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# Disagreement inside the FOMC: New Insights from Tone Analysis

Hamza Bennani and Davide Romelli

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# Disagreement inside the FOMC: New Insights from Tone Analysis\*

Hamza Bennani  
University of Nantes

Davide Romelli<sup>†</sup>  
Trinity College Dublin

## Abstract

This paper analyses the drivers of divergence in tone among Federal Open Market Committee (FOMC) members using text analysis tools. We use a financial dictionary to measure the tone of FOMC transcripts at the speaker-meeting-round level. We then relate the tone of FOMC members' remarks with their individual projections for inflation and unemployment rate. Our results show a positive relationship between inflation projections and the tone used by FOMC members, suggesting that divergence in tone among members is mainly driven by differences in their projected levels of inflation. We also show that Federal Reserve Bank presidents and voting members are those who use a more distinct tone, in particular during the economics go-round.

**Keywords:** Central banks; Monetary Policy Committees; FOMC.

JEL classification: E52, E58

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<sup>†</sup>Corresponding author: Department of Economics, Trinity College Dublin, Arts Building, Dublin 2, Ireland. email: romellid@tcd.ie.

“I’m sure it is no surprise to many of you that I had some strong disagreements in the first half of 1987 concerning monetary policy.”

—MR. ANGELL, 22 AUGUST 1989

“In terms of my own forecast, as I’ve said before, I think the output gap is less negative than is implied by this . . . Here, I guess I disagree slightly with Governor Powell that it matters whether the output gap is minus 4 percent or minus 2 percent.”

—MR. KOCHERLOKOTA, 1 AUGUST 2012

“So, in summary, Mr. Chairman, I disagree with this course. I think it is a mistake. It steers us closer to the rocks. But I have offered you my best advice under the circumstances. I wish you luck. I will do my very, very best in my public appearances in the upcoming week to support what we are going to announce, even if I have to take Allegra to do it.”

—MR. FISHER, 13 SEPTEMBER 2012

## 1 Introduction

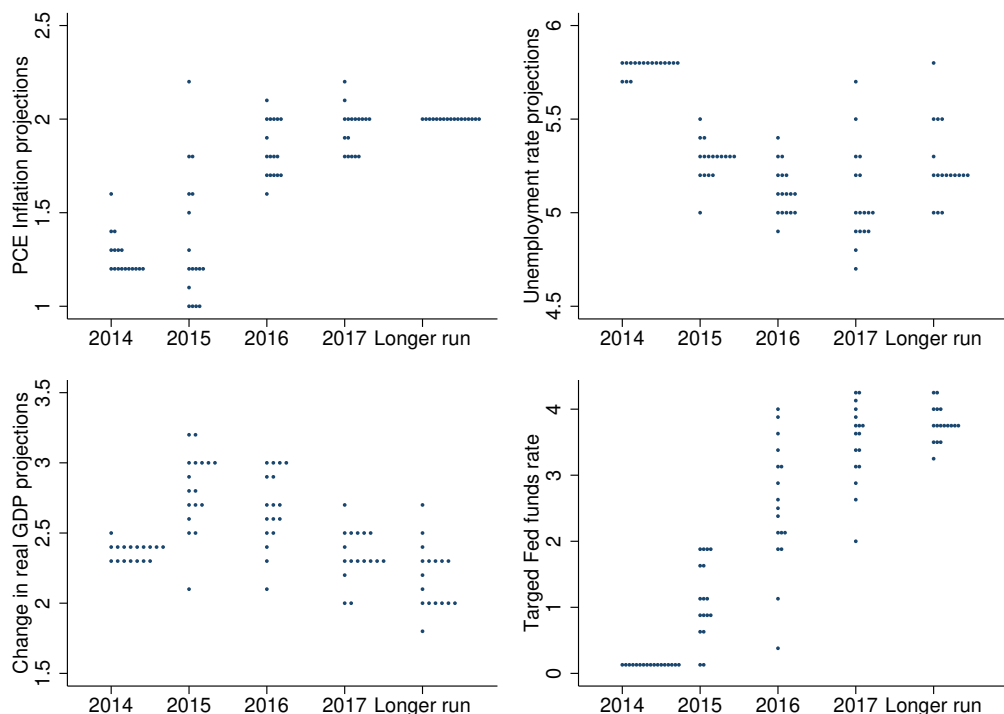
Members of the Federal Open Market Committee (FOMC) often disagree on how to implement monetary policy to achieve macroeconomic objectives. For example, [Romer and Romer \(2004\)](#) show that Federal Reserve (Fed) members are heterogeneous in their views about the workings of the macroeconomy and the effects of monetary policy. The post-crisis period was also characterized by high level disagreement among FOMC members, with an average of one dissent per meeting between 2008 and 2013.<sup>1</sup> In support of this idea, the projections published in the Summary of Economic Projections (SEP) in December 2014, i.e. ‘the dots’ (Figure 1), reflect the high degree of heterogeneity in the macroeconomic projections provided by FOMC members, suggesting internal disagreement about the future path of the policy rate.

Previous literature has found that disagreement among FOMC members influences the effectiveness of monetary policy. [Detmers \(2016\)](#) uses the discrepancy of the dot projections as a measure of disagreement. She finds that high levels of disagreement among monetary policy makers lower the information content of forward guidance and weaken the Fed’s commitment as perceived by financial markets. Following this line of thought, [Bongard et al. \(2017\)](#) show that markets react to surprises in the SEP dots. Hence, the large dispersion of the projections for the federal funds rate might add further

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<sup>1</sup>After the FOMC lowered federal funds rate (FFR) target to a range between 0.00% and 0.25% in 2008, some members expressed skepticism about the use of certain unconventional policy measures to further ease monetary conditions.

**Figure 1: Dot plot of FOMC members' projections  
(December 2014 meeting)**



Notes: This Figure shows the 'dots' for the December 2014 meeting. In particular, in the figure in the bottom-right corner, each dot is associated with the short and long run levels of the federal funds rate which would be needed to achieve the Fed statutory objectives, as suggested by each FOMC members.

noise and volatility to financial markets, thus threatening the macroeconomic objectives of the Fed. [Madeira and Madeira \(2019\)](#) show that US stock market prices increase after monetary policy announcements when the votes of FOMC members are unanimous and fall when dissent occurs. Looking at the European Central Bank (ECB) case, [Tillmann \(2021\)](#) constructs an index of dissent based on the ECB's president answers to media questions, during the press conference. He shows that dissent reduces the effectiveness of monetary policy.

Consequently, disagreement among FOMC members is an important determinant of monetary policy effectiveness. This raises a fundamental question: what are the determinants of disagreement during committee meetings? In this paper, we analyse FOMC transcripts using text analysis tools to gain insights into this question. Specifically, we use a bag-of-words approach and the financial dictionary proposed by [Loughran and McDonald \(2011\)](#) (LM) to measure the positive/negative tone of FOMC members'

discussions during the overall meeting, as well as during the economics and policy go-rounds, over the period 1992-2009. Our hypothesis is that the words used by FOMC members in their remarks allow the measuring of the tone of the discussions, and that divergence in tone among these members reflect a certain degree of disagreement. In doing so, we follow [Tillmann and Walter \(2019, 2018\)](#) who use text analysis on speeches of the ECB and the Bundesbank presidents to quantify the tone of each remark and consider differences in tone as a proxy for conflicting views.

The measurement of tone at the speaker-meeting-round level reveals that there are differences in tone among FOMC members, suggesting the existence of disagreement inside the committee. Interestingly, FOMC members seem to express disagreement during the economics go-round in particular. Next, we study the drivers of differences in tone among FOMC members, relying on the literature focusing on the drivers of monetary policy preferences, and key macroeconomic forecasts (see [Romer and Romer, 2008](#); [Eichler and Löhner, 2014, 2018](#); [Malmendier et al., 2021](#), among others). Specifically, we study how the tone used by FOMC members is related to their: (i) individual projections for inflation and unemployment rate, (ii) personal characteristics, (iii) speaker class (Board member or Bank president), (iv) voting status, (v) tenure inside the FOMC and (vi) personal experiences of inflation and recession.

Our results show that differences in inflation projections are associated with differences in the tone used by FOMC members during the economics go-round. In particular, we find that an increase of 0.2 percentage points in the projected inflation during the economics go-round, i.e. the average value of the within-meeting standard-deviation, is associated with an increase of about 0.06 in the tone, or about 1/3rd of its standard deviation. While we find a strong effect of inflation projections on the tone, our results show no evidence in support of the idea that the level of projected unemployment rate and personal characteristics influence the divergence in tone during FOMC meetings. Our results also suggest that the tone of Bank presidents and voting members is most affected by differences in the level of projected inflation, especially during the economics go-round. Interestingly, while regional economic conditions, as proxied by the district-level unemployment rate, affect the FOMC members' tone, a longer tenure inside the FOMC weakens the relationship between individual inflation projections and tone. Finally, we show that the level of inflation and recessions experienced by FOMC members during their lifetime exert a significant and negative effect on the relationship between inflation projections and tone. This suggests that FOMC members with longer tenure or with personal experiences of inflation and recession adopt a tone that is less positive in nature when their inflation projections deviate from the within-meeting mean of

inflation projections.

The robustness of these results is checked along several lines. First, we use an alternative approach to identify the tone of discussions, by computing the net index of hawkishness proposed in [Apel et al. \(2019\)](#). Next, we use a different normalisation strategy to compute the tone of discussions presented in the baseline estimations. Finally, we test the robustness of our results by focusing on the post-November 1993 period, the date after which the Chair of the FOMC made official his intention to make the FOMC transcripts available to the general public with a lag of five years. The results are robust to all these alternative specifications and provide strong evidence in support of the idea that the divergence in tone and thus, the disagreement, is mainly driven by differences in the levels of individual projected inflation.

Overall, these results show the prominent role played by inflation in explaining disagreement among FOMC members, especially during the Greenspan era. This confirms the relevance of previous findings that show (i) that there were substantial disagreement among members on how to respond to the projected levels of inflation ([Banterghansa and McCracken, 2009](#); [Jegadeesh and Wu, 2015](#)), and (ii) that non-voters use inflation forecasts to influence policy deliberations ([Tillmann, 2011](#)).

This paper contributes to two strands of the literature. First, the literature which uses text analysis tools to study central bank communication. [Hansen and McMahan \(2016b\)](#) use computational linguistics techniques to examine the effect that the release of information has on the state of the economy and the effect that guidance on future monetary policy decisions has on macroeconomic and financial variables. They find that shocks to forward guidance have a stronger impact on market and real variables than the FOMC communication of current economic conditions. [Apel et al. \(2019\)](#) measure the degree of hawkishness of FOMC members to compare the predictive content of FOMC's minutes and transcripts. They show that transcripts contain information that is filtered out of minutes and is not contained in macroeconomic and financial variables. [Shapiro and Wilson \(2019\)](#) measure the tone of FOMC deliberations to estimate their short-run loss function. Their analysis indicates that the FOMC had an implicit inflation target of approximately 1.5 percent on average over the period 2000-2013. [Cieslak and Vissing-Jorgensen \(2020\)](#) show that the tone of FOMC transcripts relates to stock returns, with high stock market returns leading to more positive stock market mentions. Finally, [Hubert and Labondance \(2021\)](#) find that the tone of FOMC statements explains monetary surprises beyond the information released on policy announcement days and that it matters more around monetary cycle turning points.

Second, we contribute to the literature investigating the determinants of differences

in FOMC members' tone during committee meetings. Cannon (2015) uses language-processing tools to measure the tone of FOMC deliberations and to examine how the tone of the discussions relates to a measure of economic activity. She finds that the composition and tone of Board members is different from the one of Bank presidents. More specifically, the tone of Bank presidents has been consistently more positive than that of Board members. In addition, she shows that the tone of the FOMC discussions is strongly related to real economic activity, but that this relationship varies by speaker class, i.e. Board member or Bank president. Finally, Malmendier et al. (2021) focus on how personal experiences explain differences in tone across FOMC members' public speeches. They find that FOMC members use a significantly more hawkish tone when their lifetime experiences imply a higher experience-based inflation forecast.

The rest of the paper is structured as follows. Section 2 describes the methodology used to compute the tone of FOMC members during FOMC meetings. Section 3 presents the data and provides some stylised facts. Section 4 introduces the empirical setup. Section 5 reports the main results while in section 6 we perform several robustness tests. Section 7 concludes.

## 2 Differences of tone inside the FOMC

### 2.1 FOMC transcripts: an overview

We collect information on the FOMC transcripts from the Federal Reserve Board of Governors' website.<sup>2</sup> Given that individual FOMC members' projections are available with a lag of 10 years, we extract the transcripts of all the regular FOMC meetings from 1992 to 2009. This period covers most of Alan Greenspan's tenure, from 1987 to 2006, and the first term of Ben Bernanke. The sample includes a total of 144 FOMC transcripts. After the exclusion of all the discussions by non-FOMC members, our database focuses on a total of 41,075 utterances (paragraphs) by 51 FOMC members, as most speakers make more than one intervention during a given meeting. Using publicly available data, we are also able to create the list of Federal reserve governors and presidents, as well as the list of voting and non-voting members over the 1992-2009 period.<sup>3</sup>

We focus our study on the FOMC transcripts as these documents provide the best tool for examining differences between FOMC members (Schonhardt-Bailey, 2013). In

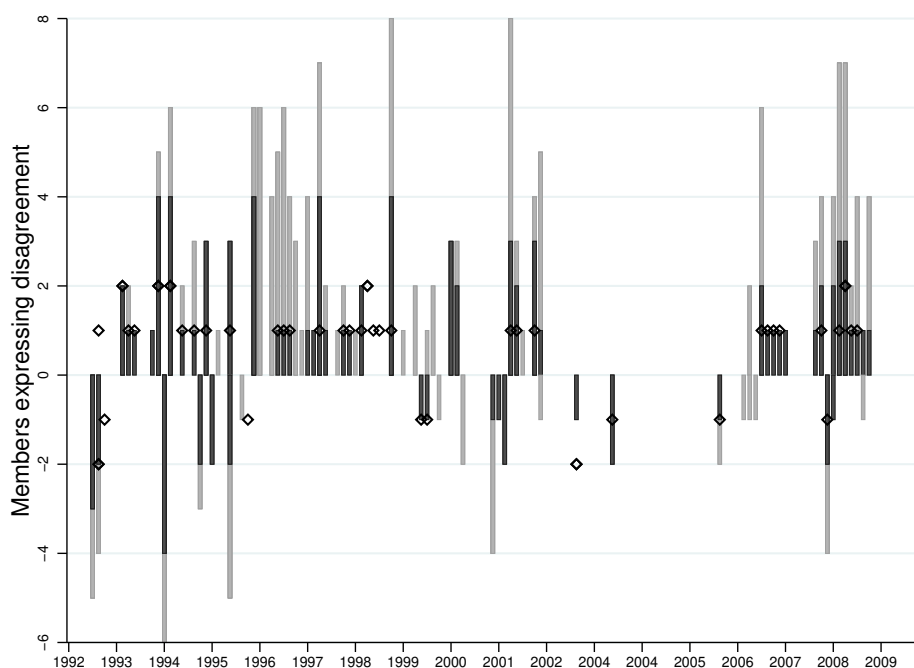
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<sup>2</sup>[https://www.federalreserve.gov/monetarypolicy/fomc\\_historical.htm](https://www.federalreserve.gov/monetarypolicy/fomc_historical.htm)

<sup>3</sup>Importantly, we classify FOMC members based on their role at the time of each remark. For instance, Janet Yellen is classified as Federal Reserve governor from August 1994 to February 1997 and president of the Federal Reserve Bank of San Francisco from June 2004 to October 2010.

addition, the verbatim transcripts of FOMC meetings provide a better picture of the differences of tone among FOMC members than voting records or minutes of meetings. Indeed, while it is relatively uncommon for a voting member to cast a dissenting vote, transcripts allow, among other things, to extract information on the differences in the desired change of the federal funds rate expressed by FOMC members during any given meeting. To support this idea, Figure 2 shows how, for most of the meetings, many of the members who expressed different views in terms of the proposed policy rate did not cast a dissenting vote.

**Figure 2: Disagreement and dissenting votes in FOMC meetings (1992-2009)**



Notes: This figure shows the number of members expressing: i) disagreement with respect to the adopted federal funds rate for voting members (dark grey bars) and non-voting members (light grey bars), and ii) dissenting votes (diamond symbol). Positive (negative) values indicate the number of members disagreeing/dissenting with tighten (loosen) monetary policy.

As the meetings' agenda follows a structured process and additional information could be extracted from the disaggregation of transcripts, we also collect information on whether an opinion was expressed during the first or second go-round of a meeting.<sup>4</sup> In particular, in the first go-round, i.e. the economics go-round, Board members and

<sup>4</sup>See [Federal Reserve Bank of Philadelphia \(2002\)](#) for a complete description of the mechanism of FOMC meetings.



Reserve Bank presidents discuss how they see economic and financial conditions. Bank presidents' remarks will typically include references to the conditions in their Districts as well as the national and global situation. While in the second go-round, i.e. the policy go-round, the Federal Reserve presidents and governors discuss their own monetary policy preferences, given current economic conditions and their personal outlook for the economy. This structure of the meetings makes the two go-rounds two distinct events. The economics go-round is an information-sharing exercise where the chair speaks very little, while in the policy go-round, the chair shares his/her vision and the other FOMC members have to react to it. This makes the informational content of the two go-rounds worthwhile to investigate.

## 2.2 The tone of FOMC Members' discussions

We compute the tone of the FOMC transcripts at the speaker-meeting-round level by using a bag-of-words approach which relies on predefined dictionaries of words. To do so, we proceed by following three steps. First, we collect all utterances made by a given FOMC member in each meeting-round. This yields 4,764 speaker\*meeting\*round observations over all meetings between 1992 and 2009. Next, we extract the number of positive and negative words mentioned by each member using the [Loughran and McDonald \(2011\)](#) (LM) dictionary. This dictionary was developed to measure the tone of financial and economic documents, and has also been used in the central bank communication literature (see [Hansen and McMahon, 2016b](#), among others).<sup>5</sup> The following sentences provide evidence of utterances conveying a positive (bold and underlined) or a negative (italics and underlines) tone, according to the LM dictionary:

“The tone of the reports that I’m getting from my business contacts in the Fourth District is **positive**, but it’s hardly reminiscent of the reports of robust growth that I was hearing earlier this year. Still, both order books and profits are reported to be fairly **strong**.”

—Ms. PIANALTO, 21 SEPTEMBER 2004

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<sup>5</sup>The LM dictionary contains 354 words which convey a positive tone and 2355 words carrying a negative tone. Individual words can have a specific semantic orientation; that is, they consistently convey a positive or negative sentiment regardless of the context in which they are used. For instance, “boom” generally conveys a positive sentiment while “recession” conveys a negative sentiment. [Loughran and McDonald \(2011\)](#) show that the LM dictionary is superior for classifying economic and financial texts to other dictionaries, such as the Harvard Psychosociological Dictionary, which, for example, miscategorizes words that are neutral in a financial/economic context, e.g. tax, costs, capital, expense, and depreciation.

“Since our last meeting, the economic data have continued to indicate a very *weak* economy and that, in all likelihood, we have entered a *recession*. Like the Greenbook, my outlook is particularly influenced by indications of significantly *weaker* labor markets and a housing market that is as yet showing no signs reaching bottom . . . Not only have we had three months of *declining* private payroll employment, but also the *decline* has been widespread across most industries . . . While most analysts are in the process of *downgrading* their forecasts from skirting to actually having a mild *recession*, the risk of a more *severe downturn* is uncomfortably high.”

—MR. ROSENGREN, 18 MARCH 2008

Finally, we measure the intensity of positive and negative words that FOMC members use in their discussions and that have a specific semantic orientation (positive or negative) according to the LM dictionary. Given the different informational content provided in the two go-rounds, for each FOMC member, we are able to capture the tone of their remarks in the entire meeting and in the two go-round phases. The tone of each remark is computed as follows:

$$Tone_{i,m}^r = \frac{pos_{i,m}^r - neg_{i,m}^r}{total_{i,m}^r}; \quad (1)$$

where  $Tone_{i,m}^r$  is the tone of FOMC member  $i$  at the meeting  $m$ , during go-round  $r$  (economics, policy or overall meeting).  $pos_{i,m}^r$  ( $neg_{i,m}^r$ ) is the number of positive (negative) words used by FOMC member  $i$  at the meeting  $m$ , during go-round  $r$ .  $total_{i,m}^r$  is the total number of words. Figure 3 shows the average tone of FOMC members and the average change in the federal funds rate proposed by the FOMC members during the meeting.

Interestingly, we find that the average meeting tone closely follows the evolution of the average change of the federal funds rate proposed by FOMC members. For instance, the steep reduction in the federal funds rate expressed during the period 2008-2009 coincides with the drop in average tone over that period.<sup>6</sup> Similar patterns can be found by looking at the evolution of the tone for Board members and Bank presidents, as well as for voting and non-voting members, reported in Figures A.1 and A.2 in the Appendix, respectively.

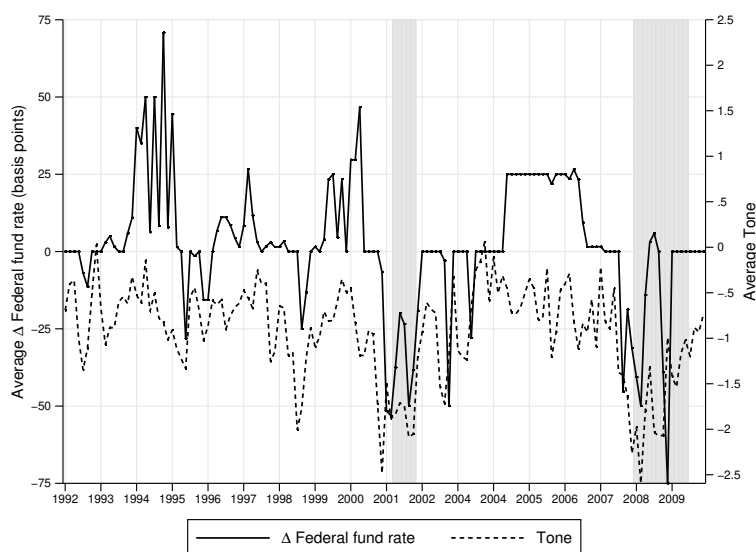
### 2.3 The disagreement among FOMC members

Following Tillmann and Walter (2019, 2018), we consider that disagreement inside the FOMC can be proxied by the average of differences of tone within FOMC members.

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<sup>6</sup>It is worth noting that since the LM dictionary contains more negative words than positive words, the average tone of meetings is almost always negative.

**Figure 3: Average meeting tone and monetary policy preferences of FOMC members (1992-2009)**



Notes: This figure shows the average change in the federal fund rate proposed by FOMC members (solid line) and the average tone of the meeting (dotted line). The shaded area corresponds with recession as identified by the NBER business cycle dating committee.

Figure 4 shows the average distribution of tone, and thus, the average of differences of tone, over the 1992-2009 period.<sup>7</sup>

We find a high level of dispersion in tone over the sample period, which shows persistent disagreement among members during committee meetings. Additional information suggests that the largest dispersion has occurred in January 2002, while the lowest one happened in June 2007. On the one hand, the uncertainty about strength in business capital and household spending prevailing during the January 2002 meeting might explain the large divergence of tone among FOMC members.<sup>8</sup> While on the other hand, the consensus on the state of the economy expressed in the June 2007 minutes might explain the low level of dispersion in the tone of FOMC members.<sup>9</sup>

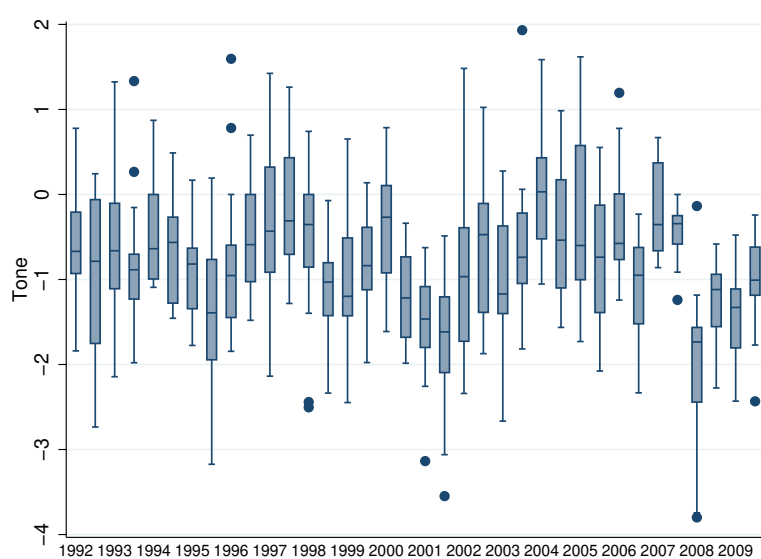
Figure A.3 in the Appendix offers further insights about the differences of tone occurring during the two go-round phases. Even though disagreement was mainly expressed during the economics go-round, some meetings were characterized by large dispersion of tone during the policy go-round. Interestingly, these meetings coincide with specific events, such as the 1997–98 Asian financial crisis and the 2000 dotcom bubble.

<sup>7</sup>For simplicity of exposition, we only show two meetings per year, i.e. the first one of each semester.

<sup>8</sup>See: <https://www.federalreserve.gov/boarddocs/press/general/2002/20020130/>.

<sup>9</sup>See: <https://www.federalreserve.gov/newsevents/pressreleases/monetary20070618a.htm>.

**Figure 4: Distribution of tone during FOMC meetings (1992-2009)**



Notes: This figure shows the distribution of meeting tone at a semiannual frequency. The middle line in the box shows the median value, while the bottom and top lines of the box show the 25th and 75th quartiles, respectively. The “whiskers” from the box extend vertically to the upper and lower adjacent values. The dots indicate points outside this range.

### 3 Data and stylised facts

As our key concern involves understanding which variables are important in explaining the differences of the tone of FOMC members, this section describes the sources of data and some stylised facts to understand the differences characterizing FOMC members.

#### 3.1 Individual projections

The individual projections of the members of the Board of Governors and the Federal Reserve Bank presidents can certainly shed light on the differences in tone inside the FOMC. For example, [Orphanides and Wieland \(2008\)](#) find that the ranges of the FOMC members projections are more important for explaining FOMC interest rate decisions than observed macroeconomic outcomes.

Between 1980 and 2007, FOMC members were asked to provide their individual projections prior to the Federal Reserve Chair’s semi-annual monetary policy report to the Congress. In particular, each FOMC member was required to provide its economic projections for nominal and real GDP, inflation and unemployment rate. The first

projections of the year were collected around the date of the first FOMC meeting of the year, during which FOMC members were asked to provide their end of year projections for the macroeconomic variables mentioned above. The second set of annual projections were typically collected around the FOMC meeting that took place in June/July, and members were asked to provide not only the projections for the current year but also the ones for the following year. These individual projections were made available to the public after a lag of 10 years and are publicly available on the Federal Reserve Bank of Philadelphia website for the period 1992-2007.<sup>10</sup>

Since 2008, the Fed started to publish quarterly economic projections on its website with a lag of 5 years. However, the data containing individual projections are anonymised, as a random participant code is assigned to each FOMC member. It is only after 10 years that participants' keys are released, which allow researchers to match the economic projections with the various FOMC members. Given our interest in associating individual projections to the tone of FOMC members' discussions and given these data limitations, our analysis focuses on the period 1992-2009.

Figure A.4 in the Appendix shows the distribution of the economic projections for inflation and the unemployment rate over the period 1992-2009. This figure reveals a significant dispersion of inflation forecasts, while the differences in the end of year level for the unemployment rate are narrow, with the exception of the period following the global financial crisis (GFC).

### 3.2 Personal characteristics

The literature on the FOMC decision-making process suggests that several personal characteristics, such as members' academic and professional background, can contribute to explain the heterogeneity of discussions and preferences between FOMC members. For instance, [Eichler and Lähler \(2014\)](#) and [Smales and Apergis \(2016\)](#) show that FOMC members with backgrounds in the government or in the private sector are more concerned about output stabilization than members with careers in academia, NGOs or the financial sector, which care more about inflation stabilization. While [Bennani et al. \(2018\)](#) find that members with a bachelor or a master degree tend to favour more dovish policies as compared to those holding a PhD. Finally, a more recent literature has highlighted the differences in policy preferences between men and women ([Masciandaro et al., 2020](#)).

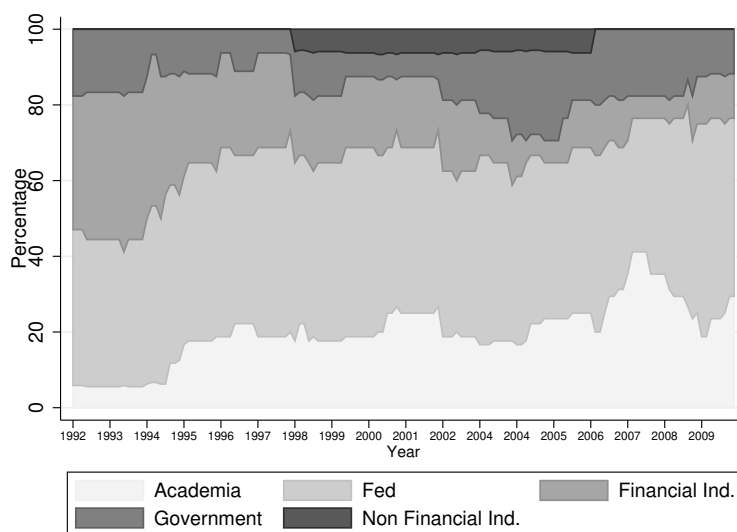
Using the Federal Reserve History website and the personal vitae of FOMC members, we construct a database able to capture for these personal characteristics. First,

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<sup>10</sup>These projections do not include those of the Chair.

we create a variable measuring the percentage of time spent by a FOMC member in *academia* (positions at universities or colleges), *Fed* (any position in the Federal Reserve System), *financial industry* (positions at banks or other financial institutions), *government* (positions in other government organisations), or *non-financial industry* (positions in private non-financial industries or NGOs), before joining the FOMC. Figure 5 shows the evolution of the composition of the FOMC in terms of professional background over the 1992-2009 period.

**Figure 5: The evolution of the composition of the FOMC in terms of professional background (1992-2009)**



Interestingly, the proportion of members with a background in academia increased from 5% in 1992 to 29% in 2009, while the share of members coming from the financial industry decreased from 35% to 12%, during the same period. Second, we create dummy variables to control for the FOMC members' highest degree, distinguishing between a bachelor degree, a Master, a Juris Doctor or a PhD. Table A.1 in the Appendix suggests that most FOMC members have a PhD degree (71%), followed by holders of Master degrees (25%). While Bachelor (3%) and Juris Doctor (1%) graduates represent a minority inside the FOMC. Next, we create a dummy variable to control for differences between men (86%) and women (14%) FOMC members. Finally, we create a variable capturing the age of the FOMC member at the time of each meeting.

## 4 Empirical setup

In our empirical estimations, we assume that cross-sectional differences in the tone between FOMC members can be characterised by an augmented Taylor-style reaction function, where these differences are explained by the individual projections as well as members' personal characteristics. In particular, we assume that FOMC members (implicitly) follow a forward-looking Taylor rule when discussing the appropriate monetary policy stance to adopt in accordance with their individual projections.<sup>11</sup> Moreover, a forward-looking Taylor rule provides a good proxy for the individual desired interest rates, based on their projections for inflation and unemployment rates (Judd et al., 1998; Reis and Blinder, 2005). Hence, we expect that cross-sectional differences in forecasts among FOMC members may lead to differences in the tone of their remarks during FOMC meetings. For instance, FOMC members with inflation (unemployment) forecasts exceeding the committee's median value might have a more positive (negative) tone during a meeting. The estimation takes the following form:

$$Tone_{i,m}^r = \alpha_m + \beta_1 \pi_{i,m}^{e_h} + \beta_2 u_{i,m}^{e_h} + \gamma' x_{i,m} + \epsilon_{i,m}; \quad (2)$$

where  $Tone_{i,m}^r$  is the tone of FOMC member  $i$  at the meeting  $m$  during go-round  $r$  (economics, policy or overall meeting).  $\pi_{i,m}^{e_h}$  and  $u_{i,m}^{e_h}$  are the end of year (horizon  $h$ ) inflation and unemployment projections of FOMC member  $i$  at meeting  $m$ . As our focus is on the cross-sectional heterogeneity in the tone of FOMC members, we employ time-fixed effects,  $\alpha_m$ , to absorb common time-variation in the use of tone (see Malmendier et al., 2021, among others).

In addition to controlling for the heterogeneity of FOMC members economic projections, we also account for members' characteristics, such as professional experience, education, age and gender.  $x_{i,m}$  is the vector of member characteristics. We use two approaches to account for these personal characteristics. In the first approach, we use the dummy variables discussed in Section 2.2 to control for prior professional experience, education and gender, and also control for the age of each FOMC member. In the second approach, we address heterogeneity by absorbing any time-invariant personal characteristics using member fixed effects. Using this approach, the coefficients of interest, i.e.  $\beta_1$  and  $\beta_2$ , are identified from within-member variation of tone as their inflation and

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<sup>11</sup>The policy scenarios proposed by the research staff at both the Federal Reserve Board and the Federal Reserve Banks are based, among others, on Taylor rule estimates obtained based on FOMC members' individual projections. For example, Appendix B of the 2008 Bluebook presents six scenarios of the future path of the economy and three of them were based on alternative Taylor rules.

unemployment rate forecasts change.

## 5 Results

The results of the baseline specification are presented in Table 1. In columns (1)-(2) the dependent variable is the tone of the FOMC members' discussions during each meeting, while in columns (3)-(4) and columns (5)-(6) the dependent variable is the tone related to the economics and policy go-rounds, respectively. Furthermore, in columns (2), (4) and (6), we replace the personal characteristics dummies with member fixed effects. The inclusion of member fixed effects is the most comprehensive way to account for unobserved person-specific determinants of the tone conveyed through FOMC members' remarks. However, it removes a substantial amount of variation coming from the differences in average professional experience, education, age and gender between FOMC members.

**Table 1: Baseline regressions: Tone and economic projections**

	Overall		Economics go-round		Policy go-round	
	(1)	(2)	(3)	(4)	(5)	(6)
Inflation	0.216*	0.167*	0.327***	0.259**	-0.283	-0.313*
	(0.112)	(0.080)	(0.138)	(0.100)	(0.193)	(0.183)
Unemployment Rate	-0.113	0.102	-0.223	0.095	-0.064	-0.104
	(0.185)	(0.143)	(0.222)	(0.163)	(0.157)	(0.157)
Prof Exp FE	✓		✓		✓	
Education FE	✓		✓		✓	
Age	✓		✓		✓	
Gender	✓		✓		✓	
Meeting FE	✓	✓	✓	✓	✓	✓
Member FE		✓		✓		✓
$R^2$	0.334	0.321	0.305	0.281	0.143	0.142
Observations	2,379	2,379	2,379	2,379	2,358	2,358
Number of members	51	51	51	51	51	51

Robust standard errors in parentheses. \*\*\*/\*\*/\* denote significance at 1, 5 and 10 percent levels, respectively.

Column (1) shows a significant effect of differences in inflation projections on the tone of FOMC members' discussions, while it provides no evidence suggesting that the level of unemployment rate correlates with the tone used. In column (2), we replace the personal characteristic variables with members fixed effects and the results remain almost unchanged.

However, as discussed in section 2.1, the tone used by FOMC members during a meeting might vary based on whether the discussion is centred around the discussion



of economics and financial conditions, i.e. during the economics go-round, or reacting to the changes in the federal funds rate proposed by the Chair, i.e. during the policy go-round. In column (3), we investigate the effect of differences in economic projections and personal characteristics on the tone of the discussions expressed by FOMC members during the economics go-round. In this specification, the coefficient for inflation projections is significantly different from zero at the 1% level. Based on the specifications in this column, a 1 percentage increase in the level of projected inflation is associated with an increase in tone of about 0.33 points. In terms of economic magnitude, an increase of 0.2 percentage points in the projected inflation – the average value of the within-meeting standard-deviation – is associated with an increase of about 0.06 in the tone, or about 1/3rd of its standard deviation. The magnitude and significance of the coefficient for the projections for the end-of-year levels of inflation remain consistent when we include member fixed effects in column (4).

Finally, in columns (5) and (6), we re-estimate the specifications presented in columns (3) and (4) focusing on the tone of the remarks made by FOMC members during the policy go-round. The coefficient of these regressions are less precisely estimated, as the results presented in column (5) show no statistical differences in tone among FOMC members, while the coefficient for inflation in column (6) is negative and only significant at the 10% level. Overall, these results provide evidence in support of the idea that the FOMC members' individual inflation projections are correlated with differences in the tone used in the discussions made during the economics go-round.

## 5.1 Board members Vs Bank presidents

Previous literature has documented the presence of differences in monetary policy preferences between the members of the Federal Reserve Board of Governors and the presidents of the Federal Reserve Banks. For example, [Meade and Sheets \(2005\)](#) find that Bank presidents are characterised by more persistent policy preferences, while [Havrilesky and Gildea \(1995\)](#) show that Bank presidents, as a group, prefer less expansionary monetary policy than Board members.

Against this background, we test the presence of differences in the tone expressed by Board members and by Bank presidents. Table 2 replicates the estimates presented in table 1 by distinguishing between Bank presidents (Panel A) and Board members (Panel B) in the empirical specification.

**Table 2: Tone and economic projections: Bank presidents Vs Board members**

	Overall		Economics go-round		Policy go-round	
	(1)	(2)	(3)	(4)	(5)	(6)
<b>Panel A: Bank presidents</b>						
Inflation	0.182 (0.139)	0.169** (0.075)	0.263* (0.157)	0.232** (0.101)	-0.352 (0.256)	-0.247 (0.237)
Unemployment Rate	0.011 (0.161)	0.127 (0.144)	-0.060 (0.135)	0.132 (0.161)	0.013 (0.213)	-0.022 (0.213)
$R^2$	0.384	0.374	0.350	0.322	0.172	0.166
Observations	1,659	1,659	1,659	1,659	1,640	1,640
Number of members	31	31	31	31	31	31
<b>Panel B: Board members</b>						
Inflation	-0.069 (0.303)	0.146 (0.339)	0.120 (0.302)	0.353 (0.330)	-0.138 (0.367)	-0.325 (0.390)
Unemployment Rate	-0.410 (0.393)	-0.266 (0.312)	-0.442 (0.478)	-0.212 (0.371)	-0.808** (0.381)	-0.811* (0.416)
$R^2$	0.435	0.414	0.428	0.401	0.307	0.308
Observations	675	675	675	675	674	674
Number of members	21	21	21	21	21	21
Prof Exp FE	✓		✓		✓	
Education FE	✓		✓		✓	
Age	✓		✓		✓	
Gender	✓		✓		✓	
Meeting FE	✓	✓	✓	✓	✓	✓
Member FE		✓		✓		✓

Robust standard errors in parentheses. \*\*\*/\*\*/\* denote significance at 1, 5 and 10 percent levels, respectively.

The results presented in this table suggest that the tone expressed by Bank presidents is affected by the differences in the level of projected inflation, especially during the economics go-round (Columns (3) and (4)), while this is not the case for Board members. These findings remain almost unchanged when we replace FOMC members' personal characteristics with members' fixed effects. Our results suggest that Bank presidents are more likely than Board members to express differences of tone when their inflation projections deviate more from the within-meeting mean of the individual projections.

## 5.2 Voting Vs Non-voting members

While FOMC meetings are attended by the members of the Federal Reserve Board of Governors and the presidents of the 12 Federal Reserve Banks, only 12 members have the right to vote at each meeting. These are the seven members of Board of Governors

and the presidents of five of the 12 Federal Reserve Banks.<sup>12</sup> Previous literature has shown that voting rights are associated with a certain degree of strategic behavior by FOMC members. For instance, [Tillmann \(2011\)](#) finds systematic differences in the individual inflation forecasts submitted by voting and non-voting members. Specifically, he shows that non-voters systematically over-predict inflation relative to the consensus forecast if they favor tighter policy, while they under-predict it if they favor looser policy. To highlight whether voting and non-voting members behave differently in terms of differences of tone during FOMC meeting discussions, we investigate the drivers of their tone. We estimate eq. (2) by splitting members based on their voting status. Table 3 shows the results when we distinguish between voting (Panel A) and non-voting (Panel B) members.

The distinction between voting and non-voting members in the empirical specification brings additional insights. In particular, columns (3) and (4) in Panel A show that higher inflation projections are associated with a more positive tone for voting members, during the economics go-round. Moreover, we find that during the policy go-round, higher unemployment is negatively related to the tone of voting members, although it is significant at the 10% level only. The coefficient estimates presented in column (6) of Panel A suggest that a 1 percentage increase in the level of the unemployment rate projections is associated with a decrease of about 0.6 points in tone.

Overall, we find that differences of tone are mainly voiced during the economics go-round by Bank presidents and members who have voting rights, in particular when they submit inflation projections that deviate from the within-meeting mean forecast.

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<sup>12</sup>The president of the Federal Reserve Bank of New York is a permanent voting member, and the presidents of the other Reserve Banks serve one-year terms as voting members in a rotation that is set by law. See [Federal Reserve](#) website.

**Table 3: Tone and economic projections: voting vs non-voting members**

	Overall		Economics go-round		Policy go-round	
	(1)	(2)	(3)	(4)	(5)	(6)
<b>Panel A: voting members</b>						
Inflation	0.199 (0.153)	0.267* (0.159)	0.371** (0.164)	0.434** (0.167)	-0.191 (0.258)	-0.324 (0.297)
Unemployment Rate	-0.176 (0.265)	-0.058 (0.239)	-0.248 (0.314)	-0.022 (0.275)	-0.348 (0.237)	-0.550* (0.274)
$R^2$	0.343	0.328	0.318	0.298	0.188	0.190
Observations	1,375	1,375	1,375	1,375	1,373	1,373
Number of members	49	49	49	49	49	49
<b>Panel B: non-voting members</b>						
Inflation	0.155 (0.184)	-0.022 (0.114)	0.238 (0.227)	-0.008 (0.149)	-0.325 (0.258)	-0.229 (0.268)
Unemployment Rate	-0.043 (0.216)	0.146 (0.177)	-0.206 (0.208)	0.077 (0.207)	0.539 (0.362)	0.483 (0.366)
$R^2$	0.439	0.420	0.412	0.373	0.225	0.218
Observations	959	959	959	959	941	941
Number of members	26	26	26	26	26	26
Prof Exp FE	✓		✓		✓	
Education FE	✓		✓		✓	
Age	✓		✓		✓	
Gender	✓		✓		✓	
Meeting FE	✓	✓	✓	✓	✓	✓
Member FE		✓		✓		✓

Robust standard errors in parentheses. \*\*\*/\*\*/\* denote significance at 1, 5 and 10 percent levels, respectively.

### 5.3 Tenure inside the FOMC

One implication of the influential [Rogoff \(1985\)](#)'s model is that a “conservative” central banker acts aggressively against inflation earlier in his/her career but then adopts looser policy over time.<sup>13</sup> Following this line of thought, [Hansen and McMahon \(2016a\)](#) show that central bankers act tougher against inflation early in their tenure to establish a reputation for toughness. While [Neuenkirch \(2015\)](#) finds that newly appointed governors fight inflation more aggressively during the first four to eight quarters of their tenure.

In this section, we test whether differences in the tone used by FOMC members vary with their tenure. To do so, we introduce an interaction term between the main explanatory variables, i.e. inflation and unemployment, and the tenure of each member

<sup>13</sup>For example, [Flanders \(2011\)](#) suggested that Mario Draghi will be tough on inflation following his appointment to signal his credibility.

inside the FOMC. The estimation is as follows:

$$\begin{aligned}
Tone_{i,m}^r = & \alpha_m + \beta_1 \pi_{i,m}^{e_h} + \beta_2 u_{i,m}^{e_h} + \beta_3 tenure_{i,m} + \beta_4 \pi_{i,m}^{e_h} \times tenure_{i,m} \\
& + \beta_5 u_{i,m}^{e_h} \times tenure_{i,m} + \gamma' x_{i,m} + \epsilon_{i,m};
\end{aligned}
\tag{3}$$

where  $tenure_{i,m}$  is the number of months a FOMC member  $s$  has been in office when meeting  $t$  is held. The values of the interaction terms allow us to test whether a longer time in office is associated with higher or lower differences in the tone when the individual projections for inflation and unemployment deviate from the within-meeting mean forecast.

**Table 4: Tone and economic projections: the role of tenure**

	Overall		Economics go-round		Policy go-round	
	(1)	(2)	(3)	(4)	(5)	(6)
Inflation	0.169 (0.139)	0.250** (0.116)	0.272** (0.132)	0.373*** (0.117)	-0.264 (0.255)	-0.345 (0.215)
Tenure	-0.001 (0.003)	-0.016*** (0.003)	-0.001 (0.004)	-0.008** (0.003)	0.005 (0.005)	-0.020*** (0.005)
Inflation $\times$ Tenure	0.001 (0.001)	-0.001 (0.001)	0.001 (0.001)	-0.001* (0.001)	-0.001 (0.002)	0.001 (0.001)
Unemployment Rate	-0.132 (0.165)	0.101 (0.134)	-0.252 (0.202)	0.097 (0.153)	-0.054 (0.167)	-0.088 (0.188)
Unemployment Rate $\times$ Tenure	0.001 (0.000)	-0.001 (0.000)	0.001 (0.000)	-0.001 (0.000)	-0.001 (0.000)	-0.001 (0.000)
Prof Exp FE	✓		✓		✓	
Education FE	✓		✓		✓	
Age	✓		✓		✓	
Gender	✓		✓		✓	
Meeting FE	✓		✓		✓	
Member FE		✓		✓		✓
$R^2$	0.340	0.327	0.313	0.283	0.146	0.144
Observations	2,379	2,379	2,379	2,379	2,358	2,358
Number of members	51	51	51	51	51	51

Robust standard errors in parentheses. \*\*\*/\*\*/\* denote significance at 1, 5 and 10 percent levels, respectively.

The results presented in Table 4 provide evidence that a longer tenure inside the FOMC is significantly associated with a weaker relationship between the individual inflation projections and the tone (column (4)). This suggests that FOMC members with a longer tenure are less inclined to express a positive tone in their discussions when their inflation projections deviate from the within-meeting mean forecast, in particular during the economics go-round.

## 5.4 Regional economic conditions

The composition of the voting membership of the FOMC – five Bank presidents and seven members of the Board of Governors – implies a significant influence of the regional economic conditions on FOMC members’ monetary policy preferences and voting behavior, in particular for Bank presidents (Meade and Sheets, 2005; Jung and Latsos, 2015). Using information gleaned from transcripts as well as measures of regional economic conditions that have been aggregated to the Federal Reserve district level, Chappell Jr et al. (2008) find that regional economic conditions influence FOMC members’ preferred policies, and that while both Governors and Bank presidents respond to regional conditions, the evidence is stronger for the presidents.

In this section, we investigate whether regional economic conditions affect the tone of Bank presidents’ discussions during FOMC meetings. To do so, we replace the individual projection for unemployment with the unemployment rate aggregated at the district level.<sup>14</sup> We only consider Bank presidents in the specification as they are the only members who have an explicit regional affiliation and are more likely to express differences in tone (see Table 2).

**Table 5: Tone and economic projections: the role of regional economic conditions for Bank Presidents**

	Overall		Economics go-round		Policy go-round	
	(1)	(2)	(3)	(4)	(5)	(6)
Inflation	0.067 (0.132)	0.158* (0.079)	0.125 (0.160)	0.218* (0.104)	-0.336 (0.257)	-0.242 (0.246)
District level Unemployment Rate	-0.197** (0.088)	-0.030 (0.048)	-0.243** (0.101)	-0.049 (0.079)	0.030 (0.087)	0.026 (0.126)
Prof Exp FE	✓		✓		✓	
Education FE	✓		✓		✓	
Age	✓		✓		✓	
Gender	✓		✓		✓	
Meeting FE	✓	✓	✓	✓	✓	✓
Member FE		✓		✓		✓
$R^2$	0.399	0.374	0.366	0.322	0.172	0.166
Observations	1,658	1,658	1,658	1,658	1,639	1,639
Number of members	30	30	30	30	30	30

Robust standard errors in parentheses. \*\*\*/\*\*/\* denote significance at 1, 5 and 10 percent levels, respectively.

The results of these estimations are presented in Table 5. Interestingly, we find that regional economic conditions, proxied through the district-level unemployment rate, ex-

<sup>14</sup>The unemployment data are available at: <https://fred.stlouisfed.org/searchresults?st=unemployment+rate+federal+district> [last access: September 2021]. Unfortunately, district level inflation rates are not publicly available.

ert a significant effect on the tone of Bank presidents’ discussions during FOMC meetings. Hence, a higher district-level unemployment rate is negatively and significantly related to the tone, in particular during the economics go-round and when accounting for individual fixed effects in the estimation. Nevertheless, the individual inflation projections are still positively and significantly related to tone during the economics go-round in the most stringent estimations in Column (4).

## 5.5 FOMC members personal experiences

Previous literature has also discussed the key role played by personal experiences of inflation and recession in shaping individual preferences. In this section, we test the sensitivity of our results to the inclusion of proxies able to capture FOMC members’ personal experiences with inflation and recessions.

### 5.5.1 Inflation experiences

Personal experiences of inflation exert a significant long-term influence on FOMC members’ individual projections. For example, [Malmendier et al. \(2021\)](#) find that the deviations of FOMC members’ inflation expectations from the Greenbook forecasts are explained by personal inflation experiences, and that there is a significant relationship between inflation experiences and voting decisions.<sup>15</sup> Hence, to test whether differences in members’ lifetime experiences of inflation explain the tone of FOMC members, we follow [Malmendier et al. \(2021\)](#)’s model of experience-based learning to compute a measure of inflation experiences for each FOMC member. Specifically, this variable maps each member’s lifetime history of experienced inflation with more weight given to recent experiences than those in early life. We augment the baseline specification in eq. (2) by adding a variable measuring inflation experiences and an interaction term between the individual inflation projections and the measure of inflation experiences. The estimation takes the following form:

$$Tone_{i,m}^r = \alpha + \beta_1 \pi_{i,m}^{e_t} + \beta_2 u_{i,m}^{e_t} + \beta_3 \pi_{i,q-1|m}^{exp} + \beta_4 \pi_{i,m}^{e_t} \times \pi_{i,q-1|m}^{exp} + \gamma x_{i,t} + \epsilon_{i,m}; \quad (4)$$

where  $\pi_{i,q-1|m}^{exp}$  is the level of experience-based inflation computed on the basis of the inflation history of each FOMC member  $i$  during the meeting  $m$  and based on information up to the end of quarter  $t - 1$ . The results for these estimations are presented in Table 6.

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<sup>15</sup>Specifically, a one within-meeting standard-deviation increase in the experience-based inflation forecast raises the probability of a hawkish dissent by about one third, and it lowers the probability of a dovish dissent also by about one third.

**Table 6: Tone, economic projections and individual inflation experiences**

	Overall		Economics go-round		Policy go-round	
	(1)	(2)	(3)	(4)	(5)	(6)
Inflation	1.503*** (0.452)	1.135*** (0.414)	1.453*** (0.515)	0.952** (0.469)	0.883 (0.671)	0.964 (0.662)
Inflation Experiences	29.483 (29.082)	36.926 (26.815)	20.107 (34.743)	25.976 (34.171)	12.816 (42.653)	49.180 (38.353)
Inflation × Inflation Experiences	-35.968*** (12.058)	-27.019** (11.839)	-31.484** (13.359)	-19.334 (12.716)	-32.596* (18.456)	-35.676* (18.131)
Unemployment Rate	-0.101 (0.181)	0.103 (0.143)	-0.213 (0.219)	0.096 (0.163)	-0.052 (0.160)	-0.101 (0.163)
Prof Exp FE	✓		✓		✓	
Education FE	✓		✓		✓	
Age	✓		✓		✓	
Gender	✓		✓		✓	
Meeting FE	✓	✓	✓	✓	✓	✓
Member FE		✓		✓		✓
$R^2$	0.339	0.323	0.309	0.281	0.145	0.143
Observations	2,379	2,379	2,379	2,379	2,358	2,358
Number of members	51	51	51	51	51	51

Robust standard errors in parentheses. \*\*\*/\*\*/\* denote significance at 1, 5 and 10 percent levels, respectively.

Our results show that the experience-based inflation of FOMC members has no direct effect on their tone. However, the negative and significant coefficient related to the interaction term suggests that inflation experiences influence the tone FOMC members express when their inflation projections deviate from the within-meeting mean of inflation projections. Specifically, FOMC members that have experienced higher levels of inflation during their life tend to adopt a more negative tone when their projected inflation is higher than the within meeting value. These findings are in line with those of [Malmendier et al. \(2021\)](#) who find that inflation experiences affect the behavior of FOMC members. Finally, the estimated coefficients for the main control variables, i.e. inflation and unemployment rate, remain almost unchanged both in terms of statistical significance and magnitude.

### 5.5.2 Recession experiences

Among the range of personal experiences, recessions might exert a certain influence on the tone used by FOMC members during meetings.<sup>16</sup> Previous literature has shown how childhood experiences of recession influence the behavior of central bankers. For example, [Farvaque et al. \(2020\)](#) find that central bankers who have experienced recessions in their

<sup>16</sup>For example, [Pixley et al. \(2004\)](#) highlight how: “a former Bank of England informant said: You learn from the past. [...] . Knowledge is made up of training and experience. For example, I often used to divide the members of the Monetary Policy Committee over whether they had been involved in some of the great policy disasters of the United Kingdom. If you had been involved in those policy disasters you had a very different take on life (12 March 2002)”.



early life develop greater recession-averse behavior than their counterparts. Hence, faced with the same economic data, FOMC members with different recession experiences may have dissimilar monetary policy preferences, and, thus, a different tone voiced through their discussions during a meeting. To test this hypothesis, we apply Farvaque et al.’s (2020) methodology to derive the “recession childhood effect” of FOMC members for the first 10 and 25 years of their life, respectively. By augmenting the baseline specification in eq. (2) with the variable corresponding to the “recession childhood effect” and with an interaction term including both the “recession childhood effect” and the individual inflation projections,<sup>17</sup> we obtain:

$$Tone_{i,m}^r = \alpha + \beta_1 \pi_{i,m}^{e_t} + \beta_2 u_{i,m}^{e_t} + \beta_3 rec_{i,n}^{expmonth} + \beta_4 \pi_{i,m}^{e_t} \times rec_{i,n}^{expmonth} + \gamma x_{i,t} + \epsilon_{i,m}; \quad (5)$$

where  $rec_{i,n}^{expmonth}$  represents the number of *months* a FOMC member *i* has been experiencing a recession in the first *n*, i.e. 10 or 25 years of his/her life, respectively. Table 7 shows the coefficient estimates for eq. (5). Columns (1), (3) and (5) focus on the first 10 years of life, while columns (2), (4) and (6) focus on the first 25 years of life of a FOMC member.

**Table 7: Tone, economic projections and individual recession experiences**

	Overall		Economics go-round		Policy go-round	
	(1)	(2)	(3)	(4)	(5)	(6)
Inflation	0.309 (0.203)	-0.194 (0.551)	0.453* (0.247)	-0.161 (0.637)	0.114 (0.255)	0.842 (0.633)
Recession experiences (10y)	0.027 (0.019)		0.037 (0.023)		0.045** (0.022)	
Inflation × # Recession experiences (10y)	-0.005 (0.009)		-0.007 (0.011)		-0.019** (0.009)	
Unemployment Rate	-0.079 (0.169)	-0.101 (0.177)	-0.177 (0.197)	-0.208 (0.211)	-0.057 (0.150)	-0.064 (0.156)
Recession experiences (25y)		-0.005 (0.023)		-0.005 (0.028)		0.054* (0.029)
Inflation × Recession experiences (25y)		0.008 (0.011)		0.009 (0.013)		-0.023** (0.012)
Prof Exp FE	✓	✓	✓	✓	✓	✓
Education FE	✓	✓	✓	✓	✓	✓
Age	✓	✓	✓	✓	✓	✓
Gender	✓	✓	✓	✓	✓	✓
Meeting FE	✓	✓	✓	✓	✓	✓
$R^2$	0.343	0.340	0.318	0.313	0.145	0.145
Observations	2,379	2,379	2,379	2,379	2,358	2,358
Number of members	51	51	51	51	51	51

Robust standard errors in parentheses. \*\*\*/\*\*/\* denote significance at 1, 5 and 10 percent levels, respectively.

<sup>17</sup>The results of the previous sections show that the individual inflation projections are the main determinant of differences in tone during committee meetings. Hence, we do not consider an interaction term with the unemployment rate.

Our findings suggest that the number of months in recession experienced in the first 10 and 25 years of life have a significant effect on the tone used by FOMC members during meeting discussions. Specifically, the number of months spent in recession(s) is positively and significantly related to the tone expressed during the policy go-round. Moreover, the interaction term shows that FOMC members who have experienced recessions in their childhood tend to express more negative views when their inflation projections deviate from the within-meeting mean of inflation projections. This result is similar to the one obtained with inflation experiences (see table 6) and suggests that the “recession childhood effect” helps explain the tone of FOMC members’ discussions. Hence, our results are in line with those of [Farvaque et al. \(2020\)](#) who find that monetary policy preferences of central bankers are affected by their experiences of recession.

## 6 Robustness tests

This section presents several robustness tests of the main results in the previous sections. First, we consider an alternative approach to test whether the main results are affected by the type of dictionary used to extract the tone of FOMC members’ discussions. Next, we use an alternative way of computing the baseline tone. Finally, we test the robustness of our results focusing on the FOMC meetings after November 1993, when the Chair of the FOMC announced the intention to make the verbatim transcripts of the meetings available to the general public after an embargo of five years.

### 6.1 Alternative measures to compute the tone

The measure of tone presented in section 2.2 is based on the [Loughran and McDonald \(2011\)](#) dictionary and is obtained by capturing the number of predefined positive and negative words used in FOMC members’ remarks during meetings. As the informativeness of the tone might be sensitive to the choice of the dictionary used to compute this variable, we test the robustness of our results by using a different approach. First, we quantify the tone of FOMC members’ transcripts using the automated search-and-counts approach similar to the one used in [Apel et al. \(2019\)](#), which is an extended version of the [Apel and Grimaldi \(2012\)](#) text-based measure of policy inclination contained in FOMC minutes and transcripts. This approach has been created with the specific purpose of identifying the degree of hawkishness used in FOMC transcripts and minutes and is largely used in the central bank communication literature (see [Hansen and McMahon, 2016b](#); [Malmendier et al., 2021](#), among others).

Following [Apel and Grimaldi \(2012\)](#), we first generate two-word combinations from two sets of words: nouns describing the *goals* of a central bank, and adjectives describing the *attitudes* of a central banker towards a given goal. The list of *goals* consists of words related to three topics: 1) inflation; 2) economic activity; and 3) employment. While the *attitudes* are identified as those words which determine whether it was used in a hawkish or dovish context. As in [Apel and Grimaldi \(2012\)](#) and [Malmendier et al. \(2021\)](#), we then compute the index of FOMC members hawkishness as follows<sup>18</sup>:

$$\text{Net Index}_{i,m}^r = \frac{\text{Hawkish}_{i,m}^r - \text{Dovish}_{i,m}^r}{\text{Hawkish}_{i,m}^r + \text{Dovish}_{i,m}^r} \quad (6)$$

As a second measure of robustness, we use a different normalization procedure to compute the tone of FOMC members' discussions. The alternative measure of tone is computed as follows:

$$\text{Alternative Tone}_{i,m}^r = \frac{\text{pos}_{i,m}^r - \text{neg}_{i,m}^r}{\text{pos}_{i,m}^r + \text{neg}_{i,m}^r}; \quad (7)$$

Figure [A.5](#) in the Appendix shows the average value of these alternative measures of tone and the average change in the federal funds rate proposed by the FOMC members during the meeting.

After computing these alternative measures of tone, we test the robustness of our results by replacing the dependent variable in eq. (2) with these new variables. The results of these alternative estimations are presented in Table 8. In columns (1), (3) and (5) the dependent variable is the “Net index” of hawkishness, while in columns (2), (4) and (6) the dependent variable is the alternative tone obtained using eq. (7).

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<sup>18</sup>See [Apel et al. \(2019\)](#) for details on the list of *goals* and *attributes* used for the construction of the *Net index* of hawkishness of FOMC members' remarks.

**Table 8: Alternative tones and economic projections**

	Overall		Economics go-round		Policy go-round	
	<i>Net index</i>	<i>Alt. tone</i>	<i>Net index</i>	<i>Alt. tone</i>	<i>Net index</i>	<i>Alt. tone</i>
	(1)	(2)	(3)	(4)	(5)	(6)
Inflation	0.139** (0.061)	3.930* (2.103)	0.108** (0.059)	5.090* (2.556)	-0.015 (0.145)	-7.238 (6.484)
Unemployment Rate	-0.043 (0.107)	4.434 (3.827)	-0.043 (0.126)	4.325 (4.121)	-0.118 (0.143)	3.284 (6.176)
Meeting FE	✓	✓	✓	✓	✓	✓
Member FE	✓	✓	✓	✓	✓	✓
$R^2$	0.186	0.272	0.183	0.240	0.135	0.151
Observations	2,188	2,378	2,100	2,375	1,115	1,990
Number of members	51	51	51	51	50	51

Robust standard errors in parentheses. \*\*\*/\*\*/\* denote significance at 1, 5 and 10 percent levels, respectively.

The positive and statistically significant sign of the coefficient related to inflation projections, in both the overall meeting and the economics go-round, is in line with the baseline results and suggest that a higher level of projected inflation is associated with a more hawkish and positive tone, respectively, regardless of the measure of tone used in the estimation.

## 6.2 FOMC transcripts after November 1993

Prior to November 1993, FOMC meetings operated under the assumption that meeting transcripts would never be made available to the general public. After November 1993, discussion started to be held under the premise that meeting transcripts would be publicly available after five years. Using this natural experiment, [Meade and Stasavage \(2008\)](#) provide evidence that publishing FOMC meeting transcripts made members more reluctant to offer dissenting opinions. While [Hansen et al. \(2018\)](#) find that, after November 1993, FOMC members started to exert more effort, prepare their discussions more thoroughly and engage in more open and transparent communication.

Against this background, we test whether the tone of FOMC members differs following the November 1993 decision. To do so, we replicate the estimates presented in [Table 1](#) by focusing on all the FOMC meetings which took place between November 1993 and December 2009.

**Table 9: Tone and economic projections (1994-2009)**

	Overall		Economics go-round		Policy go-round	
	(1)	(2)	(3)	(4)	(5)	(6)
Inflation	0.276** (0.115)	0.198** (0.078)	0.353** (0.142)	0.269** (0.106)	-0.228 (0.221)	-0.258 (0.199)
Unemployment Rate	-0.191 (0.192)	0.004 (0.154)	-0.327 (0.231)	-0.044 (0.168)	-0.188 (0.174)	-0.177 (0.167)
Prof Exp FE	✓		✓		✓	
Education FE	✓		✓		✓	
Age	✓		✓		✓	
Gender	✓		✓		✓	
Meeting FE	✓	✓	✓	✓	✓	✓
Member FE		✓		✓		✓
$R^2$	0.360	0.343	0.324	0.297	0.146	0.144
Observations	2,131	2,145	2,131	2,145	2,111	2,124
Number of members	49	50	49	50	49	50

Robust standard errors in parentheses. \*\*\*/\*\*/\* denote significance at 1, 5 and 10 percent levels, respectively.

The results obtained using this alternative time frame are presented in Table 9 and are qualitatively similar to those in Table 1. In particular, we find that the coefficients related to inflation are consistent across estimations; that is, inflation projections are positively related to the tone used by FOMC members, in particular during the economics go-round.

## 7 Conclusion

Both the 2008-09 Global financial crisis and the Covid-19 pandemic gave the Federal Reserve centre stage to stabilise US macroeconomic fluctuations. As a matter of fact, the Federal Reserve balance sheet has expanded from less than \$1 trillion in September 2008 to close to \$7.4 trillion in February 2021. As the FOMC is responsible for deliberating on both the federal funds rate and the open market operations to be implemented, disagreement among FOMC members can have a significant impact on the effectiveness of its monetary policy decisions. It is therefore important to shed some light on the determinants of disagreement among FOMC members.

To do so, we use text analysis tools to study FOMC transcripts and extract information on the tone used by FOMC members during the different phases of FOMC meetings. We consider that disagreement inside the FOMC can be proxied by the average of dif-

ferences of tone within FOMC members and we relate the tone at each speaker-meeting-round level to the individual projections for inflation and unemployment rates, as well as FOMC members' personal characteristics. Our results show that FOMC members' inflation projections explain differences in the tone used during meetings, in particular during the economics go-round. Further specifications suggest that Bank presidents and voting members are more likely to use different tones when their inflation projections deviate more from the within-meeting mean level of individual projections. The tenure inside the FOMC as well as regional economic conditions also seem to exert an influence on the tone used by FOMC members. Finally, FOMC member who have experienced higher inflation levels and more recessions during their lifetime tend to express more negative views when their inflation projections deviate from the within-meeting mean of inflation projections.

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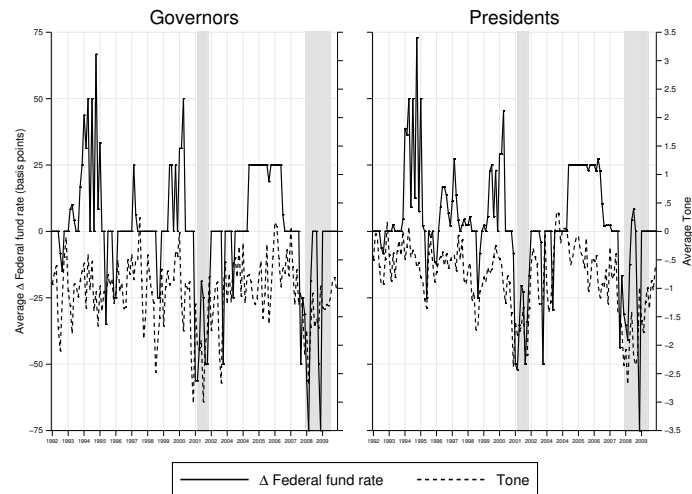


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# Appendix

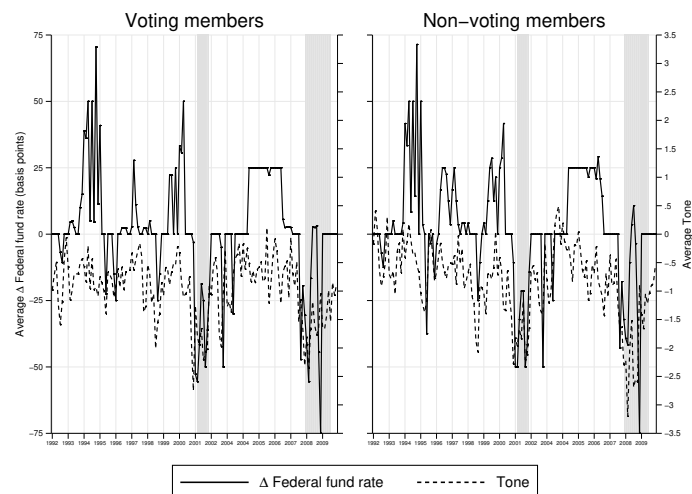
## A FOMC meetings tone

**Figure A.1: Average meeting tone and average monetary policy preferences (Governors vs Presidents)**



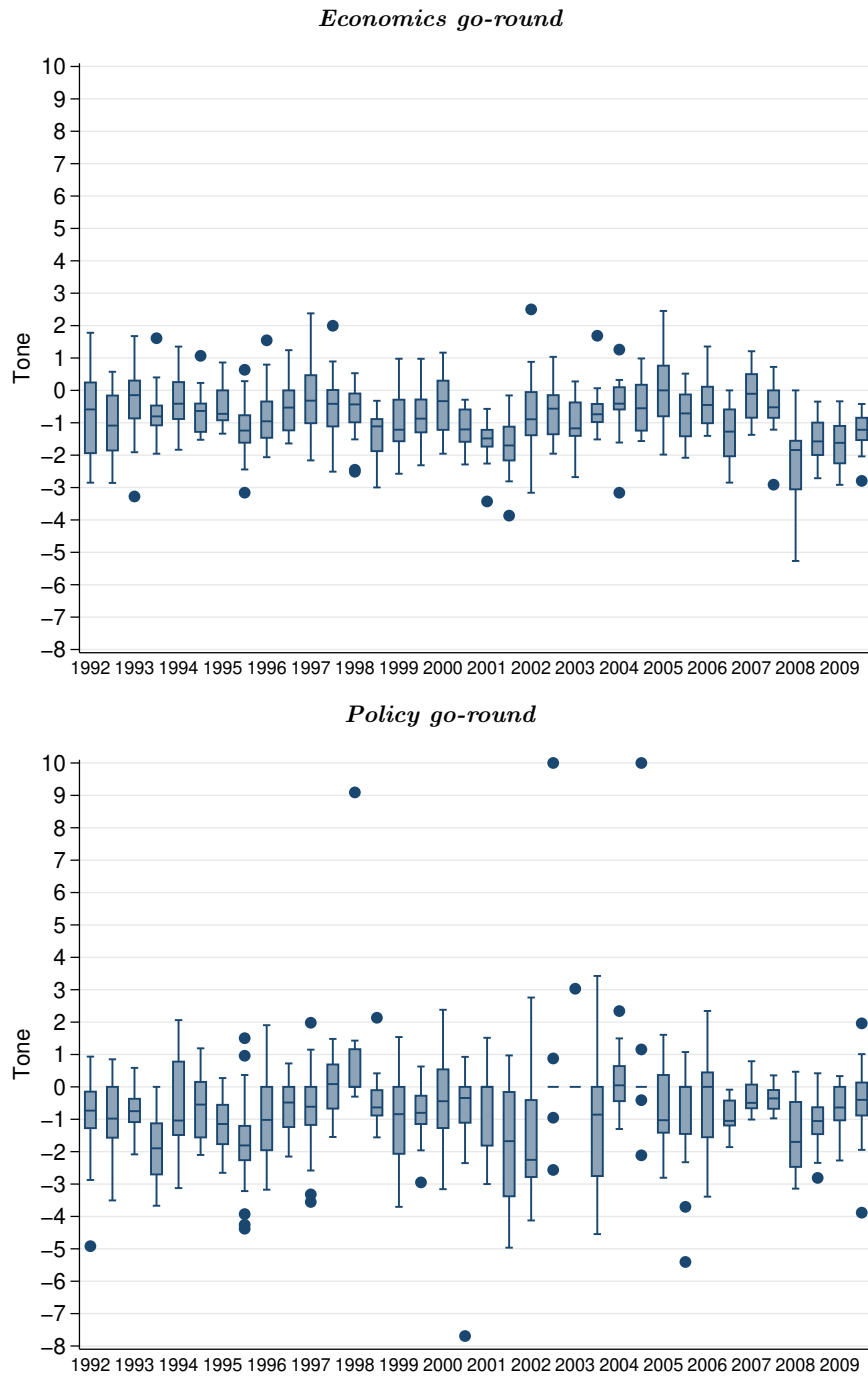
Notes: These figures show the average change in the federal fund rate proposed by FOMC members (solid line) and the average tone of the meeting (dotted line).

**Figure A.2: Average meeting tone and average monetary policy preferences (Voting vs Non-Voting members)**



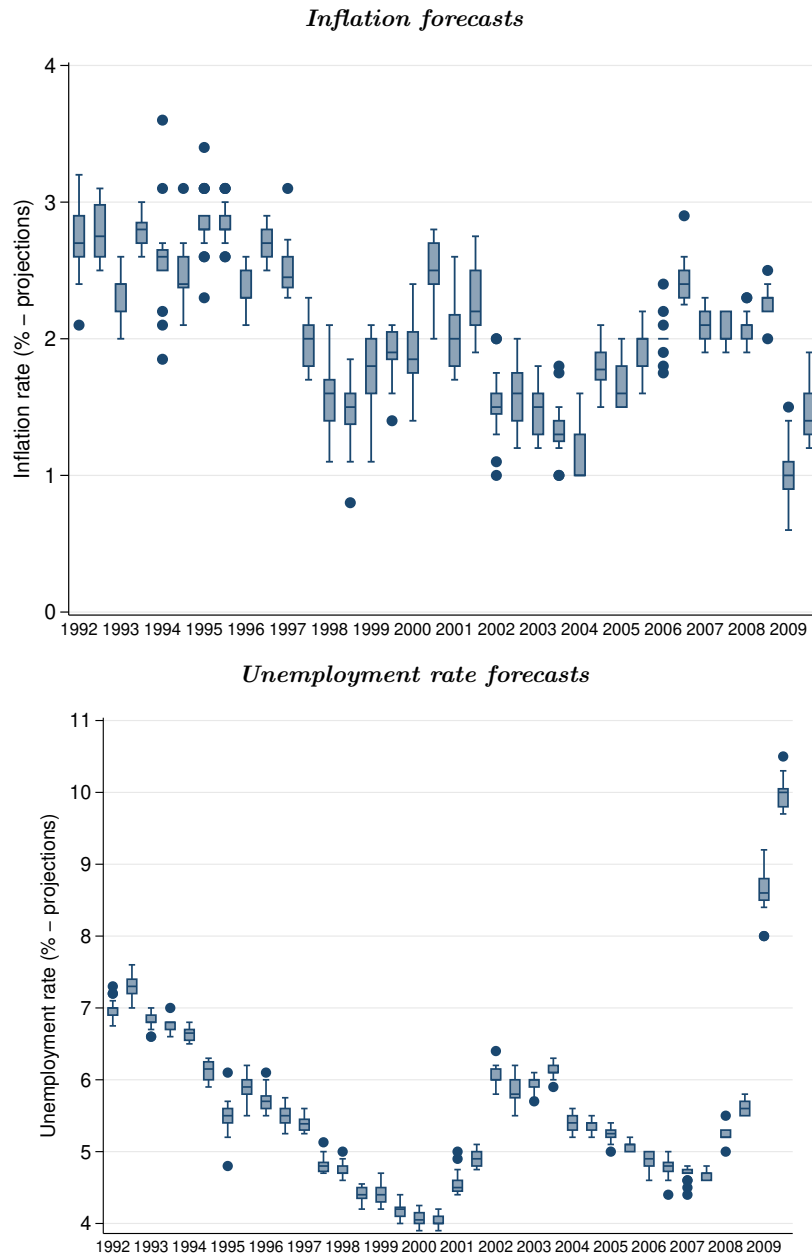
Notes: These figures show the average change in the federal fund rate proposed by FOMC members (solid line) and the average tone of the meeting (dotted line).

Figure A.3: Distribution of tone during the go-round phases (1992-2009)



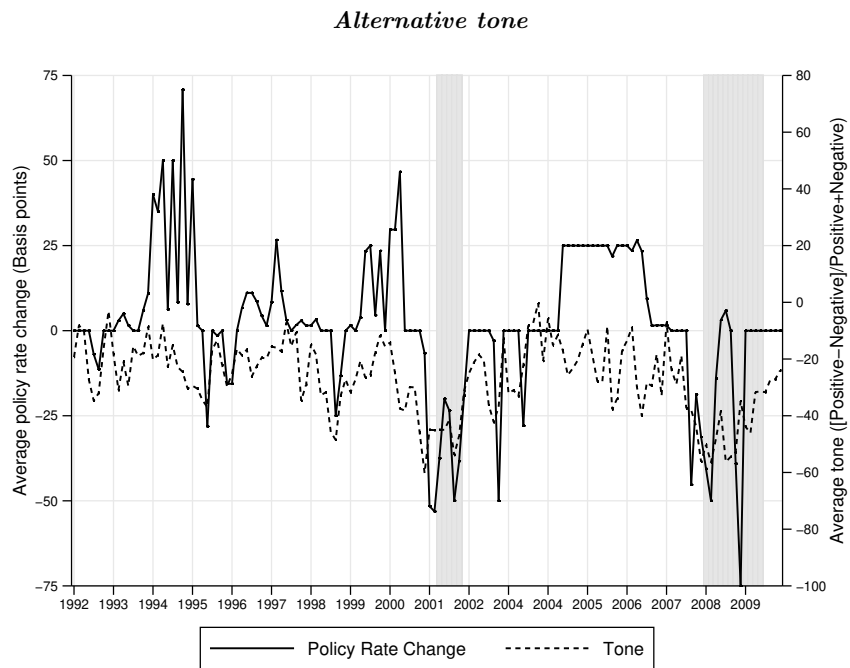
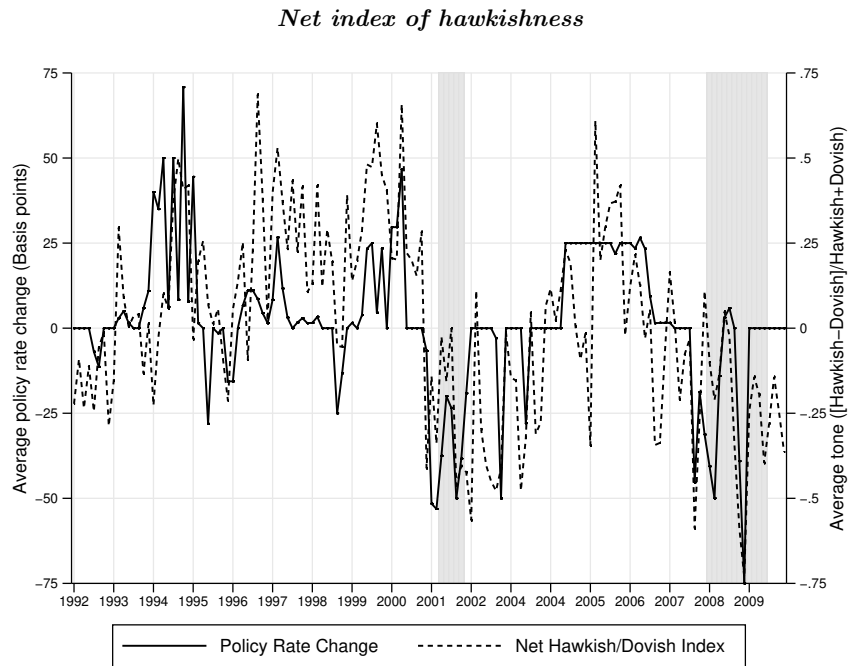
Notes: These figures show the distribution of go-rounds tone at a semiannual frequency. The middle line in the box shows the median value, while the bottom and top lines of the box show the 25th and 75th quartiles, respectively. The “whiskers” from the box extend vertically to the upper and lower adjacent values. The dots indicate points outside this range.

Figure A.4: Distribution of semiannual economic projections (1992-2009)



Notes: These figures show the distribution of economic projections for inflation and unemployment rate respectively. The middle line in the box shows the median value, while the bottom and top lines of the box show the 25th and 75th quartiles, respectively. The “whiskers” from the box extend vertically to the upper and lower adjacent values. The dots indicate points outside this range.

Figure A.5: Average meeting tone and average monetary policy preferences



Notes: Notes: These figures show the average change in the federal fund rate proposed by FOMC members (solid line) and the average values of the different tones used during the meetings (dotted line).

**Table A.1: Summary Statistics**

<b>Variable</b>	<b>Mean</b>	<b>Std. Dev.</b>	<b>Min</b>	<b>Max</b>	<b>Nr of obs</b>
<b>Dependent variable</b>					
<i>Overall meeting</i>					
Tone	-0.89	0.98	-6.59	2.63	2401
Hawkish-Dove index	0.02	0.25	-1.82	1.54	2208
Alternative tone	-25.34	26.27	-100.00	80.00	2399
<i>Economics go-round</i>					
Tone	-0.89	0.98	-6.59	2.63	2393
Hawkish-Dove index	0.02	0.25	-1.82	1.54	2202
Alternative tone	-25.38	26.19	-100.00	77.78	2392
<i>Policy go-round</i>					
Tone	-0.89	0.98	-6.59	2.63	2371
Hawkish-Dove index	0.02	0.24	-1.66	1.54	2184
Alternative tone	-25.35	26.15	-100.00	80.00	2369
<b>Independent variables</b>					
Inflation	2.09	0.54	0.60	3.60	2401
Unemployment rate	5.66	1.29	3.90	10.50	2401
Voting	0.59	0.49	0.00	1.00	2356
Board of Governors	0.29	0.45	0.00	1.00	2356
Academia	0.20	0.40	0.00	1.00	2401
Financial industry	0.19	0.39	0.00	1.00	2401
Federal Reserve	0.45	0.50	0.00	1.00	2401
Non-financial industry	0.03	0.16	0.00	1.00	2401
Government	0.13	0.34	0.00	1.00	2401
PhD	0.71	0.46	0.00	1.00	2401
Juris Doctor	0.01	0.11	0.00	1.00	2401
Master	0.25	0.44	0.00	1.00	2401
Bachelor	0.03	0.16	0.00	1.00	2401
Age	56.62	6.56	36.00	71.00	2387
Women	0.14	0.35	0.00	1.00	2401