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Why are federal central banks more activist?

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Abstract
This paper analyzes monetary policy making by a committee of regional
representatives in a currency union with asymmetric shocks. By considering
strategic delegation of monetary policy making, we show that regional
representatives in a federal policy making committee may be more activist than the
average citizen in their district. Hence, in our model federal central banks such as
the ECB and the FED respond more aggressively to output shocks when compared to
individual central banks.

Keywords: Central Banking, Asymmetric Shocks, Federations, Strategic Delegation

JEL classification: F33, F53, E58

1   Introduction

It is a well known result from the optimal currency area literature that centralizing monetary policy creates inefficiencies. In this literature, to form a currency union with other countries involves a trade-off between the efficiency gain from a common currency in conducting bilateral trade, and larger output fluctuations in the presence of asymmetric shocks. This higher output gap (positive or negative) occurs because a centralized policy takes only limited account of local conditions. In addition, De Grauwe (2000) shows that when a federal central bank selects policy on the basis of the average shock in the member states, this creates a bias towards a too conservative monetary policy.

However, only limited attention has been paid to the question how the individual members of a currency union deal with these inefficiencies. In this paper we present a model in which delegation by national governments serves as a commitment to influence the decisions of a federal monetary policy committee (the ECB Council, the FOMC). Recently, there is much attention for the role of such committees in (monetary) policy making, see Mihov and Sibert (2002), Sibert (2003), Swank and Visser (2005), and Waller (2000).[1] Our treatment of the incentives for delegation is close to Besley and Coate (2003), where two regions bargain over the centralized supply of local public goods. They show that, in the presence of a common pool problem, the median voter has an incentive to delegate to a person with a higher preference for the local public good, so as to obtain a larger share of centralized spending. With monetary policy there is no such scope for differentiation, for a federal central bank decides on a common interest rate for the monetary union. However, the median voter (or national policy maker) has an incentive to try to systematically bias the federal monetary policy towards his region by selecting a person who cares more for the local output gap. In the symmetric equilibrium both countries delegate to a more activist representative, which counterbalances the conservative stance of the centralized policy committee.[2] Further, we analyze

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[1] These authors analyze decision making when members of a committee care for their reputation. Our paper abstracts from reputational concerns as well as from other obstacles to efficient procedural decision making in committees, to focus exclusively on delegation. See Berger (2006) for a study on optimal committee design for the ECB.

[2] Delegation in our model serves as a commitment device to influence centralized bargaining. Since we do not consider an inflation bias, the purpose of delegation in our model is different

the effect of monetary policy rules on delegation.

In contrast to our paper, others discuss strategic interaction between parties or countries when they bargain over the appointment of a single monetary policy maker. Waller (1992) discusses games between two parties over the preferences of the monetary policy maker. The main focus of this paper is how central bank independency improves welfare when it reduces the competition between two political parties. More closely related to our paper is Aaron-Cureau and Kempf (2006) who discuss delegation of monetary policy making in currency unions. In their set up, two countries bargain over the preferences of a single central banker. Their focus is on asymmetries in bargaining power between the members of the monetary union in the presence of an inflation bias.

Before moving to the model, in the next section we discuss whether the ECB's institutional design leaves sufficient room for the effects of delegation to potentially play a role in shaping monetary policy. For this, we argue that national central bankers have sufficient discretionary power in the ECB Council to influence the monetary policy stance. Moreover, for delegation on preferences to be an important strategy, explicit contracts between the national principals and their monetary policy agent can not play a role.

2   The European Central Bank

The ECB is highly independent and its website quotes the intention of the relevant Treaty articles: "Neither the ECB nor the national central banks (NCBs), nor any member of their decision-making bodies, are allowed to seek or take instructions from European Community institutions or bodies, from any government of an EU Member State or from any other body. Community institutions and bodies and the governments of the Member States must respect this principle and not seek to influence the members of the decision-making bodies of the ECB (Article 108 of the Treaty)." The independence of national central bankers can not be founded more clearly in the Treaty.

Even though the independence of the ECB is large, it is not completely free to set its own goals. The Treaty states the objective for monetary policy: "The

than in Rogoff (1985), where citizens delegate to influence the future interaction between the central bank with themselves.

primary objective of the ESCB shall be to maintain price stability.....Without prejudice to the objective of price stability, the ESCB shall support the general economic policies in the Community with a view to contributing to the achievement of the objectives of the Community as laid down in Article 2." (Treaty article 105.1). However, at the start of EMU, the ECB by the first pillar still had to justify its policy on the basis of monetary aggregates. As monetary aggregates leave little room for a different interpretation for the future course of action of monetary policy, the ECB's opportunities for policy activism were restricted considerable. Over time, there has been a move towards a more flexible approach to policy making that comes closer to inflation targeting. Hence, by taking more aspects of the economy into account, this leaves more room to the ECB to motivate its course of action.

With respect to the objective of monetary policy, national central bankers often state that indeed there is a high degree of conformity to the European interest in the Governing Council. Moreover, after a wobbling start, there now is consensus among commentators that the ECB speaks with one voice (Janssen and de Haan 2005). Whether this conformity is indeed present behind closed doors is difficult to assess, for the Governing Council does not publish minutes of its discussions. Further, observers note that in ECB meetings voting is a rare occasion, which may be explained by pre-meetings. When difficult monetary decisions are to be made, there is a habit of coming to Frankfurt the evening before the meeting to discuss in private the individual opinions on the policy stance. These meetings may reflect the desire of the Governing Council members to keep disagreement from showing up in the formal meeting. One reason for this is that these formal meetings are sometimes attended by the Commission or by the chair of the Council of Ministers.

Some papers estimate Taylor rules for the ECB to offer clues whether the policy rule is more activist than can be justified by the Treaty. Aksoy et al. (2002) evaluate Taylor rules for the ECB and conclude that the governing council does attach weight to output stabilization. In addition, they find support that the ECB takes account of the average shock, but then is rather activist. Moreover, Kool (2005) shows that the ECB policy stance is relatively activist when compared to the historical records of its member states. By contrast, Heinemann and Hufner (2004) offer some preliminary evidence that the interest rate policy of the ECB is

best explained by the economic conditions in the median member state and not by the average output gap. This indicates that ECB policy to some extend reflects bargaining among the national central banks. In addition, such a median country policy rule is more activist than a policy which focuses on the average output gap.

To discuss the policy preferences of the members of the Governing Council of the ECB, a problem is that there are no minutes of the meetings available. To accommodate this problem, we resort to the study of the professional history of the members. In Table 1 we show the scores of current national central bank presidents for characteristics that are often associated with the degree of conservativeness (see e.g. Adolf 2003 and Eijffinger et al. 2000). These data are provided by national central banks on request.[3] The figures <90 give the average score for the variable in the 1960-1990 period. Age is the age at which the central banker was appointed; then there are the percentages of working life spent in the financial/private sector, public sector (including politics and university) and the central bank; the last column shows whether the central banker has a Ph.D. in economics.

Table 1 here.

First, as there is no clear trend, we can not conclude that EMU dramatically altered the delegation decision of national governments (yet). However, present regional central bankers have a longer history in bureaucracy and especially the national central bank itself, although this may simply reflect the increased technical complexity of central banking.

For other federal central banks, recent empirical research on the voting behavior of regional central bankers in the Federal Open Market Committee (FOMC) shows that their policy preferences differ from those of the Fed board. A first consistent finding is that regional FOMC members as a group are more expansionist than board members (Havrilesky and Gildea 1995, and Chappell et al. 2005). In addition, dissenting voting behavior is explained for individual governors and board members when their home regional economic conditions differ from the national situation (Chappell et al. 2005, Meade and Sheets 2002). However, as local

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[3]The Italian and Greek central bank did not cooperate, so we have excluded them. I thank Niek Timmermans for conducting the survey. The details for each past national governor are available upon request.

4

conditions add up to the overall economic situation, this last finding does not explain the group bias of federal central bankers towards a more activist monetary policy.

3　The model

We consider two countries $i = 1, 2$ of equal size in which citizens are indexed by j. With respect to monetary policy making, each citizen has a loss function:

$$L_i^j = -\lambda_i^j (y_i)^2 - (1 - \lambda_i^j)(\pi_i)^2, \tag{1}$$

where y is the output gap and π is inflation. In addition, λ is a parameter that measures the preference for output stabilization over inflation stabilization. This parameter has a uniform distribution with a median citizen λ_i^m. Because the distribution is assumed to be uniform, policies that maximize the utility of the median voter also maximize social welfare.

The economy is described by an expectations augmented Phillips curve:

$$y = \pi - \pi^e + \varepsilon_i, \tag{2}$$

in which π^e is expected inflation and ε_i a supply shock. Shocks are normally distributed with mean zero and a variance σ_i^2 that is equal for both countries. The crucial thing is that the countries are identical but for the realized magnitude of the shock. Clearly to some extend these shocks may be correlated. We abstract from an inflation bias so that expected inflation equals zero in each period. Further, for simplicity we assume that the monetary authority sets the inflation rate directly.

Following the literature, the central bank learns the shock before the public, however, the public knows the variance of shocks. For this reason, by creating surprise inflation/deflation the central bank is able to correct the shock. Citizens can predict the future policy stance of the central bank conditional on the shock, for they realize that the central banker trades-off output stabilization and inflation on the basis of observable and stable preferences. This trade-off is described by

an optimal 'policy rule' κ^* so that:

$$\pi = -\kappa^* \varepsilon_i.$$

The optimal policy rule follows from loss minimalization by the policy maker. When we substitute $y_i = (1 - \kappa)\varepsilon_i$ and $\pi_i = -\kappa\varepsilon_i$ into (1), from the first-order condition for a person with median preferences it follows that $\kappa^* = \lambda_i^m$. Moreover, as there is no inflation bias, the median voter would delegate to himself, hence, this rule will be chosen. In addition, this rule also represent the first-best outcome for the median voter, and so (from the assumption on the distribution of the preferences) $\kappa^* = \lambda_i^m$ also maximizes social welfare. Expected social welfare depends on output and inflation variance:

$$y_i^2 = var(y_i) = [(1 - \lambda^m)\varepsilon_i]^2 = \left[\lambda^2 - 2\lambda + 1\right]\sigma_i^2, \tag{3a}$$
$$\pi^2 = \lambda^2 \sigma_i^2. \tag{3b}$$

As we can see, output variance is declining and inflation variance increasing in the preferences for output stabilization.

4 Centralized policy making with federal preferences

We start with the case where centralization involves a preference shift: members of the central monetary policy committee care for the aggregate output gap in the currency union. A motivation is that in the decentralized case central bankers are unable to influence the policy outcome in other countries. If central bankers are free from regional political pressure, it may be difficult to argue why they would care more for the welfare of their own citizens than for the citizens in other countries. Hence, the policy mitigates the average union-wide shock $\varepsilon_m = 1/2(\varepsilon_1 + \varepsilon_2)$, so that inflation is $\pi = -\kappa\varepsilon_m$ and $y_m = (1 - \kappa)\varepsilon_m$.

We assume that the policy maximizes the weighted sum of welfare of the members of the policy making committee. For this reason, κ minimizes:

$$L^j = -(\lambda_1^d + \lambda_2^d)y_m^2 + (2 - \lambda_1^d - \lambda_2^d)\pi^2,$$

where λ_i^d are the preferences of the policy maker of country i in the committee.

From the first-order condition it is easy to derive that:

$$k^* = \frac{\lambda_1^d + \lambda_2^d}{2}.$$

Certainly, in a symmetric equilibrium the rule that trades-off inflation versus the output gap equals the preferences of each delegate for output stabilization.

In the first stage, the median person strategically delegates policy making. We assume that all types of citizens are available as policy maker. In addition, the optimal policy maker for the median person is interior to the set of the available policy makers. In general, we want to investigate whether the median citizen has an incentive to delegate policy to a person who has different policy preferences than that of himself. We are not interested in the question whether such a candidate is indeed available in a setting where entry of policy makers is endogenous, as in Besley and Coate (1997). The median voter maximizes:

$$U_i^j = -\lambda_i^m (y_i)^2 - (1 - \lambda_i^m)(\pi)^2, \tag{4}$$

by choosing the preferences λ_i^d, where $\pi = -\frac{(\lambda_1^d + \lambda_2^d)}{2}\varepsilon_m$ and $y_i = -\frac{\lambda_1^d + \lambda_2^d}{2}\varepsilon_m + \varepsilon_i$.

Proposition 1 *When members of the centralized monetary policy committee have federal preferences:*

1. *The median citizen delegates policy making to a person who has equal preferences as himself,*

2. *output variance is higher and inflation variance lower than with decentralized policy making.*

The proof is in the appendix. The intuition for the first part of Proposition 1 is that a delegate with federal preferences cares equally for the output shock in the foreign country as in the home country. Because $\lambda_i^d = \lambda_i^m$, it follows that:

$$y_i^2 = var(y_i) = (-\lambda^m \varepsilon_m + \varepsilon_i)^2 = \left[\frac{(1+\rho)}{2}(\lambda^2 - 2\lambda) + 1\right]\sigma_i^2,$$

$$\pi^2 = \frac{(1+\rho)}{2}\lambda^2 \sigma_i^2,$$

where ρ is the correlation coefficient between the shocks in country one and two. For the equalities we use that $var(y_m) = var(\frac{1}{2}\varepsilon_1 + \frac{1}{2}\varepsilon_2) = \frac{1}{4}\sigma_1 + \frac{1}{4}\sigma_2 + \frac{1}{2}\rho\sigma_{12} = \frac{1+\rho}{2}\sigma_1$ and $\exp \varepsilon_1\varepsilon_m = cov(\varepsilon_1, \varepsilon_m) = \frac{1}{2}\sigma_1^2 + \frac{1}{2}\rho\sigma_{12} = \frac{1+\rho}{2}\sigma_1$. Hence, when $\rho < 1$ (so that shocks are asymmetric) output variation is higher when compared to (3a) and inflation variance is lower when compared to (3b). The reason is that the delegates only look at the average shock, but that the variance of this average shock is lower than that of the country specific shock if $\sigma_m^2 < \sigma_i^2$.

Although centralization reduces welfare for each member state, the median citizen has no incentive to delegate to a policy maker who is more activist. The reason is that such a policy maker would also inflate more when the other country is faced with a positive output shock. At the margin, the benefits of lower output fluctuations in the case of a domestic supply shock are offset by the losses of larger output and inflation fluctuations in case of a shock in the other country.

5   Centralized policy making with nationalistic policy preferences

In this section we consider the case where a delegate in the centralized policy committee cares only for the output gap and inflation in his own country. We analyze two situations. First, we focus on a bargaining outcome, where in each period the delegates have to agree on the inflation rate. In a second case, we analyze what happens when delegates with nationalistic preferences ex ante have to agree on a policy rule that relates inflation to the average output shock. In the next section we analyze under which circumstances the member states prefer bargaining over such a policy rule.

5.1   Bargaining

Since we focus on symmetric equilibria, we assume that the delegates have equal bargaining power. Hence, the monetary policy outcome in the second stage reflects the preferences of the delegates such that $\pi = -\frac{1}{2}(\lambda_1^d\varepsilon_1 + \lambda_2^d\varepsilon_2)$, and $y_1 = -\frac{1}{2}(\lambda_1^d\varepsilon_1 + \lambda_2^d\varepsilon_2) + \varepsilon_1$. Knowing this, the median citizen in country 1 maximizes (4) with respect to λ_1^d.

Proposition 2 *When delegates have nationalistic preferences and shocks are to*

8

some extend asymmetric ($\rho < 1$):

1. *Median citizens delegate to persons who care more for output stabilization than themselves,*

2. *inflation variance is higher and output variance lower when compared to decentralized policy making.*

The proof is in the appendix. From the first-order conditions for the median citizens it follows that in the Nash-equilibrium:

$$\lambda^d = \frac{2\lambda^m}{1 + \rho}. \tag{5}$$

Clearly, when shocks are perfectly symmetric, median citizens see no reason to delegate to a policy maker with preferences that are different than that of their own. However, when shocks are asymmetric (for example when $\rho = 0$) then the policy maker cares more for output stabilization than the median citizen. The intuition is that delegation serves to bias the monetary policy in the country's favor in every period. In contrast to the previous section, delegation to a more activist policy maker does not increase inflation in the case of an output shock in the other country. However, there is a limit to the benefits of delegating, for a too activist policy maker would create too high inflation variance.

The second part of Proposition 2 is the main result of this paper. When shocks are asymmetric, the median citizen delegates to a rather extremely activist policy maker, given the policy maker in the other country. Since the median citizen in the other country also delegates to an activist, in the Nash equilibrium they both select policy makers that are too activist. In equilibrium these policy makers create too much surprise inflation. Hence, welfare is lower than under decentralized policy making.

5.2 The monetary policy rule

To avoid the efficiencies that may arise from bargaining, suppose that the delegates with nationalistic preferences agree (or are forced to agree) on a policy rule $\pi = \kappa\varepsilon_m$.

Proposition 3 *When delegates with nationalistic preferences agree on a policy rule that relates the federal output shock to the inflation rate:*

1. *Median citizens delegate policy making to themselves,*

2. *output variance is higher and inflation lower than with decentralized policy making,*

3. *output and inflation variance are equal to the case where the committee members have federal preferences.*

The proof is in the appendix. The intuition for the first part Proposition 3 lies in the policy rule that the delegates agree upon. The delegates realize that a more activist policy rule will increase output fluctuations and inflation in case of a positive shock in the other country. Hence, they settle for a rule that reflects the average of their preferences. Hence, in the first stage the median citizen realizes that sending a more activist policy maker also increases inflation in case of an output shock in the other country. The second part then follows, as in the symmetric equilibrium $\pi = \lambda^m \varepsilon_m$: again, because the variance of the average output shock is lower than that of the country specific shocks, inflation is lower and output variance higher than under decentralized policy making.

The crux is in part three of the proposition that states that even when delegates decide on the rule (perfect goal independence), it does not matter whether committee members have federal or nationalistic preferences. The reason is that nationalistic preferences do not affect the policy rule that is chosen in equilibrium when compared to federal preferences.[4] In the symmetric country case, this in turn takes away the incentives for strategic delegation.

6   Endogenous central bank constitutions

An interesting question is under which conditions the median citizens in the member states opt for a policy rule or whether it is more efficient to rely on bargaining. Two issues are of importance here. First, when there is a rule in place, there will be no strategic delegation, so the inefficiencies that come along with this do not

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[4]A similar result can be found in Bagwell and Staiger (1999) who argue that reciprocity in trade negotiations induces first-best policies.

Figure 1: Welfare analysis of rules versus bargaining.
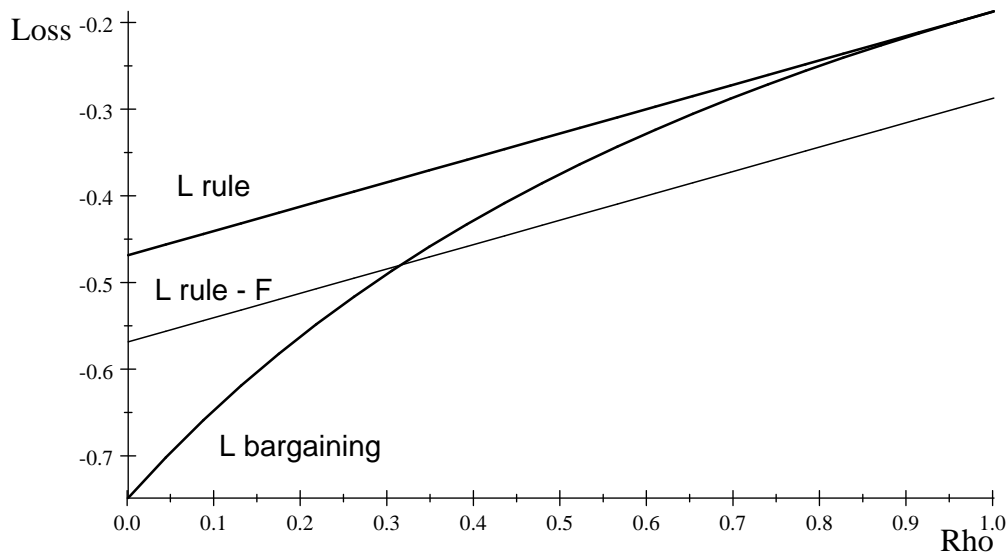
arise. However, when shocks are asymmetric, the rule results in too low inflation and too high output variation from the point of view of the median citizens.

Proposition 4 *With respect to the benefits of a rule versus bargaining*

1. *The relative benefits of having a rule decline in the correlation of the shocks ρ,*

2. *when there are (fixed) cost of having a rule, the member countries choose bargaining when the correlation of the shocks is sufficiently high. The sufficient level of ρ for the member states to choose bargaining declines in the preference for output stabilization.*

See the proof in the appendix. The result is illustrated with the aid of figure 1.

We see that the welfare loss for a monetary policy rule is higher for lower values of ρ. The reason is that when shocks are asymmetric, output variance will be low

in the monetary union. Hence, in that case the welfare loss that follows from the excessive restrictiveness of monetary policy rule is high. By contrast, when shocks are perfectly symmetric, welfare losses within the monetary union equal the first-best outcome.

The bargaining outcome is always inferior to the rule: in equilibrium, for any value of ρ, delegation produces (far) too activist policy makers. Hence, inflation variance is too high. These inefficiencies decline in ρ because higher symmetry of shocks reduces the incentives for delegation. In the limiting case when shocks are perfectly symmetric, median citizens delegate to a policy makers with equal preferences to that of themselves. Concluding, without fixed costs of the policy rule, the member states prefer a rule over bargaining, except for the case when shocks are perfectly correlated – for which they are indifferent.

By introducing fixed costs of a rule, we are able to analyze which factors influence the choice between rules and bargaining. As an example, we may argue that the median citizen is a national policy maker who faces political costs of ex ante making monetary policy mechanical in the committee. The trade-off now is that policy is too restrictive with a rule and too activist with delegation. Starting from the case when $\rho = 0$ so that bargaining is less efficient that the rule, as the inefficiencies from delegation decline more rapidly in ρ, there will a point where the welfare loss from the too activist policy with delegation is lower that that of the too restrictive rule. Hence, in that case the policy makers opt for bargaining over rules if shocks are highly symmetry. The intuition is that with asymmetric shocks the inefficiencies from delegation are relatively large, whereas they are relatively small for symmetric shocks. Clearly, the more activist the median person is, the quicker he will select bargaining over rules for lower values of ρ.

7 Conclusion

In this paper we have argued that through delegation the member states of a currency union view monetary policy as a local public good. For this reason, the national policy makers have an incentive to delegate policy making to persons who care more for output stabilization than they would do with decentralized policy making. Hence, because the central bank is stacked with policy activists, at the federal level monetary policy is likely to be too activist. Such strategic delegation

over-compensates for the conservative bias in federal monetary policy that results from asymmetry of shocks. Hence, when political processes are taken into account, the problem of low economic integration in a currency union is not that policy will be too restrictive, but that it will be too loose.

Before drawing strong policy conclusions, one important objective for future research is to consider heterogeneity. Several interesting asymmetries spring too mind. One may consider diversity in policy preferences, country size, bargaining power, and the transmission of shock. Moreover, most currency unions consist of more than two countries, the number may even be endogenous on the political economy effects discussed in this paper. All these modifications will have non-trivial effects on the process of delegation and economic outcomes.

Some broad policy conclusions are in line with the model as it stands so far. First, when economic integration is low, the member states of a currency union may want to have a credible monetary policy rule. Although some would argue that because of low integration federal policy should have the opportunity to consider specific circumstances in a member state, such provisions would result in on average too activist monetary policy. The reason is that weak rules result in strategic delegation. In addition, the Economic view of monetary integration – economic integration before monetary integration – may be extended with a political economy argument. If a policy rule is costly and difficult to enforce, economic integration is needed to mitigate the adverse political effects of strategic delegation. Hence, and probably well understood in practice, a major risk of a rush into monetary union is that the selection of more nationalistic activist policy makers would stir conflict between the member states.

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14

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Appendix

Decentralized equilibrium

We start with providing the equilibria for the benchmark decentralized case. In this appendix we economize as much as possible on notation for individuals and countries. The loss function for the median person is given by

$$L_i^d = -\lambda y_i^2 - (1 - \lambda)\pi^2$$

Loss minimalization gives the policy rule $\kappa = \lambda$ so that $\pi = -\kappa\varepsilon$ and $y = (1 - \kappa)\varepsilon$. Substitution gives

$$L_i^d = (-\lambda + \lambda^2)\sigma_i^2 \tag{A1}$$

Of which

$$var(y) = (1 - 2\lambda + \lambda^2)\sigma_i^2 \tag{A2a}$$
$$var(\pi) = \lambda^2\sigma_i^2 \tag{A2b}$$

Proposition 1: Federal policy preferences

Let the subscript a denote the average output shock, in the second stage the delegates mniimize

$$\min_{\kappa} - (\lambda_1^d + \lambda_2^d)y_a^2 - (2 - \lambda_1^d - \lambda_2^d)\pi^2$$

where $\pi = -\kappa\varepsilon_a$ and $y_a = (1 - \kappa)\varepsilon_a$. Substitution and the first-order condition give that the optimal rule is

$$\kappa = \frac{\lambda_1^d + \lambda_2^d}{2}$$

This we use in the first stage, where the median citizens in country 1 chooses the optimal delegate. The median then solves:

$$\min_{\lambda^d} L^m = -\lambda^m y_1^2 - (1 - \lambda^m)\pi^2$$

where λ^d comes in through $\pi = -\frac{\lambda_1^d + \lambda_2^d}{2}\varepsilon_a$ and $y_1 = -\frac{\lambda_1^d + \lambda_2^d}{2}\varepsilon_a + \varepsilon_1$. By imposing symmetry in equilibrium this gives

$$\frac{\lambda_1^d + \lambda_2^d}{2} = \lambda^d = \lambda^m \frac{cov(\varepsilon_i, \varepsilon_a)}{\sigma_a^2}$$

16

Because $\varepsilon_a = \frac{1}{2}\varepsilon_1 + \frac{1}{2}\varepsilon_2$, for the symmetric country case $cov(\varepsilon_i, \varepsilon_a) = \sigma_a^2 = \frac{1}{2}\sigma_i^2 + \frac{1}{2}\rho\sigma_{ij}$ it follows that $\lambda^d = \lambda^m$. Substitution gives that

$$var(y) = \left[1 - (\lambda - \frac{1}{2}\lambda^2)(1 + \rho)\right]\sigma_i^2 \tag{A3a}$$

$$var(\pi) = \frac{1}{2}(1 + \rho)\lambda^2\sigma_i^2 \tag{A3b}$$

Comparing to (A2a) and (A2b) for $\rho < 1$ shows that output variance is higher and inflation variance is lower. Welfare is

$$L^r = \left[-\lambda + \frac{1}{2}(1 + \rho)\lambda^2\right]\sigma_i^2 \tag{A4}$$

This is lower than the decentralized case.

Proposition 2: bargaining with delegation

With bargaining the committee will set $\pi = -\frac{1}{2}(\lambda_1^d\varepsilon_1 + \lambda_2^d\varepsilon_2)$, and $y_1 = -\frac{1}{2}(\lambda_1^d\varepsilon_1 + \lambda_2^d\varepsilon_2) + \varepsilon_1$. Substitution in

$$\min_{\lambda^d} L^m = -\lambda^m y_1^2 - (1 - \lambda^m)\pi^2,$$

gives the strategies of the median citizens

$$\lambda_i^d = 2\lambda_i^m - \rho\lambda_j^d,$$

so that in equilibrium:

$$\lambda^d = \frac{2\lambda^m}{1 + \rho}.$$

Hence for $\rho < 1$ it follows that $\lambda^d > \lambda^m$. Substitution of this result gives:

$$var(y) = \left[1 - 2\lambda + \frac{2}{1 + \rho}\lambda^2\right]\sigma_i^2 \tag{A5a}$$

$$var(\pi) = \frac{2}{1 + \rho}\lambda^2\sigma_i^2 \tag{A5b}$$

When $\rho < 1$ it follows that inflation variance is higher and output variance lower than in the decentralized case. Moreover, welfare is lower:

$$L^b = \left[-\lambda + (2 - \frac{2}{1 + \rho}\lambda^2\right]\sigma_i^2 \tag{A6}$$

Proposition 3: the centralized policy rule

Which a policy rule $\pi = -\kappa \varepsilon_a$ and $y_i = -\kappa \varepsilon_a + \varepsilon_i$. To find the policy rule, the delegates minimize joint welfare

$$\min_{\kappa} - \lambda_1^d y_1^2 - \lambda_2^d y_2^2 - (2 - \lambda_1^d - \lambda_2^d)\pi^2$$

This gives

$$\kappa = \frac{\lambda_1^d + \lambda_2^d}{2},$$

which is identical to the case with federal policy preferences. Because the rule is equal, the economic outcomes are also equal, hence, the remainder of the proposition follows.

Proposition 4: Welfare comparison

Let is denote the fixed costs of a rule by F, the difference between rules and bargaining $\Delta L = L^r - L^b$ is:

$$\Delta L = \left[-\lambda + \frac{1}{2}(1 + \rho)\lambda^2 \right] - F - \left[-\lambda + (2 - \frac{2}{1+\rho}\lambda^2 \right] \tag{A7}$$

where we normalize to $\sigma_i^2 = 1$. If $F = 0$, then for $\rho < 1$ and all λ it follows that $\partial \Delta U / \partial \rho < 0$. Solving for F with $\Delta L = 0$ gives the cut-off point ρ^* that follows from:

$$F = \left[\frac{1}{2}(1 + \rho^*) - 2(1 + \frac{1}{1+\rho^*}) \right] \lambda^2$$

Totally differentiating this gives

$$\frac{d\rho^*}{d\lambda} = \frac{2 \left[\frac{1}{2}(1 + \rho^*) - 2(1 + \frac{1}{1+\rho^*}) \right] \lambda^2}{\frac{1}{2} - 2(1 + \rho)^{-2}} \leq 0$$

Hence, higher preference for output stabilization reduces the incentives to implement rules. End of the Appendix.

8   Supplements

Figure 2: Central Bankers' profiles.

Country	Period	Age	Financial	Publicsector	CentralBank	PHD
Govenors						
Austria	t<'90	59	31	65	4	100
Schimetschek		65	89	0	11	no
Belgium	t<'90	61	14	71	16	75
Guarden		54	0	56	44	yes
Finland	t<'90	52	0	100	0	0
Liikanen		54	0	83	17	yes
France	t<'90	56	0	89	11	40
Noyer		53	0	85	15	yes
Germy	t<'90	59	41	26	33	67
Weber		47	0	100	0	yes
Ireland	t<'90	57	0	89	11	67
Hurley		57	0	100	0	0
Netherlands	t<90	48	17	79	4	100
Wellink		54	0	42	58	yes
Portugal	t<'90	48	13	53	33	75
Cosancio		57	14	67	19	yes
Spain	t<'90	48	4	47	48	50
Lacorte		48	67	22	11	No
The Board						
Trichet (Fr)		61	0	62	38	No
Issing (Ger)		61	0	71	29	Yes
Papedemos (Gr)		55	0	41	59	Yes
Smaghi (It)		49	0	54	46	Yes
Gonzales (Sp)		46	0	62	38	Yes
Tumpel (Aus)		51	0	0	100	No