Central Banking with Many Voices: The Communications Arms Race

Annette Vissing-Jorgensen, University of California Berkeley and NBER*

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Abstract. Federal Reserve policy is set by group decision making. If policy makers care about being predictable (i.e., not choosing a policy that differs from prior policy maker guidance), they compete for the attention of financial markets because those who succeed in moving the markets' policy expectations gain the upper hand in policy making. This leads to a cacophony of public appearances but also to a "quiet cacophony" of informal communication between policy makers and market newsletters or the news media. Informal communication gets around the FOMC's internal norm to not comment on the views of colleagues and rules against disclosing classified information. I provide: (1) a brief review of recent evidence suggesting that informal communication from the Fed has had a large stock market impact, (2) an account of discussions of leaks in FOMC documents, and (3) a model of the game theory of the quiet cacophony. Policy makers care about market expectations and are able to distort these by selectively revealing information. With sufficient disagreement, the game resembles a prisoners' dilemma. All policy makers use informal communication even though it reduces welfare via reduced policy flexibility and harms the Fed's reputation and the quality of its deliberations. I discuss approaches to improve the current undesirable state of affairs.

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1 Introduction

Around the world most central banks set policy by committee. This is motivated in part by the idea that groups reach better decisions than individuals and in part by a desire for representation of different geographical areas and economic constituencies in policy making. The Bank for International Settlements (2009) documents that across central banks, the median number of members on monetary policy boards is eight. The Federal Reserve and the ECB have substantially more decision makers than the median, with 19 members of the Federal Open Market Committee (of which 12 vote at any given time) and 25 members of the ECB's Governing Council (of which 21 vote at any given time).

An emerging literature recognizes the tension between decision making by committee and effective monetary policy communication. I focus my analysis on the Federal Reserve and start from the observation that most policy makers give frequent public appearances or comments to discuss their views of the economy and the appropriate policy response. This is the much lamented "cacophony" of speeches and comments by Federal Reserve officials. Faust (2016) argues that the cacophony can be viewed as a tug-of-war over public sector expectations, with these expectations affecting future policy. He calls for game-theoretical work to understand this communications arms race better.[1]

In this paper, I argue empirically and theoretically that the cacophony problem is even worse than commonly appreciated. In particular, the tug-of-war over public sector expectations results not only in a public cacophony of Fed voices, but also in a "quiet cacophony" of Fed policy makers seeking to drive market expectations via informal channels such as the media and market newsletters. I review recent work in asset pricing that documents large asset price movements at times of Federal Reserve debate and decision making that are not associated with public Fed communications. The main papers are Lucca and Moench (2015) on the pre-FOMC drift, Cieslak, Morse and Vissing-Jorgensen (2019) of stock returns over the FOMC cycle and Morse and Vissing-Jorgensen (2019) on abnormal stock returns on days with private interactions (calls/meetings) between Federal Reserve Board governors and Federal Reserve Bank presidents.

I then provide a history of leak discussions in FOMC documents for the period 1948-2013

[1] Recent speeches by policy makers recognize the difficulty of communicating with many voices. Examples includcde speeches by Fischer and Powell available at:
https://www.federalreserve.gov/newsevents/speech/fischer20170303a.htm
https://www.federalreserve.gov/newsevents/speech/powell20161130a.htm

in order to show that the FOMC itself expresses frequent concerns about leaks. I draw on these leak discussions to understand what motivates leaks. My reading suggests that leaks are often motivated by disagreement between policy makers and are used for tactical advantage in the policy making process. The attractiveness to the individual policy maker appears to stem from the FOMC's view that prior disclosure about policy to some extent ties the hands of the committee. Therefore, policy makers may seek to advocate for their preferred policy by selectively disclosing internally-known information that supports their view – what one could refer to as "spin". Crucially, if advocacy relies on the disclosure of internal (confidential) information (about the views of colleagues, internal projections, etc.) then it must be done via informal channels such as newspaper and financial markets newsletters through which the policy makers disclosing the information can remain anonymous and thus unpunishable. To support the claim that advocacy is more effective if supported by confidential information, I review work from the political science literature.

I use the insights gained from studying FOMC documents to provide a simple game-theoretic model of the communication arms race in order to understand the equilibrium outcome. Consistent with my reading of the FOMC narrative, the model relies on two assumptions. First, policy makers care about not being viewed as "flip-flopping", in the sense of choosing a policy that differs from prior policy maker guidance about policy preferences. Therefore, providing information about policy maker preferences reduces policy flexibility by creating a loss from setting a policy rate that differs from market expectations formed based on that information. Second, policy makers with access to internal central bank deliberations are to some extent able to distort (spin) market perceptions of policy preferences. Specifically, given a true average policy preference (known internally to policy makers), a policy maker can advocate for his or her preferred direction by selectively revealing internal information that supports a claim that policy makers' average preferred policy rate is higher (or lower) than is in fact the case.

If communication reduces flexibility and spin is possible, a given policy maker has an incentive to distort market perceptions about the average policy preference in his/her preferred direction because this will tend to move the actual policy rate chosen in this direction. In the model, two policy makers decide what to communicate to the public at an intermediate date between policy meetings. If either of them communicates with the public, policy makers incur a loss if the chosen policy rate deviates from the average preferred policy rate communicated at the

intermediate date. As a result, with communication, the chosen policy rate is a weighted average of the average preferred policy rate at the time of the meeting and the markets' perceived average preferred policy rate communicated at the intermediate date. If disagreement is sufficiently strong (judged relative to the amount of news that may arrive before the next policy meeting) and sufficient spin is possible, the unique Nash equilibrium is that each policy maker communicates with his preferred spin. However, since policy makers seek to drive market expectations in opposite directions, their advocacy cancels each other out. The net effect of communication is to reveal all internal information about average policy preferences. This disclosure reduces the ability to react to information arriving between the intermediate date and the next policy meeting and results in both policy makers being worse off than they would be if they could each commit to not using informal communication. The model is analogue to a prisoners' dilemma in which both prisoners would be better off if neither confessed but both confess in equilibrium.

The theoretical result that informal communication can lead policy makers to be worse off in equilibrium is consistent with the repeated frustration about leaks expressed in FOMC transcripts. The welfare loss from leaks in the model stems from lost policy flexibility. In addition to concerns about effects on policy flexibility, the FOMC documents reveal policy maker concern about leaks damaging both the Fed's reputation (as market integrity suffers if some in the market obtain confidential information) and the Fed's decision making process (as worries about leaks threaten the free give-and-take of ideas that are at the heart of group decision making). The model focuses on the cost from lost flexibility since this is what induces the temptation to leak. However, the other two costs are potentially equally important from a welfare perspective. For example, the perception that internal divisions lead to inside access of some in the media or in markets does not help the Fed's struggle to retain its political independence.

My negative view of the welfare effects of leaks contrasts with the literature on the freedom of the press and the benefits of advocacy. Gentzkow and Shapiro (2008) reviews this work and cite a key Supreme Court decision: " The First] Amendment rests on the assumption that the [...] dissemination of information from diverse and antagonistic sources is essential to the welfare of the public". The Fed's use of informal communication is different because public knowledge of internal confidential information is not helpful if it leads to reduced policy flexibility as well as damage to the Fed's reputation and deliberative process. There is good reason this information is made confidential in the first place.

In the last section of the paper, I discuss what can be done to improve the situation. I argue that the loss in policy flexibility from disclosure of information stems from a lack of understanding by the public of the Fed's policy reaction function. If the public fully understood how the Fed thinks, the Fed would not look less competent if it had to deviate from prior policy projections due to incoming news. One issue that makes it difficult for the public to learn the Fed's reaction function is that there is no single Fed decision maker. Given the rotation of voting among Reserve Bank presidents, there is not even a stable set of Fed decision makers. I speculate that reducing the number of policy makers and eliminating the rotation schedule may simplify communication and improve the public's understanding of the Fed's reaction function. This would involve having a subset of the current Reserve Bank presidents vote at all FOMC meetings. In practice, one could envision combining the 12 current Reserve Bank districts into a smaller set of "Super Reserve Banks" who always voted.

2 Evidence on the importance of informal communication

2.1 Review of work in asset pricing

An important paper in the literature on the impact of the Fed on asset prices is Lucca and Moench (2015). The paper documents an average return on the S&P500 of about 50 basis points (bps) in the 24 hours before scheduled FOMC announcements over the period from 1994–2011. They argue that this return is puzzling because no news appears to arrive during this period. They argue against a leak-based explanation because the monetary policy news coming out would have to be systematically positive and because leaks are "unrealistic from an institutional viewpoint".

Cieslak, Morse and Vissing-Jorgensen (2019) (CMVJ) study the return of the stock market over the full period between FOMC meetings. They document that over the "FOMC cycle", average 5-day stock returns are large not only in the week around the announcement (as Lucca and Moench showed), but also in weeks 2, 4 and 6 after the announcements. They argue based on a series of evidence that the high even-week returns are in fact driven by monetary policy news which over the post-1994 period has been positive for the stock market on average and has reached markets via informal communications channels. First, they show that changes to the Fed funds target (rare post-1994 but common before that) tend to take place in even weeks in FOMC cycle time, implying that Fed debate and decision making appears to take place disproportionately at these times. Second, they document that rates on Fed funds futures on average declined in even

weeks, consistent with unexpectedly accommodating monetary policy news. Third, even-week stock returns are higher following board meetings of the Board of Governors (with even-week meetings more important likely due to the board having a full fresh set of policy recommendations from the Reserve Banks), consistent with even-week returns being driven by information created and disseminated from the Fed. Fourth, they show that about half of the even-week returns arise due to even-week mean-reversion in the stock market following market declines. This pattern fits a "Fed put" interpretation, where the Fed provides accommodation (or promises accommodation should things get worse) following market declines, with this Fed put being stronger than expected in the post-1994 sample.[2] Finally, CMVJ find that the high even-week returns are robust to controlling for macroeconomic news releases, corporate earnings announcements and reserve maintenance periods. Their findings imply that unexpectedly accommodating monetary policy has been a central driver of the realized US equity premium over the post-1994 period. In terms of information transmissions channels, CMVJ do not find evidence that Fed information releases or speeches by Fed officials line up systematically with even weeks. They argue instead that information reaches markets via informal communication. While they provide some examples of leaks, by their nature, leaks are difficult to document.

Morse and Vissing-Jorgensen (2019) study detailed calendars of a subset of Federal Reserve governors (including chairs and some vice chairs). For the period February 2007 to November 2018, the available calendars contain about 29,000 items, with one item reflecting one appointment such as "Meeting with staff", or "Call with FR Bank President". Morse and Vissing-Jorgensen hypothesize that informal communication results from interaction of policy makers, as will be at the heart of the argument and model below. Over the period studied, the Board of Governors has tended to act as a group, with no dissents by governors. Morse and Vissing-Jorgensen therefore conjecture that interactions between governors and Federal Reserve Bank presidents play an important role for information transmission.[3] They classify calendar items into a set of categories based on the types of individuals and organizations with whom Fed policy

[2] Cieslak and Vissing-Jorgensen (2019) use textual analysis of FOMC minutes and transcripts to understand the economics underlying the Fed put and its emergence in the mid-1990s. They find that the Fed starts to focus more on the stock market in the mid-1990s and that the stock market is viewed as an important driver of consumption and, to a lesser extent, investment.

[3] Disagreement between Reserve Bank presidents may also matter but is harder to study. Since the Reserve Banks are not government agencies, they are not subject to Freedom of Information Act law. Only the New York Fed has published the calendar of its president.

makers interact. To assess which types of interactions are perceived as most important by policy makers themselves, Morse and Vissing-Jorgensen regress daily calendar item dummies on the value of VIX on the prior day. If important meetings are scheduled or not canceled in times of market stress, this approach identifies categories of items that are important and flexible in terms of scheduling. Both interactions between governors and Federal Reserve Bank presidents and FOMC interactions emerge as important based on this approach. In return analysis, stock returns in even weeks in FOMC cycle time are shown to be significantly higher on even-weeks days with governor-president interactions, FOMC interactions or Fed conference interactions. These three categories account for most of the even-week effect with the former two categories more important in economic terms. Governor-president interactions are associated with particularly high even-week returns on days that follow Board of Governors board meetings, further supporting the idea that information is created and disseminated around times of policy-maker interactions. Analysis of hourly data documents high even-week returns following the start of calendar items of the three types mentioned, consistent with a causal interpretation and counter to a story of endogenous scheduling of meeting following high intra-day returns. Furthermore, high even-week day returns on days with governor-president interactions or FOMC interactions are not driven by speeches by policy makers, consistent with a central role for informal communication.

2.2 Leak discussions in FOMC documents, 1948-2013

Table 1 provides a list of leak discussions in FOMC documents. I constructed the list by searching the Board of Governors website (https://www.federalreserve.gov/) for the words "leak", "Washington Post", "Wall Street Journal", and "New York Times" in the "FOMC information" category and reading the relevant documents. I dropped leak discussions not related to monetary policy (e.g., leaks about fiscal policy). It is apparent from the table that leaks are a repeated issue of concern for the FOMC itself, with 114 FOMC documents containing discussion of leaks. In most cases, each FOMC document corresponds to one FOMC meeting or conference call (exceptions include leak mentions in the greenbook or in memos).

Figure 1 graphs the number of FOMC documents per year with leak discussions. The average number is 1.7 documents per year, with a slight upward trend. Leak discussions take various forms. Sixty-four of the documents discuss one or more recent leaks or possible leaks. Fourty-four discuss the risk of leaks (including 8 warnings not to leak), 4 are about congressional

hearings into leaks, and a few are jokes/comments about leaks or lack of leaks.[4] The list is unlikely to be comprehensive since FOMC participants may have used other words to discuss leaks. More importantly, to the extent that informal communication is a regular part of Fed business, only the more egregious leaks may be discussed at FOMC meetings.

A repeated theme in the FOMC documents is the difficulty of detecting leakers, with efforts presumably hampered by to the large number of policy makers. To my knowledge, the only case in which a leak led to the resignation of a policy maker is the 2017 resignation of Richmond Fed President Lacker following admission of his involvement in the leak of confidential FOMC information to Medley Global Advisers in 2012. Medley Global Advisers, which was founded in 1995, was also involved in another major leak discussed in the June 1999 transcripts. Leaks to Macroeconomic Advisers, another policy intelligence firm like Medley Global Advisers, are also discussed in the FOMC transcripts.

2.3 Steps taken to reduce leaks

As evidence of the importance of Fed leaks, it is helpful to document steps taken to try to avoid them.

FOMC statements: As discussed in CMVJ (2019), the decision by the Fed to release FOMC statements emerged after pressure from Congress in the early 1990s following a series of leaks. The idea that announcements of policy decisions may help reduce leaks is a recurring theme in FOMC leak discussions.

Press conferences: Leaks may have also contributed to the introduction of press conferences after FOMC meetings. The first press conference was in April 2011, just two meetings after the most extensive discussion of leaks at FOMC meetings, according to the available transcripts. This discussion led to the FOMC's first "Policy on External Communications of Committee Participants".[5] The first principle of the policy refers to the press conferences:

"Committee participants will endeavor to enhance the public's understanding of monetary

[4] The most recent document is perhaps the most interesting. In the December 2013 transcript Chairman Bernanke mentions a memo he has sent to the Conference of Presidents (consisting of the 12 Reserve Bank presidents) regarding information security at the Reserve Banks. The Fed has declined my FOIA request for this memo and the associated Fed analysis of the issue.

[5] The policy is available at:
https://www.federalreserve.gov/monetarypolicy/files/FOMC_ExtCommunicationParticipants.pdf

policy. They are free to explain their individual views but are expected to do so in a spirit of collegiality and to refrain from characterizing the views of other individuals on the Committee. In explaining the rationale for announced Committee decisions, participants will draw on Committee communications and the Chairman's press conference remarks as appropriate."

Initially the press conference started at 2:15 p.m., following the release of the FOMC meeting statement at 12:30 p.m. In March 2013, the statement release was moved to 2 p.m. with the press conference starting at 2:30 p.m. Bloomberg attributed this shift to leaks by FOMC members in the period before the press conference (which is part of the blackout period), with Bernanke reducing the time between the statement and the press conference to take control of the message:

"Bernanke Tightens Hold on Fed Message Against Hawks. Ben S. Bernanke is tightening his control of Federal Reserve communications to ensure investors hear his pro-stimulus message over the cacophony of more hawkish views from regional bank presidents. The Fed chairman, starting tomorrow, will cut the time between the release of post-meeting statements by the Federal Open Market Committee and his news briefings, giving investors less opportunity to misperceive the Fed's intent."[6]

Withholding information from other policy makers: CMVJ argue that discount rate requests from the twelve Reserve Banks play a central role in policy making by providing information about how policy preferences evolve. Discount rate requests are submitted by the Reserve Banks to the Board of Governors. A 1996 Washington Post article about a leak clarifies how the board withholds the identity of which Reserve Bank made a given request from the other Reserve Banks:

"After the Fed Board meets each week (normally on Monday morning), the dozen reserve bank presidents are notified whether any change in the discount rate was approved. Coyne said the presidents are told how many banks sought a change and its size, but the recommendations of individual banks are not identified. Thus, the naming of the San Francisco, Minneapolis and Richmond banks as those seeking a half percentage point increase suggests that the leak must have come directly or indirectly from someone with access to information normally known only to the Fed Board and a handful of senior board

[6] https://www.bloomberg.com/news/articles/2013-03-19/bernanke-tightens-hold-on-fed-message-against-hawks

staff."[7]

Related, the members of the Board of Governors (by the nature of their position) do not make discount rate requests and can thus more easily keep their policy preferences private if they so desire. The fact that there is no formal mechanism for the Reserve Banks to obtain information about the preferences of other Reserve Banks and of the board may explain why Morse and Vissing-Jorgensen (2019) find such an important role for calls/meetings between the governors and the Reserve Bank presidents.

Limit attendance: A standard response to leaks is to limit attendance or avoid written documentation. In a survey by Linsky (1986) of around 500 current or former Federal government officials, 74% report being concerned about leaks. Of these, 77% report that their concern about leaks led them to limit the number of people involved in decision making, and 75% report that they reduced the amount of information they put in writing. These standard responses to leaks also appear in FOMC documents. After years of leaks, in July 1983 Chairman Volcker was so upset with recent leaks that he limited the policy making discussion at FOMC meetings to the committee members. Perhaps in recognition that reducing attendance would not solve the problem if leaks were made by committee members, he noted in the June 1982 meeting:

> *CHAIRMAN VOLCKER. "There's only one recourse, which is obvious, if we have some sense of lack of confidentiality. There are a lot of people in this room and we could make it quite a few fewer; we can't make it less than the Committee members."*

3 The mechanics of informal communication

To understand the basics of how informal communication works, this section draws on the FOMC leak discussions as well as work in political science. I argue that leaks are often motivated by policy makers seeking to affect policy outcomes by changing public expectations. I also review the costs of leaks. FOMC documents show repeated concern about how leaks imply lost flexibility in policy making, are detrimental to the Fed's reputation, and are harmful for the Fed's deliberative process.

[7] https://www.washingtonpost.com/archive/politics/1996/09/18/apparent-leak-of-advice-on-rates-shocks-the-fed/295fc4cd-2be8-4883-8ccf-50a538176988/?utm_term=.5fa386d5296d

3.1 Tactical advantage from changing public expectations

3.1.1 Internecine leaks and counter-leaks

The political science literature distinguishes between several types of leaks. Drawing on earlier work by Hess, Pozen (2013) lists the following types:

- *Policy leak:* Intended to help, hurt, or alter a plan or policy. Subtypes of the policy leak include the *internecine leak*, "through which competing agencies or factions within the executive branch strive to strengthen their relative positions", and the *counter-leak* (or record-correction leak), "intended to neutralize or dispute prior disclosures";
- *Trial-balloon leak:* Used to test the response of key constituencies, members of Congress, or the general public;
- *Whistleblower leak:* Meant to reveal a perceived abuse;
- *Ego leak:* Used to satisfy the leaker's sense of self-importance;
- *Goodwill leak:* Meant to curry favor with a reporter;
- *Animus leak:* Meant to settle grudges or embarrass others; and
- *Inadvertent or lazy leak:* Happens by accident or ignorance with no particular instrumental aim in mind.

In the above-mentioned survey of government officials by Linsky, 42% answered yes to the question "Did you ever feel it appropriate to leak information to the press?". The most commonly cited reasons for leaking were "to counter false or misleading information" (78%) and "to gain attention for an issue or policy option" (73%). This implies a central role for internecine leaks and counter-leaks in US government policy making. Linsky's survey is also informative about how leaks may succeed in serving the interest of the leaker: The third most common reason for leaking was "to consolidate support from the public or a constituency outside government" (64%).

I next provide evidence from FOMC documents to argue that similar issues are relevant in the Fed context in that (a) internecine leaks and counter-leaks are important, and (b) they matter because they affect public perceptions, not in the sense that some in the public will come to the support of a particular policy maker's view but in the sense that once public perceptions are formed, the Fed is reluctant to not deliver on those expectations.

3.1.2 Bernanke's frustration with leaks for tactical advantage

Appendix A contains a memo sent by Chairman Bernanke to the Federal Open Markets Committee in August 2010 regarding recent stories in the press. The memo suggests that Bernanke views these stories as policy leaks (internecine leaks) motivated by disagreement within the FOMC:

> *CHAIRMAN BERNANKE. "[...] it damages the reputation and credibility of the institution if the outside world perceives us as using leaks and other back channels to signal to markets, to disseminate points of view, or to advance particular agendas"*
>
> *CHAIRMAN BERNANKE. "[...] It is my hope that FOMC participants or observers are not intentionally or tactically conveying confidential information to the public."*

The memo also indicates what type of leaks are most valuable for those leaking:

> *CHAIRMAN BERNANKE. "It is particularly important not to characterize the views of another participant at the meeting."*

Chairman Volcker more colorfully expresses the same sentiment of internecine leaks driven by policy disagreement in the November 1982 transcript:

> *CHAIRMAN VOLCKER. "I think there is a tendency on the part of any organization, for people to say "Damn it! If somebody else is leaking, I'm going to talk to a reporter, too, and get my story out." Unless this is stopped, it's just going to cut us up."*

3.1.3 Leaks affect policy by driving market expectations

Supporting the idea that Federal Reserve policy makers care about market expectations of policy, the Fed surveys both primary dealers (in the Survey of Primary Dealers) and a set of institutional investors (in the Survey of Market Participants) about their expectations for policy prior to each FOMC meeting. Attesting to the impact of these market expectations on policy, in 2017 a private company (Macropolicy Perspectives) launched what they refer to as the *Shadow Survey of Market Participants* in order to "collect information about consensus expectations that the FOMC uses as an input into its policy decisions" and release this information to interested buyers prior to the FOMC meeting.[8]

[8] https://www.newyorkfed.org/medialibrary/media/research/conference/2019/quantitative_tools/Post_Rosner_NYATLFed

Examples from FOMC documents also provide evidence of the importance of market expectations for policy. Richard Fisher, President of the Federal Reserve Bank of Dallas expresses his concern about informal communication driving market expectations and thereby reducing policy flexibility at the June 2012 FOMC meeting:

> *MR. TARULLO. "You accused somebody here of leaking. You didn't identify who it was, but you said there was a leak."*
>
> *MR. FISHER. "What I'm saying is, I think we should work extremely hard to preserve every option that is debated at this table, and I have just noticed that this has been more intensely covered than I have seen in my seven years of sitting at this table. Everybody in this room is a decent person. I'm not casting any aspersions against anybody in this room. I'm just saying that if we can—in every way possible, however we do it—**we should try to preserve the options to be debated at this table, and then not use the argument that markets expect us to do X or Y. What is leading the markets to expect that? I haven't seen this broad-based discussion that we are having in the speeches.**"*

Chairman Bernanke states at the December 2011 FOMC meeting in response to recent leaks:

> *CHAIRMAN BERNANKE. "I also wanted, though, to mention today some press reports on the timing of our communications initiatives. It appears that at least one report had information about the agenda, in particular, that we would be discussing those matters today and providing public information in January. The substance of our discussions today on interest rate projections and on principles, inflation targets, and those sorts of issues, are well known. They were in the minutes, and they were discussed by a number of people in speeches, and so on, but **it does complicate the work of the subcommittee and of this Committee if the expectations of the public are for delivery of certain outcomes at certain dates**."*

Chairman Greenspan and Vice Chairman Corrigan state at the October 1989 FOMC meeting in response to recent leaks:

> *CHAIRMAN GREENSPAN. " ...] Secondly, let me just indicate to those to whom I haven't spoken that those articles in The Washington Post and The New York Times yesterday were not authorized releases. They were not done by myself nor anyone I'm aware of. I'm not sure at this stage particularly what damage was done, but **it clearly has very severely***

restricted our options, or it could. *I hope that during this period everyone will endeavor to stay away from the press."*

VICE CHAIRMAN CORRIGAN. "Mr. Chairman, if I could, I'd like to add a point on those unfortunate press articles. ***It is clear to me that they have already done some damage in terms of reducing [our] flexibility*** *and undermining discipline in the marketplace. It is absolutely essential, regardless of what the motivation for those particular articles may have been, that there is only one person who speaks for the Federal Reserve in these circumstances and that is you."*

In terms of reducing flexibility, Federal Reserve officials appear to think of formal and informal disclosure similarly (though perhaps with public disclosure more committal). Chairman Greenspan has argued that public disclosure ties the hands of policy makers going forward:

CHAIRMAN GREENSPAN. "Earlier release of the Directive would [...] force the Committee itself to focus on the market impact of the announcement as well as on the ultimate economic impact of its actions. To avoid premature market reaction to mere contingencies, ***FOMC decisions could well lose their conditional character****. Given the uncertainties in economic forecasts and in the links between monetary policy actions and economic outcomes,* ***such an impairment of flexibility in the evolution of policy would be undesirable****."* [1991, cited in Cieslak, Morse and Vissing-Jorgensen (2019)]

Similarly, Vice Chairman Kohn wrote in the minutes from the July 1993 FOMC meeting:

VICE CHAIRMAN KOHN. "In its discussion, the Committee reaffirmed its long-standing rules governing the confidentiality of FOMC information, including the schedule that calls for releasing the minutes of a Committee meeting, along with an explanation of the Committee's decisions, a few days after the next meeting. ***These rules are designed to safeguard the Committee's flexibility to make needed adjustments to policy*** *and also to provide adequate time to prepare a full report of the context and rationale for its decisions."*

I interpret these quotes as saying that once the Fed has publicly disclosed information about its preferred policy, it is difficult later to adjust policy in light of new information. Importantly, notice that in Greenspan's thinking what reduces the flexibility of policy makers going forward is what has been disclosed by the Fed about policy (as opposed to market expectations in general). A

natural interpretation is that it is difficult to explain the state-contingent nature of optimal policy. This leads the Fed to look less competent (flip-flopping) if it does not deliver a policy consistent with what it had earlier led the market to believe would be its preferred policy. To capture this formally, in my model below, policy makers incur a loss if the chosen policy rate differs from market expectations of policy makers' average preferred policy rate, but only if policy makers have made prior disclosures about policy preferences. Stein and Sunderam (2018) argue that the Fed behaves as if it is averse to bond market volatility. This leads to an incentive to avoid policy choices that differ from market expectations, regardless of how those market expectations were formed. Stein and Sunderam shows how this can explain gradualism in monetary policy.[9] My formulation of the problem emphasizes the idea that market expectations carry more weight in policy making when they are based on Fed disclosure about policy and policy preferences and I focus on the efforts of competing policy makers to selectively disclose information about policy preferences in order to drive the subsequent policy outcome.

Direct evidence that disclosure reduces policy flexibility comes from comparing policy making before and after the Fed started issuing statements following changes to the policy rate in February 1994 (initially statements were issued only if the policy rate was changed; in January 2000 the Fed started issuing statements after all FOMC meetings). Before 1994 the federal funds target was frequently adjusted between meetings. CMVJ report that from 1982 to 1993, 62 of 93 target changes (two thirds) took place between scheduled meetings. This dropped to 7 of 62 changes (11 percent) over the 1994-2016 period. This suggests that from 1994 on, the Fed has generally waited to the next meeting to react to news arriving between meetings, presumably because intermeeting changes and the associated disclosures is viewed as constraining policy at the next meeting. The above quotes from FOMC documents suggest that informal communication is viewed as having similar effects as formal disclosure in terms of reducing policy flexibility.

3.2 Advocacy with disclosure of confidential information

If policy makers disagree and market expectations matter for the policy outcome, policy makers will each have an incentive to reveal information that supports their preferred policy. This is similar

[9] In their model, the Fed seeks to reveal information about changes to its long-run policy target gradually in order to avoid large market surprises. However, the market foresees this and reacts strongly to a given policy change. Moving gradually thus has limited effectiveness in reducing bond market volatility but causes the policy rate to deviate further from its long-run target.

to advocacy in a courtroom in which the defense and the prosecution each reveal only the information that supports their case. For example, a hawk may want to disclose that the Fed's internal growth forecast is quite high, or that a previously dovish policy maker has been making more hawkish statements in internal debate. Importantly, if advocacy relies on the disclosure of internal confidential information then it cannot be done publicly (e.g., via speeches) and must instead be done via informal communication. This is a theme in several papers in the political science literature that focus on the US administration. Kielbowitz (2006) emphasizes the selective reporting of facts via leaks: *"Because most promotional leaks spring from institutions' upper echelons, one veteran Washington reporter famously observed that the ship of state is the only vessel that leaks mainly at the top. President Kennedy's press secretary concurred, noting that a leak "generally occurs when Presidents and governments wish to advance a certain viewpoint and pass to newspaper men documents or information of a confidential nature which would advance this point of view.""*[10] Similarly, Pozen (2013) argues that "plants must be watered by leaks", i.e., that policy makers often plant stories in the press but that these must be supported by leaks of confidential information to have impact. Pozen provides an informative cite from Abel (1987): *"In the jaundiced but not unfounded view of some veteran reporters, "[t]he guiding principle, then and now, is that when it suits an administration's purpose to leak secret information to the press, it simply ignores or temporarily overrides a document's classification.""*

In the economics literature, Milgrom and Roberts (1986) study a persuasion game where two interested parties compete in providing information to a decision maker. In equilibrium the truth comes out as long as, in any state of the world, there is one party who prefers the full-information decision. This will not necessarily be the case in the Federal Reserve context. First, the Fed faces costs from disclosure as discussed above (and elaborated on below). Second, in the Fed context public expectations play the role of Milgrom and Roberts' decision maker but not fully in that the interested parties (hawks and doves) determine policy based on both public expectations and their policy preferences. To the extent that the confidential information affects policy even without disclosure, the incentive to reveal information prior to decision-making is reduced. My model is designed to help understand when disclosure will occur and when it is welfare-reducing.[11]

[10] "Promotional leak" is another term used for policy leaks.

[11] In the classification of Gentzkow and Shapiro (2008) of bias in the market for news, advocacy by Fed hawks and doves would fit into the category of supply-driven bias (but with the bias generated by sources as opposed to news outlets).

3.3 The costs of leaks

3.3.1 Reduced policy flexibility

As discussed above, the incentive to leak stems from an impact of market expectations on the policy outcome. A potential leaker will balance any tactical advantage from leaking against the reduced ability of the Fed to react to new information that may arrive before the next FOMC meeting.

3.3.2 Damage to the central bank's reputation

The first quote from Bernanke's August 2010 memo clearly expresses his concern with the impact of leaks on the Fed's reputation and credibility. Chairman Greenspan expressed similar concerns at the July 1993 FOMC meeting:

> *CHAIRMAN GREENSPAN. "[...] Jerry Corrigan, as you may recall, said at the luncheon that we gave him on his farewell immediately following the last meeting of the FOMC that the one thing that could do this institution in is the leak question and the whole issue of the credibility of our operations. And I must tell you that Jerry is almost surely right on this."*[12]

One specific channel through which leaks affect the Fed's reputation is via a (correct) perception that some members of the private sector or the press have access to confidential information from the Fed. The January 2011 FOMC meeting again had leaks on the agenda and the transcripts contain a lengthy discussion the issue (p.5-10 and 197-230).[13] The discussion was part of the process for formulating a policy to prevent leaking by the FOMC itself. President Yellen chaired a subcommittee on the issue and stated:

> *VICE CHAIR YELLEN. "[...] As you may recall, the Chairman gave our subcommittee a three-part charge. He asked us first to assure appropriate treatment of confidential FOMC information, including our contacts with the press; second, we were to develop policies to avoid the perception that individuals outside of the Federal Reserve System are able to gain inappropriate access to FOMC information that could be valuable in forecasting monetary policy; and, third, we were to develop policies to ensure that the public*

[12] Jerry Corrigan was the 7th President of the Federal Reserve Bank of New York and vice-chair of the FOMC.
[13] The transcript is at: https://www.federalreserve.gov/monetarypolicy/files/FOMC20110126meeting.pdf

communications of FOMC participants do not undermine the Committee's decisionmaking process or the effectiveness of monetary policy."

VICE CHAIR YELLEN. "[...] We're concerned about potential leaks of documents or their contents that are discussed in an FOMC meeting as well as leaks about the substance of discussions, such as who said what."

In the discussion, several policy makers express concerns about the Fed giving away confidential information to connected parties in the financial sector or the press. Governor Tarullo states:

MR TARULLO. "[...] The most disturbing thing right now is the phenomenon of someone who comes in, talks to most or all members of the FOMC and then to a group of paying clients, essentially advertising that fact and suggesting that there's a special kind of information. This is not limited to one person, and this is not just Macroeconomic Advisers, although they have been mentioned. [...] I think this problem is more serious than most of the people around the table think it is, and I have believed since I've been here that there was a real problem waiting to explode."

Several policy makers express skepticism that any policy will be hard to enforce. President Plosser states:

MR PLOSSER. "[...] I think enforcement is going to be really, really difficult, and, again, I think we just can't legislate good judgment."

The problem did in fact explode; it was not just Macroeconomic Advisers, and the policy was hard to enforce. As mentioned above, following involvement in a leak to Medley Global Advisors in 2012, President Lacker resigned in 2017. The New York Times wrote:

"Jeffrey M. Lacker, the president of the Federal Reserve Bank of Richmond in Virginia, resigned abruptly on Tuesday, saying that he had broken the Fed's rules in 2012 by speaking with a financial analyst about confidential deliberations. Mr. Lacker said he also failed to disclose the details of the conversation even when he was questioned directly in an internal investigation."[14] [15]

[14] https://www.nytimes.com/2017/04/04/business/lacker-leak-fed.html.

[15] The Medley leak fits my framework of policy makers seeking to drive market expectations in that Lacker was a policy hawk and the Medley memo sent to investors contained a lengthy discussion of policy conditionality and

3.3.3 Damage to the central bank's decision making process

Consecutive chairs have worried about the impact of leaks on the quality of policy deliberations within the Fed. Bernanke's 2010 memo states:

> *CHAIRMAN BERNANKE. "[...] And such leaks threaten the free give and take of ideas and collegiality of the FOMC as we grapple with the difficult issues we face."*

Chairman Greenspan states at the December 1989 FOMC meeting:

> *CHAIRMAN GREENSPAN. "Before we resume our regular business, I would like to raise again a problem that continues to confront this organization with continuous damaging and corrosive effects, and that is the issue of leaks out of this Committee. We have had two extraordinary leaks, and perhaps more, in recent days [...] I'm getting a little concerned about the free discussions that go on in this group–and yesterday afternoon is a very good example of this.* ***If [our discussions] start to be subject to selective leaks on content, I think we're all going to start to shut down.*** *Frankly, I wouldn't blame anyone in the least. We wouldn't talk about very sensitive subjects.* ***If we cannot be free and forward with our colleagues, then I think the effectiveness of this organization begins to deteriorate*** *to a point where we will not have the ability to do what is required of us to do."*

At the August 1980 FOMC meeting Chairman Volcker states:

> *CHAIRMAN VOLCKER. "[...] I would like to mention and emphasize a matter on which I sent you a note. We had a leak about the aggregates [targets] for the year after our telephone consultation, which disturbed me. [...] Wherever it came from,* ***there is nothing more corroding of the confidence with which we sit around the table or in a telephone conference and discuss [policy] than the fear that somehow there is going to be a leak of what is discussed.*** *I just cannot operate in that way. [...] If you haven't already done so, I would urge you to take whatever [measures necessary to convey] the message in your own way within your own institutions to give us the best assurance we can have that this doesn't happen again. We are going to end up not talking very freely if it does. Enough of that."*

concludes by stating: "Still the momentum behind a collective desire to get away from the 2015 calendar guidance in the FOMC statement will likely force agreement on numerical conditionality before too long". The memo is available at https://assets.documentcloud.org/documents/1372212/fed-dec-bound.pdf.

4 The game theory of the quiet cacophony

This section provides a simple model of the interaction between two policy makers who each have an incentive to drive market expectations to gain an advantage in policy making. The objective is to lay out a framework in which to think about the issue in order to understand the impact of leaks on policy and welfare in equilibrium.

4.1 Policy preferences

Suppose two policy makers D and H have to decide on the interest rate at each policy meeting. They disagree on what the appropriate policy rate is given economic conditions. Policy makers' views of the appropriate interest rate given economic conditions evolve as follows:

Date 0:	Date 1:	Date 2:
Last policy meeting	Intermediate date	Current policy meeting
r_0^D	$r_1^D = r_0^D + e_1^D$	$r_2^D = r_0^D + e_2^D$
r_0^H	$r_1^H = r_0^H + e_1^H$	$r_2^H = r_0^H + e_2^H$

where the e's are shocks to policy preferences and

$$e_2^D = e_1^D + v_2^D$$
$$e_2^H = e_1^H + v_2^H$$
$$\text{cov}(e_1^D, v_2^D) = \text{cov}(e_1^H, v_2^H) = 0$$
$$\text{cov}(e_1^D, e_1^H) = \text{cov}(v_2^D, v_2^H) = \text{cov}(e_1^D, v_2^H) = \text{cov}(v_2^D, e_1^H) = 0$$

The policy rate r is set at date 2 just after the realization of e_2^D and e_2^H.[16]

Assume that r_0^D and r_0^H are observable by policy makers and markets at date 0 after the last policy meeting. Policy makers observe e_1^D, e_1^H at time 1 and e_2^D, e_2^H at time 2 (via internal communication). They have a choice of whether to reveal information about e_1^D or e_1^H to markets at date 1. If information about e_1^D or e_1^H is disclosed, this reduces policy flexibility at date 2 in that policy makers incur a loss if the chosen policy rate r differs from the market's perception of average policy preferences as of date 1. As discussed above, this loss stems from the difficulty of

[16] The setup can be augmented to allow for observable news about e_1^D and e_1^H arriving between date 0 and 1. I ignore this for simplicity since my focus is on understanding the disclosure of internally known information about e_1^D and e_1^H.

conveying the nuance of why policy makers' preferred policy rate is changing, implying that the central bank is viewed as flip-flopping if it appears to have changing preferences.

Accordingly, assume that policy makers' loss functions as a function of the policy outcome, r, are:

$$L^D = \alpha(r - r_2^D)^2 + I^{disc}\beta\left(r - E_1^{market}\left(\frac{1}{2}(r_2^D + r_2^H)\right)\right)^2$$

$$L^H = \alpha(r - r_2^H)^2 + I^{disc}\beta\left(r - E_1^{market}\left(\frac{1}{2}(r_2^D + r_2^H)\right)\right)^2$$

where $\alpha > 0,\ \beta > 0$. I^{disc} is a dummy equal to one if D or H has made a date 1 disclosure about average policy preferences. $E_1^{market}\left(\frac{1}{2}(r_2^D + r_2^H)\right)$ is the market's expectation of the average preferred policy rate given all disclosure. These loss functions capture the idea that both policy makers look equally bad if the Fed appears to be flip-flopping.[17]

As noted earlier, the model focuses on the role of lost flexibility from leaks because this is what induces the temptation to leak. The costs from loss of Fed credibility and harm to its decision making process could be added to the loss function. However, given that these costs are likely to be a function of sustained leaking as opposed to substantial costs incurred for one incremental leak, incorporating them would have only a small effect in terms of reducing the incentive to leak. For simplicity, I therefore omit them from the model. However, it is important to emphasize that these costs could materially add to the welfare loss from leaks even if they have only a minor effect on the range of parameter values for which a given equilibrium outcome emerges.

Assume that the policy outcome r at date 2 is chosen to minimize the total policy maker loss, given date 1 disclosure:

$$\min_r L\left(r|r_2^D, r_2^H, I^{disc}, E_1^{market}\left(\frac{1}{2}(r_2^D + r_2^H)\right)\right)$$

$$= L^D + L^H$$

$$= \alpha(r - r_2^D)^2 + \alpha(r - r_2^H)^2 + 2I^{disc}\beta\left(r - E_1^{market}\left(\frac{1}{2}(r_2^D + r_2^H)\right)\right)^2$$

In this setup, disclosure reduces the flexibility of policy makers to react to news arriving

[17] An alternative would be to make the loss from disclosure a function of $r - E_1(r|disclosure)$. This can lead to multiple equilbria which may be of independent interest but is not pursued here.

between date 1 and 2. Disclosure thus has a flavor of what has been called Odyssean forward guidance in the recent literature on unconventional monetary policy (Campbell, Evans, Fisher and Justianiano (2012)). However, my model works at a different frequency. It is about the pros and cons of disclosure between policy meetings, not about statements about what policy will be several meetings down the road.[18]

4.2 Advocacy (spin)

Conditional on knowing e_1^D and e_1^H (news about the evolution of policy preferences between date 0 and 1),

$$E_1\left(\frac{1}{2}(r_2^D + r_2^H)|e_1^D, e_1^H\right) = \frac{1}{2}(r_0^D + r_0^H) + \frac{1}{2}(e_1^D + e_1^H).$$

Assumption (spin): Policy makers are able to selectively reveal information about average policy preferences:

(a) For a given value of $E_1\left(\frac{1}{2}(r_2^D + r_2^H)|e_1^D, e_1^H\right)$ a policy maker could, if he was the only one disclosing, make the market expect any value for the average policy preference within S^* of the truth:

$$\begin{aligned} &E_1\left(\frac{1}{2}(r_2^D + r_2^H)|e_1^D, e_1^H\right) - S^* \\ &\leq E_1^{market}\left(\frac{1}{2}(r_2^D + r_2^H)|\text{disclosure by one policymaker}\right) \\ &\leq E_1\left(\frac{1}{2}(r_2^D + r_2^H)|e_1^D, e_1^H\right) + S^*. \end{aligned}$$

(b) If competing policy makers each advocate in opposite directions, then market expectations are the truth plus the sum of the spin:

$$E_1^{market}\left(\frac{1}{2}(r_2^D + r_2^H)|\text{disclosure by both}\right) = E_1\left(\frac{1}{2}(r_2^D + r_2^H)|e_1^D, e_1^H\right) + S^D + S^H.$$

My spin assumption is a shortcut for explicit modeling of what information is disclosed. It is intended to capture the idea that there are many pieces of information known internally to Fed policy makers and policy makers each have a choice of what, if anything, to disclose. Since there are only so many dovish or hawkish pieces of information, spin is limited between $-S^*$ and $+S^*$.

[18] In the context of forward guidance, disclosure that generates an element of commitment may be a welfare-maximizing choice in cases where the beneficial impact on medium-term rates outweighs the cost of lost flexibility.

While I do not provide micro foundations for policy makers' ability to spin, this is an interesting direction for future work both in the Fed context and in policy contexts more generally. One possibility is that markets cannot infer from non-disclosure whether a policy maker does not have a given piece of information or is strategically not disclosing it (see Milgrom (1981) for an early contribution to the literature on information unraveling).

4.3 Defining strategies and Nash equilibrium

A disclosure strategy for a given policy maker consists of a decision of whether to disclose and, if yes, what value of spin to use. A Nash equilibrium consists of:

1. A disclosure strategy for D that is optimal given the disclosure strategy of H and market expectations, and
2. A disclosure strategy for H that is optimal given the disclosure strategy of D and market expectations.

If neither D or H make a disclosure at date 1, $I^{disc} = 0$, and the policy outcome at date 2 solves

$$\min_r \ \alpha(r - r_2^D)^2 + \alpha(r - r_2^H)^2.$$

If either D or H make a disclosure at date 1, $I^{disc} = 1$, and the policy outcome at date 2 solves

$$\min_r \ \alpha(r - r_2^D)^2 + \alpha(r - r_2^H)^2 + 2\beta\left(r - E_1^{market}\left(\frac{1}{2}(r_2^D + r_2^H)\right)\right)^2$$

with $E_1^{market}\left(\frac{1}{2}(r_2^D + r_2^H)\right)$ based on disclosure by one or both policy makers.

4.4 Policy outcome given disclosure

The policy outcome at date 2 is as follows.

Lemma 1 (Policy outcome given disclosure). The policy outcome without disclosure is

$$r = \frac{1}{2}(r_2^D + r_2^H)$$

and the policy outcome with disclosure is

$$r = \frac{\alpha}{\alpha+\beta}\frac{1}{2}(r_2^D + r_2^H) + \frac{\beta}{\alpha+\beta}E_1^{market}\left(\frac{1}{2}(r_2^D + r_2^H)\right).$$

Proof: See Appendix B for all proofs.

Note that Lemma 1 implies that if advocacy (spin) was not feasible, neither policy maker would have an incentive to disclose. For example, even if $\frac{1}{2}(e_1^D + e_1^H)$ is positive, and

$E_1(r_2^H|e_1^D, e_1^H) > E_1(r_2^D|e_1^D, e_1^H)$ it is not the case that H would benefit from disclosing the true value of $\frac{1}{2}(e_1^D + e_1^H)$. The reason is that with true disclosure, the full value of $\frac{1}{2}(e_1^D + e_1^H)$ will (in expectation) be incorporated in policy even without disclosure so disclosure would only serve to reduce policy flexibility which is bad for both policy makers.

4.5 Disclosure equilibrium

Theorem 1 (Prisoners' dilemma, for sufficient disagreement and feasible spin).
Let E_1 denote expectations at time 1 conditional on e_1^D, e_1^H. Consider the situation where $E_1(r_2^H - r_2^D) > 0$, i.e., H is hawkish relative to D. If

$$\sqrt{2}\sigma_v < |\tfrac{1}{2}E_1(r_2^H - r_2^D)| \leq S^*$$

then:

(a) D prefers disclosure to non-disclosure regardless of H's choice (disclosure is a strictly dominant strategy for D). D's "spin reaction function" is as follows:
If H does not disclose, D's optimal spin (given disclosure) is negative. It is given by

$$S^D = -\frac{1}{2}E_1(r_2^H - r_2^D)$$

and implies

$$E_1(r) = E_1\left(\frac{1}{2}(r_2^D + r_2^H)\right) - \frac{\beta}{\alpha+\beta}\frac{1}{2}E_1(r_2^H - r_2^D) < E_1\left(\frac{1}{2}(r_2^D + r_2^H)\right)$$

If H discloses, and picks spin of S^H, D prefers a spin of $S^D = \max\left(-\frac{1}{2}E_1(r_2^H - r_2^D) - S^H, -S^*\right)$.

(b) H prefers disclosure to non-disclosure regardless of D's choice (disclosure is a strictly dominant strategy for H). H's "spin reaction function" is as follows:
If D does not disclose, H's optimal spin (given disclosure) is positive. It is given by

$$S^H = \tfrac{1}{2}E_1(r_2^H - r_2^D)$$

and implies

$$E_1(r) = E_1\left(\tfrac{1}{2}(r_2^D + r_2^H)\right) + \tfrac{\beta}{\alpha+\beta}\tfrac{1}{2}E_1(r_2^H - r_2^D) > E_1\left(\tfrac{1}{2}(r_2^D + r_2^H)\right)$$

If D discloses, and picks spin of S^D, H prefers a spin of $S^H = \min\left(\frac{1}{2}E_1(r_2^H - r_2^D) -\right.$

$S^D, S^*\big)$.

(c) Given (a)-(b), the unique Nash equilibrium outcome is that both disclose with $S^D = -S^*$ and $S^H = S^*$. Both policy makers are worse off in this equilibrium than if neither disclosed.

Discussion: Notice that if H does not disclose, D does not advocate so much that $E_1(r) = E_1(r_2^D)$ because advocacy has a cost in terms of lost flexibility. Similarly for H.

Figure 2 graphs the spin reaction function of H and D in S^D, S^H space to illustrate the tug of war over market expectations. If H discloses, D is trying to reach a total spin of $S^D + S^H = -\frac{1}{2}E_1(r_2^H - r_2^D)$ and thus sets $S^D = -\frac{1}{2}E_1(r_2^H - r_2^D) - S^H$ unless this is below the limit of $-S^*$. D's spin reaction function to spin by H is thus $S^D(S^H) = \max\left(-\frac{1}{2}E_1(r_2^H - r_2^D) - S^H, -S^*\right)$. Similarly, if D discloses, H is trying to reach a total spin of $S^D + S^H = \frac{1}{2}E_1(r_2^H - r_2^D)$ and thus sets $S^H = \frac{1}{2}E_1(r_2^H - r_2^D) - S^D$ unless this is above the limit of S^*. H's spin reaction function to spin by D is thus $S^H(S^D) = \min\left(\frac{1}{2}E_1(r_2^H - r_2^D) - S^D, S^*\right)$.

The spin reaction functions intersect at $S^D = -S^*$, $S^H = S^*$. Economically, this says that the outcome of the tug of war over market expectations is that each side discloses all the information that supports their case, resulting in the market learning all information (in the case with sufficient disagreement and sufficient feasible spin described in Theorem 1).

A potentially interesting observation in terms of the conditions of Theorem 1 is that if date 1 was close to date 2, σ_v would be small (making the Theorem 1 outcome applicable) as there would be less information to learn about the economy and policy maker preferences. This could provide a theory for the pre-FOMC effect.

Theorem 2 lays out the outcome of the game when the conditions in Theorem 1 do not hold, i.e., with low disagreement or in cases where it is difficult to spin.

Theorem 2 (If disagreement is low, or not much spin is feasible, then non-disclosure is possible). Consider the situation where $E_1(r_2^H - r_2^D) > 0$, i.e., H is hawkish relative to D.

Condition 1: $\sqrt{2}\sigma_v \geq |\frac{1}{2}E_1(r_2^H - r_2^D)|$.

Condition 2: S^* is sufficiently small.

If either of the above two conditions holds, then:

(a) D's spin reaction function is:

If H does not disclose, disclosure is not worthwhile for D.

If H discloses, and picks spin of S^H, D prefers a spin of $S^D = \max\left(-\frac{1}{2}E_1(r_2^H - r_2^D) - S^H, -S^*\right)$.

(b) H's spin reaction function is:

If D does not disclose, disclosure is not worthwhile for H.

If D discloses, and picks spin of S^D, H prefers a spin of $S^H = \min\left(\frac{1}{2}E_1(r_2^H - r_2^D) - S^D, S^*\right)$.

(c) Given (a)-(b), there are two Nash equilibria. In one equilibrium neither discloses. In the other equilibrium both disclose with $S^D = -S^*$ and $S^H = S^*$. Both D and H prefer the non-disclosure equilibrium. It seems natural that in this case policy makers will coordinate on the non-disclosure equilibrium.

4.6 Can leaking ever work in equilibrium?

A central assumption of my model setup is that spin by each side cancels each other out, leading the truth to come out if both policy makers use informal communication. This implies that in the equilibrium of Theorem 1, no one gains from leaking (just like the prisoners in the prisoners dilemma do not gain from confessing in equilibrium because they both confess). It would be interesting to consider variations of the model in which leaking could benefit a leaker in equilibrium. Several possibilities come to mind for further study.

First, one side may be better informed or better at spinning than the other. In that case the less informed party would not be able to fully counter the effects of leaks by the more informed party on market expectations (think of Reserve Banks having to make discount rate requests to the Board of Governors, but governors not having to disclose their policy preferences to Reserve Banks unless they so choose).

Second, perhaps record corrections do not work fully in that once markets have been influenced by the first leaker it is difficult to fully undo this (recall how Bernanke moved up his press conference in 2013 in order to "ensure investors hear his pro-stimulus message over the cacophony of more hawkish views from regional bank presidents", in Bloomberg's words). If this is the case, the market expectation of the average preferred policy rate after leaks by both parties

may be biased toward the preferred rate of the first leaker. This induces an incentive to leak fast and may provide a mechanism for leaking to benefit the first leaker in equilibrium.

Third, some policy makers may be more willing to break the rules by leaking. This could lead to distorted policy choices that are driven disproportionately by those leaking.[19]

5 What can be done?

Despite repeated attempts to stop them, leaks from the Fed continue. My model suggests a possible answer for this – it is hard to get out of a unique Nash equilibrium (the equilibrium in Theorem 1 which applies in times of sufficient disagreement).

There are obvious but unattractive solutions: One could avoid disagreement by appointing similar-thinking policy makers, but this would run counter to why we have group-decision making in the first place. Or one could publicly disclose policy preferences in real time so there is less to leak. However this would likely lead to even more loss in policy flexibility than the current framework. Think of no disclosure as retaining full flexibility, informal disclosure as generating some loss of flexibility, and public disclosure as generating the least flexibility.

Below I instead lay out an argument that links β (the parameter capturing the loss from deviating from market expectations in my model) to the public's understanding of the Fed's policy rule. I then discuss approaches to improve this understanding in order to lower β, arguing that reducing the number of policy makers and avoiding rotation of policy makers in FOMC voting may help.

5.1 Parallels to the time inconsistency literature

The quiet cacophony is in some ways similar to other time inconsistency problems in monetary policy. Policy makers would prefer no disclosure at the intermediate date if this could be enforced, but are unable to commit to non-disclosure. In response to time-consistency problems, several papers recommend appointing a central banker with different preferences. Rogoff (1985) argues for appointing a central banker with a "too large" weight on inflation relative to employment in order to overcome the standard time-inconsistency problem of policy makers creating surprise inflation to increase employment. Similarly, to avoid excessive gradualism in monetary policy, Stein and Sunderam (2018) argue that society would be better off with a central banker who cared

[19] I thank Jeremy Stein for suggesting this possibility.

less about market volatility. In the current context, what is needed is central bankers who care "too little" about delivering on policy expectations driven by Fed disclosure, relative to the representative household. Finding such central bankers seems difficult – why would potential candidates inherently have different β preferences? Incentivizing them to act as if they have low β also seems challenging as this would reward what looks like erratic policy making.

Improving the current state of affairs involves a better understanding of what drives the magnitude of β. In my view, β is not a fundamental preference parameter but is instead shaped by the public's lack of understanding of the Fed's decision rule. If the public fully understood how the Fed would optimally react to each type of incoming data, then markets would update expectations day by day as news came out about non-farm payroll, ISM, consumer confidence etc. Policy surprises (e.g., Kuttner surprises or stock returns on announcement days) would be small, yet the Fed would be unbound by prior policy statements as the public would agree that the optimal policy rate turned out different than what was expected at an intermediate date. Large policy surprises are thus a failure of communication, leaving the Fed reluctant to not deliver on what the market expects based on prior Fed disclosures. In other words, to the extent that markets do not understand the Fed's decision rule, any deviation of policy from expectations will be interpreted partly as a "Taylor rule residual", and thus make the Fed look erratic and less competent. This problem leads β to be positive which in turn drives the use of informal communication.

5.2 Fewer policy makers and no rotation: Would this help lower β?

The issue thus comes down to how to help the Fed communicate its thinking better, i.e., teach the public the quite complicated economic model the Fed has in mind when setting policy. Undoubtedly, (post-Greenspan) policy makers are trying hard to explain their thinking. However, the market's inference problem is incredibly difficult. The market needs to understand not one economic model but nineteen: the model of each of the seven members of the Board of Governors (or fewer if some governor seats are unfilled) and that of the twelve Reserve Bank presidents.[20] Furthermore, the market needs to understand the internal power dynamics of the Fed. This is a very difficult inference problem.

[20] The FOMC consists of twelve voting members. The seven members of the Board, the president of the New York Fed and four of the remaining eleven Reserve Bank presidents who serve one-year terms on a rotation schedule. Non-voting Reserve Bank presidents attend and participate in FOMC meetings.

A 2016 Brookings survey of private sector Fed watchers and academics gave poor grades to the Fed for its communications efforts.[21] Only 34% state that they have a very clear or mostly clear understanding of the Fed's policy reaction function. The most popular forms of communication are the meeting statements, chair speeches, and post-meeting press conferences which over half of respondents find useful/extremely useful. By contrast, only 24 percent find speeches by Reserve Bank presidents useful/extremely useful. Sixty-four percent want the presidents to speak less. Instead, 51 percent want the chair to speak more. The message seems clear: Have the chair take more charge of communications. The 2019 change to have eight rather than four press conferences per year is a step in the right direction. The chair should understand the 19 people's thinking and the power structure better than anyone. A central part of the chair's job should be to communicate the Fed's policy reaction function to the world in a way that markets understand in order to retain policy flexibility. One problem in doing so is the large number of policy makers and the rotation of Reserve Bank presidents on the FOMC. With four presidents rotating out and four new ones rotating in each year, the FOMC does not have a stable policy reaction function. This makes the chair's job of trying to convey the FOMC's overall policy reaction function even harder.

A somewhat radical approach would be reduce the number of Federal Reserve districts and avoid FOMC rotation. This would mean having only X of the Reserve Banks vote, but the same ones all the time. X could be chosen to maintain the balance of power between the board and the Reserve Banks. Specifically:

- Eliminating the rotation schedule would reduce the number of policy makers that markets have to understand and would improve the stability of the FOMC's policy reaction function. In turn, β would fall and policy flexibility increase as the public understood the policy reaction function better, leading the Fed to be less bound by prior statements and disclosures (public or informal).
- Having X "Super Reserve Banks" would likely also indirectly strengthen Fed research and policy-making. By concentrating Reserve Bank research at the Super Reserve Banks, these would each be able to have a larger research staff and, equally important, the staff would be serving a president who was always a voting member of the FOMC. This would increase

[21] https://www.brookings.edu/wp-content/uploads/2016/11/fed-communications-survey-results.pdf

the profile of researchers at the Super Reserve Banks which would help attract even more top talent. In turn, higher research quality would facilitate better group decision making, with each voting member having an excellent team behind him/her.

- Any functions of the Reserve Banks that require local presence could be kept as is.

6 Conclusion

The paper seeks to shine light on the use of informal communication (leaks) in monetary policy, focusing on the US Federal Reserve. Recent evidence from asset pricing suggests that information flows from the Fed to markets via informal channels. Prevalent use of informal communication is consistent with the repeated discussions of leaks in FOMC documents going back to 1948. A reading of the historical documents suggest that leaks are motivated by a tug of war over market expectations because the Fed is reluctant to choose a policy that differs from prior policy maker guidance. I provide a model of the game theory of the quiet cacophony to understand the equilibrium outcome. If disclosure ties the hand of policy makers and policy makers can spin information about policy preferences via selective disclosure, the unique Nash equilibrium is that both policy makers leak when disagreement is sufficiently large relative to the remaining uncertainty to be resolved before the next policy meeting.

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Appendix A. Memo from Chairman Bernanke to the FOMC, August 2010

BOARD OF GOVERNORS OF THE FEDERAL RESERVE SYSTEM

Date: August 24, 2010

To: Federal Open Market Committee

From: Chairman Bernanke

Subject: Recent Stories in the Press

As you are aware, there have been several recent stories in the press that have contained considerable information about policy options presented to the Federal Open Market Committee and the discussion within FOMC meetings. Needless to say, it damages the reputation and credibility of the institution if the outside world perceives us as using leaks and other back channels to signal to markets, to disseminate points of view, or to advance particular agendas. And such leaks threaten the free give and take of ideas and collegiality of the FOMC as we grapple with the difficult issues we face.

It is my hope that FOMC participants or observers are not intentionally or tactically conveying confidential information to the public. At times, many of us find ourselves in an unsettling situation where a reporter purports to have specific information from other sources and then presses for a confirmation or denial. Although no one individual provides all the information sought, by piecing together many discussions the reporter is able to get a detailed picture of developments within the Committee.

Let me ask everyone to be especially mindful going forward about providing details to the press or others outside the Federal Reserve about FOMC meetings or restricted materials. After the statement itself, the minutes should offer the clearest view of the Committee's deliberations. It is particularly important not to characterize the views of another participant at the meeting. Of course, if you want to make public your own views, there are many forums to do so, including speeches and interviews for attribution. We have a long history of considering difficult decisions in uncertain environments with collegiality and respect. Maintaining the confidentiality of our internal discussions is one important way we do so.

Thank you for your attention to these concerns. The reputation of the Federal Reserve and the quality of our discussions are public goods that we have a strong collective interest in preserving.

Source: https://www.federalreserve.gov/monetarypolicy/files/FOMC20100824memo01.pdf.

Appendix B. Proofs

Lemma 1 (Policy outcome with continuous policy).

Proof:

$$\frac{\partial L\left(r|r_2^D,r_2^H,I^{disc},E_1^{market}\left(\frac{1}{2}(r_2^D+r_2^H)\right)\right)}{\partial r}$$

$$= 2\alpha(r-r_2^D)+2\alpha(r-r_2^H)+4I^{disc}\beta\left(r-E_1^{market}\left(\frac{1}{2}(r_2^D+r_2^H)\right)\right)=0$$

which implies

$$r=\frac{\alpha}{\alpha+I^{disc}\beta}\frac{1}{2}(r_2^D+r_2^H)+\frac{I^{disc}\beta}{\alpha+I^{disc}\beta}E_1^{market}\left(\frac{1}{2}(r_2^D+r_2^H)\right).$$

Theorem 1 (Prisoners' dilemma, for sufficient disagreement and feasible spin)

Proof: (a) **If H does not disclose:**

Non-disclosure by D leads to

$$r=\frac{1}{2}(r_2^D+r_2^H)$$

whereas disclosure by D results in

$$r=\frac{\alpha}{\alpha+\beta}\frac{1}{2}(r_2^D+r_2^H)+\frac{\beta}{\alpha+\beta}\left(E_1\left(\frac{1}{2}(r_2^D+r_2^H)\right)+S^D\right).$$

Therefore, D's expected losses are, with non-disclosure by D

$$E_1(L^D)=\alpha E_1\left(\frac{1}{2}(r_2^D+r_2^H)-r_2^D\right)^2$$

$$=\alpha E_1\left(\frac{1}{2}E_1(r_2^H-r_2^D)+\frac{1}{2}(v_2^H-v_2^D)\right)^2$$

$$=\alpha\frac{1}{4}[E_1(r_2^H-r_2^D)]^2+\alpha\frac{1}{4}E_1[(v_2^H-v_2^D)^2]$$

$$=\alpha\frac{1}{4}[E_1(r_2^H-r_2^D)]^2+\alpha\frac{1}{2}\sigma_v^2$$

and with disclosure by D

$$E_1(L^D)$$

$$=\alpha E_1\left(\frac{\alpha}{\alpha+\beta}\frac{1}{2}(r_2^D+r_2^H)+\frac{\beta}{\alpha+\beta}\left(E_1\left(\frac{1}{2}(r_2^D+r_2^H)\right)+S^D\right)-r_2^D\right)^2$$

$$+\beta E_1\left(\frac{\alpha}{\alpha+\beta}\frac{1}{2}(r_2^D+r_2^H)+\frac{\beta}{\alpha+\beta}\left(E_1\left(\frac{1}{2}(r_2^D+r_2^H)\right)+S^D\right)-\left(E_1\left(\frac{1}{2}(r_2^D+r_2^H)\right)+S^D\right)\right)^2$$

$$= \alpha E_1\left(\frac{\alpha}{\alpha+\beta}\left[E_1\left(\frac{1}{2}(r_2^D + r_2^H)\right) + \frac{1}{2}(v_2^D + v_2^H)\right] + \frac{\beta}{\alpha+\beta}\left(E_1\left(\frac{1}{2}(r_2^D + r_2^H)\right) + S^D\right) - r_2^D\right)^2$$

$$+\beta E_1\left(\frac{\alpha}{\alpha+\beta}\left[E_1\left(\frac{1}{2}(r_2^D + r_2^H)\right) + \frac{1}{2}(v_2^D + v_2^H)\right] - \frac{\alpha}{\alpha+\beta}\left(E_1\left(\frac{1}{2}(r_2^D + r_2^H)\right) + S^D\right)\right)^2$$

$$= \alpha E_1\left(E_1\left(\frac{1}{2}(r_2^H + r_2^D)\right) + \frac{\alpha}{\alpha+\beta}\frac{1}{2}(v_2^D + v_2^H) + \frac{\beta}{\alpha+\beta}S^D - r_2^D\right)^2$$

$$+\beta E_1\left(\frac{\alpha}{\alpha+\beta}\frac{1}{2}(v_2^D + v_2^H) - \frac{\alpha}{\alpha+\beta}S^D\right)^2$$

$$= \alpha E_1\left(E_1\left(\frac{1}{2}(r_2^H - r_2^D)\right) + \frac{\beta}{\alpha+\beta}S^D + \frac{\alpha}{\alpha+\beta}\frac{1}{2}v_2^H + \left(\frac{\alpha}{\alpha+\beta}\frac{1}{2} - 1\right)v_2^D\right)^2$$

$$+\beta E_1\left(\frac{\alpha}{\alpha+\beta}\frac{1}{2}(v_2^D + v_2^H) - \frac{\alpha}{\alpha+\beta}S\right)^2$$

$$= \alpha\left[E_1\left(\frac{1}{2}(r_2^H - r_2^D)\right) + \frac{\beta}{\alpha+\beta}S^D\right]^2$$

$$+\left[\alpha\left(\frac{\alpha}{\alpha+\beta}\frac{1}{2}\right)^2 + \alpha\left(\frac{\alpha}{\alpha+\beta}\frac{1}{2} - 1\right)^2 + \beta\left(\frac{\alpha}{\alpha+\beta}\right)^2\frac{1}{2}\right]\sigma_v^2 + \beta\left(\frac{\alpha}{\alpha+\beta}S^D\right)^2$$

$$= \alpha\left[E_1\left(\frac{1}{2}(r_2^H - r_2^D)\right) + \frac{\beta}{\alpha+\beta}S^D\right]^2 + \frac{\alpha}{\alpha+\beta}\left[\alpha\frac{1}{2} + \beta\right]\sigma_v^2 + \beta\left(\frac{\alpha}{\alpha+\beta}S^D\right)^2$$

where the last equality follows from

$$\left[\alpha\left(\frac{\alpha}{\alpha+\beta}\frac{1}{2}\right)^2 + \alpha\left(\frac{\alpha}{\alpha+\beta}\frac{1}{2} - 1\right)^2 + \beta\left(\frac{\alpha}{\alpha+\beta}\right)^2\frac{1}{2}\right]$$

$$= \left[\alpha\frac{\alpha^2}{(\alpha+\beta)^2}\frac{1}{2} + \alpha\left(\frac{\beta}{\alpha+\beta}\right) + \beta\frac{\alpha^2}{(\alpha+\beta)^2}\frac{1}{2}\right] = \frac{\alpha}{\alpha+\beta}\left[\alpha\frac{1}{2} + \beta\right].$$

Conditional on disclosure, the FOC for D's choice of spin is:

$$0 = 2\alpha\frac{\beta}{\alpha+\beta}\left[E_1\left(\frac{1}{2}(r_2^H - r_2^D)\right) + \frac{\beta}{\alpha+\beta}S^D\right] + 2\beta\left(\frac{\alpha}{\alpha+\beta}\right)^2 S^D$$

$$0 = \left[E_1\left(\frac{1}{2}(r_2^H - r_2^D)\right) + \frac{\beta}{\alpha+\beta}S^D\right] + \frac{\alpha}{\alpha+\beta}S^D \Longrightarrow S^D = -\frac{1}{2}E_1(r_2^H - r_2^D).$$

Under the condition $|\frac{1}{2}E_1(r_2^H - r_2^D)| \le S^*$, S^D is not constrained by S^*.

Substituting $S^D = -\frac{1}{2}E_1(r_2^H - r_2^D)$ into D's expected loss:

$$E_1(L^D) = \alpha\left[E_1\left(\frac{1}{2}(r_2^H - r_2^D)\right) - \frac{\beta}{\alpha+\beta}\frac{1}{2}E_1(r_2^H - r_2^D)\right]^2$$

$$+\frac{\alpha}{\alpha+\beta}\left[\alpha\frac{1}{2} + \beta\right]\sigma_v^2 + \beta\left(\frac{\alpha}{\alpha+\beta}\frac{1}{2}E_1(r_2^H - r_2^D)\right)^2$$

$$= \frac{1}{4}\left(E_1(r_2^H - r_2^D)\right)^2\left[\alpha\left(\frac{\alpha}{\alpha+\beta}\right)^2 + \beta\left(\frac{\alpha}{\alpha+\beta}\right)^2\right] + \frac{\alpha}{\alpha+\beta}\left[\alpha\frac{1}{2} + \beta\right]\sigma_v^2$$

$$= \alpha\frac{1}{4}\left(E_1(r_2^H - r_2^D)\right)^2\left[\frac{\alpha}{\alpha+\beta}\right] + \frac{\alpha}{\alpha+\beta}\left[\alpha\frac{1}{2} + \beta\right]\sigma_v^2.$$

Thus, D's expected loss given disclosure is smaller than D's expected loss given non-disclosure if

$$\alpha\frac{1}{4}\left(E_1(r_2^H - r_2^D)\right)^2\left[\frac{\alpha}{\alpha+\beta}\right] + \frac{\alpha}{\alpha+\beta}\left[\alpha\frac{1}{2} + \beta\right]\sigma_v^2 < \alpha\frac{1}{4}[E_1(r_2^H - r_2^D)]^2 + \alpha\frac{1}{2}\sigma_v^2 \Leftrightarrow$$

$$\frac{1}{\alpha+\beta}\left[\alpha\frac{1}{2} + \beta - \frac{1}{2}(\alpha+\beta)\right]\sigma_v^2 < \frac{1}{4}[E_1(r_2^H - r_2^D)]^2\left(\frac{\beta}{\alpha+\beta}\right) \Leftrightarrow$$

$$\frac{1}{2}\sigma_v^2 < \frac{1}{4}[E_1(r_2^H - r_2^D)]^2 \Leftrightarrow$$

$$\sqrt{2}\sigma_v < |E_1(r_2^H - r_2^D)|.$$

If H does disclose: The policy outcome is

$$r = \frac{\alpha}{\alpha+\beta}\frac{1}{2}(r_2^D + r_2^H) + \frac{\beta}{\alpha+\beta}\left[E_1\left(\frac{1}{2}(r_2^D + r_2^H)\right) + S^D + S^H\right]$$

and D picks S^D to minimize:

$$E_1(L^D) = \alpha\left[E_1\left(\frac{1}{2}(r_2^H - r_2^D)\right) + \frac{\beta}{\alpha+\beta}[S^D + S^H]\right]^2 + \frac{\alpha}{\alpha+\beta}\left[\alpha\frac{1}{2} + \beta\right]\sigma_v^2 +$$

$$\beta\left(\frac{\alpha}{\alpha+\beta}[S^D + S^H]\right)^2$$

which results in a reaction function of $S^D = \max\left(-\frac{1}{2}E_1(r_2^H - r_2^D) - S^H, -S^*\right)$.

(b) The proof is similar to that for (a).

(c) With no disclosure

$$r = \frac{1}{2}(r_2^D + r_2^H)$$

$$E_1(L^D) = \alpha\frac{1}{4}[E_1(r_2^H - r_2^D)]^2 + \alpha\frac{1}{2}\sigma_v^2$$

With both disclosing and $S^D = -S^*$ and $S^H = S^*$

$$r = \frac{\alpha}{\alpha+\beta}\frac{1}{2}(r_2^D + r_2^H) + \frac{\beta}{\alpha+\beta}E_1\left(\frac{1}{2}(r_2^D + r_2^H)\right)$$

$$E_1(L^D) = \alpha\frac{1}{4}[E_1(r_2^H - r_2^D)]^2 + \frac{\alpha}{\alpha+\beta}\left[\alpha\frac{1}{2} + \beta\right]\sigma_v^2.$$

D is thus worse off with both disclosing than neither disclosing since

$$\frac{\alpha}{\alpha+\beta}\left[\alpha\frac{1}{2} + \beta\right] > \alpha\frac{1}{2} \Leftrightarrow \left[\alpha\frac{1}{2} + \beta\right] > (\alpha+\beta)\frac{1}{2} \Leftrightarrow \beta > \beta\frac{1}{2}$$

which is true for any $\beta > 0$. Similarly, disclosure by both is worse for H relative to no disclosure.

Theorem 2 (If disagreement is low, or not much spin is feasible, then non-disclosure is

possible)

Proof: **Suppose condition 1 holds,** $\sqrt{2}\sigma_v \geq |\frac{1}{2}E_1(r_2^H - r_2^D)|$

(a) If H does not disclose: Using the arguments from the proof of Theorem 1 (a), D's expected loss given disclosure is now equal to or larger than D's expected loss given non-disclosure, even if spin is unconstrained, $|\frac{1}{2}E_1(r_2^H - r_2^D)| \leq S^*$, and thus also if spin is constrained. If H does disclose, D's thinking is as in Theorem 1 leading to the same reaction function.

(b) The proof is similar to that for (a).

(c) follows directly from (a) and (b). The fact that both prefer the non-disclosure equilibrium follows from the argument used in the proof of Theorem 1 (c).

Suppose condition 2 holds, S^* sufficiently small.

(a) If H does not disclose: D's expected loss is, with non-disclosure by D

$$E_1(L^D) = \alpha\frac{1}{4}[E_1(r_2^H - r_2^D)]^2 + \alpha\frac{1}{2}\sigma_v^2$$

and with disclosure by D

$$E_1(L^D) = \alpha\left[E_1\left(\frac{1}{2}(r_2^H - r_2^D)\right) - \frac{\beta}{\alpha+\beta}S^*\right]^2 + \frac{\alpha}{\alpha+\beta}\left[\alpha\frac{1}{2} + \beta\right]\sigma_v^2 + \beta\left(\frac{\alpha}{\alpha+\beta}S^*\right)^2$$

D thus prefers non-disclosure if:

$$\alpha\left(\frac{\beta}{\alpha+\beta}S^*\right)^2 - 2\alpha E_1\left(\frac{1}{2}(r_2^H - r_2^D)\right)\frac{\beta}{\alpha+\beta}S^* + \frac{\alpha}{\alpha+\beta}\left[\alpha\frac{1}{2} + \beta\right]\sigma_v^2 + \beta\left(\frac{\alpha}{\alpha+\beta}S^*\right)^2 >$$

$\alpha\frac{1}{2}\sigma_v^2 \Leftrightarrow$

$$\frac{\alpha\beta}{\alpha+\beta}(S^*)^2 - 2\alpha E_1\left(\frac{1}{2}(r_2^H - r_2^D)\right)\frac{\beta}{\alpha+\beta}S^* + \frac{\alpha}{\alpha+\beta}\left[\alpha\frac{1}{2} + \beta\right]\sigma_v^2 > \alpha\frac{1}{2}\sigma_v^2$$

which is the case for S^* sufficiently small since $\frac{\alpha}{\alpha+\beta}\left[\alpha\frac{1}{2} + \beta\right] > \alpha\frac{1}{2}$ (for any $\beta > 0$).

If H does disclose, D's thinking is as in Theorem 1 leading to the same reaction function.

(b) The proof is similar to that for (a).

(c) follows directly from (a) and (b). The fact that both prefer the non-disclosure equilibrium follows from the argument used in the proof of Theorem 1 (c).

Figure 1. Number of FOMC documents with leak mentions, 1948-2013

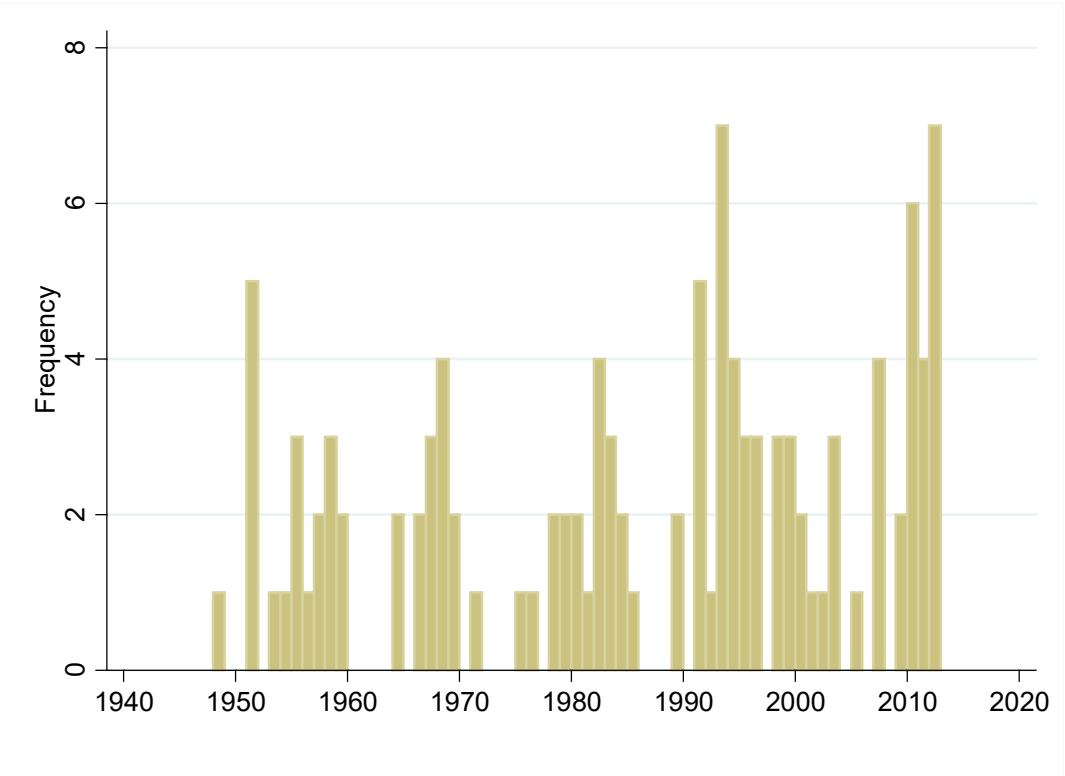


Figure 2. The tug of war over market expectations in the model: Spin reaction functions

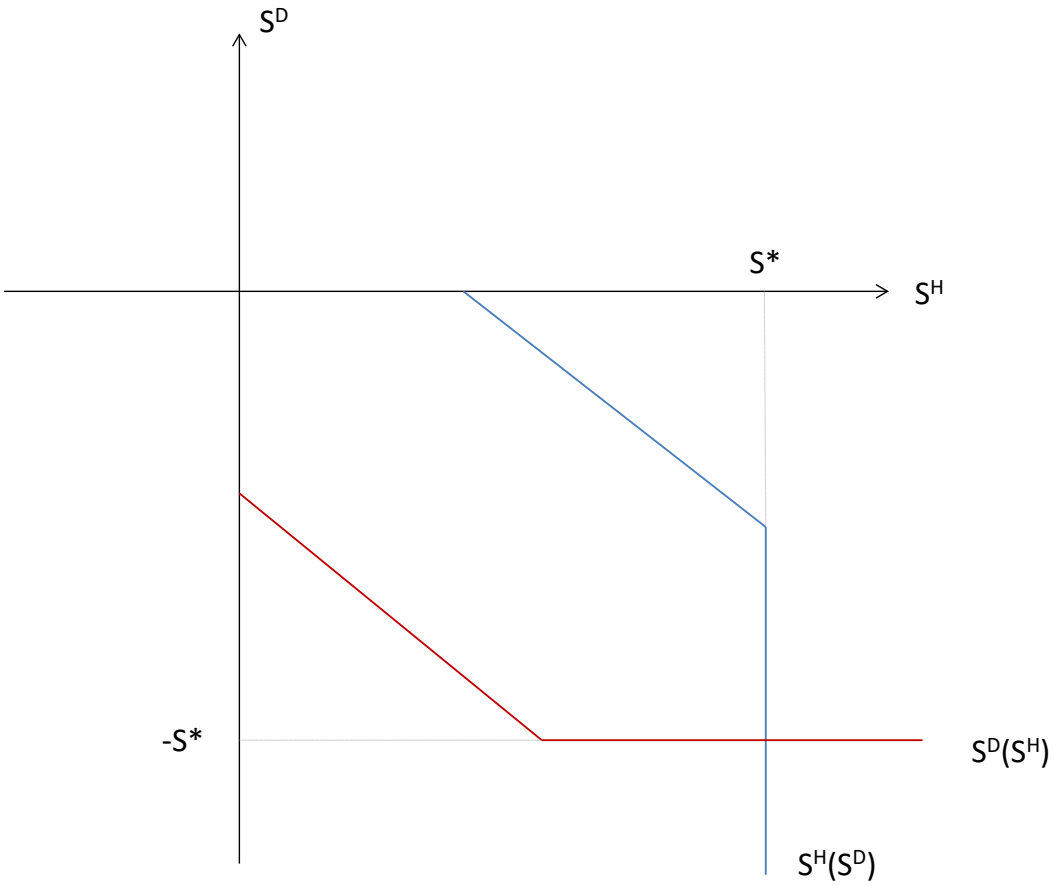


Table 1. FOMC documents with leak mentions

Date	FOMC document	Category	Topic
12/17-12/18, 2013	Meeting transcript	Risk of leaks	FOMC information security at the Reserve Banks.
3/19-3/20, 2013	Meeting transcript	Recent leaks	Lack of results from investigation of prior leaks. Governor Tarullo concerned about risk of divided loyalty of board staff serving multiple governors.
1/29-1/30, 2013	Meeting transcript	Recent leaks	Leaks to New York Times and Medley Global Advisors
12/11-12/12, 2012	Meeting transcript	Recent leaks	Investigation into leaks to New York Times and Medley Global Advisors
10/23-10/24, 2012	Meeting transcript	Recent leaks	Investigation into leaks to New York Times and Medley Global Advisors. Separately, concern about leaks if SEP forecasts by name are circulated internally within the Fed.
7/31-8/1, 2012	Meeting transcript	Risk of leaks	Risk of leaks if Summary of Economic Projections includes names
6/20/2012	Meeting transcript	Possible leak	Possible leaks about plans for the maturity extension program (MEP)
12/13/2011	Meeting transcript	Recent leaks	Leaks of the FOMC agenda ahead of the meeting
11/28/2011	Conf call transcript	Recent leak	WSJ article on leak to newsletter writer
9/20-9/21, 2011	Meeting transcript	Risk of leaks	Fisher pushing back against more information sharing with reserve banks due to risk of leaks
1/25-1/26, 2011	Meeting transcript	Recent leaks	Long discussion to formulate policy to prevent leaks from FOMC participants
11/3/2010	Meeting transcript	Recent leaks	Recent leaks to the press
10/15/2010	Conf call transcript	Recent leaks	Chairman disappointed with recent leaks of FOMC information
9/21/2010	Meeting transcript	Recent leaks	Leaks from August 10, 2010 FOMC meeting
8/24/2010	Memo	Recent leaks	Recent leaks of FOMC information to the press
5/9/2010	Conf call transcript	Risk of leaks	Risk of leaks via Congress
1/26-1/27, 2010	Meeting transcript	Risk of leaks	Leaking to Larry Meyer of Macroeconomic Advisers
4/28-4/29, 2009	Meeting transcript	Recent leak	Leaked stress-test results
2/7/2009	Conf call transcript	Warning not to leak	Chairman reminder to avoid leaks
10/31/2007	Meeting transcript	Possible leak	WSJ obtaining confidential information
8/16/2007	Conf call transcript	Risk of leaks	Need for fast action to avoid leaks. Geithner leak to Bank of America
6/27-6/28, 2007	Meeting transcript	Warning not to leak	Chairman reminder to avoid leaks
3/20-3/21, 2007	Meeting transcript	Risk of leaks	Preference for transparency to not look non-transparent if information leaks
1/30-1/31, 2007	Conf call transcript	Recent leak	Concern about someone talking to New York Times
2/1-2/2, 2005	Meeting transcript	Recent leak	Leak of FOMC agenda
12/9/2003	Meeting transcript	Recent leak	Washington Post article moving market expectations
9/15/2003	Meeting transcript	Recent leaks	Several recent leaks. Need to announce shortly after the decision.

6/25/2003	Meeting transcript	Recent leaks	Washington Post and WSJ articles moving market expectations
11/6/2002	Meeting pres materials	Recent leak	Washington Post article moving market expectations
1/3/2001	Meeting transcript	Recent leak	WSJ leak before last meeting
12/19/2000	Meeting transcript	Recent leak	Recent leak to WSJ
10/3/2000	Meeting transcript	Possible leak	Possible front-running of FX intervention
5/18/1999	Meeting transcript	Risk of leaks	Announcement to avoid leak
3/30/1999	Meeting transcript	Recent leak	Leak of March 1998 directive
2/2-2/3, 1999	Meeting transcript	Recent leaks	Discussion of various policies regarding confidentiality in context of leak over prior years.
6/30-7/1, 1998	Meeting transcript	Risk of leaks	Discussion of disclosure of tilt in directive to avoid leaks. Separately, Greenspan concerned about leak of internal working paper on the zero lower bound.
5/19/1998	Meeting transcript	Recent leak	Impact of recent leak of policy bias on emerging markets
5/19/1998	Meeting transcript	Recent leak	WSJ article with leaked directive
9/24/1996	Greenbook	Recent leak	Leak of discount rate proposals moving market
9/24/1996	Meeting pres materials	Recent leak	WSJ article moving market expectations
7/2-7/3, 1996	Meeting transcript	Recent leaks	Recent leaks
7/5-7/6, 1995	Meeting transcript	Warning not to leak	Importance of avoiding leaks of discussion of downside risks
3/28/1995	Meeting transcript	Risk of leaks	Mention of risk of leak of directive
1/31-2/1, 1995	Meeting transcript	Risk of leaks	Earlier period of leaks to WSJ
12/30/1994	Conf call transcript	Risk of leaks	Risk of leak of swap facility with Mexico
3/22/1994	Meeting transcript	Risk of leaks	Immediate announcement to avoid perception of leaks
2/28/1994	Conf call transcript	Risk of leaks	Risk of leak if policy action is delayed
2/4/1994	Meeting transcript	Risk of leaks	Need for statement due to risk of leak
11/16/1993	Meeting transcript	Congressional	Risk of leak from giving information to Congress
10/15/1993	Conf call transcript	Congressional hearings on leaks	Further discussion of what to say in response to Congressional push for more disclosure in response to leaks
10/5/1993	Conf call transcript	Congressional hearings on leaks	Leaks undercut Fed argument to delay release of information about policy
7/6-7/7, 1993	Meeting transcript	Recent leak	Leak leading to lost flexibility in policy making
3/1/1993	Conf call transcript	Recent leak	John Berry story in Washington Post (leaked GDP revision)
2/2-2/3, 1993	Meeting transcript	Risk of leaks	Immediate announcement to avoid leaks
1/6/1993	Meeting pres materials	Congressional hearings on leaks	Letter from Congressman Gonzalez to the Fed about leaks
6/30-7/1, 1992	Meeting transcript	Recent leak	WSJ article moving market expectations massively
11/5/1991	Meeting transcript	Risk of leaks	Risk of leak from decision made but not disclosed to market
10/31/1991	Conf call transcript	Joke about leaks	Joke about using leaks to affect Reserve Bank presidents voting

5/1/1991	Conf call transcript	Recent leak	Chairman warning not to leak following leak to WSJ
2/5-2/6, 1991	Meeting transcript	Recent leaks	Greenspan shutting down efforts to reduce leaks
1/9/1991	Conf call transcript	Recent leaks	WSJ, NYT writing about policy change before it was known to some policy makers
12/18-12/19, 1989	Meeting transcript	Recent leaks	Recent leaks and negative effect on Fed reputation and deliberations
10/16/1989	Conf call transcript	Recent leaks	Recent leak to Washington Post. Leak reducing flexibility.
5/21/1985	Meeting transcript	Risk of leaks	Risk of leaks from sharing information with Council of Economic Advisers
3/26-3/27, 1984	Meeting transcript	Recent leak	Recent leak, possibly via providing Greenbook to Treasury/CEA/OMB. Reducing number of staff at FOMC meetings to cut back on leaks
1/30-1/31, 1984	Meeting transcript	Recent leak	GAO report on leak of Monetary Policy Report
8/22/1983	Discussion transcript	Recent leaks	Recent leaks of directive
7/12-7/13, 1983	Meeting transcript	Recent leaks	Recent leaks leading Volcker to restrict attendance at policy session of FOMC meeting
2/8-2/9, 1983	Meeting transcript	Warning not to leak	Chairman warning not to leak
11/16/1982	Meeting transcript	Recent leak	Recent leaks. Arguments for immediate release of directive to stop leaks. Volcker arguing it reduces flexibility.
10/5/1982	Meeting transcript	Lack of leaks!	Chairman commending FOMC for not leaking since last meeting
6/30-7/1, 1982	Meeting transcript	Recent leaks	Recent leaks. Reduction in attendance to prevent leaks.
2/1-2/2, 1982	Meeting transcript	Risk of leaks	Avoiding making final decisions to prevent leak
7/17/1981	Conf call transcript	Recent leak	Leak of last week's policy decision to the Washington Post
12/19/1980	Meeting transcript	Recent leak	Recent possible leak. Effect on Fed credibility.
8/12/1980	Meeting transcript	Recent leak	Recent leak. Reduction in attendance to prevent leaks or know better who leaked
7/11/1979	Meeting transcript	Risk of leaks	Leaks each month
6/27/1979	Conf call transcript	Recent leak	Leak of GNP figure
9/19/1978	Meeting transcript	Recent leak	Leak of economic forecast
8/15/1978	Meeting transcript	Possible leak	Recent leaks
11/16/1976	Meeting transcript	Risk of leaks	FOMC phone system not secure. Risk of leak lead to no call.
2/19/1975	Memorandum of	Risk of leaks	Risk of leaks from Reserve Bank directors
11/16/1971	Memorandum of discussion	Risk of leaks	Risk of leaks from conversations with the British about swap line. Resulted in no conversations held.
9/9/1969	Memorandum of discussion	Risk of leaks	Risk of leaks of postponement of British loan payments.
1/14/1969	Memorandum of discussion	Recent leak	Investigation into leak of information on Treasury financing.

12/17/1968	Memorandum of discussion	Recent leak	Leak of information on Treasury financing.
7/16/1968	Memorandum of discussion	Warning not to leak	Importance of avoiding leaks of negotiations about gold price.
4/30/1968	Memorandum of discussion	Recent leak	Leak of information on Treasury financing.
1/9/1968	Memorandum of discussion	Risk of leaks	Risk of leaks from the French
12/12/1967	Memorandum of discussion	Recent leaks	Leaks of international negotiations
11/27/1967	Memorandum of discussion	Recent leaks	Leaks reducing British policy flexibility
11/14/1967	Memorandum of discussion	Risk of leaks	Risk of leaks at meeting in Paris
8/23/1966	Meeting minutes	Risk of leaks	Risk of leaks of swap line plans.
3/22/1966	Meeting minutes	Recent leak	Leaks of IMF proposal
5/5/1964	Meeting minutes	Recent leaks	Avoid paper documents to prevent leaks
1/28/1964	Meeting minutes	Recent leaks	Recent leaks about policy preferences
3/3/1959	Meeting minutes	Recent leaks	Reducing number of staff at FOMC meetings to cut back on leaks or know better who leaked
2/10/1959	Meeting minutes	Risk of leaks	Risk of leaks if discussing future policy
7/30/1958	Meeting minutes	Possible leak	Concern about policy move different from New York Times article
4/15/1958	Meeting minutes	Warning not to leak	Chairman reminder to avoid leaks
1/7/1958	Meeting minutes	Risk of leaks	Chairman concern about leaks
11/12/1957	Meeting minutes	Possible leak	Concern about someone talking to New York Times
7/9/1957	Meeting minutes	Risk of leaks	Risk of leak of discount rate requests
3/6/1956	Meeting minutes	Risk of leaks	Whether increased access to FOMC information at reserve banks would lead to leaks
8/2/1955	Meeting minutes	Recent leak	Recent leak to newsletter
6/22/1955	Meeting minutes	Risk of leaks	Risk of leaks with more attendees
1/11/1955	Meeting minutes	Recent leak	Recent leak of directive
12/7/1954	Meeting transcript	Warning not to leak	Chairman asking members who leak to make sure recepients don't cite leak as source
5/13/1953	Exec committee meeting minutes	Risk of leaks	Reluctance to give specific instructions to New York Desk about weekly purchases for fear of number being leaked
8/27/1951	Meeting minutes	Warning not to leak	Warning by chairman to avoid leaks
5/7/1951	Exec committee meeting minutes	Risk of leaks	Chairman comments regarding Treasury concern about leaks of Fed refunding recommendations
3/3/1951	Exec committee meeting minutes	Warning not to leak	Warning by chairman to avoid leaks. Suggestion to adopt rules about FOMC members talking to market newsletters.
3/2/1951	Meeting minutes	Risk of leaks	Need to avoid leaks
2/6-2/8,1951	Meeting minutes	Recent leak	Leaks of content of first day of FOMC meeting

11/11/1948	Meeting minutes	Risk of leaks	Chairman citing Treasury secretary for suggesting immediate disclosure of a decision to prevent leaks