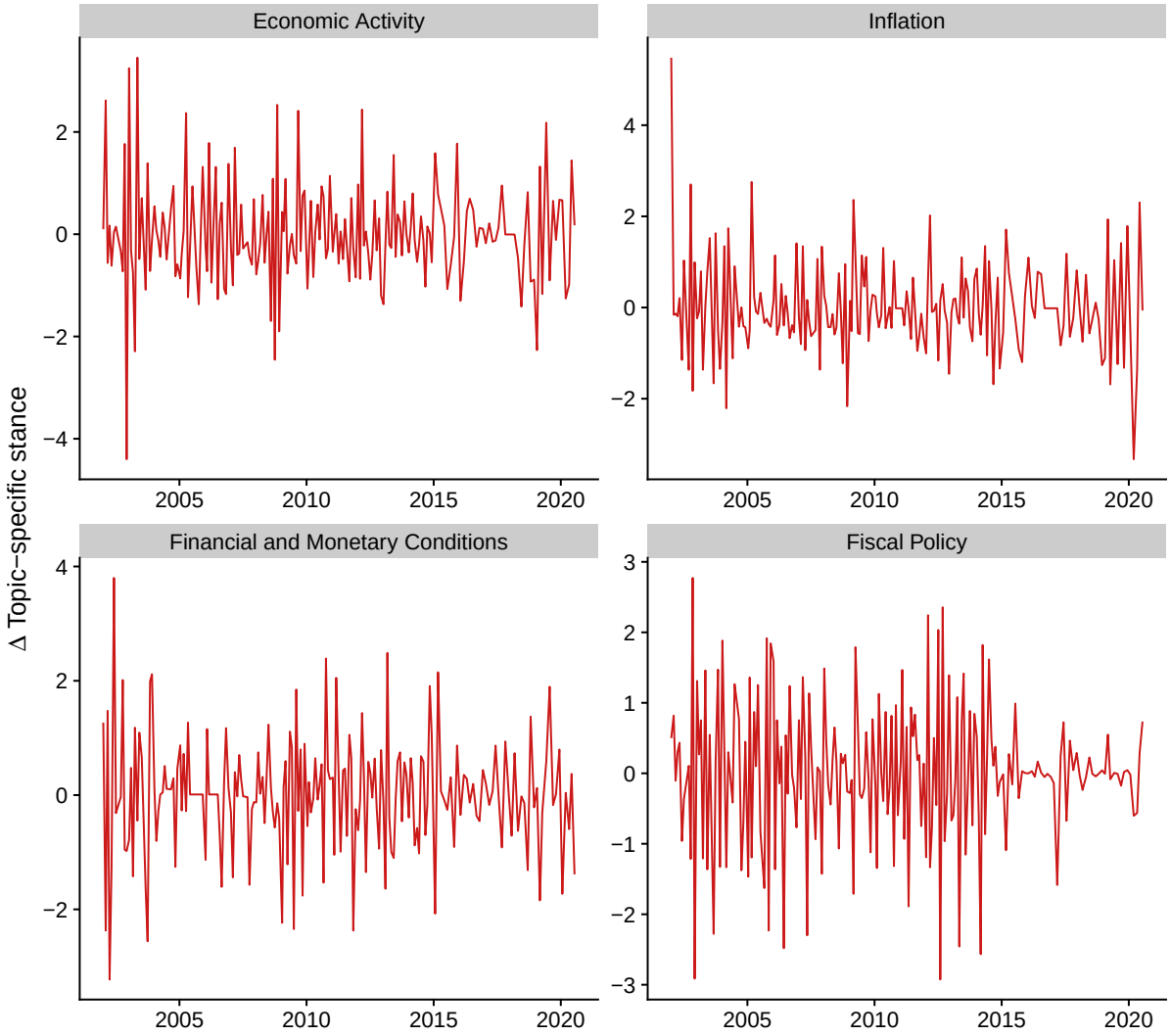


Figure IA.2: Communication effects across the term structure

This figure presents coefficient estimates for regressing different OIS maturities on changes in the ECB's topic-specific measures of stance in the introductory statement from 2002 until July 2020. Regressions correspond to the model in 4 and include the most comprehensive set of control variables. Each panel shows coefficient estimates for a specific topic, across regressions with different maturities as the dependent variable. 95% confidence intervals are based on standard errors corrected for heteroscedasticity (White, 1980).

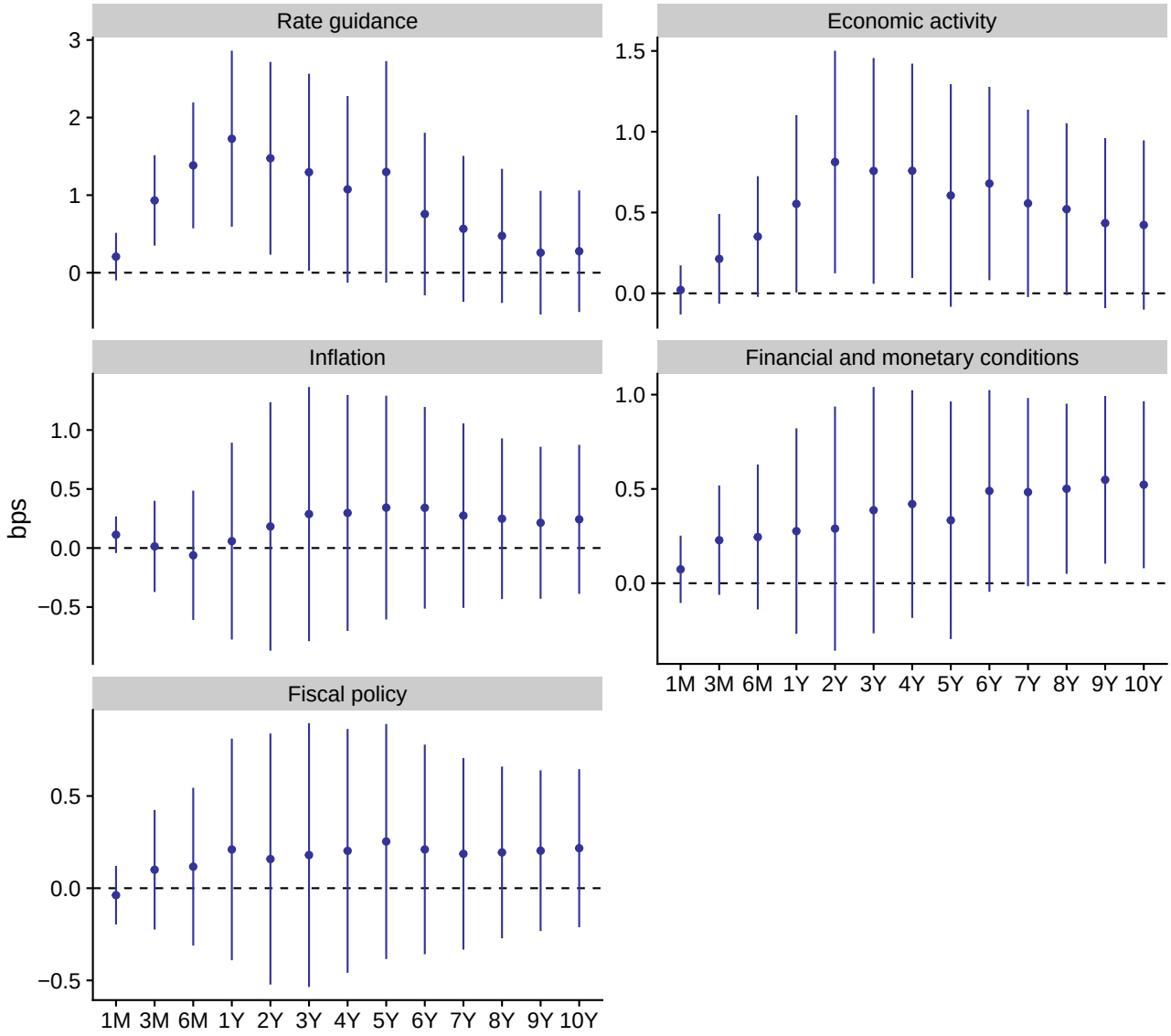
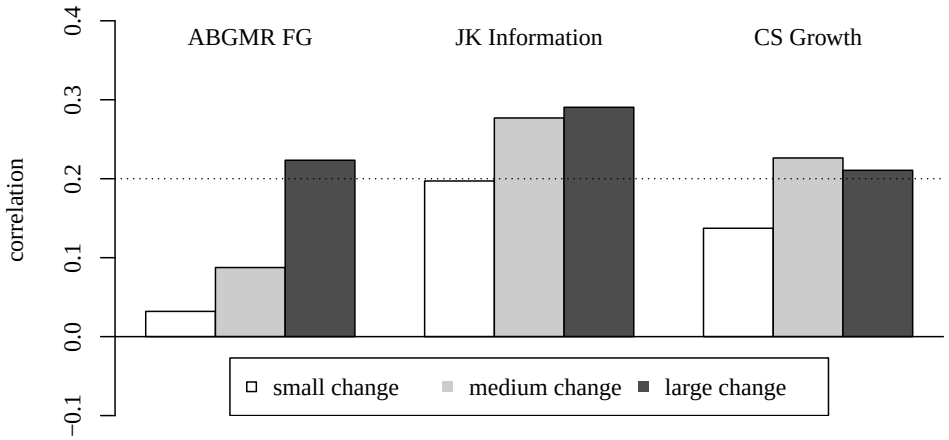


Figure IA.3: Correlation conditional on stance change size

This figure shows correlation coefficients between ECB stance measures and monetary policy shocks conditional on the size of stance change. We sorted stance changes by absolute magnitude into three buckets and then calculated the correlation with monetary policy shocks within each bucket. The upper panel corresponds to the stance on 'economic activity', the lower to the stance on 'financial & monetary conditions'. Stance changes are computed from the last press conference to the current. For 'economic activity', shocks comprise the'Forward Guidance' factor of Altavilla et al. (2019, ABGMR), the 'information' shock of Jarociński and Karadi (2020) and the 'growth' shock of Cieslak and Schrimpf (2019, CS). For 'financial & monetary conditions', shocks comprise the change in the 10-year OIS rate, the 'QE' factor of ABGMR and the 'risk premium' shock of CS. The topic-specific stance is measured as the ECB's tone on topic i at press conference t, i.e. $\tau_{i,t} = 1 - \frac{\#\text{ negative words in topic } i \text{ at press conference } t}{\#\text{ words in topic } i \text{ at press conference } t}$. Correlations for 'fiscal policy' are measured from 2009 to the sample end. All other correlations are based on the full sample.

Panel A. 'Economic activity'



Panel B. 'Financial & monetary conditions'