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Abstract

This paper develops a model of committee decision-making where members of different expertise deliberate and share private information prior to voting. The model predicts that members truthfully reveal their private information and are willing to “change their minds” as a result of deliberation. The predictions of the model are evaluated using data from the Federal Open Market Committee.

JEL classification: D7, E5
Key Words: Deliberation, voting, mind-changes.

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1 Introduction

Policy-making typically involves selecting one action among several alternatives in an uncertain environment. Since available information is often dispersed and it is interpreted differently by different individuals, groups are believed to make fewer mistakes than a single decision-maker (de Condorcet, 1785). This view is widely shared and explains why in practice many policy decisions are made by groups such as, corporate boards, deliberative assemblies, and monetary policy committees. In all these examples, the final decision is generally made by vote after a round of deliberation during which individuals exchange their views on the issue at hand. In this paper we present a simple model of deliberation and voting in a committee, where members with different expertise must choose between two policy alternatives on the basis of both public and private information about the unknown state of nature.

More precisely, we study a committee composed of two members (say, the chair and median of a committee with more than two members) and assume that whether a given policy choice is optimal depends on the current state of nature. Since the state is not perfectly observed, it is not obvious which policy is the “right one” to adopt.\(^1\) We assume that committee members have the same preferences: they agree which decision is optimal in each state and their utility is maximized when such policy is chosen. Put differently, members have “outcome concerns”. Both members hold the same prior probability over the state, which arises from public information (evidence or reports) available to the committee. In addition, each member receives private information in the form of a piece of evidence (or a “signal”) about the true state of nature. This signal summarizes all private information that a member brings to the meeting. Members differ in their level of expertise and expertise is observable.\(^2\) Members with higher expertise receive a less noisy private signal than members with lesser expertise.

Decision-making at the meeting unfolds as follows. In the first part of the meeting there is a deliberation stage (straw vote) where members simultaneously exchange their private information. In the second part of the meeting, members vote over the policy to implement. A policy change requires the agreement of both members and without agreement, the status quo stays in place. We show that in this simple environment 1) members truthfully disclose their private information, 2) the probability of sending a message favoring the status quo depends in a non-trivial manner on the prior and on the member’s expertise, and 3) less expert members change their mind more often than more expert ones.

Our highly stylized model generates empirical predictions and we attempt to evaluate them using data from the meetings of the Federal Open Market Committee (FOMC). The predictions of the model depend on the prior members have about the state and on their expertise. Neither of these two variables is observed by the econometrician. We respond to this challenge by constructing an

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\(^1\)For instance, think of a monetary policy committee that must decide whether to increase or to keep unchanged the key interest rate in a situation where increasing it would be the right decision only if inflation is about to rise.

\(^2\)In a companion paper under preparation (Riboni and Ruge-Murcia, 2018) we relax this assumption and consider the case where expertise or ability is unobserved.
empirical counterpart of the prior using data from the Greenbooks that are circulated to all FOMC attendees before the meeting and have comprehensive economic statistics, and by constructing a proxy of expertise in monetary policy-making based on the number of meetings attended by each member. Empirical results provide support for some of the model implications, but provide limited or no support for others. We evaluate the relative successes and failures of the model and suggest future avenues of research.

Our work is related to the theoretical literature on the Condorcet Jury Theorem (CJT). In its original formulation, the CJT states that under incomplete information, the probability of a group coming to a correct decision by majority vote tends to one as the size of the committee goes to infinity. Since efficiency holds only asymptotically, the theorem predicts that many real-world committees would often make mistakes. Austen-Smith and Banks (1996) and Feddersen and Pesendorfer (1998) study the CJT under strategic voting. Coughlan (2000) allows for communication by supposing that the committee takes a nonbinding straw vote before the final vote. In his model all committee members want to choose the policy that matches the state, but they have different biases (i.e., different valuations about the costs associated with the mistake of choosing the wrong policy). When preference biases are known and not too different, committee members share the information in the preliminary vote, which improves the accuracy of the decision even in small committees.

This paper is also related to the empirical literature on deliberation and voting in monetary committees. For example, Meade and Stasavage (2008) consider a model with mixed objectives (both reputation and outcome concerns) and examine the incentives to dissent under private or public deliberation. Hansen et al. (2014) study a model where members have different preferences and expertise, and find that differences in beliefs about economic conditions, arising from differences in expertise, help explain voting behavior in the FOMC. Lahner (2018) finds that committee members with longer tenure have a lower probability of displaying inconsistent voting behaviour during FOMC meetings—i.e., preferring a given interest rate during deliberation but casting a formal vote for another policy. Lopez-Moctezuma (2015) finds that the information learned during sequential deliberation often dominates private information. Finally, Acosta (2015) and Hansen et al. (2017) focus on transparency and its implication for the discussion at the FOMC meetings. Using semantic analysis, Hansen et al. (2017) find that the 1993 regime shift in transparency (namely, the decision to publish FOMC minutes and transcripts) increased the incentive to acquire information before the meeting in order to appear competent, but it also led to more conformity and herding.

The paper is organized as follows. Section 2 presents the committee, including the assumptions about the information structure, decision protocol, etc., and the main analytical results. Section 3 describes our strategy to examine the model predictions and reports empirical results. Section 4 discusses caveats to our results and the implications of this paper for future research.
2 The Model

Consider a committee composed of two members, A and B. The committee selects the policy \( x \in \{R, S\} \) taking as given the status quo. The status quo is the policy that was in place at the beginning of the meeting and, without loss of generality, it is assumed to be \( S \). The assumption of a binary policy space is made primarily for simplicity and has several possible interpretations. For example, it may correspond to “continue investing in a project or not” in the case of a company board of directors, to “adjust the interest rate or not” in the case of a monetary policy committee, etc. We assume that a strong form of supermajority—that is, unanimity—is required to change policy. There are two states of nature, \( \psi \in \{R, S\} \). The prior probability that the state of nature is \( R \) is given by \( \alpha \). We study equilibria for all non-degenerate priors:

\[
\Pr(R) = \alpha \in (0, 1).
\]

Committee members may differ in their level of expertise and we denote this difference by labelling the member as either of higher expertise (\( H \)) or of lesser expertise (\( L \)). Each member observes her own type, and also the type of the other member. In principle, both members can be of higher expertise, or both members can be of lesser expertise, or one member can be of higher expertise and the other member of lesser expertise.

The meeting consists of two stages, namely a deliberation stage and a voting stage, and the timing is as follows: At the beginning of the meeting, members A and B receive a signal, either \( \xi^R \) or \( \xi^S \), which is informative about the state of nature. In the first part of the meeting, or deliberation stage, members simultaneously express their opinion by sending a public message. The messages can be either \( r \) or \( s \), that is a message “in favor” of either state \( R \) or state \( S \), respectively. In the second part of the meeting, or voting stage, members vote (with no abstention allowed). Since the decision to change the status quo is made under unanimity rule, A and B must agree to make a policy change from \( S \) to \( R \).

The signals received by the members are conditionally independent random draws and the extent to which they are informative about the state of nature depend on the member type. The probability that a member with higher expertise observes the “correct” signal is \( \Pr(\xi^i | j, H) = p \) if \( i = j \) and \( \Pr(\xi^i | j, H) = 1 - p \) if \( i \neq j \), where \( i, j \in \{R, S\} \). Since \( p > 1/2 \), a member with higher expertise receives the signal \( \xi^R \) with higher probability in state \( R \) than in state \( S \). For a member with lesser expertise, the probabilities are given by \( \Pr(\xi^i | j, L) = q \) if \( i = j \) and \( \Pr(\xi^i | j, L) = 1 - q \) if \( i \neq j \), where \( i, j \in \{R, S\} \) and \( 1/2 < q < p \). Note that in all cases the signal is informative about the state
of nature, but that a member with higher expertise receives a less noisy signal than a member with lesser expertise. Or, put differently (and paraphrasing Orwell), all members are expert, but some are more expert than others. This specification is meant to represent the fact that membership in actual committees (e.g., corporate board, monetary policy committees, etc.) requires a minimum of knowledge about the subject matter the committee decides upon.

Members care only about the outcome of their decision. The utility of committee members is

\[
U_n(\psi, x) = \begin{cases} 
1, & \text{if } \psi = x, \\
0, & \text{otherwise.}
\end{cases}
\]  

for \( n = A, B \). In other words, both committee members want to make the “right” decision, meaning they want to select the policy that corresponds to the actual, but unobserved, state of nature.

Since the game is dynamic, our solution concept is Perfect Bayesian equilibrium (PBE). On top of the usual requirements for a PBE, we introduce an additional refinement. We require that members do not use weakly dominated strategies.\(^6\) This extra requirement, which is standard in the voting literature, avoids that all players vote for something they do not like simply because a single decision would not affect the outcome.\(^7\) In spite of this refinement, multiplicity of equilibria arises for two other reasons. First, because communication is cheap talk, there is always a “babbling” equilibrium in which no information is revealed in the deliberation. As it is standard in the literature, we disregard these equilibria. Second, in some cases message strategies are indeterminate because voting is not “responsive” to what occurs in the deliberation. For example, when the prior strongly favors one alternative, the final vote of committee members is determined by the prior only, and does not depend on the received signal and on the observed messages. For extreme priors, the final vote is already settled and, in a sense, deliberation is unnecessary. The set of priors for which deliberation affects voting is denoted by the interval \( D_{(m,k)} \) where \((m, k)\) is a vector indicating, respectively, the expertise of members \(A\) and \(B\), with \(m, k = \{H, L\}\). We refer to \( D_{(m,k)} \) as the deliberation interval and characterize it for all possible combinations of \(H\) and \(L\) in the Appendix. The more expert committee members are, the larger the set of priors for which private information can overturn public information. Formally, we obtain \( D_{(L,L)} \subset D_{(L,H)} = D_{(H,L)} \subset D_{(H,H)} \subset [0, 1] \). The derivations in the Appendix also show that the width of the deliberation interval is decreasing in the precision of the signals. For instance, in the case where both members are of lesser expertise and \( q \to 1/2 \), the width of the deliberation interval shrinks to zero. This result is intuitive: if the signals are pure noise, then there is no gain from exchanging private information during the meeting.

The following proposition focuses on the priors in the deliberation interval (i.e., those for which deliberation affects voting). It establishes that private information is shared and that members vote for the policy that maximizes their expected utility conditional on both signals.

\(^6\)We say a voting strategy is weakly dominated for a player by another strategy if, for every choice of strategies of the other players, \( n \)'s payoff from choosing the other strategy is at least as great as \( n \)'s payoff from choosing the initial strategy (with one strict inequality).

\(^7\)An example of such an equilibrium would be one in which both members vote for \( S \) (even if they do not like it) because a single deviation would not make a difference as the change to \( R \) needs two favorable votes.
Proposition 1. Let \((m, k)\) denote the vector of expertise levels in the committee. For any \(\alpha \in D_{(m,k)}\) there exists a PBE in which all individuals are truthful in the deliberation and reveal their signal. The committee selects the decision that is more likely to be correct on the basis of all available information and it does so with an unanimous vote.

Proof. Suppose that messages are truthful during deliberation. It is straightforward to see that both members have the incentive to vote for the policy that is more likely to be correct given both messages. Since the voting decision is efficient, i.e., it maximizes the expected payoff of both members conditional on the two signals by nature, the two members cannot strictly improve their payoffs by sending an untruthful message. This confirms the initial claim that messages are truthful, thus supporting the equilibrium. □

Since committee members do not have conflicting interests and they all receive an informative signal, sharing their private information enhances the probability of selecting the policy that all members prefer. Truth-telling is therefore an equilibrium strategy during deliberation. A similar result is reported by Coughlan (2000) in a model with limited heterogeneity in preferences. In this model, all members compute the posterior probability of the two states according to Bayes rule, taking into account the quality of the information received by each member. Since signals are truthfully revealed, beliefs are identical for all members in equilibrium, and the final decision is unanimous and optimal (i.e., it coincides with the best decision given all the available information).

From this proposition, Corollaries 1 and 2 follow.

Corollary 1 The probability of sending a message that favours the status quo is decreasing in \(\alpha\) and increasing in the member’s expertise when \(\alpha < 1/2\) and decreasing in the member’s expertise when \(\alpha > 1/2\).

These predictions are intuitive: Under truth-telling, the probability of sending a message for the status-quo policy \((S)\) is simply the probability of receiving signal \(\xi^S\). For members with higher and lesser expertise this probability is respectively given by

\[
\begin{align*}
\Pr(\xi^S \mid H) &= (1 - \alpha)p + \alpha(1 - p), \\
\Pr(\xi^S \mid L) &= (1 - \alpha)q + \alpha(1 - q).
\end{align*}
\]

The probability is decreasing in \(\alpha\) in both cases because \(p > q > 1/2\). That is, when state \(R\) is ex-ante more likely, members are less likely to send a message for the status quo \(S\). Note also that \(\Pr(\xi^i \mid H)\) is larger (resp. smaller) than \(\Pr(\xi^i \mid L)\) when \(\alpha < 1/2\) (resp. \(\alpha > 1/2\)). In other terms, when the prior favors the status quo, members with higher expertise receive less noisy signals and, consequently, will be more likely to receive a signal that favors the status quo. The opposite holds when the prior favors a change of policy.
In what follows, we will use the term “mind change” to indicate the situation where a member votes for a policy that is different from the one favoured during deliberation. Members with higher- and lesser expertise have different incentives to stick to the message they sent in the straw vote. A member with higher expertise attaches more weight to her signal and less weight to the message of the other member, who on average is less expert. Because of this, a member with higher expertise tends to learn less from the other member’s message and is more consistent across the two stages of the meeting. Previous literature refers to this as the “sticking to their guns” effect (see e.g., Fehrler and Hughes, 2018). An additional reason for why a member with higher expertise is more consistent during a meeting is that she receives a more precise signal that is thus less likely to be contradicted by the other member’s message. Thus:

**Corollary 2.** Members with higher expertise change their mind less often than members with lesser expertise.

**Proof:** First, suppose that the committee includes two members who have the same expertise. We show that the probability of observing a mind change is decreasing in expertise. We know from Proposition 1 that members are truthful during deliberation and that the final vote is unanimous. It immediately follows that a mind change is observed only if $A$ and $B$ receive different signals. If $A$ and $B$ are both of higher expertise, the probability that nature sends two opposite signals is

$$2((1 - \alpha)p(1 - p) + \alpha(1 - p)p),$$

which is equal to $2p(1 - p)$. Since $p > 1/2$ the probability that two individuals receive conflicting signals (and thus change their minds) is decreasing in $p$. Therefore, we are less likely to observe a mind change in a committee of two members with higher expertise. Second, suppose that committee members have different expertise. We show that the member with higher expertise is less likely to change her mind during the meeting. Without loss of generality, in what follows suppose that $\alpha \leq 1/2$ and that $A$ is the member with higher expertise, while $B$ is the member with lesser expertise. A mind change occurs only when $A$ or $B$ receive conflicting signals. There are two possibilities. First, it could be that $A$ receives signal $\xi^S$ and $B$ receives $\xi^R$. This event occurs with probability

$$\alpha(1 - p)q + (1 - \alpha)p(1 - q).$$

Since $A$ has higher expertise than $B$ and $\xi^S$ favours the prior, we have that voting for $S$ is the optimal strategy for both members. Then, with probability equal to (5), there is a mind change by member $B$, who is the less expert member. The other possibility is that $A$ receives signal $\xi^R$ and $B$ receives signal $\xi^S$. This event occurs with probability

$$\alpha(1 - q)p + (1 - \alpha)(1 - p)q.$$  

In this case, both members optimally vote for $S$ when $\alpha$ is sufficiently low such that

$$\frac{\alpha p(1 - q)}{\alpha p(1 - q) + (1 - \alpha)(1 - p)q} \leq \frac{1}{2}. $$
where $1/2$ is the threshold at which committee members are indifferent between the two policy alternatives. When (7) holds, the member with higher expertise changes her mind. Since (6) is smaller than (5), we conclude that the member with higher expertise is less likely to change her mind during the meeting. When instead (7) does not hold, the two members vote for $R$ and the member with lesser expertise changes her mind. Then, the higher-expertise member never changes her mind, also proving Corollary 2. \(\square\)

3 Empirical Analysis

We explore the predictions of our model of deliberation and voting using data from the meetings of the Federal Open Market Committee (FOMC) of the U.S. Federal Reserve. FOMC meetings broadly resemble the stylized meetings in our model and their rich documentation allows us to construct the variables necessary to examine the empirical implications of the model. In what follows, we describe the data and the construction of our empirical counterparts of the prior and the member’s expertise, and report the extent to which the data supports or not the implications of our model.

3.1 The Data

Regular meetings of the FOMC take place about eight times a year and are held at the offices of the Board of Governors of the Federal Reserve in Washington, D.C.\(^8\) The meetings are attended by the seven governors of the Federal Reserve (including the chairman), the twelve presidents of the regional Federal Reserve Banks, and staff from both the Board and regional banks. Although all regional bank presidents participate in the discussion, only five of them vote in each meeting following an annual rotation scheme. In broad terms, an FOMC meeting has two parts (see e.g., Meade et al. 2015). First, Board staff reviews current economic conditions and, then, the governors and bank presidents discuss their views on economic developments and the outlook. This first part of the meeting is known as the “economic go-round”. Second, Board staff outlines policy options and discuss several alternatives for the statement that the committee issues after the meeting. Following questions, the governors and bank presidents sequentially outline their views on policy and (except for the chairman) usually voice an explicit policy preference. This second part of the meeting is known as the “policy go-round”. The meeting ends with a final vote on a proposal made by the chairman about the policy to be followed over the period until the next FOMC meeting.

The raw data consists of 72 face-to-face meetings between February 1989 and December 1997 with a total 804 observations for 36 individuals (including the chairman). The sample period is determined by the availability of data on voiced preferences during deliberation, which are obtained from Meade (2005). Based on the analysis from the transcripts of the meetings, Meade reports the

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\(^8\)In exceptional circumstances conference calls are held as well, but they do not follow an established protocol. For this reason, we follow the literature (e.g., Meade, 2005) in focusing only on face-to-face meetings and excluding conference calls from the sample.
policy preferences and final vote for each member of the FOMC. Thus, her dataset allow us to infer instances where a member voiced one policy preference at the beginning of the policy go-around, but voted for another one after deliberation. The sample features a full cycle of interest rate decreases and increases by the FOMC, and includes meetings before and after October 1993 when members became aware that transcripts of the meetings were permanently kept at the Board of Governors and were to be published with a five-year delay. This natural experiment on transparency is interesting because our model, where agents care about outcomes rather than about individual reputations, implies that the publication of transcripts should have no effect on members’ behavior.

3.2 The Prior

In this application the two states in the model correspond to 1) keeping unchanged the federal funds rate target that was in place at the beginning of the meeting (i.e., maintaining the status quo or $S$) or 2) adjusting the target ($R$). An empirical counterpart of the prior in the model is constructed using data from the Greenbooks (formally entitled “Current Economic and Financial Conditions”) prepared by the staff at the Federal Reserve Board before each FOMC meeting. These books contain in-depth analysis of the U.S. and international economies, including forecasts up to four-quarters ahead and historical values of many economic variables.\footnote{These data are available from the Real-Time Data Research Center at the Federal Reserve Bank of Philadelphia (www.philadelphiafed.org).} The Greenbooks are ideal to estimate the common prior ($\alpha$ in our model) because they are extremely comprehensive in their coverage and, crucially, they are circulated to all FOMC attendees about one week before the meeting. Hence, the Greenbooks constitute the single most important source of common information regarding the current state of the U.S. economy before a FOMC meeting takes place. Although we abstract from other sources of common information (e.g., newspapers), it seems reasonable to assume that the economic analysis and coverage from these sources is less detailed than that of the Greenbooks, which typically go over 150 pages in two parts and one supplement. Private information—e.g., regional information available to bank presidents, but not to the Board staff that produce the Greenbooks—is, by definition, not observable by the econometrician and forms part of the private signal in our model.

Since adjustments to the federal funds rate target involve decreases as well as increases, we estimate the ordered probit

\[ \Delta i_t = \begin{cases} -1 & \text{if } \Delta i^*_t \leq \eta_1, \\ 0 & \text{if } \eta_1 < \Delta i^*_t \leq \eta_2, \\ 1 & \text{if } \Delta i^*_t > \eta_2, \end{cases} \]

(8)

where $\Delta i_t$ is the change in the funds target, $-1$, 0, and 1 respectively refer to a decrease, no change, and an increase in the target, $\eta_1$ and $\eta_2$ are constant thresholds, and $\Delta i^*_t$ is the latent variable. The latent variable follows the process

\[ \Delta i^*_t = X_t \beta + u_t, \]

(9)
where $X_t$ is a vector of explanatory variables, $\beta$ a conformable vector of constant coefficients, and $u_t$ is a normally distributed disturbance with mean zero and variance equal to 1. The explanatory variables are drawn from the Greenbooks produced prior to the meeting held at time $t$. Since we want to approximate all quantitative information available to FOMC participants, we use all data series for which the Greenbook reports current values and four-quarter-ahead forecasts. More precisely, the elements in $X_t$ are the previous interest rate decision, the bias agreed in the previous meeting, and the expected change between the four-quarter-ahead forecast and the current value of the unemployment rate, measured in percentage points; housing starts, measured in millions of units; and the quarterly growth rates of real gross domestic product (GDP), the implicit GDP deflator (GNP deflator before the second quarter of 1992), the consumer price index (CPI), real personal consumption expenditures, real business fixed investment, real residential investment, real federal government consumption and gross investment, and the industrial production index, all measured in annualized percentage points.

Our estimate of the prior probability that the true state of nature involves keeping the interest rate unchanged is

$$1 - \alpha_t = \Phi(c_2 + X_t\beta) - \Phi(c_1 + X_t\beta).$$

(10)

Conversely, our estimate of the prior probability that the true state of nature involves adjusting the interest rate is

$$\alpha_t = \Phi(c_1 + X_t\beta) + (1 - \Phi(c_2 + X_t\beta)),$$

(11)

where the first term in the right-hand-side of (11) is the probability of an interest rate decrease and the second term is the probability of an interest rate increase. The estimated prior probability ($\alpha_t$) and the complementary probability ($1 - \alpha_t$) are reported in the top panel of figure 1, where we can see that there is substantial time variation in the priors throughout the sample. Adding up the probability of an increase and a decrease to obtain the probability of an interest rate change, as we do in (11), is a practical way to reconcile the model with the data, where an adjustment can take two directions. However, the lower panel of figure 1, which plots separately the prior probabilities of an increase and a decrease, shows a clear distinction between these probabilities in the sense that when one is quantitatively large, the other one is very low and close to zero. This means that in a given meeting FOMC members effectively face a binary choice—between keeping the status quo and a change in one specific direction (either a decrease or an increase)—as the committee members in the model do.

The expertise of members is public information in the model, but it is not directly observed by the econometrician. However, since it seems likely that expertise on actual monetary policy decision-making would increase with tenure at the FOMC, we use experience—measured by the number of meetings attended by each FOMC member up to and including the current meeting—as a proxy for expertise. We compiled these figures from the attendance record in the transcripts, which report the

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10 We exclude, however, variables that are not available for the complete sample (for example, the core consumer price index, which is only available since February 1986), or variables with missing observations, like consumption and gross investment by state and local governments.
names of all individuals present in an FOMC meeting. In the case of bank presidents, we include meetings even when they are attended in the role of non-voting member. In all cases, we exclude meetings where the member was supposed to attend, but, for some reason, was not present. Since the relevant expertise in the model is that relative to the other member, we compute for each member in each meeting the difference between the number of meetings he/she attended and those of the median.

3.3 Evaluation of the Model Predictions

3.3.1 Deliberation

The model predicts that when the prior is extreme (i.e., it strongly favors either of the alternatives), the final vote of committee members is determined by the prior alone and it does not depend on the signals received or on the observed messages. This implies that deliberation is not necessary to reach a decision. Instead, when the prior does not clearly favor one of the alternatives, the final vote depends on both the prior and on the exchange of private information or signals. Put differently, in this case, the decision does depend on the deliberation. This means empirically that the discussion in a meeting with an extreme initial prior is likely to be shorter than the discussion in a meeting with more a centered initial prior. Intuitively, the reason is simply that the course of action is clearer in the former than in the latter case and, thus, less deliberation is required to reach a decision.

As a measure of the length of deliberation in each FOMC meeting we use the actual number of words pronounced by all participants in the meeting as recorded in the transcripts. Following the usual approach in text analysis, we exclude from our count stop words such as “the”, “which”, and “on”. Although a word count cannot fully capture the intensity of the discussion during a meeting, it is not hard to imagine that meetings that involve more deliberation and information exchange feature a higher word count than meetings that involve less deliberation.

We perform an ordinary least squares (OLS) regression of the word count for each meeting on an intercept, the prior, and the prior squared, and report the results in column 1 of table 1 and the fit of the regression in figure 2. The sample consists of the 72 meetings in our sample. In the figure, the vertical axis is words (in thousands) and the horizontal axis is the prior probability, $\alpha$. The table and figure show that the data provide some support for the model prediction in the form of statistically significant coefficients and a concave function that implies less deliberation (or fewer words) in the transcripts from meetings with extreme priors than from meetings with centered priors. This result, however, should be interpreted with caution because coefficients are only significant at the 10% level.

Results are reasonably robust to including a dummy for the meetings after October 1993, when members became aware that the transcripts of the meetings would be made public with a five-year lag. These results are reported in column 2 of table 1. The relation between deliberation and the prior is still concave but the coefficient on the prior squared is no longer significant at the 10% level ($p$-value = 0.126). The coefficient on the dummy on transparency is not significant at the 10% level either ($p$-value = 0.138), although this result is marginal.
3.3.2 Mind-Changes

In the model there are instances where a member votes for a different policy than the one implied by her message in the first part of the meeting. These “mind-changes” are the result of the exchange of messages during the meeting. In other words, mind-changes are the result of deliberation. Moreover, the model implies that informed members are less likely than uninformed members to change their minds as a result of deliberation.

As noted above, FOMC transcripts provide empirical counterparts to the messages and votes in the model. During the policy go-around and after members have been briefed by Board staff, members express their views on policy and usually voice an explicit policy preference. Expressing a preference is nearly universal: as shown in Table 1 of Meade (2005), out of 1225 interventions by members (other than the chairman) in the meetings from February 1989 and December 1997, policy-makers expressed an opinion about the direction of the interest rate change on 1,205 occasions (that is, 98.4 percent of the total) and about the magnitude of the interest rate change in basis points on 1,162 occasions (that is, 94.9 percent of the total). In terms of our model, this is akin to the public message sent by members in the deliberation stage of the meeting (either \( r \) or \( s \)) about the current state (either \( R \) or \( S \)). Similarly, the voting at the end of the FOMC meeting is akin to voting in the second stage of our model. Hence, both in the data and in the model, there are mind-changes in the sense that after messages are exchanged, members may vote for a different policy in the final round.

In this section the sample consists of all observations where a member both voiced an explicit policy preference and voted. This selection criterion excludes regional bank presidents who were not scheduled to vote under the rotation scheme and the chairman, who never voices an explicit policy preference in the “policy go-round”. The total number of observations is 706. Define by \( y_t \) the observation of a mind-change and consider the probit model

\[
y_t = \begin{cases} 
0 & \text{if } y_t^* \leq \lambda, \\
1 & \text{if } y_t^* > \lambda,
\end{cases}
\]

where 0 and 1 respectively refer to a no-mind-change and a mind-change, \( \lambda \) is a constant threshold, and \( y_t^* \) is the latent variable. The latent variable follows the process

\[
y_t^* = Z_t \gamma + v_t,
\]

where \( Z_t \) is a vector of explanatory variables, \( \gamma \) a conformable vector of constant coefficients, and \( v_t \) is a normally distributed disturbance with mean zero and variance normalized to be 1. Results are reported in column 3 of table 1, where the explanatory variables are an intercept, experience (denoted by \( E \)), and experience squared, and in column 4 where the explanatory variables also include as controls a dummy for transparency that takes value 1 for meetings after October 1993 and a dummy for Board members, which takes value 1 if the member is a Board Governor and zero otherwise.

\[\text{[11]}\]

\[\text{[11]}\] However, one difference between the model and the data is that the message in the model is sent at the beginning of the meeting, while the policy preference in FOMC meetings is stated at the beginning of the policy go-round, after some discussion on economic conditions has taken place during the economic go-around.
Results in column 3 show that more experienced members change their mind more, rather than less, often than less experienced members. The coefficient on experience is positive and statistically significant at the 5% level. The coefficient of experience squared is also statistically different from zero at the 5% level, but its magnitude is very small and not economically significant. When additional controls are added in column 4, the coefficient on experience is no longer statistically different from zero. As before, the coefficient of experience squared is statistically significant but quantitatively very small. Thus, experience appears to have limited predictive power over mind changes once we condition on committee membership and transparency.

The coefficient of the transparency dummy is statistically significant suggesting that the eventual publication of transcripts has an effect on mind-changes. This result is consistent with Lahner (2018), who finds a decrease in the probability of casting inconsistent votes between the policy go-round and the final vote after 1993. Since members in our model care only about outcomes rather than about individual reputations, the publication of transcripts should have no effect on their behavior. Finally, the coefficient of the dummy for Board membership is negative and statistically different from zero. This result just reflects the fact that in the raw data the rate of mind-changes for Board member is 6.87%, while that of bank presidents is somewhat higher at 9.34%. This result implies that mind-changes are (statistically) related to committee membership, whether Board governor or regional bank president.

In the model mind changes occur more frequently when the prior is around 1/2 relative to when the prior is less centered. The intuition is simply that for centered priors there is considerable uncertainty about the state and deliberation can lead members to change their minds. Instead, for extreme priors there is basically no deliberation and, consequently, there are no mind changes. In order to examine this implication of the model, we estimate the probit regression (12)-(13) with the explanatory variables in $Z_t$, being an intercept, the prior, and the prior squared. Results are reported in column 5 of table 1 and show that the coefficient of the prior is positive and statistically significant and the coefficient of the prior squared is negative and statistically significant. These estimates imply a concave relation between the prior and mind changes. This relation is plotted in figure 3, which reports the fit of the probit model. As predicted by the model, mind changes are more likely for centered than for extreme priors. Column 6 shows that this result is robust to including the dummy for transparency and the dummy for Board membership among the regressors, in part because their coefficients are quantitatively small and not statistically different from zero.

### 3.3.3 Status-quo

Finally, we examine the model predictions regarding the members’ voiced preference for the status quo. To do so, we run the probit regression (12)-(13), but with $y_t$ standing for a discrete variable that takes value 1 if the member voiced an explicit policy preference for keeping the interest rate unchanged, and 0 otherwise. The sample consists of the same observations used in section 3.3.2.
above. Results are reported in columns 7 through 11 of table 1. In column 7, where the regressors are a constant and the prior, results show that the probability of voicing a preference for the status quo is monotonically decreasing in the prior. This result is intuitive as it implies that as the state of nature that requires an interest rate change becomes more likely, the probability of members favouring the status quo (i.e., keeping the interest rate unchanged) decreases.\textsuperscript{12} This result is robust to adding as controls a dummy for transparency for meetings after October 1993 and a dummy for Board members (see column 8). Note that the transparency dummy is negative and statistically different from zero, meaning that the probability that a member favors the status quo was lower after October 1993, even after controlling for prior information. Since in a committee where members care about outcomes alone transparency should have no effect on their actions, this result suggests that members’ voiced support for the status quo may be affected by reputational considerations as well. In contrast, the dummy for Board members is not statistically different from zero and, thus, the nature of committee membership has no effect on the voiced preference to keep the status quo policy.

In addition, the models predicts a particular nonlinear interaction between the prior and expertise. In particular, the probability of sending a signal in favor of the status quo is higher (resp. smaller) for individuals with higher expertise when $\alpha < 1/2$ (resp. $\alpha > 1/2$). We examine this prediction using a probit regression where the regressors are an intercept, experience times a dummy variable for instances where the prior is below $1/2$, experience times a dummy variable for instances where the prior is above $1/2$, and the previous dummies for transparency and committee membership. Results are reported in column 9. Support for the model’s predictions is limited in that although point estimates are in line with the prediction, they are not statistically significant. Moreover, the transparency dummy is quantitatively large and statistically significant, suggesting the reputational considerations may be quantitatively important.

In order to inspect further the above results, we estimate the same probit regression in a subsample of bank presidents (column 10) and a subsample of board members (column 11). (Naturally, we exclude the Board dummy from the regressors in these cases.) Results for the subsample of bank presidents provides some support for the model predictions. However, results for the subsample of board members delivers point estimates of sign opposite to that predicted by the model with one of the coefficients statistically significant at the 10\% level. More specifically, when the prior favors the status quo, board members with longer experience tend to take a contrarian position and favor a policy change. The contrasting behavior of bank presidents and board members account for the weak empirical results in column 7.

\textsuperscript{12}In preliminary work, we also considered adding the prior squared as one of the regressors, but its coefficient was not statistically significant.
4 Conclusion

This paper develops a simple model of committee decision-making where members of different expertise deliberate and share private information prior to voting. The model predicts that members truthfully reveal their private information and are willing to “change their minds” as a result of deliberation. Despite the highly stylized nature of the model, we attempt to evaluate its predictions in order to guide future research. Using various data from the FOMC (transcripts, Greenbooks, attendance rolls), we construct empirical counterparts of the model variables and use the model to guide our econometric analysis. The data support the implications that the length of deliberation and the probability of members changing their minds depend nonlinearly on the priors held before the meetings and that the preference for the status-quo policy is also related to prior information. However, the data also suggests that reputational considerations and the nature of committee membership (e.g., whether Board member or Bank president) may also have an effect on decision-making. Extending the member utility to allow for reputational concerns and other forms of heterogeneity will form part of our future research.
<table>
<thead>
<tr>
<th>Regressors</th>
<th>Deliberation</th>
<th>Mind Changes</th>
<th>Preference for Status-quo</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
</tr>
<tr>
<td>Constant</td>
<td>24.490*</td>
<td>22.990</td>
<td>−1.395*</td>
</tr>
<tr>
<td></td>
<td>(2.528)</td>
<td>(2.688)</td>
<td>(0.073)</td>
</tr>
<tr>
<td>$\alpha$</td>
<td>30.179†</td>
<td>28.457†</td>
<td>2.778*</td>
</tr>
<tr>
<td></td>
<td>(16.925)</td>
<td>(16.713)</td>
<td>(0.974)</td>
</tr>
<tr>
<td>$\alpha^2$</td>
<td>−31.032†</td>
<td>−28.086</td>
<td>−2.327*</td>
</tr>
<tr>
<td></td>
<td>(18.501)</td>
<td>(18.332)</td>
<td>(1.066)</td>
</tr>
<tr>
<td>$E \times 10^2$</td>
<td>0.433*</td>
<td>0.202</td>
<td>0.046</td>
</tr>
<tr>
<td></td>
<td>(0.177)</td>
<td>(0.193)</td>
<td>(0.142)</td>
</tr>
<tr>
<td>$E^2 \times 10^4$</td>
<td>−0.335*</td>
<td>−0.485*</td>
<td>−0.552*</td>
</tr>
<tr>
<td></td>
<td>(0.154)</td>
<td>(0.154)</td>
<td>(0.110)</td>
</tr>
<tr>
<td>Transparency</td>
<td>3.397</td>
<td>−0.462*</td>
<td>0.103</td>
</tr>
<tr>
<td></td>
<td>(2.289)</td>
<td>(0.139)</td>
<td>(0.142)</td>
</tr>
<tr>
<td>Board</td>
<td>−0.547*</td>
<td>−0.159</td>
<td>0.109</td>
</tr>
<tr>
<td></td>
<td>(0.150)</td>
<td>(0.140)</td>
<td>(0.108)</td>
</tr>
<tr>
<td>$E \times 10^2 \times I(\alpha \leq 1/2)$</td>
<td>0.104</td>
<td>0.236</td>
<td>−0.721†</td>
</tr>
<tr>
<td></td>
<td>(0.146)</td>
<td>(0.167)</td>
<td>(0.384)</td>
</tr>
<tr>
<td>$E \times 10^2 \times I(\alpha &gt; 1/2)$</td>
<td>−0.416</td>
<td>−0.641†</td>
<td>1.058</td>
</tr>
<tr>
<td></td>
<td>(0.323)</td>
<td>(0.353)</td>
<td>(0.874)</td>
</tr>
</tbody>
</table>

*Note: The superscripts * and † denote statistical significance at the 5 and 10 percent levels, respectively.*
Appendix Derivation of the Deliberation Intervall

We begin by computing $D_{(L,L)}$. Suppose that members are both of lesser expertise. When the initial prior $\alpha$ is sufficiently low, so that

$$\frac{\alpha q^2}{\alpha q^2 + (1 - \alpha)(1 - q)^2} < \frac{1}{2},$$

the committee favours policy $S$ regardless of the signals received by the two members. In particular, policy $S$ is chosen even when two $\xi^R$ signals are observed. Also, when the prior is sufficiently high so that

$$\frac{\alpha(1 - q)^2}{\alpha(1 - q)^2 + (1 - \alpha)(q)^2} > \frac{1}{2},$$

the committee chooses policy $R$ regardless of the signals. After simple algebra, the set $D_{(L,L)} = [\alpha_1, 1 - \alpha_1]$, where $\alpha_1$ is implicitly defined by

$$\frac{\alpha_1}{(1 - \alpha_1)} = \left(\frac{1 - q}{q}\right)^2.$$ 

Similarly, we obtain $D_{(H,L)} = D_{(L,H)} = [\alpha_2, 1 - \alpha_2]$ and $D_{(H,H)} = [\alpha_3, 1 - \alpha_3]$ where $\alpha_2$ and $\alpha_3$ solve

$$\frac{\alpha_2}{(1 - \alpha_2)} = \frac{(1 - p)(1 - q)}{pq},$$

$$\frac{\alpha_3}{(1 - \alpha_3)} = \left(\frac{1 - p}{p}\right)^2.$$
References


Figure 2: Deliberation and the Prior

![Graph showing the relationship between Prior and Number of Words in the Transcript.](image-url)
Figure 3: Mind Changes and the Prior
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