

WORKING PAPERS

N° 1532

May 2024

“Forward Guidance and Credibility”

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Forward Guidance and Credibility*

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May 7, 2024

Abstract

This paper measures variation in central bank credibility through the level of agreement in a monetary policy committee and empirically studies its relevance for the effectiveness of forward guidance. In the European Central Bank's (ECB) institutional framework, high-frequency identification shows that non-unanimity within the Governing Council makes financial markets doubt the credibility of their commitment to forward guidance promises. Instead, they expect a change in policy direction, regardless of the ECB promising the opposite. Reduced credibility of the commitment then dampens the effect the easing bias in communication has on expectations while confirming unanimity does not seem to reinforce it.

*I am grateful to Tiziana Assenza, Fabrice Collard, Patrick Fève, Christian Hellwig, and Nicolas Werquin for their advice, guidance, and support. I would also like to thank Eugenia Gonzalez-Aguado, Ulrich Hege, Giacomo Mangiante, Nour Meddahi, Christopher Roth, Dmitriy Sergeyev, Michael Weber and participants at the Midwest Macro Fall Meeting 2023, Banque de France - TSE Workshop 2023, EWMES 2023, Northwestern Macro Lunch Seminar and TSE Macro Workshop for valuable discussions, comments, and suggestions. This research was funded in whole or in part by the French National Research Agency (ANR) under project ANR-23-CE26-0011-01.

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“When a central bank’s word is as important as its deed, it pays to be believed.”

Alan S. Blinder, 1998

1 Introduction

Blinder (2000) defines a central bank as credible if “people believe it will do what it says” even if bound by no rule and having an incentive to renege. Before the Great Recession, conventional monetary policy ensured credibility by strictly adhering to a clear policy rule, while in its aftermath the newly-adopted unconventional measures required a greater degree of trust. For instance, a forward guidance promise to keep policy rates low beyond the zero lower bound period entails a subsequent deviation from the policy rule and anchors expectations insofar as the public believes in the central bank’s commitment. However, unprecedented circumstances and time inconsistency leave room for doubt in the central bank’s ability to deliver on the promise, especially if causing avoidable excess inflation, therefore reducing the power of the expectations mechanism. To insist on commitment, central banks can emphasize strong agreement within the decision-making committee, hoping to enhance the policy’s effectiveness. Conversely, weak agreement may make commitment appear less credible.

This paper shows that a lack of unanimity within the monetary policy committee undermines both central bank credibility and the effectiveness of forward guidance while confirming unanimity does not seem to reinforce it. By exploiting the European Central Bank’s (ECB) institutional framework where voting information is released separately from policy announcements and utilizing high-frequency identification, the paper shows that during the period when the ECB strongly commits to monetary easing, news of non-unanimity in the Governing Council leads markets to behave as if anticipating a policy contraction.

The ECB is known to claim a collegial approach to its decision-making, insisting on building consensus and seldom publicly discussing individual opinions.¹ However, that does not mean that the Governing Council never votes. Over the years, as part of their

¹In the words of Wim Duisenberg from July 2002, “The Governing Council’s decisions are decisions by a collegiate body and that every individual member of that body will defend and describe the outcome of certain discussions as if he had been 100% enthusiastic about those decisions.”

regularly held press conference, the ECB presidents often responded to media inquiries about the decision-making process, despite never formally publishing its official voting records. When asked about the voting outcome, they consistently answer by using one of three categories: unanimity, consensus, and majority, describing the latter two as holding notably less agreement than unanimity. For instance, in April 2011, Jean-Claude Trichet said: “*We don’t necessarily wait for consensus when taking our decisions [...] We can decide by majority decision, we can decide by consensus and we can decide unanimously. These are the three categories.*”² The voting outcome information can then be collected from the press conference transcripts. One can reasonably assume that the ECB aims to signal equal commitment with either of the categories; however, it is not a priori clear whether the market interpretation aligns with their intention nor how relevant the interpretation is for the effectiveness of forward guidance.

The key identification challenge lies in separating the market response to voting outcomes from the response to policy announcements, which is feasible in the ECB’s communication framework.³ On the day of a monetary policy meeting, the ECB publishes a press release with decisions of the Governing Council 45 minutes before the press conference. The 45-minute delay and high-frequency financial data enable the identification of the market reaction to press conference communication, including the voting outcomes, that is not confounded with reactions to policy announcements.⁴ As reported in the EA-MP Database of Altavilla et al. (2019), changes in Overnight Index Swaps (OIS) and EURO STOXX 50 stock price index in narrow windows around the two events are used as a proxy for interest rate and output expectations, respectively, and as their identified reaction to policy communication. Once the market reaction to press conference communication is identified, one can test how much of that reaction can be explained by the voting outcome information; by projecting the high-frequency changes in OIS yields and the EURO STOXX 50 index on the categorical voting variable. Estimated coefficients

²Similarly, in January 2015 Mario Draghi said: “The consensus means the following, means that everybody could either agree or not object. The large majority means that a lot of people agreed and a few people objected. So, they are different notions. And you’ll have to get used to these qualifiers. From now on I cannot say we had a fantastic majority or things like that. No. There will be either a majority or a large majority or a consensus, or unanimity.”

³Both the Federal Reserve and Bank of England publish policy announcements and voting records simultaneously.

⁴Brand et al. (2010), Altavilla et al. (2019), and Leombroni et al. (2021), among others, use the same setting and the high-frequency identification approach developed by Gürkaynak et al. (2005) to study the monetary policy of the euro area.

related to unanimous and non-unanimous voting outcomes describe the average direction and magnitude of the financial market response to press conference communication on occasions when the voting information is disclosed, relative to days when it was not. Furthermore, high-frequency co-movement between interest rates and stock prices reveals more information about market expectations (see e.g. Jarociński and Karadi (2020)). Lower interest rate expectations combined with higher output expectations suggest that markets anticipate accommodative policy, and vice versa. Positive co-movement reveals so-called information effects in policy communication.⁵

In this setup, the main empirical finding shows that during the period of forward guidance, in response to non-unanimous voting outcomes financial markets adjust their interest rate expectations *upwards* and output expectations *downwards*, which is in line with anticipating a policy contraction. At the zero lower bound, the ECB engages in a policy that promises to keep interest rates low for the foreseeable future. For that period, the coefficient related to non-unanimous voting outcomes is significant and positive for OIS yields and significant and negative for stock prices, meaning that markets adjust their expectations in the opposite direction of the ECB's promises. Moreover, almost all of the reactions to non-unanimous decisions in this period display the same pattern. Such an adjustment suggests that non-unanimity in the Governing Council is perceived as a signal of change in policy direction, regardless of them promising the opposite. In other words, when faced with disagreement, markets seem to doubt the credibility of the ECB's commitment, undermining the intended impact of the forward guidance efforts. Interestingly, no similar relationship between voting information and either interest rate or output expectations is observed in the pre-forward guidance period, and unanimity does not have a significant impact in either sample.

The rest of the paper is structured as follows. Section 1.1 reviews the related literature. Section 2 describes the voting outcome data and the high-frequency identification of financial market reactions to policy communication. Section 3 shows the results of the interaction between the two. Section 4 concludes.

⁵For instance, if a central bank promises to keep interest rates low for a certain amount of time, markets can interpret the announcement as (i) news of accommodative monetary policy with an optimistic view of the future, causing a decrease in interest rate and an increase in output expectations (*negative co-movement*), or (ii) news of the poor economic outlook, causing a decrease in both interest rate and output expectations (*positive co-movement*).

1.1 Related literature

The challenge of identifying the importance of perceived commitment for the effectiveness of forward guidance lies in its unobservability, keeping the empirical evidence scarce. This paper, to the best of my knowledge, is the first one to develop a measure of central bank credibility and provide reduced-form evidence of its relevance for the proper functioning of policy mechanisms. Andrade et al. (2019), through the Survey of Professional Forecasters, document the existence of a pessimistic type of forecaster who, during the period of forward guidance trusts the Fed to keep interest rates low but simultaneously expects low macroeconomic activity, interpreting the announcement as a sign of worsening economic conditions, as if not believing in the Fed's ability to deliver on its mandate. This paper focuses on financial markets where the lack of credibility seems to work through a different mechanism; the reaction is present already in the interest rate expectations that adjust in the opposite direction of the forward guidance commitment. Other papers studying the relevance of credibility for the effectiveness of forward guidance through a structural model include Bodenstein et al. (2012), Afrouzi et al. (2023), and Park (2023).

This paper contributes to two other strands of literature. The first one studies the impact of voting outcomes and disagreement in monetary policy committees on financial market expectations. Outside of the zero lower bound environment, communicating non-unanimity has been shown to signal a future change in policy direction and improve monetary policy predictability (Gerlach-Kristen, 2004; Horváth et al., 2012; Riboni and Ruge-Murcia, 2014), but also to be counterproductive by negatively affecting stock markets (Madeira and Madeira, 2019; Blot et al., 2023), and policy transmission mechanisms (Tillmann, 2021), making the evidence of the benefits of procedural transparency unclear. Studies that are the closest to the approach of this paper are Tillmann (2021) and Blot et al. (2023). Both use a similar voting dataset to construct an index of dissent; Tillmann (2021) to show that it dampens the reaction of long-term interest rates to policy surprises, and Blot et al. (2023) to show that it acts as an uncertainty shock and negatively affects stock prices. This paper makes two contributions: (i) it shows that the voting outcome information plays a different role in the context of forward guidance and (ii) instead of building an index of dissent, it uses the voting outcome information to measure cen-

tral bank credibility. In an environment where central banks, through forward guidance, clearly announce the future path of policy rates, the predictability role of disagreement loses its purpose and instead affects the credibility of their promises. When a central bank commits to keeping policy rates low for the foreseeable future but simultaneously confirms policy decisions to be non-unanimous, it leaves room for doubt in the credibility of its commitment.

Second, the paper contributes to the empirical literature on the signaling channel of monetary policy, which uses the high-frequency identification methodology developed by Gürkaynak et al. (2005), and mainly to its extension about “information effects” in central bank communication (Nakamura and Steinsson, 2018; Altavilla et al., 2019; Jarociński and Karadi, 2020; Andrade and Ferroni, 2021; Acosta, 2023). By observing the co-movement between interest rate and output expectations, the literature shows that monetary policy announcements convey news about the future path of policy rates and simultaneously private information about the central bank’s assessment of the economic outlook (i.e. the information effect). In the period of the ECB’s forward guidance, the policy news dominates, with little evidence of information effects; Altavilla et al. (2019) also note that after 2014 information shocks are rare. However, the voting information uncovers another layer: although the co-movement is predominantly negative, suggesting policy news, responses to non-unanimous decisions are in line with anticipating a monetary policy tightening in a period of the ECB’s strong commitment to policy easing. In such an environment, describing the financial market reaction as only “policy news” hides an important dimension of the credibility of the central bank’s commitment.

2 Data

2.1 Voting outcomes

The ECB press conferences take place after every regularly scheduled monetary policy meeting and consist of an “introductory statement”, detailing the reasoning behind policy choices and the economic outlook, and a Q&A session with the attending members of the media. Considering that the ECB has never officially published its voting records,

during the Q&A sessions journalists often inquire about the details of the decision-making process. Over the years, the presidents were conveniently consistent with the voting classification when answering journalists' questions, allowing for extracting the information from press conference transcripts,⁶ and grouping it into categories that they defined: *unanimity*, *consensus* and *majority*.

Next to unanimity and majority with a straightforward meaning, consensus is described as a situation where everybody either agrees or no one objects to a particular matter, and a vote is unnecessary.⁷ The difference between unanimity and consensus is not immediate, but the fact that they communicate it separately signals consensus as holding less agreement than unanimity. For this reason, consensus and majority fit in a *non-unanimous* category. The voting outcome is classified as *unknown* whenever journalists do not ask about the voting or the president avoids or refuses to answer.

Gathering information in this fashion results in a dataset that includes all monetary policy decisions the Governing Council took in regularly scheduled meetings, followed by a press conference, between November 2003 and November 2019, matched with the voting outcome, if available. The period covers the presidencies of Jean-Claude Trichet and Mario Draghi, who consistently used the same voting categories.⁸ The policy decisions are grouped into two main categories: (i) decisions on the ECB key policy rates (marginal lending facility rate, main refinancing operation rate, and deposit facility rate), and (ii) decisions on other measures, where the latter covers asset purchases, forward guidance, and credit operations. During Draghi's presidency, other measures were often announced in packages including both new announcements or re-calibrations of earlier measures, spanning several categories, where the voting outcome does not reflect decisions about the containing items but rather about the package itself. Similarly, there was always only one voting outcome reported for the decision on all three interest rates. Therefore, for each regularly scheduled policy meeting, the dataset reports one voting outcome related to the decision on the interest rates and one voting outcome related to other measures, if

⁶Similarly to <https://www.bruegel.org/blog-post/evolution-ecb-governing-councils-decision-making>

⁷"Deciding by consensus does not mean that there is necessarily unanimity, in the sense that if there were a vote all would vote the same. Deciding by consensus means that the conclusions reached by the Governing Council as a whole [...] are supported by the entire Governing Council, by some more enthusiastically than others, but this does not require a vote."
Wim Duisenberg, July 2002

⁸Wim Duisenberg avoided discussing the voting outcomes and would only occasionally confirm consensus.

introduced.

In total, 171 regular meetings are covered by the full sample, out of which 94 were under Trichet’s presidency. Each of the meetings included a decision on the interest rates but only 65 of them introduced other measures, of which 62 were during Draghi’s term. 60 decisions on interest rates and 23 on other measures were reported as unanimous, while 32 on interest rates and 15 on other measures as non-unanimous. Among the other measures, there were 15 announcements of asset purchases, 8 of credit operations, and 57 instances of forward guidance.

Both Tillmann (2021) and Blot et al. (2023) use similar datasets. However, between the three, the voting outcomes are classified following different rules. Tillmann (2021) builds an index of dissent that takes a value of 1 if the president “hints at dissent”. Meetings with no voting information are removed from the dataset, and all other meetings are coded with a 0. Blot et al. (2023), in comparison to Tillmann (2021), describe their data collection as covering measures other than policy rates. For instance, in March 2010, Trichet confirmed that the decision not to change the policy rates was taken unanimously but also that “*there was an overwhelming consensus on the decisions on the unwinding of non-conventional measures*”. As Blot et al. (2023) point out, the meeting in March 2010 is coded as *unanimous* in Tillmann (2021) dataset, while they code it as *dissent*, to include voting on other policy measures. In the dataset of this paper, these two votes are coded separately, unanimity for the decision on policy rates and non-unanimity for other measures.

Another reason for collecting the voting outcomes on the *measure* level is that in some instances sole mentions of either unanimity or dissent might be misleading. For example, in April 2014, the ECB introduced a new type of forward guidance which stated that “*the Governing Council is unanimous in its commitment to using also unconventional instruments*”. Several months later, in September 2014, when confirming that a majority vote decided an asset purchase, a journalist asked Draghi to “*address what appears to be an apparent contradiction*” in saying that they are unanimously supporting the use of non-standard measures and “*yet today [they] had no unanimity*”. Draghi replied that they are “*unanimous in the intent*”, but when deciding exactly which measures to undertake “*there could be differences of view*”.

Figure 1 shows the voting outcomes reported in the described dataset. The top three panels show the level of the ECB’s three key interest rates. The bottom one shows decisions on other measures grouped into three categories: credit operations, asset purchases, and forward guidance. All panels are color-coded according to the voting outcomes.

2.2 High-frequency identification

On the day of every regularly scheduled monetary policy meeting, the ECB press conference takes place 45 minutes after publishing the policy announcement. The 45-minute delay and high-frequency data allow for identifying financial market reaction to press conference communication that is not confounded with reactions to policy announcements. Once the market reaction to the press conference is identified, one can test how much of that reaction can be explained by the voting outcomes.

The information divided in such a way is available in the EA-MP Database constructed by Altavilla et al. (2019). The database contains intraday asset price changes at the time around the policy announcements and subsequent press conferences, for a broad array of assets and several maturities. To calculate the asset price changes, Altavilla et al. (2019) use high-frequency tick data in ten-minute intervals before and after both the press release and the press conference. The data is first discretized by taking the last quote of every minute, and then the median price of an interval is used as either the pre- or post-release quote. The difference between the two is the identified asset price change resulting from the policy event, either the press release or the press conference. To test the impact of communicating voting outcomes to the financial markets, the analysis in this paper includes Overnight Index Swap (OIS) rates with 3 and 6-month and 1, 2, 5, and 10-year maturities, to proxy the risk-free yield curve of the euro area⁹, and EURO STOXX 50 index, to measure high-frequency changes in stock prices.

Due to the particular institutional setting, where the ECB policy communication spans two separate windows (press release and press conference), markets can update expectations about future policy in response to both events separately. Figure 2 combines the

⁹For the 5-year and 10-year maturities the high-frequency OIS data is available only starting from August 2011. Following Altavilla et al. (2019), the dataset uses yields on German sovereign bonds as a proxy for risk-free rates for the two maturities prior to 2011. They show that for identifying market surprises using German yields for the entire period does not make a significant difference.

high-frequency changes in the EURO STOXX 50 index and OIS yields over the whole yield curve, across the two communication windows on each policy-meeting day, for the period between November 2003 and November 2019. Importantly, it verifies that the monetary surprises are independent across the two windows and are measuring reactions to separate sets of news.

3 Results

We can estimate the following equation to investigate the relationship between the identified financial market reaction to press conference communication and the Governing Council’s voting outcomes:

$$\Delta y_{it} = \alpha_i + \beta_{1i} \text{Non-unanimous}_{jt} + \beta_{2i} \text{Unanimous}_{jt} + \beta_{3i} X_t + \epsilon_{it}, \quad (1)$$

where Δy_{it} are high-frequency changes in EURO STOXX 50 index (in percentage points) and OIS yields for maturity i ranging between three months and ten years (in basis points), in a narrow window around a press conference.¹⁰ The high-frequency changes are projected on a categorical voting outcome variable with three levels – unanimous, non-unanimous, and unknown separately for decisions on interest rates and other measures (j) while controlling for general economic uncertainty, volatility in the financial markets, the direction of policy rate changes, and re-calibrations of asset purchase programs (X_t).¹¹

The same is repeated on two separate samples covering (i) forward guidance and, for comparison, (ii) Trichet presidency. The sample relevant to forward guidance spans from July 2013 to November 2019, marking the first official use of forward guidance as a policy option and the end of Draghi’s presidency, respectively. During this period, forward guidance was communicated in some way in every introductory statement released by the ECB. The sample covers 57 meetings which include 10 decisions on interest rates and 12 on other measures that were reported as non-unanimous, 5 on interest rates and 21 on other

¹⁰It is relevant to look only at the press conference window as this is when the voting information is provided.

¹¹Controls include: (i) EURO STOXX 50 Volatility Index (VSTOXX), (ii) European Economic Policy Uncertainty Index (Baker et al., 2016), (iii) dummy variable controlling for the direction of the interest rate change, and (iv) dummy variable controlling for announcements and re-calibrations of the asset purchase programs.

measures reported as unanimous; the rest is coded as unknown. Trichet sample covers the period between November 2003 and November 2011; he uses the same voting categories as Draghi but operates in a pre-forward guidance environment. Out of 94 meetings, there were 48 unanimous and 14 non-unanimous decisions on interest rates. Out of three other measures introduced in that period, two were unanimous and one non-unanimous.

Figure 3 shows the estimated coefficients β_{1i} (*non-unanimous*) and β_{2i} (*unanimous*) for decisions on interest rates, with 95% confidence intervals, in the forward guidance sample and the Trichet sample in the top and bottom panel, respectively.¹² It displays two important points. First, there is a significant difference in the explanatory power of the voting variable between the two samples: the adjusted R-squared for OIS yields ranges between 0.18 and 0.40 in the top panel, compared to around zero in the Trichet sample, showing the voting outcomes to be much more relevant for explaining the financial market reactions to press conference communication in the period of forward guidance. Second, in the forward guidance sample, non-unanimous decisions are associated with a significant *increase* in OIS yields across the whole yield curve, of magnitude between 1 and 2.5 basis points, and with a significant *decrease* in stock prices, of magnitude around 0.5 percentage points, relative to occasions with no voting information available.

An increase in interest rate expectations coupled with a decrease in output expectations is in line with a response as if anticipating a policy contraction. Such an adjustment suggests that disagreement is perceived as a signal of change in the policy direction, even if the ECB is promising the opposite. The forward guidance period features exclusively easing policy measures, and as the interest rates are already at or very close to zero, the ECB engages in unconventional policy. They actively communicate an easing bias and reassure the markets that they intend or expect to keep interest rates low for the foreseeable future. Easing monetary measures, combined with an easing bias in communication, are expected to, if anything, shift the interest rate expectations downwards. However, when the Governing Council confirmed non-unanimity, the adjustment in expectations on average moved in the opposite direction of what they were promising the future to be.

If the central bank commits to keeping policy rates low for a certain amount of time

¹²Figure 6.5 shows similar results for votes on other measures, however only for the forward guidance sample; there were very few *other* measures introduced during Trichet's presidency.

but simultaneously confirms that a particular decision to change or not change the rates was not unanimously supported by the policy committee, markets may question the credibility of the promise and interpret it instead as a signal of the future move in the opposite direction occurring sooner than initially anticipated. This suggests that the news of non-unanimity makes the easing bias in communication less credible, making it counter-productive to policy measures.

Interestingly, in the Trichet sample, the voting variable is insignificant with no explanatory power, and unanimity does not seem to have a significant effect in either sample. In the forward guidance sample, the sign of the unanimity coefficients is, as expected, negative but estimated on too few observations. The number of unanimity occurrences in other measures is much larger but the estimates are similar both in terms of size and significance (see Figure 6.5).

The ECB’s historical insistence on acting as a “collegiate body” combined with a higher frequency of unanimous voting outcomes seemingly has led markets to expect unanimity to be the norm. The relatively rare occurrence of disagreement then carries substantial weight, influencing market behavior contrary to the ECB’s forward guidance, ultimately reducing its effectiveness.

3.1 Information effects and credibility

When studying financial market response to central bank communication, recent literature (e.g., Nakamura and Steinsson (2018), Jarociński and Karadi (2020), Acosta (2023)) examines the high-frequency co-movement between interest rate and output expectations to isolate the response to news about the future path of policy rates from the contemporaneous news about the central bank’s assessment of the economic outlook. For instance, if a central bank announces a promise to keep policy rates low during a certain period, it reveals simultaneously the good news of a more accommodative monetary policy and the bad news of a poor economic outlook. The literature terms the latter “information effects” and argues that the contrasting interpretations of the effects of a lower future interest rate path should yield opposite impacts on expectations of future output. Negative co-movement between the two implies that markets place greater emphasis on actual

policy news, while positive co-movement indicates a stronger market response to news about the central bank's assessment of the economic outlook.

Figure 4 expands on the previous exercise and displays scatter plots including the high-frequency changes in OIS yields and stock prices, color-coded according to the voting outcome of interest rate decisions, for the forward guidance sample and the Trichet sample in the top and bottom panels, respectively. For simplicity, it shows changes in OIS yields at maturities between one and ten years, where the voting variable seems to matter the most, although similar effects are also observed at the shorter end of the yield curve (see Figure 6.6).

First, the figure displays the high-frequency reactions to all press conferences in both samples, which proves useful considering the size of the sample. It shows that the negative co-movement in the forward guidance sample documented in the previous section is not driven by one or two observations, but that almost all non-unanimous decisions across the whole yield curve are related to an increase in yields and a decrease in stock prices. Second, in an environment including both accommodative and restrictive policy measures, a negative correlation implies that the market reaction reflects more the policy news relative to the outlook news. However, the period covered by the forward guidance sample includes exclusively easing policy moves, coupled with a strong easing bias in communication, which means that market responses should primarily lie in the second or the third quadrant, depending on the reaction in output expectations. Instead, a cluster of responses is positioned in the fourth quadrant, with the strongest ones related to non-unanimous decisions. In such an environment, describing the market reaction as only "policy news" hides the dimension of the credibility of the central bank's commitment, highlighting its importance in shaping market responses to the communication policy. No similar patterns can be observed in the Trichet sample.

4 Conclusion

This paper measures variation in central bank credibility through the level of agreement in a monetary policy committee and empirically studies its impact on the effectiveness of forward guidance. In the ECB's institutional setting, it extracts voting information

from press conference transcripts and utilizes a high-frequency identification strategy to separate the financial market reaction to general policy communication from the reaction to policy announcements. Combining the two helps in understanding how much of the market response to press conference communication can be explained by the voting outcome information.

The main empirical finding shows a significant increase in interest rate expectations and a decrease in output expectations related to non-unanimous voting outcomes in the period of forward guidance, suggesting anticipation of a change in the policy direction, regardless of the ECB promising the opposite. The reduced credibility of the ECB's commitment lessens the expectations mechanism of forward guidance, decreasing its effectiveness, while confirming unanimity does not seem to reinforce it. The surprisingly asymmetric relationship between voting outcomes and market expectations calls for a re-consideration of the communication strategy that seems to become counterproductive to policy efforts.

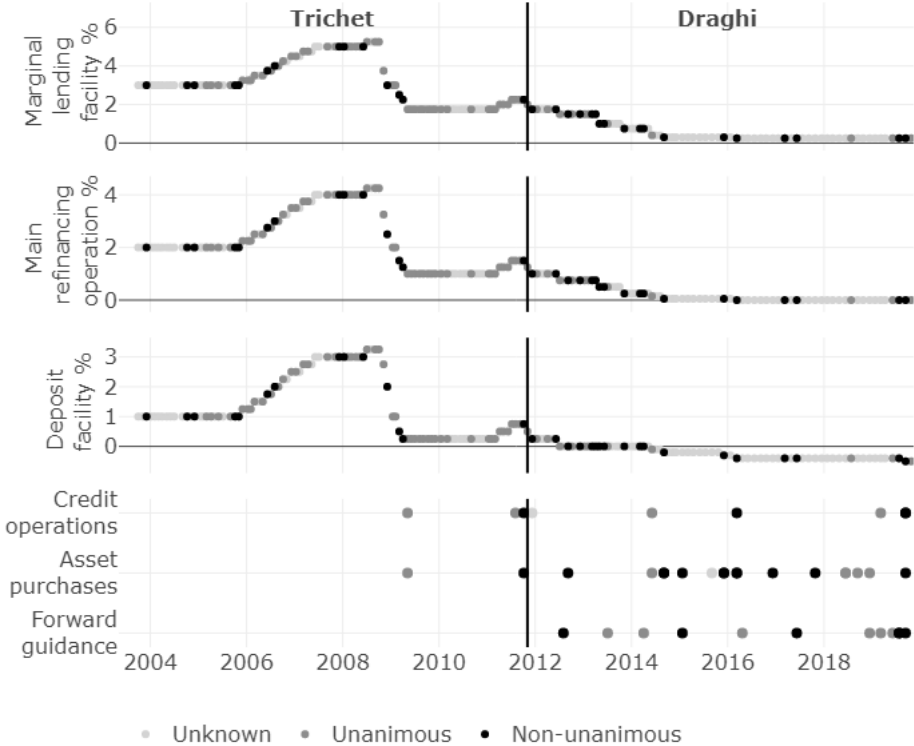
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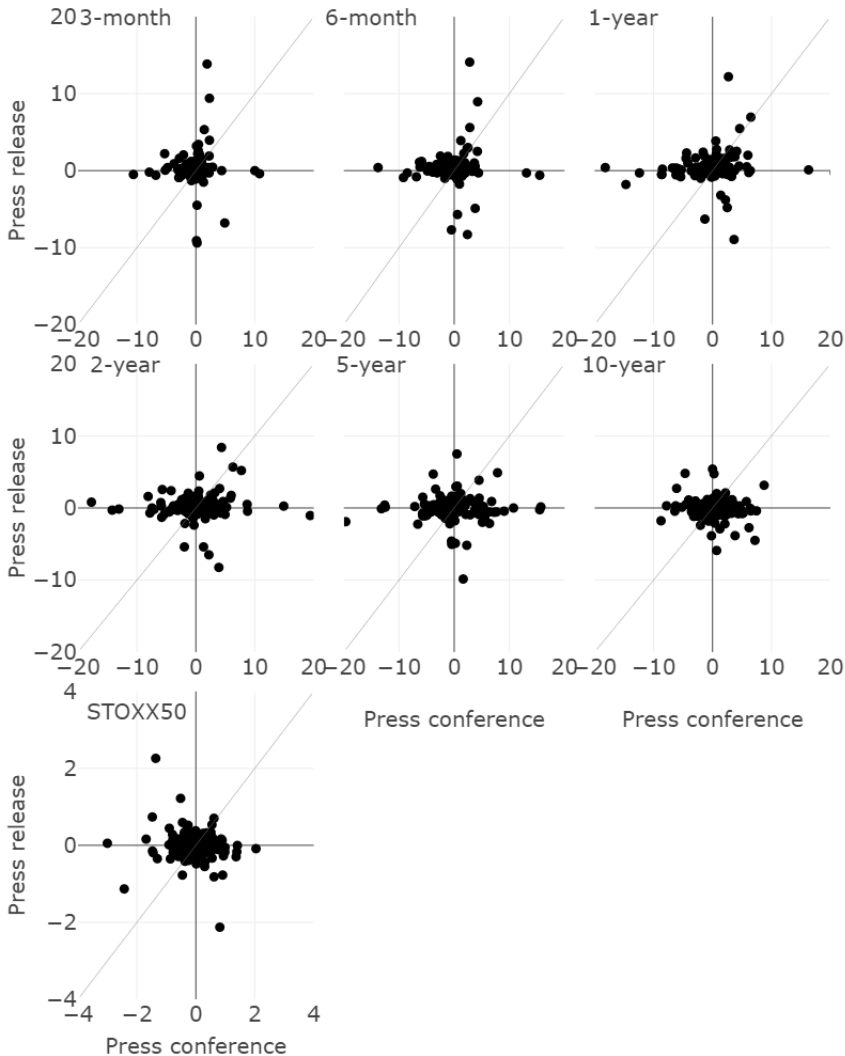
5 Figures

Figure 1: Voting outcomes



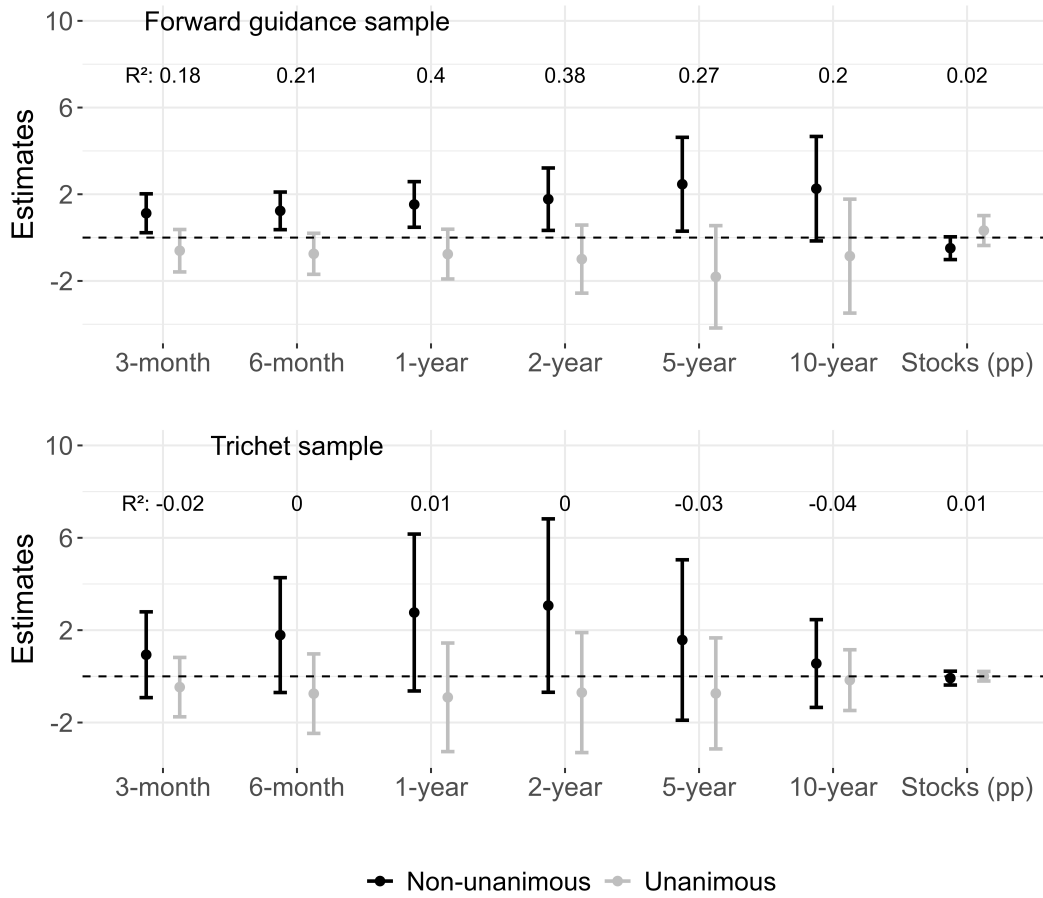
Note: The chart shows the level of the ECB’s three key policy rates (marginal lending facility rate, main refinancing operation rate, and deposit facility rate) in the top three panels, and the decisions on all other policy measures in the bottom panel, between November 2003 and November 2019, color-coded according to the voting outcome of the Governing Council. Asset purchases include new announcements and re-calibration of existing programs. For simplicity, the forward guidance category in the figure includes only new announcements and subsequent re-wordings, while the dataset covers all forward guidance communication.

Figure 2: High-frequency reactions to press releases and press conferences



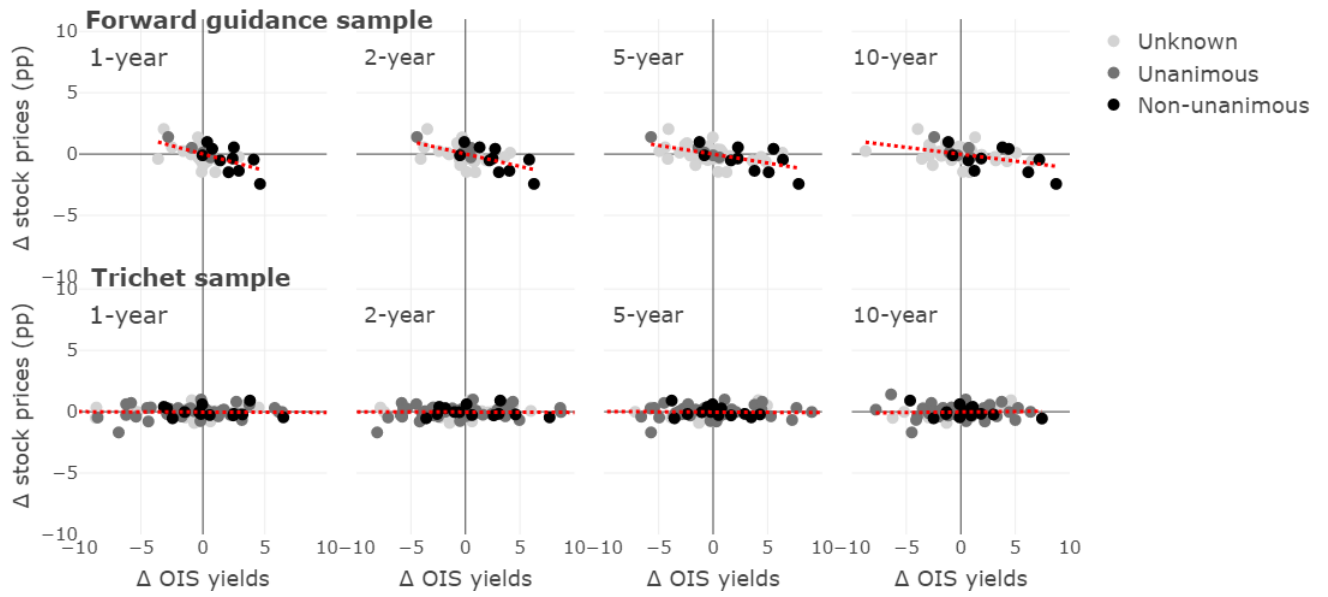
Note: The chart shows high-frequency changes in OIS yields for the maturities between three months and ten years (in basis points), and high-frequency changes in the EURO STOXX 50 index (in percentage points), both around press releases (on the vertical axis) and press conferences (on the horizontal axis), for the period between November 2003 and November 2019. One dot on the chart represents one policy meeting.

Figure 3: Results - Interest rate decisions



Note: The figure shows estimated coefficients of equation (1) (β_{1i} and β_{2i}) for decisions on interest rates, for OIS yields in basis points and the EURO STOXX 50 index in percentage points, with 95% confidence intervals, in the forward guidance sample (07/2013-11/2019) and the Trichet sample (11/2003-11/2011) in the top and bottom panels, respectively. Text in the body of the charts shows adjusted R-squared for all maturities and both samples.

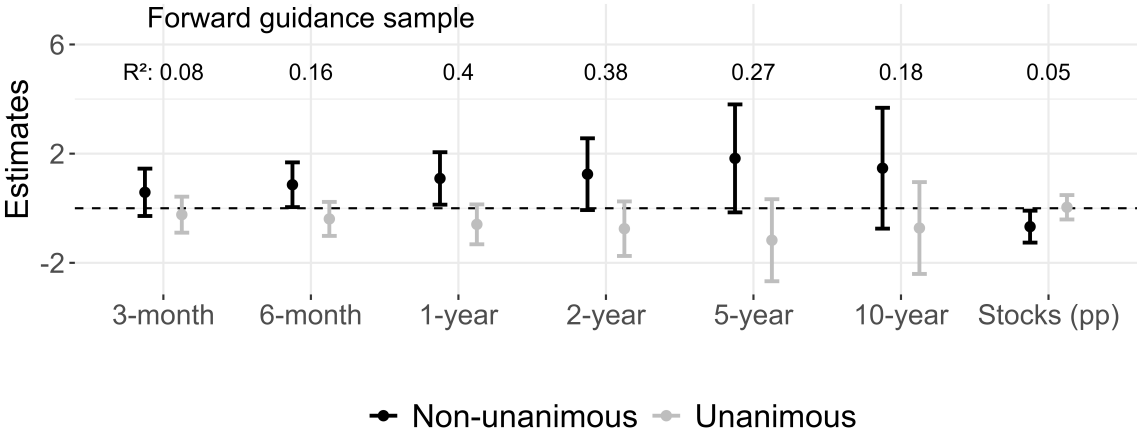
Figure 4: Co-movement of monetary surprises



Note: The charts show the co-movement between the high-frequency changes in the EURO STOXX 50 index (vertical axis, in percentage points) and high-frequency changes in OIS yields (horizontal axis, in basis points) of maturities between 1-year and 10-years, and are color-coded according to the voting outcome. The top and bottom panels cover the forward guidance sample and Trichet sample, respectively.

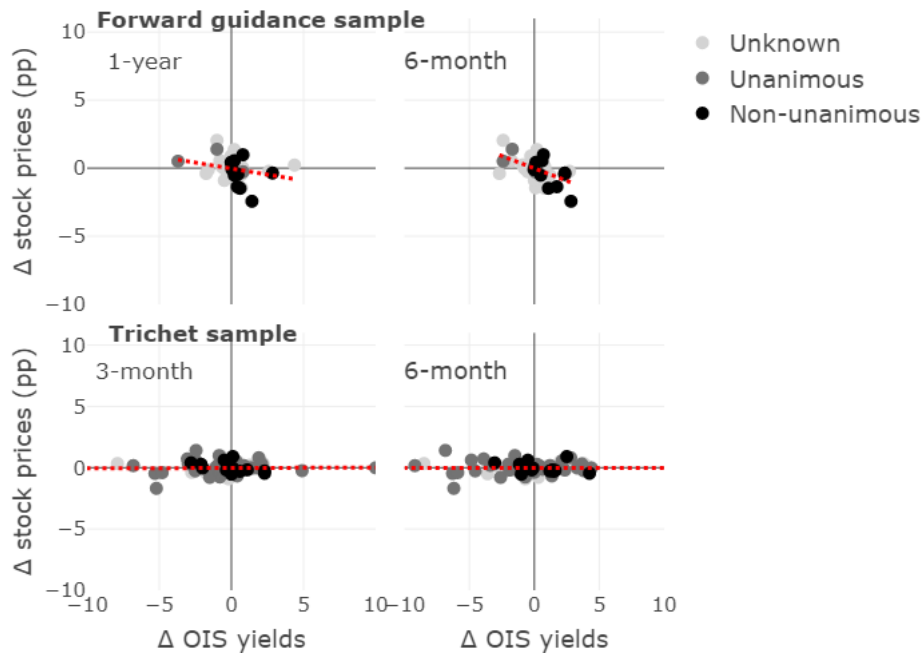
6 Appendix

Figure 6.5: Results - Decisions on other measures



Note: The figure shows estimated coefficients of equation (1) (β_{1i} and β_{2i}) for votes on other measures, for OIS yields in basis points and the EURO STOXX 50 index in percentage points, with 95% confidence intervals, in the forward guidance sample (07/2013-11/2019). Text in the body of the charts shows adjusted R-squared for all maturities and both samples.

Figure 6.6: Co-movement of monetary surprises



Note: The charts show the co-movement between the high-frequency changes in the EURO STOXX 50 index (vertical axis, in percentage points) and high-frequency changes in OIS yields (horizontal axis, in basis points) for 3-month and 6-month maturities, and are color-coded according to the voting outcome. The top and bottom panels cover the forward guidance sample and Trichet sample, respectively.