Publicity of Debate and the Incentive to Dissent: Evidence from the US Federal Reserve

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January 2004

Abstract
When central banks are transparent about their decision making, there may be clear benefits in terms of credibility, policy effectiveness, and improved democratic accountability. While recent literature has focused on all of these advantages of transparency, in this paper we consider one potential cost: the possibility that publishing detailed records of deliberations will make members of a monetary policy committee more reluctant to offer dissenting opinions. Drawing on the recent literature on expert advisors with "career concerns", we construct a model that compares incentives for members of a monetary policy committee to voice dissent when deliberations occur in public, and when they occur in private. We then test the implications of the model using an original dataset based on deliberations of the Federal Reserve's Federal Open Market Committee, asking whether the FOMC's decision in 1993 to begin releasing full transcripts of its meetings has altered incentives for participants to voice dissenting opinions. We find this to be the case with regard to both opinions on short-term interest rates and on the "bias" for future policy.

Keywords: transparency, central banking, career concerns
JEL classifications: E42, E58, E65

This paper was produced as part of the Centre's International Financial Stability Programme. The Centre for Economic Performance is financed by the Economic and Social Research Council.

Acknowledgements
We would like to thank Chris Crowe at LSE and Jacob Kirkegaard of the Institute for International Economics for research assistance.

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Published by
Centre for Economic Performance
London School of Economics and Political Science
Houghton Street
London WC2A 2AE

ISBN 0 7530 1709 1

Individual copy price: £5

1 Introduction

There has been much recent discussion of the advantages of transparency in monetary policymaking. When central banks decide to publish macroeconomic forecasts, reveal individual votes on monetary policy committees, or release minutes of meetings, it is commonly argued that these steps will lead to improved economic outcomes. Transparency makes it easier to judge whether a central bank is committed to an announced policy, and in related fashion, transparency can improve the effectiveness of monetary policy to the extent that financial markets find it easier to interpret policy changes.[1] Transparency also has the advantage of facilitating democratic accountability. While recent research has attempted to model and empirically evaluate the benefits of transparency, there has been less effort to systematically examine whether there might also be disadvantages for monetary policymaking. This is a critical question because, in the absence of such costs, it might seem that full transparency should always be the rule. In this paper we focus on one specific type of transparency, publishing detailed records of central bank board meetings, and one specific reason why this type of transparency might not be desirable, the possibility that the quality of deliberation on a central bank board will suffer if deliberation occurs in public. We develop a theoretical model that helps identify the potential costs of this type of transparency, and we then empirically test the model using an original dataset on deliberations of the Federal Reserve's Federal Open Market Committee (FOMC). Our empirical tests focus in particular on the observed effect of the institutional change that occurred in 1993, when the FOMC decided to begin releasing transcripts of its meetings after a delay of five years.

To investigate the above issue, we first develop a model of deliberation on a monetary policy committee, where members care both about reaching the correct decision and about convincing an outside audience that they have a high level of expertise. We consider a three-member committee that must decide on a binary action, with the "correct" action depending on the realization of an unobserved state variable. One interpretation would be to have the binary action be the choice between raising interest rates or holding them constant, while the state variable could be whether output is at or above its potential level. Individual committee members receive informa-

[1] See Faust and Svensson (2001) for a model that demonstrates how credibility depends upon transparency. Gerlach-Kristen (2003) presents empirical evidence on releasing voting records of monetary policy committees. See Geraats (2002) for a survey of the literature on transparency in monetary policy. See also Kohn and Sack (2003), Thornton(2003), Goodfriend (1986) for an early discussion of the issue, and empirical evidence in Chortareas, Stasavage, and Sterne (2003).

tive private signals about the state variable and, as a result, the committee is more likely to make the correct policy choice when members accurately reveal this information. In addition, we assume that committee members are uncertain about the accuracy of their private signal, that they speak in sequence, and that a committee member who is known to have a high level of expertise speaks first. As discussed below, these assumptions closely fit current FOMC practice. We consider how the incentive for committee members to truthfully reveal their private signals varies depending on whether the statements they make during committee deliberations are subsequently revealed to the public. In a previous paper that considers a similar model and the case of public deliberation, Ottaviani and Sorensen (2001) show that when a committee member who is known to have high expertise speaks first, then subsequent speakers can face an incentive to mimic the behavior of the known expert rather than accurately reveal their private information. This result parallels a number of other papers in the literature on expert advisors with "career concerns", which have shown how advisors can face incentives to withhold private information if accurate revelation would lead principals to infer that they have a low level of expertise.[2] The idea that deliberation may be hindered by publicity is not a new one. Speaking about the secrecy rule that prevailed during the US Constitutional Convention of 1787, James Madison emphasized that full publicity would have made members more reluctant to freely express their true opinions, and he saw secrecy as having been critical to the Convention's ultimate success.[3] As we will discuss below, similar opinions have been expressed regarding the discussions of the FOMC.

In Section 2 we show that members of a monetary policy committee will have a greater incentive to truthfully reveal their private information if their individual statements in committee meetings *are not* subsequently made public. When deliberation occurs in private, incentives of individual committee members are more closely aligned with those of the committee as a whole, because outside observers will establish inferences about the expertise of individual committee members based on the quality of the committee's policy decision, rather than on the accuracy of individual statements. Based on this result, we develop the testable proposition that any committee that switches from private to public deliberation (provided members care sufficiently about their reputations and a known expert speaks first) should be associated with

[2] See Ottaviani and Sorensen (2003), Levy (2003), and Scharfstein and Stein (1990) for examples. Prat (2003) is an exception in this literature in considering both a case where an expert's recommendation is observed and a case where it is not observed.

[3] Max Farrand (ed.) *The Records of the Federal Convention of 1787*, New Haven (1911) Vol III, p.478.

fewer instances in which committee members express opinions that dissent from those expressed by the chair. It should be emphasized that because our model focuses on the specific issue of incentives for officials to reveal information, it cannot be used to make a general assessment of when private deliberation is preferable. Such a calculation would depend upon weighing the costs of transparency in terms of reduced quality of deliberation against the observed benefits in terms of increased accountability and increased effectiveness of monetary policy.

In Sections 3 and 4, we test our proposition about public vs. private deliberation by considering a natural experiment involving the US central bank's policymaking body, the FOMC. Before 1993, the FOMC published individual votes of committee members as well as summary minutes of meetings, but it did not publish full transcripts that would allow outside observers to determine exactly what individual committee members said during proceedings. Under pressure from Congress, in the fall of 1993 the FOMC agreed to release lightly-edited transcripts of each meeting after a five-year delay. As discussed in Section 3, while the five-year delay was implemented to ensure that committee members would continue to express their opinions freely, some observers at the time thought that even a five-year delay might not be sufficient for this purpose. Our empirical evidence supports this concern. Fortunately for our purposes, the FOMC decision involved the publication of lightly-edited transcripts going back to 1976, based on literal transcriptions made from tape recordings. While many officials knew that FOMC meetings were tape-recorded, most thought the recordings were used to prepare meeting minutes and then the tapes were recorded over. Because transcripts exist from a time when meeting participants did not know that their deliberations would be made public, we are able to compare the behavior of committee members before 1993, when committee members believed that their remarks were private, and after 1993, when they knew that all statements would eventually be made public. To do this we make use of an original dataset that records whether individual FOMC members expressed verbal opposition to the Fed chairman's policy proposals for both the appropriate level of the short-term rate (the Fed funds rate) and the policy "bias" or "tilt" that provides an indication of the likely future direction of policy. It is important to consider these cases of verbal dissent, because Meade (2002) has previously established that in the majority of instances where members of the FOMC verbally dissent from the chair's position, they do not subsequently dissent from the chair's position in the official vote. As a result, analyzing only actual votes, and not the statements made during the committee discussion, can provide a misleading interpretation of FOMC

debates.

We find clear evidence of a change in the character of FOMC deliberations following the 1993 decision to release full transcripts. Distinguishing between FOMC members who are Board Governors, those who are voting Presidents of regional Federal Reserve Banks, and those who are non-voting Presidents, we find that the two former groups in particular have been significantly less likely to express verbal dissents on policy decisions since 1993. In addition, all three groups have been significantly less likely to dissent from the chair's position regarding the "bias" or "tilt" of future policy. The results remain robust when controlling for a number of other potential determinants of individual committee member positions including macroeconomic variables and uncertainty among forecasters. They are also robust to controls for individual specific effects. Finally, these results are supported by a number of parallel observations about the changing character of FOMC debate since 1993. While before 1993 FOMC discussions were characterized by frequent "off the cuff" remarks and interruptions, since 1993 there has a been an increased tendency for committee members to present the sort of pre-prepared statements that may result in less real deliberation. These empirical results have significant implications for the design of monetary policy institutions, as well as for the operation of committee-based government decisionmaking more generally. They suggest that while transparency in policymaking may have many important benefits, attention should also be given to the possibility that publicity might stifle debate.

In what follows we first present our model of monetary policy deliberation in public and private settings in Section 2. Section 3 discusses the 1993 debate regarding the advantages and disadvantages of publishing transcripts. Section 4 presents our data on FOMC deliberations and reviews our empirical estimates of the likelihood of verbal dissent. Section 5 concludes.

2 Monetary Policy Deliberation

In this section we present a simple model of a three player monetary policy committee, composed of players A, B, and C that must decide on a binary action $a \in \{0, 1\}$. While the assumption that the action is binary is made for simplicity, it is not unrealistic given that central banks are known to make interest rate changes in discrete steps. Each committee member receives a binary signal s_i about a state of the world $\omega \in \{0, 1\}$, with each state equally probable. Player A has a known level of expertise, and her signal is accurate

with probability p with $p > 0.5$. Players B and C also receive a separate signal s_i. With probability λ each of these officials has the same high level of expertise as A (they are of type h), and with probability $(1 - \lambda)$ their signal is uninformative, and they have a low level of expertise (they are of type l). Players B and C know these priors, but they do not know their own type, and they do not subsequently learn their own type. The expected accuracy of the signals of Player B and C is represented by $q = p\lambda + (1 - \lambda)0.5$.[4] These assumptions closely follow those adopted in Ottaviani and Sorensen (2001).

We assume that utility for each player depends on both choosing the best policy and on an outside observer's *ex post* assessment of the player's level of expertise. This outside observer could be someone who is considering whether to reappoint the committee member, or it could be a prospective employer for the member subsequent to her period of committee service (a firm, university, or other). More generally, even if members of a monetary policy committee are not motivated by explicit future career concerns, they may be motivated by the more simple desire to appear for posterity as someone who has made expert predictions about the state of the economy.[5] In this case all of the assumptions, and thus the predictions, of our model remain fully applicable. The best policy action a matches the realization of the state variable ω. The outside observer's *ex post* assessment that a player is of type h is conditional on observing the action chosen by the committee, the realization of the state ω, and (when these can be observed) the message m_i that an individual sends during committee deliberations and her vote v_i. Following a common assumption in the literature on career concerns, we assume that each player receives a reputational payoff proportional to the outside observer's posterior probability that the player has a high level of expertise $\Pr(h|a, m_i, v_i, \omega)$. In addition, we assume that this reputational payoff is scaled by the parameter β with $\beta > 0$. There are a number of factors that might affect the value of β, but one in particular is that officials who have a longer term to serve on the committee before receiving their reputational payoff would logically discount the present value of this payoff

[4] We would obtain the same results if we assumed that players of type l had informative signals, provided these signals are less accurate than are the signals of players of type h.

[5] It is also possible that members of a monetary policy committee want to present a "united front" and appear to the public to reach decisions by consensus and without internal tensions. In this case, making deliberation public may result in less disagreement among committee members but not due to reputational concerns. We do not model this desire for consensus, but mention it because it appears to be important for some monetary policy committees, such as the ECB Governing Council.

more heavily.[6] Utility for each player follows the following state-dependent function.

$$\begin{cases} a + \beta \Pr(h|a, m_i, v_i, \omega) & if \quad \omega = 1 \\ (1-a) + \beta \Pr(h|a, m_i, v_i, \omega) & if \quad \omega = 0 \end{cases} \tag{1}$$

To the extent that they would like to choose the right policy, players have an incentive to fully reveal their signals. However, their reputational concerns can conflict with this incentive for accurate revelation. We will demonstrate how incentives to reveal information accurately depend on the outside observer's ability to monitor an individual's message and on the parameter β. The timing of the game is as follows:

1. The state of the world ω is realized (but not observed) and private signals s_i are realized.

2. Each player sends a message m_i with the A speaking first, followed by Player B, then Player C.

3. Players vote on an action $a \in \{0, 1\}$ in the same sequence as during the message round.

4. The state of the world ω becomes public, and each player receives a payoff determined by the action a and the posterior probability that she has high expertise $\Pr(h|a, m_i, v_i, \omega)$.

Given the above assumptions, there will always be an equilibrium where A reports her signal truthfully and where B and C mimic A's message, regardless of their private signals. This equilibrium can be sustained, both under public deliberation and private deliberation, as long as B and C each anticipate that the other will mimic A.[7] In this "uninformative" equilibrium, at the voting stage all three players will have a clear incentive to vote according to A's message $v_i = m_a$. This equilibrium will obviously be inefficient, because the private information held by B and C has no effect on the policy outcome. In what follows, we identify conditions for existence of an "informative" equilibrium where B always reports her message truthfully and C reports her message truthfully if it is "pivotal". A message is "pivotal" here if truthful reporting would result in other players changing their beliefs about which state of the world is more likely.

[6] One interpretation would be to have $\beta = c\delta^n$, where c is a parameter, δ is a discount factor reflecting the rate of time preference, and n is the number of periods before receiving the reputational payoff. However, this would also raise the issue of incentives to truthfully reveal signals in a multi-period game.

[7] As in any model with costless messages, there will also always exist a "babbling" equilibrium in which all three players send untruthful messages.

In the informative equilibrium all players will have an incentive to vote $v_i = 1$ if two or more players previously sent a message $m_i = 1$, and they will vote $v_i = 0$ otherwise. The fact that voting, which takes place after the message round, is unanimous implies that, under our assumptions, it is irrelevant whether the voting round occurs in private or in public. Given that all players vote the same way, outside observers cannot use individual votes to derive information about a player's level of expertise. What matters for the outcome is whether the message round takes place in private, in which case outside observers must base their inferences about players' levels of expertise exclusively on the policy outcome a, or whether the message round instead occurs in public, in which case outside observers can base their inferences on individual messages. In a richer model that allowed for different preferences over policy between committee members, then it would be possible to have non-unanimous voting outcomes, as occurs on actual monetary policy committees like the FOMC. Since voting incentives are relatively straightforward, we relegate further discussion of them to the appendix, and in the next two sub-sections we concentrate on showing how the incentives for B and C to send truthful messages vary depending on whether deliberation occurs in public or in private.

2.1 Public Deliberation

For players B and C the condition for existence of the informative equilibrium involves their incentive to truthfully reveal their signal, even if it differs from that reported by Player A, who has a known high level of expertise. Consider first the incentives faced by Player C. If A and B send identical messages, then C knows that her message will not be pivotal, and she has a clear incentive to mimic the message sent by A and B regardless of the signal she receives. The incentives for C are not as straightforward if A and B do not send the same message. If A and B send different messages about the state, and the signal received by C corresponds to the message reported by B, then C's belief about the state will be as follows,

$$\Pr(m_a = \omega | m_a, m_b, s_c) = \frac{\frac{p(1-q)^2}{p(1-q)+(1-p)q}}{\frac{p(1-q)^2}{p(1-q)+(1-p)q} + (1 - \frac{p(1-q)}{p(1-q)+(1-p)q})q} \tag{2}$$

which simplifies to the expression below (we denote this by θ)

$$\Pr(m_a = \omega | m_a, m_b, s_c) = \frac{p(1-q)^2}{p-2pq+q^2} = \theta \tag{3}$$

Under these conditions, if $\theta < 0.5$, meaning C's message is pivotal, and C truthfully reports her signal, then her expected payoff is shown in expression (4).

$$(1-\theta) + \beta((1-\theta)\frac{p\lambda}{p\lambda+0.5(1-\lambda)} + \theta\frac{(1-p)\lambda}{(1-p)\lambda+0.5(1-\lambda)}) \tag{4}$$

In expression (4) and the subsequent expressions, the reputational payoff in the case that C's message corresponds to the true state is $\Pr(h|m_c = \omega) = \frac{p\lambda}{p\lambda+0.5(1-\lambda)}$. Her payoff in the case where her message turns out to be incorrect is $\Pr(h|m_c \neq \omega) = \frac{(1-p)\lambda}{(1-p)\lambda+0.5(1-\lambda)}$.[8] If Player C falsely reports her signal, then her expected payoff is shown in (5).

$$\theta + \beta(\theta\frac{p\lambda}{p\lambda+0.5(1-\lambda)} + (1-\theta)\frac{(1-p)\lambda}{(1-p)\lambda+0.5(1-\lambda)}) \tag{5}$$

Based on (4) and (5), it is straightforward to observe that if $\theta < 0.5$, then the expected utility from truthful reporting will be higher than the expected utility from false reporting. As a result, Player C has an incentive to report her signal accurately if her message is pivotal (in the sense that it will result in both A and B believing that the probability that A's message is accurate is less than 0.5).

Consider now the incentives faced by Player B. If Player B receives the same signal as reported by A, then it is straightforward to show that B has an incentive to truthfully report. The key question is what incentives face Player B if her signal does not correspond to the message reported by A. If $s_b \neq m_a$ then B's belief that the state is as reported by A is $\Pr(\omega = m_a|m_a, s_b) = \frac{p(1-q)}{p(1-q)+(1-p)q}$. If B herds by sending a false message $m_a = m_b$, then she knows that Player C will also send the same message, and all players will vote $v_i = m_a$. As a result, her expected utility from false reporting is

$$\frac{p(1-q)}{p(1-q)+(1-p)q} + \beta((\frac{p(1-q)}{p(1-q)+(1-p)q})\frac{p\lambda}{p\lambda+0.5(1-\lambda)} + (1-\frac{p(1-q)}{p(1-q)+(1-p)q})\frac{(1-p)\lambda}{(1-p)\lambda+0.5(1-\lambda)}) \tag{6}$$

If B instead reports her signal accurately, then she receives the following expected utility (provided that $\theta < 0.5$):

$$q + \beta((1-\frac{p(1-q)}{p(1-q)+(1-p)q})\frac{p\lambda}{p\lambda+0.5(1-\lambda)} + (\frac{p(1-q)}{p(1-q)+(1-p)q})\frac{(1-p)\lambda}{(1-p)\lambda+0.5(1-\lambda)}) \tag{7}$$

[8] This reputational payoff assumes that the player also pursues the equilibrium voting strategy as specified above.

Based on (6) and (7), as long as the following inequality is satisfied, B will report her signal truthfully.

$$q - \frac{p(1-q)}{p(1-q)+(1-p)q} > \beta(2\frac{p(1-q)}{p(1-q)+(1-p)q} - 1)(\frac{p\lambda}{p\lambda+0.5(1-\lambda)} - \frac{(1-p)\lambda}{(1-p)\lambda+0.5(1-\lambda)}) \quad (8)$$

When the expression in (8) is satisfied, Player B will accurately report her signal, regardless of whether it corresponds to the message sent by A. This inequality can be satisfied for a plausible range of parameters, but it is less likely to be satisfied as $\beta \to \infty$. As mentioned above, one factor that may lead to a higher value of β is if a player has a relatively short term to serve on the committee. This provides us with a first proposition (see the appendix for all proofs).

Proposition 1 *When a known expert speaks first, other committee members will only dissent if their reputational concerns are sufficiently weak.*

2.2 Private Deliberation

In strong contrast to what one observes with public debate, when deliberation takes place in private, the informative equilibrium always exists, irrespective of the strength of reputational concerns. If both Player A and Player B truthfully report their signals, then Player C will continue to have an incentive to truthfully reveal her signal if it is pivotal, as was the case under private deliberation.[9] Player B's incentives change significantly when deliberation takes place behind closed doors. As before, we focus on the incentive for Player B to truthfully report her signal, even if it contradicts the message sent by Player A. We noted above that when deliberation occurs in public, Player B faces a trade-off when $s_b \neq m_a$; reporting her signal accurately may provide higher expected utility in terms of the policy outcome, but it will provide lower expected utility in terms of reputation. When deliberation instead occurs in private, if she reports truthfully Player B receives higher expected utility both in terms of policy as well as in terms of reputation. This is because her reputational payoff now depends strictly on the policy outcome a and on the realization of the state variable ω. If Player B truthfully reports her signal, her expected payoff is as expressed in (9), provided

[9] In addition, when her signal is not pivotal, Player C will now be indifferent between herding and truthful reporting when sending her message, because her reputational payoff will not depend on her message.

that the condition $\theta < 0.5$ holds. This ensures that if both B and C receive a different signal from A, the posterior that the state is as declared by A is less than 0.5. Otherwise, both B and C would always mimic A's message.

$$q + \beta(q \Pr(h|a = w) + (1 - q) \Pr(h|a \neq w)) \tag{9}$$

If Player B falsely reports her signal, then her expected payoff is

$$\frac{p(1-q)}{p(1-q)+(1-p)q} + \beta(\frac{p(1-q)}{p(1-q)+(1-p)q} \Pr(h|a = w) + (1 - \frac{p(1-q)}{p(1-q)+(1-p)q}) \Pr(h|a \neq w)) \tag{10}$$

Based on the above two expressions and after several algebraic steps (which are provided in the appendix), we can show that B's payoff will always be higher under truthful reporting. When we compare equilibrium outcomes under public and private deliberation, this then leads us to our principal proposition for empirical testing.

Proposition 2 *When a known expert speaks first and career concerns are sufficiently strong, there is a greater likelihood that committee members will dissent if deliberation occurs in private.*

3 Deliberation and the Fed's FOMC

From time-to-time, the US Federal Reserve has been subjected to pressures to make its procedures more transparent. One important instance of this sort commenced in the fall of 1992 when the chairman of the House Banking Committee,[10] Representative Henry Gonzalez, requested that the Fed publish detailed accounts of discussions by its monetary policymaking committee, the FOMC, shortly after the conclusion of each meeting.[11] Gonzalez' request culminated in Federal Reserve testimony before Congress on two occasions in October 1993, and the FOMC's subsequent decision in November of that year to publish lightly-edited transcripts of FOMC meetings after a five-year delay.[12] We briefly summarize the debate over this issue based upon FOMC transcripts and Congressional records from that period. One topic that received considerable attention at that time was the effect of transcript

[10] The official name is the Committee on Banking, Finance and Urban Affairs.

[11] Specifically, the Federal Reserve Accountability Act of 1993 introduced in January 1993 called for minutes, a transcript, and a videotape to be made available to the public within 60 days of an FOMC meeting.

[12] At the time, the FOMC's decision applied only to meetings from 1976 to 1993. The active decision to publish lightly-edited transcripts of all meetings going forward was not taken until January 1995.

publication on the freedom of debate in policy meetings—the question we address in this paper.

Gonzalez' challenge to Fed practices arose in the context of changing attitudes about the rights of government agencies to secrecy. Goodfriend (1986) argues that after the passage of the Freedom of Information Act (FOIA) in 1966, Federal agencies could no longer "keep documents confidential merely by arguing that secrecy was in the public interest" (p. 64). In the midst of the Gonzalez episode, President Clinton's Justice Department changed its interpretation of FOIA as it applied to deliberative materials from a presumption of secrecy to a presumption of disclosure. And, in a legal challenge to FOMC disclosure policy in the mid-1970s (Merrill v. FOMC), the presiding district court stated in its decision that "if it is necessary for the FOMC to carry out its monetary policy in secrecy then that determination must be made by Congress and not this Court" (Goodfriend 1986, p. 67).[13]

During the fall of 1992, in several letters to Fed Chairman Alan Greenspan and the Presidents of the Fed's twelve district banks (who serve in a fixed rotation on the FOMC), Gonzalez called for the prompt publication of detailed minutes of FOMC meetings. In his request, Gonzalez recalled that the FOMC had in the past published accounts of its meetings in a heavily-edited transcript called the Memorandum of Discussion, but that this practice had been discontinued in the spring of 1976.[14] After the first FOMC discussion of the Gonzalez request, Greenspan responded in writing that:

> "The major concern in assessing these proposals is their effect on the deliberative process—the free flow of information and ideas essential to policymaking. Members need to feel free to trade ideas, question assumptions, advance hypotheses, make projections, speculate on alternative policies and possible outcomes, and especially to change their views in response to the arguments of others."

During October 1993, there was considerable discussion of Gonzalez' proposed legislation and its implications in the context of testimony by

[13] A number of issues arose in the context of the Gonzalez legislation and hearings, but we only address those that bear directly on the hypothesis examined in this paper.

[14] Publication of these Memoranda was discontinued after the passage of FOIA. A "precipitating factor" in the decision to discontinue them was the FOMC's concern that FOIA could be interpreted to mean that "a considerable portion of the memorandum might have to be made public with a very short lag" (see Kohn, 1992 Transcripts, November 17 meeting).

Alan Greenspan (on the 13th) and by six Fed Board members (including Greenspan) and ten Reserve Bank Presidents (on the 19th). In an FOMC conference call prior to the testimonies, Edward Boehne, President of the Federal Reserve Bank of Philadelphia and the only Fed policymaker to have been part of FOMC deliberations in the 1970s, indicated that at the time that the Memoranda of Discussion were published, "meetings were much more formal [with] less give-and-take and there was a tendency for people to come in with prepared statements, which made it difficult for the subsequent give-and-take that I think has become a real strength of the Committee (p. 4, 1993 Transcripts, October 5 conference call). Boehne's comment provides evidence that in a prior experience with this sort of transparency practice, the FOMC's discussion had been noticeably affected, despite a lag of five years before publication.

In his testimony before the House Banking Committee on October 13, Greenspan stated that "... central banks should be disclosing everything they can up to the point where the disclosure affects their effectiveness" (p. 27, Hearing, 1993a). In his subsequent testimony, Greenspan elaborated on his concerns that certain disclosure practices could impede the deliberation process, saying (p. 10, Hearing, 1993b):

> "A considerable amount of free discussion and probing questioning by the participants of each other and of key FOMC staff members takes place. In the wide-ranging debate, new ideas are often tested, many of which are rejected... The prevailing views of many participants change as evidence and insights emerge. This process has proven to be a very effective procedure for gaining a consensus around which a directive to the Open Market Desk can be crafted. It could not function effectively if participants had to be concerned that their half-thought-through, but nonetheless potentially valuable, notions would soon be made public. I fear in such a situation the public record would be a sterile set of bland pronouncements scarcely capturing the necessary debates which are required of monetary policymaking. A tendency would arise for one-on-one premeeting discussions, with public meetings merely announcing already agreed-upon positions or for each participant to enter the meeting with a final position not subject to the views of others."

Between the two Congressional hearings in October 1993, FOMC members were informed that the Fed staff had kept raw, unedited transcripts of

all FOMC discussions since 1976. Until this revelation, Fed officials thought that any changes in transparency practices would affect future, but not past, meetings. Although discussions were tape-recorded, most FOMC officials thought that these tapes were used to construct minutes and then recorded over at the next meeting. What few policymakers knew was that the staff prepared literal transcriptions of the tapes in the process of writing the minutes, and that these literal transcriptions were on file from 1976. With this revelation, the question was no longer whether to publish transcripts, but when to publish them, in what form, and after what time lag.

At its meeting in November 1993, the first item on the agenda was FOMC practices and, in short order, the committee voted to publish lightly-edited transcripts with a five-year delay in the case of meetings for which literal transcriptions were available,[15] and to defer the question of future practices pending further consideration by a sub-committee. What is notable about the transcript of this meeting is a decidedly scripted element to the discussion—official statements appear to have been prepared and read into the record and, in contrast with earlier meetings, there is much less give-and-take.

In January 1995, a sub-committee headed by Alan Blinder reviewed the transcript issue and proposed that the committee agree to continue with the publication of lightly-edited transcripts after a delay of five years. There was no clear consensus among policy officials regarding the effects of known transcription on the quality of deliberation and debate. The view of the sub-committee was that the FOMC would have been better served if the tape had never been running. An extreme view was offered by Reserve Bank President Hoenig who stated that "the tape has had some chilling effect on our discussions. I see a lot more people reading their statements." (p. 20, 1995 Transcripts, January meeting). But, Greenspan's tone was more moderate, noting that "there is very little evidence that the quality of our discussions has been reduced." (p. 22, 1995 Transcripts, January meeting). This variation in view suggests that, on the margin, the deliberative process may have been affected by the publication of the transcripts—the hypothesis we test in section 4.

[15] Fed attorneys obtained permission from the US Archivist to destroy the unedited, literal transcriptions once lightly-edited transcripts were published; other possible options would not have permitted the destruction of the literal transcriptions.

4 Test of the Deliberation Hypothesis

4.1 The FOMC Transcript Data

Although the Fed publishes the votes of FOMC members, the transcripts also provide an interesting source from which to assess agreement and disagreement among policymakers. Our dataset is taken from Meade (2002) which provides detail on the organization of FOMC meetings, the structure of discussion, and the construction of the data. In brief, meetings are divided into two "rounds" of discussion. In the first round officials present their general views on the economy, while in the second round officials discuss policy options. The second round culminates in a formal vote. The first policymaker to speak in the second round is Alan Greenspan, who generally offers lengthy remarks on his views and makes a policy recommendation. Other policymakers follow. At the end of the discussion, a formal vote is taken (with the chairman casting his vote first). Thus, the model used in this paper follows the actual structure of FOMC discussions in which a known expert, Greenspan, speaks first. Although there are only twelve voting members at any given FOMC meeting, it is typical for all nineteen policy officials to participate in both rounds of the discussion. It is therefore possible to ascertain whether non-voting participants behave differently from official voters with respect to the policy proposal.

Blinder *et al* (2001) noted strong internal pressure for official FOMC voters to agree with Greenspan's policy proposal, suggesting that official votes over-state the extent of consensus within the committee. The official votes do indeed suggest a strong element of consensus, with dissents during the Greenspan period averaging just over 6 percent. Interestingly, dissents have declined markedly since the end of 1993: between August 1987 (Greenspan's first FOMC meeting) and the end of 1993, official dissents were nearly 9 percent of all votes; since 1994, the dissent rate has been less than 4 percent. Krause (1994) found evidence that dissent rates have declined as the tenure of various Fed chairmen rose and attributed this to the rise in the number of Fed officials appointed during a chairman's term. Another possible explanation for the decline in official dissents during the Greenspan period is the hypothesis explored here.

Our dataset codes voiced policy preferences based on the transcripts for FOMC meetings between 1989 and 1997.[16] Because the policy under consideration at each meeting has two dimensions (a level for the Fed funds rate

[16] We did not use voiced preferences for 1988 owing to restricted availability of several explanatory variables.

and a policy "bias" or "tilt"), our dataset contains a policy preference on two variables, the short-term interest rate and the bias, for each participant who voiced a view. We focus on the short-term interest rate despite the fact that the Fed formally targeted borrowed reserves over much of our sample period (other researchers have done this as well, see Thornton and Wheelock, 2000). The policy bias figured in monetary policy from 1983 through 1999 and provides an indication of the likely direction of future policy moves. Bias was said to be "symmetric" if the likelihood of future tightening and easing were equal, and "asymmetric" in a specified direction if future tightening was more likely than easing or vice versa.

After some experimentation with the dating of a dummy variable to capture the effects of transcript release on the deliberation process, we decided to exclude observations for all 1993 meetings (our empirical results are not sensitive to this decision). It is difficult to determine with any certainty when meeting participants knew that the literal transcriptions existed and that their comments would eventually become public. In fact, the dating of this must range widely, because Greenspan knew about the existence of the literal transcriptions from late 1992, while some officials did not find out until the Gonzalez hearings in October 1993.[17] Thus, our empirical analysis examines the pre-tape period of 1989 through 1992 and the post-tape period of 1994 to 1997, a total of 56 FOMC meetings. From those 56 meetings, the transcript dataset contains 924 voiced preferences for the level of the Fed funds rate and 746 voiced preferences for the policy bias (voiced preferences are the views expressed by voting and non-voting meeting participants other than Greenspan and are not the official FOMC votes).

The frequency distribution for policymakers' agreement or disagreement with Greenspan's proposed rate and bias over the pre- and post-tape periods is shown in table 1. We have broken down the identity of policymakers into Board members (the Governors, excluding Greenspan, who vote at every FOMC meeting), voting Federal Reserve Bank Presidents (the New York Bank President and four others), and non-voting Presidents (seven participate but do not vote). In general, the degree of consensus has risen in the post-1993 period. With respect to the interest rate proposal, there has been a much greater increase in consensus for Board members than for voting Bank Presidents. With respect to the bias proposal, the rise in consensus for the three groups is very similar. Only the behavior of the non-voting Presidents with respect to the interest rate reflects greater dissensus after 1993 than before.

[17] In a conference call on 15 October 1993, Greenspan and other officials discussed when they first became aware of the literal transcriptions (see FOMC Transcripts).

4.2 Binomial Estimation Results

Next, we used binomial logit estimation to examine the effects of transcript release on voiced policy preferences. The dependent variable in the regressions was a binomial indicator of agreement (0) or disagreement (1) with the Greenspan proposal. The explanatory variables were a simple set of indicator, dummy variables, and interaction terms: a linear trend to capture effects associated with Greenspan's tenure on the committee (TREND), a dummy to pick up the effects of known transcription after 1993 (TAPE), a dummy to detect differences in behavior between Board members and Bank Presidents (BOARD), a dummy to distinguish between voting Bank Presidents and other meeting participants (BPVOTER), an interaction of the tape and Board dummies (TAPE*BOARD), and an interaction of the tape and voting Bank President dummies (TAPE*BPVOTER). In these initial regressions, we ignore the influence of macroeconomic data and forecast uncertainty on the decision to agree or disagree with Greenspan's policy proposal; in the next sub-section, we turn to a richer and more complicated formulation that includes these variables.

Table 2 provides coefficient estimates and standard errors for a standard logit and a random-effects logit specification. The coefficient on the TAPE dummy is significant and negative in all equations, indicating that once Fed policymakers knew that their discussions were being taped, they tended to voice greater agreement with Greenspan's proposals. The interaction term TAPE*BOARD is also negative and significant in the equations for the short-term interest rate, indicating that the effects of known taping were even more important for the behavior of Board members.

Table 3 summarizes the marginal effects of the dummies and interaction terms for each type of FOMC meeting participant. The estimated probability of disagreement with Greenspan's rate and bias proposals drops sharply after 1993.[18] This drop is roughly similar for the three types of participants with regard to the bias, but varies by group with regard to the interest rate. After 1993, the probability of dissent from the proposed interest rate is only 2 percent for a Board member and 8 percent for voting Bank Presidents. Interestingly, although the probability of dissent falls after 1993 for non-voting Bank Presidents as well, the estimated probability of dissent for this group remains higher than the estimated probability for the other two groups. These

[18]The estimated probability for each group before and after 1993 was calculated by setting the relevant dummy variables equal to 1 or 0, while other variables were set to their means. So, for example, to calculate the estimated probability of dissent for board members after 1993 we set TAPE=1, BOARD=1, BPVOTER=0, TAPE*BOARD=1, TAPE*BPVOTER=0, and TREND equal to its mean.

results may align with the magnitude of the reputational payoff parameter discussed above. Over the period studied, the term of a Board member averaged 5.8 years, less than the 12 year average of a Bank President. Thus, reputational concerns could play more of a role for Board members than for Bank Presidents, accounting for greater herding behavior and less dissent among the former than the latter after 1993. Although we do not examine separately the terms in office for voting and non-voting Bank Presidents, it would not be surprising if the reputational concerns of non-voters were weaker than for participants whose official votes are recorded.

Given the lower frequency of disagreement after 1993 on both interest rate and policy bias decisions, we considered the possibility that the results presented in Tables 2 and 3 might be influenced by heteroskedasticity, particularly with respect to the TAPE variable. Standard Lagrange multiplier tests indicated that our interest rate regressions were not influenced by heteroskedasticity but that this particular form of heteroskedasticity might be present in our bias regressions. Subsequently, we estimated a heteroskedastic probit model for both the interest rate and bias equations; in these heteroskedastic probit regressions, the equation's variance was estimated as a function of TAPE and TREND. The results were very similar to those reported in Tables 2 and 3. In addition, estimated probabilities of disagreement remained very similar to those reported in Table 3 when we split our sample into two time periods and estimated one logit equation using pre-1993 observations and another using post-1993 observations.

4.3 Multinomial Estimation Results

Finally, we used multinomial logit estimation which allows us to judge the effects of transcript release in a specification that controls for macroeconomic data and forecast uncertainty. In these regressions, the dependent variable was an indicator of agreement (0), dissent for tighter policy (1), or dissent for easier policy (-1) relative to Greenspan's proposal. The macroeconomic variables were: the weekly Fed funds rate (FF), the monthly unemployment rate (UNEMPL), the 1-month change in industrial production (IP), an estimate of the output gap (GAP), and the 1-month change in inflation (CPI); all variables were lagged one observation relative to the date of an FOMC meeting. In order to gauge the uncertainty of the economic situation at the time of the FOMC meeting, we used monthly forecasts for real GDP growth and inflation at one- and two-year horizons to construct forecast uncertainty

variables (denoted fGDP1, fGDP2, fCPI1, fCPI2).[19] In estimating these equations, we constrained the coefficients on our non-economic variables to be equal across the dissent for tighter policy (1) and dissent for easier policy (-1) categories.[20]

Table 4 provides results from the multinomial logit estimation. Table 5 gives the estimated probability of disagreement before and after 1993 for each type of FOMC participant. After controlling for macro data and uncertainty, the overall likelihood of dissent by each category of participant is somewhat smaller than the likelihoods given in Table 2. With regard to interest rates, the probability of dissent (for lower or higher rates) is smaller for Board members after 1993, is unchanged for voting Bank Presidents, and is higher for non-voting Bank Presidents. With regard to the bias, the likelihood of dissent is lower after 1993 for all meeting participants. Thus, the main result holds in a more complex specification that accounts for macroeconomic developments and uncertainty, and affirms some effect of known taping on the deliberation process.

5 Conclusion

In this paper, we have considered the effects of a specific type of transparency—the publication of detailed transcripts from monetary policy meetings—on the quality of a monetary policy committee's discussion and debate. We first developed a theoretical model of deliberation on a three-member monetary policy committee in which a known expert speaks first and all members of the committee are concerned both about making the correct policy decision and about having a good reputation in public. We showed that in this model the likelihood of having an informative equilibrium in which members accurately reveal private information is greater when deliberation takes place behind closed doors than when deliberation occurs in public. We then subjected this model to empirical testing using an original dataset on deliberations of the Federal Reserve's FOMC from 1989-1997. The Fed provides a natural experiment for testing our model because of an institutional change in 1993 after which the FOMC decided to begin releasing transcripts of its meetings after a delay of five years. During its 1993 debate over whether or not to change its transparency practices, FOMC officials discovered that the Fed's

[19] Forecast uncertainty for each variable at each forecast horizon was proxied by the standard deviation from a linear trend. The forecasts for real output growth and inflation were taken from Consensus Economics.

[20] In an unconstrained model standard tests suggested we could not reject the null that the coefficients on the political variables for the (1) and (-1) categories were equal.

staff had maintained literal transcriptions of FOMC meetings dating back to 1976. Thus, there are transcripts for FOMC meetings during a period when monetary policymakers did not know such transcripts existed (before 1993) and for a period when these officials knew that their deliberations would eventually be published (after 1993). Using simple binomial logit regressions and more complicated multinomial specifications that take into account the direction of dissent and macroeconomic data and uncertainty, we find that the empirical evidence gives clear support to our hypothesis. Fed policymakers appear to have responded to the decision to publish meeting transcripts by voicing less dissent with Greenspan's policy proposals for the short-term interest rate and policy bias. Our work provides some theoretical and quantitative evidence for one downside to transparency, in contrast to much of the literature that argues for greater openness in policymaking without considering any potential drawbacks.

A Appendix

A.1 Proof of proposition 1

Here we demonstrate the conditions for existence of a unique informative equilibrium, which under public deliberation is less likely to exist when reputational concerns are strong. The first step in this proof is to show that in the informative equilibrium each player will have an incentive to vote $v_i = 1$ if at least two players report a message of 1, and to vote 0 otherwise. If the voting round occurs in public, players would not gain in terms of reputation by deviating from this strategy as long as outside observers held the following, plausible out-of-equilibrium belief (meaning the belief after an action that never takes place in equilibrium) about the expertise of a player who voted $\widetilde{v}_i$ when the other two players voted v_i under public deliberation: $\Pr(h|m_i, \widetilde{v}_i) < \Pr(h|m_i, v_i)$. Likewise, no player would ever gain in terms of reputation from deviating if both the message round and voting round are private. Both under public and private deliberation, players would also anticipate that unilateral deviations from the equilibrium voting strategy would have no effect on the policy outcome. The only alternative voting strategy profile that could possibly constitute equilibrium behavior in this game would be for A to vote $v_a = s_a$, for B to vote $v_b = s_b$ and for C to vote $v_c = s_c$ if she is pivotal and $v_c = v_a$ otherwise.[21] This non-unanimous voting profile, which represents the same set of actions that occurs in our informative equilibrium, could only occur if during the message round neither B nor C reported their message truthfully. While it is technically possible for this to occur given that uninformative messages may always be equilibrium behavior, there is no obvious reason why this would ever take place unless the message round occurred in public and the voting round took place in private, a possibility we have not considered in this paper because this pattern of organization does not seem to be the case with actual committees (and certainly not the FOMC).

Moving to incentives in the message round, which have already been considered in detail in the text, when we substitute into (8) with $q = (p\lambda + (1-\lambda)0.5)$ we have the following condition for existence of the informative equilibrium, expressed in terms of the accuracy of the A's signal, the prior probability that B and C have a high level of expertise, and the weight placed

[21] In order for this to be the only other potential equilibrium voting strategy profile we would need to make the plausible assumption, which is commonly used in this type of game, that players do not pursue weakly dominated strategies. That is, a player would not vote for a less preferable option, just because she is not pivotal, and because doing so would have no effect on her reputation.

on the reputational payoff.

$$\begin{aligned} & (p\lambda + (1-\lambda)0.5) - \tfrac{p(1-(p\lambda+(1-\lambda)0.5))}{p(1-(p\lambda+(1-\lambda)0.5))+(1-p)(p\lambda+(1-\lambda)0.5)} \qquad (11) \\ > \quad & \beta(2\tfrac{p(1-(p\lambda+(1-\lambda)0.5))}{p(1-(p\lambda+(1-\lambda)0.5))+(1-p)(p\lambda+(1-\lambda)0.5)} - 1)(\tfrac{p\lambda}{p\lambda+0.5(1-\lambda)} - \tfrac{(1-p)\lambda}{(1-p)\lambda+0.5(1-\lambda)}) \end{aligned}$$

The alternative possibilities for informative equilibria in pure strategies under private deliberation can be ruled out as follows. First of all, it could never be an equilibrium for B to mimic A's signal and for C to subsequently report truthfully, because C would know that in the case where her message contradicted a truthful message sent by A, her belief about the state would be $\Pr(m_a = \omega | m_a, s_c) = \frac{(1-q)p}{(1-q)p+(1-p)q}$, which will always be greater than 0.5, given our assumption that $q < p$. Consequently, Player C would have an incentive to send the same message as A. Second, it can never be an equilibrium for B to report truthfully and for C to report truthfully in all cases (and not only when she is pivotal). If C observes that both A and B have sent the same message, and $s_c \neq m_a, m_b$, and Player C believes that these messages are truthful, then C's belief that the state is as announced by A and B will be simply p. Since $p > 0.5$ by definition, if C accurately reports her signal she will not change the belief about which state is more likely, and thus it will not change the final outcome a. As a consequence, when deciding what message to send, player C will only take into account the impact on her reputational payoff $\Pr(h|m_c, \omega)$. If after revelation of the state $m_c = \omega$ this payoff is $\frac{\Pr(m_c=\omega|h)\lambda}{\Pr(m_c=\omega|h)\lambda+\Pr(m_c=\omega|l)(1-\lambda)} = \frac{p\lambda}{p\lambda+0.5(1-\lambda)}$. If after revelation of the state $m_c \neq \omega$ this payoff is $\frac{(1-p)\lambda}{(1-p)\lambda+0.5(1-\lambda)}$. Since the reputational payoff will clearly be higher if the state is guessed accurately, player C would not have an incentive to report her signal accurately.

A.2 Proof of proposition 2

Proposition 2 is proved by demonstrating that when reputational concerns are sufficiently strong, there is a range of parameters for which an informative equilibrium exists under private deliberation, but this equilibrium does not exist under public deliberation. Based on the conditions for informative equilibrium under public deliberation established above, we can draw this conclusion by showing that the informative equilibrium will always exist when deliberation occurs in private. The incentives for Player C have already been considered in the text. Player B will earn higher expected utility from truthful reporting as long as the following inequality is satisfied (which shows

expected utility from truthful and false reporting).

$$q + \beta(q \Pr(h|a = w) + (1 - q) \Pr(h|a \neq w)) > \frac{p(1-q)}{p(1-q)+(1-p)q} + \beta(\frac{p(1-q)}{p(1-q)+(1-p)q} \Pr(h|a = w) + (1 - \frac{p(1-q)}{p(1-q)+(1-p)q}) \Pr(h|a \neq w)) \tag{12}$$

This expression can be simplified in the following steps.

$$q - \frac{p(1-q)}{p(1-q)+(1-p)q} > \beta((\frac{p(1-q)}{p(1-q)+(1-p)q} - q) \Pr(h|a = w) + (q - \frac{p(1-q)}{p(1-q)+(1-p)q}) \Pr(h|a \neq w)) \tag{13}$$

$$1 > \beta(\Pr(h|a \neq w) - \Pr(h|a = w)) \tag{14}$$

The above inequality will always be satisfied as long as

$$\Pr(h|a = w) > \Pr(h|a \neq w) \tag{15}$$

$$\frac{\Pr(a=w|h)\lambda}{\Pr(a=w|h)\lambda+\Pr(a=w|l)(1-\lambda)} > \frac{\Pr(a\neq w|h)\lambda}{\Pr(a\neq w|h)\lambda+\Pr(a\neq w|l)(1-\lambda)} \tag{16}$$

$$\Pr(a = w|h) > \Pr(a = w|l) \tag{17}$$

This inequality will always be satisfied given the specified equilibrium strategy where B reports truthfully.

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Table 1. Percent disagreeing with Greenspan policy proposal

	Pre-1993	Post-1993
	Short-term Interest Rate	
Voting Board members	11.4	3.1
Voting Bank Presidents	17.8	13.8
Non-voting Bank Presidents	14.6	22.9
	Policy Bias	
Voting Board members	26.2	10.3
Voting Bank Presidents	28.4	11.3
Non-voting Bank Presidents	23.6	9.3

Table 2. Binomial Logit Estimates[1]

Dependent variable: Agreement with Greenspan proposal (0), Dissent (1)

	Short-term Interest Rate			
	Logit[2]	SE	Logit w/RE	SE
TREND	0.04	(0.01)	0.05	(0.01)
TAPE	-0.86	(0.48)	-1.20	(0.56)
BOARD	-0.30	(0.37)	-0.07	(0.55)
BPVOTER	0.26	(0.33)	0.22	(0.37)
TAPE*BOARD	-1.94	(0.61)	-2.27	(0.71)
TAPE*BPVOTER	-0.89	(0.44)	-0.66	(0.48)
No. observations	924		924	
Pseudo R^2	0.06		Chi bar[2]	31.65

	Policy Bias			
	Logit[2]	SE	Logit w/RE	SE
TREND	0.00	(0.01)	0.00	(0.01)
TAPE	-1.02	(0.60)	-1.11	(0.59)
BOARD	0.14	(0.31)	0.19	(0.42)
BPVOTER	0.25	(0.31)	0.42	(0.34)
TAPE*BOARD	-0.02	(0.50)	0.04	(0.56)
TAPE*BPVOTER	-0.03	(0.51)	-0.14	(0.54)
No. observations	746		746	
Pseudo R^2	0.05		Chi bar[2]	11.61

[1]Constants included but not reported.
[2]Equations estimated using White standard errors.

Table 3. Estimated probability of disagreement with Greenspan policy proposal (based on marginal effects from binomial logit regression, standard errors in parentheses)

	Pre-1993		Post-1993	
	Short-term Interest Rate			
	Prob	SE	Prob	SE
Voting Board members	0.22	(0.06)	0.02	(0.01)
Voting Bank Presidents	0.33	(0.07)	0.08	(0.02)
Non-voting Bank Presidents	0.27	(0.06)	0.14	(0.03)
	Policy Bias			
	Prob	SE	Prob	SE
Voting Board members	0.25	(0.07)	0.11	(0.04)
Voting Bank Presidents	0.27	(0.07)	0.12	(0.04)
Non-voting Bank Pres.	0.23	(0.06)	0.10	(0.03)

Table 4. Multinomial Logit Estimates
Dependent variable: Dissent for lower (-1), Agreement (0), Dissent for higher (1)

	Short-term Interest Rate			
	Coefficient	SE	Coefficient	SE
	Dissent for lower rate (-1)		Dissent for higher rate (1)	
TREND[1]	0.06	(0.03)	0.06	(0.03)
TAPE[1]	0.95	(0.75)	0.95	(0.75)
BOARD[1]	-0.32	(0.37)	-0.32	(0.37)
BPVOTER[1]	0.28	(0.35)	0.28	(0.35)
TAPE*BOARD[1]	-1.95	(0.62)	-1.95	(0.62)
TAPE*BPVOTER[1]	-0.92	(0.45)	-0.92	(0.45)
FF[2]	0.61	(0.34)	0.96	(0.32)
UNEMPL[2]	3.49	(0.78)	0.70	(0.71)
IP[2]	-0.95	(0.49)	-0.19	(0.23)
GAP[2]	-0.63	(0.42)	-0.04	(0.33)
CPI[2]	0.18	(0.15)	-0.16	(0.09)
fGDP1	-1.92	(3.39)	-5.60	(2.12)
fGDP2	0.54	(3.58)	-0.20	(2.12)
fCPI1	-7.16	(2.63)	-2.36	(1.86)
fCPI2	0.87	(3.82)	8.12	(2.73)
No. observations	924		Pseudo R^2	0.18

	Policy Bias			
	Coefficient	SE	Coefficient	SE
	Dissent for lower rate (-1)		Dissent for higher rate (1)	
TREND[1]	-0.08	(0.03)	-0.08	(0.03)
TAPE[1]	-1.38	(0.82)	-1.38	(0.82)
BOARD[1]	0.19	(0.32)	0.19	(0.32)
BPVOTER[1]	0.40	(0.33)	0.40	(0.33)
TAPE*BOARD[1]	-0.01	(0.51)	-0.01	(0.51)
TAPE*BPVOTER[1]	-0.13	(0.51)	-0.13	(0.51)
FF[2]	-0.87	(0.39)	-0.33	(0.40)
UNEMPL[2]	-2.28	(0.84)	-0.87	(0.92)
IP[2]	-0.03	(0.38)	0.72	(0.30)
GAP[2]	0.43	(0.33)	0.25	(0.27)
CPI[2]	0.07	(0.18)	0.03	(0.08)
fGDP1	4.25	(3.69)	-0.14	(2.48)
fGDP2	0.25	(2.29)	-4.41	(2.37)
fCPI1	-0.04	(4.50)	-1.03	(2.19)
fCPI2	-16.09	(7.30)	-5.15	(2.85)
No. observations	746		Pseudo R^2	0.11

Equations estimated using White standard errors. Constants included but not reported.
[1]Coefficients constrained to be equal across categories. [2]Variables lagged one observation relative to date of meeting.

Table 5. Estimated probability of disagreement with Greenspan policy proposal (based on marginal effects from multinomial logit regression, standard errors in parentheses)

Short-term Interest Rate

Dissent for lower rate

	Pre-1993		Post-1993	
	Prob	SE	Prob	SE
Voting Board members	0.01	(0.01)	0.00	(0.00)
Voting Bank Presidents	0.02	(0.01)	0.02	(0.01)
Non-voting Bank Presidents	0.01	(0.01)	0.03	(0.01)

Dissent for higher rate

	Pre-1993		Post-1993	
	Prob	SE	Prob	SE
Voting Board members	0.04	(0.02)	0.02	(0.01)
Voting Bank Presidents	0.07	(0.03)	0.07	(0.00)
Non-voting Bank Presidents	0.06	(0.03)	0.13	(0.04)

Policy Bias

Dissent for lower rate

	Pre-1993		Post-1993	
	Prob	SE	Prob	SE
Voting Board members	0.07	(0.03)	0.02	(0.01)
Voting Bank Presidents	0.08	(0.03)	0.02	(0.01)
Non-voting Bank Presidents	0.06	(0.02)	0.02	(0.01)

Dissent for higher rate

	Pre-1993		Post-1993	
	Prob	SE	Prob	SE
Voting Board members	0.18	(0.08)	0.05	(0.02)
Voting Bank Presidents	0.21	(0.09)	0.06	(0.02)
Non-voting Bank Presidents	0.15	(0.07)	0.05	(0.02)

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