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The effect of increased transparency on an individualistic monetary policy committee[*]

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Abstract

Most empirical research on the effects of transparency on monetary policy committees is based on a natural experiment in 1993 at the Federal Reserve, when it was decided that transcripts of meetings would be released with a five-year lag. Evidence is found of both a conformity effect (reluctance to offer dissenting opinions) and a discipline effect (more thorough preparation). We investigate the effects of increased transparency on a monetary policy committee using another and arguably more timely natural experiment. In May 2007, the Swedish central bank started to include the names of Executive Board members in the minutes of monetary policy meetings. We find that members began to put more effort into explaining their views (a form of discipline effect), that interaction between members decreased, and that references to members' own previous views became more common. A key insight is that the effects of increased transparency depend on the nature of the change and the type of committee.

Keywords: Central bank communication, central bank transparency, committee decision making, text analysis.
JEL codes: D71, E52, E58.

1 Introduction

A growing literature analyses different aspects of decision-making by monetary policy committees. One line of research looks at how increased transparency influences policy-makers' deliberations.

On the theoretical side, studies have highlighted different mechanisms whereby the incentives of committee members may be affected. On the one hand, increased transparency may make members more reluctant to express dissenting opinions, thereby giving rise to herding and conformism – *a conformity effect*. If members are driven by career concerns and know that their actions are observed, they may have an incentive to behave in a conformist manner.[1] On the other hand, transparency combined with career concerns may also make members more inclined to take contrarian positions, leading to anti-herding and *non-conformism*.[2] Whether increased transparency leads to more conformism or more non-conformism, it distorts members' behaviour and thus may result in inferior policy decisions.

There are also theoretical models that imply that increased transparency may improve policy decisions. Transparency will have the effect that the members' personal responsibility becomes more apparent. This, in turn, will strengthen their incentives to prepare more thoroughly for the meetings.[3] This has been called the *discipline effect* of transparency.

Some papers have studied how transparency influences committee decision making by using laboratory experiments.[4] In this paper, we focus on the rather limited empirical literature based on real-world data. This literature almost exclusively emanates from a natural experiment at the Federal Reserve. In 1993, it was decided that the transcripts of previous meetings of the Federal Open Market Committee (FOMC) should be released with a five-year lag. The perception among FOMC members up until then was that the meetings were taped merely as a help to the minutes writers. It soon became clear that transcripts should be released with the same lag also going forward.[5] Thus, prior to November 1993, transcripts reflect a discussion where the FOMC members assumed that their individual statements would never be public. After November 1993, discussions were held on the understanding that everything each member said during the meeting would eventually become known.

Meade & Stasavage (2008) were the first to exploit this natural experiment. They provide

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[1] See, for example, Prat (2005) and Visser & Swank (2007).
[2] See, for example, Levy (2004, 2007).
[3] Holmström (1999) and Gersbach & Hahn (2012).
[4] For example Fehrler & Hughes (2018).
[5] For a detailed discussion, see Lindsey (2003).

evidence that publishing verbatim transcripts of the FOMC meetings made members more reluctant to offer dissenting opinions. Thus, this supports the prediction in the theoretical literature of a conformity effect. A number of studies have since then studied the effect of the 1993 natural experiment using automated approaches to analyse the text of FOMC transcripts: Schonhardt & Bailey (2013), Acosta (2015), Egesdal et al. (2015) and Woolley & Gardner (2017). These studies tend to support the conformity hypothesis. Hansen et al. (2018) use computational linguistics algorithms to investigate which is the more important of the two, the negative conformity effect or the positive discipline effect. They find evidence for both effects but conclude that the discipline effect dominates.

Over the past decades, central banks have become increasingly transparent through various reforms. There are therefore good opportunities to empirically examine the effect of increased transparency on the deliberations of monetary policy committees. The Swedish Riksbank is ranked as one of the world's most transparent central banks, so it is a suitable candidate in this context.[6] In 2007, it implemented a reform that can be seen as a natural experiment. Like the one at the Federal Reserve, it implied that the discussion during the monetary policy meeting was "de-anonymized", revealing which member had said what.

On 10 May 2007, the Swedish Riksbank's General Secretariat wrote the following.

"It is proposed that the Executive Board should decide to publish the names of the Board members who express opinions at the monetary policy meetings in the minutes of the meetings. Together with speeches where members of the Executive Board provide further explanations of the way they reasoned at the previous meeting, minutes of meetings that include the names with the contributions to the discussion will provide a good basis for assessing how individual members – and accordingly the Executive Board as a collective – will reason at the next meeting. This will make it easier to forecast how monetary policy will be conducted. It will also be easier to evaluate monetary policy. Including the names in the minutes is accordingly another step towards greater openness and clarity."

Up until then, the minutes had contained wordings such as "one member considered" and "another member agreed" etc. The Executive Board decided in favour of the proposal and on 11 May 2007 a press release was published in connection with First Deputy Governor Irma Rosenberg holding a speech, "Changes in monetary policy communication". The change took effect at the next policy meeting in June.[7]

In this paper we make use of this natural experiment. There are several contributions to the existing literature. First, the natural experiment is quite different from the Federal

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[6] Dincer et al. (2022) .

[7] To the best of our knowledge, so far only three central banks include members' names in the minutes. The Czech National Bank started with this in February 2020, and the Bank of England includes individual members' statements in the minutes from November 2025.

Reserve experiment and has most likely stronger incentive effects. At the time the change was made, the minutes of the monetary policy meeting were published after around ten days (nowadays, the time lag has been shortened to approximately five working days). Thus, compared to the natural experiment at the Fed of publishing transcripts with a lag of five years, this natural experiment is likely to have considerably stronger implications for members' behaviour. Second, the type of monetary policy committee at the Riksbank is different from that at the Federal Reserve (see Section 2). This has both pros and cons. Evidence of how increased transparency affects the deliberations of different types of monetary policy committee is certainly desirable, but comparisons and generalizations may be difficult (although this in itself is an important insight). Third, our results indicate that a specific type of discipline effect is particularly important. Due to the short time lag between the meeting and the publication of the minutes it is crucial for members to explain their particular policy standpoint in a detailed way to financial markets and the public, as a communication tool. Fourth, we test for what we call a consistency effect, that is, whether increased transparency tends to make members act and reason more consistently over time. To our knowledge, this has not been investigated before in this literature.

There is however also another circumstance which is worth highlighting. In February 2007, a few months earlier, another change was made that also increased transparency. The Riksbank then began to publish a forecast for the policy rate in the coming years. Previously, the forecast for how the economy would develop had been based on the policy that the market expected the Riksbank to pursue, measured by the pricing in financial markets. Thus, one can argue that not just one but two natural experiments were carried out in 2007, both of which aimed to increase transparency in different ways.

However, the two experiments differ in an important respect. Previous empirical studies have examined changes in *incentives* from increased transparency in terms of a discipline effect and a conformity effect. Examining this is also the main purpose of this study. The introduction of a forecast for the policy rate is not necessarily something that will change the incentives of the board members. It can, for example, make discussions longer, but this is simply because there is an additional issue to discuss – much like any other issue that would have been added. Introducing names in the minutes, on the other hand, is a measure that potentially affects individual incentives. It is also a similar change to that at the Fed, in that both have the effect of de-anonymizing the statements of board members'. In the empirical section we attempt to separate the effects of including names in the minutes from the effects of introducing a policy rate forecast.

The outline of the study is as follows. Section 2 describes the differences between the Riksbank and the Federal Reserve, both in terms of the type of monetary policy committee and the setup of the monetary policy processes. In Section 3 we discuss the

above-mentioned consistency effect. Section 4 describes the data and how they are processed and Section 5 presents the empirical results. Section 6 provides robustness checks, and Section 7 concludes.

2 Differences between the Riksbank's Executive Board and the FOMC

2.1 The type of committee

For the further analysis, it is useful to describe the Riksbank Executive Board more in detail and, in particular, how it differs from the Federal Reserve's FOMC. During the investigation period, the Executive Board consisted of six full-time members. Today, the number is reduced to five.[8] Thus, the Riksbank's monetary policy committee is considerably smaller than the FOMC which consists of 12 voting members. Seven non-voting members also attend the Fed's policy meetings, participating in the discussions, and contributing to the Committee's assessment of the economy and policy options.

The Riksbank Executive Board is, furthermore, an *individualistic committee* in the terminology of Blinder (2007). Members of an individualistic committee express their own opinions verbally and act on them by voting. The group's decision is made by literal majority vote. At the monetary policy meetings, the pros and cons of possible measures are discussed, committee members weigh the equities of the case, and then they vote. When the Riksbank's Board consisted of six members the Governor had the casting vote in case of a tie vote. Unanimity is neither sought nor necessarily expected. Once the minutes have been published, members can publicly express their own views on the decision.

The FOMC, in contrast, is regarded as a *collegial committee*. Members may argue for their own points of view behind closed doors, but they ultimately compromise on a group decision, and then each member takes ownership of that decision. More specifically, the FOMC under chairman Alan Greenspan (which is the period most of the existing empirical studies refer to) was considered to be an *autocratically collegial committee*, where the chairman more or less dictated the group "consensus".

However, the description of the FOMC as a collegial committee is not clear-cut. The fact that the FOMC has acted as a collegial committee is more a matter of practice than something that is regulated in law, and practices may change over time. Recently,

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[8] According to the new Sveriges Riksbank Act, which entered into force on 1 January 2023, the Executive Board shall consist of five members. There was originally a transition period until the end of 2028, but when one of the members resigned and left the Board at the end of June 2023, the General Council decided not to appoint a new member.

there have been tendencies towards the FOMC beginning to function as an individualistic committee. For example, the seven governors have usually voted as a bloc. However, in September 2024, a dissenting vote from a governor was the first since 2005, and in 2025, dissenting votes by governors hit their highest level since the late 1990s.

2.2   The monetary policy processes

There are also some notable differences in the monetary policy processes at the Riksbank and the Fed. Most FOMC meetings last one day except for the meetings that precede the Monetary Policy Report for the President, which last two days.[9] Before FOMC meetings, members receive briefing in advance, such as the Green Book (staff forecasts), the Blue Book (staff analysis of monetary policy alternatives), and the Beige Book (regional Fed analysis of economic conditions in each district).

After a presentation by the staff, there is a discussion at the meeting about the economic situation (FOMC1 in Hansen et al. 2018), where members present their view on the economic outlook. Then comes a discussion of the monetary policy strategy (FOMC2), where members discuss their policy preferences. The FOMC then votes on the policy decision. Votes are generally unanimous (or close to) but there is more dissent in the discussion.

The monetary policy process at the Riksbank is somewhat different in that the board members are involved in the process leading to a policy decision more or less from the start.[10] At the beginning of the process, representatives of the Monetary Policy Department discuss with the Executive Board the issues on which the preparation will focus. The purpose of this first meeting is for the department to receive guidance from the Executive Board on whether the issues suggested by the department are appropriate and respond to the needs of the Board.

Over the next couple of weeks, the staff prepare a proposal for the main scenario and for monetary policy. This is presented to the Board at a preparatory meeting about two weeks before the monetary policy meeting. The proposed monetary policy is not a recommendation from the department, but the aim is that the proposal that is produced and presented to the Executive Board should reflect how the Board has normally chosen to act on the basis of economic and inflation prospects. Normally, these preparatory meetings are held for one or two days. The aim of the meeting is to provide the Board

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[9] The process of the Fed is described in more detail in for example Hansen et al. (2018).

[10] For a more detailed overview of the process leading up to a monetary policy decision at the Riksbank, see Sjödin (2022). However, it should be noted that the process described in the text and in the reference is the one in effect until 2024. There were then five or six monetary policy meetings with a Monetary Policy Report published in conjunction with each one of them. From 2024 there are eight monetary policy meetings and a Monetary Policy Report is published only in conjunction with every second meeting. A shorter publication, a Monetary Policy Update, is published in conjunction with the other four meetings.

with the information and data they need to be able to begin to form a view of the future of the economy and monetary policy.

During the meeting, there is a discussion between the members of the Executive Board and staff economists on the main scenario and alternative scenarios. Important assumptions and factors that affect economic prospects, such as developments abroad, financial conditions, or specific domestic factors that have an effect on the real economy and inflation, are addressed. This is also an opportunity for the Executive Board to ask detailed questions directly to staff experts and to order further analyses they may need for the decision. To ensure that different perspectives are presented, and groupthink can be avoided, the Riksbank has assigned a researcher or other senior employee to act as an opponent, a kind of "devil's advocate", when the staff's monetary policy proposals are presented.

During a second part of the discussion, where a more limited group of staff attends, the focus is on the monetary policy issues. The Monetary Policy Department presents various options with regard to the policy rate and other measures to enable a structured discussion of monetary policy considerations. Based on this information, individual members express their views on forecasts and monetary policy. The Executive Board can also make additional requests for information, and the results of these are presented at a follow-up meeting a day or so later. The monitoring of data and how these affect assessments in the main scenario or the risks surrounding the forecasts will continue until the monetary policy meeting.

The staff continue their work after this meeting by following up any requests from the Executive Board and producing a proposal for forecasts and monetary policy which it is expected to gain majority support from the Board. At the same time, texts are prepared that are compiled into a Monetary Policy Report.

At the monetary policy meeting, the Executive Board decides on the Monetary Policy Report, but the process is designed so that the forecasts and the wording of the report can be adjusted after the meeting if necessary to accurately reflect the reasoning at the meeting. The following day, the decision is announced in a press release, a press conference is held, and the Monetary Policy Report is published. Information about who has dissented and their preferred policy was initially published together with the minutes. Since May 2009, this information has also been provided directly in the press release announcing the monetary policy decision.

The fact that a detailed Monetary Policy Report is published in conjunction with the policy decision reflects the ambition to carefully explain and provide the foundation for the decision to the public directly after it is made. This also makes it necessary to work out forecasts and alternative scenarios on which a majority is likely to agree prior to

the monetary policy meeting. This means that the meeting has a somewhat different character from monetary policy meetings at the Federal Reserve.

As stated by Svensson (2009): "The discussion and exchange at the final monetary policy meeting do not start from scratch but are the culmination and summary of [a long series] of meetings. Therefore, one would not expect too much spontaneity, but rather the presentation of the essential summaries and the reasons for the decision by each member."

Support for the perception that members make their decision somewhere along the way rather than at the actual monetary policy meeting is provided by Apel et al. (2010). A questionnaire study directed to all present and former members of the Executive Board, in which the responses were treated confidentially, found that it was very unusual that members were not sure before the meeting how they would vote, and that they very rarely changed their minds during the meeting. This should not come as a surprise. During the preparatory process, board members have become aware of the other members' views and arguments, and have had time to process and evaluate them. If, instead, members were to hear the arguments of other members for the first time at the monetary policy meeting, there is, of course, less time for reflection and perhaps, therefore, it is easier to be persuaded by other members that another decision is preferable.[11]

The fact that much seems to be settled before the policy meeting raises the question whether the policy decision in practice, even if not formally, is made elsewhere than at the meeting. However, the Riksbank's decision is ultimately made at the policy meeting and there is always a preparedness for adjusting the Monetary Policy Report in case of last-minute changes, should the majority view turn out to be different than expected. The Executive Board members certainly interact with each other and with the staff at the preparatory meetings, but there is no "secret" meeting where the board members agree on the final outcome beforehand. The General Council is responsible for monitoring the work of the Executive Board and the activities of the Riksbank on behalf of the parliament, and the Council Chair and Deputy Chair can participate in the preparatory meetings and the regular Board meetings.[12] Since 2016 the minutes also contain a brief summary of the discussions held during the preparatory meetings. Presumably, the process towards a monetary policy decision at the Riksbank, with interactions along the way between the committee members and the staff and among committee members themselves, is not very different from that in many other central banks.

If the policy meeting as such were to capture all the interaction between board members

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[11] It may be noted that survey evidence for the monetary committees in both Sweden and Norway suggests that input from the staff plays a more important role in forming members' views than do deliberations within the committee at the monetary policy meeting, see Apel et al. (2015).

[12] They both have the right to express opinions, but not to put forward proposals or take part in any decisions.

and with the staff that matters for a policy decision, as in the simplistic standard model in the literature on monetary policy committees, the preparatory process at the Riksbank would have to be fundamentally different. The Executive Board would have to be more or less excluded from the preparatory process and would not be able to discuss topical economic issues even among themselves until the policy meeting. Since the staff and all the board members work in the same building, such an arrangement appears highly inefficient and not very feasible. Moreover, from an accountability and transparency perspective, the most pertinent aspect is that members clearly explain why they take the position they decide to finally take.[13]

3   A possible consistency effect

A mechanism that may potentially occur when members' names are included in the minutes, and which to our knowledge has not been discussed before in the context of monetary policy committees, is suggested in the work by Falk & Zimmermann (2018). If increased transparency makes individual members' views public, this may make them less inclined to subsequently change their minds and increase their desire to act consistently over time. In the words of Falk and Zimmermann: "Given previous commitments, changes of mind are particularly hard to execute, as inconsistencies become evident and difficult to conceal". In an experimental setting, Falk & Zimmermann (2018) find evidence that commitment to a first opinion leads to the neglect of new and challenging information. Being asked to write down an initial estimate before additional information is obtained significantly and substantially reduces the accuracy of final beliefs. Interestingly, Falk & Zimmermann (2018) also find that the desire to be consistent seems to be driven by internal rather than social motives, which means, in their experimental setting, that letting others know your beliefs instead of keeping them secret does not add to the commitment effect. Translated to our monetary policy setting, this means that including names in the minutes would have no great effect on whether or not committee members tend to stick to a specific view.

However, testing for such an effect may still be worthwhile. First, in their evaluation of Swedish monetary policy for the period 2005–2010, Goodhart & Rochet (2011) (p. 76) argue that the Riksbank's monetary policy meetings in recent years appear to have become "something of a spectator sport" and can be "a confrontational exercise, which runs the danger of exaggerating and intensifying splits within the Board".

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[13] The Bank of England releases transcripts only from the second day of its two-day meetings, with a lag of eight years. At this second meeting, members read from prepared scripts that explain their policy stances. Members spend the first day in a free-flowing debate about the economy, in a similar way as during the drafting process at the Riksbank. Hansen et al. (2018) see this as an attempt to maximize the discipline effect and minimize the conformity effect. Since November 2025, the Bank of England has included individual members' statements in the minutes.

Goodhart and Rochet do not explicitly blame this on the fact that minutes were attributed in 2007, but this may potentially have contributed. Again, such an effect, should it exist, is likely to be stronger if committee members' views and arguments are published more or less in real time, as in the Riksbank's case, than if they are published with a lag of five years, as in the case of the Federal Reserve.

Second, there is also another side of the coin. Martin Flodén, who ended an eleven-year long term at the Executive Board in May 2024 talked about his experience of the attributed minutes in one of his last speeches (Flodén 2024): "The minutes also force the members to take responsibility for their own positions over time. It becomes more difficult for a member to quickly and without a good justification change their opinion on a matter where they have previously communicated their own position. This could be both good and bad, but I suspect that the benefits dominate by making monetary policy a bit more consistent and predictable."

Even though Flodén does not rule out that there are shortcomings with attributed minutes, he argues that due to the discipline effect members tend to think through their position more thoroughly. As a result, they may be less inclined to change their mind hastily and in the mood of the moment. In this case, instead of being a commitment effect that potentially distorts policy decisions, it is a *result* of the discipline effect that improves decisions.[14] Thus, an observed increase in consistency among board members may have different causes. We call this effect *the consistency effect* of transparency. We construct text-based measures of consistency, described in the next section, and investigate whether they are affected by including members' names in the minutes.

We try to distinguish between the two causes of consistency by also looking at the voting record. There is reason to believe that if increased consistency in the discussion over time depends on members to a larger extent taking certain positions that they are unwilling to reassess and abandon despite new information, this will also show up in their voting. In this case, there will be a tendency for the number of dissenting votes to increase under transparency. If, on the other hand, the increase in consistency is due to the discipline effect and members avoid changing their position without a good justification, this will also be reflected in their voting, but in this case as a tendency to dissent to a lesser degree.

It should be noted that consistency and conformity are related but different concepts. One may argue that conformity is a sufficient but not necessary condition for consistency.

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[14] Martin Flodén's time on the Board was after the minutes had been de-anonymized in June 2007. We also interviewed Lars Heikensten who was a board member from the start in 1999 and Governor 2003–2005. He emphasized the importance of publishing minutes as such, but had no strong opinion on the implications of including the names of the members in them. As the Executive Board has been an individualistic committee from the beginning, he did not think that this affected the amount of effort members put into forming their view.

Members may have quite different views, and argue and vote in the same way meeting after meeting. Then they are consistent, but not conform. However, if they argue and vote more and more conformally, converging toward a common view, they also by necessity become more and more consistent.

4   The data

4.1   Measures from the minutes

Following the approach of Hansen et al. (2018) we construct a number of measures that capture different aspects of the deliberation and investigate whether and how they have been affected by increased transparency. A shortcoming of our data compared to those in Hansen et al. (2018) is that we are unable to tie the statements in the anonymous minutes before June 2007 to individual board members. Thus, we can only do the estimations at the meeting level.

We made an attempt to identify the statements of the individual members before June 2007 using supervised machine learning. Our idea was that if we could find a method that identified individual members for the period after June 2007 – where we know for sure who said what – using only the minutes and the speeches of the members as input, we would also be able to identify the statements of the members before June 2007 with reasonable precision using the same method. As shown in Holmer et al. (2023) we were able to identify the members after June 2007 with an accuracy of 60–65 percent using standard supervised machine learning methods, and with well above 80 percent if adding more features. Although these results are much better than chance, we did not deem this to be sufficiently accurate to identify speakers in the anonymous minutes.

The main data used for this study are the minutes of monetary policy meetings from February 2000 to April 2018 and the voting records for the same period. The minutes cover 59 meetings up to May 2007, when members' names were not revealed, and 66 meetings from June 2007 up to April 2018, when they were. We refer to the minutes from the previous period as *anonymous*, and to those for the later period as *transparent*. In most meetings, all six board members are present. There are a few meetings where fewer members attend.

In the anonymous minutes references to speakers are made with descriptions such as 'one member', 'another member', 'the member' or 'this member'.[15] Sometimes views are attributed collectively to several members with references such as 'two other members' or 'all members'. In the transparent minutes, members are first referred to by title and

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[15] In the analysis, we use the Swedish version of the minutes. However, for simplicity we provide the closest corresponding English expressions in the text.

Table 1: Overview of the minutes data used in the study.

Data type	Numbers
Anonymous minutes	59
Transparent minutes	66
Members present at meetings	5-6
Number of members from February 2000 to May 2007	8
Number of members from June 2007 to April 2018	12
Individual contributions	1987
Anonymous mode	1079
Transparent mode	908

name, e.g., 'Deputy Governor Lars Nyberg', and in repeated references with their last name or 'he', or 'she'.

In the section of the minutes with the heading 'Monetary policy discussion' we identified parts of the discussion that can be attributed to an individual member. We refer to these parts as 'contributions'. In anonymous minutes, we also classify the joint statements made by two or more members as contributions.[16] This approach resulted in 1079 contributions in the anonymous minutes and 908 in the transparent ones. Table 1 shows a summary of the minutes data. The pre-processing of the minutes is described in Appendix A.

From these data, we construct a number of measures that capture different aspects of the discussion. We use the following measures: The length of the discussion (*Length*), the number of contributions (*Contributions*), the frequency of numbers and words related to statistics and data mentioned in the discussion (*Number words*), and the frequency of references to research or studies (*Research words*). In Figure 1, these measures are shown.

A measure that could potentially contain information on the nature of the deliberation is the frequency of questions. For example, a large number of questions in a meeting can be an indication of a free-flowing discussion. However, we chose to disregard this measure for two reasons. First, the most natural way to detect questions in a text is to look for question marks. Before June 2007, however, minutes had more the character of an account of the discussion. In such an account, explicit question marks are rarely used. Instead, questions would be indicated by phrases such as 'a member asked another member if...', etc. After June 2007, it became more common to have direct citations of questions. Using words indicating a question, such as 'when', 'where' or 'question', is not very helpful either since they are frequently used in contexts that do not indicate an explicit question (such as '*when* it comes to the *question* of...').[17] Second, when looking closer at the occurrences of question marks in the transparent minutes, we found that a large share of them were due to members using rhetorical questions and hypophoras in

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[16] The number of joint statements is smaller than the number of individual statements.

[17] Again, it should be noted that we use the Swedish version of the minutes in the analysis. This problem is however similar in Swedish and English.

longer contributions, and then providing the answer themselves. Such rhetorical devices may help a member to explain her point of view more clearly but are not signs of a lively discussion back and forth.

A reasonable hypothesis is that when it becomes public who said what at the policy meeting, members' contributions become longer: to argue well for your point of view, you need to speak more. The question of how the duration of the entire discussion will be affected is less clear. Longer contributions do not necessarily imply a longer discussion, as the number of contributions may be lower because members have already elaborated on their opinion.

Hansen et al. (2018) argue that a primary channel through which discipline may operate is to encourage members to gather additional information between meetings. This may increase the quantitative content in their contributions, that is, the frequency with which they mention more data, statistics, and numbers. Such preparations may also include reading research reports and studies and referring to them at the meeting.

We also construct different measures to investigate the hypothesis of a *consistency effect*. First, we measure the number of references that the members make to their own statements and opinions expressed at a previous meeting (*Own references*). Before June 2007, an example could be: "the member reminded that she at the meeting in April...". From June 2007, "the member" would be replaced by the member's name.

Second, we construct a text-based measure of the similarity of the discussion as a whole between consecutive meetings (*Similarity*). The assumption here is that if all or most members become more consistent in their arguments, this would be reflected in the discussion as a whole.[18]

Finally, we construct three measures of consistency from the voting record, described in the next section.

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[18] We measure this by the cosine similarity between the discussions, see Appendix B.

(a) Length

(b) Contributions

(c) Number words
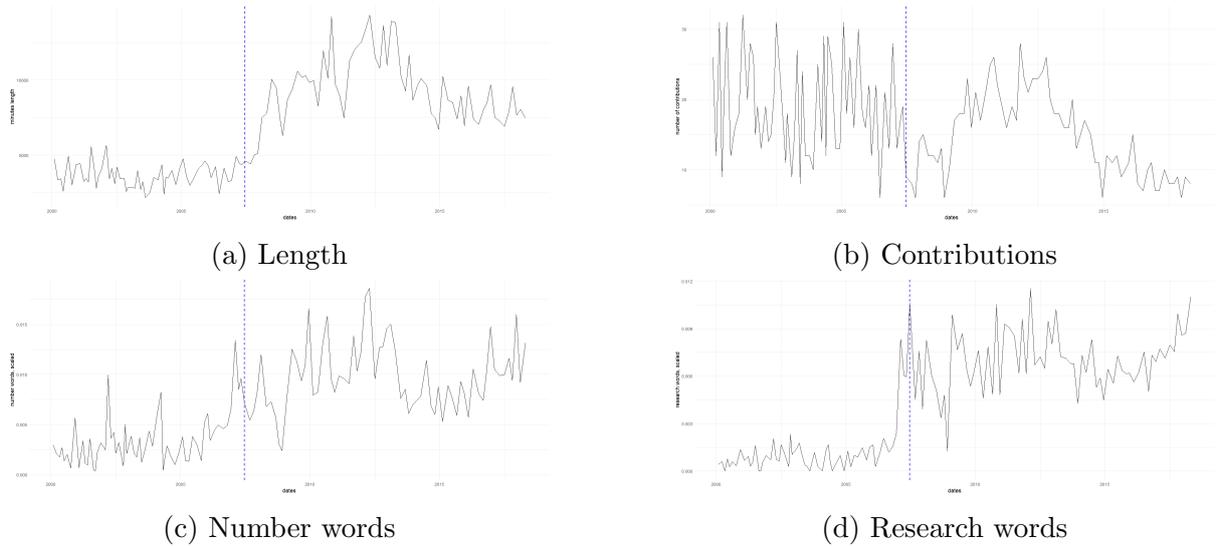
(d) Research words

Figure 1: Overview of the *Effort* measures

Note: Each subplot represents a different dimension of *Effort*, including (a) length of minutes, (b) number of contributions, (c) use of words with quantitative content and (d) research-related vocabulary. In each plot, the vertical blue dotted line marks the start of the increased transparency period.

(a) Similarity

(b) Own references

(c) Divergence
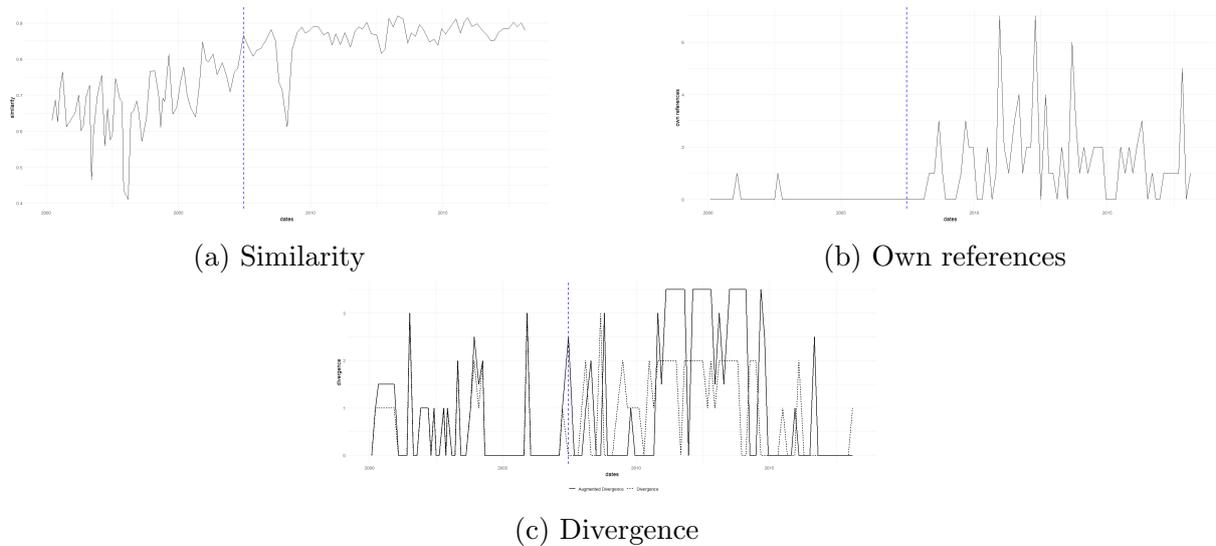
Figure 2: Overview of the *Consistency* measures

Note: Each subplot represents a different dimension of *Consistency*, including (a) text similarity between contiguous meetings, (b) number of board members' self-references, and (c) and measures of consistency based on voting records. In plot (c), *Divergence* is the difference between the preferred interest rate of the board member i at the meeting at time t and the majority vote; *Augmented Divergence* is the *Divergence* adjusted if the vote persitst and if the Board member votes with their peers. We assign value 1 if voting diverged and 0 otherwise. In each plot the vertical blue dotted line marks the start of the increased transparency period.

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4.2   Measures based on voting records

In a collegial committee such as the FOMC, members compromise on a group decision, which is thus generally unanimous. Different opinions among members are seen mainly in the discussions before the decision. However, in an individualistic committee such as the Riksbank's Executive Board, it could be that voting also is affected by greater transparency. This could be the case if, as implicitly suggested by Goodhart and Rochet (2011), de-anonymizing minutes has the effect of exaggerating and intensifying splits within the Board, leading to non-conformism also in voting. It could also be the case that de-anonymizing makes it harder for members to change their opinion without a good justification, as suggested by Flodén (2024), possibly leading to more agreement.

Board members may diverge from the majority vote in different ways. They may vote differently from the majority only occasionally, for example by dissenting in one meeting and then vote with the majority in the next. Alternatively, they may *persistently* diverge by voting for a different interest rate decision than the majority over a series of consecutive meetings. If there is a consistency effect one would expect such persistent divergence to be more likely after minutes were de-anonymized than before.

Finally, if two distinct groups emerge within the board, members may begin to align by voting with their "peers". In such cases, divergent votes within a particular group would likely cluster. Voting with peer behavior has been found to matter in many settings. In an experimental setup, Gortner & van der Weele (2019) show that peer information affects equilibrium outcomes in asset markets and find evidence for conformity. In political science, the influence of peers on voting patterns has been well recognized and found to strongly affect the outcome (Kulachai et al. 2023). Individuals often align their political beliefs and voting behaviors with those of their social circles. This alignment stems from the need for social conformity and the reinforcement of shared values within peer groups (Campos et al. 2017). For the Riksbank's Board, given the diverse backgrounds of its members, one possible choice is to distinguish between those who are professors in economics and those who are not, one of the few meaningful classifications we can make.

In order to capture whether or not increased transparency led to more or less splitting in the group we construct a new variable *divergence* defined as the difference between the preferred interest rate of member i at the meeting at time t, $vote_{i,t}$, and the majority vote, $vote_t$. We assign value 1 if voting diverged and 0 otherwise. As a means of capturing *persistence* in voting divergence we add to $divergence_{i,t}$ a small positive arbitrary value α. If, in the current meeting, the board member continued to diverge the $divergence_t$ is increasred by α. Note that the persistence α value is the same for each board member and that for simplicity we keep it constant, so that $divergence_{i,t}$ is defined as follows:

$$Divergence_{i,t} = \begin{cases} \begin{cases} 1 + \alpha & \text{if vote persists} \\ 1 & \text{if vote does not persist} \end{cases} & \text{if vote diverges} \\ \\ 0 & \text{if vote does not diverge} \end{cases}$$

To obtain divergence at aggregate level for each meeting we sum $Divergence_{i,t}$, so that

$$\text{Divergence}_t = \sum_i \text{Divergence}_{i,t} \qquad (1)$$

As an example, in the case where one out of six board members diverges the aggregate divergence value is one. If one member had already diverged from the majority at the previous meeting the value of $Divergence_t$ is increased by α, if two members had diverged then $Divergence_t$ is adjusted by adding 2α. We will refer to this adjusted $Divergence_t$ as persistent divergence, *Persistent Divergence*.

To measure the "voting-with-peers" behavior, we add a small constant value θ to $Divergence_t$, so that this augmented-with-peer-behavior divergence is *Augmented Divergence* $= 1 + \alpha + \theta$ in case of persistent divergence and $1 + \theta$ when divergence does not persist.

We present the consistency measures based on voting records in plot (c) of Figure 2.

4.3   Control variables

The nature of the deliberations in the committee may differ depending on whether there is much or relatively little macroeconomic uncertainty. Measures such as the economic policy uncertainty index (EPU index) for the United States are often used as a proxy for domestic uncertainty in small open economies such as Sweden. However, shocks to a domestic index have somewhat different effects from shocks to the US index. In our estimations, we use a Swedish EPU index calculated by Armelius et al. (2017) as a control variable (EPU).

The nature of the deliberations may also differ depending on whether the economy is experiencing a situation of increased financial and economic stress. For example, the unanimity within the Board may be more pronounced during bad economic times or crisis situations such as during the global financial crisis. To account for this, we construct a dummy variable, GFC, that takes value 1 for the period 2008-2010 and 0 otherwise.

As in Hansen et al. (2018), we control for the fact that board members holding a PhD may express themselves somewhat differently than other members. In particular, they may use more scientific terms and refer more to research. As we do the estimations on the meeting level, we use a measure showing the share of board members with a PhD for

every meeting (PhD). During the last fifteen years or so, it has also become common that at least some board members are full professors of economics. We therefore also use the share of professors in the Board as a separate measure ($Professor$). Thus, an increase in the use of technical and research-oriented language may not be a more general discipline effect of greater transparency. Instead, it could reflect a change in the composition of the Board toward members with a more pronounced academic background.

Hansen et al. (2018) investigate how relatively new FOMC members, rookies, are affected by increased transparency. As we cannot identify individual board members before June 2007, we are unable to use this approach. However, what we can do is to construct a measure (*Experience*) of the experience of the Board *as a whole* at every meeting and use this as a control variable. For example, if a member is replaced by a new member between two meetings, the experience measure will fall and be considerably lower at the second meeting. How much it will fall depends on how long the previous member has been on the Board and how many members are replaced (it has happened that two members have left the Board at the same time).

Deliberations in a central bank's monetary policy committee can also be influenced by discussions on crucial issues in the academic world. In normal times, members interpret the economic situation and decide if they think monetary policy should be looser, tighter, or stay the same. However, at times the decision is more difficult because it also concerns the monetary policy strategy in a more fundamental sense. By far the most important international academic debate of this kind during the period we investigate is whether or not monetary policy should 'lean against the wind', that is, if the policy rate should be set somewhat higher than otherwise to try to counteract the build-up of financial imbalances. This debate gained momentum in particular after the global financial crisis of 2007–2008.[19] The crisis underscored the importance of financial stability and led to increased scrutiny of whether central banks should incorporate financial stability considerations into their monetary policy frameworks. The intensity of the debate waned around the mid-2010s as central banks developed and adopted macroprudential tools aimed specifically at financial stability. To control for the influence of this international academic debate, we use a dummy (*Debate*) that is equal to 1 during the period 2008–2014.

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[19] The decades before the global financial crisis are commonly called the Great Moderation. It was characterized by a reduction in the volatility of business cycle fluctuations and the perception that the introduction of new central bank frameworks and policies had solved many of the problems of previous decades. Thus, there was little debate in the academic world over fundamental monetary policy issues.

Table 2: Summary statistics of main variables

variable	n	mean	sd	median	min	max
Length	125	6625.92	3315.17	5643.00	2168.00	14308.00
Lemma	125	509.76	183.84	471.00	211.00	938.00
Research words	125	37.29	37.70	32.00	0.00	154.00
Number words	125	55.96	55.28	42.00	1.00	266.00
Intensity	125	16.74	6.85	16.00	6.00	32.00
Divergence	123	0.70	0.88	0.00	0.00	3.00
Persistent Divergence	123	0.91	1.13	0.00	0.00	3.00
Augmented Divergence	123	0.93	1.30	0.00	0.00	3.50
Similarity	122	0.78	0.12	0.82	0.41	0.92
Own References	123	0.79	1.39	0.00	0.00	7.00
Experience	125	3.84	1.18	3.82	1.09	6.35
PhD	125	3.69	0.47	4.00	3.00	4.00
Professor	125	0.23	0.10	0.17	0.00	0.33
EPU	125	89.81	18.20	88.91	53.73	144.59

Note: This table reports summary statistics for the main variables used in the analysis. *Length* denotes length of minutes as measured by number of words, while *Lemma* refers to the total number of unique lemmas. *Research words* captures the number of research-related words, *Number words* is the number of quantitative terms. *Intensity* is measured by number of contributions. *Divergence*, *Persistent Divergence* and *Augmented Divergence* are our measures of divergence based on voting records and in the latter cases adjusted by persistency and persistency and "voting-with-peers" behavior, respectively. *Similarity* denotes textual similarity between consecutive minutes. *Own References* refers to the number of self references, *Experience* is the average tenure in years of the board members serving at time t. *PhD* is the number of board members holding a PhD degree while *Professor* indicates the share of board members who are professor in economics at time t. Finally, *EPU* represents the Economic Policy Uncertainty index for Sweden.

5 Empirical results

Our baseline specification is:

$$y_{i,t} = \alpha_t + \gamma D(Transparency)_t + \delta X_t + \epsilon_{i,t}. \tag{2}$$

where $y_{i,t}$ are our different measures indexed by i for minutes at each time t and $D(Transparency)_t$ is a dummy that takes value 1 after June 2007, i.e. after the minutes became attributed, and 0 otherwise. X_t is a set of controls and $\epsilon_{i,t}$ is the error term.

The vector X_t includes the five control variables we have described in the previous section. Our sample goes from January 1999 to April 2018, and in total we have 125 minutes. In 2 we report summary statistics of the main variables used in the empirical analysis.

5.1 Effect of transparency on *Effort* measures

In the literature, it is common to talk about the *Discipline Effect*. We prefer instead to use the term *Effort Effect*. We find it hard to believe that members do not do their best, lack discipline, when it comes to carefully thinking through different alternatives before every meeting and arriving at a recommended policy decision. That is, after all, what they are expected to do and get paid for. This should be the case, in particular, in a small individualistic committee, such as the Riksbank, with only six members. Their effort in other respects may vary; for example, in how thoroughly they motivate and substantiate their position at the policy meeting.

In this section, we show the results of estimating equation 2 when the dependent variable is based on what we have labeled above *Effort* measures. These measures aim to capture whether increased transparency motivated board members to put more effort into explaining their position during meetings. As *Effort* measures, we include *Length*, *Lemma*, *Research words* and *Number words*. To ensure comparability across minutes, the latter three measures are scaled by the length of the minutes. In Table 3, columns (1)-(4) report the associated estimation results based on equation 2.

As shown in Table 3, columns (1)-(4), the impact of $Transparency$ is positive and statistically significant for all *Effort* measures. With increasing transparency, minutes became significantly longer, as reflected in the measure *Length* and richer in content as measured by *Lemma*.[20] At the same time, there was an increase in the use of research-related terms (column (3)) and quantitative expressions (column (4)), indicating that board members were more inclined to build their arguments and explain their reasoning by referring to research studies, using research-related terminology more broadly, and incorporating data and statistical evidence more often.

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[20] The variable *Lemma* takes into account word inflections and is based on lemmatizing the text, as the name suggests. After lemmatizing the documents, all words are reduced in their base form, reflecting their canonical meaning. In order to have an adjusted by length measure, we divide the unique lemmas we identified in each minutes by the square root of each minutes' total number of words, corresponding to Guiraud's R measure of lexical diversity.

Table 3: The impact of *Transparency* on *Effort*

	Length	Lemma	Research words	Number words
Transparency	2387.62***	0.68**	0.01***	0.01***
	(496.11)	(0.29)	(0.00)	(0.00)
Experience	197.46*	0.31***	0.00***	0.00***
	(97.08)	(0.06)	(0.00)	(0.00)
Professor	8520.40***	0.57	0.00	0.00
	(2236.09)	(1.01)	(0.00)	(0.01)
GFC	−729.47	−0.35*	0.00	0.00
	(587.14)	(0.21)	(0.00)	(0.00)
Debate	3051.85***	0.34**	0.00	0.00**
	(492.31)	(0.16)	(0.00)	(0.00)
EPU	−3.08	0.00	0.00	0.00
	(8.18)	(0.00)	(0.00)	(0.00)
Num. Obs.	125	125	125	125
R2 (Adjusted)	0.83	0.44	0.75	0.56

Note: This table reports regression results for estimating the effect of increased transparency on *Effort* measures. *Transparency* is a dummy variable with value 1 from the date the minutes became attributed, *Experience* is the average tenure (in years) of board members at time t, *Professor* is the share of board members that are professor in economics at time t, *GFC* denotes a dummy for the period of the Global Financial Crisis (2008-2010) and *Debate* is a dummy for the period of the debate on "leaning-against-the-wind" policies (2010-2014), *EPU* denotes the Economic Policy Uncertainty index for Sweden. *Length* denotes length of minutes as measured by number of words, *Lemma* is the total number of unique lemmas scaled by the square root of total number of words, *Research words* is the length-adjusted number of research-related words, and *Number words* is the length-adjusted number of quantitative terms.
*, **, *** symbols denote p-value < 0.1, < 0.05, < 0.01, respectively. Robust standard errors in parentheses.

5.2 Effect of transparency on *Intensity of discussion*

The increase in transparency through the attribution of minutes may have influenced monetary policy discussions in ways beyond what is captured by *Effort*. In particular, it could have altered the nature and dynamics of interactions within the Board during monetary policy meetings.

In an active and dynamic environment, opinions and ideas are not only shared but also clarified and refined through interaction, rather than simply stated once. Such settings are typically characterized by frequent exchanges among participants.

To approximate the dynamics of interactions within the Board, we extract individual contributions from the pre-processed meeting documents and compute their absolute frequency, which we define as the *intensity of discussion*. In a lively back-and-forth exchange of views, one would expect a higher number of individual contributions compared to a setting where members primarily present pre-committed positions. Table 4 reports the results of estimating the baseline model in equation 2 using the *Intensity* measure. The findings indicate that *Transparency* has a negative and statistically significant effect on the intensity of the discussion as the frequency of interactive exchanges decreased substantially after minutes began to be attributed.

Table 4: The impact of *Transparency* on *Intensity*

	Intensity
Transparency	−13.51***
	(2.04)
Experience	0.14
	(0.45)
Professor	27.28***
	(8.25)
GFC	−0.85
	(1.88)
Debate	8.72***
	(1.63)
EPU	−0.05
	(0.03)
Num. Obs.	125
R2 (Adjusted)	0.324

Note: This table reports regression results for estimating the effect of increased transparency on the *Intensity* measure as measured by number of contributions. *Transparency* is a dummy variable with value 1 from the date minutes became attributed, *Experience* is the average tenure (in years) of board members at time t, *Professor* is the share of board members that are professor in economics at time t, *GFC* denotes a dummy for the period of the Global Financial Crisis (2008-2010) and *Debate* is a dummy for the period of the debate on "leaning-against-the-wind" policies (2010-2014), *EPU* denotes the Economic Policy Uncertainty index for Sweden. *, **, *** symbols denote p-value < 0.1, < 0.05, < 0.01, respectively. Robust standard errors in parentheses.

This suggests that attribution, while improving accountability, may have unintentionally reduced spontaneity, shifting discussions toward more scripted statements rather than genuine dialog.

How problematic this is depends on how the monetary policy process is designed. If members only meet at the monetary policy meeting, this is their main opportunity to exchange thoughts and opinions. In that case, de-anonymization would risk leading to too little monetary policy discussion among the members. As described in Section 2.2, the Riksbank's Executive Board is involved in the policy process more or less from the start and continuously discusses and exchanges views during this process. Nevertheless, it may be that the reduced interactivity in the deliberations at the monetary policy meeting is an unintended and less desired side effect.

5.3 Effect of Transparency on *Consistency*

To explore the effect of increased transparency on *Consistency*, we use two different measures. The first measure is based on references that board members make to their own stance at previous meetings. We call this measure *Own References*. More specifically, for each board member (contribution) in the post-transparency (pre-transparency) period, we compute the frequency of expressions such as "As I said in/at [*period/meeting*]...", "Similarly/In line with what I stated in/at [*period/meeting*]..." and other similar expressions that board members may use to refer to their previously stated position.

For example, in the following excerpt from the minutes of the meeting held on 25th April 2018, the board member references her previous assessment to contextualize their current position: *"My opinion in February was that the forecast for the repo rate, which we published at that time should be interpreted as meaning it probably would be appropriate to raise the repo rate by 0.25 percentage points at one of the monetary policy meetings in July, September or October."*

We also find a few instances of forward-looking consistency, where board members commit to their own stance also for the future. For example, in the minutes of the meeting held on 25 October 2014, it is written that Mr Flodén

"... sees no reason to make a decision on this today but he wishes nevertheless to point out that he does not expect to advocate an extension to the (QE) programme at the meeting in December."

In this sentence, the board member explicitly states that she will keep her current stance in future meetings. These forward-looking references are few and therefore we exclude them from the analysis.

Self-references can be both positive - if the board members positively refer to their previous position as in the example above - or negative - if they have changed position as would be the case if they express themselves as in "Contrary to what I thought previously...". We find that positive self-references are an overwhelming majority. There are only two negative self-references in our sample, and they were both from the period before the minutes became attributed.[21] An increase in *Own References* indicates an increase in consistency, as board members validate and reinforce their current position by connecting it with previous assessments and rationales, showing continuity - a *consistency* - in their stated opinion.

The second measure is *Similarity*. This measures the textual similarity of the contributions in two adjacent meetings. If consistency increases after making minutes non-anonymous, the similarity of contributions in consecutive meetings is also expected to increase, as board members will tend to use a set of similar arguments and rationales to reaffirm their position.

To further investigate whether divergence within the Board changed after minutes were attributed, we use the measures based on voting records *Divergence*, *Persistent Divergence*, and *Augmented Divergence* that we described in Section 4.2.

In Table 5, columns (1)-(2), we report the results of *Own References* and *Similarity*, respectively. In columns (3)-(5) we present the results based on *Augmented Divergence*

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[21] In the minutes there are also general references to earlier monetary policy reports. We exclude this type of general reference from our sample.

and *Persistent Divergence* and *Divergence*.

Reading the results across columns, we find that the effect of *Transparency* on self-references is positive and statistically significant, indicating that, after the attribution of the minutes, the board members tended to refer to their own position and showed a greater continuity - or *consistency* - in their position. Such consistency was not as strong in the pre-transparency period. *Transparency* is also positively associated with an increase in *Similarity*. Content-wise, individual board members' contributions became more similar in the post-transparency period, and thus the similarity of the document increased as well.

Turning to the voting-based measures, estimates in columns (3) to (5) show that divergence decreased in the post-transparency period. We also find that the proportion of professors on the Board has a significant effect on divergence. Professors also tended to diverge persistently (column 4) and displayed a higher likelihood of voting with their peers (column 3). However, the interpretation of this result is not obvious and it should be emphasized that while during the post-transparency period there were at least two board members who were professors of economics, during the pre-transparency period there was only one.

To further investigate whether it is an extensive academic background that makes members deviate more, we control in the robustness tests in section 6 for the proportion of board members with a PhD. This proportion is higher and varies less between the two periods than the proportion of professors (see Table 2). The results with this measure are not as significant (see Table 8).

It is notable that the variable *Debate* has a positive effect on *Own References*, as it does on the divergence measures, indicating that during the debate on "leaning-against-the-wind" policies both the frequency of self-references and the degree of splitting within the Board increased.

The variable picking the global financial crisis, *GFC*, and, to some extent, economic policy uncertainty, *EPU*, are negatively associated with *Consistency*. Naturally, during a period of increased financial stress, there is less room for self-references and less similarity in contributions. We also find that there is a lower divergence between board members. It is reasonable that it is easier to agree on what measures to take or, more generally, there is less willingness to diverge during a crisis period or when economic policy uncertainty increases substantially.

Together, these results suggest that in the post-transparency period, board members tend to maintain their own position longer by consistently reiterating their stance in subsequent meetings, produced text that was content-wise more similar in adjacent meetings, and

tended to diverge if they were economics professors.

Table 5: The effect of Transparency on Consistency

	Own References	Similarity	Augmented Divergence	Persistent Divergence	Divergence
Transparency	0.44*	0.21***	−0.58*	−0.67**	−0.50**
	(0.25)	(0.03)	(0.30)	(0.28)	(0.24)
Experience	0.09	0.02***	0.08	0.06	0.04
	(0.08)	(0.00)	(0.08)	(0.08)	(0.06)
Professor	2.53**	−0.11	3.17**	3.97***	2.60**
	(1.15)	(0.10)	(1.51)	(1.33)	(1.12)
GFC	−1.06**	−0.05**	−1.40***	−0.64*	−0.35
	(0.51)	(0.02)	(0.43)	(0.33)	(0.26)
Debate	1.18**	0.01	1.95***	1.60***	1.06***
	(0.48)	(0.01)	(0.33)	(0.28)	(0.21)
EPU	0.00	0.00*	−0.01	−0.01*	−0.01
	(0.01)	(0.00)	(0.01)	(0.01)	(0.00)
Num.Obs.	125	122	131	131	131
R2 Adj.	0.355	0.667	0.299	0.297	0.199

Note: This table reports the coefficients from regressions using different consistency measures. In column (1)-(2) we report text-based consistency measures, and in columns (3)-(5) measures based on voting records. *Transparency* is a dummy variable with value one from the date minutes became attributed, *Experience* is the average number of years that the board members have served on the Board at time t, *Professor* is the share of board members who are professor in economics at time t, *GFC* is a dummy variable with value one for the period 2008-2010, and *Debate* is a dummy variable covering the period of the debate about "leaning-against-the-wind" policies (2009-2014), *EPU* denotes the Economic Policy Uncertainty index for Sweden. Robust standard errors are in parentheses. The symbols * , **, *** are for p-value < 0.1, < 0.05, < 0.01, respectively.

6 Robustness checks

To validate the robustness of our empirical baseline results, we perform robustness checks controlling for the introduction of the policy rate path, for the composition of the Board and for using alternative variables and model specification. We find that the results do not change substantially.

An important robustness check is whether the introduction of the policy rate path, which coincided with that of attributed minutes, may have influenced our measures. To account for this, we exclude sentences referring to the path and the interest rate from our analysis. Specifically, from each set of minutes we remove those sentences that reference "path" and/or "interest rate". This includes expressions such as "repo rate path", "repo path", "interest rate", and "policy interest rate". In addition, we exclude sentences immediately before and after them, acknowledging that discussions surrounding the repo rate path may be framed in terms of interest rates and may form part of a longer discussion. On the remaining text we recompute the *Effort* measures, the *Intensity* measure and the two text-based *Consistency* measures *Own References* and *Similarity*.[22] In Figure 3, we

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[22] In further robustness checks, we extend this exclusion to include up to three sentences before and after any sentence mentioning "path" and/or "interest rate". This exercise gives qualitatively similar results.

Table 6: Regression results: exclusion of "path" and "interest rate"

	Length	Research words	Number words	Intensity	Similarity
Transparency	0.20***	0.01***	0.01***	−13.35***	0.20***
	(27.01)	(0.001)	(0.001)	(1.78)	(0.03)
Experience	0.07***	0.000**	0.001***	0.09	0.02***
	(4.02)	(0.000)	(0.000)	(0.48)	(0.01)
Professor	−0.81***	−0.01***	−0.01	24.93***	−0.14
	(109.42)	(0.003)	(0.004)	(8.03)	(0.10)
GFC	−41.11**	−0.001*	−0.002**	−0.86	−0.04*
	(26.36)	(0.001)	(0.001)	(1.24)	(0.02)
Debate	65.45***	−0.002***	−0.001	8.09***	−0.01
	(21.32)	(0.000)	(0.001)	(1.00)	(0.01)
EPU	−0.27	0.000	0.000	−0.04	−0.001
	(0.41)	(0.000)	(0.000)	(0.03)	(0.000)
Num.Obs.	125	125	125	125	123
R2 Adj.	0.75	0.66	0.35	0.33	0.62

Note: This table shows regression results from estimating the effect of increased transparency on minutes after removing expressions such as "repo rate path", "repo path", "interest rate", and "policy interest rate", as well as removing one sentence immediately after and before. In columns (1)-(3), we report results on *Effort* measures, in column (4) on the *Intensity* of discussion as measured by the number of individual contributions and column (5) on the text-based *Consistency* measures, *Similarity*. *Transparency* is a dummy variable with value 1 from the date minutes became attributed, *Experience* is the average experience of board members at time t, *Professor* is the share of board members who are professor in economics at time t, *GFC* denotes a dummy for the period (2008-2010) and *Debate* is a dummy for the period of the debate on "leaning-against-the-wind" policies (2010-2014), *EPU* denotes the Economic Policy Uncertainty index for Sweden. Robust standard errors are in parentheses; the symbols *, **, *** denote p-value < 0.1, < 0.05, < 0.01, respectively.

show the total number of sentences (Total) and the adjusted one (Total, adjusted), i.e. the total number of sentences after removing "path" and "interest rate" sentences whereas in Table 6 we report the results on *Transparency* (and controls) of estimating equation 2 after removing sentences referencing to "path" and/or "interest rate" as described above. As shown in the table, the results remain robust.

In a second set of robustness checks, we control for the different personalities of the board members. During the debate on whether a central bank should lean against the wind or not, one of the board members had a strong view that it should not, and advocated this in many, very long and detailed contributions. The opponents tended to use much fewer words. Even if we have tried to take this particular period into account using a dummy, it is useful to investigate whether the extensive contributions of this particular member affect the overall results. If so, the results would capture that the committee at the time happened to have a particular composition of individuals, rather than the effect of introducing names in the minutes. As a robustness check, we therefore run the baseline regression with the member's contributions excluded. We present the results in Table 7.

Table 7: Regression results controlling for composition of the Board

	Effort Measures			Intensity	Consistency measures		
	Length	*Research words*	*Number words*	*Intensity*	*Similarity*	*Own References*	*Divergence*
Transparency	204.40***	0.01***	0.01***	−13.18***	0.22***	0.48	−0.25
	(36.13)	(0.00)	(0.00)	(1.86)	(0.03)	(0.26)	(0.24)
Experience	15.27***	0.00*	0.00*	−0.13	0.02***	0.06	−0.07
	(4.81)	(0.00)	(0.00)	(0.48)	(0.00)	(0.08)	(0.06)
Professor	58.22	−0.01***	−0.01**	22.06***	−0.12	2.47	0.53
	(123.43)	(0.00)	(0.00)	(7.83)	(0.11)	(1.13)	(1.15)
GFC	−43.22**	0.00**	0.00***	−1.38	−0.04*	−0.92**	−0.39
	(24.42)	(0.00)	(0.00)	(1.04)	(0.02)	(0.48)	(0.25)
Debate	44.36**	0.00***	0.00***	5.73***	−0.01	0.86**	0.60***
	(21.14)	(0.00)	(0.00)	(0.80)	(0.01)	(0.47)	(0.18)
EPU	−0.01	0.00	0.00	−0.02	0.00*	0.01	0.00
	(0.44)	(0.00)	(0.00)	(0.03)	(0.00)	(0.01)	(0.00)
Num.Obs.	124	124	124	124	122	125	125
R2 Adj.	0.807	0.709	0.521	0.351	0.646	0.315	0.038

Note: Transparency is a dummy variable with value 1 from the date minutes became attributed, *Experience* is the average experience of board members at each time t, *Professor* is the share of board members who are professor in economics at each time t, *GFC* denotes a dummy for the period (2008-2010) and *Debate* is a dummy for the period of the debate on "leaning-against-the-wind" policies, *EPU* denotes the Economic Policy Uncertainty index for Sweden. *Length* denotes length of minutes as measured by number of words, *Rwords* is the number of research-related words, *Numbers* is the number of quantitative words, *Intensity* of discussion is measured by individual contributions; *Similarity* denotes the content similarity of the contributions in two adjacent meetings; *Own References* is the number of references that board members make to their own stance at previous meetings; *Divergence* is defined as the difference between the preferred interest rate of member i at the meeting at time t, and the majority vote. Robust standard errors are in parentheses; the symbols *, **, *** denote p-value < 0.1, < 0.05, < 0.01, respectively.

Finally, we perform several robustness checks regarding the choice of variables. In particular, we use alternative control variables and, in further robustness checks, we include additional variables. We also test the results using alternative measures for the dependent variable.

As alternative control variables, we compute the number of board members who hold a PhD at each point in time and use this new variable - PhD - as an alternative to the share of board members who are professor in economics ($Professor$). As an alternative to the variable EPU and to control for changes in the business cycle, we use the Economic Tendency Indicator computed by the National Institute of Economic Research (NIER). We label this variable BI. We report the results in Table 8.
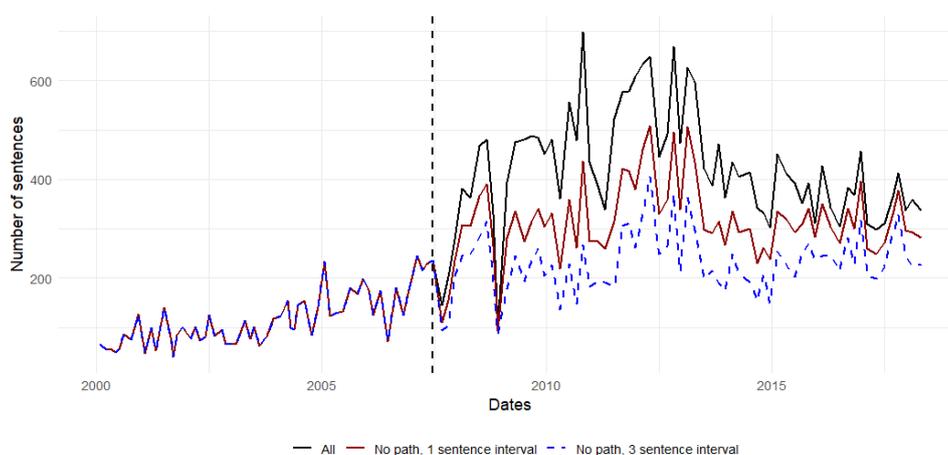
Figure 3: Number of sentences in the minutes

Note: The solid black line shows the total number of sentences in each set of minutes and the solid red and blue dashed line the number of sentences after removing sentences that mention "path" and/or "interest rate" as well as one or three sentences before and after. The vertical dotted line marks the start of the period with attributed minutes.

Table 8: Regression results: alternative controls

Variable	Effort measures			Intensity	Consistency measures				
	Length	*Research*	*Number*	*Intensity*	*Own Ref*	*Similarity*	*Divergence*	*PersDiverg*	*AugDiverg*
Transparency	3767.71***	0.01***	0.01***	-10.95***	0.88***	0.15***	-0.45*	-0.62**	-0.47*
	(410.39)	(0.00)	(0)	(1.66)	(0.31)	(0.02)	(0.23)	(0.26)	(0.27)
Experience	211.64	0.001***	0.001***	-0.13	0.04	0.01**	-0.10	-0.12	-0.22**
	(129.48)	(0.00)	(0.00)	(0.56)	(0.12)	(0.01)	(0.07)	(0.09)	(0.09)
PhD	-70.60	-0.001**	-0.001*	1.37	0.13	0.003	0.37*	0.46*	0.48*
	(418.48)	(0.00)	(0.00)	(1.94)	(0.25)	(0.02)	(0.22)	(0.28)	(0.27)
GFC	-1165.19*	-0.001	-0.001	-1.44	-1.12**	-0.01	-0.41	-0.65*	-2.00***
	(639.73)	(0.00)	(0.00)	(1.62)	(0.49)	(0.01)	(0.28)	(0.36)	(0.37)
Debate	3179.29***	0.000	0.002**	9.45***	1.24**	0.01	1.27***	1.89***	2.43***
	(558.22)	(0.00)	(0.001)	(1.21)	(0.53)	(0.01)	(0.22)	(0.29)	(0.32)
BI	-0.43	0.000	0.000	0.06	0.01	0.002***	0.01	0.01	0.01
	(17.22)	(0.00)	(0.00)	(0.07)	(0.01)	(0.001)	(0.01)	(0.01)	(0.01)

Note: This table reports the coefficients from regressions using different controls variables than in the baseline. In column (1)-(3) we report *Effort* measures *Length*, *Research words*, *Number words*; in column (4) we report results referring to the *Intensity* measure and in columns (5)-(9) the *Consistency* measures. As in the baseline, *Transparency* is a dummy variable with value one from the date minutes became attributed, *Experience* is the average number of years that the board members have served on the Board at each time t, *GFC* is a dummy variable with value one for the period 2008-2010 and *Debate* is a dummy variable covering the period of the debate about "leaning-against-the-wind" policies (2009-2014). *PhD* is the share of board members that hold a PhD in economics, *BI* denotes the Economic Tendency Indicator computed by the National Institute of Economic Research (NIER). Robust standard errors are in parentheses. The symbols * , **, *** are for p-value < 0.1, < 0.05, < 0.01, respectively.

Regarding alternative measures of the dependent variable, we use an alternative minutes-based measure - *lemma_ave* - that takes the average number of lemmas for each sentence identified in the text. Additionally, we measure length with two new measures, which are based on the number of orthographic words. We call these two new measures *raw_ave* and *raw_tot*.

As an alternative voting-records-based measure for *Consistency*, we compute the proportion of board members who vote with the majority as an alternative measure of divergence. If, as Goodhart and Rochet (2011) indirectly suggest, attributing minutes amplifies and deepens divisions within the Board, it would encourage the formation of two groups - a minority and majority - while also increasing the propensity of board members to consistently align with their respective groups. We call this new measure *m_prop* and we compute it as follows:

$$\text{m\_prop}_t = \frac{N_{\text{majority},t}}{N_t} \tag{3}$$

where N is the total number of board members and $N_{\text{majority},t}$ is the number of board members who voted with the majority.

As a further check, we use the *skew* measure computed by Gerlach-Kristen (2004). The measure *skew* is defined as the difference between the average policy rate voted on by the individual board members and the policy rate that is the result of the majority vote. We present the results of these robustness checks in Table 9.

Table 9: Regression results for alternative dependent variables

	Lemma_ave	Raw_tot	Raw_ave	Majority	Skew
Transparency	603.59	2,919.72***	560.53***	0.09***	0.0001
	(496.11)	(0.01)	(0.001)	(0.001)	(0.0002)
Experience	31.29	444.73***	28.58***	0.004***	−0.0000
	(97.08)	(0.001)	(0.0001)	(0.0002)	(0.0000)
Professor	−164.92	6,739.24***	−155.52***	−0.44***	−0.001
	(2,236.09)	(0.02)	(0.004)	(0.01)	(0.001)
GFC	−27.44	−1,089.43***	−23.65***	0.07***	0.0002
	(587.14)	(0.003)	(0.001)	(0.001)	(0.0001)
Debate	−172.17	3,275.73***	−159.40***	−0.20***	−0.001***
	(492.31)	(0.003)	(0.0005)	(0.001)	(0.0001)
EPU	1.82	−5.47***	1.69***	0.001***	0.0000
	(8.18)	(0.0001)	(0.0000)	(0.0000)	(0.0000)
Constant	−95.46	128.93***	−86.49***	0.88***	0.0002
	(748.34)	(0.01)	(0.001)	(0.001)	(0.0003)
Observations	125	125	125	123	123
$R^2 Adj.$	0.82	0.83	0.82	0.24	0.32

Note: This table reports the coefficients from regressions using different dependent variables. *Lemma_ave* refers to the average of lemmas identified in each minutes. *Raw_tot* and *Raw_ave* refers to raw count. In column (4), *Majority* refers to the proportion of board members voting with the majority. In column (5), *Skew* refer to the measure as in Gerlach-Kristen (2004) based on minority voting. *Transparency* is a dummy variable with value one from the date minutes became attributed, *Experience* is the average number of years the board members have served at each time t, *Professor* is the share of board members that are professor in economics at time t, *GFC* is a dummy variable with value one for the period 2008-2010 and *Debate* is a dummy variable covering the period of the debate about "leaning-against-the-wind" policies (2010-2014), *EPU* denotes the Economic Policy Uncertainty index for Sweden. Robust standard errors are in parentheses. * , **, *** are for p-value < 0.1, < 0.05, < 0.01, respectively.

7 Conclusion

In this paper, we investigate the effects on the deliberations of a monetary policy committee of a natural experiment at the Swedish Riksbank: the decision to start publishing attributed minutes from June 2007. Like Hansen et al. (2018) observe for the Federal Reserve, we find that increased transparency has made meetings less interactive, more scripted, and more quantitatively and technically oriented. This is perhaps even less surprising when it comes to the Riksbank than the Federal Reserve. During the investigated period, the Riksbank minutes were published only around ten days after the policy meeting (the time lag today is even shorter). Thus, there should be strong incentives for members to elaborate more thoroughly on their own specific view as a guide to markets and the public. As members' contributions have become longer but fewer, this is indeed what seems to have happened.

This is an important way in which the discipline effect manifests itself in the Riksbank's case. It is harder to tell whether this reflects that members not only exert more effort in *explaining* their view, but also in *arriving at it* by preparing more thoroughly between meetings. Assuming, as do Hansen et al. (2018), that the latter is reflected in the use of more numbers and data and a more technical language, both effects may be present.

That meetings become less interactive and more scripted appears to be a general effect of this kind of increased transparency, since it holds for both natural experiments and both types of monetary policy committee. Other effects may be more case-specific.

For example, we find that one effect is that Riksbank board members become more consistent over time in their opinions and assessments. For instance, they refer more often to what they have said earlier. Such an effect has not been documented for the Fed and is probably due to the fact that in the Riksbank's case external observers can follow the reasoning of individual members more or less in real time.

Another case-specific aspect is that the Riksbank Board is an individualistic monetary policy committee, whereas the FOMC is a collegial committee. In a collegial committee, members argue for their own points of view behind closed doors, but eventually take ownership of the group decision. When 'doors open' in a collegial committee, members may choose to moderate differences in views that may exist, also in the discussion prior to the decision. Finding a conformity effect in a collegial committee, as is done in several studies on the Federal Reserve, is therefore perhaps not so surprising. In an individualistic committee, in contrast, unanimity is neither sought nor necessarily expected. Thus, increased transparency with respect to deliberations during meetings will make less of a difference. Consequently, we find little evidence of a conformity effect in the Riksbank's case.

A summary conclusion is that transparency can have different effects depending on the nature of natural experiment and the characteristics of the committee. Thus, it is hard to generalize the effect of transparency on monetary policy committees. One has to take into account that both these concepts are multi-dimensional.

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A Pre-processing of data

Minutes were originally in either doc- or PDF-format. Texts were extracted from the PDF-files using the Apache Tika parser[23] accessed via a Python port[24]. From the minutes, we then used regular expressions to remove data that were not text, such as multiple empty lines, page headers, pagination, and table cell data.

The outline of the minutes has changed over the years, but is typically divided into four numbered sections. Some minutes have less than four sections and a few of them have more. Each section is supplied with a heading that starts with an initial '§'-sign. We have extracted sections that contain reports of the discussions and deliberations. These are found in the headings *Monetary policy discussion*, or just *Discussion*. We have then identified parts of the discussion that can be attributed to a single member, or, in the anonymous minutes, to two or more members. We refer to these parts as "contributions".

A contribution in the anonymous minutes usually starts with an indefinite noun phrase having the noun 'member' as head. Examples are *one member, three members*, followed by a speech act verb such as *stated, argued* or an auxiliary verb, e.g., *wanted, had*. A contribution is assumed to continue until a new indefinite reference of the same kind is encountered.

A contribution in the transparent minutes is introduced with the member's title, e.g., *First Deputy Governor*, and full name. All text following this introductory phrase and lasting until a new introduction of the same type is encountered has been allocated to a single contribution. The total number of individual contributions is 1079 in the anonymous mode and 908 in the transparent condition.

The minutes are parsed by the Sparv parser (Borin et al. 2016). The information obtained from Sparv includes lemmas, part-of-speech tags, and word senses, which we have used in subsequent processing. For both individual (after June 2007) and aggregated data, the length of the contributions varies significantly. As seen in Table 1, the aggregated contributions range from 30 to 4682 tokens.

All contributions with metadata and generated data, further elaborated on in the following section, have been stored in a pandas dataframe, accessible at GithubLiU.

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[23] https://tika.apache.org/
[24] https://github.com/chrismattmann/tika-python

B   Similarity metric

When comparing the similarity of minutes from adjacent meetings, we used a variant of cosine similarity, a common approach in information retrieval and text mining. The documents to be compared are then represented with vectors and cosine similarity of the vectors is used as a metric. Given two vectors, $U = <u_i>$ and $V = <v_i>$, with N elements, the cosine similarity is defined as

$$\cos(U, V) = \frac{U \cdot V}{|U||V|} = \frac{\sum_i^N u_i v_i}{\sqrt{\sum_i^N u_i^2} \cdot \sqrt{\sum_i^N v_i^2}} \tag{4}$$

The vector elements may be determined in different ways. In our case, we extracted the most frequent content words (i.e., their lemma) from the entire corpus of the categories noun and verb. After some experimentation, we found that the 200 most frequent ones from this list would give us dense enough representations of all meetings. This means that the value could vary between 0 and 1, where 1 means that the two representations are identical, and the documents very similar, and 0 means that none of the 200 selected words are in common for the two documents being compared.

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