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DISSENT IN MONETARY POLICY DECISIONS

Dissent in Monetary Policy Decisions*

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Abstract

Voting records indicate that dissents in monetary policy committees are frequent and predictability regressions show that they help forecast future policy decisions. In order to study whether the latter relation is causal, we construct a model of committee decision making and dissent where members' decisions are not a function of past dissents. The model is estimated using voting data from the Bank of England and the Riksbank. Stochastic simulations show that the decision-making frictions in our model help account for the predictive power of current dissents. The effect of institutional characteristics and structural parameters on dissent rates is examined using simulations as well.

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1 Introduction

This paper studies dissenting behavior in monetary policy committees and its implications for policy decisions. The subject matter is potentially important because dissents are a key feature of the minutes and voting records of monetary committees. The data from the committees at the Bank of England, the Riksbank, and the Federal Reserve show that dissents occur frequently: At least one member dissents in 63, 38, and 34 percent of meetings, respectively. However, it is by no means obvious that dissents should matter for policy decisions. By definition, a dissenting vote does not prevent the implementation of the policy preferred by the majority of members. On the other hand, in a setup where members interact repeatedly, a dissenter may have an effect on the future actions of fellow members and, hence, on policy.

In this paper, we report empirical evidence that a current dissent by a committee member is helpful in forecasting the future policy actions of other members. Thus, for instance, a current dissent in favor of an interest rate cut is a predictor of votes for an interest rate cut by other members in the next meeting. Then, it is not surprising to find that dissents are helpful in forecasting the policy action of the committee as a whole, as was first pointed out by Gerlach-Kristen (2004) for the Bank of England, and is documented here for the Riksbank and Federal Reserve.[1] We also examine how the predictive power of dissents depends on the seniority and previous dissent rate of the dissenter. More specifically, we construct measures of dissent where dissenting votes are weighted according to either the tenure or the previous voting record of the dissenter. Results show that seniority does not seem to provide additional information and modify the predictive power of equally-weighted dissenting votes. In contrast, dissents by members that have often dissented in the past (i.e., "serial" dissenters) appear to be much less informative about future policy, perhaps because other members may tend to discount them.

Of course, the finding that dissents are useful in forecasting future individual and committee policy actions does not establish a causal relation. Yet, establishing whether the relation is causal or not has important policy implications. If the relationship is not causal, future policy actions are unaffected by the decision to either cast or conceal a dissenting opinion. In this case, it could be argued that internal norms of consensus that discourage

[1] In contrast, Meade (2002) uses FOMC dissents, both official ones in the minutes and verbal ones inferred from the transcripts, for the period 1992 to 1996 and finds that dissents do not help predict future policy changes. Andersson et al. (2006) analyze the effect of dissents on the yield curve in Sweden and find that the minority view, as reflected in the minutes published a few weeks after the monetary policy meetings, has a quantitatively large but statistically insignificant effect on investors' expectations about future Repo rate decisions.

dissent are suboptimal because valuable information that would improve the predictability of future policy changes is not conveyed to the public.[2] A causal relation may arise, for example, in dynamic models where members care about their reputation.[3] In this case, the occurrence of dissent may alter the strategic interactions in the next meeting. As a result, normative conclusions would be less straightforward because transparency may distort the incentives to make correct decisions in the future.

In order to examine the potential role of reputation or other mechanisms in explaining the reported predictability, we pursue the following approach. First, we formulate a model of committee decision making and dissent where current decisions are independent of dissents in the previous meeting. That is, by construction, there is no behavioral channel through which dissents affect future policy decisions. The model is estimated using individual and aggregate voting data from the Bank of England and the Riksbank. Then, stochastic simulations are used to study how dissenting rates depend on institutional characteristics and structural parameters, and, importantly, whether current dissents help forecast future policy actions. Under the null hypothesis, the coefficient of our dissent measure would be statistically different from zero a proportion of times equal to the nominal size of the test. However, we find that the test over-rejects and so, a non-causal mechanism may be partly responsible for the predictability results. We provide an intuition for this mechanism, argue that it arises from frictions inherent to consensual decision making, and show via simulations that shock persistence magnifies its effect.

The model of committee decision making and dissent extends the consensus model in Riboni and Ruge-Murcia (2010) in two important dimensions.[4] First, the model assumes that policy makers can choose only among a discrete set of interest rate changes. (Our earlier contribution assumed that interest rate changes was a continuos variable.) This extension is important because interest rate changes usually take place in multiples of 25 basis points and because it means that, in addition to decision-making frictions, committee members face size frictions as well. As we will see below, this means that the key voting members face a trade-off between two possible interest rate changes. Instead with continuos policy options,

[2]This argument is made, for example, by Gerlach-Kristen and Meade (2010). For a discussion of the literature on central bank communication, see Blinder et al. (2008).

[3]To our knowledge this question has not yet been studied by the literature. Visser and Swank (2007), Levy (2007), and Meade and Stasavage (2008), study reputational concerns in committees but they focus on static settings. Conversely, Prendergast and Stole (1996) and Li (2007) analyze sequential decision making but consider a single agent. Depending on the specifics of the model, the above mentioned literature shows that reputational concerns may lead to either anti-herding (i.e., dissent and inconsistent decisions over time) or herding behavior (i.e., conformity and few "mind changes").

[4]We use Riboni and Ruge-Murcia (2010) as our point of departure because in that paper we estimated four different voting protocols using data from five central banks (including the three studied here), and found that for all of them the consensus model fits actual policy decisions better than the other models.

their exact preferred policy option is implementable and these members face no trade-off. Second, the model incorporates a simple rule for registering dissents. This extension allows us to study the possible implications of dissents for monetary policy making under a well defined benchmark.

The paper is organized as follows: Section 2 describes the voting records used in the analysis and reports empirical regularities. Section 3 constructs and estimates a model of committee decision making and dissent, and reports its quantitative analysis. Finally, Section 4, concludes and outlines our future research agenda.

2 Empirical Regularities

2.1 Voting Records

The analysis is based on the voting records from three central banks, namely the Bank of England, the Swedish Riksbank, and the U.S. Federal Reserve.

For the Bank of England, we use the voting records of the Monetary Policy Committee (MPC) for the 148 meetings between June 1997 and August 2009.[5] The sample period starts with the first meeting of the MPC and covers the governorships of Sir Edward George and Mervin King (ongoing). The MPC consists of nine members of which five are internal, that is, chosen from within the ranks of bank staff, and four are external appointees. Internal members are nominated by the Governor, while external members are appointed by the Chancellor. Meetings are chaired by the Governor and take place monthly. Decisions concern the target value for the Repo Rate and are made by simple-majority rule on a one-person, one-vote basis. Prior to November 1998, the records report the interest rate preferred by assenting members and whether dissenting members favored a tighter or a looser policy. Thereafter, the records report the interest rates preferred by each member, including the dissenters. These records are available at *www.bankofengland.co.uk.*

For the Riksbank, we constructed the voting records of the Executive Board (EB) using the minutes of the 81 meetings between February 1999 and September 2009. The minutes are available at *www.riksbank.com.* Under the Riksbank Act of 1999, the Executive Board consists of the Governor and five Deputy Governors. Meetings of the EB are chaired by the Governor and take place about seven times a year. During the sample period, the Gover-

[5]Since the data were collected in the Fall of 2009, the samples for all central banks end in August/September of that year. We have considered extending the sample beyond this period but, since monetary policy in the aftermath of the financial crisis has been implemented by means other than interest rate adjustments, it is not clear that recent voting records adequately capture the policy stands of committee members.

nors have been Urban Backstrom, Lars Heikensten, and Stefan Ingves (ongoing). Decisions concern the target value for the Repo Rate and are taken by majority vote. However, formal reservations against the majority decision are recorded in the minutes and explicitly state the interest rate preferred by the dissenting member.

For the Federal Reserve, we use the formal voting records of the Federal Open Market Committee (FOMC) for the 183 meetings from August 1987 to September 2009. FOMC meetings are chaired by the Chairman of the Board of Governors. During the sample period, the Chairmen have been Alan Greenspan and Ben Bernanke (ongoing). FOMC decisions concern the target value for the Federal Funds Rate and are taken by majority rule among voting members. Voting members include all the seven members of the Board of Governors, the president of the New York Fed, and four members of the remaining district banks, chosen according to an annual rotation scheme. The voting records up to December 1996 were taken from Chappell et al. (2005), and those from January 1997 onwards were constructed by ourselves using the minutes of FOMC meetings, which are available at *www.federalreserve.gov*. Unlike the Riksbank and the Bank of England, dissenting members in the FOMC do not state the exact interest rate they would have preferred, and the minutes record only the direction of their dissent (whether tightening or easing) compared with the policy selected by the committee.

2.2 A Look at the Data

The voting records show that dissents in monetary policy decision are frequent: The fraction of meetings where at least one member dissents is 0.63, 0.38 and 0.34 in the Bank of England, the Riksbank and the Federal Reserve, respectively. The fraction of meetings where exactly one member dissents is about 0.25 in all three central banks, and the fraction where exactly two members dissent is close to 0.20 in the Bank of England and to 0.10 in both the Riksbank and the Federal Reserve. Furthermore, the number of dissenting members in the Bank of England has been the largest possible (four) in about 8 percent of the meetings, with the governor himself a dissenter in two meetings (in August 2005 and in June 2007), and there have been three instances in the Riksbank where three members out of six have expressed a reservation concerning the policy selected by the committee and the Governor has been forced to use his formal tie-breaking power.

As it is well know, dissent behavior varies with the nature of committee membership. In the Bank of England and the Federal Reserve committee members belong to either one of two distinct groups—that is, internal or external in the former case, and Bank president or Board member in the latter case. As shown in table 1, 70 percent of dissents in our FOMC sample are entered by Bank presidents and they tend to be in favor of a tighter policy than that selected by the committee. Belden (1989) reports similar results using data from 1970 to 1987. Thus, the higher frequency and direction of dissent on the part of Bank presidents appears to be a robust feature of the FOMC.[6] Similarly, 68 percent of dissents in the MPC are entered by external members and they are usually for a looser policy than that adopted by the committee. This observation has been previously reported by Gerlach-Kristen (2003). Spencer (2005) finds that the voting difference between internal and external members is statistically significant (see, also, Harris and Spencer, 2008).

The number of dissents also varies with the type of decision made by the committee (that is, whether no change, easing or tightening). In general, most dissents take place when the committee decides to keep the interest rate unchanged. This is the case for 72 percent of dissents in the Bank of England (that is, 129 out of 179 total dissenting votes), 61 percent in the Riksbank (27 out of 44), and 48 percent in the Federal Reserve (45 out of 94).[7] The more detailed records of the former two banks allow us to examine the nature of the dissents in cases where the committee adjusts the interest rate. In the Bank of England there were 50 dissents in this situation: 29 in favor of keeping the interest rate unchanged and 21 in favor of a policy in the same direction as that adopted by the committee but of a usually larger magnitude.[8] In the Riksbank, there were 17 dissents in meetings where the EB agreed to adjust the interest rate: 11 were in favor of keeping the Repo rate unchanged and 6 in favor of a change in the same direction as that chosen by the committee (in two cases of a smaller magnitude and in four cases of a larger magnitude).

In summary, about 80, 70, and 50 percent of the dissents in the Bank England, the Riksbank, and the Federal Reserve, respectively, arise in situations where individual members prefer a larger interest rate change than the one agreed by the committee, either because (*i*) the rate has been kept unchanged but the dissenter would prefer a change, or (*ii*) the rate

[6] Previous literature suggests that additional factors in FOMC dissent are career background, and regional and political affiliation. Havrilesky and Gildea (1992) argue that Democratic (Republican) appointees dissent more frequently in favor of easier (tighter) monetary policy. Moreover, members who started their career in the government are associated with a preference for easier monetary policy, while the voting records of professional economists are predictable on the basis of partisan affiliation. Meade and Sheets (2002) and Chappell et al. (2008) show that Bank presidents are influenced by economic conditions in their regions. Other work on dissent patterns at the FOMC includes Havrilesky and Schweitzer (1990), Gildea (1992), and Chappell et al. (1995).

[7] Since this result may be partly due to the fact that keeping the status quo is the most common policy decision in all three committees, we also computed the average number of dissents for each type of policy decision. In both the MPC and the EB, keeping the interest rate unchanged generally remains the most controversial policy decision. However, in the case of the FOMC, the highest average number of dissenting votes takes place when the committee lowers the interest rate.

[8] For example, in the MPC meeting on 5 April 2001, the committee agreed to cut the interest rate by 25 basis points but two members dissented in favor of a larger cut of 50 points.

has been changed but the dissenter would prefer an even larger change. Overall, this finding suggest that dissents arise from committees being more cautious in adjusting interest rates than an individual would be at a given point in time.

2.3 A Measure of Dissent

Consider a committee $\mathcal{N} = \{1, .., N\}$ and let $\mathcal{G} \subseteq \mathcal{N}$ be a subgroup within the committee. Define the indicator function

$$I(\Delta i_{m,t} - \Delta i_t) = \begin{cases} 1 & \text{if member } m \in \mathcal{G} \text{ prefers a tighter policy than the committee,} \\ 0 & \text{otherwise,} \\ -1 & \text{if member } m \in \mathcal{G} \text{ prefers a looser policy than the committee,} \end{cases}$$

where $\Delta i_{m,t}$ is the policy favoured by member m and Δi_t is the policy selected by the committee. Then, define the measure of dissent

$$L_{\mathcal{G},t} = \sum_{m=1}^{G} (1/G) I(\Delta i_{m,t} - \Delta i_t), \tag{1}$$

where G denotes the cardinality of group $\mathcal{G}$. To lighten the notation, we write L_t instead of $L_{\mathcal{N},t}$ when $\mathcal{G} = \mathcal{N}$. In our empirical analysis, we construct measures of dissent for the three committees in our sample (that is, the FOMC, the MPC, and the EB) and for various subgroups, such as, Bank Presidents and Board members of the FOMC, and internal and external members of the MPC of the Bank of England.

An attractive feature of our dissent measure is that it is based on an indicator function that can be easily constructed for all three central banks. This allows us to sidestep the problem created by the limited information in the FOMC minutes and the early MPC records, which do not report the interest rate preferred by the dissenter but only his/her preferred policy direction (whether tightening or easing) compared with the policy selected by the committee.

In order to inspect whether conclusions may be affected by the use of an indicator instead of the actual interest rates, we also constructed the measure

$$D_{\mathcal{G},t} = \sum_{m=1}^{G} (1/G) \left(\Delta i_{m,t} - \Delta i_t\right).$$

This measure is the skewness variable used by Gerlach-Kristen (2004, 2009) and (except for the different timing) the minority view indicator in Andersson et al. (2006). Notice that, by construction, $\Delta i_{m,t} - \Delta i_t = 0$ for assenting members, just as in (1). It is clear that both D_t and L_t may be computed for the Riksbank and the Bank of England (after November 1998), while only L_t may be computed for the Federal Reserve. However, since the correlation between both measures is 0.99 for the Bank of England and 0.97 for the Riksbank, it is likely that both measures will lead to similar conclusions and, more importantly, that results for the FOMC will not be hindered by the fact that its records are less detailed than those of the other committees. The main reason both measures are so similar is that dissents are almost always 25 basis points away from the selected policy. For the Riksbank, 82 percent of dissents (36 out of 44) are of 25 points.[9] For the MPC sub-sample for which the preferred policy of dissenting members is recorded, the corresponding statistic is 97 percent (that is, 152 out of 156). Thus, there is a sense in which our dissent measure simply uses the indicator function (± 1), instead of the ± 0.25 that characterizes an overwhelming majority of dissents.

Notice that our dissent measure in (1) weights equally all dissents. As part of this project, we also construct a related measure where more senior members receive a larger weight than more junior ones, and one where members who have dissented often in the past have a larger weight than those who have not. The first measure seeks to capture the idea that individuals with more experience may have more influence in committee decisions. Let $S_{m,t}$ denote the tenure of member $m \in \mathcal{G}$, which coincides with the number of meetings attended until time t. Then, the dissent measure is

$$L^s_{\mathcal{G},t} = \sum_{m=1}^{G} \left(S_{m,t} / \sum_{n=1}^{G} S_{n,t} \right) I(\Delta i_{m,t} - \Delta i_t).$$

In the case where $\mathcal{G} = \mathcal{N}$, L^s_t measures the relative seniority of the dissenter compared to that of all members of the committee. In the case where $\mathcal{G}$ is a strict subset of $\mathcal{N}$, $L^s_{\mathcal{G},t}$ measures seniority relative to that of all members in that group. Defining the weights in this way means that they add up to one regardless of $\mathcal{G}$.[10]

The second measure is designed to assess the effect of "serial" dissenters on future policy decisions. The idea is that individuals who are more willing to openly express their disagreement with the committee may (or may not) have more influence on its decisions. Let $H_{m,t}$ denote dissent rate of member $m \in \mathcal{G}$, measured as the proportion of meetings with a dissenting vote in the voting history of member m up to meeting t. Then, the dissent

[9] Of the remaining dissents, 7 are of a size larger than 25 points (1 of 30, and 6 of 50, points), and there is one exceptionally small dissent of 10 basis points.

[10] In preliminary work, we considered a slightly different specification where the seniority of each member of group $\mathcal{G}$ is measured relative to that of all committee members. That is,

$$L^s_{\mathcal{G},t} = \sum_{m=1}^{G} \left(H_{m,t} / \sum_{j=1}^{N} H_{j,t} \right) I(\Delta i_{m,t} - \Delta i_t).$$

However, results using this measure are basically the same as those reported here.

measure is

$$L^h_{\mathcal{G},t} = \sum_{m=1}^{G} \left(H_{m,t} / \sum_{n=1}^{G} H_{n,t} \right) I(\Delta i_{m,t} - \Delta i_t).$$

As before, the weights add up to one regardless of $\mathcal{G}$.

2.4 Effect on Other Members' Votes

In this Section, we investigate whether current dissents help predict individual voting decisions in future meetings. (Given the ambiguity associated with how tenure should be defined for the alternate voting members of the FOMC, we limit the analysis in this section to the Bank of England and the Riksbank.) Specifically, we perform the regression[11]

$$\Delta i_{m,t+1} = \alpha + \beta L_{-m,t} + \boldsymbol{\gamma} \mathbf{x}_t + \xi_t, \tag{2}$$

where $\Delta i_{m,t+1}$ is the interest rate change favoured by member m, $L_{-m,t}$ denotes one of the dissent measures defined in the previous section but where member m is excluded, α is an intercept term, β is a scalar coefficient, $\boldsymbol{\gamma}$ is a $1 \times r$ vector of coefficients, $\mathbf{x}_t$ is a $r \times 1$ vector of regressors, and ξ_t is a disturbance. In particular, we specify $\mathbf{x}_t = [\Delta i_t, \Delta i_{t-1}, \Delta \pi_{t+1}, \Delta u_{t+1}]'$.

Including Δi_t and Δi_{t-1} among the regressors is a simple way to capture the fact that interest rate changes are serially correlated and that, consequently, current and past changes may help forecast a future change. We also include in $\mathbf{x}_t$ the change in inflation and unemployment between the previous and the current meeting.[12] Inflation is measured by the twelve-month percentage change in the Consumer Price Index (Sweden), the Consumer Price Index for All Urban Consumers (United States), the Retail Price Index excluding mortgage-interest payments (United Kingdom until December 2003) and the Consumer Price Index (United Kingdom from January 2004 onwards).[13] The unemployment rate is measured by the deviation of the seasonally adjusted rate from a constant term, but result using a quadratic or a Hodrick–Prescott trend yield similar results to the ones reported here.

At the time when the data were collected, twenty-eight (thirteen) individuals have been members of the MPC (EB). However, since the regression above requires a sufficient number of observations to reliably obtain parameter estimates, we restrict the sample to members

[11] In preliminary work, we also performed Probit regressions but conclusions are essentially the same as those based on (2). In this paper we focus on the linear regression model because it has been used by most of the previous literature and we would like to be able to compare our results with theirs.

[12] We also considered a slightly different specification of $\mathbf{x}_t$, that is $\mathbf{x}_t = [\Delta i_t, \Delta i_{t-1}, \Delta \pi_t, \Delta u_t]'$, with basically the same results as those reported.

[13] The change in inflation measure for the United Kingdom is motivated by the fact that until 10 December 2003, the inflation target applied to the twelve-month change in the RPIX, while, thereafter, it applies to the change in the CPI.

with at least fifteen observations.[14] This criteria limits the number of available MPC members to twenty-two and of EB members to nine.

Estimates of β for MPC members are reported in table 2 and for EB members in table 3. As can be seen in both tables, dissents have a positive and (usually) statistically significant coefficient meaning that current dissents help predict future individual policy decisions, even after controlling by changes in inflation and unemployment and past changes in the interest rate. The fact that the coefficient is positive means that the future policy decision is likely to be in the same direction as that of the current dissent. That is, for example, a dissent for an interest rate cut today is a predictor of votes in favor of an interest rate cut in the next meeting.

Specifically, column 1 of table 2 shows that past dissents in the committee as a whole have predictive power over the individual decisions of 16 MPC members (out of the 22 in our sample). Exceptions include five external members (Blanchflower, Besley, Buiter, Goodhart and Sentance) and one internal member (Vickers). Interestingly, in three cases (Buiter, Goodhart and Sentance) estimates become significant when considering dissents cast by members of the same group those three members belong to. Similarly, column 1 of table 3 shows that dissents at the Riksbank have predictive power over future choices of most members. (The only exception is Mr. Backstrom.)

By looking at columns 7 and 3 in tables 2 and 3, respectively, we can see that the seniority of dissenters does not appear to have additional forecasting power over future individuals' choices: Point estimates are of the same order of magnitude as those obtained when all dissents receive the same weight (see column 1 in both tables). On the other hand, when the dissenting vote of a member is weighted by the proportion of dissenting votes previously cast by that member, estimates of β have the same (positive) sign and remain statistically significant but their size is considerably reduced. This result is true for both the Bank of England and the Riksbank, and suggests that dissents by "serial" dissenters have less forecasting power over future individuals' decisions, perhaps because other members may tend to discount them.

2.5 Predictability of Policy Decisions

After studying individual voting decisions, we now investigate the role of dissents as predictors of future policy actions by the committee as a whole. In addition to the Bank of England and the Riksbank, the analysis in this section includes the monetary decisions of

[14] Note, however, that conclusions are generally robust to using instead thresholds of twelve and twenty observations.

the FOMC. Consider again the regression

$$\Delta i_{t+1} = \alpha + \beta L_t + \boldsymbol{\gamma} \mathbf{x}_t + \xi_t, \tag{3}$$

where Δi_{t+1} is the interest rate change passed by the committee, L_t is one of the dissent measures defined in Section 2.3, and all other notation is as previously defined.

Estimates of β are reported in the first column of table 4. In all three central banks, dissents by all members have a positive and statistically significant coefficient. This result should not be surprising given that we have previously established that dissenting votes have forecasting power over future decisions of most committee members.

The predictive power of dissent holds for the Bank of England when we construct separate dissent measures for internal and external members, although the magnitude of β is smaller for each group separately than for all dissents as a whole.[15] Instead, dissenting votes by Board members in the FOMC do not seem to help predict future policy changes, while those of Bank presidents do, and to a far larger extent than dissents as a whole. In line with the results presented in Section 2.4, we find that the seniority of dissenters does not add forecasting power and that dissents by "serial" dissenters predict less future committee decisions (see columns 3 and 5 of table 4). For the Bank of England, this result is robust to separately considering the dissents of external and internal members.

Finally, we perform Granger causality tests. As it is well know, a Granger causality test is not tests of economic causality but rather a test of statistical forecastability (i.e., whether one variable is helpful in forecasting another one). We estimate a vector autoregression (VAR) involving four variables (that is, Δi_t, $\Delta \pi_t$, Δu_t and L_t) and then perform a F-test of the null hypothesis that past values of L_t are not useful for predicting the future value of Δi_t, controlling for past values of the other variables. The number of lags in the VAR was determined using the Akaike Information Criterion (AIC). As shown in table 5, the hypothesis that dissent, as measured by L_t, does not Granger-cause interest rate changes can be rejected for all central banks and for all except one of the measures of dissents. In line with previous results, the hypothesis that dissent by Board members does not Granger-cause future policy changes by the FOMC cannot be rejected.

3 A Model of Dissent

In this Section, we use a tractable economic model to determine the members' preferred interest rates at the time of a meeting, and then develop a simple model of committee

[15] Gerlach-Kristen (2009) constructs separate measures of dissent for internal and external members and finds that only dissents by outsiders help forecast future policy changes.

decision making and dissent. The voting model extends in two ways the consensus model developed in our previous work (see Riboni and Ruge-Murcia, 2010). First, it considers discrete policy options, instead of the continuos set we previously assumed. This extension is important because one empirical feature of interest rate changes is that they typically take multiple values of one-quarter point. Second, it incorporates a simple rule for registering dissents.

3.1 The Economy

Following Svensson (1997), the behavior of the private sector is summarized by a Phillips curve

$$\pi_{t+1} = \pi_t + \alpha_1 y_t + \varepsilon_{t+1}, \tag{4}$$

and an aggregate demand curve

$$y_{t+1} = \beta_1 y_t - \beta_2(i_t - \pi_t - \iota) + \eta_{t+1}, \tag{5}$$

where π_t is inflation, y_t is an output measure, i_t is the nominal interest rate, ι is the real interest rate, $\alpha_1, \beta_2 > 0$ and $0 < \beta_1 < 1$ are constant parameters, and η_t and ε_t are disturbances. The disturbances respectively follow the moving average processes $\varepsilon_t = \kappa u_{t-1} + u_t$ and $\eta_t = \varsigma v_{t-1} + v_t$, where $\kappa, \varsigma \in (-1, 1)$ and u_t and v_t are mutually independent innovations. The innovations are Normally distributed white noises with zero mean and constant conditional variances σ_u^2 and σ_v^2, respectively.

3.2 The Committee

The monetary policy committee consist of a set of members $\mathcal{N} = \{1, .., N\}$, where N is an odd integer.[16] The utility function of a generic member n is

$$E_\tau \left(\sum_{t=\tau}^{\infty} \delta^{\tau-t} U_n(\pi_t) \right), \tag{6}$$

where E_τ denotes the expectation conditional on information available at time τ, $\delta \in (0, 1)$ is the discount factor, and $U_n(\pi_t)$ is the instantaneous utility function. We assume that

$$U_n(\pi_t) = \frac{-\exp\left(\mu_n(\pi_t - \pi^*)\right) + \mu_n(\pi_t - \pi^*) + 1}{\mu_n^2}, \tag{7}$$

[16] The assumption that N is odd allows us to uniquely pin down the identity of the median and eases the exposition, but it is not essential for our analysis.

where π^* is an inflation target and μ_n is a member-specific preference parameter. This asymmetric function was proposed by Varian (1974) to model differential costs in forecasting errors, and has been previously used to model central bank preferences by, among others, Ruge-Murcia (2003), Dolado et al. (2004), and Surico (2007). Specifically, when $\mu_n > 0$ ($\mu_n < 0$), a positive deviation from π^* causes a larger (smaller) decrease in utility than a negative deviation of the same magnitude.[17] Notice that under this specification all committee members share the same inflation target but differ in their prudence motive vis-à-vis the target because the values of their preference parameter μ_n is idiosyncratic. To see this note that the coefficient of relative prudence (Kimball, 1990) is $\mu_n(\pi_t - \pi^*)$, which is proportional to μ_n.

Before proceeding, note from (4) and (5) that in the model the interest rate at time t affects inflation only after two periods. Then, consider the member-specific interest rate $i^*_{n,t}$ chosen at time t to maximize the expected utility of member n at time $t+2$. That is,

$$i^*_{n,t} = \underset{i_t \geq 0}{\arg\max}\ \delta^2 E_t U_n(\pi_{t+2}), \tag{8}$$

subject to equations (4) and (5).

Because of the shocks that occur during the control lag period, ex-post inflation will typically differ from π^*. This induces a prudence motive in the conduct of monetary policy which varies with μ_n. The first-order necessary condition is

$$E_t \exp\left(\mu_n(\pi_{t+2} - \pi^*)\right) = 1. \tag{9}$$

Under the assumption that innovations are Normally distributed, the inflation rate at time $t+2$ (conditional on the information available at time t) is also Normally distributed. Thus, $\exp\left(\mu_n(\pi_{t+2} - \pi^*)\right)$ is distributed Log-normal with mean $\exp\left(\mu_n(E_t\pi_{t+2} - \pi^*) + \mu_n^2\sigma_\pi^2/2\right)$ where σ_π^2 stands for the conditional variance of π_t. Substituting into (9) and taking logs,

$$E_t\pi_{t+2} = \pi^* - \mu_n\sigma_\pi^2/2. \tag{10}$$

Finally, using equations (4) and (5), it is possible to write the interest rate preferred by member n as

$$i^*_{n,t} = a_n + b\pi_t + cy_t + \zeta_t, \tag{11}$$

where $a_n = \iota - (1/\alpha_1\beta_2)\pi^* + (\mu_n/2\alpha_1\beta_2)\,\sigma_\pi^2$, $b = 1 + (1/\alpha_1\beta_2)$, $c = (1+\beta_1)/\beta_2$, and $\zeta_t = (\kappa/\alpha_1\beta_2)\,u_t + (\varsigma/\beta_2)\,v_t$. Notice that since u_t and v_t are white noise, ζ_t is also white noise and its variance is $\sigma^2 = (\kappa/\alpha_1\beta_2)^2\,\sigma_u^2 + (\varsigma/\beta_2)^2\,\sigma_v^2$.

[17] It can be shown that when $\mu_n \to 0$, the utility in (7) becomes the standard quadratic utility function widely used in the literature. See Ruge-Murcia (2003, fn. 4) for a formal proof.

Since the coefficients of inflation (b) and the output gap (c) are positive, the reaction function (11) implies that in order to keep the inflation forecast close to π^*, the nominal interest rate should be raised if inflation or the output gap increase. It is important to notice that the preference parameter μ_n enters the individual reaction function (11) only through the intercept, a_n. Specifically, committee members who weights positive deviations from π^* more heavily than negative deviations will generally favor higher interest rates.

Finally, order now the N committee members so that individual 1 (N) is the one with the smallest (largest) preference parameter. That is, $\mu_1 \leq \mu_2 \leq ... \leq \mu_N$. As usual, the median member is defined as the one with index $M = (N+1)/2$.

3.3 Decision Protocol

Let q_t be the value of the interest rate at the beginning of the meeting at time t. We refer to q_t as the status quo policy. The policy space is assumed to be discrete. Let $\mathcal{I}$ denote the finite set of feasible interest rates that can be put to a vote. Note that because of the discreteness of $\mathcal{I}$, the committee will not be able, in general, to select of the (unconstrained) preferred interest rates defined in (11).

In each meeting, committee members first vote over the current nominal interest rate. At the end of the voting game, committee members decide whether or not to cast a dissenting opinion.

We first describe the timing of the voting game. Assume that at the beginning of the meeting, the committee decides by simple-majority rule the direction (either increase or decrease) of the interest rate change. Without loss of generality, suppose that the committee decides to consider an interest rate increase. In the second stage of the voting game, suppose that a "clock" initially indicates the status quo. The clock keeps gradually increasing the interest rate in discrete-sized steps (say, of 25 basis points) as long as a super-majority of at least $(N+1)/2+K$ members gives its consent. The assumption that a qualified majority of votes is needed to pass a policy is a simple way of capturing the idea that monetary policy committees make decisions by consensus. When consensus falls below $(N+1)/2+K$ members, the meeting is concluded and the committee implements the policy reflected on the clock at the time it stopped. It is immediate to observe that the size of the super-majority increases in K, where the integer $K \in [0,(N-1)/2]$ is the minimum number of favorable votes beyond simple majority that are necessary for a proposal to pass. This specification includes as special cases unanimity rule, when $K = (N-1)/2$, and simple majority rule, when $K = 0$.

Committee members are assumed to be forward-looking within each meeting. That is, in giving their consent, they foresee the consequences that this may have on the final decision at the meeting.[18] It bears stressing that voting decisions do not depend on (voting and dissent) decisions that have been made in the previous meeting.

After the voting game, members decide whether or not to dissent. Assume that member n registers a dissent if and only if her preferred policy is sufficiently distant from i_t, the approved policy. It is also assumed that the decision to dissent does not depend on what happened in the previous meeting. That is, a dissent by member n is observed if and only if

$$\left| i^*_{n,t} - i_t \right| > f(K), \tag{12}$$

where $i^*_{n,t}$ is given by (8) and $f(K)$ is the consensus norm. The consensus norm is increasing in K, meaning that the more consensual the voting rules, the less willing is member n to dissent. Throughout, we assume that $f(K) \geq 0$ for all positive integers K. In what follows, we use the functional form

$$f(K) = \gamma \left(\frac{2K}{N-1} \right)^{1/2}, \tag{13}$$

where $\gamma > 0$ is a constant coefficient.

In period $t+1$, the committee meets again and a new decision is made. It is assumed that the status quo in the next meeting is $q_{t+1} = i_t$.

Before describing the equilibrium of the voting game, we introduce some notation. Fix any $q_t \in \mathcal{I}$ and let $\bar{i}^*_{n,t}$ denote the preferred interest rate by member n among the feasible interest rates that lie (weakly) above q_t. That is,

$$\bar{i}^*_{n,t} = \underset{i_t \in \{i_t \in \mathcal{I}:\ i_t \geq q_t\}}{\arg\max} \ \delta^2 E_t U_n(\pi_{t+2}), \tag{14}$$

subject to equations (4) and (5). Similarly, we let $\underline{i}^*_{n,t}$ denote the preferred interest rate by member n among the feasible interest rates that lie (weakly) below q_t.

In Proposition 1 below, we characterize the equilibrium policy decision that is adopted by the committee.

Proposition 1: *Let q_t be the status quo at time t. The policy outcome at time t is given by*

$$i_t = \begin{cases} \underline{i}^*_{M+K,t}, & \text{if } q_t > \underline{i}^*_{M+K,t}, \\ q_t, & \text{if } \bar{i}^*_{M-K,t} \leq q_t \leq \underline{i}^*_{M+K,t}, \\ \bar{i}^*_{M-K,t}, & \text{if } q_t < \bar{i}^*_{M-K,t}. \end{cases} \tag{15}$$

[18] However, they abstract from the consequences of their voting decision on future meetings via the status quo. See Riboni and Ruge-Murcia (2010, p. 410), where we argue that removing this assumption does not alter the main thrust of our results.

Proof: First note from (7), (4) and (5) that for each committee member the induced preferences over the interest rate are single-peaked, with a peak given by (8). Next, we define the undominated set $\mathcal{U}$ of the super-majority relation in set $\mathcal{I}$ as the set of alternatives that are not defeated in a direct vote against any alternative in $\mathcal{I}$. The set $\mathcal{U}$ contains all feasible alternatives in the interval $[\bar{i}^*_{M-K,t}, \underline{i}^*_{M+K,t}]$.

Let $\tau \geq 0$ denote the time of the "clock" and let $\boldsymbol{\sigma}^*$ denote the equilibrium of the voting game. It is claimed that if any policy in $\mathcal{U}$ is the default at any time τ, that policy must be the final outcome of the meeting. By way of contradiction, suppose that this is not true. Let $i_{\mathcal{U}}$ denote any policy in $\mathcal{U}$ and let $\widehat{i}$ denote the final outcome in case a super-majority of committee members let the "clock" continue when the default is $i_{\mathcal{U}}$. We need to distinguish two cases: $\widehat{i}$ may or may not belong to $\mathcal{U}$. In the former case, this implies that a super-majority prefers $\widehat{i}$ to $i_{\mathcal{U}}$. This contradicts the initial hypothesis that $i_{\mathcal{U}}$ is in $\mathcal{U}$. Suppose instead that $\widehat{i}$ does not belong to $\mathcal{U}$. This contradicts the hypothesis that $i_{\mathcal{U}}$ belongs to the undominated set. We then conclude that if any policy in $\mathcal{U}$ is the default at any time $\tau \geq 0$, that policy must be the final outcome. This explains why $i_t = q_t$ if $\bar{i}^*_{M-K,t} \leq q_t \leq \underline{i}^*_{M+K,t}$.

If instead $q_t < \bar{i}^{\,*}_{M-K,t}$, it is easy to see that the committee will choose to consider an interest rate increase in the first stage of the voting game. In doing so, the "clock" will reach and stop at $\bar{i}^{\,*}_{M-K,t}$, which is majority-preferred to any $q_t < \bar{i}^{\,*}_{M-K,t}$. Following a symmetric argument, it is easy to show that if $q_t > \underline{i}^{\,*}_{M+K,t}$, the committee will agree to reduce the interest rate. In this case, the committee will eventually reach and pass $\underline{i}^{\,*}_{M+K,t}$. ¶

Proposition 1 establishes that for status quo policies that are sufficiently extreme, compared with the values preferred by most members, the committee adopts a new policy that is closer to the median outcome. More specifically, suppose that the current status quo at time t is a low interest rate and assume that a positive shock hits the economy. From (11) we know that the preferred interest rate of all committee members move upwards. In this case, Proposition 1 states that the committee will increase the nominal interest rate up to $\bar{i}^*_{M-K,t}$, the preferred alternative (among the ones that can be put on the agenda) by member $M-K$. Note that a nominal interest rate above $\bar{i}^*_{M-K,t}$ would be favoured by a majority of members (including M) but would fall short of the implicit majority requirement in place. Symmetrically, when the current status quo is a high nominal interest rate and a negative shock hits the economy, Proposition 1 establishes that the final decision will be $\underline{i}^*_{M+K,t}$, a more hawkish policy than the one favoured by M.

According to Proposition 1, when instead the status quo lies close to the median's preferred policy, the committee does not change the interest rate. In other terms, our voting game features a gridlock interval, that is, a set of status quo policies where policy changes are not possible (in other words, the clock simply does not get started). The gridlock interval includes all status quo policies $q_t \in [\bar{i}^*_{M-K,t}, \underline{i}^*_{M+K,t}]$ and its width is increasing in the size of the super-majority, K. Note that when $K = 0$, this model predicts no gridlock interval and delivers the median's preferred interest rate (among the feasible ones) regardless of the initial status quo.

To summarize, the main parameters that determine dissent in this model are the super-majority requirement K and the coefficient γ, both of which enter the consensus norm, $f(\cdot)$. In addition, preference heterogeneity, as measured by the variance of μ_n, plays a role in dissenting behavior because it implies that the members' preferred policies are less or more spread out. Finally, notice that an increase in inflation volatility also leads to more spread out policy preferences. To see this note that in the intercept of the reaction function (11), μ_n and σ_π enter multiplicatively and have a positive coefficient.

It is immediate to see that an increase of γ and/or a decrease of σ_π and of the variance of μ_n all lead to lower dissenting frequencies. Instead, the effect of K on dissenting behavior is ambiguous. On the one hand, an increase of K raises the right hand side of (12) and discourages dissent. On the other hand, Proposition 1 implies that an increase of K makes the gridlock interval wider. This implies that policies that are further away from the median policy (hence, more extreme) may be approved. Because of this, the left-hand side of (12) may increase and, consequently, dissent is more likely to occur.

3.4 Estimation

The model parameters are the coefficients of the individual reaction functions (a_n, b, c), the standard deviation of the reduced-form disturbance (σ), the parameter γ, and the super-majority requirement (K). Since the political aggregator (that is, the equilibrium mapping from q_t to i_t) in our decision protocol has kinks (and it is, therefore, non differentiable) and the super-majority parameter is an integer, it is not possible to estimate the model using a gradient-based method to optimize a statistical objective function. Thus, we use instead the simulated annealing algorithm in Corana et al. (1987). This algorithm does not require the computation of numerical derivatives to update the search direction and is generally robust to local optima. However, it is subject to the curse of dimensionality because it randomly surveys all dimensions of the parameter space and so estimating a large number of parameters is computationally demanding. For this reason, we use the following two-step strategy.

In the first step, we estimate the coefficients of the individual reaction function (11) using a fixed-effect regression whereby the coefficients of inflation and unemployment (b and

c, respectively) are the same for all members and the intercept (a_n) is member specific, as implied by our model.[19] The dependent variable in this regression is the preferred interest rate by committee members taken from the MPC and EB voting records. The data on inflation and unemployment were described above in Section 2.1. In the case of the Bank of England, the inflation target enters as a separate regressor because its value was adjusted in December 2003 (see footnote 13), while in the case of the Riksbank, it is subsumed in the intercept because its value is constant throughout the sample. This means that the estimates of the intercepts are not comparable across the two central banks. The total number of pooled observation is 1169 and 478 for the Bank of England and the Riksbank, respectively. Pooling the data allow us to easily impose the model's restriction that b and c are equal across members, increases the precision of the estimates, and permits the use of data from all members, including those with a small number of observations.

In the second step, with the reaction function coefficients fixed and given a value of the super-majority requirement (K), we estimate γ and σ by the simulated method of moments (SMM). SMM was originally proposed by McFadden (1989) and Pakes and Pollard (1989) for the estimation of discrete-choice models in i.i.d. environments, and later extended by Lee and Ingram (1991) and Duffie and Singleton (1993) for the estimation of time-series models with serially correlated shocks. Under the conditions spelled out in Duffie and Singleton (1993), the estimator is consistent and asymptotically normally distributed. Intuitively, the SMM estimator minimizes the weighted distance between the moments computed from the data and those implied by the model, where the latter are obtained by means of stochastic simulations.

In this application, we use the identity matrix as weighting matrix and compute the long-run variance of the moments using the Newey-West estimator with a Barlett kernel and bandwidth given by the integer of $4(T/100)^{2/9}$ where T is the sample size. Since the analysis takes inflation and unemployment as given, we simulate 100 histories and compute the moments of the model by pooling all simulated data. The moments used to estimate the model are the variance and the first-order autocovariance of the interest rate, the covariances of inflation and unemployment with the interest rate, the proportion of dissents, and the proportion of observations where the interest rate was kept unchanged. These six moments are used to estimate two parameters and, thus, the number of degrees of freedom is four. Recall that the simulations take as given the super-mayority requirement, K. Thus, we construct an estimate of K by performing this second step for all admissible values of K and

[19] Note that since inflation and unemployment are predetermined in the model and it is reasonable to assume that they do not react contemporaneously to changes in monetary policy in the data, this regression delivers consistent estimates of the coefficients.

comparing the values of the SMM objective function at the minimum. The estimate of K is the value that delivers the lowest value of the objective function across all values of K.

Results are reported in tables 6 and 7 for the Bank of England and the Riksbank, respectively. In all cases, member-specific intercepts are positive and statistically different from zero. The null hypothesis that intercepts are the same for all members can be rejected for both central banks (p-values are < 0.001 in both cases). The inflation response is positive, as expected, and statistically significant. The unemployment response is negative and also statistically significant. The standard deviation (σ) of the disturbance is 1.19 for the UK and 0.53 for Sweden. It is interesting to note that these SMM estimates are quantitatively close to the estimates of σ that could be constructed from the residuals of the fixed-effect regressions (0.85 and 0.48, respectively). This means that results (at least as far as σ is concerned) are likely to be robust to the method used to estimate the model.

3.5 Quantitative Analysis

In this section, we use stochastic simulations to study the quantitative implications of the model. In particular, we simulate 1000 histories of committee meetings conditional on the observed path of inflation and unemployment, drawing shock realizations from the unconditional distribution of ζ_t.

First, we study the relation between various committee characteristics and the rate of dissent, defined as the ratio of the number of dissent over the number of votes. Figure 1 plots the predicted dissent rate for different values of the standard deviation of the shock (column 1), the coefficient γ in the consensus norm (column 2), and preference heterogeneity (column 3). The predicted dissent rate is computed as the average dissent rate over the 1000 histories for each parameterization. Preference heterogeneity is proxied by the standard deviation of the intercepts in the individual reaction functions, which are affine transformations of the idiosyncractic preference parameter μ_n (see equation (11)).

As we can see in Figure 1 for both the Bank of England (top row) and the Riksbank (bottom row), the dissent rate is only mildly increasing in the standard deviation of the shock. The reason is simply that dissents in the model are determined by the position of the members' preferred policies relative to that selected by the committee. Since shocks are common to all members, they shift the distribution without altering the distance between preferred interest rates. As one would expected, the dissent rate is decreasing in γ and increasing in preference heterogeneity. A larger value of γ means that, given her preferred interest rate and the policy selected by the committee, a member is less likely to register a formal dissent. Larger preference heterogeneity implies a larger standard deviation in the distribution of the members' preferred interest rates and, consequently, makes dissents more likely.

Second, using the 1000 simulated histories of MPC and EB meetings, we compute our dissent measure (1) and run the OLS regression (3) for each history. column 1 in table 8 reports the proportion of times where the coefficient of the lagged dissent measure (that is, β) is positive and statistically significant. Note that since voting strategies in the model are independent of dissents in the previous meetings, β should equal zero. However, sample variability means that the hypothesis $\beta = 0$ would be rejected 5 percent of the times when one uses a t-test of nominal size equal to 5 percent. Instead, table 8 shows that the hypothesis can be rejected 11 and 15 percent of times for the Bank of England and the Riksbank, respectively. Furthermore, the 95 percent confidence interval around the empirical size does not include the nominal size of 5 percent. In other words, since the test tends to over-reject the hypothesis, a researcher using data generated from this model could find that dissents have predictive power over future policies, despite the fact that, by construction, there is no channel through which dissents affect policy decisions.[20]

In order to understand why current dissents have predictive power in our model, consider the following example. Suppose that a positive inflation shock hits the economy and makes a majority of committee members want to increase the interest rate. Suppose, however, that this group falls short of the (implicit) majority requirement necessary to pass policy changes. As a result, the status quo policy is kept in place in the current meeting. Because no change has been made, it is likely to observe one (or more) members who dissent in favor of an interest rate increase. Move on now to the next period. Two cases are possible: the shock that hits the economy in the next period may either raise or lower the preferred interest rates of all committee members. In the former case, other committee members will join the group of individuals advocating an interest rate hike. Since that group already constituted a majority in the previous meeting, an interest rate increase is now very likely to pass. In the latter case, recall that in the previous meeting a majority of committee members believed that the final decision implied too loose a monetary policy. Then, it is unlikely that a broad enough consensus can now be reached to pass an interest rate decrease. A more likely outcome is that the committee will maintain the interest rate that was selected in the previous period. This asymmetry arises from the decision making frictions in the model and induces a statistical correlation between dissents and future policy actions, despite the fact that voting strategies are independent of past dissents.

The counter-factual experiments in table 8 show that this asymmetry is further reinforced

[20] Since the sample has 1000 observations and results are robust to using an even larger sample of 5000 observations, it is safe to rule out the possibility that the over-rejection is just a small-sample problem.

when shocks are positively serially correlated. The reason is simply that now the former case in our example is more likely than the latter one. Thus, after observing one (or more) dissents in favor of an interest rate increase, an interest rate increase is more likely to pass in the next meeting than an interest rate decrease.

3.6 An MPC without External Members

One characteristic of external MPC members is that, as pointed out in Section 2.2, they tend to dissent more often than internal members. It is interesting, thus, to consider an artificial counterpart of the MPC composed only of internal members and compare dissent behavior and policy with the actual MPC and with the Riksbank. Using the same simulation strategy as above, we compute the dissent rate, the proportion of meetings where there is a dissent, and the proportion of dissents for either easing or tightening monetary policy in the MPC without external members. The parameters are the same as those reported in table 6, except that we use $N = 5$ and $K = 1$ in the consensus norm defined by (13). We set $N = 5$ because the artificial committee consists of five internal members, and $K = 1$ because a larger super-majority requirement (say, $K = 1$) implies unanimity, while a smaller one ($K = 0$) implies that the policy selected by the committee is always that preferred by the median. Thus, $K = 1$ is the only admissible value under the consensus model.

The statistic reported in table 9 are averages over the 1000 simulated histories and show that the MPC without external members features a lower dissent rate, a smaller proportion of meetings where there is a dissent, and a more equal proportion of dissents for either decreasing or increasing the interest rate compared with the actual MPC with both member types. Indeed, the MPC without external members closely resembles the Executive Board of the Riksbank, where all members are internal.

Figure 2 plots the interest rates selected by artificial committees with only internal members (dotted line) and with both external and internal members (continuos line) in one of our simulated histories. As can be seen, the decisions of both committees are broadly similar, despite the fact that the latter would feature more frequent dissents. On the other hand, it is interesting to note that the average standard deviation of the interest rate (computed using the standard deviations in all histories), is larger in the committee with internal members only (1.39) compared with the one with more member types (1.28). We find this result because a MPC including only internal members is more homogenous, thereby leading to a smaller gridlock interval and, consequently, to more policy changes.

4 Conclusions

We propose here a stylized model where monetary policy decisions are made by consensus (or super-majority rule) and where dissent decisions are non strategic and involve a simple comparison between the member's preferred policy and the one that is approved at the meeting. In spite of the fact that in our model current (voting and dissent) decisions do not depend on previous dissents, we find that decision making frictions help account for robust empirical evidence showing that dissent in monetary policy committees are useful in forecasting future policy decisions.

Throughout our analysis, we have assumed that committee members are only motivated by policy outcomes. An interesting question would be to ask how the predictive power of dissent that we find here would be affected when committee members also care about their reputation. Reputational concerns will likely make current (voting and dissent) decisions depend on previous decisions and introduce a causal link from current dissents to future policy choices. Formally looking at reputational concerns is a key question that is ripe for future research.

Table 1. Number of Dissents

Central Bank	Total	Dissents For Easing	Dissents For Tightening
Bank of England			
All members	179	101	78
		(0.56)	(0.44)
Internal members	57	14	43
		(0.25)	(0.75)
External members	122	87	35
		(0.71)	(0.29)
Riksbank			
All members	44	22	22
		(0.50)	(0.50)
Federal Reserve			
All members	94	27	67
		(0.29)	(0.71)
Bank presidents	66	9	57
		(0.14)	(0.86)
Board members	28	18	10
		(0.64)	(0.36)

Notes: The figures in parenthesis are the proportion of dissents in a given direction over the number of total dissents.

Table 2. Predictability of Individual Policy Actions
Bank of England

	Weight in Dissent Measure									
	Equal						Seniority		Dissent Rate	
	All		Internal		External		All		All	
Member	β	s.e.	β	s.e	β	s.e	β	s.e.	β	s.e.
George[c]	0.236*	0.087	0.155	0.098	0.190*	0.062	0.236*	0.086	0.142*	0.050
King[c]	0.439*	0.095	0.325*	0.110	0.261*	0.060	0.434*	0.110	0.267*	0.055
Lomax	0.229*	0.083	0.197*	0.088	0.120*	0.055	0.182	0.980	0.150*	0.052
Large	0.330*	0.112	0.356*	0.174	0.178*	0.066	0.334*	0.119	0.224*	0.072
Tucker	0.510*	0.130	0.568*	0.158	0.226*	0.078	0.451*	0.151	0.282*	0.074
Bean	0.476*	0.103	0.343*	0.113	0.262*	0.065	0.448*	0.114	0.265*	0.061
Barker[‡]	0.630*	0.119	0.426*	0.117	0.358*	0.083	0.571*	0.134	0.333*	0.069
Nickell[‡]	0.558*	0.102	0.374*	0.099	0.415*	0.083	0.516*	0.106	0.385*	0.070
Allsopp[‡]	0.391*	0.131	0.256	0.130	0.396*	0.111	0.384*	0.121	0.252*	0.079
Bell[‡]	0.353*	0.132	0.292	0.173	0.235*	0.085	0.349*	0.137	0.185*	0.070
Lambert[‡]	0.314*	0.092	0.249*	0.103	0.214*	0.068	0.327*	0.099	0.220*	0.069
Buiter[‡]	0.487	0.384	0.108	0.281	0.651*	0.313	0.442	0.400	0.556	0.293
Goodhart[‡]	0.194	0.175	0.010	0.188	0.267*	0.122	0.181	0.173	0.133	0.093
Vickers	0.134	0.184	−0.053	0.205	0.196	0.129	0.116	0.181	0.079	0.098
Julius[‡]	0.331*	0.128	0.253*	0.116	0.359*	0.131	0.326*	0.137	0.170*	0.086
Wadhwani[‡]	0.414*	0.145	0.292*	0.133	0.437*	0.138	0.414*	0.134	0.260*	0.091
Plenderleith	0.339*	0.118	0.162	0.135	0.337*	0.083	0.349*	0.121	0.199*	0.069
Clementi	0.413*	0.108	0.298*	0.134	0.352*	0.075	0.389*	0.107	0.227*	0.060
Gieve	0.798*	0.299	0.417	0.366	0.448*	0.169	0.636	0.377	0.447*	0.161
Blanchflower[‡]	0.393	0.362	0.182	0.334	0.322	0.259	0.153	0.421	0.288	0.245
Besley[‡]	0.683	0.377	0.436	0.345	0.492	0.278	0.568	0.436	0.386	0.240
Sentance[‡]	0.698	0.366	0.434	0.340	0.581*	0.292	0.596	0.426	0.422	0.217

Notes: The sample excludes committee members Budd, Davies, Walton, Dale, Fisher, and Miles because the number of their available observations is less than fifteen. The superscripts ‡ and c respectively denote an external member and a current/former chairman. The superscript $*$ denotes statistical significance at the five percent level.

Table 3. Predictability of Individual Policy Actions
Swedish Riksbank

	Weight in Dissent Measure					
	Equal		Seniority		Dissent Rate	
Member	β	s.e.	β	s.e.	β	s.e
Heikensten^c	0.521*	0.163	0.609*	0.177	0.287*	0.085
Srejber	0.885*	0.243	0.895*	0.255	0.413*	0.140
Bergström	0.557*	0.193	0.929*	0.256	0.285*	0.098
Nyberg	0.513*	0.141	0.730*	0.209	0.283*	0.085
Persson	0.591*	0.145	0.754*	0.217	0.551*	0.192
Öberg	0.706*	0.291	0.528*	0.192	0.526*	0.235
Bäckström^c	0.431	0.222	0.442	0.237	0.164	0.093
Rosenberg	0.654*	0.176	0.640*	0.185	0.423*	0.122
Ingves^c	0.717*	0.241	0.523*	0.182	0.469*	0.143

Notes: The sample excludes committee members Hessius, Wickman-Parak, Svensson, and Ekholm because their number of observations is less than fifteen. The superscript c denotes a current/former chairman. The superscript $*$ denotes statistical significance at the five percent level.

Table 4. Predictability of Committee Policy Actions

	Weight in Dissent Measure					
	Equal		Seniority		Dissent Rate	
Central Bank	β	s.e	β	s.e.	β	s.e
Bank of England						
All members	0.358*	0.075	0.333*	0.079	0.193*	0.042
Internal members	0.285*	0.085	0.261*	0.091	0.139*	0.053
External members	0.223*	0.050	0.194*	0.047	0.159*	0.035
Riksbank						
All members	0.551*	0.151	0.492*	0.132	0.260*	0.078
Federal Reserve						
All members	0.461*	0.214	–	–	–	–
Bank presidents	0.728*	0.263	–	–	–	–
Board members	−0.035	0.352	–	–	–	–

Notes: s.e. stands for standard error. The dependent variable is the change in the policy variable. The regressions also included an intercept, two lags of the change in the policy variable, and the change in inflation and unemployment since the previous meeting. The superscript $*$ denotes statistical significance at the five percent level.

Table 5. Granger Causality Tests

	Weight in Dissent Measure				
	Equal			Seniority	Dissent Rate
Central Bank	All	External or Presidents	Internal or Board	All	All
Bank of England	26.00	22.79	13.16	20.18	24.63
	(< 0.001)	(< 0.001)	(< 0.001)	(< 0.001)	(< 0.001)
Riksbank	16.54	–	–	16.55	12.40
	(< 0.001)			(< 0.001)	(< 0.001)
Federal Reserve	3.49	8.01	0.02	–	–
	(0.03)	(< 0.001)	(0.98)		

Notes: This table report the F-statistic and p-value (in parenthesis) for the null hypothesis that dissents do not help forecast future interest rate changes. The numbers of lags in the vector autoregressions are 1 (Bank of England and Riksbank) and 2 (Federal Reserve), and were chosen using the Akaike Information Criterion (AIC).

Table 6. Parameter Estimates
Bank of England

Parameter	Estimate	s.e.
Individual intercepts		
George[c]	6.287*	0.381
King[c]	5.707*	0.335
Lomax	5.315*	0.318
Large	4.737*	0.345
Tucker	5.173*	0.322
Bean	5.288*	0.329
Barker‡	5.177*	0.327
Nickell‡	5.203*	0.348
Allsopp‡	5.607*	0.389
Bell‡	4.638*	0.356
Lambert‡	4.728*	0.338
Budd‡	7.954*	0.491
Buiter‡	7.515*	0.416
Goodhart‡	7.563*	0.416
Vickers	7.558*	0.407
Julius‡	7.233*	0.395
Wadhwani‡	6.410*	0.389
Plenderleith	6.736*	0.386
Clementi	6.641*	0.384
Walton‡	5.177*	0.382
Gieve	5.789*	0.328
Blanchflower‡	5.549*	0.330
Besley‡	5.666*	0.331
Sentance‡	5.648*	0.332
Dale	4.813*	0.386
Fisher	4.413*	0.473
Miles‡	4.706*	0.590
Inflation	0.222*	0.043
Inflation target	−1.250*	0.045
Unemployment	−0.726*	0.148
Standard deviation	1.194*	0.345
Coefficient in consensus norm	1.153*	0.068
Super-majority	3.0	

Notes: See notes to table 2.

Table 7. Parameter Estimates
Swedish Riksbank

Parameter	Estimate	s.e.
Individual intercepts		
Heikensten[c]	2.461*	0.073
Hessius	2.797*	0.127
Srejber	2.458*	0.070
Bergström	2.474*	0.073
Nyberg	2.308*	0.066
Persson	2.227*	0.083
Öberg	1.985*	0.109
Bäckström[c]	2.650*	0.091
Rosenberg	2.139*	0.087
Ingves[c]	1.982*	0.112
Wickman-Parak	1.907*	0.137
Svensson	1.807*	0.137
Ekholm	1.416*	0.283
Inflation	0.503*	0.026
Unemployment	−0.410*	0.029
Standard deviation	0.531*	0.070
Coefficient in consensus norm	0.386*	0.043
Super-majority	2.0	

Notes: See notes to table 3.

Table 8. Proportion of Histories where Dissents Forecast Policy

			Counter-factuals			
	$\rho = 0$		$\rho = 0.5$		$\rho = 0.95$	
Central Bank	Estimate	s.e.	Estimate	s.e.	Estimate	s.e.
Bank of England	0.107	0.010	0.311	0.015	0.617	0.015
Riksbank	0.152	0.011	0.303	0.015	0.981	0.004

Notes: Proportions were computed on the basis of 1000 simulated histories using the parameters reported in tables 7 and 8, and regressions identical to that in (3).

Table 9. An MPC without External Members

Central Bank	Dissent Rate	Meetings with Dissents	Proportion of Dissents For Easing	For Tightening
Bank of England				
Current	0.133	0.628	0.564	0.436
Without external members	0.075	0.473	0.501	0.499
Riksbank	0.095	0.383	0.500	0.500

Notes: The statistics for the MPC without external members were computed on the basis of 1000 simulated histories. The statistics for the current MPC and for the EB were computed by the authors.

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Figure 1: Relation between Dissent Rate and Committee Characteristics

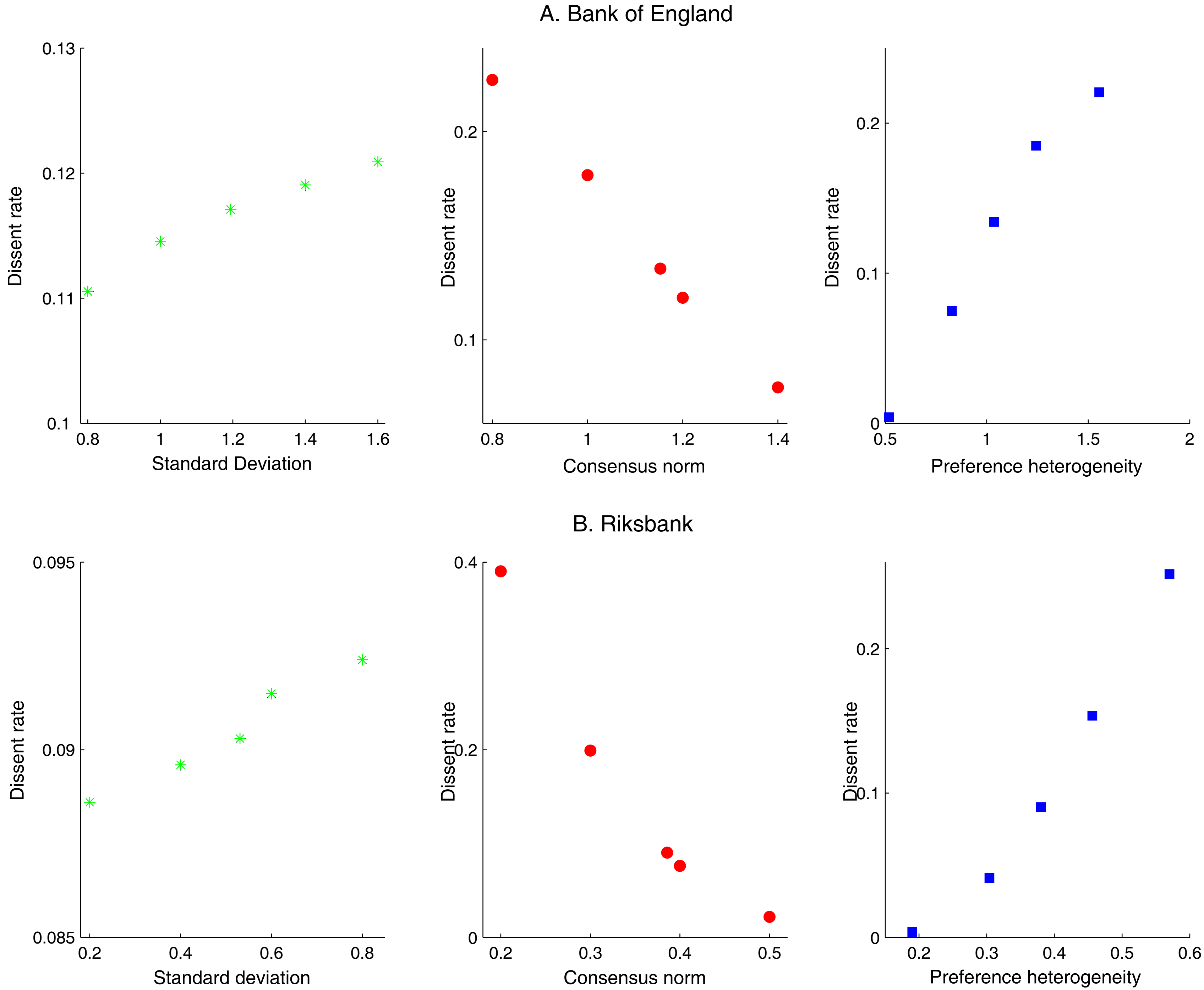

Figure 2: An MPC without External Members