DISCUSSION PAPER SERIES

DP16213

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MONETARY ECONOMICS AND FLUCTUATIONS

CEPR

*ISSN 0265-8003*

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Discussion Paper DP16213
Published 02 June 2021
Submitted 31 May 2021

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## Abstract

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JEL Classification: D71, D72, E58

Keywords: voting right rotation, Monetary policy committee, central bank communication, FOMC, financial market response



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Acknowledgements
This paper has been circulated earlier under the title “Strategic interactions in preparing for committee meetings”. It presents the authors’ personal opinions and does not necessarily reflect the views of the ECB or the Eurosystem. We would like to thank Philippe Andrade, Hans Gersbach, Klodiana Istrefi, Moritz Janas, Robin Lumsdaine, Ellen Meade, Mike Powell, Annette Vissing-Jorgensen, and participants at the EEA Annual Congress 2019, the 2019 Deutsche Bundesbank Macro Workshop and at seminars at the ECB and Erasmus University Rotterdam for helpful comments and conversations.

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## 1. Introduction

We study the effect of voting rights on the behavior of individual members of a decision-making committee in a context that allows for causal inference. We exploit the rotation of voting rights among Federal Reserve Bank presidents on the Federal Open Market Committee (FOMC), the monetary policy committee of the United States. Rotation at the FOMC is mechanical. It is also without exclusion: nonvoting presidents customarily "attend the meetings of the Committee, participate in the discussions, and contribute to the Committee's assessment of the economy and policy options."[1] That is, the only difference with voting presidents is that nonvoting presidents do not vote. We use 20 years of data to answer three questions. Does the voting status of presidents affect their interventions during meetings and their speeches between meetings? Does it affect how financial markets react to their speeches? And is the difference in market reaction consistent with the observed difference in behavior?

The FOMC holds eight scheduled meetings per year. Decisions taken by the FOMC, such as those on the target for the federal funds rate, have economy-wide effects.[2] The seven members of the Board of Governors of the Federal Reserve System and the president of the Federal Reserve Bank of New York are permanent members of this committee and vote on monetary policy at every meeting. The remaining four seats that come with the right to vote are assigned to four groups of 11 Federal Reserve districts. Which district in each group has the right to vote is determined by the rotation scheme. This scheme has been in place since 1943. In any district, Reserve Bank presidents are appointed for a five-year period that is renewable. As a result, they typically experience years with and without the right to vote.

A Reserve Bank president is expected to bring intelligence about the regional economic and credit conditions to the discussion on monetary policy at the FOMC, including extensive anecdotal evidence that is hard to obtain for outsiders. Moreover, the president of a Reserve Bank is the chief executive officer of the Bank and is accountable to the Bank's

[1] The quote is taken from the FOMC website, https://www.federalreserve.gov/monetarypolicy/fomc.htm, accessed September 29, 2020.

[2] There is ample evidence about the macroeconomic effects of monetary policy (see, e.g., Bernanke and Mihov 1998). The FOMC decides on the target for the federal funds rate and authorizes open market operations–the buying and selling of U.S. government securities–by the Federal Reserve to reach that target. The federal funds rate is the interest rate at which commercial banks lend balances at the Federal Reserve to other commercial banks overnight, and affects a wide range of other interest rates (Drechsler et al. 2017.

board of directors. These boards have strong ties with the districts' regional financial industry, businesses and community in general. In line with this, many students of the FOMC relate the behavior of presidents not only to national but also to regional economic variables. Meade and Sheets (2005) and Chappell et al. (2008), among others, have indeed found evidence that regional variables---in particular, district-level unemployment--- affect speeches and even policy preferences stated in the meeting and actual votes cast.

Our primary data consists of the transcripts of 160 FOMC meetings and the texts of around 2800 speeches (875 speeches of which on monetary policy matters) during the period 1994-2013. Speeches appear a natural place to start an analysis of behavioral changes in intermeeting periods. They are publicly observable and can furthermore influence financial markets (Blinder et al. 2008). This large influence on financial markets is one of the reasons why FOMC participants must observe a "blackout period on monetary policy communications" around FOMC meetings[3]. FOMC members also give interviews during intermeeting periods. As these are typically shorter than speeches, they seem less amenable to textual analysis. Other communication channels, like phone conversations with governors or other presidents, or informal contacts with the press appear impossible to observe.[4]

We formulate two hypotheses on the effects of voting right rotation on presidents' behavior. The loss-compensation hypothesis is inspired by the literature on influence activities and strategic information transmission by informed and interested parties without decision-making power (Crawford and Sobel 1982, Milgrom and Roberts 1986, and 1988). It maintains that in years *without* the right to vote presidents seek to compensate for the loss of the formal voting right by making more intense use of intermeeting speeches and meeting interventions. The gain-enhancement hypothesis is inspired by the literature on decision-making authority in organizations (Aghion and Tirole 1997, Baker Gibbons and Murphy 1999). It maintains that in years *with* the right to vote presidents are more committed and involved in the decision-making process and this leads them to make more

[3] See Federal Open Market Committee (2011) and Ehrmann and Fratzscher (2009). At present, the blackout period starts on the Saturday before the meeting and lasts until the end on the day following the end of the meeting.

[4] The agendas of six Federal Reserve governors that Morse and Vissing-Jorgensen (2020) obtained through a Freedom of Information request do not show the identity of the presidents with whom governors spoke. Vissing-Jorgensen (2020) shows that informal contacts with the press and the possibility of leaks are a recurring topic at FOMC meetings.

intense use of intermeeting speeches and meeting interventions. We study in particular the tone and number of intermeeting speeches and the tone and length of meeting interventions. The loss-compensation hypothesis predicts that these depend more strongly on regional economic variables in years without the right to vote than in years with. The gain-enhancement hypothesis maintains the opposite: their dependence becomes stronger in years with the right to vote.

We find that, by and large, patterns in the data support the gain-enhancement hypothesis and go against the loss-compensation hypothesis, both when we study the intermeeting speeches and the meeting interventions.

Dissenting votes at the FOMC are infrequent and signal strong disagreement about the decision[5]. In the context of the loss-compensation hypothesis, having the right to vote in such circumstances is particularly valuable, and not having it is particularly costly. It therefore predicts that dissents at the last meeting will increase the dependence of the number and tone of speeches by presidents *without* the right to vote on regional economic circumstances. The gain-enhancement hypothesis predicts the same stronger dependence for presidents *with* the right to vote; the strong disagreement about the recent decision makes them more committed and involved. Again, the data are consistent with the gain-enhancement hypothesis, not with the loss-compensation hypothesis.

Voting status might matter to financial markets. We measure the market reaction to presidents' speeches by the absolute daily change in constant maturity Treasury yields, with maturities varying from three months to five years. We find a 'vote discount:' the market responds systematically *less* to speeches in years presidents vote than in years they do not vote. The estimated coefficient is large compared to the average absolute change in the dependent variable. This finding is robust and becomes stronger if we extend the sample period of speeches to 2018 or limit attention to speeches covered by the newswire Reuters.

This pattern might seem surprising–after all, formally a president is more influential in years with the right to vote than without. We argue that this vote discount is consistent with the difference in behavior due to voting status. Under the assumption that participants in the U.S. treasury market are more interested in national than in regional information, our

[5] Schultz, a former governor and vice-chairman of the FOMC states "We should argue in the Board meetings but close ranks in public (Greider 1987, p. 390). See Visser and Swank (2007) for the reputational value of speaking with one voice.

argument is that markets can extract more information that is relevant to them from a speech given by a president in years without the right to vote than in years with the right to vote. In further support of this argument, we find that the vote discount by the market is especially large for speeches given before the publication of the Beige Book with district-level information; these are precisely the speeches that respond most strongly in tone and number to the economic situation at the district-level when a president has voting status.

The exogenous nature of the voting right rotation at the FOMC makes causal inferences about behavioral changes possible. Also, the monetary policy context of the committee helps identification. First, the meetings of such committees are often well documented. One can analyze minutes and, in the case of the FOMC, even transcripts of the meetings for behavioral reactions to voting status. Second, meetings are held regularly and are typically structured in the same way and deal with the same type of decision. This facilitates comparison over time. Third, members of monetary policy committees give public speeches, an instrument that they can use to potentially shape the final decision independently of their voting status. Thanks to their public nature, one can add them to the corpus of texts to be analyzed. Last, these speeches are monitored carefully by financial markets. Thus, one can test whether and how financial markets react to the difference in voting status.

The remainder of this paper is organized as follows. Section 2 develops our hypotheses on the behavioral effects of voting status. Section 3 discusses our data and Section 4 presents the empirical analysis. Section 5 first explains how the current FOMC emerged with its peculiar rotation scheme without exclusion; it then compares that scheme with schemes used by other committees to share voting rights. Next we use our findings to speculate about possible consequences of four proposals by academics and U.S. lawmakers that would change FOMC membership; all involve changes to the current rotation scheme. The section ends with a discussion of some related literature. Section 6 concludes.

## 2. Two hypotheses about the way the right to vote affects presidents' behavior

The rival hypotheses that we test maintain that the strength of the relationship between regional economic conditions and Bank president behavior varies systematically with their voting status on the FOMC. To motivate these hypotheses, we begin by arguing that, by

design, Bank presidents put particular emphasis on regional conditions in preparation for and during the meeting.

The FOMC's mandate from Congress is "to promote effectively the goals of maximum employment, stable prices, and moderate long-term interest rates" in the U.S. economy.[6] As the U.S.A. is a large country, each Federal Reserve Bank systematically collects information about its district. Part of this information is obtained "through reports from [Federal Reserve] Bank and Branch directors, plus phone and in-person interviews with and online questionnaires completed by businesses, community contacts, economists, market experts, and other sources."[7] Various processes are in place to bring this information to bear on FOMC decision making. Intelligence based on the anecdotal information is presented in *The Beige Book. Summary of Commentary on Current Economic Conditions by Federal Reserve District*, a report that Board governors and Reserve bank presidents receive about two weeks before an FOMC meeting. Regional information about economic and credit conditions is also regularly reviewed during an FOMC meeting. In the economy go-round, the first part of a meeting, Bank presidents discuss and comment on regional conditions.

The governance of the Federal Reserve System also has a strong regional component. Since its inception in 1913, presidents of Reserve Banks have been chief executive officers of their Banks. Each bank has its own board of directors. Directors have strong ties with regional financial industry, businesses and the community in general. Presidents are accountable to these boards.

Both the regional nature of governance and the role of regional information at FOMC meetings make it plausible that presidents identify with their districts. As a result, many students of the FOMC have indeed found evidence that regional economic variables affect presidents' behavior and even policy preferences. Hayo and Neuenkirch (2013) find that economic conditions in the district are reflected in presidential speeches. Chappell et al (2008), Jung and Latsos (2015) and Bennani et al (2018) find that an increase in regional unemployment (relative to U.S.-wide unemployment) is associated with a voiced preference for a lower policy rate. While Tootell (1991) finds no evidence that regional variables explain actual votes, Gildea (1992), Meade and Sheets (2005) and Eichler et al.

[6] Federal Reserve Act, section 2A. Monetary policy objectives.
[7] The quote appears in the colophon of the *Beige Book*.

(2018) find that a relatively weaker economy in the district is associated with an increased probability of voting in favor of lower policy rates, even if this implies a dissenting vote.

Our hypotheses claim that the *strength* of the relationship between regional economic conditions and a president's behavior changes systematically with a president's voting status. We must therefore first formulate a hypothesis about the *sign* of the relationship. Inspired by the research just cited, we assume that a president gives more speeches between meetings and speak for longer during meetings, the larger is the absolute difference between regional and U.S. average unemployment. Also, we assume that the tone of presidents' speeches and interventions in the meeting becomes more negative, the higher is unemployment in their district.

Whether presidents react more strongly to regional economic conditions in years with or without the right to vote is a priori unclear. On the one hand, Crawford and Sobel (1982) and Milgrom and Roberts (1986, 1988) explain how agents without decision rights but with an interest in the outcome turn to alternative means to influence the decision, including the strategic revelation of decision-relevant information that they privately hold. Economic conditions can vary across Fed districts and presidents may have different preferences over policy options. Presidents without the right to vote can view their intermeeting speeches and meeting interventions as alternative means to influence the decision-making process. The loss-compensation hypothesis maintains that in years *without* the right to vote a president makes more use of these means to influence monetary policy. On the other hand, Aghion and Tirole (1997) and Baker, Gibbons and Murphy (1999) stress that obtaining the right to decide motivates to collect and interpret decision-relevant information as one no longer depends for the decision on somebody else with possibly different interests. This suggests a gain-enhancement hypothesis that maintains that in years *with* the right to vote a president shows greater involvement. A voting right on the FOMC is a decision right in a group decision-making process, and this precludes that a member can unilaterally determine the decision. Preparing the decision is then not only an exercise in identifying the best option; it is also an exercise in convincing others of one's arguments, one's interpretation of current and future economic conditions and one's preferred choice.

In our empirical analysis, we focus on intermeeting speeches and meeting interventions. Both can be used to influence the committee's decision and can reflect greater involvement. For example, they can be used to signal to other members on the FOMC what is on a

president's mind or to constituencies in the Bank's district that a president is sensitive to their interests. This may be particularly important in the absence of a voting right. Meade and Sheets (2005, p. 676) argue that a dissenting vote probably reflects the "desire to demonstrate sensitivity to developments in the home region in a way that does not antagonize the Chairman or bias the overall stance of monetary policy." In years without the right to vote, speeches or interventions could be used for the same purpose. On the other hand, speeches can also be used as a test ground for lines of argumentation and interpretation of current events.

A more intense use of speeches or a change in tone may reflect greater involvement stimulated by the voting right or compensation triggered by its loss. Similarly, interventions during the meeting can be used to compensate for the loss of the right to vote or may reflect greater involvement thanks to gaining it.

***The loss-compensation hypothesis*** predicts that, to compensate for the loss of voting right, (i) the number of speeches and the length of the interventions react more strongly to the absolute difference between regional and U.S. unemployment in years that presidents cannot vote than in years they can; (ii) the tone of a speech and of interventions reacts more strongly to the regional unemployment in years that presidents cannot vote than in years they can. ***The gain-enhancement hypothesis*** predicts that these reactions are stronger in years that a president has the right to vote.

All else equal, the loss in voting power is more costly in periods when there are conflicting views within the FOMC, or when uncertainty about the right decision is large. Similarly, involvement will be stronger in periods of conflicting views within the FOMC or uncertainty about the right decision, i.e. when more is at stake. Thus, ***the loss-compensation hypothesis*** predicts that, all else equal, in such periods, the number and tone of speeches of *nonvoting* presidents react more strongly to local economic conditions than otherwise; the ***gain-enhancement hypothesis***, instead, predicts that in such periods *voting* presidents react more strongly to local economic conditions.

## 3. Data

To empirically test our hypotheses, we collect data from various sources.

***Speeches.*** We use the database of speeches originally presented in Tietz (2018). It contains the entire text of 2,887 unique speeches given by the presidents of the Federal Reserve

Banks and the governors of the Board of the Federal Reserve System between 1994 and 2013. Tietz (2018) collected the texts from the webpages of the Reserve Banks and of the Board of Governors, from the BIS archive of central bank speeches[8] and from FedInPrint,[9] an index of publications by the Federal Reserve System. We limit attention to speeches given by Bank presidents in the rotation scheme. Before the analysis, we split each speech into sentences, remove all non-alphabetic characters, stop words and words with less than 3 characters, and convert the remainder to lower case.

We construct a measure of the economic tone a speech expresses, using the negative word list constructed by Loughran and McDonald (2011) for the analysis of company reports. Following Tietz (2018), we adjust the dictionary to account for the jargon specific to the central banking context. Because of the Federal Reserve's mandate, the term 'unemployment' is used more frequently in its texts than in other financial contexts. In addition, bigrams like 'declining unemployment' do not have the negative connotation that, e.g., 'declining growth' has. We thus exclude the word "unemployment" from the list of negative words. For all sentences that contain the word "unemployment" but not the words "inflation", "employment", or "growth", we delete "decline", "declining" and "declined" from the list of negative words and add "higher" and "high". We then count sentence-by-sentence the number of negative words, *N*, and the total number of words, *T*.[10] We sum the word counts for each speech and compute the sentiment measure $\tau_i$ for speech *i* as

$$\tau_i = 100 \times \left(1 - \frac{N_i}{T_i}\right). \quad (1)$$

Speeches by Fed officials can be entirely unrelated to monetary policy affairs. To reduce noise in our analysis, we remove such speeches from the dataset. This requires a classification of speeches as either related to monetary policy or not. We follow the procedure in Tietz (2018), which, in turn, is based on Gentzkow and Shapiro (2010). This uses a method from supervised machine learning to identify words that are distinctive for

[8] See http://www.bis.org/list/cbspeeches/index.htm.
[9] See https://www.fedinprint.org/series.html.
[10] An alternative way of measuring the tone of speeches is by constructing net positivity as the share of positive words minus the share of negative words. Following earlier literature (e.g. Schmeling and Wagner 2017), we decided to restrict the measurement to negative words, in particular given that positive words are more frequently negated than negative words, therefore making the measurement of tone relatively more noisy.

speeches about monetary policy and classifies speeches based on the occurrence of these distinctive words according to a simple threshold rule.

We begin by forming bigrams, pairs of words like "monetary policy" that often occur together in the complete set of speeches.[11] Next, we consider all phrases *p*, i.e., bigrams or words, in the 300 speeches that Tietz (2018) labelled manually as either related to monetary policy, *m*, or not, *n*. Let $N_{pm}$ and $N_{pn}$ be the number of instances of phrase *p* in either type of speech and let $N_{\sim pm}$ and $N_{\sim pn}$ be the number of phrases *different* from *p* in either type of speech. As in Gentzkow and Shapiro (2010), we compute the Pearson's $\chi^2$ statistic for each phrase,

$$\chi_p^2 = \frac{\left(N_{pm}N_{\sim pn} - N_{pn}N_{\sim pm}\right)^2}{(N_{pm}+N_{pn})(N_{pm}+N_{\sim pm})(N_{pn}+N_{\sim pn})(N_{\sim pm}+N_{\sim pn})}. \quad (2)$$

If the counts $N_{pm}$ and $N_{pn}$ are drawn from multinomial distributions, $\chi_p^2$ is a test statistic for the null hypothesis that the propensity to use phrase *p* in a speech about monetary policy is the same as in a speech about another topic. It therefore captures how distinctive the phrase is.

We proceed with the 200 phrases most distinctive for the monetary policy topic, i.e., with the largest values of $\chi_p^2$. For each speech, we then count the occurrences of the distinctive phrases and classify it as related to monetary policy if the distinctive phrases make up a certain percentage of the total number of phrases. We use a threshold of 7.5% as our baseline and check our results for robustness.

The last step in the preparation of the speech data for our econometric analysis is to aggregate them to the FOMC meeting frequency. The FOMC meets eight times a year. For each meeting period and each Bank president, we calculate the number of speeches given in the intermeeting period and the overall tone, which is the simple average of the tone expressed in each individual speech. Appendix Table A.1 provides a set of summary statistics for the resulting variables.

***Interventions made during the FOMC meetings.*** We obtain the verbatim transcripts of each FOMC meeting during 1994-2013[12] from the website of the Federal Reserve.[13] For

[11] Wang and Manning (2012) show that this improves the performance of topic classification algorithms. The bigrams are formed using the R-package "wordVectors", see Mikolov et al. (2013).
[12] The end of our sample period is 2013 as transcripts are released with a five-year lag.
[13] https://www.federalreserve.gov/monetarypolicy/fomc_historical.htm.

each president, we determine the total length of the interventions by a simple word count and their overall tone by a negative word share as with the speeches. Given that the transcripts provide a verbatim record of the meeting, there are many instances of short remarks. Moreover, as the meeting starts with an economy go-round and ends with a policy go-round before members cast their votes, the length and tone of interventions may change over the course of the meeting. We have therefore also computed word counts and tones for subsets of a president's interventions.

***Voting records.*** We collect voting records from the website of the Board of Governors.[14] We use this to determine whether a meeting is characterized by one or more dissenting votes.

***Regional economic data.*** The regional economic data cover unemployment, inflation and return on assets of the financial sector. District-level unemployment rates are readily available for download from FRED.[15] The data are provided by the Federal Reserve Bank of St. Louis based on statistics released by the Bureau of Labor Statistics.[16]

We construct district-level CPI inflation rates by mapping data for Metropolitan Statistical Areas (MSAs) to districts. We focus on year-on-year inflation rates to avoid seasonality issues. If a district contains more than one MSA for which we have inflation data, we weigh the MSAs by population as obtained from the 2010 Census figures. We summarize data sources and the mapping from MSAs to districts in Table A.2 in the appendix; we report population weights in Table A.3. From FRED, we also retrieve data on the return on assets for banks that are geographically located in each district. Table A.1 provides summary statistics for the resulting variables.

The original time series for unemployment and inflation are monthly, those for return on assets quarterly. As the FOMC meets eight times per year, we adapt the frequency of these series as follows. For each series, we identify the release dates to trace the most recently available data at each point in time. Based on these, we construct a weighted average over the entire FOMC intermeeting period, where each release gets weighted with the relative

[14] https://www.federalreserve.gov/monetarypolicy/fomc_historical.htm.
[15] https://fred.stlouisfed.org.
[16] These data were discontinued in 2015. For a robustness test where we extend the speech data to 2018, we construct regional unemployment by mapping U.S. states to Federal Reserve districts based on population weights, which are tabulated in Table A.3 in the Appendix. Over the common sample, the district-level unemployment rates computed by us and those obtainable through FRED are near-perfectly correlated, with a correlation coefficient of 99%.

number of days during which it represented the most recently available data. This implies that our economic conditions relate to the publicly available date at the time of the speaking engagements. Our dataset does not account for revisions and is therefore subject to the critique by Orphanides (2001). However, to the best of our knowledge, no real-time dataset can be constructed based on the publicly available data. Also, while we would ideally want to have forward-looking data, these appear to be unavailable.

***Beige Book.*** Finally, we collect the Beige Books over 1994-2013 to construct an alternative measure of economic conditions at the district level. For that purpose, we calculate the tone of the section on each district separately in the same way as for speeches and meeting interventions.

## 4. Results

### 4.1. Confirming the exogeneity of voting status

Our identification strategy rests on the assumption that voting status varies exogenously and is uncorrelated with economic conditions. Given that the voting scheme has been in place since 1943, well before the beginning of our sample period, we expect no correlation between the voting status of a Reserve Bank president and contemporaneous economic conditions. We confirm this in a simple probit model, in which we explain voting status with regional inflation, unemployment and financial sector return on assets. Table A.4 in the appendix reports the estimates of the marginal effects. There is indeed no systematic relationship between voting status and any of the three economic conditions, confirming the exogeneity of the voting scheme.

**Table 1: Number of speeches by individual presidents per intermeeting period**

| Number of | Total | | Non-voters | | Voters | |
|---|---|---|---|---|---|---|
| speeches | Observations | Share (in %) | Observations | Share (in %) | Observations | Share (in %) |
| 0 | 1,121 | 64.69 | 717 | 64.95 | 404 | 64.23 |
| 1 | 376 | 21.70 | 246 | 22.28 | 130 | 20.67 |
| 2 | 176 | 10.16 | 109 | 9.87 | 67 | 10.65 |
| 3 | 50 | 2.89 | 26 | 2.36 | 24 | 3.82 |
| 4 | 10 | 0.58 | 6 | 0.54 | 4 | 0.64 |
| Sum | 1,733 | 100.00 | 1,104 | 100.00 | 629 | 100.00 |

Notes: The table shows how many speeches individual presidents have delivered in the various intermeeting periods as well as the share of each category, for all presidents in the voting rotation ("Total") and separately for voting and non-voting presidents in the voting rotation.

### 4.2. Difference in speech behavior in the intermeeting period

***Summary statistics.*** The summary statistics in Table 1 suggest that the *average* behavior of voters and non-voters is similar over the sample. In around 65% of all intermeeting periods, presidents do not deliver any monetary policy-related speech, a share that is virtually identical for voters and non-voters. The table also shows that there is a minimum of 0 and a maximum of 4 speeches that presidents have delivered in intermeeting periods covered by our sample. This motivates us to estimate an ordered probit model.

***Number of speeches.*** We first test the hypotheses on the responsiveness of the number of speeches to regional economic conditions across years with and without the right to vote. We do this based on the following ordered probit regression equation:

$$\Pr(N_{i,t} = o) = \Pr\begin{pmatrix} \kappa_{o-1} < \mu_i + \mu_t + \beta_u^N \left|u_{d,t} - u_{US,t}\right| \\ +\beta_v^N v_{d,t} + \gamma^N \left|u_{d,t} - u_{US,t}\right| v_{d,t} + \varepsilon_{i,t} \leq \kappa_o \end{pmatrix}. \quad (3)$$

We explain the number of speeches $N_{i,t}$ by Reserve Bank president $i$ in intermeeting period $t$, with president fixed effects $\mu_i$, period fixed effects $\mu_t$, the absolute difference between the economic conditions in district $d$ of president $i$ and U.S. economic conditions, $\left|u_{d,t} - u_{US,t}\right|$, the voting status of the Reserve Bank $v_{d,t}$ and the interaction of regional economic conditions with the voting status.

President fixed effects control for the possibility that time-invariant characteristics of the president, like personality, affect speech behavior. Malmendier et al. (2017) and Bordo and Istrefi (2018) find that the background of individuals shapes policy preferences. While the fixed effect controls for time-invariant characteristics, it cannot account for the time variation in preferences that Istrefi (2019) identified. Period fixed effects remove all variation that is common across all presidents in an intermeeting period, such as variation in the general economic situation. We cluster standard errors by Reserve Bank president.[17]

On the basis of the literature we expect presidents of either type to deliver more speeches, the larger is the difference between regional and national unemployment, i.e. $\beta_u^N > 0$ and $\beta_u^N + \gamma^N > 0$. The key parameter to test our hypotheses is $\gamma^N$, as it measures the difference

[17] Note that the equation uses district-level macroeconomic variables and voting status. Given that there is always at most one president per Reserve Bank for each FOMC meeting, and given that there is no single individual who has been president of several Reserve Banks in our sample, we could also use a notation whereby macroeconomic variables and voting status are indexed with *i* rather than *d*.

in responsiveness of the number of speeches to regional economic conditions across voting status. The loss-compensation hypothesis predicts $\gamma^N < 0$, while the gain-enhancement hypothesis predicts $\gamma^N > 0$.

Table 2 reports the results of the estimation. The first specification, without presidents' voting status, shows that regional unemployment matters for the number of speeches that presidents give: they tend to give more speeches, the larger is the difference between regional and U.S. unemployment. This is in line with the earlier evidence. The benchmark estimation in column 2 differentiates voters and non-voters. It shows that in years they vote on the FOMC, the effect of regional unemployment on the number of speeches nearly doubles. This reaction is statistically significant at the 1% level, as can be seen by the sum of the two estimated coefficients, $\beta_u^N + \gamma^N$, provided in the middle panel of Table 2. In Appendix Table A.5, we report the marginal effects. In years a president has voting status, an increase in the difference between regional and national unemployment by one percentage point reduces the probability that the president does *not* deliver a speech by 13%. In non-voting years, that probability is reduced by only around 6% (and is statistically insignificant). Voting status itself does not affect the propensity to deliver speeches, consistent with the summary statistics.

These findings support the gain-enhancement hypothesis and go against the loss-compensation hypothesis. Presidents' speeches respond more strongly to regional conditions in years they vote, rather than in the years they do not.

These results are robust to redefining the threshold for identifying monetary policy speeches from 7.5% to 5% or 10% (columns 3 and 4). The effect of regional economic conditions also holds for speeches covered by Reuters, i.e., speeches that are apparently deemed relevant for a more national audience (column 5). The most relevant margin seems to be whether or not a president decides to deliver a speech. Conditioning on speaking, there is no further effect on the number of speeches (column 7) and estimating a probit model would in principle have been sufficient for our purposes (column 8). Another robustness test in column 9 shows that removing period fixed effects and instead controlling for the number of speeches given by all other members, voting and non-voting, on the FOMC (but excluding those by the respective president) does not alter our findings in a substantive manner. Results are also unaltered when we add regional inflation and the

financial sector return on assets (column 10), which by themselves do not affect the propensity to give speeches.[18] Another robustness test is provided in column 11, where we extend the sample of speeches until 2018. Restricting the sample to 2013 because of the availability of the FOMC meeting transcripts does apparently not change the picture in an important manner.

The last three columns of Table 2 extend the analysis to include different aspects of the Beige Book. Column 12 shows that the pattern identified above also exists if we proxy regional economic conditions with the content of the Beige Book. This is comforting evidence in two ways. First, it suggests that our measurement of the tone of the Beige Book captures economic conditions. Second, it also implies that our use of unemployment as a sole proxy for regional economic conditions is not biasing our results.

Columns 13 and 14 provide a subsample analysis. Here, regional economic conditions are once more proxied by unemployment, but we split every intermeeting period into a period before the release of the Beige Book, and a (shorter) period after its release. The findings suggest that the voting right makes the president more committed in particular in the period in which the Reserve Banks gather regional information, and where this information has not yet been widely shared.

[18] There could be various reasons why we find that regional unemployment affects speech behavior, but regional inflation and returns on asset do not – a finding which is recurrent in the literature (Meade and Sheets 2005, Hayo and Neuenkirch 2013, Eichler et al. 2018). Unemployment is more salient as it is measured at the district level. Moreover, Fed staff talks to companies, and while it is relatively easy to aggregate information on hiring and firings, it appears considerably harder to aggregate data on price setting and changes. Also, unemployment tends to be a good proxy for the business cycle and the output gap and so is highly relevant. Finally, unemployment data is released relatively early.

## Table 2: Determinants of the number of speeches given

| | (1) Without voting status | (2) Benchmark | (3) 5% threshold | (4) 10% threshold | (5) Reuters coverage | (6) No Reuters coverage | (7) Conditional on speaking | (8) Probit model | (9) Controlling for # of others' speeches | (10) Adding inflation and RoA | (11) Until 2018 | (12) Tone of beige book proxies for economy | (13) Pre-beige book release | (14) Post-beige book release |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Absolute unemployment gap ($\beta^N_u$) | 0.357** | 0.277 | 0.255 | 0.335* | 0.186 | 0.602 | 0.299 | 0.253 | 0.264* | 0.277 | 0.253 | -6.007 | 0.365* | -0.308 |
| | (0.174) | (0.186) | (0.163) | (0.172) | (0.184) | (0.393) | (0.268) | (0.227) | (0.150) | (0.177) | (0.176) | (6.060) | (0.210) | (0.254) |
| Absolute unemployment gap * voting status ($\gamma^N$) | -- | 0.264* | 0.340*** | 0.253 | 0.323* | 0.091 | -0.030 | 0.337** | 0.261* | 0.232 | 0.232* | 18.445** | 0.277** | 0.405 |
| | | (0.158) | (0.123) | (0.163) | (0.183) | (0.329) | (0.238) | (0.131) | (0.152) | (0.156) | (0.131) | (8.038) | (0.138) | (0.334) |
| Voting status ($\beta^N_v$) | -- | -0.028 | -0.111 | -0.036 | -0.036 | 0.015 | 0.391** | -0.123 | -0.037 | -0.127 | 0.029 | -0.044 | -0.090 | -0.105 |
| | | (0.115) | (0.095) | (0.099) | (0.127) | (0.292) | (0.177) | (0.123) | (0.129) | (0.177) | (0.102) | (0.119) | (0.136) | (0.192) |
| Speeches by other members | -- | -- | -- | -- | -- | -- | -- | -- | 0.064*** | -- | -- | -- | -- | -- |
| | | | | | | | | | (0.011) | | | | | |
| Absolute inflation gap (non-voters) | -- | -- | -- | -- | -- | -- | -- | -- | | 0.099 | -- | -- | -- | -- |
| | | | | | | | | | | (0.111) | | | | |
| Absolute inflation gap * voting status | -- | -- | -- | -- | -- | -- | -- | -- | | 0.142 | -- | -- | -- | -- |
| | | | | | | | | | | (0.140) | | | | |
| Absolute RoA gap (non-voters) | -- | -- | -- | -- | -- | -- | -- | -- | | -0.096 | -- | -- | -- | -- |
| | | | | | | | | | | (0.231) | | | | |
| Absolute RoA gap * voting status | -- | -- | -- | -- | -- | -- | -- | -- | | 0.039 | -- | -- | -- | -- |
| | | | | | | | | | | (0.271) | | | | |
| Absolute unemployment gap for voters ($\beta^N_u+\gamma^N$) | -- | **0.550*** ** | **0.632*** ** | 0.628*** | **0.546*** ** | 0.700 | 0.315 | **0.589*** ** | **0.521*** ** | 0.523*** | **0.485** ** | **12.438*** | **0.642*** ** | 0.096 |
| | | (0.184) | (0.182) | (0.177) | (0.174) | (0.580) | (0.241) | (0.218) | (0.161) | (0.170) | (0.210) | (6.932) | (0.197) | (0.27) |
| Period FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | No | Yes | Yes | Yes | Yes | Yes |
| President FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Observations | 1,735 | 1,735 | 1,735 | 1,735 | 1,735 | 1,735 | 586 | 1,570 | 1,735 | 1,735 | 2,084 | 1,735 | 1,735 | 1,735 |

Notes: The table shows coefficient estimates for the effect of regional macroeconomic conditions and voting status on the number of speeches given by FOMC members in the rotation scheme, based on an ordered probit model following equation (3). The term "unemployment gap" denotes the difference between regional and national unemployment. Column (1) includes unemployment without allowing for a differential effect for voters. Column (2) is the benchmark model. Columns (3) and (4) are for monetary policy speeches identified at a 5% and 10% threshold, respectively. Columns (5) and (6) differentiate speeches depending on whether they were covered by Reuters. Column (7) tests for the number of speeches given, conditional on a speaker giving at least one speech in a given intermeeting period. Column (8) excludes time fixed effects and replaces these with the number of speeches given by all other members on the FOMC. Column (9) reports results for a probit model. Column (10) includes regional inflation and financial sector return on assets. Column (11) extends the sample to 2018. Column (12) proxies regional economic conditions with the tone of the relevant section of the Beige Book. Columns (13) and (14) split the sample into the period before and after the release of the Beige Book. Numbers in brackets are standard errors. Coefficients in bold are statistically significantly different from the top row coefficients at least at the 10% level. ***/**/* denote statistical significance at the 1%/5%/10% level.

***Speech tone.*** To investigate the extent to which the tone $\tau_{i,t}$ expressed in the speeches depends on a president's voting status, we estimate the relationship

$$\tau_{i,t} = \mu_i + \mu_t + \beta_u^\tau u_{d,t} + \beta_v^\tau v_{d,t} + \gamma^\tau u_{d,t} v_{d,t} + \varepsilon_{i,t} \quad (4)$$

As before, we include president and period fixed effects and cluster standard errors by president. Appendix Table A.1 provides basic summary statistics for the speech tone.

We expect the tone of a speech of a president in years with and without the right to vote to be negatively related to regional unemployment, $\beta_u^\tau < 0$ and $\beta_u^\tau + \gamma^\tau < 0$. The parameter of interest for a test of the hypotheses is $\gamma^\tau$, as it measures the difference across voting status. The loss-compensation hypothesis predicts $\gamma^\tau > 0$, i.e. the relationship between tone and regional unemployment is more negative in years a president does not have the right to vote, while the gain-enhancement hypothesis predicts the opposite, $\gamma^\tau < 0$.

We present the estimation results in Table 3. The first specification shows that a president tends to use a more negative tone, the larger is difference between regional and national unemployment, but that this relationship is not statistically significant. The benchmark estimation in column 2 differentiates voters and non-voters. It shows that presidents' tone reacts more strongly to the regional unemployment situation when they have voting rights: their estimated reaction to regional unemployment is more than twice as large. This reaction is statistically significant at the 5% level, as can be seen by the sum of the two estimated coefficients, $\beta_u^\tau + \gamma^\tau$, provided in the middle panel of Table 3. The estimate implies that a 1 percentage point increase in regional unemployment relative to the U.S. figure lowers the sentiment of the speeches that presidents deliver in years with the right to vote by one fourth of its standard deviation.

The findings on speech tone again support the gain-enhancement hypothesis and go against the loss-compensation hypothesis.

## Table 3: Determinants of the tone of speeches

| | (1) Without voting status | (2) Benchmark | (3) 5% threshold | (4) 10% threshold | (5) Reuters coverage | (6) No Reuters coverage | (7) Controlling for tone of others' speeches | (8) Adding inflation and RoA | (9) Until 2018 | (10) Tone of beige book proxies for economy | (11) Pre-beige book release | (12) Post-beige book release |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Regional unemployment ($\beta^{\tau}_{u}$) | -0.148 | -0.112 | -0.123 | -0.235 | 0.011 | -0.831 | -0.083 | -0.181 | -0.230** | 9.568* | -0.167 | 0.808 |
| | (0.118) | (0.119) | (0.135) | (0.170) | (0.120) | (1.323) | (0.063) | (0.111) | (0.110) | (5.279) | (0.162) | (0.870) |
| Regional unemployment * voting status ($\gamma^{\tau}$) | -- | -0.156** | -0.138** | -0.196** | -0.192*** | -0.102 | -0.150*** | -0.231*** | -0.105 | -2.448 | -0.202*** | -0.100 |
| | | (0.062) | (0.059) | (0.073) | (0.059) | (0.515) | (0.047) | (0.070) | (0.063) | (7.674) | (0.061) | (0.444) |
| Voting status ($\beta^{\tau}_{v}$) | -- | 1.139** | 1.015** | 1.435*** | 1.410*** | 0.831 | 1.056*** | 2.007*** | 0.752* | 2.480 | 1.556*** | -0.097 |
| | | (0.425) | (0.413) | (0.483) | (0.400) | (3.100) | (0.320) | (0.628) | (0.406) | (7.454) | (0.401) | (4.180) |
| Speeches by other members | -- | -- | -- | -- | -- | -- | 0.587*** | -- | -- | -- | -- | -- |
| | | | | | | | (0.071) | | | | | |
| Regional inflation (non-voters) | -- | -- | -- | -- | -- | -- | -- | -0.043 | -- | -- | -- | -- |
| | | | | | | | | (0.076) | | | | |
| Regional inflation * voting status | -- | -- | -- | -- | -- | -- | -- | 0.049 | -- | -- | -- | -- |
| | | | | | | | | (0.082) | | | | |
| Regional RoA (non-voters) | -- | -- | -- | -- | -- | -- | -- | -0.105 | -- | -- | -- | -- |
| | | | | | | | | (0.154) | | | | |
| Regional RoA * voting status | -- | -- | -- | -- | -- | -- | -- | -0.443* | -- | -- | -- | -- |
| | | | | | | | | (0.226) | | | | |
| Regional unemployment for voters ($\beta^{\tau}_{u}+\gamma^{\tau}$) | -- | **-0.268**** | **-0.262*** | **-0.431*** | **-0.180** | -0.934 | **-0.233***** | **-0.412***** | -0.335** | 7.120 | **-0.369**** | 0.708 |
| | | (0.127) | (0.127) | (0.205) | (0.138) | (1.359) | (0.062) | (0.130) | (0.125) | (4.934) | (0.178) | (1.150) |
| Period FE | Yes | Yes | Yes | Yes | Yes | Yes | No | Yes | Yes | Yes | Yes | Yes |
| President FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Observations | 586 | 586 | 714 | 471 | 510 | 85 | 586 | 586 | 745 | 586 | 470 | 116 |
| R2 | 0.615 | 0.625 | 0.574 | 0.612 | 0.624 | 0.792 | 0.393 | 0.632 | 0.596 | 0.618 | 0.665 | 0.864 |

Notes: The table shows coefficient estimates for the effect of regional macroeconomic conditions and voting status on the tone of speeches given by FOMC members in the rotation scheme, following equation (4). Column (1) includes unemployment without allowing for a differential effect for voters. Column (2) is the benchmark model. Columns (3) and (4) are for monetary policy speeches identified at a 5% and 10% threshold, respectively. Columns (5) and (6) differentiate speeches depending on whether they were covered by Reuters. Column (7) excludes time fixed effects and replaces these with the tone of speeches given by all other members on the FOMC. Column (8) includes regional inflation and financial sector return on assets. Column (9) extends the sample to 2018. Column (10) proxies regional economic conditions with the tone of the relevant section of the Beige Book. Columns (11) and (12) split the sample into the period before and after the release of the Beige Book. Numbers in brackets are standard errors. Coefficients in bold are statistically significantly different from the top row coefficients at least at the 10% level. ***/**/* denote statistical significance at the 1%/5%/10% level.

We subject these findings to the same robustness tests as before, by changing the threshold for identifying monetary policy-related speeches, by separating speeches that are covered by Reuters and those that are not, by removing period fixed effects and instead controlling for the tone of the speeches by all other FOMC members, by adding regional inflation and the financial sector return on assets, and by extending the sample to 2018. Results are robust.[19]

As before, we also relate our estimation to the Beige Book. Using the content of the Beige Book as an alternative proxy for regional economic conditions yields largely insignificant results.[20] When we split the sample into pre-Beige Book release and post release, the findings suggest that the voting right makes the president more committed in particular in the period in which the Reserve Banks gather regional information, and where this information has not yet been widely shared.

***Intermeeting speech behavior following dissent or a surprise decision.*** We now test the predictions concerning speech behavior in periods of conflicting views within the FOMC or uncertainty about the right decision. Recall that the loss-compensation hypothesis maintains that, all else equal, in such periods, the number and tone of speeches of *nonvoting* presidents react more strongly to local economic conditions than otherwise, whereas the gain-enhancement hypothesis maintains that in such periods *voting* presidents react more strongly to local economic conditions.

We say that a period is characterized by conflicting views if at the last FOMC meeting at least one member cast a dissenting vote. We say that a period is characterized by uncertainty about the right decision if the decision at the last meeting surprised the market. We measure market surprises with the high-frequency responses in Fed funds futures

[19] As an additional robustness check, we estimate the effects on the number of speeches and speech tone jointly in a Heckman model. The underlying idea is that we observe the sentiment of the speeches by Reserve Bank presidents who decide to deliver a speech, but that we cannot observe the sentiment of those who do not. If the decision to give a speech is not random, it could introduce a sample selection bias in our estimates. The Heckman procedure corrects for such potential bias. The procedure involves a two-stage estimation method. In the first stage (selection), the probability of being included in the sample (in our application, the decision to deliver a speech or not) is estimated by way of a probit model. In the second stage (option), the sentiment expressed in the speeches is explained. The estimation of our model is conveniently identified, given the exclusion restriction that the absolute deviations of regional economic conditions from the U.S. average affect the number of speeches but do not affect the sentiment contained in the speeches. The results of this exercise, which we do not reported for brevity, show that our results are highly robust, both quantitatively and qualitatively.

[20] Note that we would expect the relationship between Beige-Book tone and speech tone to be positive, which is what we find.

around the FOMC announcements provided in Nakamura and Steinsson (2018). We classify a decision as surprising if the associated monetary shock is large in absolute value, i.e., if it is larger than the 75th percentile or smaller than the 25th of the shocks' distribution.

We run separate tests for each situation. In either case, we extend the speech and tone regression models by a dummy, $P_t$, that equals one if the last meeting has the characteristic. We interact this dummy with the regional economic conditions, the voting status and with both variables. For the number of speeches, the model becomes

$$\Pr(N_{i,t} = o) = \Pr\left( \begin{array}{c} \kappa_{o-1} < \mu_i + \mu_t + \beta_u^N \left| u_{d,t} - u_{US,t} \right| + \beta_v^N v_{d,t} \\ +\gamma_{uv}^N \left| u_{d,t} - u_{US,t} \right| v_{d,t} + \gamma_{uP}^N \left| u_{d,t} - u_{US,t} \right| P_t + \gamma_{vP}^N v_{d,t} P_t \\ +\delta^N \left| u_{d,t} - u_{US,t} \right| v_{d,t} P_t + \varepsilon_{i,t} \leq \kappa_o \end{array} \right), \quad (5)$$

while the model for the tone of speeches turns into

$$\begin{aligned} \tau_{i,t} = \mu_i + \mu_t + \beta_u^\tau u_{d,t} + \beta_v^\tau v_{d,t} + \gamma_{uv}^\tau u_{d,t} v_{d,t} + \gamma_{uP}^\tau u_{d,t} P_t \\ +\gamma_{vP}^\tau v_{d,t} P_t + \delta^\tau u_{d,t} v_{d,t} P_t + \varepsilon_{i,t}. \end{aligned} \quad (6)$$

The loss-compensation hypothesis predicts $\gamma_{uP}^N > 0$ for speech number and $\gamma_{uP}^\tau < 0$ for speech tone; the gain-enhancement hypothesis predicts $\delta^N > 0$ for speech number and $\delta^\tau < 0$ for speech tone.

*Dissent.* We first analyze the effect of the presence or absence of dissenting votes. Column 1 in Tables 4 and 5 show the results for the number of speeches and their tone, respectively. For presidents in non-voting years, whether the last meeting was characterized by dissent or not appears irrelevant for the relationship between, on the one hand, regional conditions and, on the other, speech number and tone; for presidents in voting years, the character of the last meeting matters. In such years, dissent in the meeting is associated with speech number and tone in the next intermeeting period responding more strongly to regional economic circumstances.

The middle parts of Tables 4 and 5 report the relevant sums of coefficients for the number and tone regressions, respectively, for various combinations of voting status and type of last meeting. After an FOMC meeting with dissent in a year that presidents have voting power, the number and tone of their public speeches react around four times more strongly to regional conditions than after a meeting *without* dissent in a year that they do *not* have voting power (0.894 versus 0.197 and -0.426 versus -0.099, respectively).

*Surprise decision.* The relationship between speech behavior and regional economic circumstances does not seem to depend on whether the last FOMC decision surprised the market. The relevant coefficients in column 2 of Tables 4 and 5 are statistically insignificant in years with and without the right to vote.

The relevant sums of coefficients in the middle parts of Tables 4 and 5 show that the influence exerted by regional conditions on the number and tone of presidential speeches is considerably stronger following a decision that surprised the market in a year a president has the right to vote than following an *unsurprising* decision in a year *without* the right to vote (0.698 versus 0.252 for number of speeches and -0.317 versus -0.087 for their tone).

The findings on speech behavior after dissenting votes provide further support for the gain-enhancement hypothesis, and no support for the loss-compensation hypothesis; the findings on speech behavior after a surprising decision do not favor any of the hypotheses.

## Table 4: The number of speeches after dissent or a surprise decision

| | (1) Dissent at previous meeting | (2) Large surprise at previous meeting |
|---|---|---|
| Absolute unemployment gap ($\beta^N_u$) | 0.197 | 0.252 |
| | *0.212* | *0.196* |
| Absolute unemployment gap * voting status ($\gamma^N_{uv}$) | -0.053 | 0.173 |
| | *0.142* | *0.203* |
| Absolute unemployment gap * characteristic ($\gamma^N_{uP}$) | 0.164 | 0.065 |
| | *0.228* | *0.156* |
| Absolute unemployment gap * characteristic * voting ($\delta^N$) | 0.585** | 0.208 |
| | *0.228* | *0.219* |
| Voting status ($\beta^N_v$) | 0.192 | 0.066 |
| | *0.125* | *0.147* |
| Voting * Characteristic ($\gamma^N_{vP}$) | -0.447*** | -0.204 |
| | *0.161* | *0.194* |
| Absolute unemployment gap for voters w/out characteristic ($\beta^N_u+\gamma^N_{uv}$) | 0.144 | 0.425** |
| | *0.234* | *0.181* |
| Absolute unemployment gap for non-voters with characteristic ($\beta^N_u+\gamma^N_{uP}$) | 0.361 | 0.317 |
| | *0.227* | *0.202* |
| Absolute unemployment gap for voters with characteristic ($\beta^N_u+\gamma^N_{uv}+\gamma^N_{uP}+\delta^N$) | ***0.894****** | ***0.698****** |
| | *0.188* | *0.226* |
| Period FE | Yes | Yes |
| President FE | Yes | Yes |
| Observations | 1,735 | 1,735 |

Notes: The table shows coefficient estimates for the effect of regional macroeconomic conditions and voting status on the number of speeches given by presidents in the rotation scheme, based on an ordered probit model following equation (5), allowing for differential effects for voting members depending on whether there has been dissent in the last meeting (Column 1) or a relatively large surprise in the last meeting (Column 2). The term "unemployment gap" denotes the difference between regional and national unemployment. Numbers in italics are standard errors. Coefficients in bold are statistically significantly different from the top row coefficients at least at the 10% level. Coefficients in bold and italics are furthermore statistically significantly different from the voters without the characteristics at least at the 10% level. ***/**/* denote statistical significance at the 1%/5%/10% level.

## Table 5: The tone of speeches after dissent or a surprise decision

| | (1) Dissent at previous meeting | (2) Large surprise at previous meeting |
|---|---|---|
| Regional unemployment ($\beta^{\tau}_{u}$) | -0.099 | -0.087 |
| | *0.129* | *0.109* |
| Regional unemployment * voting status ($\gamma^{\tau}_{uv}$) | -0.086 | -0.123 |
| | *0.076* | *0.098* |
| Regional unemployment * characteristic ($\gamma^{\tau}_{uP}$) | -0.033 | -0.056 |
| | *0.124* | *0.134* |
| Regional unemployment * characteristic * voting ($\delta^{\tau}$) | -0.207* | -0.051 |
| | *0.101* | *0.153* |
| Voting status ($\beta^{\tau}_{v}$) | 0.620 | 0.818 |
| | *0.51* | *0.693* |
| Voting * Characteristic ($\gamma^{\tau}_{vP}$) | 1.634** | 0.542 |
| | *0.75* | *0.979* |
| Regional unemployment for voters w/out characteristic ($\beta^{\tau}_{u}+\gamma^{\tau}_{uv}$) | -0.185 | -0.210 |
| | *0.125* | *0.127* |
| Regional unemployment for non-voters with characteristic ($\beta^{\tau}_{u}+\gamma^{\tau}_{uP}$) | -0.132 | -0.143 |
| | *0.137* | *0.162* |
| Regional unemployment for voters with characteristic ($\beta^{\tau}_{u}+\gamma^{\tau}_{uv}+\gamma^{\tau}_{uP}+\delta^{\tau}$) | **-0.426*** ** | **-0.317*** |
| | ***0.148*** | ***0.169*** |
| Period FE | Yes | Yes |
| President FE | Yes | Yes |
| Observations | 586 | 586 |
| R2 | 0.630 | 0.626 |

Notes: The table shows coefficient estimates for the effect of regional macroeconomic conditions and voting status on the tone of speeches given by presidents in the rotation scheme, following equation (6), allowing for differential effects for voting members depending on whether there has been dissent in the last meeting (Column 1) or a relatively large surprise in the last meeting (Column 2). Numbers in italics are standard errors. Coefficients in bold are statistically significantly different from the top row coefficients at least at the 10% level. Coefficients in bold and italics are furthermore statistically significantly different from the voters without the characteristics at least at the 10% level. ***/**/* denote statistical significance at the 1%/5%/10% level.

### 4.3. Voting status and deliberation behavior in the FOMC meeting

The results so far have provided compelling evidence supporting the gain-enhancement hypothesis with regard to communication behavior in the intermeeting period. We now test whether this behavioral pattern prevails during the deliberation stage at the FOMC meetings. Recall that the FOMC meeting starts with an economy go-round, where all participants discuss the economic situation. In this round, presidents discuss, inter alia, the regional economic conditions. Subsequently, the discussion moves on to the implications for the monetary policy decisions. Since monetary policy is set for the U.S. aggregate economy, we would expect regional economic conditions to be playing a lesser role in this part of the meeting. This meeting structure naturally suggests that it will be important to analyze the first intervention of each president separately from their entire set of interventions.

For brevity, we relegate results regarding the length of the interventions to the appendix. Appendix Table A.6 shows that hardly any of the regression variables has statistically significant effects. That neither regional economic conditions nor the number of speeches delivered during the intermeeting period influence the length of interventions might be due to the set duration of the meeting. This limits the freedom of individual presidents to choose the number and length of their interventions.

The study of the tone of the interventions yields more interesting results. Analogous to the speech tone regression, we test whether presidents adapt the tone of their meeting interventions $T_{i,t}$ to regional unemployment, and whether this adaptation depends on their voting status. We also investigate to what extent speech behavior between meetings and interventions during the meeting are linked, and whether any link depends on presidents' voting status. In its most general form, we estimate

$$T_{i,t} = \mu_i + \mu_t + \beta_u^T u_{d,t} + \beta_v^T v_{d,t} + \gamma_{uv}^T u_{d,t} v_{d,t} + \beta_\tau^T \tau_{i,t} + \gamma_{\tau v}^T \tau_{i,t} v_{d,t} + \varepsilon_{i,t} \qquad (7)$$

As before, we include president and period fixed effects and cluster standard errors by president.

We expect the tone of an intervention in years with and without the right to vote to be negatively related to regional unemployment, $\beta_u^T < 0$ and $\beta_u^T + \gamma_{uv}^T < 0$. The parameter of interest for a test of the hypotheses is $\gamma_{uv}^T$, as it measures the difference across voting status. The loss-compensation hypothesis predicts $\gamma_{uv}^T > 0$, i.e. the relationship between tone and

regional unemployment is more negative in years a president does not have the right to vote, while the gain-enhancement hypothesis predicts the opposite, $\gamma_{uv}^{T} < 0$.

As these regressions are conditional on presidents having given speeches in the intermeeting period, we first repeat the earlier analysis that relates intervention tone to regional unemployment, but condition on the observations with intermeeting speeches.

The results for the first intervention by a president are shown in the left panel of Table 6, while the results for all interventions pooled are shown in the right panel. Column (1) shows that the tone of a president's first intervention becomes more negative, the larger is the difference between regional and national unemployment. This negative impact is significantly stronger in years presidents have the right to vote than in years they don't have that right. If we limit attention to those presidents who gave a speech in the preceding intermeeting period, the evidence in favor of the gain-enhancement hypothesis and against the loss-compensation hypothesis becomes stronger, see column (2). The right panel shows that for all interventions pooled, the relationship with regional unemployment is absent. This is as expected, given that regional economic conditions are primarily discussed in the first go-round.

The inclusion of speech tone as an explanatory variable turns this variable into the main vehicle through which presidents' voting status influences their tone at the meeting. In particular, in years with the right to vote speech tone and intervention tone are more strongly correlated than in years a president does not have the right to vote. This appears consistent with the stronger commitment thanks to the right to vote, and inconsistent with an attempt at an unambiguous message to compensate for the loss of voting right.

**Table 6: Determinants of the tone of interventions at the FOMC meeting**

| | First intervention | | | | All interventions | | | |
|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| Regional unemployment ($\beta^T{}_u$) | -0.425*** | -0.583* | -- | -0.599** | -0.052 | -0.154 | -- | -0.158 |
| | (0.150) | (0.304) | | (0.281) | (0.084) | (0.127) | | (0.121) |
| Regional unemployment * voting status ($\gamma^T{}_{uv}$) | -0.135* | -0.282** | -- | -0.193 | -0.042 | -0.094 | -- | -0.057 |
| | (0.073) | (0.130) | | (0.141) | (0.035) | (0.058) | | (0.058) |
| Tone of speeches ($\beta^T{}_\tau$) | -- | -- | -0.243 | -0.240 | -- | -- | -0.071 | -0.070 |
| | | | (0.202) | (0.199) | | | (0.049) | (0.049) |
| Tone of speeches * voting status ($\gamma^T{}_\tau$) | -- | -- | 0.501* | 0.368 | -- | -- | 0.178** | 0.139* |
| | | | (0.254) | (0.281) | | | (0.073) | (0.072) |
| Voting status ($\beta^T{}_v$) | 0.550 | 1.756* | -0.048 | 1.224 | 0.269 | 0.780* | 0.181* | 0.555 |
| | (0.437) | (0.916) | (0.230) | (0.976) | (0.252) | (0.432) | (0.097) | (0.434) |
| Regional unemployment for voters ($\beta^T{}_u+\gamma^T{}_u$) | **-0.560*** ** | **-0.865*** ** | -- | -0.792*** | -0.094 | -0.248* | -- | -0.215 |
| | (0.141) | (0.272) | | (0.280) | (0.084) | (0.138) | | (0.139) |
| Tone of speeches for voters ($\beta^T{}_\tau+\gamma^T{}_\tau$) | -- | -- | **0.258** | 0.128 | -- | -- | **0.107** | **0.069** |
| | | | (0.226) | (0.240) | | | (0.065) | (0.057) |
| Period FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| President FE | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| R2 | 0.145 | 0.333 | 0.331 | 0.339 | 0.472 | 0.568 | 0.569 | 0.572 |
| Observations | 1,714 | 582 | 582 | 582 | 1,714 | 582 | 582 | 582 |

Notes: The table shows coefficient estimates for the effect of regional macroeconomic conditions, the tone of speeches and voting status on the tone of meeting interventions, based on an OLS model following equation (7). Columns (1) and (5) include all observations for meeting interventions, all other columns are conditional on the speaker at the meeting also having delivered at least one intermeeting speech. The left panel relates to the tone of the first intervention at the FOMC meeting, the right panel to the tone of all interventions together. Numbers in brackets are standard errors. Coefficients in bold are statistically significantly different from the top row coefficients at least at the 10% level. ***/**/* denote statistical significance at the 1%/5%/10% level.

### 4.4. Market reaction: a vote discount

The goal of this section is to understand whether the reaction of financial markets to a speech depends on the voting status of the president delivering the speech. As before, we limit attention to speeches about monetary policy. To ensure clean inference, we further restrict our analysis to days on which only a single speech was given, leaving us with 585 observations. We measure the market reaction as the absolute daily asset price change, where we focus on constant maturity Treasury yields with maturities ranging from 3 months to 5 years (for maturities below 3 months and beyond 5 years, we do not find any statistically significant results).

Using the absolute value of the asset price change allows us to test for the extent to which speeches move markets, regardless of whether the relevant information pertains to the economic outlook or to the monetary policy inclination. As shown by Nakamura and Steinsson (2018) and Jarocinski and Karadi (2020), markets might respond in opposite directions depending on whether central bank announcements affect beliefs about economic fundamentals or about monetary policy. By analyzing the absolute change, we can remain agnostic about the source of market movement.

To test for differential market reaction, we regress the absolute value of the daily change in Treasury yields, $|dR|_t$, on the voting dummy

$$|dR|_t = \mu_i + \mu_{dow} + \beta v_{d,t} + \varepsilon_{it} \quad (8)$$

controlling for president fixed effects $\mu_i$ and day-of-the-week fixed effects, $\mu_{dow}$.

The top panel of Table 7 presents the benchmark estimates. These show some first evidence of a vote discount: presidents who deliver a speech in years that they vote move markets less than in years they do not vote, albeit at low levels of statistical significance. A regression coefficient of 0.005 implies a change of half a basis point. To put the size of this difference into perspective, Table 7 also reports the average absolute daily change for the various maturities, and the absolute size of $\beta$, the coefficient of interest, as a fraction of the average absolute daily change. The fractions tend to be substantial, ranging from more than 25% for 3-month rates to slightly above 10% for 5-year rates. As before, we separately analyze the subsamples pre- and post-Beige Book. Compared to the overall sample, the differences are larger and more statistically significant in the pre-Beige Book subsample (panel B, up to 36% at the 3-month maturity). In contrast, there is no difference across years with and without the voting right in the post-Beige Book subsample (panel A in appendix Table A.7). This is in line with our earlier finding that after the publication of the Beige Book, speech behavior does not depend on voting status.

We also separately analyze speeches given after meetings with or without dissent. Our earlier analysis shows that speeches of voting presidents delivered after FOMC meetings with dissent were particularly responsive to regional conditions. As shown in panel C, in this case we find a significant vote discount, both in statistical and economic terms, whereas the evidence for a vote discount is much less pronounced following meetings without dissent (reported in panel B of appendix Table A.7).

For robustness, we extend our sample to include all monetary policy speeches until 2018, and replicate our earlier findings, at higher levels of statistical significance (panel D). Statistical and economic significance also increase when we condition on speeches that are reported on Reuters (panel E).

We deal with the issue that our speech data does not contain time stamps; hence, we only know the day of a speech, not the exact time when it was delivered. Market closing for the Treasury yields is at 03:30pm Eastern Time, implying that any speech delivered afterwards affects yields on the subsequent day. To address this, we rely on "FOMC speak", an

alternative speech dataset provided by the Federal Reserve Bank of St Louis,[21] which contains the time stamp of a large number of speeches. This allows us to appropriately time the speeches. However, the dataset does not differentiate monetary policy speeches and other speeches. The results in panel F for 568 speeches delivered in the years 2011-2019 confirm our earlier findings.

Finally, we conduct another robustness tests, the results of which are shown in Table A.8 in the appendix. We exploit the around-the-clock nature of currency trade to measure the impact of speeches. We calculate the absolute change of the Japanese Yen-U.S. Dollar exchange rate between London fixing and Tokyo close of business, times that correspond to 11am Eastern Time and midnight Pacific Time (or 01am Pacific Time during U.S daylight saving time), respectively.[22] The results show that presidents move also this market less in years they vote. The difference in impact (estimated at the 10% significance level), compared to the average absolute daily change in the exchange rate, is, at 20%, substantial.

[21] https://www.stlouisfed.org/fomcspeak/viewbydate.

[22] Based on the speeches with time stamp from "FOMC speak", the time window for the treasury yields appropriately allocates 68% of all speeches (and wrongly allocates the speeches given later in the day). The exchange rate time window would allocate 63% of all speeches correctly and generates a mismatch for the speeches given early in the day. The two time windows do therefore nicely complement one another, as they capture the set of speeches that is missing from the other time window.

**Table 7: Effect of speeches on Treasury rates on the day of speech**

| | 3-month rates | 6-month rates | 12-month rates | 2-year rates | 5-year rates |
|---|---|---|---|---|---|
| *Panel A: benchmark* | | | | | |
| Voting | -0.006* | -0.004 | -0.005* | -0.006* | -0.005 |
| | (0.003) | (0.003) | (0.003) | (0.004) | (0.004) |
| Average absolute change | 0.023 | 0.021 | 0.026 | 0.036 | 0.045 |
| Fraction | 0.260 | 0.188 | 0.191 | 0.168 | 0.111 |
| Observations | 585 | 585 | 585 | 585 | 585 |
| R-squared | 0.064 | 0.134 | 0.163 | 0.118 | 0.072 |
| *Panel B: pre-Beige Book* | | | | | |
| Voting | -0.008** | -0.007*** | -0.008** | -0.008** | -0.007 |
| | (0.004) | (0.003) | (0.003) | (0.004) | (0.005) |
| Average absolute change | 0.022 | 0.021 | 0.026 | 0.036 | 0.045 |
| Fraction | 0.357 | 0.335 | 0.311 | 0.225 | 0.157 |
| Observations | 483 | 483 | 483 | 483 | 483 |
| R-squared | 0.069 | 0.144 | 0.176 | 0.128 | 0.070 |
| *Panel C: post-dissent* | | | | | |
| Voting | -0.009 | -0.007* | -0.007 | -0.010* | -0.014** |
| | (0.006) | (0.004) | (0.005) | (0.005) | (0.006) |
| Average absolute change | 0.022 | 0.019 | 0.021 | 0.030 | 0.042 |
| Fraction | 0.403 | 0.377 | 0.328 | 0.335 | 0.332 |
| Observations | 264 | 264 | 264 | 264 | 264 |
| R-squared | 0.167 | 0.181 | 0.235 | 0.227 | 0.164 |
| *Panel D: beyond 2013* | | | | | |
| Voting | -0.005** | -0.004** | -0.004* | -0.006** | -0.006* |
| | (0.002) | (0.002) | (0.002) | (0.003) | (0.003) |
| Average absolute change | 0.021 | 0.019 | 0.023 | 0.032 | 0.042 |
| Fraction | 0.244 | 0.213 | 0.174 | 0.186 | 0.142 |
| Observations | 769 | 769 | 769 | 769 | 769 |
| R-squared | 0.069 | 0.142 | 0.165 | 0.128 | 0.081 |
| *Panel E: speeches on Reuters* | | | | | |
| Voting | -0.008** | -0.006** | -0.005* | -0.006 | -0.005 |
| | (0.004) | (0.003) | (0.003) | (0.004) | (0.005) |
| Average absolute change | 0.023 | 0.020 | 0.024 | 0.034 | 0.045 |
| Fraction | 0.355 | 0.306 | 0.206 | 0.175 | 0.112 |
| Observations | 438 | 438 | 438 | 438 | 438 |
| R-squared | 0.057 | 0.135 | 0.166 | 0.123 | 0.079 |
| *Panel F: speeches from FOMC speak* | | | | | |
| Voting | -0.001 | -0.002** | -0.003** | -0.002 | -0.005** |
| | (0.001) | (0.001) | (0.001) | (0.002) | (0.002) |
| Average absolute change | 0.011 | 0.010 | 0.012 | 0.021 | 0.032 |
| Fraction | 0.091 | 0.195 | 0.243 | 0.097 | 0.156 |
| Observations | 568 | 568 | 568 | 568 | 568 |
| R2 | 0.082 | 0.102 | 0.136 | 0.103 | 0.073 |

Notes: The table shows coefficient estimates for the effect of speeches on the daily absolute change in constant maturity treasury yields, following equation (8). Panel A shows results for all speeches on days with only one speech. Panels B and C split [PAS OP!!] this sample into pre-Beige Book release and speeches following FOMC meetings with dissent. Panel D extends the speech sample until 2018. Panel E restricts the sample to speeches reported upon by Reuters. Panel F uses speeches with a time stamp as recorded in the "FOMC speak" database. Rows "average absolute change" report the average absolute change of the dependent variable for the full sample. Rows "fraction" report the absolute value of the estimated coefficient on the voting dummy as a fraction of the average absolute change of the dependent variable. Numbers in brackets are standard errors. ***/**/* denote statistical significance at the 1%/5%/10% level.

***Consistency of market reaction and presidents' behavior.*** How to explain the vote discount? After all, the influence of voting presidents on the FOMC decision is more direct thanks to their votes. At first sight, one might therefore expect a stronger market reaction to their views. We explain the vote discount in terms of the difference in information that speeches delivered by presidents with and without the right to vote contain.

Speeches potentially contain information of relevance to financial markets, as speech characteristics and economic variables correlate. The exact relationship between various economic variables and speech characteristics is unknown. This creates an inference or signal extraction problem: speeches are potentially useful, but the information contained in them must be inferred or extracted. The information that speeches contain can differ in relevance for the pricing of a nation-wide asset. To price nation-wide assets such as U.S. government securities or the U.S. dollar, market participants are likely more interested in national than regional information: national information is more directly relevant, while regional information could be relevant after its translation to the national level. Speeches with characteristics that are more strongly correlated with national information will lead to larger price reactions than speeches that are less strongly correlated with national information. Our findings show that the information content varies across voting status: speeches in voting years are more strongly correlated with regional information than speeches in nonvoting years. Thus, relatively speaking, the correlation between national variables and speech characteristics is weaker in years with than in years without the right to vote. A vote discount then logically follows.

Table 8 provides more details. It presents the estimates of two regressions for the number of speeches that presidents give. Column 1 is the benchmark model from Table 2; column 2 uses the same specification, except that we removed the period fixed effects. Period fixed effects capture what is common to all districts in an intermeeting period, including the general, U.S.-wide economic situation. Without the period fixed effects, regional unemployment has a significant effect on the number of speeches that presidents give, whether they vote or not. The introduction of the period fixed effects shows that in years in which they do not vote, the number of speeches does not react to idiosyncratic regional unemployment, whereas in years in which they do vote, it does so substantially.

**Table 8: What does the market learn from the number of speeches?**

| | (1) Benchmark | (2) No period f.e. |
|---|---|---|
| Absolute unemployment gap ($\beta^N_u$) | 0.277 | 0.255* |
| | (0.186) | (0.134) |
| Absolute unemployment gap * voting status ($\gamma^N$) | 0.264* | 0.245 |
| | (0.158) | (0.150) |
| Voting status ($\beta^N_v$) | -0.028 | -0.028 |
| | (0.115) | (0.133) |
| Absolute unemployment gap for voters ($\beta^N_u+\gamma^N$) | **0.550*** ** | 0.500*** |
| | (0.184) | (0.156) |
| Period FE | Yes | No |
| President FE | Yes | Yes |
| Observations | 1,735 | 1.735 |

Notes: See notes to Table 2. Column (1) replicates the benchmark specification in column (2) of that table. Column (2) is based on the benchmark specification, but without period fixed effects.

When we turn to speech tone, the same pattern holds. Table 9 presents the estimates of two regressions. Column 1 is the benchmark model from Table 3. Column 2 uses the same specification, except that we removed the period fixed effects.

**Table 9: What does the market learn from the tone of speeches?**

| | (1) Benchmark | (2) No period f.e. |
|---|---|---|
| Regional unemployment ($\beta^\tau_u$) | -0.112 | -0.186** |
| | (0.119) | (0.071) |
| Regional unemployment * voting status ($\gamma^\tau$) | -0.156** | -0.214*** |
| | (0.062) | (0.047) |
| Voting status ($\beta^\tau_v$) | 1.139** | 1.434*** |
| | (0.425) | (0.369) |
| Regional unemployment for voters ($\beta^\tau_u+\gamma^\tau$) | **-0.268**** | **-0.400***** |
| | (0.127) | (0.076) |
| Period FE | Yes | No |
| President FE | Yes | Yes |
| Observations | 586 | 586 |
| R2 | 0.625 | 0.303 |

Notes: See notes to Table 3. Column (1) replicates the benchmark specification in column (2) of that table. Column (2) is based on the benchmark specification, but without period fixed effects.

Without the period fixed effects, regional unemployment determines the tone of presidents' speeches, albeit to different degrees, whether they vote or not. The introduction of the period fixed effects shows that in years in which they do not vote, the tone of their speeches

does not react to idiosyncratic regional unemployment, whereas in years in which they do vote, it does so substantially.

Thus, the speech activity of non-voting presidents is driven by the component of regional economic conditions that moves in tandem with U.S.-wide economic conditions. Instead, in years that they vote, their speech activity is driven both by economy-wide conditions and to a considerable extent by idiosyncratic regional conditions. In other words, during years with the right to vote speech characteristics and national economic conditions are less correlated than during years without the right to vote. As the market extracts less information from the speeches in such years, the associated asset price change is smaller.

Consistent with this line of reasoning, panels B and C in Table 7 shows that the vote discount is especially large for speeches given before the publication of the Beige Book with district-level information, and following FOMC meetings with dissent; Tables 2 and 3 as well as Tables 4 and 5 show that these are precisely the speeches that respond most strongly in tone and number to the economic situation at the district-level when a president has voting status.

## 5. Discussion

In this section, we start with an account of how the current structure of the FOMC came about. Then we compare the FOMC rotation scheme with schemes used by other committees to share voting rights. Next we discuss various proposals by lawmakers and academics to change FOMC membership, all of which affect the current practice of rotation. We end with a discussion of related literature.

### 5.1. How did the current FOMC come about?

After a series of depressions and banking panics in the period 1870-1907, the need to form an institution performing central banking functions to support the liquidity and stability of the banking system was widely felt. The *governance* of such an institution, however, was a topic of intense debate, as some feared an institution dominated by New York and Wall Street, others feared government control over money and yet others feared that bankers' interests would prevail over public interests (Meltzer 2003, Binder and Spindel 2013). The Federal Reserve Act of 1913 created the Federal Reserve System, a hybrid structure. It consisted of a Federal Reserve Board with president-appointed and Senate-confirmed

governors,[23] and 12 Federal Reserve banks, independently chartered corporations, each with its own board of directors, district and Federal Reserve city, and a chief executive officer appointed by its directors.[24]

In the first decades after its birth, the balance of power between the Board and the Reserve banks changed dramatically. In the early 20th century, monetary policy was conducted mainly via lending to depository institutions through the "discount window" rather than via open market operations. Reserve banks were free to sell and purchase in the open market subject to rules and regulations of the Board. With the emergence of a national financial market, coordinated actions were required, and the New York Reserve bank gained a more important role because of the size of its banking sector and its role in the international financial system. Struggles for power resulted, both among the Reserve banks, and between the Reserve banks and the Board.

In 1922, the Reserve banks established a committee for the execution of open market operations, consisting of the governors of five Reserve banks, with the governor of the New York Reserve bank as its chairman. Its role was limited to recommendations and to execution of orders sent by Reserve banks. Reserve banks retained their right to perform open market operations at their discretion, also outside this committee. This committee was an informal arrangement; formally, the Board had to approve purchases and sales. This procedure became a source of friction. As open market operation increased in importance and discount rate policy declined, the Board lost influence. In 1923, the Board abolished this committee and established the Open Market Investment Committee (OMIC) instead. It initially consisted of the same five Reserve banks, but subsequently – following pressure from the Board – included all Reserve bank governors.

The Great Depression and banking crises of the 1920s and early 1930s were taken as proof that the U.S. central banking system had failed and needed to be re-assessed radically. The Banking Act of 1933 gave legal status to the open market committee that included all Reserve banks as members and called it the Federal Open Market Committee. The Act

[23] The Comptroller of the Currency and the Secretary of Treasury were *ex officio* members until the Banking Act of 1935.

[24] To be precise, it was a committee tasked with the actual formation of the System, the Reserve Bank Organization Committee, that decided in 1914 on the number of districts within the bounds set by the Act, their boundaries and the Federal Reserve cities. By and large, the district boundaries have remained the same to this date.

made the decisions of this committee binding on the Reserve banks. The Banking Act of 1935 moved the locus of power to the Board in Washington. The act marked the end of the semiautonomous nature of the Reserve Banks and by and large formed the FOMC as it still is today. All 7 Board members obtained a seat on the FOMC and one of them became its chair. The 12 districts were grouped, and one seat was assigned to each of the 5 groups, as follows: the Reserve banks of New York and Boston; Philadelphia and Cleveland; Chicago and St. Louis; Richmond, Atlanta and Dallas; and Minneapolis, Kansas City and San Francisco. The change in the formal balance of power was further stressed by changing the title of the chief executive officer of a Reserve Bank from Governor to President, by changing the name of the board from Federal Reserve Board to Board of Governors and by making the nomination of a Reserve Bank president conditional on approval by the Board of Governors. To accommodate two or three districts with one seat, the amended Federal Reserve Act stipulates that the boards of directors of the Reserve banks in the same group elect annually their representative, and that each board have one vote. From 1936 onward, FOMC membership started to rotate on a yearly basis within each group. This was a practical solution to sharing one vote; rotation was not – and still is not – a legal requirement.[25] From the September 1939 meeting onward, also nonvoting presidents were present at the meetings. A change in the law in 1942 kept the five-way split of the Reserve banks, but made the Federal Reserve Bank of New York a group on its own, effectively giving it a permanent seat on the FOMC. The accompanying reshuffling of districts gave rise to the following remaining four groups, effective from 1943: the Reserve Banks of Chicago and Cleveland; Boston, Philadelphia and Richmond; St. Louis, Dallas and Atlanta; and Kansas City, Minneapolis and San Francisco. These groups have remained unchanged since.

Struggles for power over monetary policy continued, especially between the Board and the New York Fed. Until 1955, the FOMC "delegated decisions to an executive committee […] The committee was basically run by the Chairman and the New York Fed president" (Bordo and Prescott (2019), p. 20). In that year, this committee was abolished and from then onwards, the entire FOMC "became more involved with the open market decisions."

[25] Former Reserve bank president Kocherlakota (2017) "suspect[s] that few, if any, directors know that the act gives them the freedom to deviate from the rotation scheme."

In 1970, then-chairman Arthur Burns initiated the compilation of the first Beige Book, at the time called Red Book. Burns intended the Beige Book to replace parts of the presidents' verbal reporting about regional conditions during the meeting, and thus make the gathering of opinions and judgements from the districts more efficient and effective (FOMC minutes of May 5, 1970). Starting May 1983, the Beige Book was made public. Its release date was set to two weeks before the FOMC meeting (Fettig et al. 1999).

The decision at the FOMC meeting is taken by a formal vote at the end of the meeting. Historically, the vote count has always led to the approval of the proposed policy decision. Dissent is rare and usually limited to 1 or 2 dissenting votes.

### 5.2 Committees and the sharing of voting rights

Voting right rotation can be used to dilute the power of a group of potential decision makers or to increase group decision-making efficiency. It is an equitable way of sharing decision-making power among actors if the number of voting rights is smaller than the number of potential decision makers.[26] The FOMC is not the only committee to have rotation without exclusion; the monetary policy committee of the European Central Bank (ECB), the Governing Council (GC), uses it too. Short of complete exclusion from the group of (potential) decision makers, there are other ways to dilute power or improve decision-making efficiency. We briefly present two such ways.

The Security Council (SC) of the United Nations (UN) has five permanent members and ten nonpermanent members. There is no mechanical rotation; instead, its nonpermanent members are elected for two-year terms by the member states of the UN. Article 23 of the Charter of the UN requires that "an equitable geographical distribution" has to be respected, not unlike the regional grouping of voting rights at the FOMC, but also states' contribution "to the maintenance of international peace and security" have to be considered. Each member of the SC has one vote, but only on procedural matters do votes of permanent and nonpermanent members have equal weight; on all other matters decisions "shall be made by an affirmative vote of nine members including the concurring votes of the permanent members" (Article 27). UN member states who are not a member of the SC cannot attend SC meeting; only if a member is "a party to a dispute under consideration by

[26] The right to chair a meeting can also rotate, and often comes with agenda-setting rights. Within the European Union the presidency rotates.

the SC [shall it] be invited participate, without vote, in the discussion relating to the dispute" (Article 32).

The Executive Board of the World Health Organization (WHO) uses a scheme that is in some sense between the rotation without exclusion that characterizes the monetary policy committees of the Fed and the ECB and the elected nonpermanent members with exclusion of the Security Council.[27] The WHO has 194 member states. Its Executive Board consists of 34 persons who have been designated by as many member states of the WHO. There is no mechanical rotation; instead, member states are elected for three-year terms by the World Health Assembly, the WHO's supreme decision-making body. Moreover, members may be re-elected, and the election outcome should reflect "an equitable geographical distribution". Much like the FOMC, all member states without a representative on the Board may "designate a representative who shall have the right to participate without vote in the deliberations of meetings of the Board."[28] Many member states make use of this possibility.[29] But unlike the situation at the FOMC, not having the right to vote does affect other rights: "Representatives of Member States and Associate Members participating in meetings under this Rule shall have the following rights: (a) the right to speak after members of the Board; (b) the right to make proposals, and amendments to proposals, which shall be considered by the Board only if seconded by a Board member; and (c) the right of reply." That is, the right to vote is bundled with other rights that a member state loses when it loses membership of the Board.

The fact that membership of the Security Council of the UN and the Executive Board of the WHO is not exogenous but a matter of election and that losing the right to vote implies losing other rights make these committees less attractive for a causal analysis of the behavioral consequences of a member's voting status. In addition, the regular schedule of FOMC meetings, the uniformity of each meeting and the similarity of the decision it takes

[27] We are grateful to Hans Gersbach for bringing this example to our attention.
[28] This is Rule 3 of the Rules of Procedure of the Executive Board of the World Health Organization (WHO 2020a)
[29] The attendance list of the February 8 2020 EB meeting is 99 pages long (WHO 2020b). The first 23 pages cover the delegates, alternates and experts designated by the members of the EB. The next 36 pages cover the representatives of member states not represented on the EB. The remaining 50 pages list representatives of observers, specialized agencies, other intergovernmental organizations, and non-state actors in official relations with WHO.

facilitate the analysis. It also means that extrapolation of our findings is difficult as few other contexts are similar.

### 5.3 Current proposals to change FOMC membership.

Academics and U.S. lawmakers have proposed various changes to FOMC membership. Bill H.R. 10 of the 115th Congress proposes to replace the five groups by six groups of two Reserve districts, putting the Federal Reserve Bank of New York back into the rotation system, and would make yearly rotation a legal requirement for the first time. In contrast, both H.R. 4759 and H.R. 6741 of the 115th Congress propose to make all Reserve presidents members of the FOMC and would thus remove rotation. These bills appear to aim at a change in preferences on the FOMC, see Congressional Research Service (2018). Conti-Brown (2016) proposes to have only members of the Board of Governors determining monetary policy. They should also appoint the presidents of the Reserve banks. He argues that this would simplify governance at the Federal Reserve, and thus clarify accountability. Finally, Vissing-Jorgensen (2020) proposes to eliminate rotation and reduce the number of Reserve districts and thus the number of Bank presidents on the FOMC. The point of her proposal is that the reduction of the number of FOMC members and the elimination of the rotation scheme will simplify the communication of the committee's reaction function and enhance its transparency.

Our analysis can shed light on some possible consequences of these proposals for the behavior of FOMC members. Some proposals remove the voting right rotation but keep voting rights for Reserve bank presidents. Arguably, presidents with a permanent position on the FOMC may feel even more committed than presidents with a nonpermanent position. Hence, ceteris paribus, a consequence of these proposals could be that district-specific economic conditions will play a larger role in presidents' speeches and interventions, and, as a result, markets would react less to presidents' speeches.

Removing the voting rights for Reserve bank presidents altogether may have as a consequence that they seek other ways than participating in and voting at FOMC meetings to influence policy. After all, the regional information that Reserve bank presidents presently bring to the table forms a vital part of the meeting input and will continue to be sought for. This gives presidents a natural role in the deliberation process, if not during then prior to the meeting.

Finally, the proposal by Vissing-Jorgensen (2020) to reduce the number of Reserve bank districts and to give each a permanent voting right could have two effects. On the one hand, an FOMC made up of only governors and, say, five permanent presidents would make it easier for the chairman to communicate the policy reaction function. On the other hand, thanks to the permanence of their positions presidents could become even more committed and thus more responsive to district-level information. This would make it harder for observers to extract relevant information. At the same time, the districts would be larger, and would likely be more correlated with the U.S. economic developments. Overall, the net effect is unclear.

### 5.4 Related literature

**The effects of differences in voting rights.** Few others appear to have studied voting right rotation. Tietz (2018) introduces the speech data set we use and finds that presidents react more strongly to misperceptions by the market about upcoming policy decisions in years they have voting status. Tillmann (2011) shows that non-voting presidents overpredict (underpredict) inflation relative to the consensus forecast if they favor tighter (looser) policy, suggesting that they use their forecast in an attempt to influence policy. Rieder and Gnan (2021) study ECB communication policy breaches by Governing Council members during the quiet periods immediately before GC meetings. They find, using the exogeneity of the voting right rotation scheme, that voting status does not affect the probability that a statement in this period is a breach. Bosman et al. (2013) run a laboratory experiment to study voting right rotation *with* exclusion. They find that rotation creates both larger total welfare and larger inequality among members than committee decision-making without rotation.

The effects of *obtaining* voting rights were discussed by proponents and opponents any time an extension of the elective franchise was debated. Although these contexts are quite different from ours, it is interesting to note that the proponents of women's suffrage stressed, without using the term, the complementarity between obtaining the right to vote and women's fight to "establish fair custody laws, better access to education, safer working conditions, real control of their property, and effective security against sexual abuse, among other things" to promote women's interests (Lopez-Guerra 2015). Opponents stressed substitution with household chores due to time constraints.

Finally, company shares can come with and without voting rights; dual-class firms have issued both. Gompers, Ishii and Metric (2008) show that firm value of such firms is decreasing in insider voting rights. Li, Ortiz-Molina and Zhao (2008) find that the unification of dual-class shares into a single class by granting voting rights to all shareholders, attracts institutional investors.

**Monetary policy committees.** Monetary policy committees have attracted much attention in the economics literature for at least two reasons: their decisions are important and their decision-making processes have become more transparent over time.[30] Besides the literatures on the communication of the committee's decision, the influence of regional economic conditions and the role of reputational concerns to which we referred earlier, papers have studied the role of the chairman (e.g., Chappell et al., 2004) or differences in behavior between presidents and governors (e.g., Riboni and Ruge-Murcia 2010, 2014), the effect of transparency on deliberation and voting (e.g., Gersbach and Hahn 2004, Hansen et al. 2017 and Swank and Visser 2013) and social learning during the meeting (Lopez-Moctezuma 2019). In addition, whether and how committees should communicate the personal views of individual committee members without generating a cacophony of voices has also been studied (e.g., Bernanke 2004, Blinder 2018 and Meade et al. 2015).

**Asset pricing and central bank communication.** There is robust evidence that central bank announcements, including speeches by central bankers move asset prices (Blinder et al. 2008), be it because they provide information about monetary policy or about the underlying economic fundamentals (Nakamura and Steinsson 2018). It is also apparent that financial markets differentiate the attention they give to the different individuals, e.g. along the hawks vs doves dimension (Istrefi 2019), between the chair and all other committee members or between governors and Reserve bank presidents (Ehrmann and Fratzscher 2007). Much of this literature uses event study methodologies which require measuring financial market reactions in a relatively narrow time window around the communication events. While the current paper also uses an event study setup to measure market reactions, we are mainly interested in the *differential* effects between voters and non-voters, such that our identification scheme relies on the – presumably uncontroversial – assumption that identification of the time windows is not systematically different across these two groups.

[30] See Blinder (2004, 2007) and Geraats (2002).

## 6. Conclusion

The FOMC provides an unusually clean environment in which two effects of an agent's voting status can be seen – changes in the agent's behavior and reactions by financial markets to that behavior. We find that patterns in the public speeches of Reserve Bank presidents and in the transcripts of their FOMC meeting interventions go against the loss-compensation hypothesis but support the gain-enhancement hypothesis. We also find that speeches by presidents in years they have the right to vote move markets less, and argue that this vote discount is consistent with the observed change in presidents' behavior.

We conclude with three topics for further research. The design of rotation schemes for voting rights deserves special attention because, as we found, committee members adjust their behavior to their voting status. Our contribution is descriptive; a normative framework should be used to assess whether this change in behavior is desirable and, if not, how it could be mitigated. Second, further research on the question whether committee members act strategically in the run up to the meeting is promising. While this aspect is studied in some theoretical papers, see for example Swank et al. (2008) and Swank and Visser (2013) on pre-meetings, the empirical literature largely ignores this aspect, with Vissing-Jorgensen (2020) on leaks being a notable exception. Third, consistent with investor rationality, financial markets appear to internalize the communication decisions by committee members. We focus on speeches between meetings; a next step could be to investigate the joint use of speeches and interviews and their reception by financial markets.

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## Appendix

### Table A.1: Summary statistics

| | Observations | Mean | Std. Dev. | Min | Max |
|---|---|---|---|---|---|
| Number of speeches | 1,733 | 0.530 | 0.834 | 0.000 | 4.000 |
| Tone of speeches | 612 | 96.080 | 1.371 | 90.537 | 99.457 |
| Regional unemployment | 1,733 | 5.744 | 1.762 | 2.725 | 11.525 |
| Absolute unemployment gap | 1,733 | 0.650 | 0.542 | 0.001 | 2.746 |
| Regional inflation | 1,733 | 2.405 | 1.316 | -3.826 | 6.275 |
| Absolute inflation gap | 1,733 | 0.685 | 0.643 | 0.000 | 4.490 |
| Regional return on assets | 1,733 | 1.185 | 0.556 | -3.330 | 2.780 |
| Absolute return on assets gap | 1,733 | 0.258 | 0.299 | 0.000 | 3.230 |

Notes: The table reports summary statistics of the variables employed in the econometric analysis. The term "gap" denotes the difference between regional and national variables.

**Table A.2: District-level CPI inflation, data sources**

| District | MSA | MSA-states | Series ID | Source |
|---|---|---|---|---|
| Boston | Boston-Cambridge-Newton | MA-NH | CUURA103SA0 | fred |
| New York | New York-Newark-Jersey City | NY-NJ-PA | CUURA101SA0 | fred |
| Philadelphia | Philadelphia-Camden-Wilmington | PA-NJ-DE-MD | CUURA102SA0 | fred |
| Cleveland | Cleveland-Akron | OH | CUURA210SA0 | fred |
| Richmond | Washington-Baltimore (pre 2008) | DC-VA-MD-WV | CUURA311SA0 | fred |
| Richmond | Washington-Arlington-Alexandria | DC-VA-MD-WV | CUURS35ASA0 | BLS |
| Atlanta | Atlanta-Sandy Springs-Roswell | GA | CUURA319SA0 | fred |
| Chicago | Chicago-Naperville-Elgin | IL-IN-WI | CUURA207SA0 | fred |
| St. Louis | St Louis | MO-IL | CUURA209SA0 | fred |
| Minneapolis | Minneapolis-St.Paul-Bloomington | MN | CUURS24ASA0 | bls |
| Kansas City | Denver-Aurora-Lakewood | CO | CUURS48BSA0 | bls |
| Dallas | Dallas-Fort Worth-Arlington | TX | CUURA316SA0 | fred |
| Dallas | Houston-The Woodlands-Sugar Land | TX | CUURA318SA0 | fred |
| San Francisco | Los Angeles-Riverside-Orange County | CA | CUURA421SA0 | fred |
| San Francisco | San Francisco-Oakland-Hayward | CA | CUURA422SA0 | fred |

Notes: The table shows lists the data sources used to compile CPI inflation for individual districts of the Federal Reserve System.

**Table A.3: Population weights of states within Fed districts**

| District | State | Weight | District | State | Weight |
|---|---|---|---|---|---|
| Boston | Connecticut | 0.199 | St Louis | Illinois | 0.113 |
| | Maine | 0.099 | | Missouri | 0.278 |
| | Massachusetts | 0.486 | | Arkansas | 0.188 |
| | New Hampshir | 0.090 | | Indiana | 0.068 |
| | Rhode Island | 0.081 | | Kentucky | 0.164 |
| | Vermont | 0.045 | | Mississippi | 0.080 |
| New York | Connecticut | 0.034 | | Tennessee | 0.108 |
| | New Jersey | 0.220 | Minneapolis | Michigan | 0.042 |
| | New York | 0.745 | | Minnesota | 0.578 |
| Philadelphia | Delaware | 0.058 | | North Dakota | 0.084 |
| | New Jersey | 0.209 | | South Dakota | 0.092 |
| | Pennsylvania | 0.733 | | Wisconsin | 0.099 |
| Cleveland | Ohio | 0.673 | | Montana | 0.105 |
| | Kentucky | 0.101 | Kansas | Kansas | 0.183 |
| | Pennsylvania | 0.214 | | Missouri | 0.120 |
| | West Virginia | 0.011 | | Colorado | 0.243 |
| Richmond | Virginia | 0.265 | | New Mexico | 0.071 |
| | West Virginia | 0.070 | | Wyoming | 0.034 |
| | Dc | 0.026 | | Oklahoma | 0.232 |
| | Maryland | 0.205 | | Nebraska | 0.117 |
| | North Carolina | 0.284 | Dallas | Louisiana | 0.050 |
| | South Carolina | 0.149 | | Texas | 0.920 |
| Atlanta | Georgia | 0.203 | | New Mexico | 0.030 |
| | Tennessee | 0.111 | San Francisco | California | 0.637 |
| | Alabama | 0.127 | | Hawaii | 0.024 |
| | Florida | 0.406 | | Nevada | 0.026 |
| | Louisiana | 0.103 | | Arizona | 0.078 |
| | Mississippi | 0.049 | | Idaho | 0.022 |
| Chicago | Illinois | 0.327 | | Oregon | 0.061 |
| | Indiana | 0.153 | | Washington | 0.104 |
| | Iowa | 0.091 | | Utah | 0.037 |
| | Wisconsin | 0.135 | | Alaska | 0.012 |
| | Michigan | 0.293 | | | |

Notes: The table shows the weights of each state within a Fed district based on population weights based on material published by the Federal Reserve Board (access link here).

## Table A.4: Confirming the exogeneity of the voting scheme

| | Voting status |
|---|---|
| Regional inflation | 0.005 |
| | (0.010) |
| Regional unemployment | 0.012 |
| | (0.009) |
| Regional return on assets | 0.017 |
| | (0.026) |
| Observations | 1,733 |

Notes: The table shows marginal effects of a probit model that explains voting status with district-level inflation, unemployment and return on assets of the financial sector. Numbers in brackets are standard errors. No parameter is estimated to be statistically significant at the 10% level.

## Table A.5: Determinants of the number of speeches given, marginal effects

| | (1) Without voting status | (2) Benchmark | (3) 5% threshold | (4) 10% threshold | (5) Reuters coverage | (6) No Reuters coverage | (7) Conditional on speaking | (8) Controlling for # of others' speeches | (9) Probit model | (10) Adding inflation and RoA | (11) Until 2018 | (12) Tone of beige book proxies for economy | (13) Pre-beige book release | (14) Post-beige book release |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Absolute unemployment gap ($\beta^N_u$) | -0.084 | -0.065 | -0.066 | -0.068 | -0.036 | -0.031 | -0.075 | -0.072 | 0.065 | -0.065 | -0.062 | -0.047 | -0.078 | 0.026 |
| | (0.041)** | (0.043) | (0.042) | (0.035)** | (0.036) | (0.028) | (0.067) | (0.041)* | (0.057) | (0.041) | (0.043) | (0.027)* | (0.044)* | (0.018) |
| Absolute unemployment gap * voting status ($\gamma^N$) | -- | -0.062 | -0.088 | -0.051 | -0.063 | -0.005 | 0.008 | -0.071 | 0.086 | -0.054 | -0.057 | -0.037 | -0.059 | -0.034 |
| | | (0.037)* | (0.032)*** | (0.033) | (0.036)* | (0.017) | (0.059) | (0.042)* | (0.034)** | (0.037) | (0.033)* | (0.022)* | (0.030)** | (0.023) |
| Voting status ($\beta^N_v$) | -- | 0.007 | 0.029 | 0.007 | 0.007 | -0.001 | -0.098 | 0.010 | -0.031 | 0.030 | -0.007 | 0.042 | 0.019 | 0.009 |
| | | (0.027) | (0.025) | (0.020) | (0.025) | (0.015) | (0.044)** | (0.035) | (0.032) | (0.042) | (0.025) | (0.026) | (0.029) | (0.016) |
| Speeches by other members | -- | -- | -- | -- | -- | -- | -- | -0.018 | -- | -- | -- | -- | -- | -- |
| | | | | | | | | (0.003)*** | | | | | | |
| Absolute inflation gap (non-voters) | -- | -- | -- | -- | -- | -- | -- | -- | -- | -0.023 | -- | -- | -- | -- |
| | | | | | | | | | | (0.026) | | | | |
| Absolute inflation gap * voting status | -- | -- | -- | -- | -- | -- | -- | -- | -- | -0.033 | -- | -- | -- | -- |
| | | | | | | | | | | (0.033) | | | | |
| Absolute RoA gap (non-voters) | -- | -- | -- | -- | -- | -- | -- | -- | -- | 0.022 | -- | -- | -- | -- |
| | | | | | | | | | | (0.054) | | | | |
| Absolute RoA gap * voting status | -- | -- | -- | -- | -- | -- | -- | -- | -- | -0.009 | -- | -- | -- | -- |
| | | | | | | | | | | (0.064) | | | | |
| Meeting f.e. | Yes | Yes | Yes | Yes | Yes | Yes | Yes | No | Yes | Yes | Yes | Yes | Yes | Yes |
| Speaker f.e. | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Observations | 1,735 | 1,735 | 1,735 | 1,735 | 1,735 | 1,735 | 586 | 1,735 | 1,570 | 1,735 | 2,084 | 1,735 | 1,735 | 1,735 |

Notes: The table shows marginal effects for the effect of regional macroeconomic conditions and voting status on the number of speeches given by FOMC members in the rotation scheme, based on an ordered probit model following equation (3), for the outcome of zero speeches. The term "unemployment gap" denotes the difference between regional and national unemployment. Information in the columns follows the format of Table 2. Numbers in brackets are standard errors. ***/**/* denote statistical significance at the 1%/5%/10% level.

## Table A.6: Determinants of the length of meeting interventions

| | First intervention | | | All interventions | | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Absolute unemployment gap ($\beta^W_u$) | 0.058 | -- | 0.064 | 0.024 | -- | 0.023 |
| | (0.143) | | (0.144) | (0.044) | | (0.044) |
| Absolute unemployment gap * voting status ($\gamma^W_u$) | -0.095 | -- | -0.107 | 0.018 | -- | 0.020 |
| | (0.138) | | (0.147) | (0.034) | | (0.036) |
| Number of speeches ($\beta^W_N$) | -- | -0.065 | -0.068 | -- | 0.010 | 0.009 |
| | | (0.051) | (0.048) | | (0.010) | (0.010) |
| Number of speeches * voting status ($\gamma^W_N$) | -- | 0.070 | 0.079 | -- | -0.011 | -0.014 |
| | | (0.061) | (0.060) | | (0.015) | (0.016) |
| Voting status ($\beta^W_v$) | -0.052 | -0.146*** | -0.082 | 0.011 | 0.027 | 0.016 |
| | (0.089) | (0.046) | (0.089) | (0.023) | (0.023) | (0.025) |
| Absolute unemployment gap for voters ($\beta^W_u+\gamma^W_u$) | -0.037 | | -0.044 | 0.042 | | 0.043 |
| | (0.125) | | (0.133) | (0.031) | | (0.029) |
| Number of speeches for voters ($\beta^W_N+\gamma^W_N$) | | 0.004 | 0.012 | | -0.001 | -0.004 |
| | | (0.056) | (0.060) | | (0.011) | (0.012) |
| Period FE | Yes | Yes | Yes | Yes | Yes | Yes |
| President FE | Yes | Yes | Yes | Yes | Yes | Yes |
| R2 | 0.335 | 0.335 | 0.336 | 0.849 | 0.849 | 0.849 |
| Observations | 1,714 | 1,714 | 1,714 | 1,714 | 1,714 | 1,714 |

Notes: The table shows coefficient estimates for the effect of regional macroeconomic conditions, the number of speeches and voting status on the tone of interventions at the FOMC meeting, following the OLS regression $W_{i,t} = \mu_i + \mu_t + \beta^W_u |u_{d,t} - u_{US,t}| + \beta^W_v v_{d,t} + \gamma^W_{uv} |u_{d,t} - u_{US,t}| v_{d,t} + + \beta^W_N N_{i,t} + \gamma^W_{Nv} N_{i,t} v_{d,t} + \varepsilon_{i,t}$. The term "unemployment gap" denotes the difference between regional and national unemployment. The left panel relates to the tone of the first intervention at the FOMC meeting, the right panel to the tone of all interventions together. Numbers in brackets are standard errors. Coefficients in bold are statistically significantly different from the top row coefficients at least at the 10% level. ***/**/* denote statistical significance at the 1%/5%/10% level.

## Table A.7: Effect of speeches on Treasury rates, additional results

| | 3-month rates | 6-month rates | 12-month rates | 2-year rates | 5-year rates |
|---|---|---|---|---|---|
| *Panel A: post-Beige Book* | | | | | |
| Voting | -0.003 | 0.005 | -0.001 | -0.009 | -0.006 |
| | (0.009) | (0.007) | (0.008) | (0.009) | (0.011) |
| Average absolute change | 0.026 | 0.023 | 0.029 | 0.036 | 0.046 |
| Fraction | 0.114 | 0.219 | 0.035 | 0.247 | 0.130 |
| Observations | 102 | 102 | 102 | 102 | 102 |
| R-squared | 0.325 | 0.365 | 0.341 | 0.403 | 0.346 |
| *Panel B: post no dissent* | | | | | |
| Voting | -0.004 | -0.002 | -0.003 | -0.002 | 0.004 |
| | (0.005) | (0.004) | (0.004) | (0.006) | (0.006) |
| Average absolute change | 0.024 | 0.023 | 0.030 | 0.040 | 0.047 |
| Fraction | 0.169 | 0.085 | 0.099 | 0.049 | 0.085 |
| Observations | 321 | 321 | 321 | 321 | 321 |
| R-squared | 0.076 | 0.141 | 0.151 | 0.094 | 0.092 |

Notes: The table shows coefficient estimates for the effect of speeches on the daily absolute change in constant maturity treasury yields, following equation (8). Panel A shows results for speeches post-Beige Book release, panel B for speeches given following FOMC meetings without dissent. Rows "average absolute change" report the average absolute change of the dependent variable for the full sample. Rows "fraction" report the absolute value of the estimated coefficient on the voting dummy as a fraction of the average absolute change of the dependent variable. Numbers in brackets are standard errors. ***/**/* denote statistical significance at the 1%/5%/10% level.

## Table A.8: Effect of speeches on the yen-dollar exchange rate

| | Yen-$ exchange rate |
|---|---|
| Voting | -0.072* |
| | (0.039) |
| Average absolute change | 0.365 |
| Fraction | 0.197 |
| Observations | 579 |
| R-squared | 0.058 |

Notes: The table shows coefficient estimates for the effect of speeches on the daily absolute change in the yen-dollar exchange rate, following equation (8). Row "average absolute change" reports the average absolute change of the dependent variable for the full sample. Row "fraction" reports the absolute value of the estimated coefficient on the voting dummy as a fraction of the average absolute change of the dependent variable. Numbers in brackets are standard errors. ***/**/* denote statistical significance at the 1%/5%/10% level.