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# Exploring the informativeness and drivers of tone during committee meetings: the case of the Federal Reserve

August 12, 2024

## Abstract

This paper examines the informativeness and drivers of the tone used by FOMC members to gain insights into the decision-making process of the FOMC. We use a bag-of-words approach to measure the tone of transcripts at the speaker-meeting-round level from 1992-2009 and find persistent differences in tone among FOMC members. We also document how Presidents of regional Federal Reserve Banks use a more volatile and positive tone than the members of the Federal Reserve Bank Board of Governors. Next, we investigate whether the tone used during FOMC deliberations is associated with future monetary policy decisions and study the drivers of differences in tone among FOMC members. Our results suggest that tone is useful to predict future policy decisions and that differences in tone are mainly associated with the differences in the individual inflation projections of FOMC members.

**Keywords:** Central banks; Federal Reserve; FOMC; monetary policy committees; text analysis.

**JEL classification:** E52, E58.

# 1 Introduction

The development of textual analysis tools and the availability of qualitative data released by central banks (such as minutes of meetings, transcripts and press releases) have contributed to shed light on the decision-making process of central banks. As an illustration, [Cieslak and Vissing-Jorgensen \(2021\)](#) use textual analysis of FOMC documents to show how the FOMC pays attention to the stock market performance while adopting their decisions. Following the same textual approach, [Shapiro and Wilson \(2022\)](#) estimate the Federal Reserve short-run loss function and suggest that it had an implicit inflation target of approximately  $1\frac{1}{2}$  percent over the 2000-2013 sample period.

The information gained from the textual analysis is even more important as several studies find that, following the FOMC's decision in 1993 to begin releasing full transcripts of its meetings, internal deliberations became less diverse and less informative.<sup>1</sup> In their seminal paper, [Meade and Stasavage \(2008\)](#) use the natural experiment that led to the release of the FOMC transcripts in 1993 to show that the tendency to dissent from the Chair of the Federal Reserve decreased following the change in the FOMC's transparency practices. Following this line of thought, [Hansen et al. \(2018\)](#) show that meetings become less interactive, more scripted and more quantitatively oriented. Finally, [Egedal et al. \(2015\)](#) evaluate the evolution of language used in Federal Reserve deliberations between 1976 and 2007, and find that the similarity of the documents increased by around 20% after 1993. Hence, the results of this literature provide evidence that the publication of transcripts since 1993 has altered FOMC members' incentives to cast dissenting votes, even though disagreement is present within the FOMC ([Claussen et al., 2012](#)).

Against this background, this paper aims to utilize a specific dimension of central bank communication, i.e. the tone of transcripts, which is likely to deliver more subtle qualitative information about the preferred policy stance of FOMC members than dissenting votes, in particular following the 1993 transparency reform. More precisely, we aim to show how the tone used during committee meetings is informative about future

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<sup>1</sup>For more details about the 1993 FOMC transparency reform, see [Meade and Stasavage \(2008\)](#)

monetary policy decisions and to investigate which variables drive the differences in tone observed among FOMC members. By doing so, we are able to overcome the limitations of using voting records, which have been shown to be less likely to reflect the preferred policy stance of FOMC members since 1993 and to gain more insights on the working of the Federal Reserve’s monetary policy committee. We compute a measure of the tone of transcripts at the speaker-meeting-round level over the period 1992-2009, by using a bag-of-words approach and the [Loughran and McDonald’s \(2011\)](#) dictionary.

We find persistent differences in tone among FOMC members and document how Presidents of regional Federal Reserve Banks use a more volatile and positive tone than the members of the Federal Reserve Bank Board of Governors. Interestingly, FOMC members seem to express a divergent tone mostly during the economics go-round, while some specific meetings were also characterized by differences in the tone used in the policy go-round, i.e. during the 1997-98 Asian financial crisis and the 2000 dot-com bubble. To investigate the informativeness of tone, we follow [Riboni and Ruge-Murcia \(2014\)](#) and examine whether the tone used during FOMC deliberations is associated with the future monetary policy decisions adopted by the FOMC. Next, we study the drivers of differences in tone among FOMC members relying on the literature focusing on the drivers of monetary policy preferences (see [Romer and Romer, 2008](#); [Eichler and Lähner, 2014, 2018](#); [Malmendier et al., 2021](#), among others). Specifically, we study how the tone used by FOMC members during committee meetings is related to their (i) individual projections for inflation and unemployment rate, (ii) personal characteristics, (iii) speaker class, i.e. Board Governors or Presidents of regional Federal Reserve Banks, (iv) voting status, and (v) personal experiences of inflation.

Our results show that the tone of other FOMC members is useful to predict the future changes in the Federal Funds Rate proposed by a member and that the average tone used by the committee is associated with the future monetary policy decisions adopted by the committee as a whole. Moreover, we find that differences in inflation projections are associated with differences in the tone used by FOMC members during the economics go-round. In terms of economic magnitude, an increase of 1 percentage

point in the projected inflation during the economics go-round is associated with an increase of about 0.26 points in the tone, or about 1 standard deviation of the within-meeting standard deviation of tone. While we find a strong effect of deviations in inflation projections on differences in tone among FOMC members, our results show no evidence that deviations in the level of projected unemployment rate or personal characteristics influence the differences in tone during committee meetings. Our findings also suggest that the tone of Presidents of regional Federal Reserve Banks and voting members is most affected by deviations in the level of projected inflation, especially during the economics go-round. Finally, we find that regional economic conditions, as reflected by the district-level unemployment rate, affect the tone of Presidents of regional Federal Reserve Banks, while the level of inflation experienced by FOMC members during their lifetime has a significant effect on the tone used during meetings' discussions.

The robustness of these results is checked along several lines. First, we use an alternative approach to identify the tone of discussions, i.e. the net index of hawkishness proposed in [Apel et al. \(2022\)](#). Second, we use a different normalisation strategy to compute the tone of discussions. Our results are robust to all these alternative specifications and provide strong evidence in support of the idea that tone is useful to explain the future monetary policy decisions adopted by the committee and that the differences in tone are mainly driven by deviations in the levels of individual projected inflation. Overall, these results show the importance of considering tone to gain insights into the decision-making process of the FOMC, in a context in which dissenting votes are less informative about FOMC members' monetary policy preferences.

This paper contributes to two strands of the literature. First, to the literature which uses text analysis tools on central bank communication to study its monetary policy-making process. [Apel et al. \(2022\)](#) 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. [Hubert and Labondance \(2021\)](#) find that the tone of FOMC statements explains monetary surprises beyond the information released

on policy announcement days. Second, we contribute to the literature investigating the determinants of differences in FOMC members' tone during committee meetings. [Cannon \(2015\)](#) finds that the tone of FOMC deliberations is strongly related to real economic activity, but that this relationship varies by speaker class, i.e. Board Governors or Presidents of regional Federal Reserve Banks. [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.

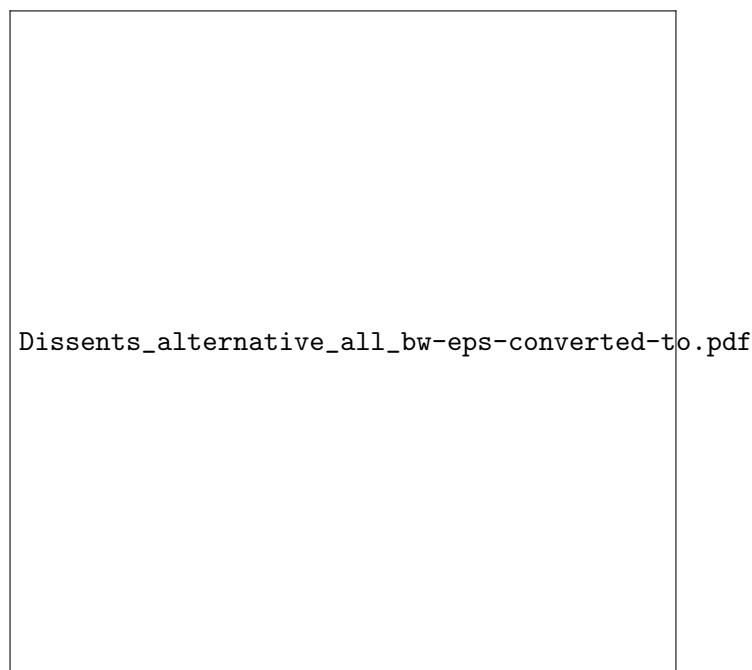
The paper is organised as follows. Section 2 describes the methodology used to compute the tone of FOMC members during committee meetings. Section 3 focus on the importance of tone to predict future monetary policy decisions. Section 4 presents the data and stylised facts and introduces the empirical setup used to investigate the drivers of differences in tone among FOMC members. Section 5 reports the main results while in section 6 we perform several robustness tests. Section 7 concludes.

## 2 The tone of FOMC members

We measure the tone of FOMC transcripts as these documents provide the best tool for examining differences in opinion between FOMC members ([Schonhardt-Bailey, 2013](#)). Indeed, the verbatim transcripts of FOMC meetings provide a better picture of the differences in terms of monetary policy stance among FOMC members than voting records. Hence, 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 1 shows how, for most of the meetings, many of the members who expressed different views in terms of the proposed Federal Funds Rate did not cast a dissenting vote.

Against this background, we extract the transcripts of all the FOMC meetings be-

**Figure 1: Different monetary policy preferences and dissenting votes in FOMC meetings (1992-2009)**



Notes: The figure shows the number of members expressing: i) different monetary policy preferences with respect to the adopted Federal Funds Rate for voting members (bars), and ii) dissenting votes (diamond symbol) cast by these members. Positive (negative) values indicate the number of members dissenting with tighten (loosen) monetary policy.

tween 1992 and 2009 from the Federal Reserve Board of Governors' website.<sup>2</sup> This period covers most of Alan Greenspan's tenure (1987-2006), and the first term of Ben Bernanke (2006-2009). 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 members of the Federal Reserve Bank Board of Governors and the Presidents of regional Federal Reserve Banks, as well as the list of voting and non-voting

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<sup>2</sup>The starting and ending period of our analysis is constrained by the availability of FOMC members' individual projections. On the one hand, individual projections are only available since 1992. On the other hand, the "Summary of Individual Economic Projections" is released after 5 years, but anonymous keys are assigned to the various FOMC members. It is only after 5 additional years that the "Key for Participant Numbers Used in the Anonymous Projections Package" is provided, allowing for a match between the individual projections and the respective FOMC members. Therefore, a complete match between the individual projections and FOMC members' identities is possible only after 10 years.

members over the 1992-2009 period.<sup>3</sup>

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, members of the Federal Reserve Board of Governors and Presidents of Regional Federal Reserve Banks discuss how they see economic and financial conditions. Federal Reserve Banks 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 Presidents of regional Federal Reserve Banks and Board Governors discuss their own monetary policy preferences, given current economic conditions and their personal outlook on the economy. This structure of the meetings makes the two go-rounds two distinct events: (i) the economics go-round is an information-sharing exercise where the Chair of the Federal Reserve speaks very little, while in (ii) the policy go-round, the Chair shares his/her vision and the other FOMC members react to it. This makes the informational content of the two go-rounds worthwhile to investigate.

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 first aggregate 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 remove all irrelevant information such as numbers, stop words, i.e. “the”, “and” or “a”, and punctuations and we lemmatize words to trace it back to its basic form. We then extract the number of positive and negative words mentioned by each member using the [Loughran and McDonald \(2011\)](#)'s dictionary (LM, hereafter).<sup>5</sup>

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<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.

<sup>4</sup>See [Federal Reserve Bank of Philadelphia \(2002\)](#) for an overview of the structure of FOMC meetings.

<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



The following sentences provide examples of utterances conveying a positive (bold and underlined) or a negative (italics and underlines) tone, according to the LM dictionary:

“There are a few **positives**, which give some hope of some **improvement** next year. We have talked about energy and commodity prices as they relate to inflation, but of course, the *decline* in energy and commodity prices is also a plus for consumers and raises real incomes and would be supportive of sentiment, as we have already seen. There are a few **positive** indications here and there on the housing market, a few glimmers of **stability**, particularly in some regions..”

— CHAIR BERNANKE, 16 SEPTEMBER 2008

“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, for each FOMC member, we measure the frequency of words that have a semantic orientation, i.e. positive or negative, according to the LM dictionary. Given the different informational content provided in the two go-rounds, we are able to compute the tone of the remarks made by each FOMC member during the entire meeting, as well as during the two go-round phases. The tone of each remark is computed as follows:

$$Tone_{i,m}^r = \frac{Positive_{i,m}^r - Negative_{i,m}^r}{Total\ Words_{i,m}^r}; \quad (1)$$

where  $Tone_{i,m}^r$  is the tone of FOMC member  $i$  at meeting  $m$ , during go-round  $r$ , i.e. economics, policy or overall meeting.  $Positive_{i,m}^r$  ( $Negative_{i,m}^r$ ) is the number of

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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.

positive (negative) words used by FOMC member  $i$  at meeting  $m$ , during go-round  $r$ .  $Total\ Words$  is the total number of words used by FOMC member  $i$  at meeting  $m$ , during go-round  $r$ .

Figure 2 shows the average tone of FOMC members and the average change in the Federal Funds Rate proposed by FOMC members during meetings.<sup>6</sup> We find that the average meeting tone closely follows the evolution of the average change in the Federal Funds Rate expressed by FOMC members. For instance, the steep reduction in the Federal Funds Rate in 2008-2009 coincides with the drop in average tone during that period.

**Figure 2: Average meeting tone and change in the Federal Funds Rate proposed by FOMC members (1992-2009)**

Notes: The figure shows the average change in the Federal Funds Rate proposed by FOMC members (solid line) and the average tone of the meeting (dotted line).

### 3 The importance of tone to predict future policy decisions

FOMC members' internal discussions reveal subtle information about the monetary policy-making process of the central bank. In this context, we aim to investigate the informativeness of tone for explaining the future monetary policy decisions adopted by the FOMC. This analysis is motivated by the literature that evaluates the extent to which central bank communication can help explain current and future monetary policy decisions. For instance, [Hayo and Neuenkirch \(2010\)](#) find that communication indicators are a strong predictor of the policy rate decisions of the FOMC, [Gerlach-Kristen \(2004\)](#) shows that the voting record of the Monetary Policy Committee of the Bank of England helps predict future policy rate changes. while [Ehrmann et al. \(2019\)](#) analyse how the tone of FOMC members' speeches in the inter-meeting period is related to votes at the next meeting.

We assess the informativeness of the tone of FOMC members using an approach

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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.

similar to [Riboni and Ruge-Murcia \(2014\)](#), who investigate the predictive power of dissent in predicting future policy decisions. Following their strategy, but focusing on the tone rather than the dissent cast by FOMC members, we investigate how the tone of a member is helpful in predicting the future changes in the Federal Funds Rate of other members. In addition, we also test whether the average tone of a meeting is helpful in predicting the future policy decision of the committee as a whole.

### 3.1 Tone and future proposed policy rate changes

In this section, we investigate the informativeness of the tone of other members in explaining the changes in the Federal Funds Rate proposed by an FOMC member during committee meetings. To do so, we estimate the following regression:

$$\Delta FFR_{i,m+1} = \alpha + \beta \text{Tone}_{-i,m} + \gamma \text{Tone}_{i,m+1} + \zeta x_m + \varepsilon_{i,m+1}. \quad (2)$$

where  $\Delta FFR_{i,m+1}$  is the proposed change in the Federal Funds Rate expressed by member  $i$  during the committee meeting  $m + 1$ .  $\text{Tone}_{-i,m}$  is the average meeting tone of the meeting computed excluding the tone of FOMC member  $i$ .  $\text{Tone}_{i,m+1}$  is the tone used by FOMC member  $i$  during committee meeting  $m + 1$ .  $\alpha$  is an intercept term,  $\beta$  and  $\gamma$  are scalar coefficients,  $\zeta$  is a  $1 \times r$  vector of coefficients,  $x_t$  is a  $r \times 1$  vector of regressors, and  $\varepsilon$  is a disturbance. In particular, we specify  $x_t = [\Delta FFR_t, \Delta FFR_{t-1}, \Delta\pi_{t+1}, \Delta u_{t+1}]$ .

The inclusion of the current and lagged changes in the Federal Funds Rate,  $\Delta FFR_t$  and  $\Delta FFR_{t-1}$ , is motivated by the fact that policy rate changes are serially correlated and, as a consequence, current and past changes in the Federal Funds rate may help forecast future monetary policy decisions. In addition,  $x_t$  also includes the change in both inflation ( $\Delta\pi_{t+1}$ ) and unemployment ( $\Delta u_{t+1}$ ) between the previous and the current meeting. Inflation is measured by the Consumer Price Index for All Urban Consumers and the unemployment rate is measured by the deviation of the seasonally adjusted rate from a constant term.

Panel A of Table 1 show the estimated coefficient  $\beta$  of equation (2), in which the tone of other FOMC members is computed using the average tone of a meeting, excluding FOMC member's  $i$  tone. In Panel B, the tone of others is weighted based on the tenure of each member, i.e. based on the number of years since the member was appointed to the committee.

**Table 1: Average tone and predictability of individual policy rate decisions**

	Overall		Economics go-round		Policy go-round	
	$\beta$	$R^2$	$\beta$	$R^2$	$\beta$	$R^2$
<b>Panel A: Equally-weighted tone</b>						
All members	14.843*** (1.364)	.416	14.568*** (1.073)	.427	3.411*** (.802)	.342
Bank Presidents	9.84*** (1.271)	.389	9.698*** (1.059)	.397	1.964** (.937)	.347
Board Governors	10.112*** (1.775)	.393	9.147*** (1.53)	.392	1.469** (.6)	.335
<b>Panel B: Tenure-weighted tone</b>						
All members	20.574*** (1.7)	.383	9.911*** (.909)	.376	10.738*** (.883)	.372
Presidents	13.2*** (1.703)	.367	7.544*** (.83)	.372	8.614*** (.874)	.365
Board Governors	16.089*** (4.595)	.368	4.872*** (1.35)	.348	6.153*** (1.023)	.358

The table reports the coefficient of the average tone ( $\beta$ ) of other members. Panel A presents the results for an equally-weighted tone, while in Panel B the tone of other members is weighted by their tenure inside the FOMC. Standard errors in parentheses and p-values in brackets. \*\*\*/\*\*/\* indicate significance at the 1%/5%/10% level.

The estimation results show that the coefficient related to the tone of other FOMC members,  $\beta$ , is always positive and statistically significant, even when controlling for inflation, unemployment and current and past proposed policy rate changes in both the equally and tenure-weighted approaches. This suggests that the tone used by other FOMC members is helpful in explaining the future policy rate changes proposed by an FOMC member. In addition, several observations are worth highlighting. First, the relationship between the tone and the future proposed rate change is more pronounced during the economics go-round than the policy go-round, except when the tenure-weighted tone is included in the regression. This result implies that the informativeness of tone

regarding future proposed policy rate changes is conditional on the type of weighting used in the specification. Second, when comparing the  $R^2$  for the different subgroups, i.e. Bank Presidents and Board Governors, we find that the predictive power of tone is marginally higher for Bank Presidents than for Board Governors in the economics and policy go-rounds.

### 3.2 Tone and future adopted policy rate changes

Next, we investigate the role of tone as a predictor of the future policy actions adopted by the committee as a whole. In this case, we estimate the following regression:

$$\Delta FFR_{m+1} = \alpha + \beta Tone_m + \zeta x_m + \varepsilon_{m+1}. \quad (3)$$

where  $\Delta FFR_{m+1}$  is the change in the Federal Funds Rate passed by the committee.  $Tone_m$  is the average tone used by FOMC members during meeting  $m$ , while  $x$  is the vector of regressions used to control for previous policy changes, as well as changes in inflation and unemployment rate. Estimates of  $\beta$  when the average tone of the meeting is weighted equally for all FOMC members are reported in Panel A of Table 2, while Panel B reports the estimates for the average tone computed using a tenure-weighted value of tone.

**Table 2: Average tone and predictability of FOMC policy rate decisions**

	Overall		Economics go-round		Policy go-round	
	$\beta$	$R^2$	$\beta$	$R^2$	$\beta$	$R^2$
<b>Panel A: Equally-weighted tone</b>						
All members	.269*** (.061)	.462	.245*** (.054)	.462	.062** (.029)	.328
Bank Presidents	.204*** (.057)	.416	.174*** (.047)	.411	.047* (.028)	.323
Board Governors	.187*** (.046)	.423	.172*** (.044)	.42	.029 (.019)	.317
<b>Panel B: Tenure-weighted tone</b>						
All members	.397*** (.108)	.417	.184*** (.058)	.389	.184*** (.058)	.391
Bank Presidents	.286*** (.093)	.375	.136*** (.045)	.366	.136*** (.046)	.368
Board Governors	.287*** (.088)	.405	.093** (.036)	.352	.094** (.036)	.356

The table reports the coefficient of the average tone ( $\beta$ ) of FOMC meetings. Panel A presents the results for an equally-weighted tone, while in Panel B the tone of other members is weighted by their tenure inside the FOMC. Standard errors in parentheses and p-values in brackets. \*\*\*/\*\*/\* indicate significance at the 1%/5%/10% level.

The results presented in Table (2) are in line with those of the previous section. Specifically, the average meeting tone is positively and statistically associated with future policy rate decisions regardless of the meeting round, the member status, and the weighting strategy considered in the specification.

## 4 Data and empirical setup of drivers of tone

In section 3 we have shown that tone matters to predict future monetary policy decisions proposed and adopted by the committee. In this context, questions arise as to the magnitude of differences in tone among FOMC members and the variables that might explain these differences.

Against this background, Figure 3 shows the divergence in tone among FOMC members over the 1992-2009 period.<sup>7</sup> While we observe persistent differences over the sample

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

period, the highest dispersion in tone took place in January 2002 and the lowest one in June 2007. Figure A.1 in the Appendix offers insights on the divergence in tone occurring during the two go-round phases. Even though the tone expressed by FOMC members diverges mainly during the economics go-round, some meetings are characterized by larger dispersion in tone during the policy go-round.

**Figure 3: Distribution of tone during FOMC meetings (1992-2009)**



Notes: The figure shows the distribution of 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 percentiles, respectively. The “whiskers” from the box extend vertically to the upper and lower adjacent values. The dots indicate points outside this range.

#### 4.1 Data and stylised facts

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

### 4.1.1 Individual projections

The individual projections of the members of the Federal Reserve Board of Governors and Presidents of regional Federal Reserve Banks can certainly shed light on the differences in tone inside the FOMC.<sup>8</sup> As an illustration, [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, while [Eichler and Lähler \(2014\)](#) show that higher individual inflation (unemployment) forecasts significantly increase (decrease) the probability of dissenting for a tighter monetary policy.

Prior to 2007, FOMC members were required to provide their end-of-year projections for nominal and real GDP, inflation, and the unemployment rate for inclusion in the Federal Reserve Chair's semi-annual monetary policy report to Congress. From 1992 to 2007, these individual projections were made available on the Federal Reserve Bank of Philadelphia website with a 10-year delay. Since 2008, the Federal Reserve has been publishing quarterly economic projections of FOMC members on its website. However, the "Summary of Individual Economic Projections" is released with a 5-year embargo, during which anonymous keys are assigned to the various FOMC members. It is only after the publication of the "Key for Participant Numbers Used in the Anonymous Projections Package", which occurs 10 years after an FOMC meeting, that it becomes possible to match the individual projections with the respective 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.

### 4.1.2 Personal characteristics

The literature on the FOMC decision-making process suggests that several personal characteristics, such as members' academic and professional backgrounds, can contribute to explaining the heterogeneity of discussions and preferences between FOMC members. For instance, [Eichler and Lähler \(2014\)](#) show that FOMC members with backgrounds

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<sup>8</sup>These projections do not include those of the Chair.



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. At the same time, [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, more recent literature has highlighted the differences in policy preferences between men and women monetary policy committee members (?).

Using the Federal Reserve History website and the personal vitae of FOMC members, we construct a database able to capture these personal characteristics. First, we create a variable measuring the percentage of time spent by an FOMC member in *academia* (positions at universities or colleges), the *Fed* (any position in the Federal Reserve System), the *financial industry* (positions at banks or other financial institutions), the *government* (positions in other government organisations), or the *non-financial industry* (positions in private non-financial industries or NGOs), before joining the FOMC. [Figure 4](#) shows the composition of the FOMC in terms of professional background over the 1992-2009 period.

**Figure 4: FOMC composition by professional background (1992-2009)**

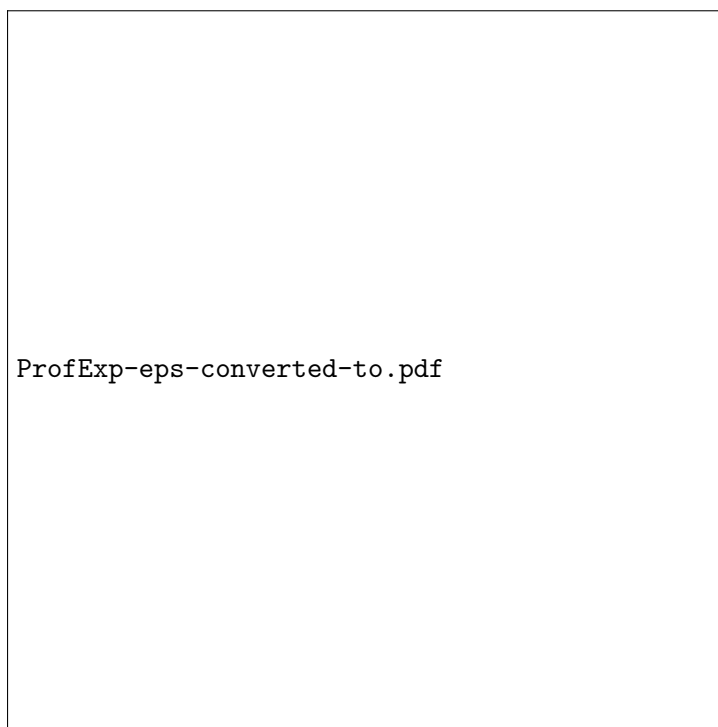


Figure 4 reveals that the proportion of members with a background in academia increased from 5% in 1992 to 29% in 2009, while the share of members coming from the financial industry decreased from 35% to 12%, during the same period. Second, we create dummy variables to control for the FOMC members' highest 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 a Master degree (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.

## 4.2 Empirical setup

In our empirical estimation of the drivers of differences in tone among FOMC members, we assume that cross-sectional differences in tone can be characterised by an augmented Taylor-style reaction function, where these differences are explained by the individual macroeconomic 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>9</sup> Hence, we expect that cross-sectional differences in macroeconomic forecasts and/or personal characteristics 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 mean value might have a more positive (negative) tone during a meeting. Our baseline estimation strategy takes the following form:

$$Tone_{i,m}^r = \beta_0 + \beta_1 \pi_{i,m}^{e_h} + \beta_2 u_{i,m}^{e_h} + \alpha_m + \gamma' x_{i,m} + \epsilon_{i,m}. \quad (4)$$

where  $Tone_{i,m}^r$  is the tone of FOMC member  $i$  at 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  $m$ .

Since our focus is on the cross-sectional heterogeneity in the tone of FOMC members, we employ meeting fixed effects,  $\alpha_m$ , to absorb common time-variation in the use of tone (see [Malmendier et al., 2021](#), for example). This allows us to obtain identification from differences in inflation and unemployment projections across individuals within a meeting. Equation (4) can thus be expressed as:

$$(Tone_{i,m}^r - \overline{Tone_m^r}) = \beta_0 + \beta_1 (\pi^{e_h} - \overline{\pi_m^{e_h}}) + \beta_2 (u_{i,m}^{e_h} - \overline{u_m^{e_h}}) + \alpha_m + \gamma' x_{i,m} + \epsilon_{i,m}. \quad (5)$$

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<sup>9</sup>The policy scenarios proposed by the research staff at both the Federal Reserve Board and the regional Federal Reserve Banks are based, among other things, 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 are based on alternative Taylor rules.

where  $\overline{Tone}_m^r$ ,  $\overline{\pi}_m^{eh}$  and  $\overline{u}_m^{eh}$  reflect the within-meeting mean values of tone, inflation and unemployment projections during meeting  $m$ , respectively.

In addition to controlling for the heterogeneity of FOMC members' economic projections, we also account for their personal characteristics, such as professional experience, education, age and gender.  $x_{i,m}$  is the vector of members' personal characteristics. We use two approaches to account for this. In the first approach, we use the variables discussed in Section 4.1.2 to control for prior professional experiences, education, gender, and the age of each FOMC member. In the second approach, we address heterogeneity by absorbing any time-invariant personal characteristic using member-fixed effects. The inclusion of member fixed effects is the most comprehensive way to account for unobserved personal-specific determinants of the divergent tone of FOMC members' remarks. Using this approach, the coefficients of interest, i.e.  $\beta_1$  and  $\beta_2$ , are identified from the within-member variation of tone as their inflation and unemployment rate forecasts deviate from the within-meeting mean value of these variables.

## 5 Drivers of differences in tone among FOMC members

### 5.1 Baseline model

The estimations results of eq. (5) are presented in Table 3. In columns (1)-(2) the dependent variable is the tone of the FOMC members' discussions during the overall meeting, while in columns (3)-(4) and (5)-(6) the dependent variable is the tone used during the economics and policy go-rounds, respectively. In columns (1), (3) and (5), we control for members' personal characteristics, while in columns (2), (4) and (6) we employ member-fixed effects.

**Table 3: 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	-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

In columns (1)-(2) the dependent variable is the tone of the FOMC members' discussions during the overall meeting, while in columns (3)-(4) and (5)-(6) the dependent variable is the tone used during the economics and policy go-rounds, respectively. Inflation is the end-of-year projection of inflation of FOMC member  $i$ . Unemployment is the end-of-year projection of the unemployment rate of FOMC member  $i$ . Prof Exp FE are variables measuring the percentage of time spent by a FOMC member in academia, the Fed, the financial industry, government or non-financial industry, before joining the FOMC. Education FE are dummy variables used to indicate FOMC members' highest academic degree. Age is the FOMC member  $i$ , during meeting  $m$ . Gender is a dummy equal to 1 for female FOMC members. Meeting FE are dummies to control for meeting fixed effects. Member FE are dummies to control for FOMC members' fixed effects. A constant term is included but not reported. Robust standard errors are in parentheses. \*\*\*/\*\*/\* denote significance at 1, 5 and 10 percent levels, respectively.

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

However, as discussed in section 2, 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 of the Federal Reserve, i.e. during the policy go-round. In column (3), we investigate the effect of deviations in individual economic projections and personal characteristics on the differences in the tone of the discussions expressed by FOMC members during the economics go-round.

In this specification, the coefficient for inflation projections is positive and significantly different from zero at the 1% level. The magnitude and significance of the coefficient for the projections of the end-of-year levels of inflation remain consistent when we include member fixed effects in column (4). Based on this specification, a 1 percentage increase in the level of individual projected inflation is associated with an increase in the tone of about 0.26 points. In terms of economic magnitude, an increase of 0.2 percentage points in the individual projected inflation – the average value of the within-meeting standard deviation – is associated with an increase of about 0.05 in the tone, or about 1/4th of its standard deviation.

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 coefficients of these regressions are less precisely estimated, as the results presented in column (5) show no statistical effect of deviations in inflation projections on differences in tone among FOMC members, while the coefficient for inflation projections in column (6) is negative but only significant at the 10% level. This sign might reflect the alignment of FOMC members to the Chair through the tone of their discussions during this specific round, despite the existing divergence in inflation projections. This might be explained by the dominant role played by Alan Greenspan in influencing the policy rate to adopt during meetings ([El-Shagi and Jung, 2015](#)).

Overall, these results provide evidence in support of the idea that the FOMC members' individual inflation projections are correlated with the differences in the tone of the discussions, in particular those made during the economics go-round.

## 5.2 Bank Presidents Vs Board Governors

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 regional Federal Reserve Banks. For example, [Havrilesky and Gildea \(1995\)](#) show that Federal Reserve Banks Presidents, as a group, prefer less expansionary monetary policy than Board Governors, while [Meade and Sheets \(2005\)](#) find that Federal Reserve Banks

Presidents are characterised by more persistent policy preferences.

Against this background, we assess the drivers of differences in the tone expressed by the members of the Federal Reserve Board of Governors and the Presidents of regional Federal Reserve Banks separately. Table 4 replicates the estimates presented in table 3 by distinguishing between Bank Presidents (Panel A) and Board Governors (Panel B) in the empirical specification.

**Table 4: Tone and economic projections: Bank Presidents Vs Board Governors**

	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	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 Governors</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	-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		✓		✓		✓

In columns (1)-(2) the dependent variable is the tone of the FOMC members' discussions during the overall meeting, while in columns (3)-(4) and (5)-(6) the dependent variable is the tone used during the economics and policy go-rounds, respectively. Inflation is the end-of-year projection of inflation of FOMC member  $i$ . Unemployment is the end-of-year projection of the unemployment rate of FOMC member  $i$ . Prof Exp FE are variables measuring the percentage of time spent by an FOMC member in academia, the Fed, the financial industry, government or non-financial industry, before joining the FOMC. Education FE are dummy variables used to indicate FOMC members' highest academic degree. Age is the FOMC member  $i$ , during meeting  $m$ . Gender is a dummy equal to 1 for female FOMC members. Meeting FE are dummies to control for meeting fixed effects. Member FE are dummies to control for FOMC members' fixed effects. A constant term is included but not reported. Robust standard errors are in parentheses. \*\*\*/\*\*/\* denote significance at 1, 5 and 10 percent levels, respectively.

The results presented in this table suggest that the divergent tone expressed by Bank Presidents is explained by the deviations in the level of individual projected inflation, especially during the economics go-round (columns (3) and (4)), while this is not the case for Board Governors. Interestingly, columns (5) and (6) in Panel B highlight the significant relationship between deviations in the level of individual projected unemployment



and the differences in tone expressed by Board Governors. Specifically, a 1 percentage increase in the level of individual projected unemployment from the within-meeting mean forecast is associated with a decrease in the tone of about 0.8 points. These findings remain almost unchanged when we replace FOMC members' personal characteristics with member-fixed effects. Our results thus suggest that Bank Presidents (Board Governors) are more likely to express a divergent tone when their inflation (unemployment) projections deviate from the within-meeting level of mean projections.

### 5.3 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 regional Federal Reserve Banks, only 12 members have the right to vote at each meeting. These are the seven members of the Board of Governors and the Presidents of five of the 12 regional Federal Reserve Banks.<sup>10</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.

To highlight whether voting and non-voting members behave differently in terms of differences in tone during FOMC meeting discussions, we investigate the drivers of their tone separately. Table 5 shows the results when we distinguish between voting (Panel A) and non-voting (Panel B) members.

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<sup>10</sup>The President of the Federal Reserve Bank of New York is a permanent voting member, and the Presidents of the other Federal Reserve Banks serve one-year terms as voting members in a rotation that is set by law. See [Federal Reserve](#) website for more information.

**Table 5: 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	-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	-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		✓		✓		✓

In columns (1)-(2) the dependent variable is the tone of the FOMC members' discussions during the overall meeting, while in columns (3)-(4) and (5)-(6) the dependent variable is the tone used during the economics and policy go-rounds, respectively. Inflation is the end-of-year projection of inflation of FOMC member  $i$ . Unemployment is the end-of-year projection of the unemployment rate of FOMC member  $i$ . Prof Exp FE are variables measuring the percentage of time spent by a FOMC member in academia, the Fed, the financial industry, government or non-financial industry, before joining the FOMC. Education FE are dummy variables used to indicate FOMC members' highest academic degree. Age is the FOMC member  $i$ , during meeting  $m$ . Gender is a dummy equal to 1 for female FOMC members. Meeting FE are dummies to control for meeting fixed effects. Member FE are dummies to control for FOMC members' fixed effects. A constant term is included but not reported. Robust standard errors are in parentheses. \*\*\*/\*\*/\* denote significance at 1, 5 and 10 percent levels, respectively.

The distinction between voting and non-voting members in the specification brings additional insights. In particular, columns (3) and (4) in Panel A show that inflation projections above the within-meeting mean forecast are associated with a more positive tone for voting members, during the economics go-round. Specifically, a 1 percentage points increase in the level of individual inflation projections from the within mean fore-

cast is associated with an increase of about 0.4 points in the tone of an FOMC member from the within-meeting average tone, i.e. 1/3 of its standard deviation. Moreover, we find that during the policy go-round, higher individual unemployment projections are associated with a more negative tone, although the coefficient is only significant at the 10% level (column (6)). On the contrary, the results presented in Panel B show no association between the personal projections of inflation and unemployment for non-voting members and the tone they use during meetings.

## 5.4 Regional economic conditions

The composition of the voting membership of the FOMC – five Bank Presidents and the seven members of the Federal Reserve Board of Governors – implies a significant influence of the regional economic conditions on FOMC members’ voting behavior, in particular for Bank Presidents (Meade and Sheets, 2005; Jung and Latsos, 2015). Using information obtained from transcripts as well as economic data aggregated at the Federal Reserve Banks’ district level, Chappell Jr et al. (2008) find that regional economic conditions influence the preferred policies of all FOMC members, but the effects are larger for Bank Presidents.

In this section, we investigate whether regional economic conditions affect the differences in the tone used by Bank Presidents during FOMC meetings. To do so, we replace the individual projections for unemployment with the unemployment rate in the 12 districts of the Federal Reserve System.<sup>11</sup> We focus this analysis on Bank Presidents as they are the only members who have an explicit regional affiliation and are more likely to discuss the conditions in their Districts during committee meetings.

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<sup>11</sup>The unemployment data are available at: <https://fred.stlouisfed.org/searchresults?st=unemployment+rate+federal+district>. Unfortunately, district-level inflation rates are not publicly available.

**Table 6: 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	-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

In columns (1)-(2) the dependent variable is the tone of the FOMC members' discussions during the overall meeting, while in columns (3)-(4) and (5)-(6) the dependent variable is the tone used during the economics and policy go-rounds, respectively. Inflation is the end-of-year projection of inflation of FOMC member  $i$ . District-level Unemployment is the end-of-year level of unemployment rate in the district of FOMC member  $i$ . Prof Exp FE are variables measuring the percentage of time spent by a FOMC member in academia, the Fed, the financial industry, government or non-financial industry, before joining the FOMC. Education FE are dummy variables used to indicate FOMC members' highest academic degree. Age is the FOMC member  $i$ , during meeting  $m$ . Gender is a dummy equal to 1 for female FOMC members. Meeting FE are dummies to control for meeting fixed effects. Member FE are dummies to control for FOMC members' fixed effects. A constant term is included but not reported. Robust standard errors are in parentheses. \*\*\*/\*\*/\* denote significance at 1, 5 and 10 percent levels, respectively.

The results presented in Table 6 suggest that regional economic conditions, reflected by the district-level unemployment rate, exert a significant effect on the differences in the tone of Bank Presidents during FOMC meetings. Hence, a higher than average level of unemployment rate projections is associated with a more negative tone, in particular during the economics go-round and when accounting for FOMC members' personal characteristics. Furthermore, deviations in individual inflation projections are positively and significantly related to differences in tone during the economics go-round in the most stringent estimation in column (4).

## 5.5 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. Hence, to test whether differences in members' lifetime experiences of inflation explain the differences in the tone of FOMC members, we follow [Malmendier et al. \(2021\)](#) and compute a measure of the individual inflation experiences of each FOMC member using their model of experience-based learning. The measure of inflation experiences maps each member's lifetime history of experienced inflation assigning more weight to recent experiences than those in early life.<sup>12</sup>

We expand our baseline estimations by adding a variable measuring inflation experiences as well as an interaction term between the individual inflation projections and the measure of inflation experiences. The results for these estimations are presented in [Table 7](#).

**Table 7: 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	-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

In columns (1)-(2) the dependent variable is the tone of the FOMC members' discussions during the overall meeting, while in columns (3)-(4) and (5)-(6) the dependent variable is the tone used during the economics and policy go-rounds, respectively. Inflation is the end-of-year projection of inflation of FOMC member  $i$ . Inflation experiences is the measure of inflation experiences for FOMC member  $i$ , as proposed in [Malmendier et al. \(2021\)](#). Unemployment is the end-of-year projection of the level of the unemployment rate of FOMC member  $i$ . Prof Exp FE are variables measuring the percentage of time spent by a FOMC member in academia, the Fed, the financial industry, government or non-financial industry, before joining the FOMC. Education FE are dummy variables used to indicate FOMC members' highest academic degree. Age is the FOMC member  $i$ , during meeting  $m$ . Gender is a dummy equal to 1 for female FOMC members. Meeting FE are dummies to control for meeting fixed effects. Member FE are dummies to control for FOMC members' fixed effects. A constant term is included but not reported. Robust standard errors are in parentheses. \*\*\*/\*\*/\* denote significance at 1, 5 and 10 percent levels, respectively.

<sup>12</sup>More precisely, the level of experience-based inflation is computed on the basis of the inflation history of each FOMC member  $i$  up to meeting  $m$ .

The negative and significant coefficient of the interaction term suggests that inflation experiences influence the tone used by FOMC members. In particular, our results suggest that, for the same level of inflation, those members who have experienced higher levels of inflation during their life tend to use a more negative tone. 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.

## 6 Robustness tests

This section presents several robustness tests of the main results obtained in the previous sections, i.e. sections 3 and 5. In particular, we consider alternative approaches to testing whether the results are affected by the type of dictionary or the normalization procedure used to compute the tone of FOMC members' discussions.

The measure of tone presented in section 2 is based on the [Loughran and McDonald \(2011\)](#) dictionary. As the informativeness of the tone regarding future proposed and adopted policy rates and their drivers 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 dictionary. Specifically, we quantify the tone of FOMC members' transcripts using the automated search-and-counts approach proposed by [Apel et al. \(2022\)](#).<sup>13</sup> This approach has been created with the specific purpose of identifying the degree of hawkishness used in FOMC transcripts and minutes and had been already used in the central bank communication literature (see [Hansen and McMahon, 2016](#); [Hubert and Labondance, 2021](#); [Malmendier et al., 2021](#), among others).

Following [Apel et al. \(2022\)](#), 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

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<sup>13</sup>The approach developed by [Apel et al. \(2022\)](#) is an extended version of the [Apel and Grimaldi \(2012\)](#) text-based measure of policy inclination contained in FOMC minutes and transcripts.

hawkish or dovish context. As in [Apel et al. \(2022\)](#) and [Malmendier et al. \(2021\)](#), we compute the index of FOMC members’ hawkishness as follows:<sup>14</sup>

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

Figure [A.2](#) in the Appendix shows the average value of the alternative measure of tone when using the [Apel et al. \(2022\)](#)’s dictionary and the average change in the Federal Funds Rate proposed by the FOMC members during the meeting.

The robustness of our results can also be tested using an alternative normalisation strategy of the [Loughran and McDonald \(2011\)](#) dictionary. This alternative measure of tone is computed as follows:

$$\text{Alternative Tone}_{i,m}^r = \frac{\text{Positive}_{i,m}^r - \text{Negative}_{i,m}^r}{\text{Positive}_{i,m}^r + \text{Negative}_{i,m}^r}. \quad (7)$$

After computing these alternative measures of tone, we are able to test the robustness of our results by replacing the tone measure in eqs. [\(2\)](#), [\(3\)](#) and [\(4\)](#) with these new variables. The results of these robustness estimations are presented in Appendix Tables [A.2](#), [A.3](#) and [A.4](#). In particular, Appendix Table [A.2](#) reports the relationship between the equally-weighted tone of other FOMC members and the changes in the Federal Funds Rate proposed by individual members, while Appendix Table [A.3](#) show the relationship between the equally-weighted tone of a meeting and the future monetary policy decisions adopted by the committee as a whole. Finally, Appendix Table [A.4](#) exposes the relationship between FOMC members’ individual economic projections and the tone they use during FOMC meetings.

On the one hand, the positive and statistically significant sign of the coefficient related to tone ( $\beta$ ) in Appendix Table [A.2](#) indicates that the latter is still relevant to explain how the tone of other members is helpful in predicting the future policy rate changes proposed by a member, in particular during the economics go-round. On the

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<sup>14</sup>See [Apel et al. \(2022\)](#) for details on the list of *goals* and *attributes* used for the construction of the *Net index* of hawkishness of FOMC members’ remarks.

other hand, the Net Index seems to be less informative of the future monetary policy decisions adopted by the committee as a whole (see Appendix Table A.3, Panel A). This indicates that the informativeness of tone, at least for the future policy decisions adopted by the committee as a whole, is conditional on the dictionary used to measure it and the rounds of discussion. Finally, our results confirm that a positive deviation of individual projected inflation from the within-meeting mean forecast is associated with a more positive tone, in both the overall meeting and the economics go-round (Appendix Table A.4).

## 7 Conclusion

As the FOMC is responsible for deliberating on both the Federal Funds Rate and the open market operations to be implemented, differences in tone among FOMC members during committee meetings can have a significant impact on the effectiveness of its monetary policy decisions. It is therefore important to shed some light on the informativeness and drivers of the tone of FOMC members.

For this purpose, 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. In the first part of the analysis, we use predictability regressions to test whether tone helps predict future policy decisions. Our results show that the tone of other FOMC members helps predict the future changes in the Federal Funds Rate proposed by a member. In addition, we also find evidence that the average tone of FOMC meetings is helpful in predicting the future monetary policy decisions adopted by the committee as a whole. As a next step, we investigate the drivers of differences in tone among FOMC members within a meeting and relate them to their 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. Regional economic conditions also seem to exert an influence on the tone used by FOMC members. Finally, FOMC members who have experienced higher inflation levels 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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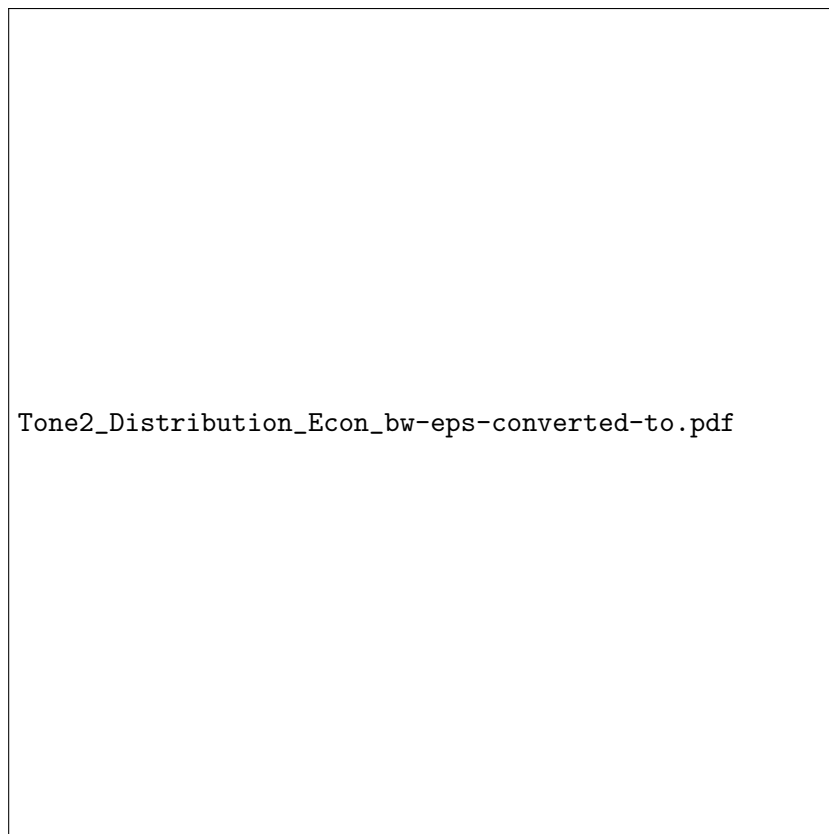
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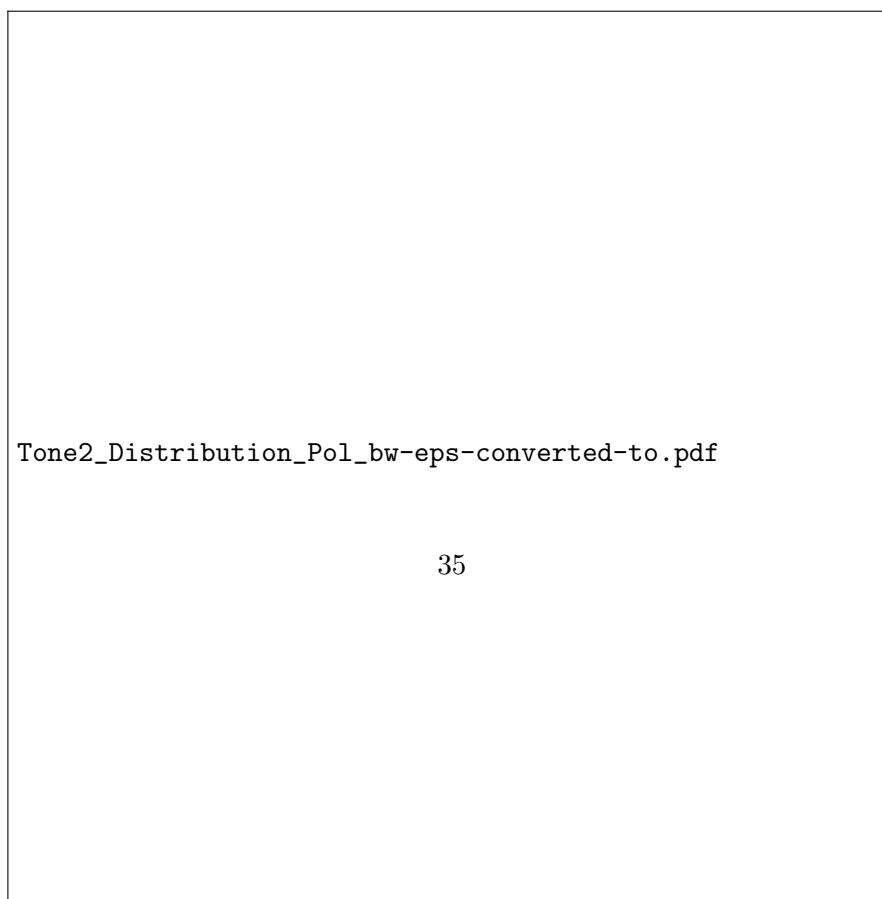
## Appendix

Figure A.1: Distribution of tone during the go-round sessions (1992-2009)

*(a) Economics go-round*



*(b) Policy go-round*



**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
Net 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
Net 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
Net 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

**Figure A.2: Average meeting Net index of hawkishness and average monetary policy preferences**



Notes: The figure shows the average change in the Federal Funds Rate proposed by FOMC members (solid line) and the average values of the Net Index of hawkishness proposed in [Apel et al. \(2022\)](#) (dotted line).

**Table A.2: Alternative tone and predictability of individual policy rate decisions**

	Overall		Economics go-round		Policy go-round	
	$\beta$	$R^2$	$\beta$	$R^2$	$\beta$	$R^2$
<b>Panel A: Net index</b>						
All members	12.794*** (1.592)	.369	13.782*** (1.387)	.373	4.193*** (2.132)	.363
Bank Presidents	6.844*** (1.492)	.369	6.513*** (1.3)	.363	-0.521 (2.767)	.393
Board Governors	6.691*** (1.901)	.347	7.975** (1.297)	.351	-.228 (2.746)	.4
<b>Panel B: Alternative Tone</b>						
All members	.494** (.053)	.387	.387*** (.051)	.371	.072*** (.022)	.336
Bank Presidents	.341* (.043)	.381	.297*** (.04)	.375	.101*** (.027)	.353
Board Governors	.291* (.066)	.357	.212*** (.057)	.343	-.007 (.022)	.314

The table reports the coefficient of the alternative average tones ( $\beta$ ) of other members. Panel A presents the results for the equally-weighted Net Index of [Apel et al. \(2022\)](#), while in Panel B we tenure-weighted alternative tone of other members. Standard errors in parentheses and p-values in brackets. \*\*\*/\*\*/\* indicate significance at the 1%/5%/10% level.

**Table A.3: Alternative tone and predictability of FOMC policy rate decisions**

	Overall		Economics go-round		Policy go-round	
	$\beta$	$R^2$	$\beta$	$R^2$	$\beta$	$R^2$
<b>Panel A: Net index</b>						
All members	.129** (.065)	.321	.129* (.07)	.318	.01 (.065)	.283
Bank Presidents	.09* (.047)	.316	.077* (.046)	.31	.03 (.062)	.275
Board Governors	.084 (.063)	.315	.089 (.063)	.315	-.021 (.045)	.266
<b>Panel B: Alternative Tone</b>						
All members	.009*** (.002)	.412	.006*** (.002)	.381	.001** (.001)	.322
Bank Presidents	.006*** (.002)	.387	.005*** (.002)	.371	.002** (.001)	.334
Board Governors	.006*** (.002)	.369	.004** (.002)	.346	.001 (.001)	.304

The table reports the coefficient of the average tone ( $\beta$ ) of FOMC meetings. Panel A presents the results for the equally-weighted Net Index of [Apel et al. \(2022\)](#), while in Panel B we tenure-weighted alternative tone of other members. Standard errors in parentheses and p-values in brackets. \*\*\*/\*\*/\* indicate significance at the 1%/5%/10% level.

**Table A.4: Alternative tone 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	-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

In columns (1), (3) and (5) the dependent variable is Net index of hawkishness of FOMC member  $i$ , as proposed in [Apel et al. \(2022\)](#). In columns (2), (4) and (6) the dependent variable is the alternative tone measure in eq. (7). Inflation is the end-of-year projection of inflation of FOMC member  $i$ . Unemployment is the end-of-year projection of the level of the unemployment rate of FOMC member  $i$ . Meeting FE are dummies to control for meeting fixed effects. Member FE are dummies to control for FOMC members' fixed effects. A constant term is included but not reported. Robust standard errors are in parentheses. \*\*\*/\*\*/\* denote significance at 1, 5 and 10 percent levels, respectively.