Does Central Bank Tone Move Asset Prices?*

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Abstract

This paper shows that changes in the *tone* of central bank communication have a significant effect on asset prices. Tone captures how the central bank frames its monetary policy and tone changes correlate with revisions of economic projections and policy actions. When tone becomes more positive, stock prices and interest rates increase whereas credit spreads decrease, and vice versa when tone becomes more negative. These tone effects on asset prices are robust to controlling for fundamentals and policy actions, which suggests that communication provides a channel through which monetary policy can affect risk premia embedded in market prices.

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

Keywords: Central bank communication, stock returns, return predictability, bond yields, monetary policy shocks, textual analysis

*First version: February 10, 2015. This version: June 8, 2017. We thank Alessandro Beber, Oliver Boguth, Gino Cenedese, Marco Di Maggio, Chris Downing, Michael Ehrmann, Rainer Haselmann, Tarek Hassan, Marcin Kacperczyk, Mark Kamstra, Ralph Koijen, Holger Kraft, Tim Kroencke, David Lando, Christian Laux, Michael Lemmon, Tim Loughran, Alex Michaelides, Silvia Miranda-Agrippino, Michael Melvin, Menno Middeldorp, Philippe Mueller, Thomas Nagel, Florian Nagler, Evgenia Passari, Lasse Pedersen, Tarun Ramadorai, Jesper Rangvid, Lucio Sarno, Christian Schlag, Andreas Schrimpf, Vania Stavrakeva, Andrea Tamoni, Desi Volker, Anette Vissing-Jorgensen, Paul Whelan, Fredrik Willumsen, and participants at the American Finance Association (AFA) Meetings 2017, Western Finance Association (WFA) Meetings 2016, the SFS Cavalcade 2016, the INQUIRE UK 2016 conference, the 2*nd* London Empirical Asset Pricing (LEAP) Meeting 2015, the European Finance Association (EFA) Meetings 2015, as well as seminar participants at the Bank for International Settlements, Bank of England, the Board of Governors of the Federal Reserve System, BlackRock, Copenhagen Business School, the German Institute for Economic Research (DIW, Berlin), Norges Bank, Norges Bank Investment Managers, Sveriges Riksbank, University of Frankfurt, and the Vienna Graduate School of Finance (VGSF) for helpful comments and suggestions. Christian Wagner acknowledges support from the Center for Financial Frictions (FRIC), grant no. DNRF102.

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"As I had often remarked, monetary policy is 98 percent talk and 2 percent action."

Ben Bernanke (2016, p. 498)

"I don't think I'm stepping up my rhetoric on inflation, Draghi said [...]. Financial market analysts nonetheless detected a shift in tone if not in substance of monetary policy."

Reuters, April 4th, 2012

"Given the uncertainty, how Ms. Yellen frames what the Fed is doing will be as important as what the Fed actually does." Wall Street Journal, September 16th, 2015

"All eyes will be on the ECB this afternoon. If the tone is clearly dovish, then it could maybe stop the bleeding on the market." Reuters, August 7th, 2014

1. Introduction

Monetary policy strongly affects asset prices, a prime example being the effect of monetary policy announcements on stock prices (e.g., Bernanke and Kuttner, 2005; Lucca and Moench, 2015; Cieslak et al., 2016). A large part of the information released on announcement days comes in the form of verbal communication, rather than quantitative releases, and central banks (CBs) use such communication to explain their policy decisions, the economic outlook, and to shape market expectations. CB communication is thus closely followed by market participants, extensively covered by the financial press, and CBs evaluate the media coverage of their statements to gauge the effectiveness of their communication.[1] Importantly, market participants do not only pay attention to the content but also, as the above quotes illustrate, to the *tone* of CB statements, i.e., to *how the central bank frames* its policy decisions and the economic outlook. Hence, a natural question is: Does communication matter for asset prices beyond policy actions? Ben Bernanke's view that "monetary policy is 98 percent talk and 2 percent action" suggests that it should.

The contribution of our paper is to show that the tone of CB communication indeed

[1]For an overview of the literature on CB communication see, e.g., Woodford (2005) and Blinder et al. (2008). Berger et al. (2011) discuss how the ECB evaluates communication effectiveness via media reception.

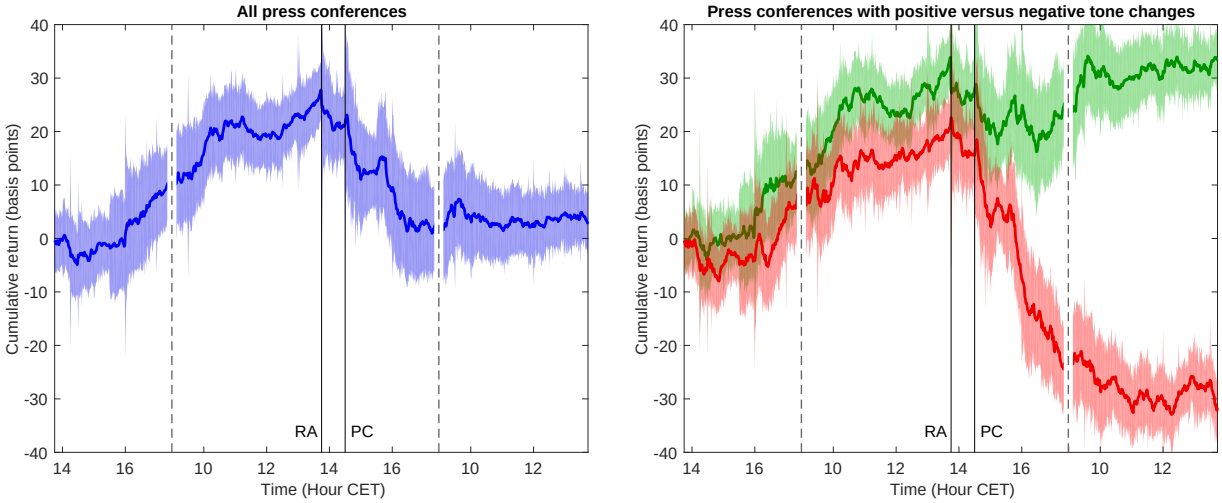
matters for asset prices. To quantify the tone of a CB statement, we use the financial dictionary developed by Loughran and McDonald (2011) to identify *negative* words, evaluate the statement's tone by assessing the prevalence of negative words, and construct a measure of tone such that higher values reflect a more positive tone of the CB statement and vice versa. Repeating this procedure for a sequence of CB statements, we construct a time-series of CB tone and show that changes in CB tone matter for asset prices even when controlling for hard facts, such as the central bank's policy actions and the release of economic projections, as well as conventional measures of monetary policy shocks.

In our main analysis, we focus on press conferences held by the European Central Bank (ECB), because the ECB was the first CB to set up comprehensive press conferences after meetings of its Governing Council. These press conferences are broadcasted live and thus represent a source of real-time information for market participants. We evaluate the tone of the ECB president's statement during these press conferences from January 1999 to October 2014. Since ECB press conferences take place on Thursdays in the early afternoon (14:30 CET), any information revealed during the press conference can affect financial market prices immediately on the same day. Moreover, since the ECB also announces changes in its key policy rates earlier on the same day (at 13.45 CET), we can use the high-frequency response of market prices at these two points in time of the day to disentangle news about policy rates from news embedded in CB communication (e.g., Ehrmann and Fratzscher, 2009).

We first verify that our measure of CB tone indeed captures how the ECB frames macroeconomic fundamentals. We show that phrases such as "global imbalances", "disorderly correction", "excessive deficit" and discussions about fundamentals that, e.g., "remain weak" are among the most important drivers of tone. Moreover, tone changes are positively correlated with current and future changes in key policy rates and the ECB's macroeconomic projections for real GDP growth. These results lend credence to the view that CB tone is a key tool for communicating views about the future path of the economy and future monetary policy. We provide further support for this view by showing that there is a positive relation between changes in ECB tone and government bond yields, consistent with the idea that a more positive tone is related to a more positive framing of the economic outlook.

Turning to the relation between CB communication and asset prices, we first study how equity markets respond to changes in tone. Figure 1 provides a preview of our results by plotting the average cumulative returns of the EuroStoxx 50 (a European large cap stock index) in a 48-hour window around policy rate announcements of the ECB.

Figure 1: Stock returns in the 48 hours around ECB policy rate announcements



This Figure shows cumulative returns of the EuroStoxx 50 index in the 48 hours around ECB policy rate announcements. The ECB announces its rate decision at 13:45 (CET) and then holds a press conference, which starts at 14:30 CET. The time-window shown is from 13:45 on the day before until 13:45 on the day after the announcement. The dashed vertical lines indicate the end of a trading day whereas the two solid lines indicate the time of the policy rate announcement ("RA") and the start of the press conference ("PC"), respectively. The left figure shows average cumulative returns across all announcement days from January 1999 to October 2014. The right figure plots average cumulative returns separately for press conferences with tone being more positive than at the previous press conference (green, upper line) and more negative tone (red, lower line).

The plot on the left shows the average cumulative return across all 185 press conferences in our sample. There is a pre-announcement drift before the policy rate announcement at 13:45 CET (indicated by the solid vertical line labeled "RA"), akin to the findings in Lucca and Moench (2015) for FOMC meetings. Contrary to the FOMC pre-announcement drift, however, these returns are completely reversed in the 24 hours after the announcement. The plot on the right shows average cumulative returns over the same time window but separately for press conferences (PCs) with a more positive tone (green line) and PCs with a more negative tone (red line) compared to the previous PC. Three effects stand out from this figure. First, PCs with a positive tone are associated with significantly higher returns than

PCs with a more negative tone. Second, returns are not significantly different at the time of the policy rate announcement ("RA") but only start to diverge significantly after the press conference has started at 14:30 CET (vertical line labeled "PC"). Hence, the return spread of about 60 basis points between a more positive versus more negative tone is unlikely to be driven by the policy rate decision. Rather, it must be driven by information communicated during the press conference. Third, the return spread between PCs with positive and negative tone changes appears to persist beyond policy meeting days.

In our empirical analysis, we show that this link between tone and stock returns is economically large and statistically significant. Most importantly, the significant effect of tone changes on equity returns is robust to a battery of control variables, such as actual policy rate changes, announcements of unconventional monetary policy (UMP), changes in macroeconomic projections, as well as conventional measures of monetary policy shocks, such as shocks to the level of short-term interest rates and shocks to the expected path of future monetary policy. Moreover, the effect of tone on stock prices is not short-lived but extends well beyond the PC day and increases until the day before the next press conference. For instance, in daily data, we find that the difference in PC-day returns of PCs with more positive tone relative to more negative tone is about 60 basis points and that this spread grows to about 110 basis over the cycle to the next PC (approximately one month later). Our findings are very similar when we repeat the analysis for other Eurozone stock market indices as well as for the stock markets of individual Eurozone member countries.

All these results are consistent with the idea that central bank tone is an instrument for monetary policy that complements other tools and conveys generic information for market participants: While tone is related to the ECB's monetary policy and macroeconomic expectations, tone changes matter for stock prices beyond policy actions, macro fundamentals, and interest rates. This finding suggests that the link between tone and stock prices is not based on a pure 'growth channel', in which more positive tone signals more (expected) GDP growth and thus lifts stock prices. Instead, tone changes matter for equity returns over and above changes in fundamentals. Hence, a natural candidate could be a channel in which tone affects risk embedded in market prices, akin to Bernanke and Kuttner (2005) who find that

risk premia account for most of the stock price response to policy actions. More recently, a growing literature provides theoretical and empirical evidence that monetary policy affects market participants' attitude towards risk and, as a consequence, the taking and pricing of risk (e.g., Borio and Zhu, 2012; Bekaert et al., 2013; Chodorow-Reich, 2014; Hanson and Stein, 2015; Morris and Shin, 2014; Gertler and Karadi, 2015; Drechsler et al., 2017).

To explore this potential channel, we look beyond stock markets and explore how tone affects corporate credit spreads, i.e. yield differentials of BBB-AAA rated bonds. The idea is to study assets whose prices are particularly sensitive to changes in risk aversion (which itself is unobservable) to explore whether CB tone affects asset prices via a 'risk-taking channel'. We find that a more positive CB tone is related to significantly lower credit spreads for both financial and non-financial firms, on PC days and over PC cycles, and that this effect is robust to controls for policy actions, unconventional monetary policy announcements, changes in the macroeconomic outlook, and conventional measures of monetary policy shocks. Hence, the tone of CB communication appears to be an important channel through which monetary policy can affect the risk-taking behaviour of market participants: a more positive tone lowers the risk premium required by investors and thus increases stock prices.

Finally, we present evidence that the Fed Chair's tone in Congressional Testimonies matters for U.S. asset prices. Our findings are qualitatively identical to the ECB results: a more positive Fed tone is associated with higher Treaasury yields, higher equity returns, and lower credit spreads, whereas the opposite is true when tone becomes more negative. Given that testimonies do not coincide with actual monetary policy decisions, these results corroborate our conclusion that CB tone contains generic information for asset prices.

The rest of the paper unfolds as follows. The next section reviews the related literature. Section 3 discusses sources of central bank communication, describes how we measure tone, and summarizes the data used in the empirical analysis. Section 4 validates our tone measure by showing how tone relates to monetary policy actions and macroeconomic expectations. Section 5 presents empirical results on the relation between ECB tone and Eurozone asset prices, and Section 6 reports corroborating evidence for the U.S. Section 7 concludes. A separate Internet Appendix contains additional empirical results and robustness checks.

2. Relation to literature

On a general level, our work relates to previous research that analyzes the effect of monetary policy on asset prices and risks. A large part of our analysis focuses on equity returns, thereby following the work of Bernanke and Kuttner (2005) who were among the first to show that monetary policy decisions by the Federal Reserve have a strong effect on stock prices. Other studies analyze equity returns around policy meetings (e.g. Lucca and Moench, 2015) and over cycles between policy meetings (e.g. Cieslak et al., 2016), providing evidence for a pre-announcement drift leading up to FOMC meetings and weekly return patterns over FOMC cycles, respectively.[2] Neuhierl and Weber (2016) show that expectations about the future path of monetary policy, measured from Fed Fund futures across different maturities, predict stock returns in the U.S. Other papers that have documented monetary policy effects in different settings and for different assets include, for instance, Rigobon and Sack (2004); Bjornland and Leitermo (2009); Buraschi et al. (2014); Campbell et al. (2015). Related, there is a literature that quantifies monetary policy shocks from changes in market prices (e.g. bond yields) in short windows around policy announcements (e.g., Kohn and Sack, 2004; Guerkaynak et al., 2005; Brand et al., 2010; Krishnamurthy and Vissing-Jorgensen, 2011; Hanson and Stein, 2015; Chodorow-Reich, 2014; Nakamura and Steinsson, 2016; Boguth et al., 2017; Ferrari et al., 2017).

Our paper contributes to these strands of the literature by showing that central bank tone matters for the prices of stocks and other assets. Since we find that these tone effects remain significant when controlling for policy actions, revisions of economic projections, and standard proxies of monetary policy shocks, our results suggest that central bank tone affects asset prices largely through their risk premium component. Our results are consistent with the notion of a 'risk-taking channel' of monetary policy, i.e. with previous evidence that monetary policy affects market participants' attitude towards risk and, as a consequence, the taking and pricing of risk. Early work includes Shiller et al. (1983), who find that the response

[2]More generally, Savor and Wilson (2013, 2014) show that asset prices (stocks, bonds, currencies) behave very differently on days with scheduled U.S. macro news announcements and that risky assets earn higher returns on announcement days, including FOMC anouncement days.

of long-term yields to money stock announcements suggests that monetary policy affects term premia. Related, Hanson and Stein (2015) argue that monetary policy affects the risk-taking behavior of investors in their choice of short- versus long-term bonds. Similarly, Gertler and Karadi (2013, 2015) stress the importance of monetary policy effects on term premia and credit spreads. Moreover, Bernanke and Kuttner (2005) find that monetary policy affects stock prices mostly via expected excess returns. Recent empirical and theoretical work that provides evidence for a risk-taking channel, typically emphasizing institutional realities and market frictions arising via financial intermediation and regulation, includes, e.g., Borio and Zhu (2012); Morris and Shin (2014); Stein (2014); Brunnermeier and Sannikov (2016); Drechsler et al. (2017). Recent studies that focus on unconventional monetary policy include, e.g., Krishnamurthy and Vissing-Jorgensen (2011); Chodorow-Reich (2014); Hattori et al. (2015); Krishnamurthy et al. (2015). The key difference of our paper to all these earlier papers is that we explore how changes in tone affect asset prices rather than policy actions.

Since we construct our measure of tone from central bank statements, our work relates to the large literature on central bank communication (e.g., Woodford, 2005; Blinder et al., 2008, for a comprehensive survey). More specifically, our paper contributes to previous research that extracts information from statements, reports or meeting minutes by means of textual analysis. These approaches differ along various dimensions, such as the degree of human judgement, automated processing, text components extracted (e.g. words or sentences), etc. Early work includes Romer and Romer (2004) who apply a narrative approach to central bank documents to identify monetary policy shocks. Lucca and Trebbi (2009) analyze the content of FOMC statements by semantic orientation scores that are computed from an extremely large set of information obtained through search engines. Jegadeesh and Wu (2015) extract topics from FOMC minutes and find that these, despite being released only with a substantial lag after the meetings, still contain information relevant for markets. Hansen et al. (2015) investigate how transparency affects deliberation of FOMC members in a natural experiment setting. Hansen and McMahon (2016) explore how FOMC communication affects economic and financial variables and whether forward guidance is more important than information about current macroeconomic conditions. More recently, Ehrmann and Talmi (2016) use a

human scoring approach to investigate how (small) changes in central bank communication affects its impact on financial markets. Other studies that use combinations of different more or less subjective methods to analyze different characteristics of central bank communication (such as content, tone, similarity, readability, etc) include Bligh and Hess (2007); Rosa and Verga (2007); Rosa (2011); Amaya and Filbien (2015).

The key features of our setup are that we only use central bank communication that is specifically designed to inform the public in real-time and that we exclusively rely on an off-the-shelf financial dictionary (by Loughran and McDonald, 2011) and thereby avoid hindsight bias from using the data twice, e.g., for first constructing a dictionary or training an algorithm that is subsequently applied to the same documents to gauge effects on market prices. We describe our approach and discuss the relation to the aforementioned papers in more detail in Section 3. To the best of our knowledge, our study is the first to employ an objective real-time approach to assess how central bank tone affects market prices (i) at intraday-, daily-, and longer frequencies, (ii) disentangling tone-effects from policy actions and macroeconomic projections, (iii) thereby allowing us to explore the channels through which central bank communication, and specifically its tone, affects asset prices.

3. Measuring central bank tone

This section discusses potential data sources for measuring central bank tone and presents our approach to computing the tone of central bank statements. The last subsection describes the central bank, macroeconomic, and asset price data used in the empirical analysis.

3.1. Discussion of potential data sources for measuring central bank tone

Our goal is to measure the impact of CB tone on asset prices at different frequencies. This requires the use of CB statements with a precise timing, i.e., it needs to be clear when these statements become publicly available to market participants. In this respect, press conferences by the European Central Bank (ECB) provide an ideal setup. Following the meetings of the Governing Council (which are scheduled well ahead of time), the ECB first

announces the policy rate decision at 13:45 CET. At 14:30 CET the ECB holds a press conference that begins with a statement by the president. This statement is drafted in advance and serves to inform the general public about the council's decisions, why these decisions have been made, how they have been reached, and a general outlook. With the press conferences taking place on Thursdays in the early afternoon at 14:30 CET, any new information revealed during the press conference can affect financial market prices on the same day. ECB press conferences are broadcasted live, are thus available in real time to all market participants, and the ECB makes transcripts publicly available on its website. In our empirical analysis, we will use the time lag between the announcement of the policy rate (13:45) and the start of the press conference (14:30) to disentangle the asset price effects of new information about policy rates from the tone of central bank communication.

Moreover, we focus on ECB press conferences because the ECB was the first central bank to establish live press conferences after meetings of its Governing Council and thus provides the longest time series of press conferences. By contrast, other central banks have only introduced similar live press conferences in recent years and a reliable empirical study is not feasible due to the low number of observations. For instance, the U.S. Fed held its first comparable press conference on April 27, 2011 and at the time of writing this paper only 14 press conferences have been held. Likewise, other central banks have introduced press conferences only recently and at lower frequency; for example, the Swiss National Bank has adopted a news conference setting in 2011 that takes place in July and December only.

Another source of communication could be the minutes of CB meetings such as FOMC meetings or the Minutes of the Bank of England's Monetary Policy committee. However, these minutes are only available with a time lag and are edited transcripts of actual discussions at these meetings and therefore, by their nature, not designed as a device to directly communicate with market participants. Alternatively, some CBs issue statements about their decisions (e.g., the Fed releases a statement after FOMC meetings). Compared to the president's statement at ECB press conferences, these are typically much shorter and, thus, less suited for our purpose. As an example, the average number of words in FOMC statements since the 1990s is lower than that of the shortest ECB statement during our whole

sample period. Hence, the information contained in these statements is rather limited.

For the U.S., a further source of information could be Testimonies to the U.S. Congress given by the Fed Chair. Transcripts for these biannual testimonies are available from July 1996 onwards and this provides a series of 37 transcripts up to fall 2014 (the end of our sample period). Compared to ECB press conferences, these testimonies are available at a much lower frequency. Nonetheless, these speeches may be particularly interesting for the following reasons. First, similar to ECB press conferences, these speeches are scheduled in advance, available in real time, and are closely followed by financial markets. Second, different from ECB press conferences, these speeches do not concur with meetings of the FOMC and thus allow us to measure the effect of tone on asset prices without potentially confounding effects from actual policy decisions. For these reasons, we also examine the link between Fed testimony tone and asset prices in the U.S. in Section 6 to corroborate our conclusion that central bank tone matters beyond actions.

3.2. Computing tone

To compute a quantitative measure of CB tone, we prepare the transcripts of the ECB press conferences for the subsequent textual analysis as follows: we (i) convert all words to lower case, (ii) remove numbers, (iii) remove punctuation, (iv) remove English stop words (e.g., for, very, and, of, are, etc.), and (v) strip whitespace as is common in the textual analysis literature. After preparing the text files, we construct a proxy for CB tone using the financial dictionary developed by Loughran and McDonald (2011). More specifically, we use this dictionary to identify words that can be classified as *negative* in financial contexts.[3] We then count the number of negative words in each transcript and compute the ratio of the number of negative words (N) to the total number of words (T), N/T. We define CB tone (τ) as

$$\tau = 1 - N/T \tag{1}$$

[3]We only use negative words because the usefulness of positive words for measuring tone is very limited, as discussed by Loughran and McDonald (2011) and also noted by others before. The main reason is that positive words are frequently negated. By contrast, negation of negative words is far less common.

such that lower values reflect a more negative CB tone and higher values imply a more positive (i.e., less negative) tone. In our empirical analysis, we focus on *changes in tone*, $\Delta\tau$, measured as the first difference in τ between two subsequent press conference. Accordingly, we interpret increases in τ as tone becoming more positive and decreases in τ as tone becoming more negative.

A few words on this procedure are in order. Our choice of scoring the tone of CB statements based on the Loughran and McDonald (2011, LM) dictionary is mainly driven by two considerations. First, we rely on a well-established dictionary to classify words as negative to avoid the need for a subjective classification of words as being negative or not. An alternative approach would be to build our own dictionary of CB language, either based on just selecting words as being negative based on common sense or based on a statistical procedure that classifies certain words as negative based on the market's reaction to the occurrence of these words. However, (subjectively) defining a list of negative words ourselves would essentially mean that we have control over the resulting time series of tone and, thus, the outcome of our empirical analysis later in the paper. Using a statistical procedure to generate a negative word list would require us to use the same data twice, first to build the dictionary and, subsequently, to analyze the effect of tone on asset prices, thereby leading to hindsight bias. To avoid such a double usage of the data, we could split the sample into a training and a test sample but that would significantly reduce the sample period that we can cover in our empirical analysis. Employing the LM dictionary alleviates these concerns as we are not using the same data twice and because we have no control over the list of negative words.

Second, the LM dictionary is explicitly designed to be informative for financial documents, in contrast to, e.g., the widely used Harvard Dictionary. The LM dictionary was originally designed for 10-K filings but has proven useful in other financial contexts as well; see, e.g., the recent papers by Gurun and Butler (2012) and Hillert et al. (2014) as well as the survey of Loughran and McDonald (2016). Of course, we cannot preclude that central bank language differs from the typical language used in 10-K filings to a certain extent. However, any such misclassification should work against us in our empirical analyses and raise the hurdle to

find a link between tone and asset prices.

Finally, we choose to measure tone by means of simple words counts rather than more elaborate techniques. Approaches such as term weighting or topic modelling would require to look ahead through all documents before starting the empirical analysis of market prices, which would again imply a hindsight bias. Hence, to avoid all these potential biases, we choose simplicity and transparency over more elaborate alternatives.[4]

The downside of this simple approach is that there can be misclassifications, i.e., cases where a phrase is identified as being negative even though it is not. For example, a statement like "unemployment is declining" would be counted as negative since both "unemployment" and "decline" are negative words in the LM dictionary. As noted above, such misclassifications will only raise the bar for detecting a significant link between tone and returns. Hence, our results reported below can be seen as a lower bound on the effect of tone on stock prices.

3.3. Data used in the empirical analysis

In most of our empirical analysis (Sections 4 and 5), we study the tone of the ECB, measured from the introductory statement given by its president at the beginning of the press conferences held after meetings of the Governing Council. The ECB makes transcripts of its press conferences publicly available on its website.[5] We obtain these transcripts, starting with the introduction of the Euro, for a total of 185 press conferences between January 7, 1999 and October 2, 2014. From these transcripts, we extract the opening statement of the ECB president and process the text as described in Section 3.2. For our analysis of Fed tone (Section 6), we use transcripts of the Chair's Testimonies to the U.S. Congress.

To study the drivers of ECB tone and its effect of asset prices, we rely on data from various sources, as we briefly discuss here and in more detail in Appendix A.1. From the

[4]For the same reason, we do not make use of human scoring techniques, i.e. ask human readers to evaluate central bank statements. For instance, while a potential advantage of that approach may be that human readers are better in processing certain nuances of texts, a disadvantage is that human judgement cannot be avoided in the scoring process, thereby neither guaranteeing an avoidance of misclassification nor 'reader-fixed effects' in tone measures (e.g., Ehrmann and Fratzscher, 2007). Moreover, it would be difficult to set up a generic out-of-sample analysis of how central bank tone matters for asset prices, as multiple readers would have to be trained on a large body of statements.

[5]See, for instance, the following link for transcripts of all ECB Press Conferences in 2014.

ECB website, we obtain data on policy rates and announcement dates as well as data on the quarterly projections for real GDP and HICP for the subsequent year. Additionally, we obtain data on a range of macroeconomic fundamentals from Datastream, at monthly and quarterly frequencies. For our analysis of the term structure of interest rates, we obtain yield curve data from the ECB and the Bundesbank for maturities of one to 20 years, and to compute interest rate-based measures of monetary policy shocks we additionally obtain the 3-month OIS rate from Datastream.

In our empirical analysis of Eurozone asset returns, we use stock price data at the minute frequency for the EuroStoxx 50 index as well as daily data for the EuroStoxx 50, the MSCI EMU, the MSCI EMU Value, and the MSCI EMU Growth index. The MSCI EMU index is a broad index of Eurozone stock markets (taking into account the evolving membership of countries over time) whereas the EuroStoxx 50 covers the 50 largest companies in the Eurozone. The MSCI EMU Value and growth indices represent corresponding subsamples of MSCI EMU firms. Additionally, we obtain credit spread data of BBB vs AAA rated firms, for all corporates, financials, and non-financials. For an additional robustness analysis, we use data on the VSTOXX volatility index, computed from options on the EuroStoxx 50.

4. What information does central bank tone pick up?

At the beginning of the press conference, the ECB president reads out an introductory statement to explain the rationale behind the policy rate decision made by the Governing Council and to express the ECB's views on the economy. Naturally, one expects the statement's tone to reflect the fundamental information communicated in the statement, and we show in this section that tone changes are indeed related to the ECB's policy actions and revisions of its macroeconomic projections. More specifically, we provide evidence that *ECB tone captures how the central bank frames its views* about current and future economic conditions. In the next section, we then show that this framing of communication contains information for asset prices over and above hard facts related to policy actions and fundamentals.

4.1. Descriptive statistics for ECB tone

Our sample covers a total of 185 ECB press conferences from January 7, 1999 to October 2, 2014. Table I presents some descriptives statistics, first showing that ECB press conferences take place regularly but not at equidistant intervals. The average PC cycle is around 22 trading days, with the range spanning 10 to 50 days for the shortest and longest intervals, respectively. The second column summarizes statistics for the ratio of the number of negative words to the number of total words (N/T), which we use to compute the tone measure defined in Equation (1). On average, the ratio of negative to total words is around 2.7% but it is associated with substantial variability within the range of 0.4% and 5.7%. The third column presents the properties of tone changes, $\Delta\tau$, measured as the difference in tone between two subsequent PCs in percentage points. Tone changes are close to zero on average and at the median but show substantial variation in the range from -2.4% to +2.0% and exhibit significant first-order autocorrelation over our sample period. Of the 184 ECB tone changes in our sample, we find that tone increases at 100 press conferences and decreases in 84 cases. Figure 2 plots the time series of ECB tone, τ, and changes in ECB tone, $\Delta\tau$. The grey vertical lines mark the dates of the ECB press conferences. Panel (a) shows that ECB tone reaches its minimum at the end of 2008/beginning of 2009 during the financial crisis and Panel (b) illustrates the volatility of tone changes over time.

4.2. Does tone capture the framing of fundamentals?

To provide evidence that tone indeed captures how the ECB frames macroeconomic fundamentals, we present summary statistics for the most frequently used negative words that drive our tone measure as well as for bigrams and trigrams (i.e. sequences of two and three adjacent words) in which they appear. Table II shows that the most frequently used negative words are "weak", "decline", and "imbalances".[6] The most common bigrams and trigrams involving negative words include, for instance, "global imbalances", "weaker (than)

[6]These counts are based on aggregating words by their word-stem; for example, the 361 occurrences we summarize for "weak" are the sum of occurrences for "weak" (166), "weaken" (6), "weakened" (18), "weakening" (47), "weaker" (78), "weakness" (44), and "weaknesses" (2).

expected", "disorderly correction", "financial market volatility", and "high level (of) unemployment". Reassuringly, there are no obvious misclassifications in these bi- and trigrams, suggesting that our simple, dictionary-based measure correctly captures negative phrases commonly used by the ECB. With this first evidence for tone picking up how the ECB interprets and judges economic developments, we provide several press conference excerpts, to illustrate the broader context in which tone is measured.

Table III presents excerpts from the press conference held on January 15, 2009, which our measure identifies to exhibit the most negative tone during our sample period. In these excerpts, we highlight word sequences involving negative words that we have identified in multiple statements (in red italic font) and mark the negative words by asterisks (*). From this statement, the sentence having the largest impact on our tone measure is from the discussion of economic risks, stating that

> "They relate mainly to the potential for a stronger impact on the real economy of the **turmoil* in financial markets*, as well as to **concerns** about the emergence and intensification of protectionist pressures and to *possible *adverse* developments* in the world economy stemming from a **disorderly* *correction* of global *imbalances**."

In general, reading through these paragraphs, we find support for the view that our tone measure picks up the ECB's framing of economic and financial conditions as well as the economic outlook. To provide a broader picture of what our tone measure captures, we present additional excerpts in the Internet Appendix in Section IA.1. Notably, we only find few cases in which our simple tone measure incorrectly identifies negative words in ECB press conferences, as we also discuss in the Internet Appendix.

4.3. Relation between CB tone, policy actions, and fundamentals

We now show that ECB tone changes are related to policy actions and revisions of macro projections, which is consistent with the notion that tone captures the ECB's views about fundamentals. Additionally, we provide evidence that tone changes matter for interest rates on PC days and over PC cycles.

Policy actions and economic projections. Table IV presents results for regressions of tone changes on changes in policy rates (ΔMRO), changes in the ECB's macroeconomic projections for real GDP growth and inflation, and proxies for current economic conditions (the latest real GDP growth and changes in inflation rates).[7] Panel A reports results for the subset of PC days on which the ECB also releases macroeconomic projections, whereas Panel B reports result for all PC days.[8]

When we regress the time-t tone change on the policy rate change announced on the same day, we find that tone changes are significantly positively related to policy rate changes, i.e. tone becomes more positive (negative) when the ECB increases (decreases) the policy rate; see specification (i) in Table IV. For the subsample of PC days on which there is also a release of macroeconomic projections (Panel A), we find that changes in the real GDP growth projection enter significantly positively whereas revisions to the projection of consumer price inflation (HICP) do not appear to matter much. Similarly, when using the most recent real GDP growth rate and inflation rates, we find that only real GDP growth is marginally significant whereas inflation seems unimportant for tone changes. Assessing the relative importance of policy rate changes and macro projections, we find that the significant effect of policy rate changes, ΔMRO, on tone changes vanishes once we include revisions of ECB-projected real GDP in the regression.

For the full sample of all PCs (Panel B), the current policy rate change is a significant driver of tone changes, whereas ECB revisions (filled forward from the latest quarterly release) are not significant; these results indicate that information in macro revisions is absorbed by policy rate and tone changes following the latest release. We also include proxies for current fundamentals in the regression and find that only GDP growth is (marginally) significantly related to tone changes, and its significance disappears when including ECB macro projections and/or policy rate changes.

[7] We use changes in the rate for marginal refinancing operations (MRO) to measure changes in the policy rate. The MRO rate is the main policy rate but using the rates of the deposit facility or the marginal lending facility does not change the results as all three rates are highly correlated.

[8] The ECB releases macroeconomic projections after the press conference on a quarterly frequencies. Hence, about one third of all PC days in our sample also have an associated release of macro projections whereas there are no projection releases at the other two thirds of PC days.

These results support the view that central banks use tone to frame their judgment about economic fundamentals but at the same time suggest that tone cannot be completely explained by the fundamentals. Hence tone appears to be a tool that complements central bank actions and macroeconomic projections and provides generic information on its own. Next, we provide evidence that ECB tone indeed matters for interest rates.

Government bond yields. A standard approach to gauge the news revealed by central bank announcements and actions is to measure monetary policy shocks from changes in interest rates around monetary policy events. The idea is that interest rates embody all relevant information about the future economy (as well as monetary policy to accompany the economic development) and can be directly measured from market prices; by contrast, judging the effect of monetary policy from future realizations of fundamentals is much more intricate. We thus focus on the term structure of government bond yields (with maturities from 1 to 20 years) to further understand the information contained in tone.[9]

Figure 3 presents results for the term structure of yield changes on ECB press conference days and for yield changes over cycles to the next press conference. Panel (a) shows that on average across all PC days (dashed blue line), yields of all maturities increase and more so for longer as compared to shorter maturities. When we separate PC days with positive (green) and negative (red) tone changes, we see a similar slope effect for both, but the level of yield changes is significantly different across all maturities: when ECB tone becomes more positive, all yields increase and more so for longer maturities. When ECB tone becomes more negative, yields of shorter maturities decrease whereas yields of longer maturities increase on average. Panel (b) shows estimates and confidence bands from regressions of yield changes on tone changes, suggesting a significant link at the short end of the yield curve. Over the PC cycle to the next PC, we find that tone changes are related to the level and curvature of the yield curve. Panel (c) shows that PCs with a more negative tone are followed by a drop in the yield level and a pronounced inverted hump around shorter to medium-term maturities. The opposite pattern obtains for positive tone changes. Panel (d) shows that the

[9]We use German government bond yields provided by Bundesbank. As discussed in detail in Appendix A.1.3, these yields are highly correlated with the ECB AAA yields but available for a longer sample period.

term structure of regression coefficients exhibits a hump-shape as well and that coefficients are significantly different from zero for yield maturities up to seven years. Overall, there is a significant, positive relation between tone and government yields at short maturities, consistent with the view that the central bank can manage the short-end of the yield curve. Understanding the relation between tone and interest rates will also be important for the interpretation of the results for other asset returns below.

In the Internet Appendix, we report additional results which support our interpretation that central bank tone matters for government yields because tone conveys information about the future economy. We show that tone changes contain predictive information for future changes in monetary policy rates (Section IA.2) and, to some extent, for future macro fundamentals (Section IA.3).

In summary, the above results suggest that our measure of central bank tone captures how the ECB frames its views about economic fundamentals. Tone changes are related to the ECB's macroeconomic projections and policy actions and contain information for interest rate changes such that a more positive tone is associated with higher expected real GDP growth and interest rates going forward. Nonetheless, the results also show that a large share of the variation in tone is left unexplained, suggesting that tone provides generic information on its own. In the empirical analysis that follows, we assess whether tone contains information for asset prices and we provide evidence for significant role of tone even after controlling for its drivers and interest rate-based measures of monetary policy shocks.

5. Central Bank Tone and Asset Prices

In this section, we document a strong link between asset prices and the *tone* of ECB press conference statements. A more positive (negative) tone compared to the previous press conference is associated with positive (negative) equity returns. These tone effects emerge (intra-day) during the press conference, extend over the cycle to the next press conference, and apply to aggregate Eurozone as well as to individual member country stock markets. Moreover, we find that tone changes are negatively correlated with changes in corporate

credit spreads and that tone effects on asset prices remain significant when controlling for policy actions, macro projections, and standard measures of monetary policy shocks.

5.1. The high-frequency relation between tone changes and stock returns

To start our analysis of the link between changes in ECB tone and stock prices, we use high-frequency returns, following standard practice to gauge the effect of monetary policy on asset prices (see, e.g., Cochrane and Piazzesi, 2002; Guerkaynak et al., 2005; Hanson and Stein, 2015, among others). The key idea is that any price reaction in a short time window is likely to be caused by information about (unexpected) changes in monetary policy and that this information swamps other information about returns.

We split the trading hours of the EuroStoxx 50 (9:00 to 17:30, CET) into three time windows of interest: (i) prior to the rate announcement, from 9:00 to 13:44, (ii) between the rate announcement and the press conference, from 13:45 to 14:29, and (iii) from the beginning of the press conference to the end of the trading day, from 14:30 to 17:30. We use one-minute data to compute the returns over these time intervals as well as over full ECB press conference days and run the regression

$$r_{t,j} = a_j + b_j \Delta\tau_{t-1,t} + \gamma_j x_t + u_{t,j}, \tag{2}$$

where $r_{t,j}$ is the return on PC day t in time interval j, $\Delta\tau_{t-1,t}$ is the tone change from the previous PC to the current PC, and x_t is a vector of control variables.

Panel A of Table V provides baseline regressions results (without controls x_t) that provide statistical support for the patterns visible in Figure 1: the regression intercept is significantly positive with an estimate of 0.18 for returns prior to the rate announcements at 13:45, significantly negative during the time windows after the announcement, and not different from zero over the full day. In other words, averaging across all PCs, there is a significant pre-announcement drift of 18 basis points that is reversed later. The slope coefficient on tone changes is significantly positive during the time window that captures the press conference (14:30 to 17:30) but not significant during earlier time windows. The slope estimate over

the full day is virtually identical to that of the PC window. These results suggest that ECB tone effects on stock prices on PC days are not anticipated prior to the press conference and that tone changes do not simply reflect the outcome of the rate anouncement at 13:45.

To provide evidence that ECB tone contains generic information for stock prices beyond monetary policy actions and economic projections, we now run regression (2) with a large set of controls (x_t). We include lagged tone changes (to control for autocorrelation in tone changes), changes in the announced policy rate (MRO), a dummy for unconventional monetary policy (UMP) announcements, changes in the ECB's real GDP growth and inflation projections as well as conventional measures of monetary policy shocks. We denote these monetary policy shocks as "level shocks" (i.e., changes in 3-month OIS rates on PC days) as well as "path shocks" (i.e., changes in the difference between 2-year government bond yields and 3-month OIS rates on PC days). Panel B of Table V presents results for the PC window returns from 14:30 to 17:30, which show that the slope coefficient on tone changes remains significant in all specifications with estimates in the range of 0.26 to 0.34.

At the same time, several of the control variables have significant coefficients as well. For instance, in specification (vi) that includes all control variables, we find a positive effect of policy rate changes and a very strong positive effect of UMP announcements. These results suggests that ECB tone conveys stock-relevant information beyond the ECB's actions. The ECB's macroeconomic projections are not significant in these regressions. Given the link between tone and projection changes discussed above in Section 4, we repeat the regression of stock returns on tone changes separately for PCs with and without projection releases. Our findings, reported in Section IA.4 of the Internet Appendix, suggest that results are very similar on PC days with and without macro projection releases (Table IA.5).

In sum, we document a strong link between tone changes and stock returns, that is robust to controlling for policy actions (conventional and UMP), changes in the ECB's economic projections, and conventional measures of monetary policy shocks. The tone of central bank communication thus contains information for returns over and above the information contained in these control variables.

5.2. Tone changes and equity returns at daily and lower frequencies

Our intraday-results above suggest that the effect of ECB tone on ESX50 prices over the full trading day is very similar to that arising during the press conference. Building on this finding, we now use daily data to explore the role of ECB tone for Eurozone equity markets on PC days more broadly. Moreover, Figure 1 also suggests that tone effects last beyond the PC day and we therefore also look at longer time windows until the day before the next PC ("PC cycles"). Before presenting detailed econometric results, we present our main findings that ECB tone matters on PC days and beyond for the EuroStoxx 50 as well as the MSCI EMU, MSCI EMU value, and MSCI EMU growth index in Figures 4 and 5.

Figure 4 shows that stock returns on all four indices are close to zero on average across all PC days, negative on PC days when ECB tone becomes more negative compared to the previous PC, and positive on PC days when tone becomes more positive. Figure 5 shows that the effect of tone changes on returns lasts beyond PC days and extends to longer horizons as well. Panel (a) shows that the initial tone-related return differential (on Day 0) persists beyond the PC day and widens over the next 15 trading days to more than 100 basis points. Panel (b) underpins the statistical significance of the relation between ECB tone changes and subsequent equity returns by presenting slope coefficients from regressions of cumulative k-day returns on preceding tone changes, along with 90% confidence bands. These plots confirm that the link between tone and stock returns persists and even strengthens over time.[10] Overall, we find that our results are not specific to using the ESX50 but extend to broader indices of European stocks as well as to value and growth stocks.

Table VI presents detailed regression results on the relation between tone changes and stock returns. We start by comparing equity market returns on PC days versus non-PC days, and Panel A shows that average ESX50 returns on non-PC and PC days are 1 bp (basis point) and -3 bp, respectively. Neither of these returns is statistically different from zero, and standard F-tests show that equity returns on PC compared to non-PC days are also not significantly different from each other. The same finding obtains for the MSCI index, value,

[10] As a robustness check, we also show that our conclusions remain unchanged when using equity excess returns instead of raw returns; see Section IA.5 in the Internet Appendix.

and growth stocks. Hence, stock returns are not unusually high or low on PC days.

By contrast, stock returns on PC days are very different depending on whether the tone of the ECB becomes more positive or negative. Panel B of Table VI shows that these large return differentials are significantly different from zero. On PC days with more positive tone, equity returns range from +19 bp (value stocks) to 26 bp (ESX50 and growth stocks) whereas a more negative tone is associated with returns of −38 bp (ESX50) to −35 bp (growth).

To evaluate the impact of positive versus negative tone changes on equity returns in more depth, we run regressions of PC day stock returns on tone changes and present the results in Panel C. The estimates of the intercept (a) are not different from zero, confirming that there is no pure PC day-effect. The slope coefficients of tone changes are significantly positive with estimates in the range of 0.30 to 0.40. The economic magnitude is such that a one standard deviation increase in tone (≈ 0.8) translates into an increase of stock prices of approximately 30 basis points. The R^2s range from 2.22% to 4.21% and suggest sizeable explanatory power of ECB tone changes for the daily equity returns around press conferences.

To assess the link between tone changes and subsequent equity returns over full PC cycles, we regress PC cycle returns on tone changes. More precisely, for press conferences taking place at times t and $t+1$, we compute the return from the closing price on the day before PC_t to the closing price on the day before PC_{t+1}. These returns capture the market impact of PC_t but exclude the impact of PC_{t+1}. The regression results in Panel D of Table VI show that slope coefficients for tone changes are significantly positive and R^2s of around 3% to 3.5%. The slope coefficient estimates imply that a one-sigma tone change translates into an average PC-cycle return of about ± 100 basis points across the different indices. Overall our results suggest that CB tone conveys information beyond PC days and that this information is gradually incorporated into prices over the cycle to the next press conference.In Section IA.6 of the Internet Appendix, we show that the PC cycle results remain significant when removing PC days, i.e., the significant PC cycle returns are not only driven by the initial PC day returns.

Similar to the intraday analysis above, we verify that the effect of tone on PC-day and PC-cycle returns is robust to controlling for policy actions, macroeconomic projections, con-

ventional measures of MP shocks, and lagged returns. Table VII presents supporting evidence for the ESX50; results for other equity indices are in Section IA.7 of the Internet Appendix.

5.3. Individual country equity returns

Turning to individual EMU member country stock markets, we examine all countries for which MSCI provides coverage of comparable country indexes over the full sample period. Our sample contains 10 of the 11 original EMU member countries (all except Luxembourg, for which we do not have comparable stock price data) and we find that results are very similar across all countries. Figure 6 shows that average PC day returns are relatively small (i.e., there is no PC-day effect) but that PC-day returns are different on days with more positive compared to more negative ECB tone. Panels A and B of Table VIII show that the these findings are statistically significant, except for Austria where the PC day differential of about 35 bp is associated with a p-value of 0.12. Panel C reports results for regressions of PC-day returns on tone changes and we find that the estimated slope coefficients are all positive in the range from 0.24 (Ireland) to 0.70 (Finland). R^2s range from 1.08% (Ireland) to 4.19% (Finland). Overall, the estimated slope coefficients and R^2s are close to the values we found for the aggregate European stock market indexes above. Panel D reports results for regressions of PC-cycle returns on tone changes and shows that the link between tone changes and country-level stock returns is not limited to the PC day itself but extends beyond the PC day until the next press next conference. Similar to our findings for the aggregate Eurozone market, these results remain mostly unchanged when controlling for policy actions, economic projections, and policy shocks. These detailed results are available on request.

5.4. A risk-taking channel? Evidence from corporate credit spreads

Our empirical results so far show that tone changes are correlated with monetary policy actions and changes in the ECB's economic projections. Controlling for these factors, however, does not render the link between tone and stock returns insignificant. In other words, changes in monetary policy and in growth expectations are not enough to explain the link between central bank tone and stock returns documented above.

A potential channel through which tone might affect returns is by affecting risk premia embedded in market prices. Previous research provides evidence that monetary policy indeed has an effect on market participants' attitude towards risk and, as a consequence, the taking and pricing of risk; see the literature review in Section 2 above. Among these papers, Bernanke and Kuttner (2005) find that risk premia account for most of the stock price response to unanticipated policy actions. We now study whether this is also true for the response of stock prices to changes in the tone of central bank communication.

If central bank tone affects asset prices through a 'risk-taking channel', we should find that tone changes specifically matter for assets that are particularly sensitive to changes in risk aversion. Based on this rationale, we investigate the link between central bank tone and corporate credit spreads, measured as the yield differential of BBB-rated and AAA-rated bonds; this yield spread directly measures the compensation for risk that investors demand for holding bonds with low compared to high credit quality. Below, we present results based on broad credit indices for Eurozone firms and subsets of financial and non-financial firms.

Figure 7 shows that changes in corporate credit spreads are inversely related to tone changes, i.e., the BBB-AAA-spread decreases (increases) when central bank tone becomes more positive (negative). Across all firms, the credit spread differential related to positive as opposed to negative tone changes that accumulates over the 15 days after the latest press conference is approximately 10 basis points (Panel a). The regression results (Panel b) suggest that the link between credit spread and tone changes is statistically significant and that the results are most pronounced for financial firms.

Table IX reports detailed regression results for credit spread changes on PC days and over PC cycles. On PC days, we find that ECB tone matters for credit spread changes beyond policy actions. Controlling for revisions of economic projections and interest rate-based measures of monetary policy shocks, we find that the PC day effect of tone on credit spread remains highly significant for financial firms but matters less for nonfinancial firms. Over the PC cycle, credit spread changes are significantly related to tone changes for all sets of firms in all regression specifications. In terms of economic significance, tone matters most for the credit spreads of financial firms, with the regression coefficients on tone changes

being approximately twice the estimates of non-financial firms.

In sum, our results on how central bank tone matters for credit spreads are consistent with the idea that tone changes affect risk premia embedded in asset prices.[11,12] Such a 'risk-taking channel' provides a potential explanation for the strong link between equity returns and tone documented above, even when controlling for policy actions and economic projections. When tone becomes more positive, the risk appetite of market participants increases and risk premia decrease, thereby lifting stock prices and decreasing credit spreads.

6. Fed tone and U.S. asset prices

Using a setup that is very different compared to the ECB press conferences explored above, we now provide evidence that central bank tone also matters for asset prices in the U.S. Specifically, we use data on the Fed Chair's Testimonies to the U.S. Congress, typically taking place twice a year with the Chair testifying to the U.S. House of Representatives and to the U.S. Senate on two subsequent days, in both cases delivering identical remarks. Given that the frequency of these testimonies is low and that the testimony dates do not concur with policy meetings of the Fed, the news component embedded in the Chair's testimony should be comparably small.[13]

Therefore, measuring the tone of the Fed Chair's testimony provides an interesting setup for at least three reasons. First, it allows us to check the robustness of our main results for a different country and different central bank. Second, the testimony is an event that is not tied to actual monetary policy decisions (made at the FOMC meetings) so that there should be no potential for confounding effects from actions and tone. Third, and despite the differences mentioned before, other important features of the testimony are similar to

[11] In additional tests, we use the VSTOXX volatility index to test for a link between tone changes and equity option-implied risk aversion (based on variance risk premia as in Bekaert et al., 2013). As we discuss in more detail in Section IA.8 of the Internet Appendix, we find that tone changes are inversely related to options-implied risk aversion, thereby corroborating the results based on credit spreads.

[12] On a more general level these results also square well with previous evidence that a large share of aggregate stock market fluctuations is driven by news about expected returns (risk premia) whereas news about future cash flows (fundamentals) seem much less important (e.g., Cochrane, 1992, 2008, among others).

[13] As discussed in Section 3.1, higher frequency data that allows to measure Fed tone in a way comparable to our ECB analysis has become available only very recently and the number of observations is very small.

the ECB press conferences studied above. These common features include the fact that the testimony is a scheduled event that market participants are aware of well before it takes place, that the testimony is available to market participants in real time, and that the Fed Chair's speech is drafted in advance to convey the Fed's intentions to the public.

Transcripts for these testimonies are available from July 1996, providing us with a series of 37 transcripts up to July 2014. The average time interval between a testimony and the next FOMC meeting is approximately one month, and we therefore evaluate asset price changes up to five trading weeks after a testimony. We measure Fed tone in the same way as for ECB press conferences and observe 20 positive and 16 negative tone changes, respectively.

Figure 8 documents distinct patterns for U.S. asset prices depending on whether Fed tone becomes more positive or negative. First, Panel (a) shows that tone matters for changes in the U.S. government bond yield curve, both, around the two days of the testimonies (left plot) and beyond (right plot). A more negative Fed tone is associated with a decrease in yields (across maturities up to 20 years) over the testimony days as well as over the next 25 trading days. By contrast, a more positive Fed tone is associated with an immediate increase in yields and subsequently, over the next five weeks, with a much smaller decrease in short-term yields and a small increase in long-term yields. Panel (b) plots the cumulative returns of the S&P 500 over the five weeks following the Fed Chair's testimonies. Over that period, the average stock market return is around 200 basis points when Fed tone has become more positive compared to the previous testimony, whereas it is around -150 basis points when tone has become more negative. Finally, we also find that corporate credit spreads (BBA-AAA yield spreads) decline (increase) after testimonies with a more positive (negative) tone, totalling a difference of 10 basis points over the five weeks after the testimonies. All these results are qualitatively identical to those for ECB press conferences reported above.

An obvious caveat is that we only have 36 observations available for this exercise. Nonetheless, the responses of U.S. equity as well as government and corporate bond markets to changes in Fed tone are significant from an economic perspective; in Internet Appendix IA.9, we provide evidence that these results are also statistically significant. Qualitatively, our findings are identical to those for ECB press conferences: a more positive central bank

tone is associated with higher equity returns, higher bond yields, and lower credit spreads whereas the opposite is true when central bank tone becomes more negative. Given that testimony days do not coincide with policy actions these results provide further support for a risk-taking channel of central bank communication tone.

7. Conclusion

We use a systematic approach to measure the *tone* of central bank statements and evaluate its impact on asset prices. To quantify tone, we apply standard techniques of textual analysis from the recent economics and finance literature. Our empirical analysis mostly focuses on the European Central Bank (ECB), which has been the first major central bank to establish live press conferences as a communication channel after meetings of its Governing Council. These press conferences begin with a statement by the ECB president that presents real-time news about monetary policy decisions, contains fresh information about ECB views, and is made available to all market participants at the same time. Our sample covers a total of 185 press conferences between January 1999 and October 2014.

We first show that ECB tone captures how the ECB frames its policy decisions and its assessment of economic fundamentals. Government bond yields respond to tone changes, with more positive (negative) tone compared to the previous press conference being associated with higher (lower) levels of interest rates. We find these tone effects on interest rates bpth on press conference days as well as over press conference cycles (of approximately one month) with effects being more pronounced at the short end of the yield curve.

Next, we document a strong link between ECB tone and equity prices such that a more positive tone is associated with increasing stock prices and vice versa. Using high-frequency data, we show that all of this effect occurs after the start of the press conference and that none of the effect comes from the announcement of the policy rate decision (which is released 45 minutes before the start press conference). This link between tone changes and stock returns is statistically significant, economically large, and persists over the cycle to the next press conference. Despite tone being correlated with monetary policy actions, macroe-

conomic projections, and interest rates, the effect of ECB tone on equity returns is robust to controlling for these fundamentals. In other words, central bank tone conveys generic information relevant for financial markets, thereby supporting the view that communication is an important instrument of the monetary policy toolkit.

A potential channel through which central bank communication may affect stock returns, even after controlling for fundamentals, is that tone affects the risk aversion of market participants. In line with the conjecture of such a risk-taking channel, we find that tone changes are significantly related to asset prices that are particularly sensitive to changes in risk aversion. Our results show that changes in corporate credit spreads (difference in yields of BBB- and AAA-rated bonds) are inversely related to tone changes. When tone becomes more positive (negative), credit spreads decrease (increase) on press conference days and over press conference cycles, with tone effects being most pronounced for financial firms.

Finally, we corroborate our conclusions by presenting qualitatively identical results for the link between central bank tone and asset prices in U.S. markets. Measuring the tone of the Fed chair's semiannual Congressional Testimonies, we find that a positive change in Fed testimony tone is associated with increases in Treasury bond yields, increases in equity prices, and lower credit spreads. Since these testimony days do not coincide with policy actions or releases about fundamentals, these results further support the notion that central bank tone conveys generic information for risk premia.

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Appendix

This Appendix describes the data used in our empirical analysis and also lists data sources.

A.1. Data

A.1.1. Macro data

We use data on a number of macro fundamentals for the Eurozone in our empirical analysis and all these data are available from Datastream (DS). The DS mnemonics are EMRETTOTG (Retail Sales), EMUNPTOTO (Unemployment), EKIPTOT.G (Industrial Production), EMCPCOR5F (Harmonised Index of Consumer Prices), EMCNFCONQ (Consumer Confidence), EKCNFBUSQ (Business Confidence), and EMGDP...D (GDP).

Data for the ECB's economic projections are available from the ECB's website: https://www.ecb.europa.eu/pub/projections/html/index.en.html.

A.1.2. Equity data

Our high-frequency data for the Eurostoxx 50 span 1-minute index prices for the full sample period covered by ECB press conferences, that is from January 1999 to October 2014. The Eurostoxx 50 (denoted "ESX50") contains the 50 largest firms from the Eurozone and is a European benchmark index with a highly liquid futures contract.[14]

We also obtain daily data on different European equity indexes which run from January 1999 to October 2014. To explore the overall effect on EMU equity markets, we use the EuroStoxx 50 index (as a benchmark for the results with daily returns) and data on the MSCI EMU index (denoted "MSCI") that includes all countries that have adopted the Euro, accounting for the evolving membership of countries. The MSCI index has a broader coverage than the ESX50 and also includes smaller firms. Additionally, we use the MSCI sub-indices

[14]Furthermore, there is a liquid market for options on the ESX50 and the VSTOXX, a volatility index constructed from ESX50 options. The VSTOXX is a common measure of Eurozone option-implied stock volatility (see, e.g., Miranda-Agrippino and Rey, 2014).

that specifically cover value- and growth stocks in the Eurozone, MSCI EMU Value (denoted "Value") and MSCI EMU Growth (denoted "Growth"). For our analysis on the individual country level, we include all EMU-members that have been covered by MSCI country indexes throughout our sample period: with the exception of Luxembourg, this includes the other ten of the eleven original member states: Austria, Belgium, Finland, France, Germany, Ireland, Italy, Netherlands, Portugal, and Spain. In our benchmark empirical analyses, we will look at simple stock returns (based on MSCI total return country indices) and not excess returns since we do not want to confound the effect of tone on returns and yields.

Daily data on stock returns for the EuroStoxx 50, the MSCI EMU All cap index, as well as the MSCI Value EMU and MSCI Growth EMU index. MSCI data for all three indices are obtained from Datastream and the mnemonics are MS1EMUL (MSCI All cap EMU), MSVEMUL (MSCI Value EMU), and MSGEMUL (MSCI Growth EMU). Historical price data for the EuroStoxx 50 and corresponding implied volatilities (VSTOXX) at different maturities can be downloaded from here (EuroStoxx 50 data) and here (VSTOXX implied volatilities), respectively. For the U.S., we employ MSCI data: MSUSAM$ (MSCI U.S.), MSGUSA$ (MSCI Growth U.S.), MSVUSA$ (MSCI Value U.S.), and S&PCOMP (S&P500).

A.1.3. Term structure of government bond yields

To explore the effect of ECB tone on government bond markets we use the term structure of German yields (available from the Bundesbank) which is available over our full sample period. European yield data are available from the ECB but cover a substantially shorter sample from 2004 to 2014. However, the German yield curve is highly correlated with the ECB AAA yield curve over the period September 2004 to October 2014 where both data sets are available, providing virtually identically results in our empirical analysis for the period of joint coverage. The high correlation reflections the fact that the Germany is the largest EMU member state, subject to comparably very low sovereign risk, and is typically perceived as the engine of the EMU economy. As a consequence, German yields are viewed as a benchmark against which other EMU government yield curves are referenced. This line of reasoning follows that of earlier research that attributes a lead role to Germany, some

already even prior to the introduction of the Euro during the existence of the European Monetary System (EMS) and the Exchange Rate Mechanism (ERM); see e.g. di Giovanni et al. (2009) and the references therein. We therefore use daily data of German government bond yields with maturities ranging from one to 20 years provided by Deutsche Bundesbank from January 1999 to October 2014.

Maturities for the term structure of German government bonds range from 1 to 20 years and are provided by Deutsche Bundesbank. These series can be downloaded from here. The tickers of the series we use are:

BBK01.WT3211, BBK01.WT3213, BBK01.WT3215, BBK01.WT3217, BBK01.WT3219, BBK01.WT3221, BBK01.WT3223, BBK01.WT3225, BBK01.WT3227, BBK01.WT3229, BBK01.WT3431, BBK01.WT3433, BBK01.WT3435, BBK01.WT3437, BBK01.WT3439, BBK01.WT3441, BBK01.WT3443, BBK01.WT3445, BBK01.WT3447, BBK01.WT3449.

A.1.4. Other measures based on fixed income rates.

To compute conventional measures of monetary policy, we compute changes in three months overnight index swap (OIS) rates on PC days. Following the earlier literature, e.g., Ferrari et al. (2017), we denotes these changes as "level" shocks as they represent news about the short-term level or riskfree interest rates. In addition, we also compute changes in two year government bond yields minus the change in three month OIS rates. We denote these as "path shocks" as they capture news about the expected future path of monetary policy. The OIS rate is from Datastream (mnemonic: OIEUR3M).

The corporate credit spreads for the Eurozone are based on IBOXX credit indices: IBC3AAL (AAA) and IBC3BAL (BBB). Indices for financials and non-financials are based on mnemonics IBEFN3A and IBEFN3B (financials) as well as IBENF3A and IBENF3A (non-financials). US credit spreads are based on Moody's Long-Term Corporate Bond Yield Averages (mnemonics: FRCBAAA and FRCBBAA).

Table I: The Tone of ECB Press Conference Statements

This table reports descriptive statistics for the 185 ECB press conferences between January 7, 1999 and October 2, 2014. The column 'Cycle' presents statistics on the length of the press conference (PC) cycle, i.e., the number of business days between PCs. N/T reports the ratio of the number of negative words divided by the total number of words in the president's opening statement at the PC (in percentage points). $\Delta\tau$ measures the change in tone τ compared to the tone at the previous PC, where $\tau = 1 - N/T$ as defined in Equation (1); reported numbers are the changes in percentage points. For the 184 realizations of $\Delta\tau$, we also report the coefficient of an AR(1) regression and the associated t-statistic. 'Obs $\Delta\tau > 0$' denotes the number of tone changes when tone becomes more positive and 'Obs $\Delta\tau < 0$' counts the observations when tone becomes more negative.

	Cycle [in days]	N/T [in %]	$\Delta\tau$
Mean	22.255	2.703	-0.002
Std dev	5.700	0.988	0.795
Min	10.000	0.361	-2.409
Q5	15.000	1.323	-1.419
Q25	20.000	1.990	-0.435
Median	20.000	2.616	0.047
Q75	25.000	3.230	0.445
Q95	30.000	4.799	1.271
Max	50.000	5.651	2.015
AR(1)			-0.424
t-statistic			[-6.36]
Obs $\Delta\tau > 0$			100.000
Obs $\Delta\tau < 0$			84.000

Table II: Which Words Drive Tone?

This table presents descriptives statistics for the "negative" words (as classified by the dictionary of Loughran and McDonald, 2011) that are most prevalent in ECB press conference statements. The left panel, reports the 20 most frequently used negative words, ordered by the number of their occurrence across all ECB press conferences statements. The center and right panels show the context in which negative words are most frequently used by the ECB by presenting counts for bigrams and trigrams (i.e., sequences of two and three adjacent words), respectively. The analysis is based on 185 ECB press conference statements between January 7, 1999 and October 2, 2014.

Words	#	Bigrams	#	Trigrams	#
weak	361	global imbalances	86	correction global imbalances	38
decline	321	weaker expected	46	disorderly correction global	36
imbalances	216	correction global	38	global imbalances regard	36
concerns	205	fiscal imbalances	38	imbalances regard price	36
volatility	168	imbalances regard	37	possibility disorderly correction	26
negative	163	disorderly correction	36	pressures possibility disorderly	25
deficit	148	possibility disorderly	35	financial market volatility	23
unemployment	132	excessive deficit	30	high level unemployment	22
crucial	125	level unemployment	28	prolonged period low	22
dampened	112	prolonged period	26	financial market turmoil	21
challenges	107	disorderly developments	25	disorderly developments owing	20
downward	105	remain weak	25	owing global imbalances	20
slow	88	excessive deficits	24	balance sheet restructuring	18
adverse	81	market volatility	24	concerns remain relating	18
correction	80	financial turmoil	22	crucial social partners	18
disorderly	67	high unemployment	21	weaker expected domestic	17
restructuring	67	market turmoil	21	insufficient implementation structural	16
excessive	61	revised downwards	21	unemployment euro area	16
turmoil	61	short-term volatility	21	excessive deficit procedure	15
protracted	45	address challenge	20	negative feedback loop	15

Table III: Excerpts from the ECB President's Statement on January 15, 2009

This table presents excerpts of the the ECB president's introductory statement, given at the press conference on January 15, 2009. Our measure of central bank tone identifies this statement to exhibit the most negative tone of all statements in our sample. From this statement we present the three paragraphs that have the largest impact on our tone measure, i.e. the three paragraphs with the highest ratio of negative words to total words. Words highlighted in red italic font and marked by asterisks (*) are negative words identified by the dictionary we employ. Other words highlighted in red italic font are common word sequences involving negative words that we have identified in multiple statements.

- Looking further ahead, on the basis of our current analysis and assessment, we continue to see global *economic *weakness** and very **sluggish* domestic demand *persisting** in the coming quarters as the impact of the financial tensions on activity continues. At the same time, we expect the fall in commodity prices to support real disposable income in the period ahead. Furthermore, the euro area should over time reap the full benefit from the effects of policy measures announced over recent weeks.

- In the view of the Governing Council, this outlook for the economy remains surrounded by an exceptionally high degree of uncertainty. Overall, risks to economic growth remain clearly on the downside. They relate mainly to the potential for a stronger impact on the real economy of the **turmoil* in financial markets*, as well as to **concerns** about the emergence and intensification of protectionist pressures and to *possible *adverse* developments* in the world economy stemming from a **disorderly* *correction* of global *imbalances**.

- Risks to price stability over the medium term are broadly balanced. **Unexpected* further *declines** in commodity prices or a stronger than expected slowdown in the economy could put **downward* pressure* on inflation, while upside risks to price stability could materialise particularly if the recent fall in commodity prices were to reverse or if domestic price pressures turn out to be stronger than assumed. It is therefore **crucial** that price and wage-setters fully live up to their responsibilities.

Table IV: ECB Tone, Policy Rates, and Fundamentals

This table presents results for regressions of changes in ECB tone on changes in policy rates announced at the press conference at time t (ΔMRO), changes in macroeconomic projections released by the ECB (Expected $\Delta realGDP$ and Expected $\Delta HICP$), and corresponding current fundamentals computed as the latest growth in real GDP, inflation, real industrial production, retail sales, and unemployment. Our sample includes a total of 184 tone changes between the 185 ECB press conferences from January 7, 1999 to October 2, 2014. In *Panel A*, we report results for the 56 press conferences at which also updates of macroeconomic projections have been released, in *Panel B* we report results for all 185 press conferences.

Panel A. Press Conferences with Macroeconomic Projection Releases

	(i)	(ii)	(iii)	(iv)	(v)	(vi)
const	0.00	0.00	0.00	0.00	0.00	0.00
	[0.20]	[0.08]	[0.60]	[0.23]	[0.75]	[0.20]
ΔMRO	1.35			0.49	1.25	0.31
	[2.38]			[0.86]	[1.96]	[0.51]
Expected $\Delta realGDP$		0.79		0.74		0.76
		[3.48]		[3.01]		[3.18]
Expected $\Delta HICP$		0.32		0.20		0.19
		[0.87]		[0.47]		[0.45]
Current $\Delta realGDP$			0.20		0.07	0.11
			[1.78]		[0.43]	[0.79]
Current $\Delta HICP$			-0.16		-0.15	0.01
			[-1.02]		[-0.95]	[0.09]
adj R^2 (%)	4.87	16.74	-0.20	15.79	2.83	12.94

Panel B. All Press Conferences

	(i)	(ii)	(iii)	(iv)	(v)	(vi)
const	0.00	0.00	-0.00	0.00	0.00	0.00
	[0.32]	[0.09]	[-0.13]	[0.66]	[0.11]	[0.45]
ΔMRO	0.87			1.15	1.07	1.16
	[2.39]			[2.37]	[2.45]	[2.15]
Expected $\Delta realGDP$		0.11		0.05		0.05
		[1.07]		[0.51]		[0.35]
Expected $\Delta HICP$		-0.17		-0.34		-0.33
		[-0.96]		[-1.73]		[-1.53]
Current $\Delta realGDP$			0.04		-0.04	0.02
			[0.84]		[-0.48]	[0.22]
Current $\Delta HICP$			0.04		0.05	0.03
			[0.45]		[0.62]	[0.25]
Current $\Delta RealIP$						-0.00
						[-0.02]
Current $\Delta RetSales$						-0.01
						[-0.09]
Current $\Delta Unemp$						0.01
						[0.15]
adj R^2 (%)	2.22	-0.43	-0.95	2.67	2.06	-0.46

Table V: Eurostoxx50 Returns during ECB Press Conference Days

This table presents results for regressions of EurosStoxx 50 intraday returns on changes in ECB tone and several control variables. We split the trading hours of the EuroStoxx 50 (9:00 to 17:30, CET) into three time windows: (i) prior to the rate announcement, from 9:00 to 13:44, (ii) between the rate announcement and the press conference, from 13:45 to 14:29, and (iii) from the beginning of the press conference to the end of the trading day, from 14:30 to 17:30. We compute cumulative one-minute returns over these time windows as well as over the full trading day. In *Panel A*, we regress one-minute cumulative returns over the time-windows indicated in the column headers on the change in ECB tone at the press conference at time t compared to the previous press conference ($\Delta\tau_{t-1,t}$). In *Panel B*, we use the cumulative returns during the time window from 14:30 to 17:30 in regressions on $\Delta\tau_{t-1,t}$ and several additional variables. $\Delta\tau_{t-2,t-1}$ denotes the lagged tone change. To control for policy actions, we include ΔMRO which denotes the change in the policy rate announced at the PC at time t and UMP is a dummy that takes the value one for PCs at which unconventional monetary policy actions are announced and zero otherwise. Expected $\Delta realGDP$ and Expected $\Delta HICP$ denote the latest revisions to the ECB's projections on real GDP and inflation. To measure monetary policy shocks, we use the change in the 3-month OIS rate (Level shock) and the change in the spread between the two-year (German) government yield and the 3-month OIS rate (Path shock). Finally we include the lagged return over the previous PC cycle as a control variable and report the adjusted R^2. All t-statistics for are based on White (1980) standard errors. Our sample includes a total of 184 returns between the 185 ECB press conferences from January 7, 1999 to October 2, 2014.

Panel A. Intraday returns on PC days

	9:00-17:30	9:00-13:44	13:45-14:29	14:30-17:30
const	-0.06	0.18	-0.07	-0.18
	[-0.55]	[2.86]	[-2.07]	[-2.25]
$\Delta\tau_{t-1,t}$	0.28	-0.02	0.02	0.28
	[2.03]	[-0.23]	[0.36]	[2.57]
adj R^2 (%)	1.69	-0.51	-0.45	3.53

Panel B. Intraday returns from 14:30 to 17:30 on PC days

	(i)	(ii)	(iii)	(iv)	(v)	(vi)
const	-0.18	-0.17	-0.16	-0.20	-0.27	-0.26
	[-2.25]	[-2.16]	[-2.09]	[-2.57]	[-3.22]	[-3.02]
$\Delta\tau_{t-1,t}$	0.28	0.29	0.26	0.28	0.29	0.34
	[2.57]	[2.42]	[2.33]	[2.48]	[2.40]	[2.77]
$\Delta\tau_{t-2,t-1}$		0.05	0.06	0.09	0.12	0.16
		[0.40]	[0.51]	[0.74]	[0.94]	[1.33]
ΔMRO			0.89	0.94	1.46	1.55
			[1.17]	[1.24]	[1.75]	[1.94]
UMP dummy				0.01	0.01	0.01
				[6.93]	[6.93]	[7.97]
Expected $\Delta realGDP$					-0.19	-0.26
					[-1.10]	[-1.40]
Expected $\Delta HICP$					-0.44	-0.34
					[-1.66]	[-1.34]
Level shock						-0.90
						[-0.32]
Path shock						-4.57
						[-1.91]
adj R^2 (%)	3.53	2.68	3.63	7.10	9.05	11.33

Table VI: Equity Returns on ECB Press Conference Days and over Press Conference Cycles

This table reports results for the returns of Eurozone equity indexes on days on which the ECB holds a press conference (PC) as well as over cycles between PCs. We use data for the EuroStoxx 50 (ESX50), the MSCI EMU (MSCI), the MSCI Value EMU (Value), and the MSCI Growth EMU (Growth). We compute PC-day returns from the closing prices on the day preceding the PC and the day on which the PC is held. Accordingly, we compute PC-cycle returns from the day preceding the current PC to the day preceding the next PC. For each index, our sample includes a total of 184 returns between the 185 ECB press conferences from January 7, 1999 to October 2, 2014. *Panel A* reports average returns across PC days and non-PC days in basis points, respectively. Values in brackets are t-statistics and p[F] reports the p-value of an F-test for equal means. *Panel B* reports average returns (in basis points) separately for the 100 (84) observations at which the tone of the ECB becomes more positive (negative) compared to the previous PC, along with t-statistics and p-values of F-tests for equal means. *Panels C* present results of regressing PC-day equity returns on ECB tone changes and *Panel D* reports regression results for PC-cycle returns. Values reported for a and b represent estimates of the intercept and slope coefficients. All t-statistics for PC-day returns are based on White (1980) standard errors, t-statistics for PC-cycle returns are based on Newey and West (1987) standard errors.

Panel A. PC Days versus Non-PC Days

	No PC	PC	p[F]
ESX50	1.03	-3.26	0.70
	[0.43]	[-0.27]	
MSCI	1.16	-4.02	0.62
	[0.53]	[-0.36]	
Value	1.66	-6.24	0.47
	[0.71]	[-0.54]	
Growth	0.81	-1.63	0.81
	[0.38]	[-0.14]	

Panel B. Tone Changes and PC Day Returns

	$\Delta\tau > 0$	$\Delta\tau < 0$	p[F]
ESX50	26.43	-38.59	0.01
	[1.47]	[-2.49]	
MSCI	23.00	-36.18	0.01
	[1.39]	[-2.56]	
Value	19.23	-36.57	0.02
	[1.08]	[-2.72]	
Growth	26.52	-35.13	0.01
	[1.70]	[-2.22]	

Panel C. PC Day Regressions

	a	b	R^2
ESX50	-0.03	0.38	3.26
	[-0.26]	[2.50]	
MSCI	-0.04	0.35	3.30
	[-0.36]	[2.53]	
Value	-0.06	0.30	2.22
	[-0.54]	[2.12]	
Growth	-0.02	0.40	4.21
	[-0.14]	[2.76]	

Panel D. PC Cycle Regressions

	a	b	R^2
ESX50	0.12	1.26	3.06
	[0.28]	[2.77]	
MSCI	0.18	1.32	3.52
	[0.40]	[2.95]	
Value	0.27	1.40	3.26
	[0.56]	[2.73]	
Growth	0.12	1.25	3.45
	[0.27]	[3.09]	

Table VII: EuroStoxx 50 Returns on Press Conference Days and over Press Conference Cycles

This table presents results for regressions of PC-day and PC-cycle returns of the EurosStoxx 50 index on changes in ECB tone and several control variables. We compute PC-day returns (*Panel A*) from the closing prices on the day preceding the PC and the day on which the PC is held. Accordingly, we compute PC-cycle returns (*Panel B*) from the day preceding the current PC to the day preceding the next PC. We denote the most recent change in ECB tone by $\Delta\tau_{t-1,t}$ and the lagged tone change by $\Delta\tau_{t-2,t-1}$. To control for policy actions, ΔMRO denotes the change in the policy rate announced at the PC at time t and UMP is a dummy that takes the value one for PCs at which unconventional monetary policy actions are announced and zero otherwise. Expected $\Delta realGDP$ and Expected $\Delta HICP$ denote the latest revisions to the ECB's projections on real GDP and inflation. To measure monetary policy shocks, we use the change in the 3-month OIS rate (Level shock) and the change in the spread between the two-year (German) government yield and the 3-month OIS rate (Path shock). Finally we include the lagged return over the previous PC cycle as a control variable and report the adjusted R^2. All t-statistics for PC-day returns are based on White (1980) standard errors, t-statistics for PC-cycle returns are based on Newey and West (1987) standard errors. Our sample includes a total of 184 returns between the 185 ECB press conferences from January 7, 1999 to October 2, 2014.

Panel A. PC Day Returns

	(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)
const	-0.03	-0.03	-0.01	-0.09	-0.16	-0.17	-0.17
	[-0.26]	[-0.29]	[-0.11]	[-0.81]	[-1.38]	[-1.43]	[-1.43]
$\Delta\tau_{t-1,t}$	0.38	0.42	0.38	0.40	0.45	0.43	0.42
	[2.50]	[2.65]	[2.31]	[2.55]	[2.67]	[2.34]	[2.34]
$\Delta\tau_{t-2,t-1}$		0.07	0.09	0.14	0.27	0.28	0.27
		[0.37]	[0.49]	[0.79]	[1.45]	[1.55]	[1.51]
ΔMRO			1.45	1.56	1.54	1.14	1.12
			[1.26]	[1.38]	[1.01]	[0.74]	[0.75]
UMP dummy				0.02	0.03	0.02	0.02
				[5.30]	[5.34]	[4.58]	[4.62]
Expected $\Delta realGDP$					-0.07	-0.13	-0.14
					[-0.28]	[-0.50]	[-0.53]
Expected $\Delta HICP$					0.01	-0.01	-0.02
					[0.02]	[-0.03]	[-0.05]
Level shock						8.25	8.13
						[1.48]	[1.48]
Path shock						2.38	2.31
						[0.77]	[0.73]
Lagged ret							0.01
							[0.31]
adj R^2 (%)	2.73	2.33	3.51	10.03	10.45	11.35	10.89

Panel B. PC Cycle Returns

	(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)
const	0.12	0.13	0.14	0.04	-0.15	-0.09	-0.08
	[0.28]	[0.29]	[0.31]	[0.09]	[-0.31]	[-0.19]	[-0.19]
$\Delta\tau_{t-1,t}$	1.26	1.12	1.11	1.14	1.03	0.98	0.95
	[2.77]	[2.36]	[2.34]	[2.40]	[1.84]	[1.72]	[1.67]
$\Delta\tau_{t-2,t-1}$		-0.29	-0.29	-0.22	-0.33	-0.33	-0.38
		[-0.54]	[-0.52]	[-0.40]	[-0.56]	[-0.59]	[-0.71]
ΔMRO			0.45	0.58	-0.34	-2.50	-2.54
			[0.14]	[0.18]	[-0.07]	[-0.52]	[-0.53]
UMP dummy				0.03	0.03	0.03	0.03
				[2.24]	[2.43]	[1.95]	[1.90]
Expected $\Delta realGDP$					0.72	0.91	0.89
					[0.56]	[0.78]	[0.75]
Expected $\Delta HICP$					-0.45	-0.52	-0.54
					[-0.25]	[-0.30]	[-0.31]
Level shock						30.28	29.92
						[1.51]	[1.50]
Path shock						2.49	2.29
						[0.22]	[0.21]
Lagged ret							0.03
							[0.47]
adj R^2 (%)	2.52	2.00	1.46	1.80	0.60	2.73	2.17

Table VIII: Individual Country Equity Returns

This table reports results for PC-day and PC-cycle returns of individual Euro-member country equity indexes. The presentation of the results follows the same structure as in Table VI.

Panel A. PC versus Non-PC Days

	No PC	PC	p[F]
Austria	1.00	3.53	0.83
	[0.41]	[0.31]	
Belgium	0.12	5.28	0.62
	[0.06]	[0.51]	
Finland	1.40	20.77	0.24
	[0.40]	[1.04]	
France	1.68	-5.95	0.48
	[0.73]	[-0.50]	
Germany	2.02	-8.11	0.37
	[0.84]	[-0.66]	
Ireland	-1.56	4.74	0.62
	[-0.59]	[0.35]	
Italy	0.29	-10.88	0.31
	[0.13]	[-0.88]	
Netherlands	1.26	-1.82	0.77
	[0.57]	[-0.18]	
Portugal	-1.44	-4.90	0.70
	[-0.77]	[-0.53]	
Spain	1.59	-0.16	0.88
	[0.65]	[-0.01]	

Panel B. Positive versus Negative Tone Changes

	$\Delta\tau > 0$	$\Delta\tau < 0$	p[F]
Austria	19.78	-15.83	0.12
	[1.25]	[-1.00]	
Belgium	33.77	-28.63	0.00
	[2.44]	[-1.91]	
Finland	58.47	-24.12	0.04
	[2.49]	[-0.73]	
France	24.73	-42.47	0.00
	[1.43]	[-2.88]	
Germany	17.37	-38.45	0.02
	[0.92]	[-2.71]	
Ireland	35.49	-31.88	0.01
	[1.69]	[-2.12]	
Italy	15.37	-42.13	0.02
	[0.86]	[-2.65]	
Netherlands	20.96	-28.93	0.02
	[1.38]	[-2.21]	
Portugal	10.01	-22.65	0.08
	[0.77]	[-1.79]	
Spain	25.32	-30.48	0.03
	[1.41]	[-1.82]	

Panel C. PC Day Regressions

	a	b	R^2
Austria	0.04	0.26	1.79
	[0.32]	[1.75]	
Belgium	0.05	0.28	2.49
	[0.52]	[2.09]	
Finland	0.21	0.70	4.19
	[1.07]	[2.69]	
France	-0.06	0.36	3.26
	[-0.51]	[2.45]	
Germany	-0.08	0.32	2.39
	[-0.66]	[2.08]	
Ireland	0.05	0.24	1.08
	[0.35]	[1.21]	
Italy	-0.11	0.35	2.71
	[-0.89]	[2.56]	
Netherlands	-0.02	0.28	2.48
	[-0.17]	[2.19]	
Portugal	-0.05	0.26	2.74
	[-0.53]	[2.50]	
Spain	-0.00	0.34	2.50
	[-0.01]	[2.14]	

Panel D. PC Cycle Regressions

	a	b	R^2
Austria	0.26	0.92	1.11
	[0.40]	[1.73]	
Belgium	0.09	1.21	2.43
	[0.17]	[2.22]	
Finland	0.50	1.81	2.04
	[0.67]	[2.69]	
France	0.23	1.29	3.56
	[0.55]	[2.88]	
Germany	0.33	1.53	3.47
	[0.66]	[2.81]	
Ireland	-0.34	1.02	1.48
	[-0.61]	[1.83]	
Italy	-0.07	0.93	1.51
	[-0.16]	[1.93]	
Netherlands	0.21	1.40	4.06
	[0.48]	[2.92]	
Portugal	-0.31	0.80	1.17
	[-0.67]	[1.69]	
Spain	0.29	1.11	2.02
	[0.64]	[2.26]	

Table IX: Credit Spreads on PC days and over PC cycles

This table presents results for regressions of PC-day and PC-cycle changes in corporate credit spreads (BBB-AAA rated corporate bonds) on changes in ECB tone and several control variables. We compute PC-day changes (*Panel A*) from the closing prices on the day preceding the PC and the day on which the PC is held. Accordingly, we compute PC-cycle changes (*Panel B*) from the day preceding the current PC to the day preceding the next PC. We denote the most recent change in ECB tone by $\Delta\tau_{t-1,t}$ and the lagged tone change by $\Delta\tau_{t-2,t-1}$. To control for policy actions, ΔMRO denotes the change in the policy rate announced at the PC at time t and UMP is a dummy that takes the value one for PCs at which unconventional monetary policy actions are announced and zero otherwise. Expected $\Delta realGDP$ and Expected $\Delta HICP$ denote the latest revisions to the ECB's projections on real GDP and inflation. To measure monetary policy shocks, we use the change in the 3-month OIS rate (Level shock) and the change in the spread between the two-year (German) government yield and the 3-month OIS rate (Path shock). Finally we include the lagged return over the previous PC cycle as a control variable and report the adjusted R^2. All t-statistics for PC-day changes are based on White (1980) standard errors, t-statistics for PC-cycle changes are based on Newey and West (1987) standard errors. Our sample includes a total of 184 returns between the 185 ECB press conferences from January 7, 1999 to October 2, 2014.

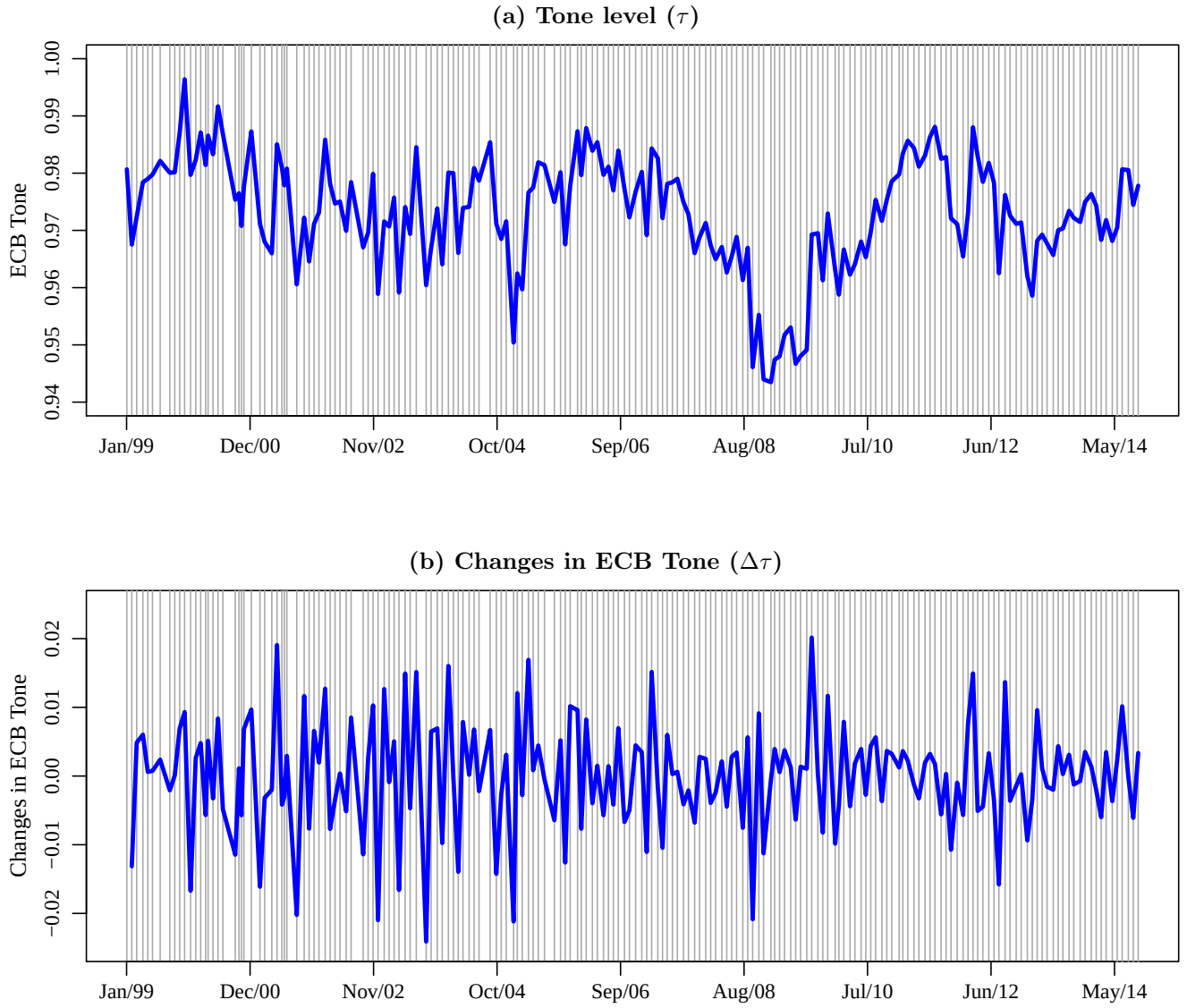
Panel A. PC day spread changes

	All firms		Financials		Nonfinancials	
	(i)	(ii)	(i)	(ii)	(i)	(ii)
const	-0.00	-0.00	-0.01	-0.00	-0.00	-0.00
	[-0.94]	[-0.83]	[-0.90]	[-0.33]	[-0.24]	[-0.52]
$\Delta\tau_{t-1,t}$	-0.01	-0.01	-0.03	-0.02	-0.01	-0.01
	[-2.56]	[-1.78]	[-3.15]	[-2.69]	[-1.95]	[-1.18]
$\Delta\tau_{t-2,t-1}$	-0.01	-0.01	-0.03	-0.02	-0.01	-0.01
	[-2.29]	[-1.78]	[-2.17]	[-2.00]	[-2.36]	[-1.84]
ΔMRO	0.08	0.10	0.13	0.25	-0.00	-0.02
	[1.30]	[1.15]	[1.40]	[1.99]	[-0.03]	[-0.78]
UMP dummy	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00
	[-2.01]	[-1.82]	[-2.57]	[-2.68]	[-2.45]	[-2.27]
Expected $\Delta realGDP$		-0.01		-0.04		-0.00
		[-1.17]		[-1.59]		[-0.46]
Expected $\Delta HICP$		0.01		0.01		0.01
		[1.34]		[0.43]		[0.77]
Level shock		-0.24		-1.06		0.08
		[-1.62]		[-2.94]		[0.38]
Path shock		-0.13		-0.34		0.01
		[-0.90]		[-1.51]		[0.04]
adj R^2 (%)	4.14	2.94	7.55	15.54	-0.23	-3.18

Panel B. PC cycle spread changes

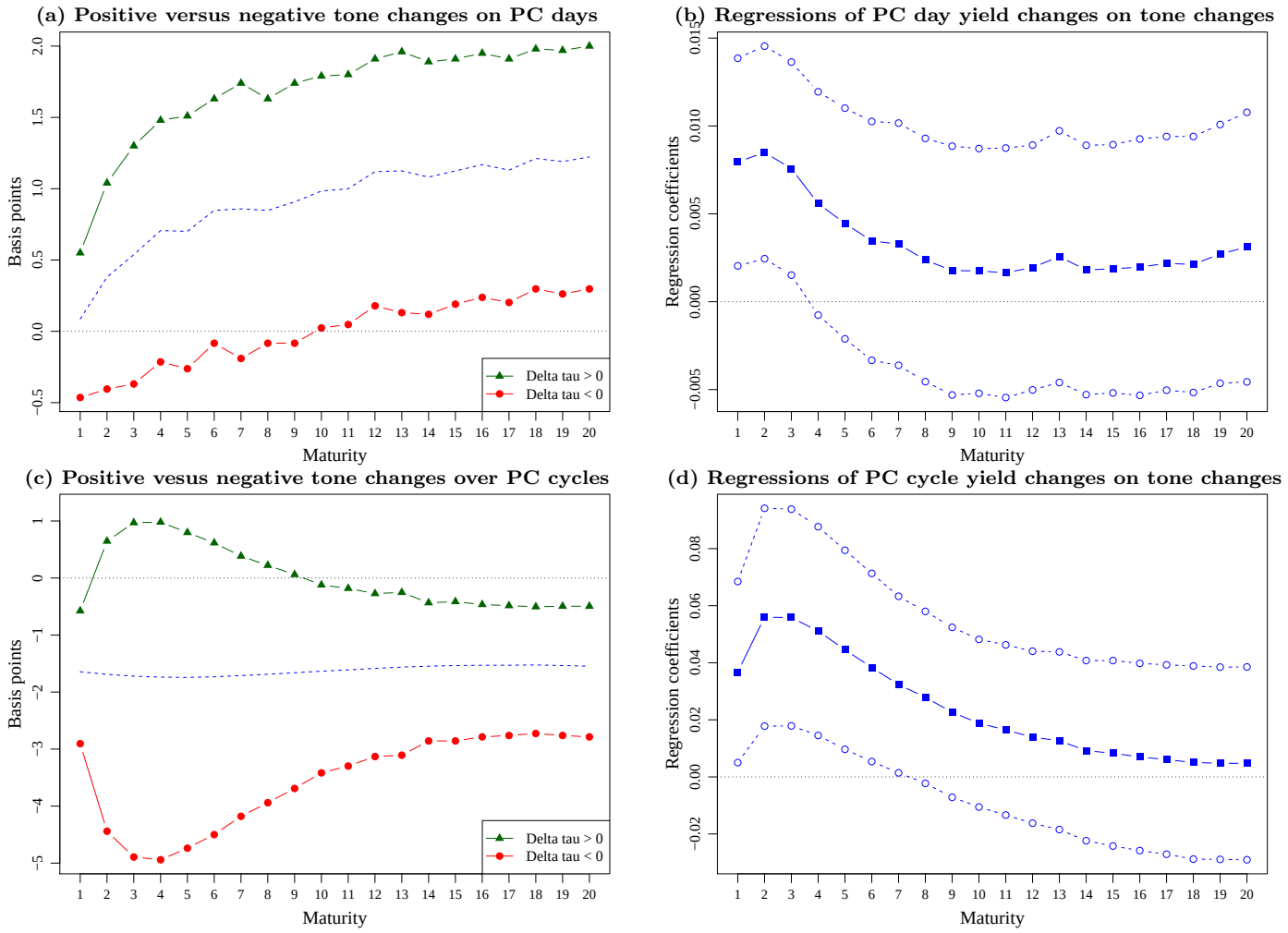
	All firms		Financials		Nonfinancials	
	(i)	(ii)	(i)	(ii)	(i)	(ii)
const	0.00	0.00	0.02	0.03	0.00	0.00
	[0.19]	[0.17]	[0.24]	[0.27]	[0.06]	[0.07]
$\Delta\tau_{t-1,t}$	-0.12	-0.12	-0.21	-0.20	-0.10	-0.09
	[-2.37]	[-2.17]	[-2.18]	[-2.32]	[-3.23]	[-2.69]
$\Delta\tau_{t-2,t-1}$	-0.04	-0.04	-0.19	-0.16	-0.01	-0.00
	[-1.99]	[-2.18]	[-1.55]	[-1.59]	[-0.40]	[-0.03]
ΔMRO	-0.11	-0.09	-0.40	1.31	0.10	0.07
	[-0.84]	[-0.38]	[-0.41]	[1.06]	[0.50]	[0.30]
UMP dummy	-0.00	-0.00	-0.01	-0.01	-0.00	-0.00
	[-2.69]	[-2.51]	[-2.63]	[-2.18]	[-1.32]	[-1.36]
Expected $\Delta realGDP$		0.06		-0.54		-0.00
		[1.08]		[-1.37]		[-0.01]
Expected $\Delta HICP$		0.09		-0.63		0.17
		[1.11]		[-1.35]		[2.22]
Level shock		-3.00		-12.34		-1.70
		[-2.37]		[-2.17]		[-2.25]
Path shock		-0.75		-3.39		-0.13
		[-1.27]		[-2.28]		[-0.29]
adj R^2 (%)	6.70	11.64	1.68	17.47	5.40	9.74

Figure 2: The Tone of ECB Press Conference Statements



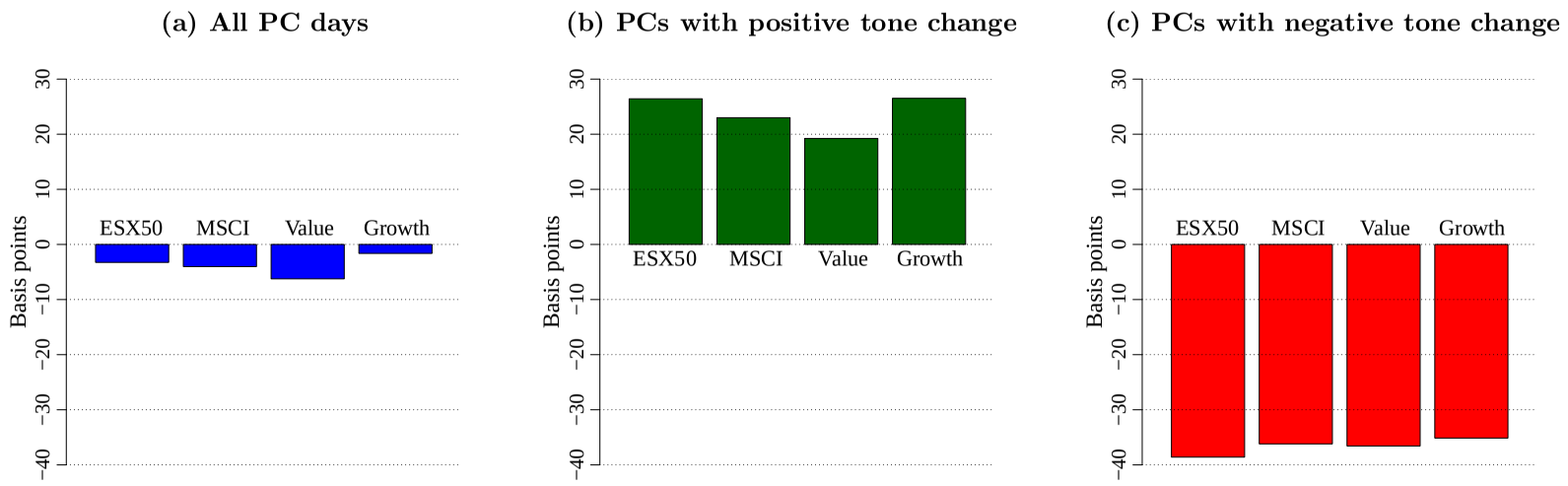
This figure plots the time-series of ECB tone, τ, and changes in ECB tone, $\Delta\tau$, in Panels (a) and (b), respectively. Tone is defined as $\tau = 1 - N/T$, see Equation (1), where N and T denote the number of negative words and the total number of words in a press conference statement. $\Delta\tau$ is measured as the difference in τ of two subsequently held press conferences. Tone is measured form the ECB president's opening statements at the 185 ECB press conferences between January 7, 1999 and October 2, 2014. The solid vertical lines mark these 185 press conferences.

Figure 3: Yield Changes on ECB PC Days and over PC Cycles



This figure presents results on changes in the yield curve (for maturities ranging from one to 20 years, x-axis) over cycles of ECB press conferences (PCs). Panel (a) presents average PC-day yield changes conditional on the tone changes at the most recent PC having been positive (green) or negative (red). Panel (b) plots the slope coefficients from regressing PC-day yield changes (of individual maturities) on changes in ECB tone ($\Delta\tau$), along with 90% confidence bands (based on White (1980) standard errors). Panel (c) presents average PC-cycle yield changes conditional on the tone changes at the most recent PC having been positive (green) or negative (red). Panel (c) plots the slope coefficients from regressing PC-cycle yield changes (of individual maturities) on changes in ECB tone ($\Delta\tau$), along with 90% confidence bands (based on Newey and West (1987) standard errors). The sample spans a total of 184 tone changes from 185 ECB press conferences between January 7, 1999 and October 2, 2014.

Figure 4: Equity Returns on Press Conference Days



This figure plots the returns of Eurozone equity indexes on days on which the ECB holds a press conference (PC). We use data for the EuroStoxx 50 (ESX50), the MSCI EMU (MSCI), the MSCI Value EMU (Value), and the MSCI Growth EMU (Growth). We compute returns from the closing prices on the day preceding the PC and the day on which the PC is held. For each index, we have a total of 184 returns between the 185 ECB press conferences held from January 7, 1999 to October 2, 2014. Panel (a) refers to average PC-day returns across all PCs. Panels (b) and (c) plot average returns separately for the 100 (84) observations at which the tone of the ECB becomes more positive (negative) compared to the previous PC.

Figure 5: Equity Returns following ECB Press Conferences

(a) Equity returns following press conferences

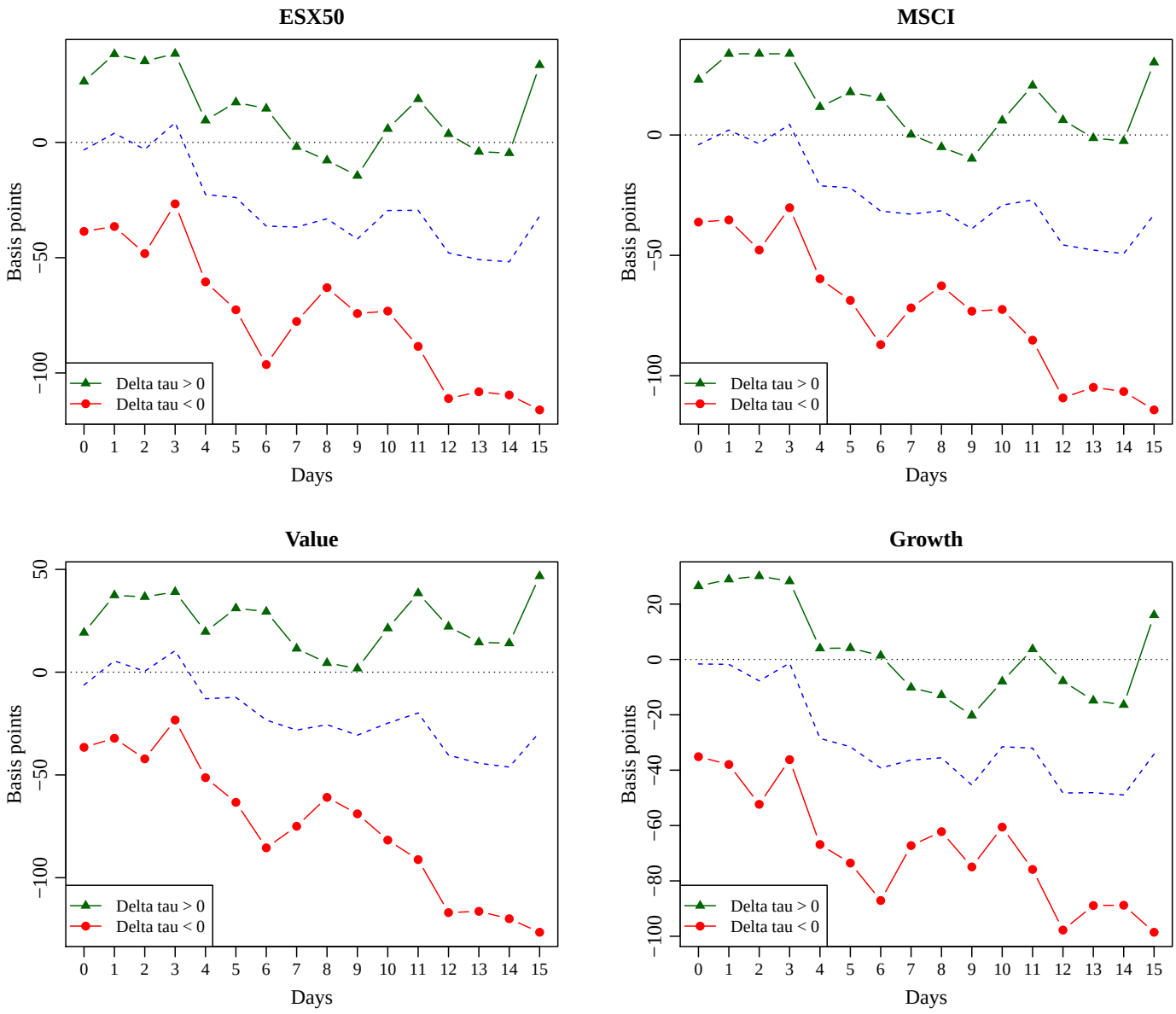


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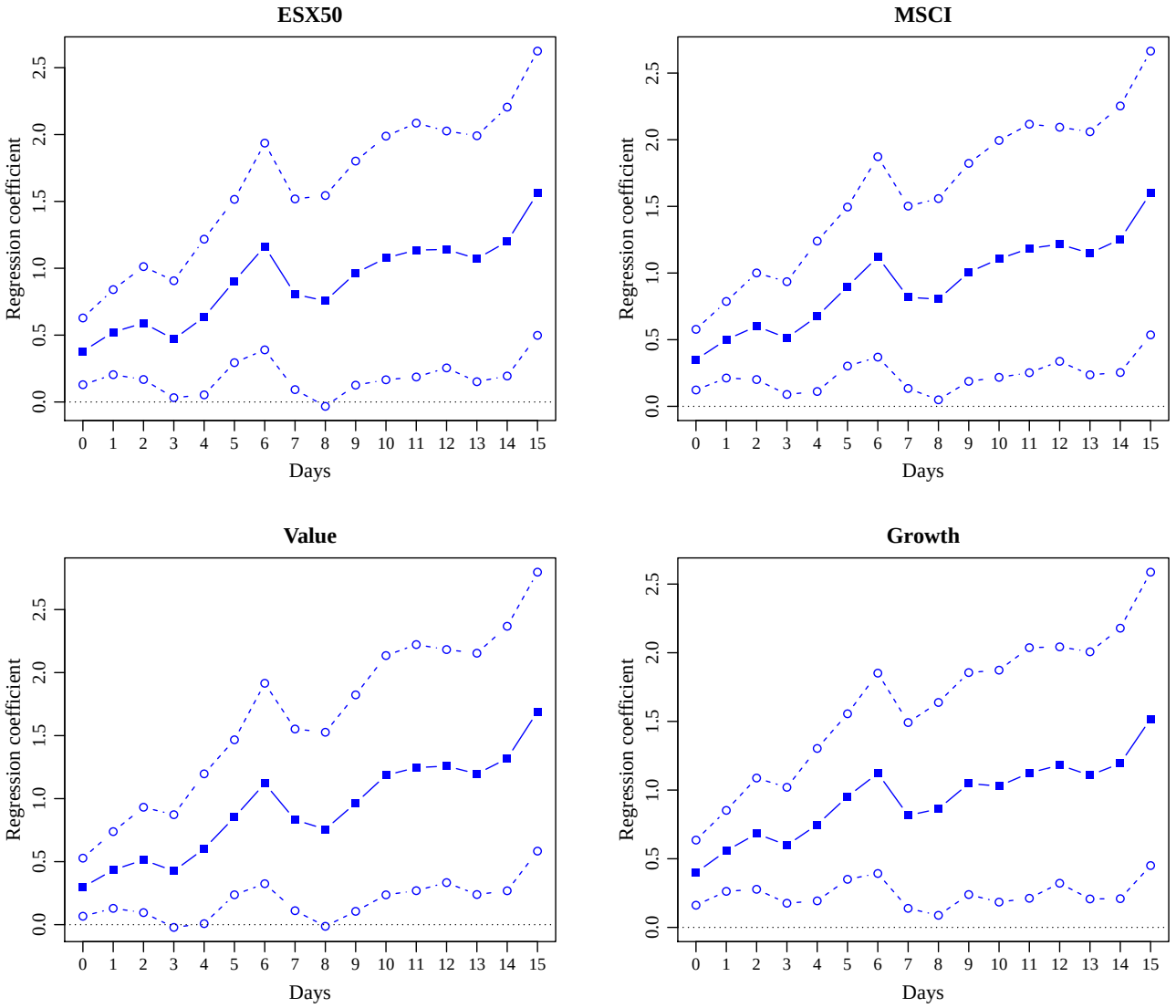
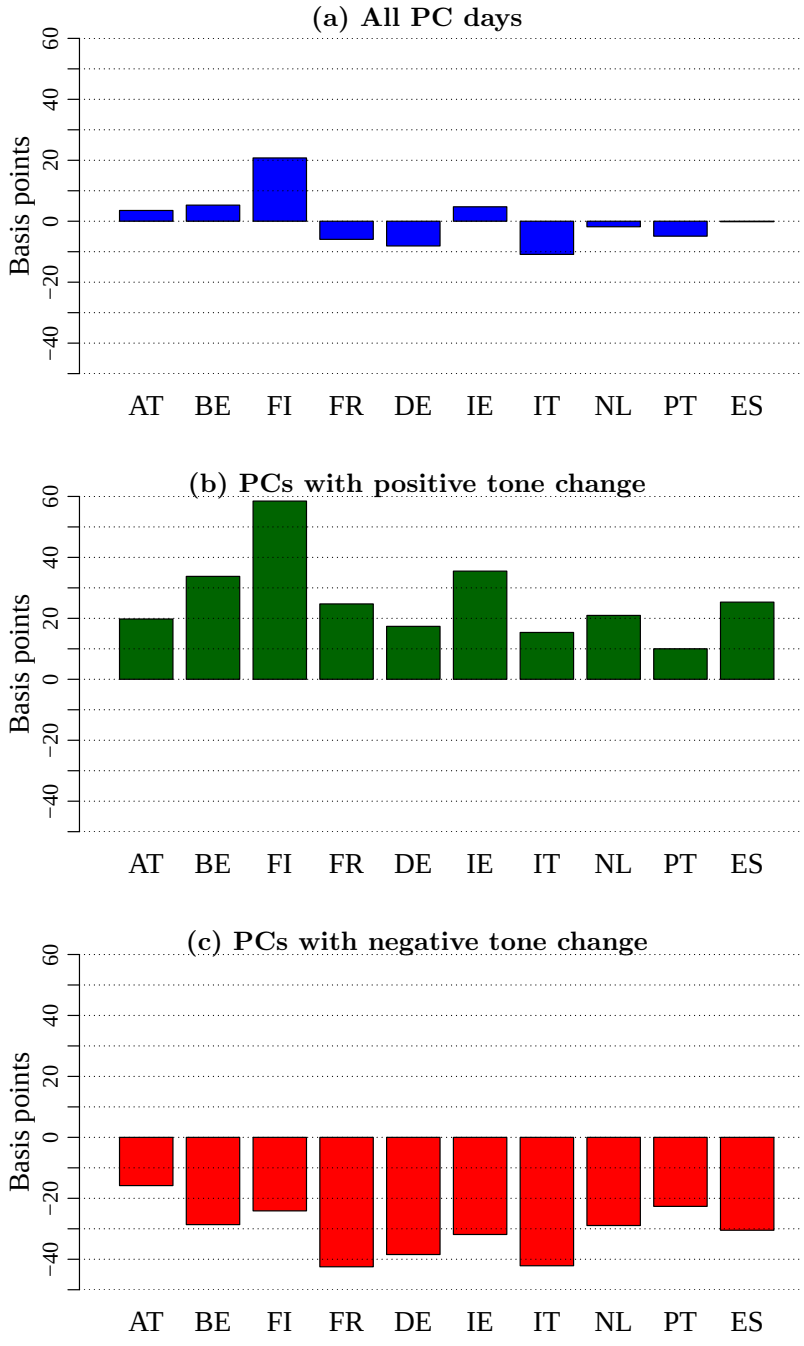
Figure 5 *(continued)*

(b) Slope coefficients from regressions of equity returns on tone changes



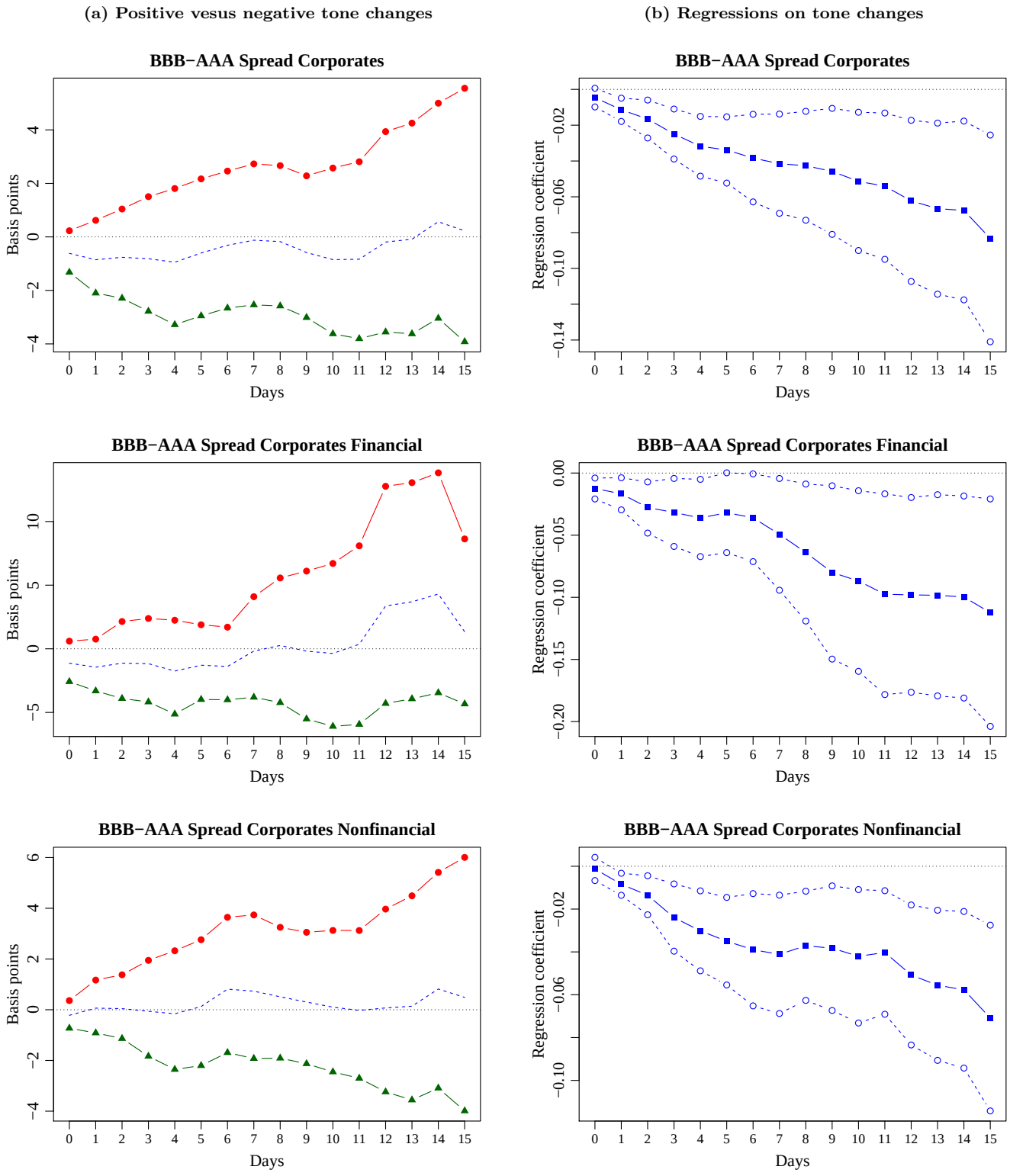
This figure shows how changes in ECB tone affect equity returns. In Panel (a), we plot the average k-day cumulative equity returns from $k = 0$ (representing the PC-day return) up to $k = 15$ days after a press conference. The green (red) lines plot the average cumulative returns on the k-th day after the PC, conditional on the tone being revealed at the press conference having been more positive (negative) compared to the previous one; values are reported in basis points. The dashed blue line represents the average return accumulating up to day k after the PC. Panel (b) plots the coefficients (and 90% confidence bands based on White (1980) standard errors) for regressing k-day cumulative returns on changes in tone revealed at the preceding press conference. The sample spans a total of 184 tone changes from 185 ECB press conferences between January 7, 1999 and October 2, 2014.

Figure 6: Individual Country Equity Returns on Press Conference Days



This figure plots the press conference (PC)-day returns of individual Eurozone country MSCI equity indexes. We compute returns from the closing prices on the day preceding the PC and the day on which the PC is held. We compute a total of 184 returns between the 185 ECB press conferences between January 7, 1999 and October 2, 2014. Panel (a) refers to average PC-day returns across from all PCs. Panels (b) and (c) plot average returns separately for the 100 (84) observations at which the tone of the ECB becomes more positive (negative) compared to the previous PC. The countries covered are Austria (AT), Belgium (BE), Finland (FI), France (FR), Germany (DE), Ireland (IE), Italy (IT), Netherlands (NL), Portugal (PT), and Spain (ES).

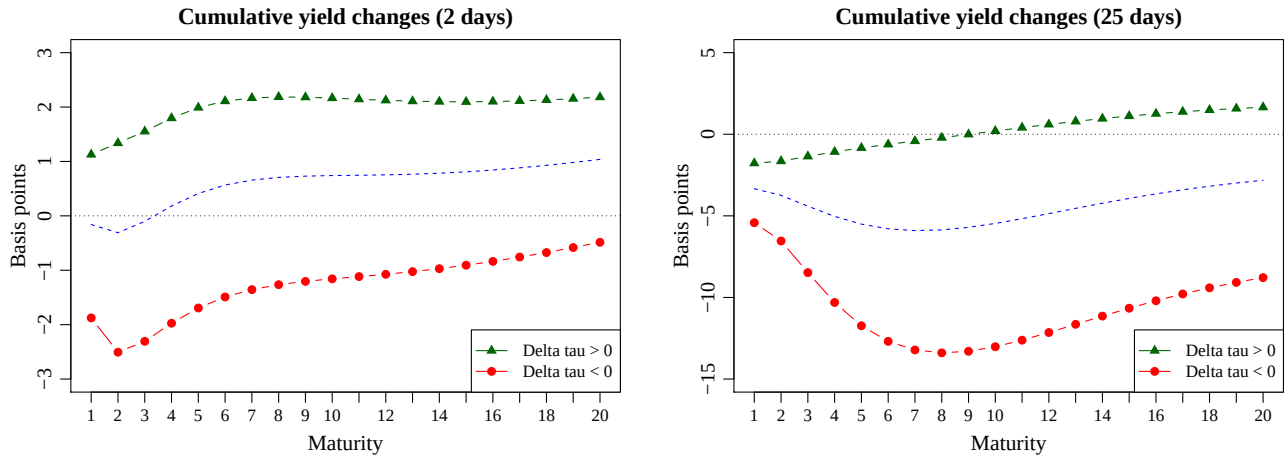
Figure 7: Corporate Credit Spread Changes



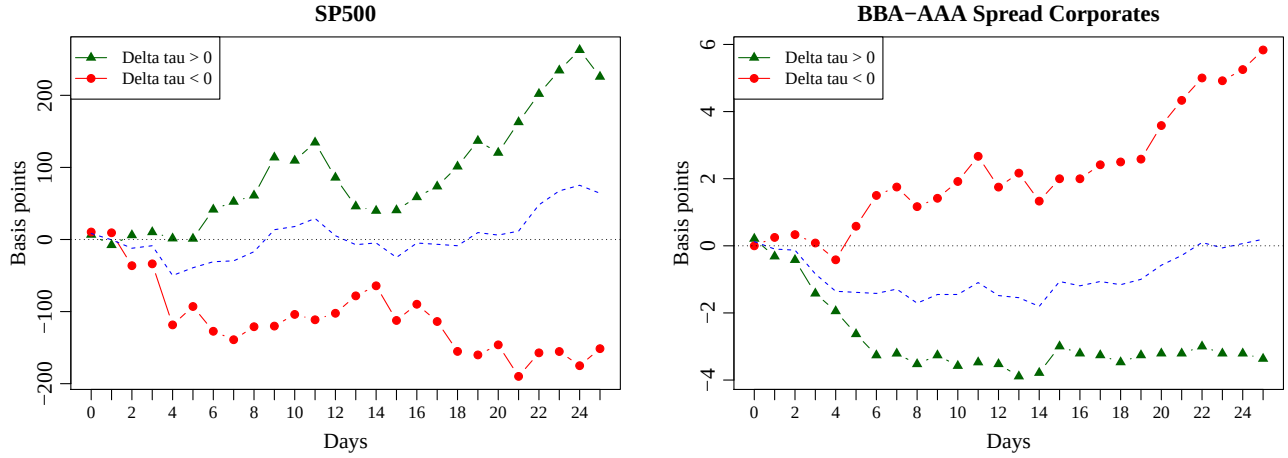
This figure presents results for the relation between ECB tone and corporate credit spreads (BBB-AAA rated corporate bonds). Panel (a) presents the average cumulative change in the credit spread conditional on tone changes at the most recent PC having been positive (green) or negative (red). Panel (b) plots the slope coefficients from regressing credit spread changes on changes in ECB tone ($\Delta\tau$), along with 90% confidence bands (based on White (1980) standard errors). The sample spans a total of 184 tone changes from 185 ECB press conferences between January 7, 1999 and October 2, 2014.

Figure 8: U.S. Asset Prices and Congressional Testimonies of the Fed Chair

(a) Changes in U.S. government bond yields



(b) U.S. stock market returns and changes in credit spreads



This figure shows how changes in tone at the Fed Chair's most recent Congressional Testimony affect U.S. government bond yield changes, U.S. stock market returns, and credit spread changes (BBA-AAA). Panel (a) presents results for U.S. government bond yields (or maturities ranging from one to 20 years. On the left we report changes in yields over the 2 days of the testimony. On the right, we report cumulative changes over a longer period of 25 days after the testimony. In both figures, we present average yield changes separately for testimonies with a more positive tone (triangles, green line) and a more negative tone (circles, red line). The dashed blue line represents average cumulative yield changes for all testimonies. Panel (b) presents results for equity returns and credit spreads. On the left, we plot the average k-day cumulative equity returns (in basis points) from $k = 0$ (representing the date of the testimony) up to $k = 25$ days. The green (red) line plots the average cumulative returns on the k-th day after the testimony, conditional on a more positive (negative) tone at the most recent testimony. The dashed blue line represents the average return accumulating up to day k after the testimony. On the right, we present the same for changes in BBA-AAA credit spreads. The sample spans a total of 36 tone changes from 37 testimonies from 1996 to 2014.

Internet Appendix for

Does Central Bank Tone Move Asset Prices?

(not for publication)

This Internet Appendix describes and reports additional results and robustness checks.

IA.1. Excerpts from ECB press conference statements

In the main part of the paper, we presented excerpts from the press conference in January 2009, which is the PC that our tone measure identifies as the most negative PC in our sample; see Table III. To provide a broader picture of what our tone measure captures, we now present additional excerpts. Table IA.1 presents excerpts from the press conference in February 2010, which has the highest count of commonly used phrases involving negative words across all statements in our sample. Table IA.2 presents excerpts from the press conference in January 2005, which according to our tone measure is the most negative PC in a pre-crisis subsample from January 1999 to June 2007.

While we find that our tone measure leads to only very few misclassifications, i.e., cases in which our procedure incorrectly treats a word or statement negative, in the ECB press conference transcripts, one example is the first sentence of the first excerpt in Table IA.2: "Downside risks to the economic outlook stemming from oil price developments have diminished somewhat over recent weeks." The dictionary identifies 'diminished' as a negative word whereas the overall sentence is obviously not negative. Nonetheless, these excerpts provide further support for the view that our tone measure generally captures the ECB's framing of economic and financial conditions.

IA.2. Central bank tone and future policy rates

We now complement the results on the relation between ECB tone and interest rates by showing that changes in tone predict future changes in policy rates. We focus on the rate of the marginal refinancing operation (MRO), which is the main tool of the ECB to manage

short-term interest rates. Table IA.3 reports results for regressions of the form

$$\Delta MRO_{t,t+k} = a + \beta \Delta MRO_{t-h} + \gamma \Delta \tau_{t-h} + \epsilon_{t,t+k}, \tag{IA.2.1}$$

where k is the forecast horizon in months and h is the lag of the predictive variable. We include lagged MRO changes in this regression as it is well-known that central banks often adjust interest rates only gradually (i.e., engage in 'interest rate smoothing'). We run these regressions with individual lags of the predictive variables (upper panel) and with multi-period changes in predictive variables (lower panels).

We find that lagged tone changes have predictive power for future policy rate changes over and above the information contained in lagged MRO changes which suggests that central bank tone is related to (and informative about) the future stance of monetary policy. This finding also squares with results in Figure 3 in the main part of the paper, which shows that tone changes positively affect government bond yields, specifically at the short end of the term structure.

IA.3. Forecasting macro fundamentals

Table IA.4 reports results for regressions of future growth rates of key Eurozone macro fundamentals on lagged ECB tone changes. We consider (log) inflation rates ($\Delta HICP$), (log) industrial production growth (ΔIP), (log) real IP growth ($\Delta RealIP$), (log) retail sales growth ($\Delta RetSales$), changes in the unemployment rate ($\Delta Unemp$), changes in consumer confidence ($\Delta ConsConf$), and changes in business confidence ($\Delta BusConf$) as dependent variables and report the predictive slope coefficient and adjusted R^2s. The left part of the table shows results for univariate predictive regressions of fundamentals on tone changes, the right part shows predictive slopes for lagged tone changes when additionally controlling for the most recent change in the policy rate (ΔMRO), a dummy for unconventional monetary policy announcements, and the most recent revisions in the ECB's projection for future

inflation and real GDP growth.

The signs of all estimated coefficients support the economic intuition that a more positive tone means higher expected (real) growth. Most of the estimates for fundamentals lack statistical significance, which is unsurprising given that it is notoriously difficult to forecast realized fundamentals in general. We do, however, find somewhat stronger evidence of significant predictability for changes in consumer and business confidence at several horizons. The relation is such that a more positive tone forecasts a rise in consumer and business confidence, which seems to be in line with the idea that central bank tone can affect the risk appetite in the economy.

IA.4. Press conferences with and without projection releases

Table IA.5 reports results for regressions of intraday Eurostoxx50 returns during the PC window (from 14:30 to 17:30, CET), separately for press conference days with and without scheduled releases of macroeconomic projections. We find that tone matters for equity returns in all regression specifications and that our results are not driven by the ECB releasing or not releasing new macro projections.

IA.5. Equity excess returns

While our results in the main paper are largely based on simple stock returns, we find that using stock excess returns does not change our findings. Figure IA.1 presents (cumulative) excess returns for the Eurostoxx50, MSCI EMU, MSCI Value, and MSCI Growth on press conference days (day 0) and up to 15 days after a press conference. The setup of this figure is the same as for Figure 5 in the main part of the paper and we simply replace stock returns with stock excess returns here (based on 3-month Eurozone LIBOR).

IA.6. Stock returns over PC cycles with and without PC days

To assess the link between tone changes and subsequent equity returns over full PC cycles, we regress PC cycle returns on tone changes. More precisely, for press conferences taking place at times t and $t+1$, we compute the return from the closing price on the day before PC_t to the closing price on the day before PC_{t+1}. These returns capture the market impact of PC_t but exclude the impact of PC_{t+1}. The regression results in Panel A of Table IA.9 show that slope coefficients for tone changes are all significantly positive and that R^2s are around 3%–3.5%. The estimated bs imply that a one-sigma tone change translates into an average PC-cycle return of about ± 100 basis points.

We repeat this PC-cycle exercise but now exclude the PC_t day return itself, by computing the return from the close on the day at which PC_t takes place to the close price on the day before PC_{t+1}, denoted by $r^{exPC}_{t,t+1}$. By excluding the direct impact on the return of the PC day, we can test whether returns are significantly related to tone changes even when the contemporaneous correlation between tone changes and PC-day returns is removed. The results in Panel B of Table IA.9 suggest that the estimates of b remain significant, albeit at a lower level, and this similarly applies to the regression R^2s. Overall, these results show that tone changes have a lasting effect on equity prices and have predictive ability for stock returns throughout PC cycles, even when excluding the PC day effect itself.

IA.7. Returns of MSCI equity indices

Tables IA.6 to IA.8 report regression results for the link between of ECB tone changes to PC-day and PC-cycle returns of the MSCI EMU, MSCI EMU Value, and MSCI EMU Growth indices, respectively. The setup is identical to that for the Eurostoxx 50 results reported in Table VII in the paper, and the results are very similar for all equity indices.

IA.8. Risk aversion and uncertainty

To provide further evidence that tone is related to the risk aversion of market participants and matters for asset prices via risk premia, we follow Bekaert et al. (2013) and decompose the VSTOXX, a volatility index computed from options on the ESX50, into proxies for *uncertainty* and *risk aversion*. We estimate *uncertainty* as the conditional stock market variance, obtained from regressing realized variance ($RVAR$) on lagged VSTOXX^2 and lagged realized variance. The proxy for *risk aversion* is the regression-implied variance risk premium. More specifically, we implement the approach of Bekaert et al. (2013) by running a regression on daily data and obtain

$$RVAR_{t,t+22d} = 0.0003 + 0.6318 \cdot VSTOXX_t^2 + 0.1643 \cdot RVAR_{t-22d,t} + e_t.$$

The fitted values from this regression ($\widehat{RVAR}_t$) provide us with a time series of conditional variance, which serves as our measure of uncertainty.[15] The variance risk premium implied by this regression, i.e. the difference in $\mathbb{Q}$- and $\mathbb{P}$-measure expected variance, is given by $VRP_t = VSTOXX_t^2 - \widehat{RVAR}_t$ and serves as our proxy for risk aversion.[16]

Table IA.10 presents results from regressions of PC-cycle changes in risk aversion (Panel A) and uncertainty (Panel B) on changes in ECB tone. We find that uncertainty and risk aversion are both negatively related to changes in ECB tone but that tone effects are more pronounced for risk aversion. More specifically, we find that changes in risk aversion are significantly related to changes in tone at the 5% level, even when we control for lagged tone changes and policy actions. When we additionally control for revisions of the ECB's economic projections, interest rate-based measures of monetary policy shocks, and lagged stock market returns, the slope coefficient on tone changes remains significant at the 10%

[15] The R^2 of this regression is 49.74% and the coefficient estimates on $VSTOXX_t^2$ and $RVAR_{t-22d,t}$ are significant at the 1% and 10% level, respectively, as judged by Newey and West (1987) standard errors.

[16] Bekaert et al. (2013) discuss the rationale for using the variance risk premium as a proxy for risk aversion by referencing to models in which risk aversion and the variance risk premium are directly related.

level. Overall, these results are inline with the notion of a risk-taking channel and support evidence based on corporate credit spreads (reported in Table IX in the paper).

IA.9. Additional results for Fed testimonies

This section provides additional results on the relation between Fed tone and U.S. asset prices. For the equity and credit spread results reported in the paper (Figure 8), we now also present regression results for S&P 500 returns and credit spread changes up to 25 days after a Congressional Testimony of the Fed Chair. Moreover, we show that the stock market results are not specific to the S&P 500 and provide very similar evidence for the broader MSCI USA index as well as subindices for value stocks and growth stocks. We report the equity results in Figure IA.2 and the results from regressions of credit spread changes on tone changes in Figure IA.3

Table IA.1: Excerpts from the ECB President's Statement on February 4, 2010

This table presents excerpts of the the ECB president's introductory statement, given at the press conference on February 4, 2010. Our textual analysis identifies this statement to contain the highest count of commonly used phrases involving negative words of all statements in our sample. From this statement we present the three paragraphs that have the largest impact on our tone measure, i.e. the three paragraphs with the highest ratio of negative words to total words. Words highlighted in red italic font and marked by asterisks (*) are negative words identified by the dictionary we employ. Other words highlighted in red italic font are common word sequences involving negative words that we have identified in multiple statements.

- The Governing Council continues to view the risks to this outlook as broadly balanced. On the upside, confidence may improve more than expected, and both the global economy and foreign trade may recover more strongly than projected. Furthermore, there may be stronger than anticipated effects stemming from the extensive macroeconomic stimulus being provided and from other policy measures taken. On the downside, **concerns* remain* relating to a *stronger or more *protracted* than expected *negative* feedback loop* between the real economy and the financial sector, renewed increases in oil and other commodity prices, the intensification of protectionist pressures and the *possibility of a *disorderly* *correction* of global *imbalances**.

- As regards fiscal policies, many euro area countries are faced with large, **sharply* rising fiscal *imbalances**, leading to less favourable medium and long-term interest rates and lower levels of private investment. Moreover, high levels of *public *deficit* and debt* place an additional **burden** on monetary policy and **undermine** the Stability and Growth Pact as a key pillar of Economic and Monetary Union. Against this background, it is of paramount importance that the stability programme of each euro area country clearly defines the fiscal exit and consolidation strategies for the period ahead. Countries will be required to meet their commitments under the *excessive *deficit* procedures*. Consolidation of public finances should start in 2011 at the latest and will have to exceed substantially the annual adjustment of 0.5% of GDP set as a minimum requirement by the Stability and Growth Pact. A strong focus on expenditure reforms is needed.

- The *key *challenge** in order to reinforce sustainable growth and job creation is to accelerate structural reforms, as the *financial *crisis* has *negatively* affected* the productive capacity of our economies. In the case of product markets, policies that enhance competition and innovation are urgently needed to *speed up *restructuring** and investment and to create new business opportunities. In labour markets, moderate wage-setting, effective incentives to work and sufficient labour market flexibility are required in order to avoid significantly *higher structural *unemployment** over the coming years. Finally, an *appropriate *restructuring** of the banking sector should play an important role. Sound balance sheets, effective risk management and transparent, robust business models are key to strengthening banks' resilience to shocks, thereby laying the foundations for sustainable growth and financial stability.

Table IA.2: Excerpts from the ECB President's Statement on January 13, 2005

This table presents excerpts of the the ECB president's introductory statement, given at the press conference on January 13, 2005. Our measure of central bank tone identifies this statement to exhibit the most negative tone of all statements in a subsample from 1999/01 – 2007/06 (i.e., the pre-crisis period). From this statement we present the three paragraphs that have the largest impact on our tone measure, i.e. the three paragraphs with the highest ratio of negative words to total words. Words highlighted in red italic font and marked by asterisks (*) are negative words identified by the dictionary we employ. Other words highlighted in red italic font are common word sequences involving negative words that we have identified in multiple statements.

- Downside risks to the economic outlook stemming from oil price developments have **diminished** somewhat over recent weeks. As regards exchange rates, we confirm our position, expressed when the euro rose **sharply**, that such moves are **unwelcome** and **undesirable** for economic growth.

- With regard to both fiscal policies and structural reforms, the governments and institutions of the European Union will have to **confront** many important **challenges** in the course of 2005.

- Foremost among these **challenges** is the need to strengthen public finances by **correcting** **excessive** **deficits** swiftly and returning to a path of vigorous fiscal consolidation. Moreover, throughout the European Union there is a need to address the considerable **challenges** that population ageing **poses** to existing pension and social security systems.

Table IA.3: Forecasting future policy rates

This table reports results for regressions of changes in the marginal refinancing operation (MRO) policy rate on lagged MRO changes and lagged tone changes. We consider forecast horizons of $1, 3$, and 12 months and lagged MRO changes and tone changes of up to twelve months. The upper panel shows regressions of MRO changes on individual lags of MRO and tone changes of up to three months. The lower two panels shows regressions of MRO changes on cumulative MRO and tone changes over the previous three and twelve months, respectively.

	$\Delta MRO_{t;t+1}$		$\Delta MRO_{t;t+3}$		$\Delta MRO_{t;t+12}$	
	(i)	(ii)	(i)	(ii)	(i)	(ii)
const	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00
	[-0.75]	[-0.55]	[-0.63]	[-0.57]	[-0.72]	[-0.76]
ΔMRO_{t-1}	0.15	0.16	0.59	0.57	0.96	0.92
	[1.18]	[1.35]	[3.44]	[3.89]	[3.15]	[2.78]
ΔMRO_{t-2}	0.12	0.13	0.45	0.42	0.63	0.57
	[2.13]	[2.25]	[4.45]	[4.08]	[1.79]	[1.53]
ΔMRO_{t-3}	0.24	0.20	0.27	0.27	0.28	0.25
	[2.85]	[2.62]	[1.68]	[1.82]	[0.80]	[0.76]
$\Delta\tau_{t-1}$		-0.01		0.05		0.13
		[-0.82]		[1.52]		[1.81]
$\Delta\tau_{t-2}$		0.03		0.08		0.23
		[1.66]		[1.93]		[2.28]
$\Delta\tau_{t-3}$		0.05		0.05		0.16
		[3.36]		[1.74]		[2.28]
adj R^2 (%)	11.92	18.17	18.98	21.20	4.36	6.04
const	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00
	[-0.75]	[-0.53]	[-0.61]	[-0.56]	[-1.08]	[-1.13]
$\Delta MRO_{t-3;t-1}$	0.17	0.17	0.44	0.42	0.63	0.58
	[4.47]	[4.55]	[5.24]	[5.41]	[2.58]	[2.40]
$\Delta\tau_{t-3;t-1}$		0.02		0.06		0.16
		[1.70]		[1.76]		[2.31]
adj R^2 (%)	12.26	14.15	18.92	21.63	4.90	7.28
const	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00
	[-0.81]	[-0.96]	[-0.88]	[-0.97]	[-1.59]	[-1.75]
$\Delta MRO_{t-12;t-1}$	0.04	0.04	0.09	0.08	0.10	0.06
	[3.09]	[2.97]	[2.30]	[2.10]	[1.05]	[0.61]
$\Delta\tau_{t-12;t-1}$		0.02		0.09		0.28
		[2.42]		[2.72]		[3.49]
adj R^2 (%)	4.86	8.25	6.16	18.24	0.61	17.11

Table IA.4: Forecasting future macro fundamentals

This table reports results for regressions of changes in macro fundamentals on lagged tone changes. We consider (log) inflation rates ($\Delta HICP$), (log) industrial production growth (ΔIP), (log) real IP growth ($\Delta RealIP$), (log) retail sales growth ($\Delta RetSales$), changes in the unemployment rate ($\Delta Unemp$), changes in consumer confidence ($\Delta ConsConf$), and changes in business confidence ($\Delta BusConf$) and report the predictive slope coefficient, adjusted R^2, and the number of monthly observations. The left part of the panel shows results for univariate predictive regressions whereas the right part shows predictive slopes for lagged tone changes when additionally controlling for the most recent change in the policy rate (MRO), a dummy for unconventional monetary policy on the most recent press conference day, and the most recent change in the ECB's projection for future inflation and real GDP growth.

	Without controls					With controls				
	1m	3m	6m	12m	24m	1m	3m	6m	12m	24m
$\Delta HICP$	-0.03	0.06	-0.03	0.01	0.03	-0.01	0.09	-0.02	0.03	0.02
	[-0.61]	[1.08]	[-0.72]	[0.28]	[0.73]	[-0.28]	[1.18]	[-0.45]	[0.81]	[0.45]
adj R^2 (%)	-0.37	-0.15	-0.34	-0.56	-0.53	-2.78	3.89	0.12	-1.53	0.37
ΔIP	0.03	0.21	0.47	0.48	0.42	0.11	0.30	0.57	0.76	1.19
	[0.27]	[1]	[1.75]	[1.55]	[1.37]	[0.79]	[1.14]	[1.64]	[1.82]	[2.01]
adj R^2 (%)	-0.49	0.09	0.54	-0.13	-0.42	9.63	11.35	3.33	2.50	3.73
$\Delta RealIP$	0.06	0.15	0.49	0.47	0.39	0.13	0.21	0.59	0.73	1.17
	[0.44]	[0.75]	[1.85]	[1.45]	[1.26]	[0.80]	[0.82]	[1.72]	[1.70]	[1.98]
adj R^2 (%)	-0.38	-0.26	0.63	-0.16	-0.45	5.30	13.17	4.30	2.51	4.33
$\Delta RetSales$	-0.06	0.10	0.13	0.05	0.06	-0.01	0.16	0.23	0.21	0.35
	[-0.88]	[1.79]	[1.68]	[0.53]	[0.53]	[-0.09]	[1.75]	[2.17]	[1.24]	[1.21]
adj R^2 (%)	-0.11	0.26	-0.01	-0.55	-0.61	-2.33	3.02	-0.41	-0.15	3.73
$\Delta Unemp$	-0.04	-0.38	-0.48	-0.65	-0.74	-0.10	-0.49	-0.46	-0.64	-1.32
	[-0.54]	[-1.75]	[-1.52]	[-1.44]	[-1.26]	[-1.03]	[-1.68]	[-1.15]	[-1.10]	[-1.45]
adj R^2 (%)	-0.44	0.72	0.06	-0.21	-0.41	22.87	23.44	14.50	8.23	-0.65
$\Delta ConsConf$	0.09	0.41	0.24	0.26	-0.12	0.16	0.61	0.49	0.51	0.62
	[0.88]	[2.46]	[1.03]	[0.82]	[-0.28]	[1.31]	[2.34]	[1.09]	[0.83]	[0.80]
adj R^2 (%)	-0.33	0.38	-0.45	-0.52	-0.62	2.68	2.76	4.57	3.53	13.13
$\Delta BusConf$	0.14	0.81	0.79	0.99	0.09	0.37	1.39	1.35	1.95	1.63
	[0.71]	[2.65]	[1.78]	[1.87]	[0.19]	[1.41]	[3.11]	[1.92]	[2.10]	[1.40]
adj R^2 (%)	-0.18	1.31	0.02	-0.22	-0.63	5.19	6.59	5.21	7.23	18.41

Table IA.5: ESX50 during Press Conference Days with and without Projection Releases

This table presents results for regressions of EurosStoxx 50 intraday returns on changes in ECB tone and several control variables. More specifically, we focus on the time window from the beginning of the press conference to the end of the trading day, i.e. from 14:30 to 17:30, and compute cumulative one-minute returns over this time window. Our sample includes a total of 184 tone changes between the 185 ECB press conferences from January 7, 1999 to October 2, 2014. In the left part of the table, we report results for the 56 press conference days at which macro projections have been released. In the right part, we report results for the 129 press conferences without macro releases. We regress the cumulative one-minute returns on the change in ECB tone at the press conference at time t compared to the previous press conference ($\Delta\tau_{t-1,t}$) as well as the lagged tone change ($\Delta\tau_{t-2,t-1}$). To control for policy actions, we include ΔMRO which denotes the change in the policy rate announced at the PC at time t and UMP is a dummy that takes the value one for PCs at which unconventional monetary policy actions are announced and zero otherwise. Expected $\Delta realGDP$ and Expected $\Delta HICP$ denote the latest revisions to the ECB's projections on real GDP and inflation. To measure monetary policy shocks, we use the change in the 3-month OIS rate (Level shock) and the change in the spread between the two-year (German) government yield and the 3-month OIS rate (Path shock). Lagged ret denotes lagged stock returns. Finally, we report the adjusted R^2. All t-statistics for are based on White (1980) standard errors.

	PCs with Macro Projections		PCs without Macro Projections	
	(i)	(ii)	(i)	(ii)
const	-0.30	-0.25	-0.16	-0.24
	[-2.45]	[-1.94]	[-1.65]	[-2.11]
$\Delta\tau_{t-1,t}$	0.32	0.41	0.28	0.35
	[1.78]	[2.17]	[2.03]	[2.12]
$\Delta\tau_{t-2,t-1}$	0.18	0.24	0.05	0.12
	[0.94]	[1.26]	[0.32]	[0.85]
ΔMRO	0.46	1.60	1.34	1.99
	[0.32]	[1.56]	[1.77]	[1.48]
UMP dummy	0.01	0.02	0.01	0.02
	[3.08]	[3.65]	[8.26]	[7.95]
Expected $\Delta realGDP$		-0.24		-0.31
		[-0.86]		[-1.31]
Expected $\Delta HICP$		-0.88		-0.07
		[-1.93]		[-0.22]
Level shock		-6.60		1.30
		[-1.64]		[0.31]
Path shock		-5.61		-3.97
		3.13		3.58
		[-1.79]		[-1.11]
adj R^2 (%)	4.96	12.13	6.01	8.84

Table IA.6: MSCI EMU Returns on Press Conference Days and over Press Conference Cycles

This table presents results for regressions of PC-day and PC-cycle returns of the MSCI EMU index on changes in ECB tone and several control variables. We compute PC-day returns (*Panel A*) from the closing prices on the day preceding the PC and the day on which the PC is held. Accordingly, we compute PC-cycle returns (*Panel B*) from the day preceding the current PC to the day preceding the next PC. We denote the most recent change in ECB tone by $\Delta\tau_{t-1,t}$ and the lagged tone change by $\Delta\tau_{t-2,t-1}$. To control for policy actions, ΔMRO denotes the change in the policy rate announced at the PC at time t and UMP is a dummy that takes the value one for PCs at which unconventional monetary policy actions are announced and zero otherwise. Expected $\Delta realGDP$ and Expected $\Delta HICP$ denote the latest revisions to the ECB's projections on real GDP and inflation. To measure monetary policy shocks, we use the change in the 3-month OIS rate (Level shock) and the change in the spread between the two-year (German) government yield and the 3-month OIS rate (Path shock). Finally we include the lagged return over the previous PC cycle as a control variable and report the adjusted R^2. All t-statistics for PC-day returns are based on White (1980) standard errors, t-statistics for PC-cycle returns are based on Newey and West (1987) standard errors. Our sample includes a total of 184 returns between the 185 ECB press conferences from January 7, 1999 to October 2, 2014.

Panel A. PC day returns

	(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)
const	-0.04	-0.04	-0.02	-0.10	-0.16	-0.17	-0.17
	[-0.36]	[-0.38]	[-0.21]	[-0.93]	[-1.45]	[-1.49]	[-1.49]
$\Delta\tau_{t-1,t}$	0.35	0.39	0.36	0.38	0.41	0.39	0.38
	[2.53]	[2.77]	[2.43]	[2.69]	[2.77]	[2.40]	[2.36]
$\Delta\tau_{t-2,t-1}$		0.09	0.11	0.15	0.27	0.28	0.25
		[0.49]	[0.60]	[0.91]	[1.55]	[1.65]	[1.56]
ΔMRO			1.32	1.42	1.40	0.98	0.96
			[1.22]	[1.34]	[0.97]	[0.68]	[0.68]
UMP dummy				0.02	0.02	0.02	0.02
				[4.83]	[4.86]	[4.16]	[4.22]
Expected $\Delta realGDP$					-0.06	-0.11	-0.13
					[-0.28]	[-0.47]	[-0.53]
Expected $\Delta HICP$					-0.03	-0.05	-0.05
					[-0.07]	[-0.13]	[-0.15]
Level shock						8.19	8.01
						[1.58]	[1.59]
Path shock						2.31	2.19
						[0.84]	[0.76]
Lagged ret							0.02
							[0.51]
adj R^2 (%)	2.77	2.43	3.58	10.51	10.78	11.98	11.73

Panel B. PC cycle returns

	(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)
const	0.18	0.19	0.19	0.10	-0.06	0.01	0.01
	[0.40]	[0.41]	[0.43]	[0.21]	[-0.12]	[0.02]	[0.02]
$\Delta\tau_{t-1,t}$	1.32	1.24	1.23	1.25	1.16	1.15	1.10
	[2.95]	[2.65]	[2.63]	[2.68]	[2.13]	[2.06]	[2.00]
$\Delta\tau_{t-2,t-1}$		-0.15	-0.15	-0.09	-0.19	-0.17	-0.28
		[-0.28]	[-0.27]	[-0.16]	[-0.33]	[-0.31]	[-0.53]
ΔMRO			0.41	0.53	-0.06	-2.03	-2.13
			[0.13]	[0.17]	[-0.01]	[-0.43]	[-0.45]
UMP dummy				0.03	0.03	0.03	0.03
				[2.33]	[2.49]	[2.10]	[2.05]
Expected $\Delta realGDP$					0.70	0.87	0.80
					[0.57]	[0.76]	[0.70]
Expected $\Delta HICP$					-0.63	-0.63	-0.66
					[-0.36]	[-0.37]	[-0.40]
Level shock						27.15	26.40
						[1.37]	[1.35]
Path shock						-1.03	-1.53
						[-0.10]	[-0.14]
Lagged ret							0.07
							[0.96]
adj R^2 (%)	2.99	2.34	1.80	2.09	0.99	3.15	2.94

Table IA.7: Value Stocks on Press Conference Days and over Press Conference Cycles

This table presents results for regressions of PC-day and PC-cycle returns of the MSCI EMU VALUE index on changes in ECB tone and several control variables. We compute PC-day returns (*Panel A*) from the closing prices on the day preceding the PC and the day on which the PC is held. Accordingly, we compute PC-cycle returns (*Panel B*) from the day preceding the current PC to the day preceding the next PC. We denote the most recent change in ECB tone by $\Delta\tau_{t-1,t}$ and the lagged tone change by $\Delta\tau_{t-2,t-1}$. To control for policy actions, ΔMRO denotes the change in the policy rate announced at the PC at time t and UMP is a dummy that takes the value one for PCs at which unconventional monetary policy actions are announced and zero otherwise. Expected $\Delta realGDP$ and Expected $\Delta HICP$ denote the latest revisions to the ECB's projections on real GDP and inflation. To measure monetary policy shocks, we use the change in the 3-month OIS rate (Level shock) and the change in the spread between the two-year (German) government yield and the 3-month OIS rate (Path shock). Finally we include the lagged return over the previous PC cycle as a control variable and report the adjusted R^2. All t-statistics for PC-day returns are based on White (1980) standard errors, t-statistics for PC-cycle returns are based on Newey and West (1987) standard errors. Our sample includes a total of 184 returns between the 185 ECB press conferences from January 7, 1999 to October 2, 2014.

Panel A. PC day returns

	(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)
const	-0.06	-0.07	-0.04	-0.13	-0.17	-0.18	-0.18
	[-0.54]	[-0.57]	[-0.41]	[-1.19]	[-1.45]	[-1.54]	[-1.54]
$\Delta\tau_{t-1,t}$	0.30	0.36	0.32	0.35	0.38	0.36	0.35
	[2.12]	[2.55]	[2.17]	[2.47]	[2.40]	[2.02]	[2.02]
$\Delta\tau_{t-2,t-1}$		0.13	0.15	0.21	0.30	0.31	0.30
		[0.72]	[0.85]	[1.19]	[1.65]	[1.76]	[1.76]
ΔMRO			1.44	1.56	1.71	1.26	1.25
			[1.22]	[1.35]	[1.09]	[0.79]	[0.80]
UMP dummy				0.03	0.03	0.03	0.03
				[4.68]	[4.68]	[4.02]	[4.05]
Expected $\Delta realGDP$					-0.10	-0.17	-0.17
					[-0.38]	[-0.61]	[-0.63]
Expected $\Delta HICP$					0.01	-0.02	-0.03
					[0.02]	[-0.06]	[-0.07]
Level shock						9.21	9.11
						[1.65]	[1.66]
Path shock						3.12	3.06
						[1.06]	[1.01]
Lagged ret							0.01
							[0.22]
adj R^2 (%)	1.69	1.59	2.93	10.91	10.50	11.84	11.32

Panel B. PC cycle returns

	(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)
const	0.27	0.27	0.26	0.18	-0.07	-0.01	-0.01
	[0.56]	[0.56]	[0.54]	[0.36]	[-0.13]	[-0.01]	[-0.02]
$\Delta\tau_{t-1,t}$	1.40	1.35	1.37	1.39	1.24	1.23	1.19
	[2.73]	[2.51]	[2.53]	[2.57]	[1.99]	[1.91]	[1.84]
$\Delta\tau_{t-2,t-1}$		-0.11	-0.12	-0.07	-0.22	-0.18	-0.28
		[-0.19]	[-0.20]	[-0.11]	[-0.35]	[-0.30]	[-0.50]
ΔMRO			-0.78	-0.67	-1.07	-3.42	-3.54
			[-0.23]	[-0.20]	[-0.22]	[-0.65]	[-0.68]
UMP dummy				0.02	0.03	0.03	0.03
				[1.84]	[2.09]	[1.69]	[1.63]
Expected $\Delta realGDP$					1.01	1.14	1.07
					[0.74]	[0.88]	[0.85]
Expected $\Delta HICP$					-0.53	-0.55	-0.57
					[-0.28]	[-0.29]	[-0.31]
Level shock						33.07	32.25
						[1.47]	[1.46]
Path shock						-0.24	-0.74
						[-0.02]	[-0.06]
Lagged ret							0.06
							[0.89]
adj R^2 (%)	2.72	2.13	1.62	1.58	0.44	2.86	2.59

Table IA.8: Growth Stocks on Press Conference Days and over Press Conference Cycles

This table presents results for regressions of PC-day and PC-cycle returns of the MSCI EMU GROWTH index on changes in ECB tone and several control variables. We compute PC-day returns (*Panel A*) from the closing prices on the day preceding the PC and the day on which the PC is held. Accordingly, we compute PC-cycle returns (*Panel B*) from the day preceding the current PC to the day preceding the next PC. We denote the most recent change in ECB tone by $\Delta\tau_{t-1,t}$ and the lagged tone change by $\Delta\tau_{t-2,t-1}$. To control for policy actions, ΔMRO denotes the change in the policy rate announced at the PC at time t and UMP is a dummy that takes the value one for PCs at which unconventional monetary policy actions are announced and zero otherwise. Expected $\Delta realGDP$ and Expected $\Delta HICP$ denote the latest revisions to the ECB's projections on real GDP and inflation. To measure monetary policy shocks, we use the change in the 3-month OIS rate (Level shock) and the change in the spread between the two-year (German) government yield and the 3-month OIS rate (Path shock). Finally we include the lagged return over the previous PC cycle as a control variable and report the adjusted R^2. All t-statistics for PC-day returns are based on White (1980) standard errors, t-statistics for PC-cycle returns are based on Newey and West (1987) standard errors. Our sample includes a total of 184 returns between the 185 ECB press conferences from January 7, 1999 to October 2, 2014.

Panel A. PC day returns

	(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)
const	-0.02	-0.02	0.00	-0.06	-0.14	-0.14	-0.14
	[-0.14]	[-0.15]	[0.00]	[-0.59]	[-1.36]	[-1.36]	[-1.37]
$\Delta\tau_{t-1,t}$	0.40	0.42	0.39	0.41	0.43	0.42	0.40
	[2.76]	[2.76]	[2.48]	[2.68]	[2.96]	[2.67]	[2.63]
$\Delta\tau_{t-2,t-1}$		0.04	0.05	0.09	0.22	0.23	0.18
		[0.20]	[0.29]	[0.54]	[1.31]	[1.40]	[1.18]
ΔMRO			1.14	1.22	1.02	0.64	0.61
			[1.14]	[1.26]	[0.78]	[0.50]	[0.50]
UMP dummy				0.02	0.02	0.02	0.02
				[4.93]	[5.08]	[4.32]	[4.43]
Expected $\Delta realGDP$					-0.03	-0.05	-0.09
					[-0.13]	[-0.24]	[-0.41]
Expected $\Delta HICP$					-0.08	-0.09	-0.10
					[-0.22]	[-0.27]	[-0.30]
Level shock						6.85	6.63
						[1.44]	[1.45]
Path shock						1.41	1.24
						[0.55]	[0.45]
Lagged ret							0.03
							[0.96]
adj R^2 (%)	3.68	3.15	3.84	8.75	10.17	11.02	11.54

Panel B. PC cycle returns

	(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)
const	0.12	0.14	0.16	0.05	-0.02	0.06	0.05
	[0.27]	[0.30]	[0.36]	[0.11]	[-0.04]	[0.15]	[0.14]
$\Delta\tau_{t-1,t}$	1.25	1.14	1.09	1.13	1.08	1.07	1.04
	[3.09]	[2.68]	[2.60]	[2.67]	[2.20]	[2.16]	[2.10]
$\Delta\tau_{t-2,t-1}$		-0.19	-0.16	-0.09	-0.15	-0.15	-0.25
		[-0.36]	[-0.32]	[-0.18]	[-0.29]	[-0.29]	[-0.48]
ΔMRO			1.77	1.92	1.23	-0.30	-0.36
			[0.55]	[0.60]	[0.32]	[-0.08]	[-0.09]
UMP dummy				0.03	0.04	0.03	0.03
				[2.72]	[2.81]	[2.55]	[2.55]
Expected $\Delta realGDP$					0.34	0.57	0.49
					[0.33]	[0.58]	[0.50]
Expected $\Delta HICP$					-0.79	-0.78	-0.81
					[-0.52]	[-0.52]	[-0.54]
Level shock						19.83	19.39
						[1.18]	[1.17]
Path shock						-2.45	-2.80
						[-0.27]	[-0.30]
Lagged ret							0.06
							[0.89]
adj R^2 (%)	2.92	2.21	1.91	2.63	1.99	3.49	3.22

Table IA.9: Equity Returns over Press Conference Cycles

This table present results on how changes in ECB tone revealed at the most recent ECB press conference (PC_t) affect equity returns. Using data for the EuroStoxx 50 (ESX50), the MSCI EMU (MSCI), the MSCI Value EMU (Value), and the MSCI Growth EMU (Growth), we compute returns from the closing prices on the day preceding PC_t and the day preceding PC_{t+1}. Results excluding PC-day return effects are based on returns computed from the closing prices of the day of PC_t to the day preceding PC_{t+1}. For each index, our sample covers a total of 184 PC-cycle returns (including or excluding PC-days) between the 185 ECB press conferences held from January 7, 1999 to October 2, 2014. *Panels A and B* present results of regressing PC-cycle equity returns on ECB tone changes including the PC-day return and excluding the PC-day return, respectively. Values reported for a and b represent estimates of the intercept and slope coefficients with associated t-statistics i n brackets.

Panel A. PC Cycle Regressions

	a	b	R^2
ESX50	0.12	1.26	3.06
	[0.28]	[2.77]	
MSCI	0.18	1.32	3.52
	[0.40]	[2.95]	
Value	0.27	1.40	3.26
	[0.56]	[2.73]	
Growth	0.12	1.25	3.45
	[0.27]	[3.09]	

Panel B. Regressions excluding PC days

	a	b	R^2
ESX50	0.13	0.89	1.78
	[0.31]	[2.03]	
MSCI	0.19	0.97	2.25
	[0.46]	[2.28]	
Value	0.30	1.10	2.34
	[0.68]	[2.24]	
Growth	0.11	0.85	1.90
	[0.26]	[2.21]	

Table IA.10: Tone Changes: Risk Aversion and Uncertainty

This table present results for regressions of changes in variance risk premia ("risk aversion", Panel A) and changes in expected variance ("uncertainty", Panel B) over PC cycles on lagged tone changes and control variables. We follow Bekaert et al. (2013) and measure uncertainty as the conditional variance ($\widehat{RVAR}_t$) obtained from a regression of realized variance on lagged realized variance and lagged $VSTOXX^2$; the VSTOXX is a volatility index computed from prices of options on the EuroStoxx 50. The regression-implied variance risk premium, i.e. $\widehat{VRP}_t = VSTOXX_t^2 - \widehat{RVAR}_t$, serves as the proxy for risk aversion. In the regressions, we multiply the risk aversion- and uncertainty estimates by 10,000. The setup and all variable names are identical to Table VII . Our sample includes a total of 184 observations between the 185 ECB press conferences from January 7, 1999 to October 2, 2014.

Panel A: Dependent variable: Risk aversion

	(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)
const	0.04	-0.09	-0.06	-0.07	-0.06	-0.06	-0.09
	[0.10]	[-0.20]	[-0.13]	[-0.15]	[-0.12]	[-0.13]	[-0.23]
$\Delta\tau_{t-1,t}$	-2.93	-2.71	-2.76	-2.76	-2.79	-2.86	-2.26
	[-2.34]	[-2.08]	[-2.10]	[-2.08]	[-1.77]	[-1.79]	[-1.75]
$\Delta\tau_{t-2,t-1}$		-0.09	-0.06	-0.06	0.09	-0.08	1.25
		[-0.08]	[-0.05]	[-0.05]	[0.06]	[-0.05]	[1.14]
ΔMRO			2.16	2.17	9.80	11.77	12.80
			[0.51]	[0.51]	[1.38]	[1.66]	[1.46]
UMP dummy				0.00	0.01	0.01	0.02
				[0.09]	[0.18]	[0.17]	[0.52]
Expected $\Delta realGDP$					-2.54	-2.23	-1.39
					[-1.35]	[-1.30]	[-0.77]
Expected $\Delta HICP$					-4.87	-5.00	-4.61
					[-1.66]	[-1.70]	[-1.43]
Level shock						-31.25	-22.40
						[-0.90]	[-0.79]
Path shock						4.17	9.20
						[0.18]	[0.47]
Lagged ret							-0.80
							[-3.42]
adj R^2 (%)	4.87	3.51	3.06	2.50	3.94	4.06	23.78

Panel B. Dependent variable: Uncertainty

	(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)
const	-0.01	-0.32	0.14	0.44	1.67	1.50	1.38
	[-0.01]	[-0.19]	[0.09]	[0.26]	[0.82]	[0.73]	[0.98]
$\Delta\tau_{t-1,t}$	-2.36	-4.25	-5.13	-5.22	-5.97	-6.52	-4.20
	[-0.80]	[-1.36]	[-1.65]	[-1.68]	[-1.77]	[-2.00]	[-1.46]
$\Delta\tau_{t-2,t-1}$		-5.91	-5.46	-5.65	-7.38	-7.92	-2.80
		[-1.88]	[-1.67]	[-1.72]	[-1.96]	[-2.13]	[-1.13]
ΔMRO			33.58	33.18	29.91	32.74	36.72
			[3.10]	[3.06]	[2.26]	[2.44]	[2.64]
UMP dummy				-0.09	-0.10	-0.11	-0.06
				[-1.53]	[-1.78]	[-1.84]	[-1.11]
Expected $\Delta realGDP$					7.95	8.60	11.88
					[2.03]	[2.23]	[3.31]
Expected $\Delta HICP$					9.11	8.17	9.66
					[1.19]	[1.12]	[1.59]
Level shock						-36.42	-2.22
						[-0.29]	[-0.02]
Path shock						50.41	69.81
						[0.62]	[1.19]
Lagged ret							-3.08
							[-7.61]
adj R^2 (%)	-0.11	1.45	4.23	4.01	6.59	6.63	43.56

Figure IA.1: Equity Excess Returns following ECB Press Conferences

(a) Equity excess returns following press conferences

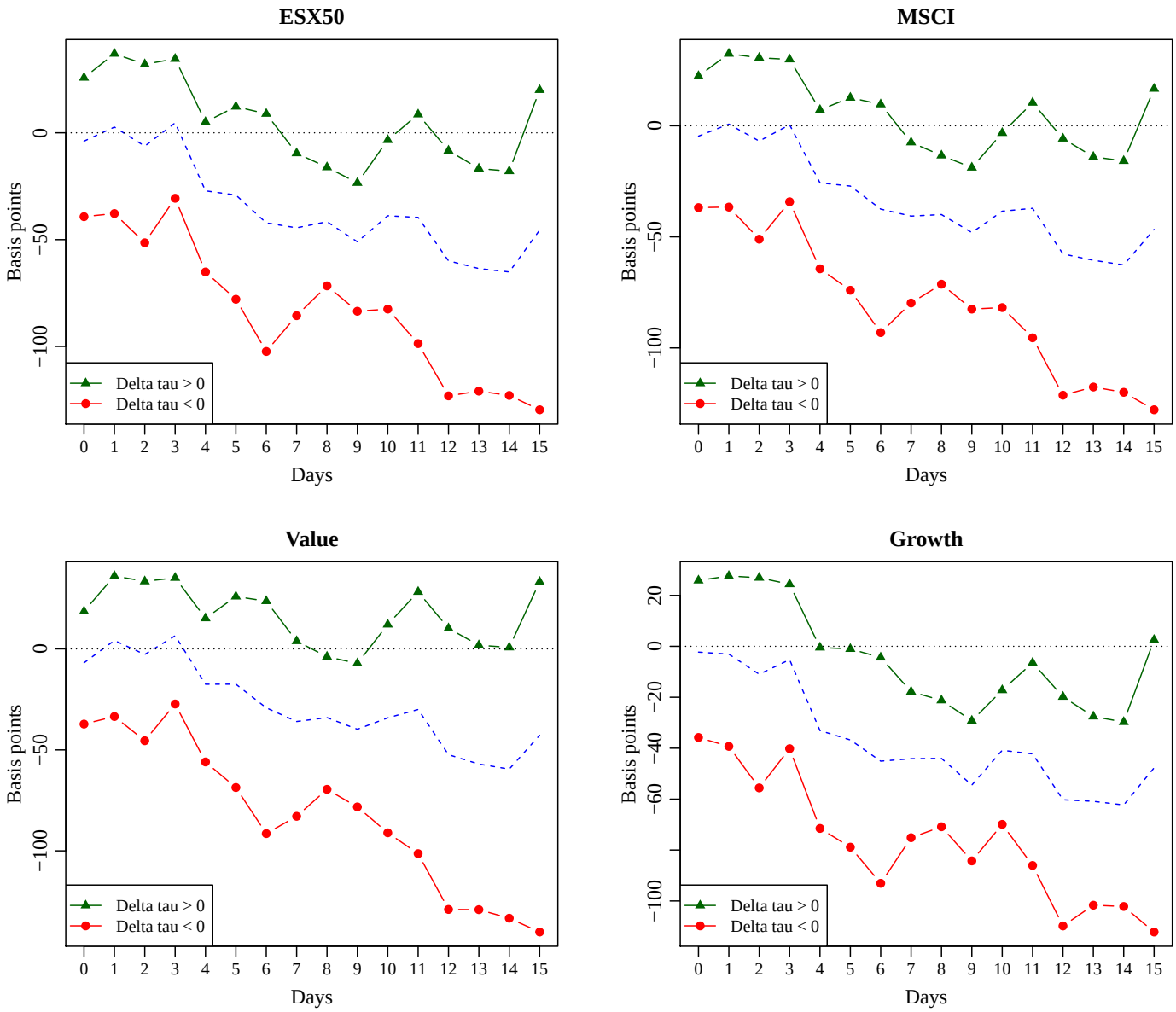


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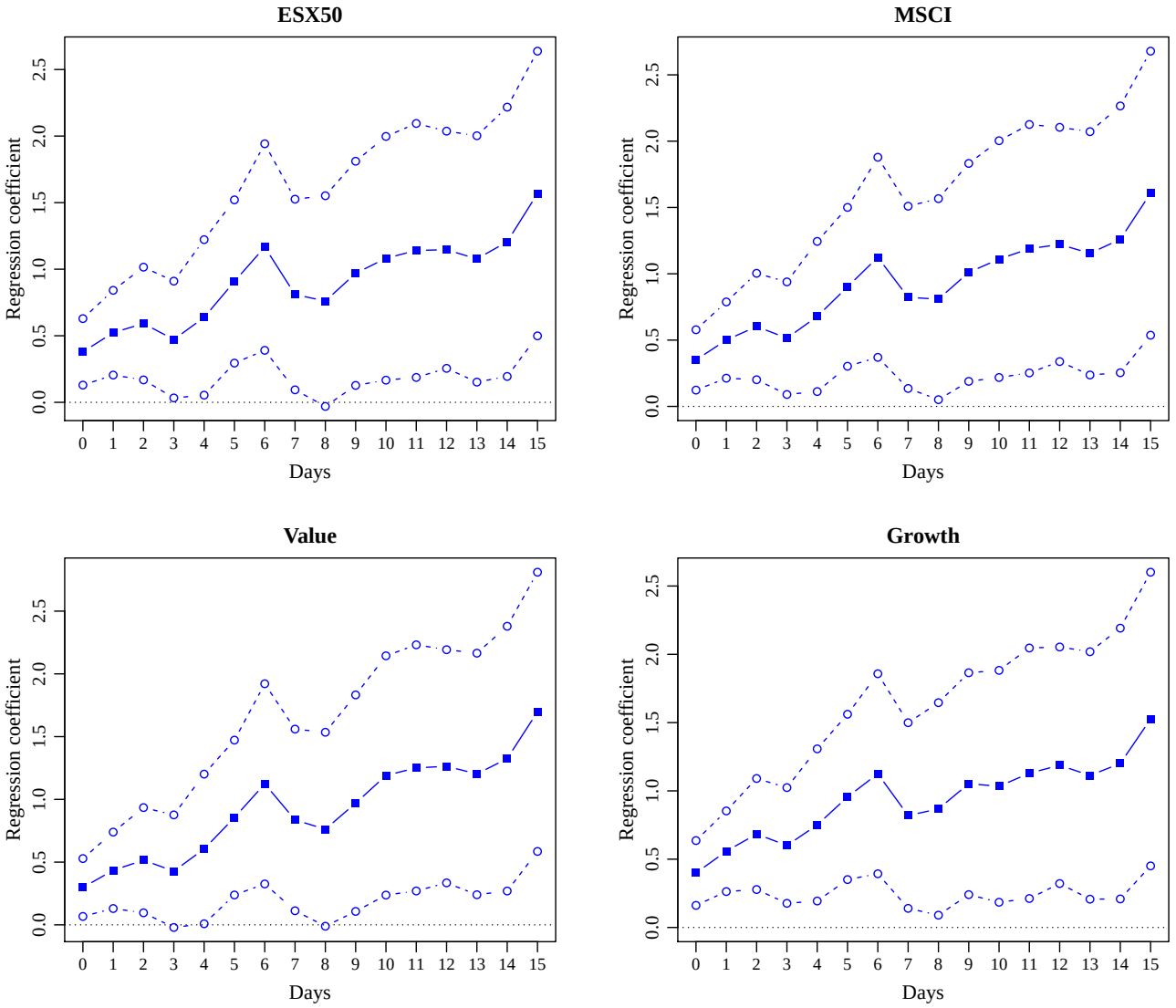
Figure IA.1 *(continued)*

(b) Coefficients of regressing equity excess returns on tone changes



This figure shows how changes in ECB tone revealed at the most recent ECB press conference (PC) affect equity excess returns. In Panel (a), we plot the average k-day cumulative equity excess returns from $k = 0$ (representing the PC-day return) up to $k = 15$. The green (red) lines plot the average cumulative excess returns on the k-th day after the PC, conditional on the tone being revealed at the press conference having been more positive (negative) compared to the previous one; values are reported in basis points. The dashed blue line represents the average excess return accumulating up to day k after the PC. Panel (b) plots the coefficients (and 90% confidence bands based on White (1980) standard errors) for regressing k-day cumulative returns on changes in tone revealed at the preceding press conference. The sample spans a total of 184 tone changes from 185 ECB press conferences between January 7, 1999 and October 2, 2014.

Figure IA.2: Equity Returns following Fed Testimonies

(a) Equity returns after testimonies

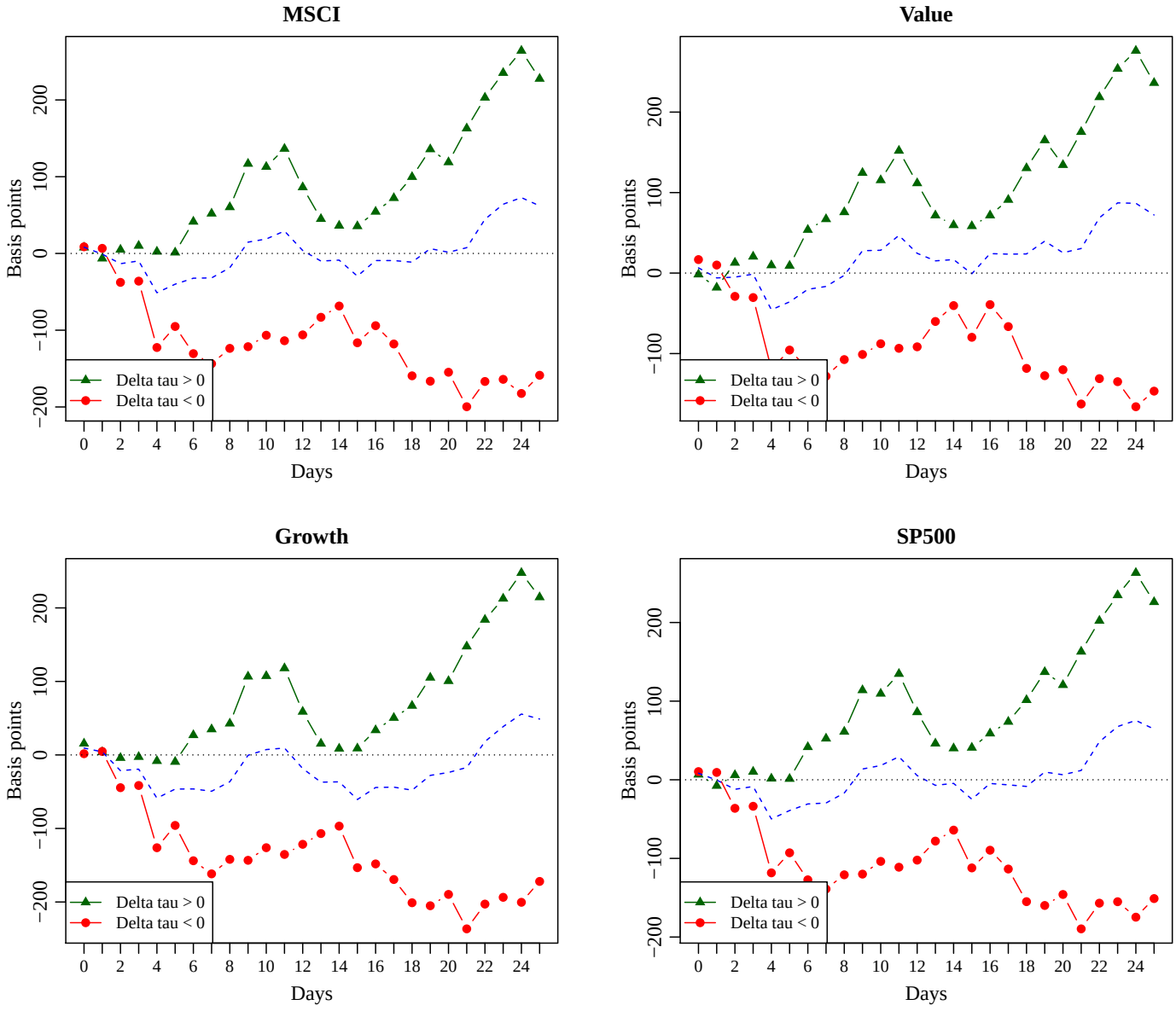


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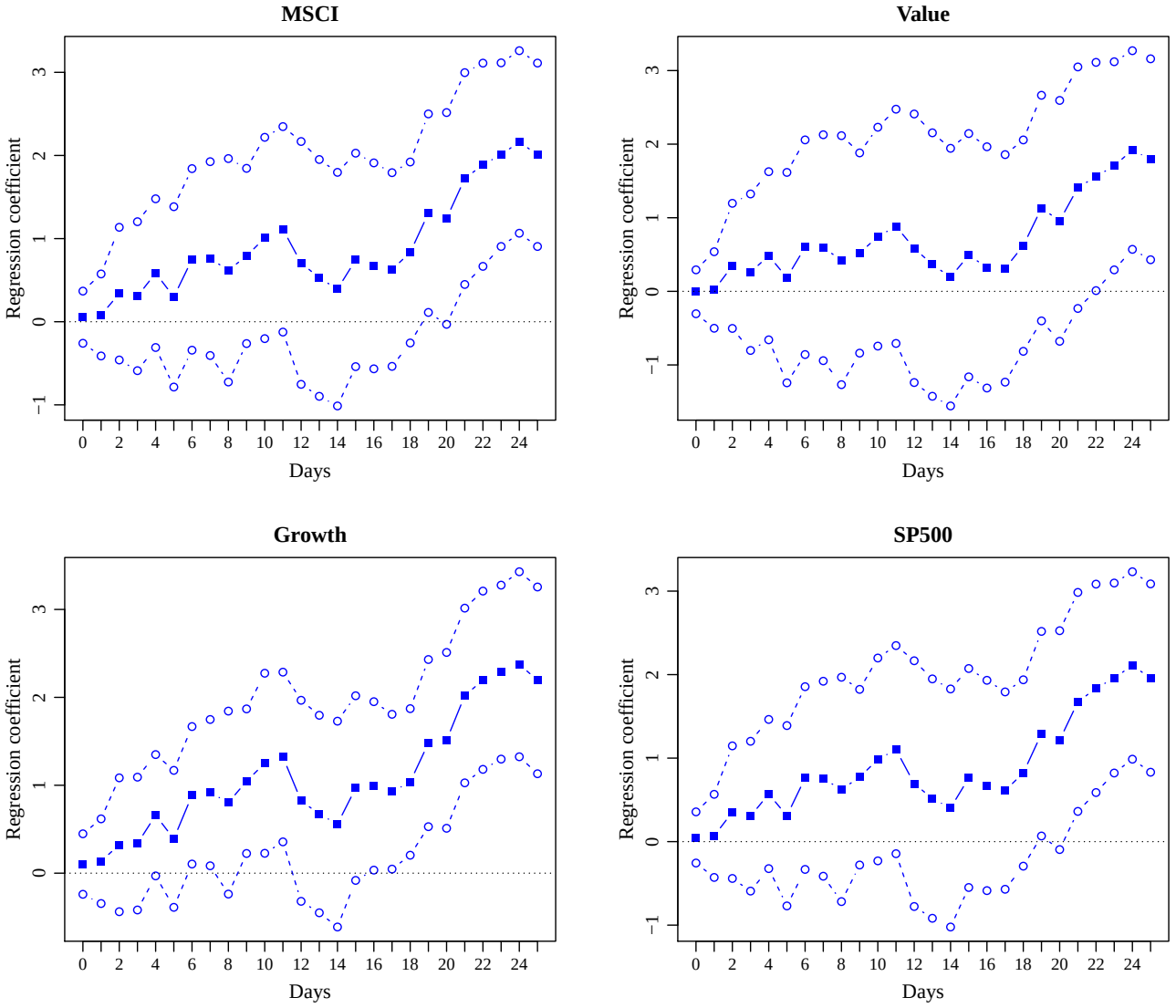
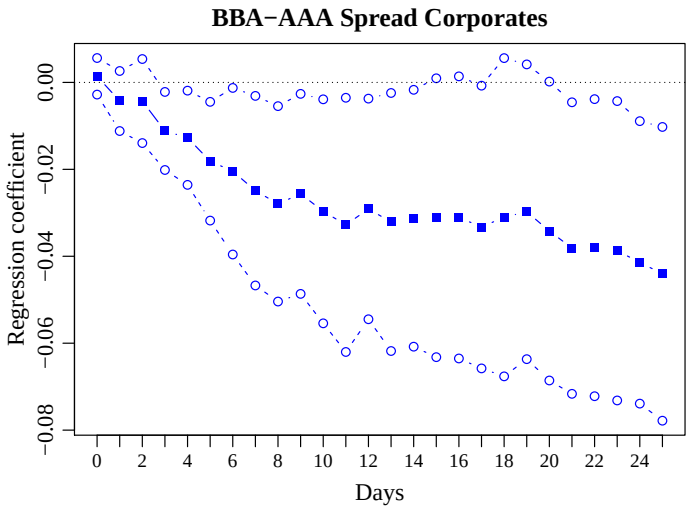
Figure IA.2 *(continued)*

(b) Slope coefficients from regressions of equity returns on tone changes



This figure shows how changes in the tone of the Fed's chair at the most recent testimony to Congress affect U.S. equity returns. In Panel (a), we plot the average k-day cumulative equity return from $k = 0$ (representing the day of the testimony) up to $k = 25$ days after the testimony. The green (red) lines plot the average cumulative excess returns (in basis points) on the k-th day after the testimony, conditional on tone having been more positive (negative) compared to the previous one. The dashed blue line represents the average return accumulating up to day k for all testimonies. Panel (b) plots the coefficients (and 90% confidence bands based on White (1980) standard errors) for regressing k-day cumulative returns on changes in tone at the most recent testimony. The sample spans a total of 36 tone changes from 37 testimonies from 1996 to 2014.

Figure IA.3: Credit Spread Changes following Fed Testimonies



This figure presents results for the relation between ECB tone and corporate credit spreads (BBB-AAA rated corporate bonds). We plot the slope coefficients from regressing credit spread changes on changes in Fed tone ($\Delta\tau$), along with 90% confidence bands (based on White (1980) standard errors). The sample spans a total of 36 tone changes from 37 testimonies from 1996 to 2014.