INTERNATIONAL MONETARY FUND

Voting Right Rotation, Behavior of Committee Members and Financial Market Reactions: Evidence from the U.S. Federal Open Market Committee

Michael Ehrmann, Robin Tietz and Bauke Visser

WP/22/105

A preliminary version of a part of this paper has been circulated 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, the Euro system or the IMF.

2022
MAY

WORKING PAPER

 WP/22/105

IMF Working Paper
Research Department

Voting Right Rotation, Behavior of Committee Members and Financial Market Reactions: Evidence from the U.S. Federal Open Market Committee

Prepared by Michael Ehrmann, Robin Tietz and Bauke Visser*

Authorized for distribution by Maria Soledad Martinez Peria
May 2022

ABSTRACT: Which Federal Reserve Bank presidents vote on the U.S. monetary policy committee depends on a mechanical, yearly rotation scheme. Rotation is without exclusion: nonvoting presidents do attend and participate in the meetings of the committee. We test two hypotheses about the dependence of presidents' behavior on voting status. (i) Loss compensation: presidents compensate the loss of the right to vote with an increased use of speeches and contributions. (ii) Motivation: presidents complement the right to vote with an increased use of speeches and contributions. The evidence favors the motivation hypothesis. Also, in years that presidents vote, their speeches move financial markets less than in years they do not vote. We argue that this vote discount is consistent with presidents' communication behavior.

JEL Classification Numbers:	D71, D72, E58
Keywords:	voting right rotation, monetary policy committee, central bank communication, FOMC, financial market response
Author's E-Mail Address:	michael.ehrmann@ecb.int , rtietz@imf.org , bvisser@ese.eur.nl

*We would like to thank Philippe Andrade, Hans Gersbach, Klodiana Istrefi, Moritz Janas, Robin Lumsdaine, Michael McMahon, Ellen Meade, Mike Powell, Adriaan Soetevent, Annette Vissing-Jorgensen, and participants at the EEA Annual Congress 2019, the 2019 Deutsche Bundesbank Macro Workshop, the 2021 International Association for Applied Econometrics Annual Conference, the 2021 Behavioural Finance Working Group Conference, the 2021 Qatar Centre for Global Banking and Finance Conference and at seminars at the ECB and Erasmus University Rotterdam for helpful comments and conversations.

1. INTRODUCTION

Voting right rotation is a way to share power and expedite decision making when committees become large. It implies that a member experiences periods with and without the right to vote. It is used, among others, at the Security Council of the United Nations, the General Assembly of the World Health Organization, and at the monetary policy committees of the most prominent central banks, the Federal Open Market Committee (FOMC) of the U.S. Federal Reserve System and the Governing Council of the European Central Bank.

We study the behavioral consequences of voting right rotation at the FOMC,[1] and the surprising reaction of financial markets. The permanent members of the FOMC are the 7 members of the Board of Governors of the Federal Reserve and the president of the Federal Reserve Bank of New York. The presidents of the remaining 11 regional Reserve Banks belong to 1 of 4 groups. Each group has 1 seat on the FOMC. Within each group, the Reserve Bank presidents take turns in a simple succession that has remained unchanged since 1943. Rotation thus creates exogenous variation in voting status. Reserve Bank presidents are appointed for five-year periods and can be renewed. As a result, they typically experience years with and without the right to vote.[2]

At the FOMC, rotation is 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."[3] That is, the only difference with voting presidents (FOMC members) is that nonvoting presidents (FOMC participants) do not vote.

We use 20 years of meeting transcripts and texts of speeches, ranging from 1994 to 2013, to answer three questions. How does the voting status of presidents influence the speeches that they deliver between meetings and the contributions that they make during meetings? How does the reaction of financial markets to a speech depend on a president's voting status? And is the observed vote discount, the weaker market reaction to a speech in years with the right to vote, consistent with the observed difference in presidents' behavior across years with and without the right to vote?

We consider two hypotheses that explain why voting status changes behavior. They predict opposite behavioral responses. First, voting status might change behavior because in years without the right to vote, a president seeks to compensate for the loss of formal power by strategically intensifying the argumentative use of intermeeting speeches and meeting contributions. According to this loss-compensation hypothesis, voting on the one hand, and speeches and contributions on the other hand are substitutes to shape the final committee decision. The rival hypothesis maintains that voting status changes behavior because in years with the right to vote, presidents are more motivated to prepare themselves for the meeting, as their efforts are more likely to pay off thanks to their formal

[1]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. It affects a wide range of other interest rates (Drechsler, Savov and Schnabl, 2017).

[2]In Appendix C, we explain how the FOMC emerged.

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

right. According to the motivation hypothesis, voting on the one hand and speeches and contributions on the other hand are complements. This complementarity leads them to strategically intensify the use of speeches and contributions during years with the right to vote.[4]

We proxy this use of speeches and contributions by the tone and number of intermeeting speeches and the tone and length of meeting contributions.

As we explain in section 2, a Reserve Bank president is expected to bring intelligence about the regional economic conditions to the discussion on monetary policy at the FOMC. Moreover, the president of a Reserve Bank is the chief executive officer of the Bank and is accountable to the Bank's board of directors, which has a strong regional base. In section 2 we also show that students of the FOMC find evidence that besides national economic variables also regional variables—in particular, district-level unemployment—affect speeches and even policy preferences stated in the meeting and actual votes cast.

Against this background, presidents are said to strategically intensify their argumentative use of intermeeting speeches and meeting contributions if speeches and contributions become more responsive to the difference between district-level unemployment and U.S.-wide level of unemployment. The loss-compensation hypothesis predicts that this happens in years without the right to vote, the motivation hypothesis in years with the right to vote.

We find that, by and large, patterns in the data support the motivation hypothesis and reject the loss-compensation hypothesis, both when we study the intermeeting speeches and the meeting contributions.

Voting status matters 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 market reaction. This finding is robust and becomes stronger if we extend the sample period of speeches to 2018.

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 speech behavior due to voting status. Essentially, as speeches given by presidents in years with the right to vote are more affected by regional conditions that national markets care less about, markets such as the U.S. Treasury market, react less to those speeches. In further support of this argument, we find that the vote discount is especially large for speeches given before the publication of the Beige Book with district-level information or after a meeting that ended with dissenting votes; 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.

[4]We formalize these hypotheses in a model in Appendix A.

The remainder of this paper is organized as follows. Section 2 develops our hypotheses on the behavioral effects of voting status. Section 3 presents the econometric models that we test. Section 4 discusses our data and section 5 presents the empirical analysis. Section 6 discusses the related literature. Section 7 concludes. Appendix A provides a simple model that formalizes the hypotheses. Appendix B contains additional tables and Appendix C provides information about how the FOMC came about.

2. Two Hypotheses About How The Right To Vote Affects Presidents' Behavior

At the FOMC, nonvoting presidents participate in the meeting, along with voting presidents. To study the possible behavioral consequences of voting status, one must thus acknowledge the possibility that, even after group deliberation, presidents may continue to have different views about the better decision. Why else would a right to vote matter?[5]

We investigate whether a president's voting status changes the effect that economic variables about her district have on her speeches between meetings and contributions during the deliberation stage of meetings. That Bank presidents put particular emphasis on regional conditions when preparing for the meeting and during the meeting is, we argue in section 2.1, by design of the Federal Reserve System. District level variables may affect behavior for at least two reasons. They can directly enter a president's preferences as she may care not just whether the decision matches the overall U.S. economy, but also her district's economy. And district-level variables may be part of the information set she uses to asses the U.S. economy. We are agnostic about the relative importance of these reasons. In section 2.2, we review the empirical literature on the influence of regional economic variables on presidents' behavior and even policy preferences. We formulate the hypotheses in section 2.3 and the econometric models that we estimate in section 3.

2.1. **The regional dimension of the Federal Reserve System.**

The Federal Reserve System consists of a Board of Governors, located in Washington, D.C., and 12 Federal Reserve Banks, one for each Federal Reserve district. The FOMC's mandate 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*

[5] Coughlan (2000) shows that if members of a committee receive private signals about a state variable and can deliberate about their private signals using cheap talk before they cast a vote, then an equilibrium exists in which they truthfully reveal their signals and cast the same vote if their ex ante preferences are homogeneous or not too heterogeneous. In this equilibrium, the voting rule is immaterial. As a result, having or not having the right to vote is also immaterial, as long as no member is excluded from deliberation.

[6] Federal Reserve Act, section 2A. Monetary policy objectives.

[7] The quote appears in the colophon of the Beige Book.

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.

2.2. **Regional economic conditions and behavior of Bank presidents.** Both the regional nature of governance and the role of regional information at FOMC meetings suggest that presidents identify with their districts. Many students of the FOMC have found evidence that regional economic variables affect presidents' behavior and policy preferences. Sheng (2015) provides evidence that regional conditions affect the forecasts of real GDP, inflation and unemployment. Chappell Jr, McGregor and Vermilyea (2008), Jung and Latsos (2015) and Bennani, Farvaque and Stanek (2018) find that an increase in the difference between regional and U.S.-wide unemployment rates is associated with a higher probability of a voiced preference for a lower policy rate. While Tootell (1991) finds no evidence that regional unemployment explains actual votes, Gildea (1992) and Meade and Sheets (2005) find that more unemployment in a president's district is associated with an increased probability of voting in favor of lower policy rates, even if this implies a dissenting vote.[8] We are unaware of other papers that study whether a change in a Bank president's voting status leads to a change in the dependence of her behavior or stated preferences on district level variables.[9]

2.3. **Hypotheses.** We investigate the effect of voting status on the relationship between, on the one hand, the number and tone of speeches between meetings and the length and tone of contributions during meetings and, on the other hand, district-level economic variables. Speeches appear a natural place to start an analysis of behavioral changes in intermeeting periods. They are publicly observable. Testimony to their potentially large influence on financial markets is a "blackout period on monetary policy communications" around FOMC meetings that participants must observe.[10] FOMC members also give interviews during intermeeting periods. As these are typically

[8]Similarily, Eichler, Lähner and Noth (2018) find that the worsening of a district's regional banking sector health is associated with a higher probability that the district's president votes to ease interest rates.

[9]Some studies make comparisons across presidents with and without voting status. None of them make within-president comparisons across years with and without the right to vote. Tillmann (2011) finds that voters predict inflation rates in line with the consensus view, whereas nonvoters overpredict inflation rates if they favor tighter policy and underpredict rates if they favor looser policy. Hayo and Neuenkirch (2013) find that predicted regional activity does not determine the probability that a speech is delivered by voters; nonvoters, however, are more likely to deliver a speech favoring a tightening stance when economic activity is predicted to expand in their districts. Meade (2005) finds that nonvoting presidents voice more disagreement with chairman Greenspan's interest rate proposal during the meeting than voting presidents. Also, the publication of verbatim transcripts of FOMC meetings from 1993 onwards made nonvoting presidents more inclined to voice disagreement, and voting presidents less inclined (Meade, 2010).

[10]See Blinder, Ehrmann, Fratzscher, De Haan and Jansen (2008), Ehrmann and Fratzscher (2009) and Federal Open Market Committee (2011). At present, the blackout period starts on the Saturday before the meeting and lasts until the end of the day following the end of the meeting.

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.[11]

The economic variables that we study are the ones that have been used in the literature: (i) the absolute difference between district and U.S. unemployment as a determinant of the number of speeches and the length of contributions,[12] and (ii) the difference between district and U.S. unemployment as a determinant of the tone of speeches and contributions. The two hypotheses that we test predict opposite effects of voting status on these relationships. A model in Appendix A formalizes the hypotheses and derives the relationships that we test empirically.

Being part of a committee precludes that any member can unilaterally determine the decision. Preparing for the decision-making process, a costly effort, is then not only an exercise in identifying the best option through the collection of intelligence; 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. A speech can be used to influence policy making, either directly, as other Bank presidents and Board governors may hear the speech or read a transcript and are influenced by it, or indirectly, as a speech can influence economic actors like financial market participants. A speech can also be used to test and hone lines of argument and interpretation of current events to be used at the upcoming meeting.[13]

On the basis of the existing literature we expect that presidents use speeches more often the larger is the absolute difference between the district unemployment rate and the U.S. unemployment rate, as more is at stake. Similarly, we expect that presidents will attempt to put more of a stamp on the economy go-round during the meeting when the difference in unemployment rates increases, as more is at stake. We operationalize this by measuring the length of a president's contributions.

Presidents can exert effort to match the tone of speeches and contributions to the district unemployment rate to aid in the transmission of the message.[14] On the basis of the existing literature we expect that the tone will become more negative the larger is the district unemployment rate.

We now discuss what distinguishes the two hypotheses.[15]

2.3.1. *Loss compensation hypothesis.* A voting right is an instrument to further one's goals; it is, however, not the only instrument. This hypothesis views speeches between meetings and contributions during meetings on the one hand and the right to vote on the other hand as substitutes to increase the likelihood that the committee takes the decision desired by the president.

[11]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 (2021) shows that informal contacts with the press and the possibility of leaks are a recurring topic at FOMC meetings.
[12]Although most regressions consider unemployment, we also look at the role played by differences in inflation and in financial sector returns.
[13]That preparing speeches and contributions to meetings takes considerable time and effort becomes quite clear when reading Meyer (2004), Laurence Meyer's account of his years as a governor of the Federal Reserve Board.
[14]Meyer, although not a Fed president, speaks of "fine-tuning the remarks [he] would make at the FOMC meeting" (Meyer, 2004, p. 75) and of working hard to get the tone of his speeches right (p. 70).
[15]We present a simple model in Appendix A to derive the consequences of the two hypotheses.

If a president looses the right to vote, she becomes more inclined to take substitute actions and gives more speeches and makes longer contributions to compensate for the loss. This is especially the case, the more district-level unemployment deviates from national unemployment, as more is at stake. Thus, the hypothesis predicts that a president's inclination to deliver a speech is more responsive to the difference in unemployment in years without the right to vote than in years with.

Similarly, without the right to vote, a president will make more effort to match the tone of speeches and contributions to the economic situation to aid in the transmission of the message. The hypothesis predicts that in years without the right to vote, the responsiveness of these tones to district unemployment will be greater than in years with the right to vote.

2.3.2. *Motivation hypothesis.* Having the right to vote makes it more likely that any other activity to promote the desired decision pays off. Obtaining the right to vote motivates a more intense use of such activities. This hypothesis views the right to vote on the one hand and speeches and contributions on the other as complementary means to increase the probability that the group makes the decision desired by the president.

If a president obtains the right to vote, she will use speeches and contributions especially when more is at stake. This hypothesis predicts that a president's inclination to deliver a speech is more responsive to the difference in unemployment in years with the right to vote than in years without. Similarly, her efforts to attune the tone of a speech are strengthened by the higher probability that such efforts pay off thanks to the voting right. The hypothesis predicts that in years with the right to vote, the responsiveness of these tones to district unemployment will be greater than in years without the right to vote.

3. Econometric models to be estimated

Sections 3.1 to 3.3.2 present the main econometric models that we estimate to test the loss compensation and motivation hypotheses. In addition, in section 3.4, we look into specific circumstances where the marginal returns from presidents' efforts presumably are higher, allowing us to test how this affects presidents' behavior, irrespective of whether they view voting status on the one hand and speeches and contributions on the other as substitutes or complements.

3.1. **Inclination to deliver a speech.** Table 1 shows that in nearly two thirds of intermeeting periods, a president does not give a speech, while they give exactly one speech in 21% of intermeeting periods. As there are only few instances with more than one speech, we use a simple probit model to estimate the probability of a president delivering at least one speech, rather than no speech, in an intermeeting period. We call this probability a president's inclination to deliver a speech.

To test our hypotheses, we use the following probit regression equation:

$$\Pr(N_{it} = 1 \mid \mathbf{x}_{it}) = \Phi(\mu_i + \mu_t + \beta_u^N |u_{it} - u_{USt}| + \beta_v^N v_{it} + \gamma_{uv}^N |u_{it} - u_{USt}| v_{it} + \epsilon_{it}), \tag{1}$$

TABLE 1. Number of speeches by individual presidents per intermeeting period

No. of speeches	Total		Non-voters		Voters	
	Observations	Share (%)	Observations	Share (%)	Observations	Share (%)
0	1,149	66.22	733	66.39	416	65.93
1	359	20.69	235	21.29	124	19.65
2	172	9.91	106	9.60	66	10.46
3	48	2.77	26	2.36	22	3.49
4	7	0.40	4	0.36	3	0.48
Sum	1,735	100.00	1,104	100.00	631	100.00

Note: 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 non-voting and voting presidents in the voting rotation.

where Φ is the cumulative standard normal distribution. In this equation, N_{it} is a dummy variable that equals 1 if president i gives at least one speech in intermeeting period t and zero otherwise. We thus explain president i's inclination to deliver a speech in intermeeting period t with president fixed effects μ_i, period fixed effects μ_t, the absolute difference between the economic conditions in the district of president i and U.S. economic conditions, $|u_{it} - u_{USt}|$, the voting status of the Reserve Bank president, v_{it}, and the interaction of regional economic conditions with the voting status. In our benchmark specification, we use unemployment to measure economic conditions.

President fixed effects control for the possibility that time-invariant characteristics of the president, such as personality, affect speech behavior. Malmendier, Nagel and Yan (2021) 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.[16]

On the basis of the literature we expect a president's inclination to deliver a speech to increase, the larger is the difference between regional and national unemployment, *i.e.*, $\beta_u^N > 0$ and $\beta_u^N + \gamma_{uv}^N > 0$. The key parameter to test our hypotheses is γ_{uv}^N. The loss-compensation hypothesis predicts that the probability of giving a speeches responds more strongly to the absolute difference in unemployment levels in years without the right to vote, $\gamma_{uv}^N < 0$, while the motivation hypothesis predicts the opposite, $\gamma_{uv}^N > 0$. The two hypotheses also make opposite predictions regarding β_v^N; the motivation hypothesis maintains $\beta_v^N > 0$, while the loss-compensation hypothesis maintains $\beta_v^N < 0$.

3.2. **Speech tone.** To investigate the extent to which the tone τ_{it} expressed in the speeches depends on a president's voting status, we estimate the relationship

$$\tau_{it} = \mu_i + \mu_t + \beta_u^\tau u_{it} + \beta_v^\tau v_{it} + \gamma_{uv}^\tau u_{it} v_{it} + \epsilon_{it} \tag{2}$$

[16]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 that no single individual 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 district d rather than i.

using OLS. In section 4, we explain how we construct the tone variable. For now, it suffices to know that the higher is τ, the more positive is the tone. As before, we include president and period fixed effects (which control, among others, for U.S. unemployment) and cluster standard errors by president. 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 $\beta_u^\tau + \gamma_{uv}^\tau < 0$. The coefficient of interest for a test of the hypotheses is γ_{uv}^τ, as it measures the difference across voting status. The loss-compensation hypothesis predicts $\gamma_{uv}^\tau > 0$, *i.e.*, a president's tone is more responsive to regional unemployment in years without the right to vote, while the motivation hypothesis predicts the opposite, $\gamma_{uv}^\tau < 0$. The two hypotheses also make opposite predictions regarding β_v^τ. As the regional unemployment share is, on average in our sample, smaller than the U.S. unemployment share (for which we control through the period FE),[17] the motivation hypothesis predicts that with the right to vote the tone becomes more positive, $\beta_v^\tau > 0$, while the loss-compensation hypothesis predicts $\beta_v^\tau < 0$.

3.3. **Contributions during the meetings.** The FOMC meeting starts with an economy go-round, where all participants discuss the economic situation. In this round, presidents discuss, among others, 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 the second part of the meeting. This meeting structure naturally suggests that it will be important to analyze the first contribution of each president separately from their entire set of contributions.

3.3.1. *Length of Contributions.* We study the effect of voting status on the length of a president's contributions by estimating

$$W_{it} = \mu_i + \mu_t + \beta_u^W |u_{it} - u_{USt}| + \beta_v^W v_{it} + \gamma_{uv}^W |u_{it} - u_{USt}| v_{it} + \beta_N^W N_{it} + \gamma_{Nv}^W N_{it} v_{it} + \epsilon_{it} \tag{3}$$

using OLS. As before, we include president and period fixed effects and cluster standard errors by president. We also allow for the number of speeches to have an effect on the length of contributions during meetings. We expect the length to be positively correlated with the difference between regional and national unemployment $\beta_u^W > 0$ and $\beta_u^W + \gamma_{uv}^W > 0$. The coefficient of interest for a test of the hypotheses is γ_{uv}^W, as it measures the difference across voting status. The loss-compensation hypothesis predicts $\gamma_{uv}^W < 0$, *i.e.*, the length of a president's contributions is more responsive to regional unemployment in years without the right to vote, while the motivation hypothesis predicts the opposite, $\gamma_{uv}^W > 0$. The two hypotheses also make opposite predictions regarding β_v^W; the motivation hypothesis maintains $\beta_v^W > 0$, while the loss-compensation hypothesis maintains $\beta_v^W < 0$.

[17] The average regional unemployment share will generally be different from the U.S. unemployment share because the average is a simple average, unweighted by regional population shares, and because the district of New York is not part of the rotation scheme. In our sample, the difference is -0.295, with a standard error of 0.021.

3.3.2. *Contribution tone.* Analogous to the speech tone regression, we test whether presidents adapt the tone of their meeting contributions T_{it} to regional unemployment, and whether this adaptation depends on their voting status. The higher is T_{it}, the more positive the tone is.[18] We also investigate to what extent speech behavior between meetings and contributions during the meeting are linked, and whether any link depends on presidents' voting status. In its most general form, we estimate

$$T_{it} = \mu_i + \mu_t + \beta_u^T u_{it} + \beta_v^T v_{it} + \gamma_{uv}^T u_{it} v_{it} + \beta_\tau^T \tau_{it} + \gamma_{\tau v}^T \tau_{it} v_{it} + \epsilon_{it}. \tag{4}$$

As before, we include president and period fixed effects and cluster standard errors by president. In section 3, we explain how we construct the tone variable. We expect the tone of a contribution in years with and without the right to vote to be negatively related to regional unemployment, $\beta_u^T < 0$ and $\beta_u^T + \gamma_u^T < 0$. The parameter of interest for a test of the hypotheses is γ_{uv}^T, as it measures the difference across voting status. The loss-compensation hypothesis predicts $\gamma_{uv}^T > 0$, *i.e.*, tone responds more strongly to regional unemployment in years without the right to vote, while the motivation hypothesis predicts the opposite, $\gamma_{uv}^T < 0$. The two hypotheses also make opposite predictions regarding β_v^T. As the regional unemployment share is, on average in our sample, smaller than the U.S. unemployment share, see footnote 17, the motivation hypothesis predicts that with the right to vote the tone becomes more positive, $\beta_v^T > 0$, while the loss-compensation hypothesis predicts $\beta_v^T < 0$.

3.4. **Responsiveness to variations in the return from effort.** Irrespective of whether presidents view voting status on the one hand and speeches and contributions on the other as substitutes or complements, a basic assumption about their behavior is that if, ceteris paribus, the marginal returns from an action increase, then the president will take more of that action. In this section, we study this hypothesis by differentiating situations with relatively higher and lower returns from effort. One test compares speeches after meetings characterized by dissenting votes with speeches after meetings without dissent. The other compares speech behavior before and after the publication of the Beige Book.

3.4.1. *Periods following meetings with or without dissent.* Dissent is infrequent and signals strong disagreement about the decision.[19] The strong disagreement at the past meeting raises the marginal returns from any persuasive effort to move the decision at the next meeting in the desired direction. This holds irrespective of a president's voting status. It is then rational,[20] that (i) the inclination to deliver a speech will be higher after a meeting with dissent than after one without; (ii) the responsiveness of a president's inclination to deliver a speech and of the tone of the speech to regional unemployment is higher after a meeting with dissent than after one without.

[18] We explain in section 4 how we construct this variable.

[19] 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.

[20] For a formal proof, see Appendix A.3.

To test the predictions, we extend the speech and tone regression models by a dummy, D_t, that equals one if the last meeting is characterized by dissent. We interact this dummy with the regional economic conditions, the voting status and with both variables. The speech inclination model becomes

$$\Pr(N_{it} = 1 \mid \mathbf{x}_{it}) = \Phi(\cdots + \gamma^N_{uD}|u_{it} - u_{USt}|D_t + \gamma^N_{vD}v_{it}D_t + \delta^N|u_{it} - u_{USt}|v_{it}D_t), \tag{5}$$

where "…" stands for the variables used in the base equation for speech number, (1). While prediction (i) concerning the direct effect on the inclination to deliver a speech is not identified in this model because of the presence of meeting fixed effects, prediction (ii) can be tested. In years a president does not have the right to vote, $v_{it} = 0$, the prediction that the inclination of a president to deliver a speech depends more strongly on regional unemployment after a meeting with dissent than one without amounts to $\gamma^N_{uD} > 0$. In years with the right to vote, the prediction becomes $\gamma^N_{uD} + \delta^N > 0$.

The model for the tone of speeches turns into

$$\tau_{it} = \cdots + \gamma^\tau_{uD}u_{it}D_t + \gamma^\tau_{vD}v_{it}D_t + \delta^\tau u_{it}v_{it}D_t, \tag{6}$$

where "…" stands for the variables used in the base equation for speech number, (2). When $v_{it} = 0$, the prediction that the negative correlation between district-level unemployment and the speech tone of presidents becomes more negative after meetings with dissent amounts to $\gamma^\tau_{uD} < 0$. In years with the right to vote, the prediction becomes $\gamma^\tau_{uD} + \delta^\tau < 0$.

3.4.2. *Speeches before and after publication of the Beige Book.* Another distinction that can be used to differentiate situations with higher and lower returns from effort is between speeches delivered before and after the publication of the Beige Book.

Compared to presidents from other districts and governors in Washington, a president has preferential access to information on her district. Speeches can be used to reveal such information and to improve the chances that the desired decision is made. Speeches and the Beige Book are substitute sources for information on the district. Once the Beige Book has been published, the informational content of a speech is reduced. It then becomes less important to deliver one or to attune its tone, and the responsiveness to district circumstances declines. Thus, the model predicts that (i) the inclination to deliver a speech will be higher in the period before the release of the Beige Book than after; and (ii) the responsiveness of a president's inclination to deliver a speech and of the tone of the speech is higher before the publication of the Beige Book than after.[21] As we have to estimate separate models for the different subperiods, prediction (i) cannot be investigated. Prediction (ii) is that both β^N_u and $\beta^N_u + \gamma^N_{uv}$ are more positive before than after publication in the inclination-to-speech regression, while both β^τ_u and $\beta^\tau_u + \gamma^\tau_{uv}$ are more negative before than after publication in the tone regression.

[21] For a formal proof, see Appendix A.3.

4. DATA

To empirically test our hypotheses, we collect data from various sources. The data start in 1994, the year after the FOMC started releasing verbatim transcripts with a five-year time lag. Meade and Stasavage (2008), Swank, Swank and Visser (2008) and Hansen, McMahon and Prat (2017) show that the publication of the transcripts changed the discussions in the meetings. To avoid a structural break in the data, we decided to focus on the time period since 1994.

We analyse the transcripts of the 160 regular FOMC meetings during the period 1994-2013 to establish whether voting status changes presidents' contributions during the meeting. We combine this with an analysis of the texts of around 2,800 speeches, 875 of which on monetary policy matters, that Fed presidents give between these meetings.

Speeches.

We use the database of speeches originally presented in Tietz (2019). 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. Tietz (2019) collected the texts from the webpages of the Reserve Banks and of the Board of Governors, from the BIS archive of central bank speeches[22] and from FedInPrint, an index of publications by the Federal Reserve System.[23] We limit attention to speeches given by Bank presidents in the rotation scheme and discard all other speeches. 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 (2019), 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.[24] We sum the word counts for each speech and compute the sentiment measure τ_i for speech i as

$$\tau_i = 100 \times \left(1 - \frac{N_i}{T_i}\right). \tag{7}$$

[22] See http://www.bis.org/list/cbspeeches/index.htm.

[23] See https://www.fedinprint.org/series.html.

[24] 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, 2019), 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 more noisy.

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 (2019), 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 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.[25] Next, we consider all phrases p, i.e., bigrams or words, in the 300 speeches that Tietz (2019) 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 $N_{\neg pm}$ and $N_{\neg pn}$ be the number of phrases different from p in either type of speech. As in Gentzkow and Shapiro (2010), we compute the Pearson's χ^2 statistic for each phrase,

$$\chi^2_p = \frac{(N_{pm}N_{\neg pn} - N_{pn}N_{\neg pm})^2}{(N_{pm} + N_{pn})(N_{pm} + N_{\neg pm})(N_{pn} + N_{\neg pn})(N_{\neg pm} + N_{\neg pn})}. \tag{8}$$

If the counts N_{pm} and N_{pn} are drawn from multinomial distributions, χ^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 χ^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 monetary policy-related speeches given in the intermeeting period and their overall tone, which is the simple average of the tone expressed in each individual speech. Table B.1 provides a set of summary statistics for the resulting variables.

Contributions made during the FOMC meetings. The verbatim transcripts of FOMC meetings are released with a five-year lag. We obtain these transcripts for each meeting during 1994-2013 from the website of the Federal Reserve.[26]

For each president, we determine the total length of the contributions 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,

[25] 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, Sutskever, Chen, Corrado and Dean (2013).
[26] https://www.federalreserve.gov/monetarypolicy/fomc_historical.htm

the length and tone of contributions may change over the course of the meeting. We have therefore also computed word counts and tones for subsets of a president's contributions.

Voting records. We collect voting records from the website of the Board of Governors.[27] We use these records 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. Table B.1 provides summary statistics for the resulting variables. We retrieve district-level unemployment rates and data on the return of assets of banks located in a district from FRED.[28] The data are provided by the Federal Reserve Bank of St. Louis.[29]

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 B.2 in the appendix; we report population weights in Table B.3.

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 number of days during which it represented the most recently available data. 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 contributions.

5. Findings

5.1. **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 in the district. 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 B.4

[27] https://www.federalreserve.gov/monetarypolicy/fomc_historical.htm

[28] https://fred.stlouisfed.org.

[29] 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 B.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%.

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.

5.2. **Difference in speech behavior in the intermeeting period.**

5.2.1. *Number of speeches.* Table 2 reports the results of the estimation of a president's inclination to give a speech, equation (1). The first specification, without presidents' voting status, shows that presidents tend to give more speeches, the larger is the difference between regional and U.S. unemployment. While this is in line with the earlier evidence, the effect is not statistically significant. 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, and significantly so. The sum of the two estimated coefficients, $\beta_u^N + \gamma_{uv}^N$, provided in the middle panel of Table 2, is statistically significant at the 1% level. In Table B.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 increases the probability that the president delivers a speech by 8.6%. In non-voting years, that probability is increased by only 6.5% (and is statistically insignificant).

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

These results are robust to redefining the threshold for identifying monetary policy speeches from 7.5% to 5% or 10% (columns 3 and 4). Another robustness test in column 5 shows that removing period fixed effects and instead controlling for the presence of speeches by other members, voting and non-voting, on the FOMC 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 6), which by themselves do not affect the propensity to give speeches.[30] Another robustness test is provided in column 7, 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 results are also robust to estimation of an ordered probit, as can be seen in column 8. It is estimated with the benchmark threshold definition of a monetary policy speech. Column 9 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

[30]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 used to be 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 inclination to give speeches

	(1) Without voting status	(2) Bench-mark	(3) 5% thresh-old	(4) 10% thresh-old	(5) Control for others' speeches	(6) Adding in-flation and RoA	(7) Until 2018	(8) Ordered probit	(9) Tone of Beige Book proxies for economy	(10) Pre-Beige Book release	(11) Post-Beige Book release
Abs. unemp. gap (β_u^N)	0.349	0.253	0.180	0.321	0.213	0.265	0.250	0.277	-7.039	0.447*	-0.393
	(0.220)	(0.227)	(0.203)	(0.205)	(0.150)	(0.219)	(0.222)	(0.186)	(5.954)	(0.239)	(0.261)
Abs. unemp. gap $\times$ v (γ_{uv}^N)		0.337**	0.497***	0.349**	0.318**	0.271**	0.320***	0.264*	19.349**	0.288**	0.402
		(0.131)	(0.131)	(0.142)	(0.132)	(0.126)	(0.121)	(0.158)	(8.485)	(0.122)	(0.340)
v (β_v^N)		-0.123	-0.208*	-0.090	-0.109	-0.240	-0.078	-0.028	-0.106	-0.135	-0.130
		(0.123)	(0.109)	(0.120)	(0.137)	(0.200)	(0.117)	(0.115)	(0.127)	(0.154)	(0.209)
Speeches by others					0.988**						
					(0.402)						
Abs. infl. gap						0.067					
						(0.110)					
Abs. infl. gap $\times$ v						0.241*					
						(0.132)					
Abs. RoA gap						-0.245					
						(0.254)					
Abs. RoA gap $\times$ v						-0.033					
						(0.300)					
Abs. unemp. gap, voting ($\beta_u^N + \gamma_{uv}^N$)		**0.589*****	**0.677*****	**0.670*****	**0.530*****	**0.536*****	**0.570*****	**0.540*****	**12.310***	**0.735*****	0.010
		(0.218)	(0.231)	(0.195)	(0.156)	(0.209)	(0.216)	(0.184)	(6.737)	(0.237)	(0.263)
Period FE	✓	✓	✓	✓	–	✓	✓	✓	✓	✓	✓
President FE	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Observations	1,570	1,570	1,590	1,501	1,643	1,570	1,912	1,735	1,578	1,485	733

Notes: The table shows coefficient estimates for the effect of regional macroeconomic conditions and voting status on the inclination of presidents in the rotation scheme to give speeches, based on a probit model following equation (1). 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. Column 5 excludes time fixed effects and replaces these with the number of speeches given by all other members on the FOMC. Column 6 includes regional inflation and financial sector return on assets. Column 7 extends the sample to 2018. Column 8 reports results for an ordered probit model. Column 9 proxies regional economic conditions with the tone of the relevant section of the Beige Book. Columns 10 and 11 split the sample into the period before and after the release of the Beige Book, respectively. Numbers in brackets are standard errors. In row "Abs. unemp. gap, voting", 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.

biasing our results. The findings in columns 10 and 11 differentiate the period before and after the release of the Beige Book. We discuss them in section 5.4.

The coefficient of the voting dummy, β_v^N, is statistically insignificant in all but one specification. The non-significance of this coefficient means that this test of the hypotheses is inconclusive.

5.2.2. *Speech tone.* We present the estimation results for the speech tone, equation (2), in Table 3. The first specification shows that a president tends to use a more negative tone, the larger is the difference between regional and national unemployment (recall that the national unemployment is controlled for via the meeting fixed effects), but that this relationship is not statistically significant. The benchmark estimation in column 2 differentiates by voting status. It shows that presidents' tone reacts more strongly to the regional unemployment situation when they have voting rights: their estimated reaction to regional unemployment becomes more than twice as large. The sum of the two estimated coefficients, $\beta_u^\tau + \gamma_{uv}^\tau$, provided in the middle panel of Table 3, is statistically significant at the 5% level. 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 support the motivation hypothesis and reject the loss-compensation hypothesis.

We subject these findings to the same robustness tests as before, by changing the threshold for identifying monetary policy-related speeches, 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.[31] The use of the content of the Beige Book as an alternative proxy for regional economic conditions yields largely insignificant results.[32] The findings in columns 9 and 10 differentiate the period before and after the release of the Beige Book. We discuss them in section 5.4.

The coefficient of the voting dummy, β_v^τ, is positive and statistically significant in all specifications but column 8, in line with the motivation hypothesis.

5.3. **Voting status and deliberation behavior in the FOMC meeting.** The results so far have provided compelling evidence for the motivation hypothesis about speech behavior in the intermeeting period. We now test which hypothesis prevails during the deliberation stage at the FOMC meetings.

[31] 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.

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

TABLE 3. Determinants of the tone of speeches

	(1) Without voting status	(2) Bench-mark	(3) 5% thresh-old	(4) 10% thresh-old	(5) Controlling for tone of others' speeches	(6) Adding in-flation and RoA	(7) Until 2018	(8) Tone of Beige Book proxies for economy	(9) Pre-Beige Book release	(10) Post-Beige Book re-lease
Regional unemp. (β_u^τ)	-0.148	-0.112	-0.123	-0.235	-0.083	-0.181	-0.230**	9.568*	-0.167	0.808
	(0.118)	(0.119)	(0.135)	(0.170)	(0.063)	(0.111)	(0.110)	(5.279)	(0.162)	(0.870)
Regional unemp. $\times$ v (γ_{uv}^τ)	–	-0.156**	-0.138**	-0.196**	-0.150***	-0.231***	-0.105	-2.448	-0.202***	-0.100
		(0.062)	(0.059)	(0.073)	(0.047)	(0.070)	(0.063)	(7.674)	(0.061)	(0.444)
v (β_v^τ)	–	1.139**	1.015**	1.435***	1.056***	2.007***	0.752*	2.480	1.556***	-0.097
		(0.425)	(0.413)	(0.483)	(0.320)	(0.628)	(0.406)	(7.454)	(0.401)	(4.180)
Speeches by others	–	–	–	–	0.587***	–	–	–	–	–
					(0.071)					
Regional infl.	–	–	–	–	–	-0.043	–	–	–	–
						(0.076)				
Regional infl. $\times$ v	–	–	–	–	–	0.049	–	–	–	–
						(0.082)				
Regional RoA	–	–	–	–	–	-0.105	–	–	–	–
						(0.154)				
Regional RoA $\times$ v	–	–	–	–	–	-0.443*	–	–	–	–
						(0.226)				
Regional unemp., voting $(\beta_u^\tau + \gamma_{uv}^\tau)$	–	**-0.268****	**-0.262***	**-0.431****	**-0.233*****	**-0.412*****	-0.335**	7.120	**-0.369****	0.708
		(0.127)	(0.127)	(0.205)	(0.062)	(0.130)	(0.125)	(4.934)	(0.178)	(1.150)
Period FE	✓	✓	✓	✓	–	✓	✓	✓	✓	✓
President FE	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Observations	586	586	714	471	586	586	745	586	470	116
R^2	0.615	0.625	0.574	0.612	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 (2). 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. Column 5 excludes time fixed effects and replaces these with the tone of speeches given by all other members on the FOMC. Column 6 includes regional inflation and financial sector return on assets. Column 7 extends the sample to 2018. Column 8 proxies regional economic conditions with the tone of the relevant section of the Beige Book. Columns 9 and 10 split the sample into the period before and after the release of the Beige Book, respectively. Numbers in brackets are standard errors. In row "Regional unemp., voting", 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 relegate results regarding the length of the contributions to Table B.6 in the Appendix as hardly any of the regression variables has statistically significant effects.

5.3.1. *Contribution tone.* We report the estimates for the contribution tone equation 4 in Table 4. The results for the first contribution by a president are shown in the left panel, while the results for all contributions pooled are shown in the right panel. Column 1 shows that the tone of a president's first contribution 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, in line with the motivation hypothesis. Columns 2-4 limit attention to those presidents who gave a speech in the preceding intermeeting period. Column 2 shows that the evidence in favor of the motivation hypothesis and against the loss-compensation hypothesis becomes stronger. The right panel shows that for all contributions pooled, the relationship with regional unemployment is absent, both when considering interventions by all presidents (column 5) and only those by presidents who gave a speech in the preceding intermeeting period (column 6). This is as expected, given that regional economic conditions are primarily discussed in the economy go-round.

The inclusion of speech tone as an explanatory variable shows that in years with the right to vote, speech tone and contribution tone are more strongly correlated than in years a president does not have the right to vote. This appears consistent with the stronger motivation thanks to the right to vote, and inconsistent with an attempt at an unambiguous message to compensate for the loss of voting right.

Having the right to vote per se tends to have a positive impact on the tone of contributions, $\beta_v^T > 0$, but its value is often imprecisely estimated. A positive impact is predicted by the motivation hypothesis.

5.4. **Responsiveness to variations in the return from effort.** We now discuss how presidents respond to changes in the marginal returns from persuasive efforts.

5.4.1. *Speeches given before or after publication of Beige Book.* Columns 10 and 11 in Table 2 present the findings for the inclination to deliver a speech before and after the publication of the Beige Book, respectively. Before its release, a larger absolute unemployment gap raises the probability that presidents deliver at least one speech, whether they do not have (β_u^N) or do have ($\beta_u^N + \gamma_{uv}^N$) the right to vote. A comparison with the speeches delivered in the (shorter) period after its release shows that, as expected, the responsiveness is larger before, and even turns insignificant afterwards, irrespective of voting status.

We do not find that β_v^N is larger before the publication of the Beige Book than after. In fact, β_v^N is insignificant in either period.

The tone of speeches responds to regional unemployment only before publication of the Beige Book and only when presidents have ($\beta_u^\tau + \gamma_{uv}^\tau$) the right to vote, see columns 9 and 10 in Table 3.

TABLE 4. Determinants of the tone of contributions at the FOMC meeting

	First contribution				All contributions			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Regional unemp. (β_u^T)	-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 unemp. $\times$ v (γ_{uv}^T)	-0.135*	-0.282**	–	-0.193	-0.042	-0.094	–	-0.057
	(0.073)	(0.130)		(0.141)	(0.035)	(0.058)		(0.058)
Speech tone (β_τ^T)	–	–	-0.243	-0.240	–	–	-0.071	-0.070
			(0.202)	(0.199)			(0.049)	(0.049)
Speech tone $\times$ v ($\gamma_{\tau v}^T$)	–	–	0.501*	0.368	–	–	0.178**	0.139*
			(0.254)	(0.281)			(0.073)	(0.072)
v (β_v^T)	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 unemp., voters ($\beta_u^T + \gamma_{uv}^T$)	**-0.560*** **	**-0.865*** **	–	-0.792***	-0.094	-0.248*	–	-0.215
	(0.141)	(0.272)		(0.280)	(0.084)	(0.138)		(0.139)
Speech tone, voters ($\beta_\tau^T + \gamma_{\tau v}^T$)	–	–	**0.258**	0.128	–	–	**0.107**	**0.069**
			(0.226)	(0.240)			(0.065)	(0.057)
Period FE	✓	✓	✓	✓	✓	✓	✓	✓
President FE	✓	✓	✓	✓	✓	✓	✓	✓
R^2	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 contributions, based on an OLS model following equation (3). Columns 1 and 5 include all observations for meeting contributions, 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 contribution at the FOMC meeting, the right panel to the tone of all contributions together. Numbers in brackets are standard errors. In the middle panel, 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 also find that, as predicted, the direct effect of voting status on speech tone is present pre-Beige Book, but insignificant post.

5.4.2. *Speeches given following meetings with or without dissent.* The second comparison relates to speech behavior across periods following meetings with or without dissent.

Table 5 shows the results for the inclination to give speeches. For presidents in non-voting years, whether the last meeting was characterized by dissent or not appears irrelevant for the relationship between regional conditions and the inclination to give speeches: γ_{uD}^N is insignificant. For presidents in voting years, dissent matters in the predicted way. In such years, dissent in a meeting is associated with a higher responsiveness of speeches to regional economic circumstances, $\gamma_{uD}^N + \delta^N > 0$ (see the last row of the middle part of Table 5).

Table 6 shows the results for the tone of speeches. Again, for presidents in non-voting years, whether the last meeting was characterized by dissent or not appears irrelevant for the relationship between regional conditions and the tone: γ_{uD}^τ is insignificant. For presidents in voting years, the character of the last meeting matters as predicted. In such years, dissent in a meeting is associated with speech tone becoming responsive to regional economic circumstances, as shown by $\gamma_{uD}^\tau + \delta^\tau < 0$ in the last row of the middle part of Table 6.

The middle parts of Tables 5 and 6 furthermore 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 much more strongly to regional conditions than after a meeting without dissent in a year that they do not have voting power (0.921 versus 0.231 and -0.426 versus -0.099, respectively).

TABLE 5. The inclination to give speeches after dissent

Abs. unemp. gap (β_u^N)	0.231
	(0.251)
Abs. unemp. gap $\times$ v (γ_{uv}^N)	-0.087
	(0.156)
Abs. unemp. gap $\times$ dissent (γ_{uD}^N)	0.049
	(0.223)
Abs. unemp. gap $\times$ dissent $\times$ v (δ^N)	0.554**
	(0.227)
v (β_v^N)	0.143
	(0.145)
v $\times$ dissent (γ_{vD}^N)	-0.647***
	(0.208)
Abs. unemp. gap, voting without dissent $(\beta_u^N + \gamma_{uv}^N)$	0.318
	(0.292)
Abs. unemp. gap, non-voting with dissent $(\beta_u^N + \gamma_{uD}^N)$	0.280
	(0.265)
Abs. unemp. gap, voting with dissent $(\beta_u^N + \gamma_{uv}^N + \gamma_{uD}^N + \delta^N)$	**0.921*** **
	(0.236)
Difference for voters, with vs without dissent $(\gamma_{uD}^N + \delta^N)$	0.602**
	(0.283)
Period FE	✓
President FE	✓
Observations	1,570

Notes: The table shows coefficient estimates for the effect of regional macroeconomic conditions and voting status on the inclination of presidents in the rotation scheme to give speeches, based on a probit model following equation (5), allowing for differential effects depending on whether there has been dissent in the last meeting. The term "unemployment gap" denotes the difference between regional and national unemployment. Numbers in brackets are standard errors. In the middle panel, 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.

5.5. **Summing up the results on presidential behavior.** Overall, our findings on *speech behavior* support the motivation hypothesis: the right to vote on the one hand and speech tone are complements. Only the direct effect of the right to vote on the inclination to give a speech is inconclusive. Our findings on *contributions during meetings* support the motivation hypothesis when it comes to the tone of the first contribution but are inconclusive when it comes to length of contributions. We find no support for the loss-compensation hypothesis.

Also, presidents adapt their speech behavior as expected to the presence or absence of the Beige Book at the moment they give a speech. Presidents also adapt their speech behavior as expected to the degree of consent at the last meeting, but only in years that they vote; when they do not vote, they are unaffected by the degree of consent.

5.6. **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,

TABLE 6. The tone of speeches after dissent

Regional unemp. (β_u^τ)	-0.099
	(0.129)
Regional unemp. $\times$ v (γ_{uv}^τ)	-0.086
	(0.076)
Regional unemp. $\times$ dissent (γ_{uD}^τ)	-0.033
	(0.124)
Regional unemp. $\times$ dissent $\times$ v (δ^τ)	-0.207*
	(0.101)
v (β_v^τ)	0.620
	(0.510)
$v \times$ dissent (γ_{vD}^τ)	1.634**
	(0.750)
Regional unemp., voting without dissent $(\beta_u^\tau + \gamma_{uv}^\tau)$	-0.185
	(0.125)
Regional unemp., non-voting with dissent $(\beta_u^\tau + \gamma_{uD}^\tau)$	-0.132
	(0.137)
Regional unemp., voting with dissent $(\beta_u^\tau + \gamma_{uv}^\tau + \gamma_{uD}^\tau + \delta^\tau)$	**-0.426*** **
	(0.148)
Difference for voters, with vs without dissent $(\gamma_{uD}^\tau + \delta^\tau)$	-0.241*
	(0.135)
Period FE	✓
President FE	✓
Observations	586
R^2	0.630

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 depending on whether there has been dissent in the last meeting. Numbers in brackets are standard errors. In the middle panel, 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 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 without having to identify the surprise component that a speech may contain: regardless of how a textual analysis might classify a certain speech, the market reaction will depend on the difference between the tone and the expected tone. Without identifying the expected tone, it is therefore impossible to understand in which direction asset prices should move, a complication that is overcome by studying absolute changes. Also, by analyzing the absolute change, we can remain agnostic about the source of market movement. As shown by Nakamura and Steinsson (2018) and Jarociński and Karadi (2020), markets might respond in opposite directions depending on whether central bank announcements affect beliefs about economic fundamentals or about monetary policy.

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

$$|dR|_t = \mu_i + \mu_{dow} + \beta v_{it} + \epsilon_{it} \tag{9}$$

controlling for president fixed effects μ_i and day-of-the-week fixed effects, μ_{dow}. This is the most direct setup to test for our hypothesis whether voting status matters. As voting status is exogenous, we refrain from adding additional explanatory variables such as (regional) economic conditions.[33]

The top panel of Table 7 presents the benchmark estimates. These show some first evidence of a vote discount: presidents' speeches move markets less in years they vote 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 β, 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.

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, see panel A in Table B.7.

We also separately analyze speeches given after meetings with or without dissent. Panel C shows that, after a meeting with dissent, the vote discount is substantial; the evidence for a vote discount is less pronounced following meetings without dissent, see panel B of Table B.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).

We also 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,[34] 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 E for 568 speeches delivered in the years 2011-2019 confirm our earlier findings.

Finally, we conduct another robustness test. 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.[35] The results, in Table B.8 in Appendix B, show that presidents move also this

[33]For simplicity, we also refrain from differentiating the non-voting period into a first subperiod where a speaker has just lost the voting right and a second subperiod where a speaker will soon regain the right. Even if this were to matter to markets, it would not add to our hypothesis whether having the right to vote at the upcoming meeting matters for financial markets.

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

[35]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

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^2	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^2	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^2	0.167	0.181	0.235	0.227	0.164
Panel D: until 2018					
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^2	0.069	0.142	0.165	0.128	0.081
Panel E: 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
R^2	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 9. Panel A shows results for all speeches on days with only one speech. Panels B and C split this sample into pre-Beige Book release and speeches following FOMC meetings with dissent. Panel D extends the speech sample until 2018. Panel E 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.

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.

time windows do therefore nicely complement one another, as they capture the set of speeches that is missing from the other time window.

5.7. **Consistency of market reaction and presidents' behavior .** How to explain the vote discount? At first sight, one might expect a stronger market reaction to presidents' speeches in years they have the right to vote. After all, the influence of voting presidents on the FOMC decision is more direct thanks to their votes. 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. 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.

Consistent with this line of reasoning, panels B and C in Table 7 show 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, for Beige Book, and 5 and 6, for dissent, show that these are precisely the speeches that respond most strongly in number and tone to the economic situation at the district-level when a president has voting status.

6. Discussion

In this section, we discuss how our findings contribute to the literature.

The effects of a voting right. The FOMC meets the two conditions that are needed to identify possible effects of a right to vote. Variation in this right is exogenously determined. And the right to vote is not bundled with other rights, like the right to attend, to participate and to receive information in preparation for the meeting.

Few others appear to have studied voting right rotation. Tietz (2019) 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. Gnan and Rieder (2021) study breaches of the European Central Bank (ECB)'s quiet period by Governing Council members. 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, Maier, Sadiraj and van Winden (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 literature on the design of committee decision making studies, among others, how committee design shapes incentives to prepare for the meeting, see for example, Persico (2004), Gershkov and Szentes (2009) and Swank and Visser (2022).[36] We are not aware of a study that considers voting right rotation as a design variable.

There is an interesting connection to the theory of authority. A voting right in a committee grants authority to its holder to make decisions together with the other members. Aghion and Tirole (1997) study how formal authority provides incentives to acquire decision-relevant information in a principal-agent model. They make two predictions. First, an agent has stronger incentives to acquire information with formal authority than without. Without it, the agent is less motivated to prepare the decision as the likelihood that her effort is brought to bear on the decision is lower: only when the investigation by the principal fails to yield conclusive evidence on the right decision will the principal turn to her. Second, the agent's motivation to acquire information thanks to formal authority becomes stronger the larger is the conflict of interest between agent and principal. Their predictions on information acquisition are thus similar to those of the motivation hypothesis regarding argumentative effort. Our findings support this hypothesis. Their principal-agent set up has led quite naturally to studies of authority and its delegation within hierarchies. We are not aware of an application to voting rights.[37]

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.[38] By and large, the literature studies determinants of behavior during meetings, including individual reaction functions (Chappell, McGregor and Vermilyea, 2005), the role of district-level economic conditions (see our review in section 2.2), the role of the chairman (*e.g.*, Chappell, McGregor and Vermilyea, 2004; Riboni and Ruge-Murcia, 2020), 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, 2008; Hansen et al., 2017; Swank and Visser, 2013) and social learning during the meeting (López-Moctezuma, 2019). As we noted in section 2.2, only few papers discuss determinants of behavior between meetings. We contribute to this literature on presidential behavior by highlighting the role played by their voting status.

Few other papers study the relationship between behavior during the FOMC meeting and behavior in between meetings. Swank et al. (2008) and Swank and Visser (2013) study pre-meetings and their relationship to behavior at the main meetings, while Vissing-Jorgensen (2021) studies how leaks influence decision making at the FOMC. That presidents, voting and non-voting, seek to influence

[36] In these papers, agents prepare for the meeting by acquiring information on the state, not by exerting persuasive effort.
[37] For a general account of influence activities by those that lack decision-making power, see Milgrom and Roberts (1988).
[38] See Blinder (2004, 2007); Geraats (2002).

policy discussions also between meetings by signalling their policy preferences is also the impression of former governor Meyer, see Meyer (2004). Our key finding in this respect is that voting status matters not only for presidents' contributions during meetings, but also for their behavior between meetings, and for the connection between the two.

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). 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).[39] We contribute to this literature by showing that the market reaction depends on a president's voting status and that the observed difference in reaction is consistent with the difference in observed communication behavior. Much of this literature uses event study methodologies. This requires the measurement of financial market reactions in a relatively narrow time window around the communication events. We also use an event study setup to measure market reactions, but are interested in the *change* in market reaction stemming from a change in a president's voting status. Identification of this change relies on the—presumably uncontroversial—assumption that identification of the time windows is not systematically different across years with and without the right to vote.

The literature on central bank communication usually takes communication events as given, whereas our paper contributes to understanding the determinants of communication. We find that, consistent with investor rationality, financial markets appear to internalize the communication decisions by committee members.

7. Conclusion

Voting rights have been rotating mechanically for nearly 80 years at the FOMC. Since 2015, voting rights rotate mechanically among the National Central Bank governors on the Governing Council of the European Central Bank. Other committees may follow their example. We use 20 years of FOMC data to understand how voting status affects behavior of Reserve Bank presidents and reactions by financial markets to their speeches. We make three contributions. First, we establish that gaining the right to vote, rather than losing it, motivates presidents to intensify their use of speeches between FOMC meetings, especially when more is at stake for their district, and to make the tone of their speeches and of their contributions during meetings more responsive to unemployment in their district. Second, we establish that speeches by presidents move markets less in years they have the right to vote. Third, we argue that this is consistent with the observed change in presidents' behavior:

[39] This has also led to an interest in understanding whether and how committees should communicate the personal views of individual committee members without generating a cacophony of voices (see, *e.g.*, Bernanke, 2004; Blinder, 2018; Meade, Burk and Josselyn, 2015; Vissing-Jorgensen, 2021).

speeches by voting presidents are more related to regional conditions that national markets care less about.

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. 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.

APPENDIX A. A MODEL AND ITS MAPPING TO THE EMPIRICS

A.1. **The model.** A simple model describes the behavior of a president and can be used to formalize the hypotheses and their implications. Rather than modelling explicitly a dynamic game of incomplete information that is repeatedly played with permanent members, rotating members, meetings consisting of a deliberation and voting stage and intermeeting periods, we take a different route. We model one president. Denote the president's voting status by $v \in \{0,1\}$. A president who has the right to vote, $v = 1$, casts a vote $w \in \{w^0, w^1\}$. Voting in favor, w^1, improves the chances of decision $d = 1$, whereas voting against, w^0, raises the chances of $d = 0$. Let θ be the state variable that president i cares about, with $\theta \in \Theta$, and Θ an interval. Let $u(d;\theta)$ denote the utility of the president in case of decision d and state θ. Let u be continuously differentiable in θ. For simplicity, we refrain from including a national variable in u, as the focus in the paper is on the role played by economic variables at the district level. In the empirical part of the paper, national variables, which are common to all presidents, are absorbed in the period fixed effects. Assume that for all θ that we consider $d = 1$ is the better decision for this president. Thus, if she has the right to vote, she would vote w^1. The decision $d = 1$ need not be the best decision for other, unmodeled presidents. Suppose furthermore that the larger is θ, the larger is the difference in payoff for president i between $d = 1$ and $d = 0$,

$$u(1;\theta) - u(0;\theta) > 0, \text{ and strictly increasing in } \theta. \tag{A.1}$$

Independent of her voting status, a president can take "action" $a \in A$. Let A be an interval. a stands for anything that, with more of it, strictly increases the probability of $d = 1$, the better decision given θ. It can be interpreted as "argumentative effort." That is,

$$p(a;v) = \Pr(d = 1 \mid a;v), \text{ with } p'(a;v) = \frac{\partial p}{\partial a}(a;v) > 0, \text{ for } v \in \{0,1\}. \tag{A.2}$$

Assume that p is continuously differentiable in a. There are costs associated with taking the action. Let $c(a) > 0$ denote those costs. The expected utility of action a in case of voting status s and state θ equals

$$U(a;v,\theta) = p(a;v)u(1;\theta) + (1 - p(a;v))u(0;\theta) - c(a). \tag{A.3}$$

It follows from (A.1) and (A.2) that the marginal benefits from a,

$$p'(a;v)\left(u(1;\theta) - u(0;\theta)\right), \tag{A.4}$$

are increasing in θ. Let $a^*(\theta;v)$ denote the optimal value of a given θ and v. As $\partial^2 U/\partial a \partial \theta > 0$, it follows from Theorem 2.3 in Vives (1999) that the following proposition holds.

Proposition 1. *$a^*(\theta;v)$ is strictly increasing in θ, irrespective of a president's voting status,*

$$\frac{\partial a^*}{\partial \theta}(\theta;v) > 0, \textit{ for } v \in \{0,1\}. \tag{A.5}$$

So, the optimal action a^* is increasing in θ. Below we will explain what this prediction means in terms of our empirical variables.

The two hypotheses that we investigate can now be formulated.

Hypothesis: motivation: $p'(a;1) > p'(a;0)$ for all a. The increase in the probability of obtaining the desired decision thanks to an increase in a is larger with the right to vote than without.

Hypothesis: loss compensation: $p'(a;0) > p'(a;1)$ for all a. The increase in the probability of obtaining the desired decision thanks to an increase in a is larger without the right to vote than with.

By the same result in Vives (1999), both hypotheses have two implications.

Proposition 2. *If $p'(a;1) > p'(a;0)$ for all a, then*

$$a^*(\theta;1) > a^*(\theta;0) \text{ and } \frac{\partial a^*}{\partial \theta}(\theta;1) > \frac{\partial a^*}{\partial \theta}(\theta;0) \text{ for all } \theta. \tag{A.6}$$

If $p'(a;0) > p'(a;1)$ for all a, then

$$a^*(\theta;0) > a^*(\theta;1) \text{ and } \frac{\partial a^*}{\partial \theta}(\theta;0) > \frac{\partial a^*}{\partial \theta}(\theta;1) \text{ for all } \theta. \tag{A.7}$$

Proposition 2 shows that each hypothesis has two implications. The motivation hypothesis predicts that, for given θ, both the level of the optimal action a^* and the responsiveness of a^* to θ are higher, when the president has the right to vote than when she does not have the right to vote. The loss compensation hypothesis delivers opposite predictions.

A.2. **Mapping from model to empirics.** In the empirical part, we proxy a by the probability with which a president delivers a speech, the length of her contributions and the tone of her speech or contribution. There is an important difference between these proxies that has implications on how the empirical analysis is conducted. The mapping to the number of speeches and the length of contributions is straightforward - more speeches and longer contributions should increase the likelihood of the president's preferred decision d, regardless of the direction of that decision. A president who wants to push the committee to raise rates will give more speeches or make longer contributions, as will a president who wants to push the committee to lower rates. The tone of the speeches or contributions, in contrast, has a certain "direction." If tone becomes more positive, this should push the committee to raise rates; if tone becomes more negative, this should push the committee to lower rates.[40]

Proposition 2 states that, under the motivation hypothesis, the reaction of a^* to unemployment is stronger when the president has the right to vote than when she has not, and vice versa for the loss compensation hypothesis. The evaluation of these predictions is the main focus of our empirical

[40] In the empirical part, the main interpretation of θ is district-level unemployment. The higher it is, the more negative one expects the tone to be. Thus, to be consistent with the model prediction that a president chooses a higher a in case of a higher θ, one should interpret a as a measure of the negativity of a tone such that more unemployment means a more negative tone. Instead, in the empirical part, the tone is defined as 1 minus the negativity. The model prediction is thus a negative correlation between our empirical tone measure and unemployment, which is what we find.

analysis. For a president's speech inclination or length of contribution, we study whether this depends on the *absolute* difference between regional and national unemployment: it is the magnitude of the difference, not its direction, which should lead to more speeches or longer contributions. For the tone, given its directional nature, our tests study its dependence on the difference between regional and national unemployment.

The other part of the prediction is that, e.g., under the motivation hypothesis, $a^*(\theta;1) > a^*(\theta;0)$. In terms of our empirical exercise, this means that the inclination to give a speech or the length of contributions should be larger in the years with a voting right than in the years without. In contrast, tone should depend on the *average* difference between regional and national unemployment in the sample - if that difference is positive (negative) on average, tone should be more negative (positive) in years with the right to vote.

A.3. **Dissent and Beige Book.** In the paper, we study speeches given after meetings with and without dissent and speeches given before and after the publication of the Beige Book.

Consider dissent first. Let N be the number of voting members and let $M \leq N$ be president i's estimate of the number of voting members who will favor $d = 1$ in the upcoming meeting. If M is close to N or close to 0, effort a is less likely to change the decision than if M is somewhere in the middle and closer to the required support for $d = 1$. As dissent at the previous meeting is an indicator of M being more in the middle than at an extreme, one would expect the marginal return from effort to be higher after a meeting with dissent than without. Define $k = 1$ as an intermeeting period following a meeting with dissent and $k = 0$ as a period following a meeting without dissent. Then,

$$p'(a;v,k=1) > p'(a;v,k=0), \text{ for } v \in \{0,1\}. \tag{A.8}$$

This implies a higher optimal a after meetings characterized by dissent. Together with (A.4), it also implies that

$$\frac{\partial a^*}{\partial \theta}(\theta;v,k=1) > \frac{\partial a^*}{\partial \theta}(\theta;v,k=0), \text{ for } v \in \{0,1\}. \tag{A.9}$$

That is, the responsiveness of tone and inclination to deliver a speech is larger after a meeting with dissent than without, whether a president has or does not have the right to vote.

Now consider the Beige Book. Compared to presidents from other districts and governors in Washington, a president of a district has preferential access to information on her district. Speeches can be used to reveal that information and to improve the chances that the desired decision $d = 1$ is made. Speech and the Beige Book are substitute means to transmit information on the district. Once the Beige Book has been published and distributed, the impact of a speech is reduced. That is, once the Beige Book has been distributed, the change in probability of decision $d = 1$ thanks to speech-related activity a goes down. Let $k = 1$ denote the part of the intermeeting period before the publication of the Beige Book, and $k = 0$ the part after its publication. Then, using again (A.8), the

comparative statics are as in (A.9): a and its responsiveness to θ are larger before the publication of the Beige Book than after, and this holds whether a president votes or does not vote.

APPENDIX B. ADDITIONAL TABLES

TABLE B.1. Summary statistics

	Observations	Mean	Std. Dev.	Min	Max
Number of speeches	1,735	0.504	0.814	0.000	4.000
Tone of speeches	586	96.093	1.337	90.810	99.457
Regional unemployment	1,735	5.745	1.763	2.725	11.481
Absolute unemployment gap	1,735	0.650	0.542	0.002	2.746
Regional inflation	1,735	2.406	1.314	-4.366	6.275
Absolute inflation gap	1,735	0.673	0.635	0.000	4.495
Regional return on assets	1,735	1.185	0.556	-3.330	2.780
Absolute return on assets gap	1,735	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 B.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 B.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 Hampshire	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 document here).

TABLE B.4. Confirming the exogeneity of the voting scheme

	Voting status
Regional inflation	0.006
	(0.010)
Regional unemployment	0.013
	(0.009)
Regional return on assets	0.018
	(0.026)
Observations	1,735

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 B.5. Determinants of the inclination to give speeches, marginal effects

	(1) Without voting status	(2) Bench-mark	(3) 5% thresh-old	(4) 10% thresh-old	(5) Control for others' speeches	(6) Adding in-flation and RoA	(7) Until 2018	(8) Ordered probit	(9) Tone of Beige Book proxies for econ-omy	(10) Pre-Beige Book release	(11) Post-Beige Book release
Abs. unemp. gap	0.090	0.065	0.049	0.073	0.063	0.067	0.065	0.024	-1.804	0.110*	-0.078
	(0.055)	(0.057)	(0.054)	(0.045)	(0.044)	(0.055)	(0.057)	(0.015)	(1.528)	(0.057)	(0.051)
Abs. unemp. gap $\times$ v		0.086**	0.134***	0.079**	0.094**	0.069**	0.083***	0.023*	4.958**	0.071**	0.080
		(0.034)	(0.035)	(0.032)	(0.039)	(0.032)	(0.032)	(0.014)	(2.125)	(0.030)	(0.067)
v		-0.031	-0.056*	-0.020	-0.032	-0.061	-0.020	-0.002	-0.027	-0.033	-0.026
		(0.032)	(0.030)	(0.028)	(0.040)	(0.051)	(0.031)	(0.010)	(0.032)	(0.038)	(0.041)
Speeches by others					0.293**						
					(0.117)						
Abs. infl. gap						0.017					
						(0.028)					
Abs. infl. gap $\times$ v						0.061*					
						(0.034)					
Abs. RoA gap						-0.062					
						(0.064)					
Abs. RoA gap $\times$ v						-0.008					
						(0.076)					
Period FE	✓	✓	✓	✓	–	✓	✓	✓	✓	✓	✓
President FE	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Observations	1,570	1,570	1,590	1,501	1,643	1,570	1,912	1,735	1,578	1,485	733

Notes: The table shows marginal effects for the effect of regional macroeconomic conditions and voting status on the inclination by Bank presidents in the rotation scheme to give speeches, based on a probit model following equation 1. 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 B.6. Determinants of the length of meeting contributions

	First contribution			All contributions		
	(1)	(2)	(3)	(4)	(5)	(6)
Abs. unemp. gap (β_u^W)	0.058	–	0.064	0.024	–	0.023
	(0.143)		(0.144)	(0.044)		(0.044)
Abs. unemp. gap × v (γ_u^W)	-0.095	–	-0.107	0.018	–	0.020
	(0.138)		(0.147)	(0.034)		(0.036)
Number of speeches (β_N^W)	–	-0.065	-0.068	–	0.010	0.009
		(0.051)	(0.048)		(0.010)	(0.010)
Number of speeches × v (γ_N^W)	–	0.070	0.079	–	-0.011	-0.014
		(0.061)	(0.060)		(0.015)	(0.016)
Voting status (β_v^W)	-0.052	-0.146***	-0.082	0.011	0.027	0.016
	(0.089)	(0.046)	(0.089)	(0.023)	(0.023)	(0.025)
Abs. unemp. gap, voters $(\beta_u^W + \gamma_u^W)$	-0.037		-0.044	0.042		0.043
	(0.125)		(0.133)	(0.031)		(0.029)
Number of speeches, voters $(\beta_N^W + \gamma_N^W)$		0.004	0.012		-0.001	-0.004
		(0.056)	(0.060)		(0.011)	(0.012)
Period FE	✓	✓	✓	✓	✓	✓
President FE	✓	✓	✓	✓	✓	✓
R^2	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 length of contributions at the FOMC meeting, following the OLS regression 3. The term "unemployment gap" denotes the difference between regional and national unemployment. The left panel relates to the tone of the first contribution at the FOMC meeting, the right panel to the length of all contributions together. Numbers in brackets are standard errors. ***/**/* denote statistical significance at the 1%/5%/10% level.

TABLE B.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^2	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^2	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 9. 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.

TABLE B.8. Effect of speeches on the yen-dollar exchange rate

	¥–$ exchange rate
Voting	-0.072*
	(0.039)
Average absolute change	0.365
Fraction	0.197
Observations	579
R^2	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 9. 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.

APPENDIX C. 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,[41] 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.[42]

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

[41]The Comptroller of the Currency and the Secretary of Treasury were ex officio members until the Banking Act of 1935.
[42]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.

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 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.[43] 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."

[43]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, Rolnick and Runkle, 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.

References

Aghion, Philippe, and Jean Tirole (1997) 'Formal and real authority in organizations.' *Journal of Political Economy* 105(1), 1–29

Bennani, Hamza, Etienne Farvaque, and Piotr Stanek (2018) 'Influence of regional cycles and personal background on fomc members' preferences and disagreement.' *Economic Modelling* 68, 416–424

Bernanke, Ben S. (2004) 'Fedspeak. Remarks at the meetings of the American Economic Association." San Diego, California, January 3, 2004, available at www.federalreserve.govboarddocs/speeches/2004/200401032/default.htm'

Binder, Sarah, and Mark Spindel (2013) 'Monetary politics: Origins of the Federal Reserve.' *Studies in American Political Development* 27(1), 1–13

Blinder, Alan S. (2004) *The quiet revolution. Central banking goes modern* (Yale University Press)

_____ (2007) 'Monetary policy by committee: Why and how?' *European Journal of Political Economy* 23(1), 106–123

_____ (2018) 'Through a crystal ball darkly: The future of monetary policy communication.' *AEA Papers and Proceedings* 108, 567–71

Blinder, Alan S., Michael Ehrmann, Marcel Fratzscher, Jakob De Haan, and David-Jan Jansen (2008) 'Central bank communication and monetary policy: A survey of theory and evidence.' *Journal of Economic Literature* 46(4), 910–45

Bordo, Michael D., and Edward S. Prescott (2019) 'Federal reserve structure, economic ideas, and monetary and financial policy.' *National Bureau of Economic Research*

Bordo, Michael D., and Klodiana Istrefi (2018) 'Perceived FOMC: The making of hawks, doves and swingers.' *Working paper, National Bureau of Economic Research*

Bosman, Ronald, Philipp Maier, Vjollca Sadiraj, and Frans van Winden (2013) 'Let me vote! An experimental study of vote rotation in committees.' *Journal of Economic Behavior & Organization* 96, 32–47

Chappell, Henry, Rob Roy McGregor, and Todd A. Vermilyea (2005) *Committee Decisions on Monetary Policy: Evidence from Historical Records of the Federal Open Market Committee* (The MIT Press)

Chappell, Henry W., Rob Roy McGregor, and Todd A. Vermilyea (2004) 'Majority rule, consensus building, and the power of the chairman: Arthur Burns and the FOMC.' *Journal of Money, Credit and Banking* pp. 407–422

Chappell Jr, Henry W., Rob Roy McGregor, and Todd A. Vermilyea (2008) 'Regional economic conditions and monetary policy.' *European Journal of Political Economy* 24(2), 283–293

Coughlan, Peter J. (2000) 'In defense of unanimous jury verdicts: Mistrials, communication, and strategic voting.' *American Political Science Review* 94(2), 375–393

Drechsler, Itamar, Alexi Savov, and Philipp Schnabl (2017) 'The deposits channel of monetary policy.' *The Quarterly Journal of Economics* 132(4), 1819–1876

Ehrmann, Michael, and Marcel Fratzscher (2007) 'Communication by central bank committee members: Different strategies, same effectiveness?' *Journal of Money, Credit and Banking* 39(2-3), 509–541

_____ (2009) 'Purdah: On the rationale for central bank silence around policy meetings.' *Journal of Money, Credit and Banking* 41(2-3), 517–528

Eichler, Stefan, Tom Lähner, and Felix Noth (2018) 'Regional banking instability and FOMC voting.' *Journal of Banking & Finance* 87, 282–292

Federal Open Market Committee (2011) 'FOMC policy on external communications of committee participants. Available at https://www.federalreserve.gov/monetarypolicy/files/fomc_extcommunicationparticipants.pdf.' Technical Report

Fettig, David, Arthur J. Rolnick, and David E. Runkle (1999) 'The Federal Reserve's Beige Book: A better mirror than crystal ball.' *The Region, Federal Reserve Bank of Minneapolis* 13(Mar), 10–13,28–32

Gentzkow, Matthew, and Jesse M. Shapiro (2010) 'What drives media slant? Evidence from US daily newspapers.' *Econometrica* 78(1), 35–71

Geraats, Petra M. (2002) 'Central bank transparency.' *The Economic Journal* 112(483), F532–F565

Gersbach, Hans, and Volker Hahn (2008) 'Should the individual voting records of central bankers be published?' *Social Choice and Welfare* 30(4), 655–683

Gershkov, Alex, and Balázs Szentes (2009) 'Optimal voting schemes with costly information acquisition.' *Journal of Economic Theory* 144(1), 36–68

Gildea, John A. (1992) 'The regional representation of Federal Reserve Bank presidents.' *Journal of Money, Credit and Banking* 24(2), 215–225

Gnan, Phillipp, and Kilian Rieder (2021) 'Who talks during monetary policy quiet periods, and why? Evidence from the european central bank's governing council.' Technical Report, CEPR Discussion Paper No. DP15735

Greider, William (1987) *Secrets of the temple: How the Federal Reserve runs the country* (Simon and Schuster)

Hansen, Stephen, Michael McMahon, and Andrea Prat (2017) 'Transparency and deliberation within the FOMC: a computational linguistics approach.' *The Quarterly Journal of Economics* 133(2), 801–870

Hayo, Bernd, and Matthias Neuenkirch (2013) 'Do Federal Reserve presidents communicate with a regional bias?' *Journal of Macroeconomics* 35, 62–72

Istrefi, Klodiana (2019) 'In Fed watchers' eyes: Hawks, doves and monetary policy.' *Banque de France Working Paper*

Jarociński, Marek, and Peter Karadi (2020) 'Deconstructing monetary policy surprises—the role of information shocks.' *American Economic Journal: Macroeconomics* 12(2), 1–43

Jung, Alexander, and Sophia Latsos (2015) 'Do federal reserve bank presidents have a regional bias?' *European Journal of Political Economy* 40, 173–183

Kocherlakota, Narayana R. (2017) 'The decentralized central bank: A review essay on The power and independence of the Federal Reserve by Peter Conti-Brown.' *Journal of Economic Literature* 55(2), 621–36

López-Moctezuma, Gabriel (2019) 'Sequential deliberation in collective decision-making: The case of the FOMC.' Technical Report

Loughran, Tim, and Bill McDonald (2011) 'When is a liability not a liability? Textual analysis, dictionaries, and 10-Ks.' *The Journal of Finance* 66(1), 35–65

Malmendier, Ulrike, Stefan Nagel, and Zhen Yan (2021) 'The making of hawks and doves.' *Journal of Monetary Economics* 117, 19–42

Meade, Ellen E. (2005) 'The FOMC: Preferences, voting, and consensus.' *Federal Reserve Bank of St. Louis Review*

_____ (2010) 'Federal Reserve transcript publication and regional representation.' *Contemporary Economic Policy* 28(2), 162–170

Meade, Ellen E., and D. Nathan Sheets (2005) 'Regional influences on FOMC voting patterns.' *Journal of Money, Credit and Banking* pp. 661–677

Meade, Ellen E., and David Stasavage (2008) 'Publicity of debate and the incentive to dissent: Evidence from the US Federal Reserve.' *The Economic Journal* 118(528), 695–717

Meade, Ellen E., Nicholas A Burk, and Melanie Josselyn (2015) 'The FOMC meeting minutes: An assessment of counting words and the diversity of views. FEDS Notes, May 2015'

Meltzer, Alan H. (2003) 'A history of the Federal Reserve vol. 1: 1913-1951.' *Book 1*

Meyer, Laurence H. (2004) *A Term at the Fed: An Insider's View* (HarperBusiness New York)

Mikolov, Tomas, Ilya Sutskever, Kai Chen, Greg S Corrado, and Jeff Dean (2013) 'Distributed representations of words and phrases and their compositionality.' *Advances in neural information processing systems*

Milgrom, Paul, and John Roberts (1988) 'An economic approach to influence activities in organizations.' *American Journal of Sociology* 94, S154–S179

Morse, Adair, and Annette Vissing-Jorgensen (2020) 'Information transmission from the Federal Reserve to the stock market: Evidence from Governors' calendars.' *Unpublished working paper. University of California at Berkeley*

Nakamura, Emi, and Jón Steinsson (2018) 'High-frequency identification of monetary non-neutrality: The information effect.' *The Quarterly Journal of Economics* 133(3), 1283–1330

Orphanides, Athanasios (2001) 'Monetary policy rules based on real-time data.' *American Economic Review* 91(4), 964–985

Persico, Nicola (2004) 'Committee Design with Endogenous Information.' *The Review of Economic Studies* 71(1), 165–191

Riboni, Alessandro, and Francisco J. Ruge-Murcia (2010) 'Monetary policy by committee: Consensus, chairman dominance, or simple majority?' *The Quarterly Journal of Economics* 125(1), 363–416

_____ (2014) 'Dissent in monetary policy decisions.' *Journal of Monetary Economics* 66, 137–154

_____ (2020) 'The power of the Federal Reserve chair.' *CEPR Discussion Paper No. DP14878*

Schmeling, Maik, and Christian Wagner (2019) 'Does central bank tone move asset prices?' *CEPR Discussion Paper No. 13490*

Sheng, Xuguang Simon (2015) 'Evaluating the economic forecasts of FOMC members.' *International Journal of Forecasting* 31(1), 165–175

Swank, Job, Otto H. Swank, and Bauke Visser (2008) 'How committees of experts interact with the outside world: Some theory, and evidence from the FOMC.' *Journal of the European Economic Association* 6(2-3), 478–486

Swank, Otto H., and Bauke Visser (2013) 'Is transparency to no avail?' *The Scandinavian Journal of Economics* 115(4), 967–994

_____ (2022) 'Committees as active audiences: Reputation concerns and information acquisition.' *Working paper*

Tietz, Robin (2019) 'How does the Fed manage interest rate expectations?' *SSRN Working Paper, 3254094*

Tillmann, Peter (2011) 'Strategic forecasting on the FOMC.' *European Journal of Political Economy* 27(3), 547–553

Tootell, Geoffrey M. B. (1991) 'Regional economic conditions and the FOMC votes of district presidents.' *New England Economic Review* Mar, 3–16

Visser, Bauke, and Otto H. Swank (2007) 'On committees of experts.' *The Quarterly Journal of Economics* 122(1), 337–372

Vissing-Jorgensen, Annette (2021) 'Central banking with many voices: The communications arms race.' In 'Conference Proceedings, 23rd Annual Conference of the Central Bank of Chile'

Vives, Xavier (1999) *Oligopoly pricing: Old ideas and new tools* (MIT press)

Wang, Sida, and Christopher D. Manning (2012) 'Baselines and bigrams: Simple, good sentiment and topic classification.' In 'Proceedings of the 50th Annual Meeting of the Association for Computational Linguistics: Short Papers-Volume 2' Association for Computational Linguistics pp. 90–94

PUBLICATIONS

Voting Right Rotation, Behavior of Committee Members and Financial Market Reactions: Evidence from the U.S. Federal Open Market Committee

Working Paper No. **WP/2022/105**