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ABSTRACT

Voting Transparency in a Monetary Union*

We examine whether the central bank council of a monetary union should publish its voting records when members are appointed by national politicians. We show that the publication of voting records lowers overall welfare if the private benefits of holding office are sufficiently low. High private benefits of central bankers lower overall welfare under opacity, as they induce European central bankers to care more about being re-appointed than about beneficial policy outcomes. We show that opacity and low private benefits jointly guarantee the optimal welfare level. Moreover, we suggest that non-renewable terms for national central bankers and delegating the appointment of all council members to a European agency would be desirable.

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1 Introduction

The conclave, the meeting in which a new pope is elected, is highly confidential. The cardinals are shut off completely from the outside world during the process. They take an oath to maintain secrecy, and the ballots are burned after each session. What is the rationale for such an extreme degree of secrecy?

In the second half of the 19th century the papacy lost control of the papal states. Consequently, the then Pope Pius IX feared that the new Italian state would seek to influence the next papal election. Accordingly, he mandated increased secrecy to protect the conclave from outside political interference.[1]

Nowadays, many central banks have decided to publish voting records and their minutes of the meetings. Among them are the Bank of England, the Fed, and the Bank of Japan. However, the European Central Bank (ECB) has always insisted on keeping the details of the decision-making process secret. In this paper we argue that the ECB has been right to do so. The opacity of decision-making may protect the ECB from political interference. Political interference may be detrimental, particularly in a monetary union in which national policy-makers may try to promote their national interests.

We present a model to examine the desirability of voting transparency in cases where central bankers in a monetary union are appointed by national politicians. The publication of voting records in a monetary union may have two detrimental effects. First, it may induce central bankers to vote in the interest of their countries as opposed to the interest of the monetary union as a whole. Second, national governments are better able to distinguish nationalist from European central bankers and can thus re-appoint nationalist central bankers only which also lowers European welfare.

Additionally, we examine several institutional features and their impact on welfare. We show that, under opacity, high wages destroy incentives for central bankers to behave optimally from a European perspective, as central bankers become too focused on holding office. It is then optimal to set wages for central bankers on a European level, because national governments are interested in paying them too much in order to influence their behavior. This, however, is not desirable for aggregate welfare. We also argue that term limits would be desirable for national central bank council members. Additionally, we show that welfare would rise if all central bankers were appointed by a European authority.

One important assumption of our analysis is that central bankers may sometimes be

[1] See e.g. Baumgartner (2003).

more interested in outcomes in their own countries than in the overall outcome for the monetary union. The importance of regional bias on the part of monetary policy committee members has recently been confirmed for the US by Meade and Sheets (2003). If US central bankers exert a regional bias, then it seems highly plausible that a national bias cannot be excluded for central bankers in the European Monetary Union. Heinemann and Hüfner (2002) find some initial empirical evidence that ECB council members take divergences of national data from Eurozone averages into account. Von Hagen 2000 has identified and studied a regional bias in a voting game. On the drawbacks of external influence on committees see also Felgenhauer and Grüner (2003).

Our paper continues the line of research on the transparency of voting records initiated by Sibert (2003), Gersbach and Hahn (2001), and Gersbach and Hahn (2004). In particular, Gersbach and Hahn (2004) suggested that the desirability of voting transparency might depend on whether the appointment of central bankers is based upon aggregate welfare or special interests. In this paper we focus on a monetary union with conflicting national interests. We also contribute to the broader issue of the optimal degree of central bank transparency, as surveyed by Goodfriend (1986), Geraats (2002), and Hahn (2002).

Our paper also contributes to an emerging range of theoretical literature on the optimal design of independent central bank boards with several members appointed by the government. Waller and Walsh (1996) provide a comprehensive account of how central bank independence can be characterized in terms of competitiveness, partisanship, and term-length. Waller (2000) shows that a group of politically appointed central bankers can produce substantial policy smoothing and low policy uncertainty. Our paper is complementary to this literature as we focus on whether the votes of individual central bankers for a given board design should be made transparent to the political authorities that appoint central bankers.

The paper is organized as follows: In the next section, we present our model. In section 3 we analyze the results under opacity. We consider transparency in section 4. In section 5 we argue that the proposed re-appointment scheme is optimal. We proceed in section 6 by deriving the optimal disclosure policy and optimal institutional features for a central bank in a monetary union. Section 7 concludes.

2 The Model

In this section we present a two-period model of decision-making in a monetary union where central bankers are appointed by national governments. Suppose that there are two types of central bankers: nationalist central bankers, who desire a monetary policy

that is only optimal for their home country, and European central bankers, who prefer a policy that is optimal for Euroland as a whole.

We consider N (N odd) countries of sizes α_j ($\alpha_j > 0$, $j = 1..N$) forming a monetary union ($\sum_{j=1}^{N} \alpha_j = 1$). There are two potential choices for monetary policy $i^{(t)} \in \{-1; +1\}$ in each period $t = 1, 2$. The optimal choice of monetary policy for an individual country i_j^* is randomly drawn from the set $\{-1; +1\}$ and is commonly known. For simplicity we assume that the optimal choice of monetary policy is constant over time for each country.[2] Welfare in country j for period t is given by

$$W_j^{(t)} = \begin{cases} 1 & \text{if } i^{(t)} = i_j^* \\ 0 & \text{if } i^{(t)} \neq i_j^* \end{cases} \tag{1}$$

where we have normalized the social gains from monetary policy to 1 (0) if monetary policy is beneficial (detrimental) for country j.

Why might the optimal monetary policy differ across countries? First, national preferences may differ. For example, in some countries price stability may be regarded as much more important than in other countries. Second, economic development and shocks may be different across countries. Thus a tightening of monetary policy may be optimal for one country, while a monetary easing may be optimal for another. This case seems of particular relevance for the EMU since there are substantial differences in national inflation rates. In August 2004, for example, the annual inflation rate measured by the HICP amounted to 0.3% in Finland and 3.3% and 3.6% in Luxembourg and Spain respectively.[3]

Aggregate welfare for the monetary union is given by

$$W^{(t)} = \sum_{j=1}^{N} \alpha_j W_j^{(t)} \tag{2}$$

It is obvious that the monetary policy maximizing the monetary union's welfare amounts to[4]

$$i^* = \begin{cases} -1 & \text{if } \sum_{j=1}^{N} \alpha_j i_j^* < 0 \\ +1 & \text{if } \sum_{j=1}^{N} \alpha_j i_j^* > 0 \end{cases} \tag{3}$$

It is useful to define $\mathbf{C}$ as the set of countries where $i_j^* \neq i^*$. In these countries a conflict arises between nationally optimal and overall optimal policy. In all countries not in $\mathbf{C}$,

[2]Note that in general i_j^* will not be constant over time. However, the strategic effects in the first period do not depend on this assumption. Hence introducing non-constant optimal interest rates would not affect our results qualitatively.

[3]See `http://europa.eu.int/rapid`.

[4]In addition, we assume that no partition of countries exists such that the sum of the respective sizes α_j is 1/2. This assumption is not essential for our results but guarantees that the monetary policy decision optimal for the monetary union is unique.

no conflict between nationally optimal and European goals arises. We use n to denote the number of countries in $\mathbf{C}$. Note that n is common knowledge in the central bank council.

It will prove advantageous to introduce the following definition. Let w be per-period European welfare if i^* is adopted.

$$w := \sum_{j \notin \mathbf{C}} \alpha_j \tag{4}$$

This implies that $1 - w$ equals per-period European welfare if i^* is not adopted.

$$1 - w = \sum_{j \in \mathbf{C}} \alpha_j$$

It follows that $w > \frac{1}{2}$.

We next specify the preferences of central bankers. European central bankers have the following utility:

$$U_j^E = W^{(1)} + B + \delta W^{(2)} + \delta \cdot \begin{cases} B & \text{when holding office in period 2} \\ 0 & \text{when not holding office in period 2} \end{cases} \tag{5}$$

B ($B \geq 0$) denotes the private benefits from holding office. These benefits may stem from the wage paid to central bankers, they may also result from the satisfaction and prestige involved in holding such a position. Finally, they may represent enhanced career opportunities of individuals serving as central bankers. The variable δ ($0 < \delta < 1$) denotes the discount factor.

Nationalist central bankers also derive utility from holding office. In addition, they are interested in national welfare:

$$U_j^N = W_j^{(1)} + B + \delta W_j^{(2)} + \delta \cdot \begin{cases} B & \text{when holding office in period 2} \\ 0 & \text{when not holding office in period 2} \end{cases} \tag{6}$$

Each central banker is appointed by a selfish national government only interested in a large value of national welfare W_j. The government is not aware of the type of candidate central bankers when it makes its appointment decision. One could, for example, argue that central bankers' preferences may change, notably, when they become part of an organization.[5] Thus the future behavior of central bankers may not be predictable for governments when making an appointment decision. There may also be incentives for candidates to hide their true goals in order to get appointed. Thus it may be reasonable

[5] The so-called "Thomas Becket" effect refers to the fact that people sometimes become much more conservative after an appointment as central banker.

to assume that there is asymmetric information with respect to candidates' preferences. The government's prior probability of a central banker being a nationalist amounts to 1/2.

At the beginning of the second period, the government can dismiss its member of the central bank council or re-appoint him.

The sequence of events is given as follows:

- **1st Period:**
  - At the beginning of the first period, the original council with N central bankers is formed ($N \geq 1$, N odd). Each member is either a nationalist or a European, with equal probability. Each member's preferences are private information.
  - Members simultaneously vote on monetary policy i.
  - The interest rate preferred by the majority is set by the central bank.
  - Voting records are published under the transparency requirement or remain secret for all outsiders under opacity.[6]
- **2nd Period:**
  - At the beginning of the second period, the re-appointment of the members of the central-bank council takes place. Each government can dismiss its central banker and replace him by another central banker from a pool of candidates. Newly appointed central bankers will be of either type, with equal probability.
  - Members simultaneously vote on monetary policy i.
  - The alternative preferred by the majority is set by the central bank.

We introduce two special equilibrium constellations:

- European equilibrium: All European central bankers in $\mathbf{C}$ vote for i^* in the first period.
- Nationalist equilibrium: All European central bankers in $\mathbf{C}$ vote for the nationally optimal interest rate in the first period.

[6] In practice, strict opacity may not always be feasible for very large councils such as the ECB council. For our basic arguments it is nevertheless sufficient that the probability of an individual central banker's behavior becoming known to the national government is lower under a formal requirement for opacity.

3 Opacity

Let us analyze the scenario with opacity. First we discuss the governments' re-appointment procedure. Of course, the optimal re-appointment procedure and the monetary policy proposed by the two types of central bankers interact and must be formulated as equilibrium strategies in the overall game. However, we simplify the analysis at this stage by assuming certain government re-appointment schemes. In section 5 we will justify these assumptions as equilibrium strategies.

Without transparency, the government can only condition its decision on the observed outcome of the election:

Re-Appointment Scheme O:

$$\text{member } j \text{ is } \begin{cases} \text{re-appointed} & \text{if } j \notin \mathbf{C} \\ \text{re-appointed} & \text{if } i^{(1)} = i_j^* \text{ and } j \in \mathbf{C} \\ \text{dismissed} & \text{if } i^{(1)} \neq i_j^* \text{ and } j \in \mathbf{C} \end{cases} \tag{7}$$

The re-appointment scheme implies that it may be optimal for governments in $\mathbf{C}$ to dismiss their central bankers, if, due to an undesirable outcome, it seems likely that these central bankers are not pursuing national interests.

Note that, in the second period, central bankers wish to maximize $W_j^{(2)}$ or $W^{(2)}$ respectively. Thus European central bankers will vote for i^*, while nationalist central bankers will vote for the respective nationally optimal monetary policy in the second period.

In the first period, it is obvious that central bankers who are not in $\mathbf{C}$ will always vote for i^*. Nationalist central bankers in $\mathbf{C}$ vote for i_j^*. This increases the likelihood of nationally optimal policy and also enhances their chances of being re-appointed. If $n < (N+1)/2$, then the voting behavior of European central bankers in $\mathbf{C}$ does not affect the election outcome or their probability of being re-appointed. They can be assumed to vote for i^*. The case with $n \geq (N+1)/2$ is more subtle and is considered in the following.

We look for symmetric equilibria in which all European central bankers follow the same equilibrium strategies. If all other European central bankers in $\mathbf{C}$ vote for i^* with probability q in the first period of the game, then it is advantageous for a European central banker j in $\mathbf{C}$ to also vote for i^* if

$$\begin{aligned} &Q\left(\frac{1}{2}q\right)(w-(1-w)) \\ &\qquad \geq \delta Q\left(\frac{1}{2}q\right)\left(P\left(\frac{1}{2}\right)(w-(1-w))+B\right) \end{aligned} \tag{8}$$

where

$$Q(x) := \binom{n-1}{\frac{N-1}{2}} (1-x)^{\frac{N-1}{2}} x^{n-1-\frac{N-1}{2}} \tag{9}$$

Note that $Q(x)$ is the probability that among the central bankers in $\mathbf{C}\backslash\{j\}$ exactly $(N-1)/2$ vote for i_j^* if each central banker votes for i^* with probability x. This constellation is crucial because it is the only case where the vote of the central banker under consideration matters.

We have also introduced

$$P(x) := \sum_{j=(N+1)/2-(N-n)}^{n} \binom{n}{j} x^j (1-x)^{n-j} \tag{10}$$

which represents the probability of a European outcome if each central banker in $\mathbf{C}$ casts a European vote with probability x.

$1/2 \cdot q$ is the likelihood of an individual central banker in $\mathbf{C}\backslash\{j\}$ casting a European vote. Therefore $Q(1/2 \cdot q)$ is the probability of exactly $(N-1)/2$ in $\mathbf{C}\backslash\{j\}$ voting for i_j^*. If there are exactly $(N-1)/2$ central bankers in $\mathbf{C}\backslash\{j\}$ voting for i_j^*, the central banker under consideration can improve the outcome of the election in the first period. He can thus ensure that European welfare amounts to w instead of $1-w$. He can also vote for the respective nationally optimal monetary policy, which enables him to be re-appointed. Then he can reap the personal benefits B in the second period as well as prevent bad policy that would have occurred with probability $P(1/2)$ if he had voted for i^* in the first period.

Let us define the critical value for B:

$$B^{(O)}(q) = \left(\frac{1}{\delta} - P\left(1/2\right)\right)(2w-1) \tag{11}$$

For $B \leq B^{(O)}(q)$ it is always optimal for a European central banker in $\mathbf{C}$ to vote for i^*, given that all European central bankers in $\mathbf{C}$ vote for i^* with probability q, i.e., voting for i^* is a dominant strategy. Note that $B^{(O)}(q)$ is always positive. Since $B^{(O)}(q)$ does not depend on q, we will omit the argument q in the following.

We obtain the following proposition:

Proposition 1
If $B \leq B^{(O)}$, then the following perfect Bayesian Nash equilibrium exists. In both periods, all nationalist central bankers vote for their preferred policy i_j^*, whilst all European central bankers vote for i^*. Each government follows the re-appointment procedure O.

We can now compute ex ante European welfare:

$$\begin{aligned} W_{OE} = & P\left(1/2\right) w + \left(1 - P\left(1/2\right)\right)\left(1 - w\right) \\ & + \delta\left[\left(P\left(1/2\right)\right)^2 w + \left(1 - \left(P\left(1/2\right)\right)^2\right)(1 - w)\right] \end{aligned} \tag{12}$$

We have introduced the subscript E, because the equilibrium is a European equilibrium. In the first period, all Europeans in **C** vote for the interest rates optimal from a European perspective.

If B is large, Europeans in **C** do not vote for i^* in the first period. Thus we obtain:

Proposition 2
If $B \geq B^{(O)}$, then the following perfect Bayesian Nash equilibrium exists. In both periods, all nationalist central bankers vote for their preferred policy i_j^*. European central bankers vote for i^*, except for those in **C** *in the first period. They vote for i_j^*. Each government follows the re-appointment procedure O.*

This equilibrium is a nationalist equilibrium, since all European central bankers in **C** vote for the nationally optimal interest rates in the first period.

Ex ante European welfare amounts to

$$W_{ON} = 1 - w + \delta\left[P\left(\frac{1}{2}\right) w + \left(1 - P\left(\frac{1}{2}\right)\right)(1 - w)\right] \tag{13}$$

The difference in welfare can be readily computed as

$$W_{OE} - W_{ON} = P\big(1/2\big)\Big(1 - \delta\left(1 - P\big(1/2\big)\right)\Big)(2w - 1) \tag{14}$$

The difference in welfare can be split into two components. In the European equilibrium there is a welfare gain of $P\big(1/2\big)(2w-1)$ in the first period, compared to the nationalist equilibrium. However, in the second period, there arises a welfare loss of $-\delta P(1/2)(1-P(1/2))(2w-1)$. Intuitively, a nationalist equilibrium is detrimental in the first period because of the increased likelihood of a nationalist outcome in the first period. In the second period, however, because national governments cannot identify a majority of European central bankers in the first period and replace them, welfare is higher because of higher chances of European monetary policy.

Overall, welfare is always higher under a European equilibrium for any value of the discount factor δ. This can easily be seen by applying $w > 1/2$. We summarize this important finding in the following proposition:

Proposition 3
Under opacity, welfare is always higher under a European equilibrium, i.e., for $B \leq B^{(O)}$, than under a nationalist equilibrium, i.e., for $B \geq B^{(O)}$.

Hence we obtain the interesting result that high wages for committee members may be detrimental because high wages make the members care too much about being re-appointed and less about overall welfare. To state it differently, high wages may destroy socially desirable behavior.

4 Transparency

Again, we first propose the re-appointment procedure. In section 5, we will show that this scheme is in fact optimal.

The re-appointment scheme has the important feature that governments make their re-appointment decision dependent on the votes of their council members.

Re-Appointment Scheme T:

$$\text{central banker } j \text{ is } \begin{cases} \text{re-appointed} & \text{if } i_j^{(1)} = i_j^* \\ \text{dismissed} & \text{if } i_j^{(1)} \neq i_j^* \end{cases} \tag{15}$$

Note that, in the second period, all nationalist central bankers will vote for i_j^*, whereas all European central bankers will vote for i^*. Now we turn to the optimal behavior of central bankers in the first period. All central bankers in **C** who are nationalists will always vote for i_j^* as this is their preferred policy, and this choice will also enhance their re-election chances. It remains to be shown how the Europeans in **C** behave.

If $n < (N+1)/2$, then European central bankers in **C** cannot influence the outcome of the election in the first period. Therefore they will always vote for i_j^*, which will guarantee re-appointment. In the following, we consider the more interesting case $n \geq (N+1)/2$.

It is optimal for a European central banker j in **C** to vote for i^* when all other Europeans in **C** vote for i^* with probability q if[7]

$$Q\left(\frac{1}{2}q\right) \geq \delta B + \frac{1}{2}\delta Q\left(\frac{1}{2}(1-q) + \frac{1}{2}\cdot q \cdot \frac{1}{2}\right) \tag{16}$$

The left side of the inequality describes the advantage of voting for i^*. By voting for i^* the central banker may enhance the outcome of the election. Since the other central bankers in **C** vote for European monetary policy with probability $\frac{1}{2}q$, this will happen with probability $Q\left(\frac{1}{2}\cdot q\right)$.

The right side of the inequality captures the disadvantages of voting for i^* for the central banker under consideration. First, the central banker loses office and thus

[7]Note that we only consider symmetric equilibria, i.e., those equilibria where all European central bankers behave identically.

forgoes the benefits from holding office in the second period. Voting for a nationalist policy and being re-appointed in turn would also enable the central banker to affect the election outcome in period 2. The central banker would cast the pivotal vote with probability $Q\left(\frac{1}{2}(1-q)+\frac{1}{2}\cdot q\cdot\frac{1}{2}\right)$. Note that $\frac{1}{2}(1-q)+\frac{1}{2}\cdot q\cdot\frac{1}{2}$ is the likelihood of a central banker in $\mathbf{C}\backslash\{j\}$ voting for i^* in the second period. $\frac{1}{2}(1-q)$ is the probability of a member being a European from the start, and $\frac{1}{2}\cdot q\cdot\frac{1}{2}$ is the probability of the central banker being a European who votes for i^* and is replaced by another European. The additional $\frac{1}{2}$ before δ is introduced to take into account the fact that the successor of the respective central banker would only be a nationalist with probability $\frac{1}{2}$.

Let us define the critical value of B as

$$B^{(T)}(q) := \frac{1}{\delta}Q\left(\frac{q}{2}\right)-\frac{1}{2}Q\left(\frac{1}{2}-\frac{q}{4}\right) \tag{17}$$

If $B \leq B^{(T)}(q)$, then it is optimal for a European central banker in $\mathbf{C}$ to cast a European vote when all European central bankers in $\mathbf{C}$ cast a European vote with probability q. If $B \geq B^{(T)}(q)$, it is optimal to cast a nationalist vote for a European central banker in $\mathbf{C}$.

Thus there may be three types of symmetric equilibria. First, if $B \geq B^{(T)}(0)$, then an equilibrium exists where all European central bankers in $\mathbf{C}$ vote for the nationally optimal monetary policy.

Proposition 4
If $B \geq B^{(T)}(0)$, then a nationalist equilibrium exists.

Interestingly, it can easily be shown that $B^{(T)}(0) < 0$ for $n > (N+1)/2$ and $B^{(T)}(0) > 0$ for $n = (N+1)/2$. This follows from $Q(0) = 1$ for $n = (N+1)/2$ and $Q(0) = 0$ for $n > (N+1)/2$. Hence these equilibria exist for any value of private benefits B if $n > (N+1)/2$. For $n = (N+1)/2$, these equilibria exist only for sufficiently large values of B.

Intuitively, if $n > (N+1)/2$, a central banker can never affect the outcome of the election if all other central bankers in $\mathbf{C}$ vote for a nationalist policy. Thus from a European's perspective it is beneficial not to vote for i^* because this would not increase the probability of a European monetary policy in the first period but would merely cause the respective central banker to be dismissed. Under opacity, these equilibria do not exist, because voting for i^* would not be detected (and thus would not cause dismissal). Hence the central banker would be indifferent between both choices. Note that we have assumed that any central banker votes for his preferred alternative if he is indifferent between both options. Thus we obtain multiple equilibria under transparency but none under opacity. By contrast, if $n = (N+1)/2$ and $q = 0$, then any

central banker in **C** could change the outcome of the election and would do so unless B were very large.

Second, if $B \leq B^{(T)}(1)$, then an equilibrium exists where all European central bankers in **C** vote for i^*.

Proposition 5
If $B \leq B^{(T)}(1)$, then a European equilibrium exists.

Third, equilibria in mixed strategies may exist. These can be calculated by solving $B = B^{(T)}(q)$ for q. In these equilibria, European central bankers in **C** are indifferent between both votes and therefore randomize between i^* with probability q and i_j^* with probability $1-q$. In general, it is not possible to calculate the solutions to $B = B^{(T)}(q)$ analytically, since $B^{(T)}(q)$ is a polynomial of order $n-1$.

It seems plausible to exclude those equilibria in mixed strategies where $\frac{\partial B^{(T)}(q)}{\partial q} > 0$ as unstable. These equilibria imply that a marginal increase in q (which implies that it is slightly more likely that other European central bankers in **C** vote for i^*) makes voting for i^* more beneficial for a European central banker in **C**. However, even if we apply this refinement, multiple equilibria usually exist under transparency for low values of B. It is important to note that $B^{(T)}(1)$ may be smaller than $B^{(T)}(0)$. As a consequence, an equilibrium in pure strategies does not always exist.

If European central bankers in **C** vote for the respective European interest rate with probability q in the first period, then ex ante welfare under transparency is given by

$$\begin{aligned} W_T(q) = {} & P\big(1/2 \cdot q\big)w + \Big(1 - P\big(1/2 \cdot q\big)\Big)(1-w) \\ & + \delta\Big[P\Big(1/2 - q/4\Big)w + \Big(1 - P\Big(1/2 - q/4\Big)\Big)(1-w)\Big] \end{aligned} \tag{18}$$

where we have used the fact that the probability of a central banker in **C** voting for European policy in the second period amounts to $1/2(1-q) + 1/2 \cdot q \cdot 1/2 = 1/2 - q/4$.

It is easy to see that $W_T(1) > W_T(0)$. This implies that a pure European equilibrium is always preferable to a pure nationalist equilibrium. Numerical analyses show that interior welfare optima exist in some cases. Hence it is not clear that $q = 1$ always represents the socially desirable equilibrium.

This illustrates a subtle advantage for transparency. If n is relatively large, some European central bankers in **C** can survive the first period of the game if they randomize with $q < 1$. This enables some Europeans to reach the second period, although i^* may have been chosen in the first period. Under opacity, all central bankers in **C** are dismissed if i^* is chosen. However, this potential advantage of transparency may only be substantial if n is large and if, by chance, the number of European central bankers

is very high in the first period. Overall this effect is not strong enough to affect the ex ante comparison of transparency and opacity. It is nevertheless interesting to note that transparency may enable some European central bankers to hide their true motives and thus reach the second period of the game, while under opacity this is impossible.

5 Optimality of Re-Appointment Schemes

Here we argue that given the behavior of central bankers the proposed re-appointment schemes represent the optimal behavior for national governments. Under transparency, it is optimal for a government in **C** to dismiss its central banker if, by voting for i^*, he has disclosed himself as being European. This increases expected national welfare for the second period, because expected national welfare is always increasing in the likelihood of the respective central banker being a nationalist.[8]

Under opacity, consider the case where a European policy has been adopted in the first period of the game. Then the probability of a central banker in **C** being European is at least as large as the probability of his being a nationalist.[9] Hence a newly chosen candidate is more likely to be a nationalist central banker than the incumbent. This, in turn, implies that it is optimal for a government in **C** to dismiss its central banker.

6 Optimal Disclosure Policy and Institutional Design

Let us now discuss optimal remuneration under opacity. From what has been said so far, it is clear that $B \leq B^{(O)}$ guarantees the highest welfare under opacity, as a very high remuneration would make European central bankers focus too much on individual re-appointment rather than on welfare.

Proposition 6
Under opacity, welfare is optimal for $B \leq B^{(O)}$.

[8] When the respective central banker's vote turns out not to be pivotal, the probability of his voting for a nationalist policy is irrelevant. By contrast, if the respective central banker's vote happens to be pivotal, a nationalist outcome is more likely, if it is more likely for him to vote for a nationalist policy.

[9] If $n < (N+1)/2$, then both probabilities are identical. Thus national governments are indifferent between dismissing or re-appointing their central bankers. Our assumption that governments replace their central bankers in this case is not essential and merely serves to simplify the exposition. If $n \geq (N+1)/2$, then the probability of a central banker in **C** being European is strictly larger than the probability of his being a nationalist.

Let us now discuss the impact of the size of B on welfare under transparency. Note that $B^{(T)}(q)$ is a polynomial and thus $B_{max} = \max_{q\in[0;1]} B^{(T)}(q)$ is well-defined. Hence if $B \geq B_{max}$, the only equilibria that exist are those where all European central bankers in **C** vote for the respective nationally optimal monetary policy. If $B < B_{max}$, then it is unclear how a change in B would impact on welfare. If multiple equilibria exist, then a change in B may affect which equilibrium is chosen.

It is interesting to ask whether the European equilibrium under opacity is superior to any equilibrium that can be achieved under transparency. It is straightforward to show that this amounts to verifying whether the inequality $P(1/2 \cdot q) + \delta P(1/2 - q/4) < P(1/2) + \delta(P(1/2))^2$ is always satisfied. As $P(x)$ is increasing in x, $P(1/2) \geq P(1/2 \cdot q)$. Thus the inequality holds for any $0 < \delta \leq 1$ if it holds for $\delta = 1$. It is therefore sufficient to show

$$P\left(\frac{1}{2} \cdot q\right) + P\left(\frac{1}{2} - \frac{q}{4}\right) < P\left(\frac{1}{2}\right) + \left(P\left(\frac{1}{2}\right)\right)^2 \tag{19}$$

This inequality holds if

$$P(1/3) < (P(1/2))^2 \tag{20}$$

This can be seen as follows: First, consider the case $q \leq 2/3$. Then $P(q/2) \leq P(1/3) < (P(1/2))^2$ and $P(1/2 - q/4) < P(1/2)$. Second, for $q > 2/3$ we can conclude that $P(1/2 - q/4) < P(1/3) < (P(1/2))^2$ and $P(q/2) < P(1/2)$.

The above condition (20) is quite complex. Thus we proceed in two ways. For the cases $n = (N+1)/2$, $n = (N+1)/2 + 1$, for symmetric equilibria in pure strategies, and for very large n we show analytically that opacity is generally preferable to transparency. For other circumstances we rely on numerical calculations.

Proposition 7
For all symmetric equilibria in pure strategies opacity is always superior to transparency if $B \leq B^{(O)}$.

The proof is given the appendix. Note that this proposition and (19) imply $P(1/4) < (P(1/2))^2$. As a corollary, we immediately obtain

Corollary 1
Any symmetric equilibrium under transparency with $q \leq 1/2$ is inferior to any symmetric equilibrium under opacity if $B \leq B^{(O)}$.

Now we consider the special case where the members in **C** represent only a relatively small majority of all central bankers.

Proposition 8
Suppose $n = (N+1)/2$ or $n = (N+1)/2 + 1$. Then opacity is always superior to transparency if $B \leq B^{(O)}$.

The proof is given in the appendix. These cases are of particular relevance because monetary policy that is optimal for the monetary union is unlikely to be detrimental to a very large number of countries.

For $N = 3$, the only relevant case is $n = 2$. For $n < 2$, there is no conflict between European welfare and national welfare for a majority of countries and thus the policy optimal from a European perspective would always be adopted. The case $n = 3$ and $N = 3$ is impossible, because the policy which is optimal for the monetary union cannot be detrimental for all individual countries. Equivalently, for $N = 5$ the only relevant cases are $n = 3$ and $n = 4$. Hence from proposition 8 we immediately obtain the following corollary:

Corollary 2
Suppose $N = 3$ or $N = 5$. Then opacity is always superior to transparency if $B \leq B^{(O)}$.

In the next proposition we consider large committees and obtain

Proposition 9
Suppose $n = (N + 1)/2 + k$ where $k \geq 0$ is an integer that is fixed. If n (and N) is sufficiently large, opacity is superior to transparency if $B \leq B^{(O)}$.

The proof is given in the appendix. For the remaining cases we rely on numerical calculations. They show that inequality (20) holds for all parameters $N \leq 100$ and $(N + 1)/2 \leq n \leq N - 1$. A numerical check of (20) yields

Proposition 10
For $N \leq 100$, opacity is always superior to transparency if $B \leq B^{(O)}$.

Hence the combination of low private benefits and opacity is beneficial as it induces European central bankers to focus on policy outcomes, as opposed to individual reappointment, and simultaneously protects European central bankers from being replaced by governments focusing on national welfare.

We have shown that high wages for central bankers under opacity may destroy their incentives to opt for European policy as holding office becomes very desirable. Is it then desirable for each country to pay low wages? The opposite is true. By paying its central banker a high wage the country can discipline its central banker and can induce him to vote in the national interest of the country. Choosing the wages of central bankers thus has the features of a prisoner's dilemma. Although all countries would be better off paying moderate wages to central bankers, each country has an incentive to pay a high wage to its central banker given the wages of the other central bankers. Consequently, it is desirable to agree on wages for central bankers at a European level (as opposed to national levels).

In a similar vein, suppose that candidates differed with respect to the size of B. Those with a high B would value holding office much more than policy outcomes (careerist). If national governments had some information on the individual candidates' value of B, they would tend to appoint careerists as their voting hehavior is much easier to influence by the threat of dismissal. This is may be socially detrimental.

Now we examine the optimal disclosure requirement for large private benefits of central bankers. If $B > B_{max}$ and $B > B^{(O)}$, the only equilibria that exist under transparency and opacity are nationalist. This implies

Proposition 11
If $B > B_{max}$ and $B > B^{(O)}$, opacity and transparency are equivalent with respect to European welfare.

For intermediate values of B, it is possible that transparency is desirable for particular values of n. The reason is the aforementioned effect that by randomizing European central bankers can guarantee a relatively high probability of good monetary policy in the first period, while at the same time maintaining a positive probability of being re-appointed and thus of good monetary policy in the second period.

We illustrate our results by two figures. Figure 1 shows the likelihood of a European central banker in **C** voting for i^* as a function of B for $N = 3$, $n = 2$ and $\delta = 0.9$. Figure 2 shows European welfare as a function of B for the same parameter values. Under opacity, only European equilibria exist for low values of B and only nationalist equilibria exist for large values of B. Under transparency there is a region of intermediate values for B where welfare is higher than under opacity. For low values of B opacity is desirable and for very high values of B both regimes lead to identical welfare. Note that for this particular constellation there is always a unique equilibrium under transparency.

We now discuss whether term limits are desirable. Let us assume that central bankers must not be re-appointed after the first period. In this case all Europeans will vote for a European policy and all nationalist central bankers will vote for a nationalist policy. This behavior is optimal irrespective of the size of private benefits and of the disclosure policy. Consequently, a European monetary policy is chosen with probability $P(1/2)$ in both periods. This implies that welfare amounts to

$$W_{TL} = (1 + \delta) \left[P(1/2)w + (1 - P(1/2)) (1 - w) \right]$$

By comparing the respective expressions for welfare with the above expression for W_{TL}, we obtain

Proposition 12
If terms are non-renewable, all European central bankers always vote for i^*, whereas

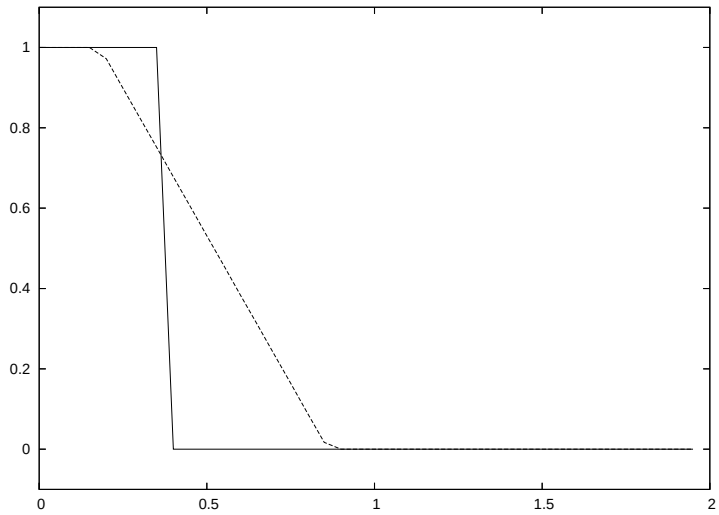

Figure 1: The likelihood of a European central banker in **C** voting for i^* as a function of B for $N = 3$, $n = 2$ and $\delta = 0.9$. Dotted line: transparency, solid line: opacity.

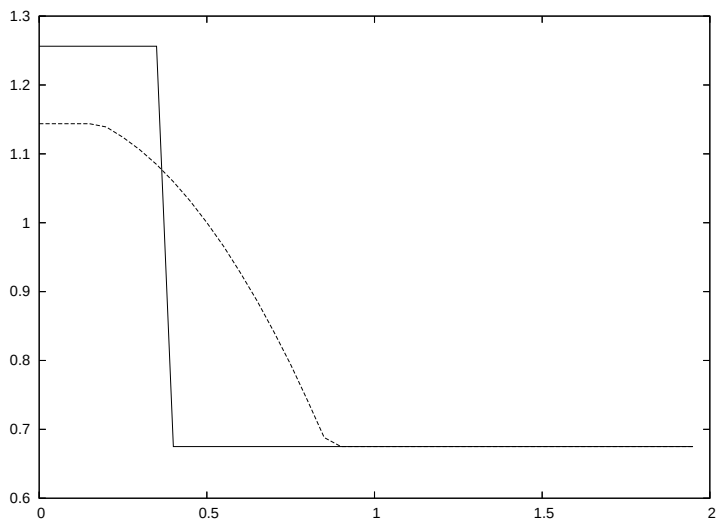

Figure 2: European welfare as a function of B for $N = 3$, $n = 2$ and $\delta = 0.9$. Dotted line: transparency, solid line: opacity.

all nationalist central bankers vote for the respective nationally optimal interest rates. Non-renewable terms always imply higher welfare than renewable terms.

Term limits induce central bankers to focus on monetary policy and less on individual re-appointment. This is beneficial from a social perspective. If the introduction of term limits is beneficial, will an individual country prefer to introduce them? The answer is no. We again have a prisoner's dilemma where each individual country does not have an incentive to introduce a term limit for its national central banker, whereas the introduction of term limits in all countries would be desirable for the monetary union.

While in the ECB terms are non-renewable for Executive Board members, the Maastricht treaty allows renewable terms for national central bankers. Our model implies that non-renewable terms for national central bankers should be incorporated into a European treaty.[10]

Another interesting question is whether an alternative appointment mechanism would yield superior results. If all central bankers were appointed on a European level, i.e., by an agency interested in European welfare, several beneficial effects would occur. European central bankers in **C** would never vote for a nationalist policy. The cherry picking of nationalist central bankers would be replaced by a cherry picking of European central bankers, which would increase European welfare in the second period. If private benefits were large, nationalist central bankers would prefer to choose a European monetary policy in the first period in order to be re-appointed.

7 Discussion and Conclusions

While a great deal of attention has been paid to the remuneration of chief executives and recently also of politicians (cf. Gersbach (2004)), we identify a new detrimental effect of high wages for central bankers in the context of a monetary union and national re-appointment decisions. High wages make re-appointment highly valuable, which induces European central bankers to vote for the respective nationally optimal monetary policy in order to secure re-appointment. High wages in our model can be thought to comprise not only the actual remuneration of central bankers but also, e.g., the size of the national central bank. It seems plausible that a national central banker's utility positively depends on the size of his institution, because a large national central bank implies more prestige and power. Thus our model may also shed light on the fact that the some national central banks in the EMU still seem excessively large.

[10] However, term limits may also have undesirable effects. For example, if a central banker has proved to be very competent, it may be beneficial to re-appoint him.

Our result is a subtle counterpoise to the idea that paying agents better will improve their performance. In the context of a monetary union, increasing the remuneration of central bankers improves the performance from the perspective of a single nation but not from a European perspective.

It is interesting to ask whether, given a certain amount of remuneration, opacity or transparency are preferable. While for sufficiently low remuneration ($B \leq B^{(O)}$) transparency is always detrimental and opacity should be chosen, one cannot obtain such a clear-cut result if remuneration is high.[11]

However, we obtain the result that low wages and opacity act in a complementary manner in increasing welfare. Both measures increase jointly the incentive of European central bankers to act as European statesmen, while at the same time protecting them from national governments. While low wages are always beneficial under opacity, the same is not necessarily true under transparency.

Since opacity and a low wage, or a low value of office in general, jointly increase welfare, we suggest that confidentiality of individual voting behavior should be accompanied by a centralized determination of remuneration for central bankers that applies to all countries. The latter requirement curbs the incentive to pay national central bank governors high wages to ensure that they vote nationalistically. It would be even better if all central bankers were accountable to a European authority. However, this solution may not be politically feasible.

On the other hand, low wages may also have detrimental effects not captured by our model, such as attracting only less able candidates. Thus the beneficial effect of low wages identified in our paper needs to be weighed against these disadvantages.

In our model term limits would generally increase welfare, because the possibility of being re-appointed would no longer influence the behavior of central bankers. Additionally, national governments could not increase the number of nationalist central bankers over time by re-appointing central bankers who have voted for a nationally optimal monetary policy. Both effects would increase European welfare.

The Governing Council has recently accepted a reform proposal. In this proposal, the principle of one-country-one-vote is upheld. However the number of governors with voting rights will be restrained through a complicated rotation scheme (for a discussion see e.g. Gros (2002) or Wyplosz (2003)). This new scheme does not eliminate the underrepresentation of large countries or the over-representation of small countries in the political balance. Thus one of our implicit assumptions remains valid, i.e. that the

[11] Our numerical calculations show that opacity or transparency may be advantageous, depending on the parameter values and on the equilibrium chosen under transparency.

stronger relative influence of small countries implies that monetary policy chosen by the council may not be optimal from an overall European perspective.[12] When more countries join the EMU in the future, the misrepresentation will become even more severe due to some very small countries such as Malta.

In our model we have neglected the Executive Board, which in the case of the ECB comprises six members. This would weaken our results somewhat, since these members are not appointed by national governments. However, Meade and Sheets (2003) showed that, in the US, FOMC members from the hub showed even more regional bias than those in the spokes. This implies that it is not unreasonable to assume that Executive Board members will also display a national bias.

It may also be possible that some national central bankers will wish to attain a position at a European organization. Then there would be incentives to signal a European type as opposed to a nationalist type. However, the incentives to signal a nationalist type may be stronger for most central bankers. Nevertheless, our conclusion that transparency may lead central bankers to use their vote as a signal of their type and thus affect decision-making would remain valid.

The Governing Council council usually reaches its decision by consensus, as opposed to formal voting. However, formal voting exists as a fall-back option. It would be interesting to assume a different mechanism of decision making, such as Nash bargaining. The basic mechanisms identified in our paper should carry over to such a model.

One implication of our model that could be tested empirically is that under opacity either a large group of central bankers or no central banker at all is dismissed, while under transparency the dismissal of only a few central bankers should be comparably frequent.

Our analysis may have applications for other committees where re-appointment or re-election and political pressure play an important role. One may conjecture, for example, that secret voting in the German "Bundesrat", where representatives of the federal states vote on national policy issues, would lead to more efficient policy-making.[13]

[12] Note that we would always obtain socially optimal results if $\alpha_j = 1/N$ for $j = 1...N$, i.e., if each country's weight in the decision-making process equalled its weight in the welfare function.

[13] A similar effect might also play a role for courts, where opacity may protect judges from socially detrimental influence. Judges, however, are usually appointed only once. However, they may nevertheless find it embarrassing, or expect career disadvantages, to vote against the interests of those politicians who have appointed them, if voting is public.

A Proof of Proposition 7

We have to verify only two cases.

1. $q = 0$. Inserting $q = 0$ into (19) yields $P(0) + P(1/2) < P(1/2) + (P(1/2))^2$. Since $P(0) = 0$ and $P(1/2) > 0$, the inequality holds.

2. $q = 1$. This is the case where all Europeans in **C** vote for i^* in the first period. It turns out to be easier not to evaluate (19) but to argue along the following line of reasoning: Note that, in the first period, welfare is identical under transparency and opacity, since the central bankers behave identically under both regimes. Hence it is sufficient to focus on welfare in the second period.

   Let us assume for the moment that there are k nationalists in **C** in the first period. If $k \geq (N+1)/2$, then we obtain the same results under transparency and opacity. In both periods i^* is not implemented. Thus we have to analyze $k < (N+1)/2$. Under transparency, the nationalist central bankers in **C** remain in office, while under opacity they are replaced in the second period. It is intuitively clear that this makes i^* less likely under transparency. However, we will also give a formal proof. We have to show that, under transparency, the likelihood of a detrimental monetary policy being implemented is higher than the respective probability under opacity. Formally, this can be stated as

$$\sum_{j=\frac{N+1}{2}-k}^{n-k} \binom{n-k}{j} \frac{1}{2^{n-k}} > \sum_{j=\frac{N+1}{2}}^{n} \binom{n}{j} \frac{1}{2^n}$$

   The left-hand side gives the probability that at least $(N+1)/2 - k$ nationalist central bankers are appointed in addition to the k nationalist incumbents. The right-hand side gives the probability of at least $(N+1)/2$ central bankers in **C** being nationalists if all central bankers in **C** are replaced.

   If we define the left-and of the inequality as $\kappa(k)$, it is sufficient to show that $\kappa(k+1) > \kappa(k)$. This is equivalent to

$$\sum_{j=\frac{N+1}{2}-k-1}^{n-k-1} \binom{n-k-1}{j} \frac{1}{2^{n-k-1}} > \sum_{j=\frac{N+1}{2}-k}^{n-k} \binom{n-k}{j} \frac{1}{2^{n-k}}$$

   Using the well-known formula for binomial coefficients, $\binom{n}{k} = \binom{n-1}{k} + \binom{n-1}{k-1}$, this

can be manipulated as follows

$$
\begin{aligned}
2\sum_{j=\frac{N+1}{2}}^{n}\binom{n-k-1}{j-k-1} &> \sum_{j=\frac{N+1}{2}}^{n}\binom{n-k}{j-k} \\
2\sum_{j=\frac{N+1}{2}}^{n}\binom{n-k-1}{j-k-1} &> \sum_{j=\frac{N+1}{2}}^{n}\left(\binom{n-k-1}{j-k}+\binom{n-k-1}{j-k-1}\right) \\
2\sum_{j=\frac{N+1}{2}}^{n}\binom{n-k-1}{j-k-1} &> \sum_{j=\frac{N+1}{2}+1}^{n+1}\binom{n-k-1}{j-k-1}+\sum_{j=\frac{N+1}{2}}^{n}\binom{n-k-1}{j-k-1} \\
\binom{n-k-1}{(N+1)/2-k-1} &> 0
\end{aligned}
$$

Hence transparency implies a lower probability of i^* being implemented in the second period. Since opacity and transparency imply the same welfare in the first period, opacity is always desirable for $q = 1$.

□

B Proof of Proposition 8

First we consider the case with $n = (N+1)/2$. Then the expression for $P(x)$ simplifies to

$$P(x) = 1 - (1-x)^n$$

Intuitively, a European monetary policy is adopted unless all central bankers in **C** vote for a national monetary policy, which happens with probability $(1-x)^n$. Inequality (20) can now be written as

$$1 - \left(1 - \frac{1}{3}\right)^n < \left(1 - \left(\frac{1}{2}\right)^n\right)^2$$

This is equivalent to

$$2 < \left(\frac{4}{3}\right)^n + \frac{1}{2^n}$$

Note that the smallest value of n is $n = 2$.[14] For $n = 2$ it is straightforward to verify that this inequality is satisfied. For $n > 2$ we note that $\left(\frac{4}{3}\right)^n > 2$, which also implies that the inequality holds.

[14] The only relevant cases are $n \geq (N+1)/2$. $N = 3$ is represents the smallest council (except for $N = 1$, which implies that transparency and opacity are equivalent.)

Second we consider $n = (N+1)/2+1$. For $n = (N+1)/2+1$ the expression for $P(x)$ simplifies to

$$P(x) = 1 - (1-x)^n - n(1-x)^{n-1}x$$

This implies

$$\begin{aligned} P(1/2) &= 1 - (n+1)\frac{1}{2^n} \\ (P(1/2))^2 &= 1 - \frac{2(n+1)}{2^n} + \frac{(n+1)^2}{2^{2n}} \\ P(1/3) &= 1 - \left(1+\frac{n}{2}\right)\left(\frac{2}{3}\right)^n \end{aligned}$$

Inequality (20) can now be written as

$$2 < \frac{1+n/2}{1+n}\left(\frac{4}{3}\right)^n + \frac{1+n}{2^n}$$

Note that the smallest value of n is $n = 4$.[15] The inequality is readily verified in this case. For $n \geq 5$, $(4/3)^n > 4$ and $(1+n/2)/(1+n) > 1/2$, which implies that the inequality also holds. Hence opacity is always socially desirable from a European perspective if $n = (N+1)/2+1$.

□

C Proof of Proposition 9

Note that $P(x)$ can be written as

$$P(x) = 1 - \sum_{j=0}^{k} \binom{n}{j} (1-x)^j x^{n-j}$$

where $k = n - (N+1)/2$. Then (20) is equivalent to

$$2\frac{1}{2^n}\sum_{j=0}^{k}\binom{n}{j} < \left(\frac{2}{3}\right)^n \sum_{j=0}^{k}\binom{n}{j}\frac{1}{2^j} + \left(\frac{1}{2^n}\sum_{j=0}^{k}\binom{n}{j}\right)^2$$

This inequality is satisfied if

$$\frac{\sum_{j=0}^{k}\binom{n}{j}\frac{1}{2^j}}{\sum_{j=0}^{k}\binom{n}{j}} > 2\left(\frac{3}{4}\right)^n$$

[15] The value of $n = 4$ corresponds to $N = 5$ and $n = (N+1)/2+1$.

Note that the left-hand side of the inequality is always larger than $\frac{1}{2^k}$, since it is a weighted average of $1, 1/2, 1/4, ..., 1/(2^{k-1}), 1/(2^k)$. For an increasing value of n and a fixed value of k, the right-hand side of the inequality becomes arbitrarily small. Hence there exists an n^* such that (20) holds for all $n \geq n^*$.

$\square$

References

Frederic J. Baumgartner. *Behind Locked Doors: A History of the Papal Elections*. Palgrave Macmillan, 2003.

Mike Felgenhauer and Hans Peter Grüner. Committees and special interests. ECB Working Paper No. 293, 2003.

Petra M. Geraats. Central bank transparency. *Economic Journal*, 112:532–565, 2002.

Hans Gersbach. *Designing Democracy: Ideas for Better Rules*. Springer Verlag, 2004.

Hans Gersbach and Volker Hahn. Should the individual voting records of central-bank council members be published? Bundesbank Working Paper, 2001.

Hans Gersbach and Volker Hahn. Voting transparency, conflicting interests and the appointment of central bankers. *Economics and Politics*, 16(3):321–345, November 2004.

Marvin Goodfriend. Monetary mystique: Secrecy and central banking. *Journal of Monetary Economics*, 17:63–92, 1986.

Daniel Gros, editor. *The Euro at 25*, 2002. CEPR, special report of the CEPS Macroeconomic Policy group.

Volker Hahn. Transparency in monetary policy: A survey. *ifo Studien*, 3:429–455, 2002.

Friedrich Heinemann and Felix Hüfner. Is the view from the eurotower purely european? national divergence and ecb interest rate policy. ZEW Working Paper No. 02-69, 2002.

Ellen E. Meade and D. Nathan Sheets. Regional influences on fomc voting patterns. *Journal of Money, Credit, and Banking*, 2003. forthcoming.

Anne Sibert. Monetary policy committees: Individual and collective reputation. *Review of Economic Studies*, 70:649–665, 2003.

Jürgen von Hagen. The composition of bank councils for heterogeneous monetary unions. In Jürgen von Hagen and Christopher J. Waller, editors, *Regional Aspects of Monetary Policy in Europe*, pages 221–240. Kluwer Academic Publishers, Boston, 2000.

Christopher J. Waller. Policy boards and policy smoothing. *Quarterly Journal of Economics*, 115(1):305–339, February 2000.

Christopher J. Waller and Carl E. Walsh. Central-bank independence, economic behavior, and optimal term lengths. *American Economic Review*, 86(5):1139–1153, December 1996.

Charles Wyplosz. The new eurosystem, 2003. Briefing Paper for the Committee for Monetary and Economic Affairs (ECON) of the European Parliament, 17 February 2003.