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FEDERAL MONETARY POLICY

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FEDERAL MONETARY POLICY

Abstract

What is the optimal institutional structure for an independent central bank? The paper shows when it will be optimal for a country to have a central bank to be organized according to federal, purely national or a combination of both aspects. The analysis is then extended to a supranational monetary union and it is shown which organizational structure of a common central bank is optimal for participating countries and when they are willing to join. The implications for an enlargement of a monetary union are derived as well.

Keywords: Monetary union, federalism, monetary policy

JEL Classification: E58, F33, F40

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1. Introduction

In several aspects, the newly created European Central Bank (ECB) which became the monetary authority for the European Monetary Union (EMU) on January 1, 1999, is modelled on the German Bundesbank. It follows the Bundesbank's example in being made independent from political pressures as far as its statutes are concerned, and it, like the Bundesbank, is a federal central bank. There are, one would assume, good reasons for both features. Yet, while the question of independence is widely discussed in the literature, there is only little discussion of the optimal institutional structure of a central bank.

There is a widespread consensus in the literature that the central bank should be independent and conservative to solve the time-consistency problem in monetary policy (Barro and Gordon, 1983, Rogoff, 1985). In this discussion, the central bank is taken as a homogeneous body where "central bank" and "the central banker" can be used interchangeably. There is no room for comparing different institutional setups for the decision making in the central bank. However, wide differences in the setup of national central banks can be observed (see Hahn, 1968; Toniolo, 1988). In some countries, such as Germany or the U.S., their federal structure is reflected in the decision making procedure within the central bank. Germany has a central bank council constituted by a directorate and regional presidents appointed by state governments. Likewise, in the U.S. the federal open market committee contains centrally appointed governors and delegates from district federal reserve banks. The relative influence of central and state governors, however, is different between the two countries. In Germany, the directorate is outnumbered by the state representatives while the opposite is true for the U.S. One reason for the different setups in different countries is undoubtedly a reflection of history and political considerations, having perhaps very little to do with economic considerations. Nevertheless, different decision making procedures have different economic implications. The exploration of these economic implications is the purpose of the present paper.

Some other papers have discussed the issue before in a political business cycle context, orgininated by Nordhaus (1975) and Hibbs (1977). Again, delegating monetary policy to an independent central bank can improve on this result as political business cycles are dampened (Alesina and Gatti, 1995). Using a similar idea, von Hagen and Süppel (1994) discuss the decision making procedure in a European Central Bank and ask what constitutional structure of that common central bank is likely to produce more output variability and inflation. They conclude that state representatives reduce the rate of inflation in the monetary union but increase output variability. If elections are held every period, the probability that the median voter in the central bank changes is lower if central bank policy is set by state representatives. Therefore, inflation is lowered. In addition, Lohmann (1998) has shown that federalism may help to overcome a political business cycle. Focusing on the German case, she argues that because elections at the national and state level are staggered, the council composed of directors appointed by the central government and presidents of regional central banks, de facto appointed by the state governments, will have no common objective to produce political business cycles.[1] The federal structure also ensures that the nominally granted independence cannot easily be revoked by the central government through changing the central bank law (Moser, 1999).

In this paper, I focus on economic implications of different central bank institutions, leaving aside political economic aspects. For this, I take independence as granted because the discussion only makes sense if the central bank is able to set monetary policy without being overridden by any government. In this sense, independence is a prerequisite to the discussion

[1] This result could be overturned if council members are engaged in a repeated game in which they agree to support each other before elections (see von Hagen, 1995).

of federal central banks.[2] It does not preclude, however, that once appointed central bankers implement the policy that is desired by the appointing body (central or regional government).

Given this independence, I proceed to discuss the institutional setup for a central bank in a national monetary union, composed of regions, and a supranational central bank, composed of nations with formerly independent monetary policies. Taking into account that countries often exhibit large differences in their regional economic structures, which would potentially rationalize independent regional monetary policies, I ask under what circumstances a region would be better off under a monetary policy set by centrally appointed central bankers, or by a central bank council of regional representatives, or by a combination of both. While this discussion takes the existence of a monetary union as given, leaving regions no choice concerning their being part of this monetary union, section 5 of the paper asks when independent countries have an incentive to join a monetary union. Again, three possible institutional setups for the central bank are considered.

It turns out that the chosen institutional setup for the ECB can be rationalized as a political compromise between the constituting member states, necessary to ensure that a sufficient number of countries join the EMU. An extreme regime, such as one only directed by centrally appointed central bankers or national representatives alone, would find the support of fewer countries. If all members have a strong interest in a large EMU, the tendency towards a "mixed" solution is strengthened. However, an extension of the EMU to more countries, in particular those in Eastern Europe, would probably imply a change in the constitutional setup of the ECB. This conclusion is illustrated by the experience with the enlargement of the German monetary union to East Germany in 1990.

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[2] While I take independence as a prerequisite for federal central banks, Moser (1999) and Lohmann (1998) see federalism as a prerequisite for credible central bank indepedence.

2. The Model

I begin by considering a federal monetary union within one country. The country is composed of i=1...I regions, where I is an odd number. This allows to disregard cases in which ties are possible; in practice this problem is often solved by giving the president of the directorate two votes in case of a tie. Each of the i regions has a regional government, in addition there is a central government.

The model, in the tradition of Barro and Gordon (1983) and Rogoff (1985), is formulated in natural logarithms with constant parameters. I denote the policymaker as "monetary authority" whose preference function is also used to assess the desirability of the different decision making procedures. There is no "representative" consumer in any region whose preferences differ from those of the monetary authority like in the political business cycle literature.

The preferences of the regional monetary authority are defined over employment and inflation. It maximizes utility over an infinite horizon. Preferences are formulated as a loss function $\Omega_i = E_0\left[\sum_{t=1}^{\infty}\beta^{t-1}L_{i,t}\right]$ where $L_{i,t}$ is the per period loss function of the monetary authority and β is the (common) discount factor. Because all periods are ex-ante identical, I suppress the time index and specify the per period loss function as

$$L_i = b_i\left(n_i - k_i\right)^2 + \pi^2. \tag{1}$$

The monetary authority in region i aims to minimize deviations of actual employment n_i from its target level k_i. Because of distortions that are created through the influence of taxation or regulation of the labor market $k_i > 0$, because (the log of) natural employment is normalized to zero. The influence of these distortions may vary from region to region. b_i is the relative weight region i puts on the employment target. The b_i's are allowed to differ to reflect that different regions may have different governments that care more or less for employment.

This could be one reason why some regions vote predominantly left and others vote generally right, consistent with the theory that left-wing government are less inflation averse and more interested in employment than right-wing governments (Hibbs, 1977; Alesina, 1987). If this is indeed the case, monetary authorities of "left-leaning regions" should adovcate a systematically different monetary policy than "right-leaning regions". For example, it has been claimed for Germany that left-wing regional governments appoint less conservative central bankers than their right-wing counterparts (Vaubel, 1997).

The second aim of the monetary authority is to keep inflation low. For simplicity, inflation is assumed to be equal across all regions and there are no regional shocks to money demand nor differences in price developments. The monetary authority has perfect control over the rate of inflation.

Employment in region i follows

$$n_i = \alpha(\pi - \pi^e) + \varepsilon_i + \gamma_i \xi. \tag{2}$$

Natural employment can be increased by an inflationary surprise $\pi > \pi^e$, where $E_{t-1} = \pi^e$ with E denoting the mathematical expectations operator. Expected inflation in period t is conditioned on information received in t-1. If wage contracts are signed at the beginning of period t and are fixed for the rest of it, inflation above the expected level reduces real wages and thus increases employment. In addition, region i may be affected by two shocks: ε_i is a pure regional shock with $E(\varepsilon_i) = 0$ and $E(\varepsilon_i^2) = \sigma_{\varepsilon_i}^2$. There is in addition a national shock ξ with $E(\xi) = 0$ and $E(\xi^2) = \sigma_{\xi_i}^2$ that affects all regions in the country, however to a varying degree, $\gamma_i \geq 0$. Although all regions may be simultaneously affected by, for instance, a technological shock or a resource price shock, some regions may be more affected than others because they rely relatively more on a particular technology or input. For simplicity, it is assumed that regional and national shocks are uncorrelated $E(\varepsilon_i \xi) = 0$. Given

this structure, each regional monetary authority would like to set a monetary policy in response to regional distortions, the regional shock, and by how strong the region is affected by the common shock.

The preferred monetary policy would be different for a monetary authority only concerned with national developments. Central bankers appointed by a central government are, by assumption, only concerned with overall national developments and they are not partisan to any particular region. I call these central bankers, appointed by the central government, *directors* (indexed D). Since all of them are chosen by the same political body they, by assumption, have the same preferences. Therefore, it makes (for now) no differences whether there is only one person (a director) or several (a directorate). Let the directorate's preferences be given as

$$\Lambda = b_D\left(N - \bar{k}\right)^2 + \pi^2, \tag{3}$$

with

$$N = \alpha\left(\pi - \pi^e\right) + \bar{\varepsilon} + \xi, \tag{4}$$

and $\sum_{i=1}^{I}\mu_i\varepsilon_i \equiv \bar{\varepsilon}$, $\sum_{i=1}^{I}\mu_i k_i \equiv \bar{k}$, $\sum_{i=1}^{I}\mu_i n_i \equiv N$, $\sum_{i=1}^{I}\mu_i \equiv 1$. μ_i is the relative weight of region i.

It is possible that directors are more inflation averse than the regional representatives or less so, $b_D \gtreqless b_i$. For example, it is argued for the German case that (at least some) regional representatives care more about employment than the directorate. For the U.S. the opposite seems to be the case as regional central bankers reflect the preferences of the financial community, which is held to be more conservative than the federal government (see Lohmann, 1998). Because the central monetary authority is concerned with total employment in the country, irrespective of the development of unemployment in any single region, increases in unemployment in one region that are compensated by a fall in another region

produce no response by the central authority. The same is true for regional shocks and regional distortions, only the average national values, N, $\bar{\varepsilon}, \bar{k}$, matter for the central authority.

3. A National Federal Monetary Union

3.1. Monetary Policy by Regional Representatives

Assume that monetary policy is conducted by a council of regional representatives alone. Each representative is called a *president* (of a regional central bank). It is assumed that each president is only concerned with economic developments in his own region; there is no consideration of other regions or national developments. His or her most preferred rate of inflation follows from the minimization of equation (1), by using (2) and imposing rational expectations, as

$$\begin{aligned} \pi_i^* &= \alpha b_i k_i - \frac{\alpha b_i}{1+\alpha^2 b_i}\left(\varepsilon_i + \gamma_i \xi\right) \\ &\equiv \alpha b_i k_i - \Gamma_i\left(\varepsilon_i + \gamma_i \xi\right) \end{aligned} . \tag{5}$$

The preferred rate of inflation of president i is increasing in the distortion in region i multiplied by his employment weight (the inflation bias) and falling in the size of positive shocks to the region and country (the stabilization role of monetary policy). The response to these shocks, summarized as Γ_i, is a function of the president's concern for employment and thus potentially varying across the regions.

The central bank council has to determine a common rate of inflation for all I regions. When all presidents vote on this common monetary policy according to (5), the policy that will be realized is that which finds at least $(I+1)/2$ votes in its favor. Since monetary policy preferences are single peaked, the median voter (indexed m) will determine the inflation rate to be set.

Then (5) can be rewritten as

$$\begin{aligned}\pi_m &= \alpha b_m k_m - \frac{\alpha b_m}{1+\alpha^2 b_m}\left(\varepsilon_m + \gamma_m \xi\right) \\ &\equiv \alpha b_m k_m - \Gamma_m\left(\varepsilon_m + \gamma_m \xi\right)\end{aligned} . \tag{6}$$

The rate of inflation that is determined by the median voter's preferences may differ from the rate president i prefers. But given that region i is part of the national monetary union it has no possibility to realize a monetary policy that differs from that of region m. Then, monetary policy conducted by the central bank implies losses for region i of

$$\begin{aligned}L_i(P) = b_i&\left(\left(\varepsilon_i + \gamma_i \xi\right) - \alpha\Gamma_m\left(\varepsilon_m + \gamma_m \xi\right) - k_i\right)^2 \\ &+\left(\alpha b_m k_m - \Gamma_m\left(\varepsilon_m + \gamma_m \xi\right)\right)^2\end{aligned} \tag{7}$$

which follows from using (6) in (1) and where P refers to the "presidential regime". Clearly, region i suffers from the shocks that affect it but this loss is reduced by how much the common central bank reacts to shocks that affect the whole country. The more similar shocks are, the lower the loss for region i is because part of these shocks is stabilized. The more the median region is affected by these shocks, the more the median central banker will care for it and thus indirectly stabilize part of this shock in region i. The second term measures the loss that region i incurs from inflation.

3.2. Monetary Policy by a Directorate

An alternative institutional setup for monetary policy is a central government-appointed bank council that consists of people who only care for national developments. These *directors* would never respond to any regional economic shock or distortion but just to the average of regional influences. Following the same steps as in the preceding section, the rate of inflation set by directors is

$$\pi_D = \alpha b_D \bar{k} - \frac{\alpha b_D}{1+\alpha^2 b_D}\left(\bar{\varepsilon}+\xi\right) \equiv \alpha b_D \bar{k} - \Gamma_D\left(\bar{\varepsilon}+\xi\right) \quad (8)$$

It results in the following loss for region i

$$L_i(D) = b_i\left(\left(\varepsilon_i + \gamma_i \xi\right) - \alpha\Gamma_D\left(\bar{\varepsilon}+\xi\right) - k_i\right)^2 + \left(\alpha b_D \bar{k} - \Gamma_D\left(\bar{\varepsilon}+\xi\right)\right)^2 \quad (9)$$

3.3. Monetary Policy by a Council of Representatives and Directors

The last institutional possibility is a central bank council in which directors and presidents of regional central banks jointly determine monetary policy. Depending on which of the two "groups" has more members, monetary policy will either gravitate towards the solution directors prefer or to that which presidents prefer. Monetary policy would be the same if the median's economic structure is equal to that of the "average region". In countries which are characterized by a very balanced economic structure this might acutally be the case. However, once regions are specialized in the production of different goods, one might expect that economic shocks differ among regions so that $\bar{\varepsilon} \neq \varepsilon_m$.[3] Also, it is possible that economic distortions in countries are unequally distributed so that $\bar{k} \neq k_m$, that $\gamma_m \neq \bar{\gamma} = 1$, or that preferences differ $b_D \neq b_m$.

Joint decision making by directors and presidents would, such as in the case of presidents with diverging preferences, imply that the monetary policy preferred by the median voter among presidents and directors is implemented. This realized rate of inflation will, given the unequal distribution of preferences, differ from the one implemented in either

[3] There is a large empirical literature on the correlation of regional and national shocks among regions and countries, mostly connected to the question of adequacy of a monetary union. A recent survey is Clark and Shin (1998).

alternative regime. Enlarging a group of regional representatives by an unequal number of directors, which all have the same preferences, would shift the median solution towards the preferred choice of the directors. By how much this "new" median would differ from the "old" would depend on how many directors are added to the presidents. The larger the relative share of directors, the closer the solution would be to their choice, and the lower their relative share the more the council solution would be equal to the "old" median. In other words, the council's decision can be understood as a weighted combination of the two alternative regimes $\pi_C(P,D) = \lambda\pi_D + (1-\lambda)\pi_m$, where λ is the relative share of directors and where the respective rates of inflation are determined in (6) and (9). This representation of the council's choice allows a direct comparison with the two alternative regimes.[4]

The relative influence of the presidents vis-à-vis the directorate may be simply determined by the respective number of persons, which in turn could be rationalized as a political compromise (or bargain) among the appointing bodies (central and regional governments) about the relative weight of directors and presidents. As already indicated above, the relative size of the two groups differs across existing monetary unions. For instance, in Germany the directorate is always outnumbered by the state central banks' presidents, while in the U.S. the regional representatives are outnumbered by central bankers appointed by the federal government.[5]

The assumptions about the council's preferences yield the following rate of inflation

$$\begin{aligned}\pi_C = {} & \lambda\left[\alpha b_D \bar{k} - \Gamma_D\left(\bar{\varepsilon} + \xi\right)\right] \\ & + (1-\lambda)\left[\alpha b_m k_m - \Gamma_m\left(\varepsilon_m + \gamma_m \xi\right)\right]\end{aligned}. \tag{10}$$

[4] As Figures 1 and 2 below show, the rate of inflation π_C can be seen as a weighted average of π_D and π_m in graphical terms too.

[5] I come back to this question below.

This can be used to calculate the per period loss function in region i

$$L_i(C) = b_i\left\{(\varepsilon_i + \gamma_i\xi) - \alpha\left[\lambda\Gamma_D(\bar{\varepsilon} + \xi) + (1-\lambda)\Gamma_m(\varepsilon_m + \gamma_m\xi)\right] - k_i\right\}^2 + \left\{\alpha\left[\lambda b_D\bar{k} + (1-\lambda)b_m k_m\right] - \left[\lambda\Gamma_D(\bar{\varepsilon} + \xi) + (1-\lambda)\Gamma_m(\varepsilon_m + \gamma_m\xi)\right]\right\}^2. \tag{11}$$

4. Comparison of Regimes

Having established monetary policy choices under the three possible regimes and the loss each implies for region i, one can ask under what circumstances region i will prefer which regime. This will on the one hand allow to determine what solution should be chosen from a normative point of view (of region i, at least). On the other hand, the positive question is when and why a particular regime that may or may not be optimal from the point of region of view i is implemented. Finally, the section addresses changes in central bank constitutions.

4.1. Directorate versus Regional Representatives

When asked about whether a directorate or a council of regional presidents would be preferred, region i would select that regime that implies lower expected losses (since the decision has to be made ex-ante). For this, inflation and employment variability in either regime have to be taken into account. A comparison of expected losses (where discounting can be neglected since both regimes have the same time horizon) yields

$$\begin{aligned} E\left[L_i(P) - L_i(D)\right] = {} & \left(1 + \alpha^2 b_i\right)\left[\Gamma_m^2\left(\sigma_{\varepsilon_m}^2 + \gamma_m^2\sigma_\xi^2\right) - \Gamma_D^2\left(\sigma_{\bar{\varepsilon}}^2 + \sigma_\xi^2\right)\right] \\ & -2\alpha b_i\left[\Gamma_m\left(\sigma_{\varepsilon_i\varepsilon_m} + \gamma_i\gamma_m\sigma_\xi^2\right) - \Gamma_D\left(\sigma_{\varepsilon_i\bar{\varepsilon}} + \gamma_i\sigma_\xi^2\right)\right]. \\ & +\alpha^2\left[\left(b_m k_m\right)^2 - \left(b_D\bar{k}\right)^2\right] \end{aligned} \tag{12}$$

The first term on the RHS of this expression compares the strength of the reaction to economic shocks by a council of presidents and the directorate. The median voter in the

council of presidents votes for a strong response to the shock in his region and to the degree that his region is affected by the common shock if his employment consideration is high (captured in this reaction parameter). If this reaction is much stronger than the directorate's reaction to the average regional shock and the common shock, losses tend to be higher for region i under the median president's regime. The same is true if the systematic component (the inflation bias) of the median's president is higher than the directorate's (the third term on the RHS). Both terms would result in a higher rate of inflation under this regime. Because region i is not necessarily affected by the same regional shocks and to the same extent by the common shock, higher inflation has no benefit for this region. Therefore, losses are higher in the regime that produces higher inflation. The countervailing influence is the second term on the RHS which captures how much the variances of economic shocks in region i are similar to those to which either the regional presidents or the directorate respond. If the correlation with the median voter's shock are higher, region i is better off under this regime and vice versa.

The trade off can be made more obvious by simplifying equation (12). Setting employment preferences across regions equal $b_i \equiv b_D \equiv b \; \forall i$ (implying $\Gamma_D = \Gamma_i = \Gamma \; \forall i$), assuming that the impact of common shocks is equal in all regions $\gamma_i \equiv 1 \; \forall i$, and that regional shocks cancel each other out $\bar{\varepsilon} = 0$, equation (12) becomes $\left(1+\alpha^2 b\right)\Gamma^2\sigma^2_{\varepsilon_m}$ $+\left(\alpha^2 b\left(k_m^2 - \bar{k}^2\right)\right) - 2\alpha b\Gamma\sigma_{\varepsilon_i\varepsilon_m}$. One sees immediately that the stronger the response of the median president to the shock in this region, the higher the losses for region i under his regime (the first term). This is also true if the inflation bias of the median president is higher than the directorate's (second term). The only thing that makes region i better off under the presidential regime is a high correlation in the variance of regional shocks (third term).

4.2. Council versus Presidents

The alternative to a monetary policy set by either regional presidents (in particular the median thereof) or a directorate is a council composed of both. As argued above, the policy set by such a council can be understood as a weighted average of the two "pure" policies. The question is then whether such a council solution is preferable from the point of view of the monetary authority in region i.

Region i would prefer the council solution to the presidential solution whenever

$$\begin{aligned} E\left[L_i(P) - L_i(C)\right] = {} & \left(1+\alpha^2 b_i\right)\left[(2-\lambda)\Gamma_m^2\left(\sigma_{\varepsilon_m}^2 + \gamma_m^2\sigma_\xi^2\right) - \lambda\Gamma_D^2\left(\sigma_{\bar{\varepsilon}}^2 + \sigma_\xi^2\right)\right] \\ & +\alpha^2\left[(2-\lambda)(b_m k_m)^2 - \lambda\left(b_D\bar{k}\right)^2\right] \\ & -2\alpha b_i\left[\Gamma_m\sigma_{\varepsilon_i\varepsilon_m} - \Gamma_D\sigma_{\varepsilon_i\bar{\varepsilon}} + \gamma_i\sigma_\xi^2\left(\gamma_m\Gamma_m - \Gamma_D\right)\right] \end{aligned} \tag{13}$$

is positive. Like in equation (12), the council is preferred to the latter whenever the inflationary response to the median region's shock is strong in comparison to the inflationary response to be expected under a directorate. The countervailing influence, once again, is expressed in the third term on the RHS. The regional presidents' solution is preferred when the variances of shocks in region i are higher correlated to those in the "median region" than to national shocks. This reflects the fact that directors will mediate the strong inflationary response of the median president. The council is preferred because it provides some mediation but still ensures more regard for regional shocks than the "pure" directorate.

4.3. Council versus Directorate

Finally, it remains to compare a "mixed" council with one composed of directors only. The mixed council will be preferred by region i if the inflationary response by directors to national shocks and average distortions in the economy is strong (compared to the policy set by the median president alone), which is reflected in the first three terms on the RHS of the following equation (mediated by the relative weight of the presidents $(1-\lambda)$):

$$
\begin{aligned}
E\left[L_i(D)-L_i(C)\right] = {} & (1-\lambda)^2\left(1+\alpha^2 b_i\right)\left[\Gamma_D^2\left(\sigma_{\bar{\varepsilon}}^2+\sigma_\xi^2\right)-\Gamma_m^2\left(\sigma_{\varepsilon_m}^2+\gamma_m^2\sigma_\xi^2\right)\right] \\
& +(1-\lambda)^2\alpha^2\left[\left(b_D\bar{k}\right)^2-\left(b_m k_m\right)^2\right] \\
& +2\lambda\left[\left(1+\alpha^2 b_i\right)\Gamma_D^2\left(\sigma_{\bar{\varepsilon}}^2+\sigma_\xi^2\right)+\alpha^2\left(b_D\bar{k}\right)^2\right] \\
& -2(1-\lambda)\alpha b_i\left[\Gamma_D\sigma_{\varepsilon_i\bar{\varepsilon}}-\Gamma_m\sigma_{\varepsilon_i\varepsilon_m}+\gamma_i\sigma_\xi^2\left(\Gamma_D-\gamma_m\Gamma_m\right)\right]
\end{aligned}
\tag{14}
$$

Similar to the case discussed above, because the director's influence does not completely disappear in the council, in either regime the directors' preferences have some influence on monetary policy. If the variance in region i's shocks is more correlated to national shocks than to those in the median region, the solution of a pure directorate would be preferred.

4.4. When and Why is a Council Chosen?

The preceding sections have derived under what conditions a regional monetary authority would prefer to have a central bank policy conducted by directors, by regional presidents (implementing the median president's most preferred policy), or when it would prefer a council composed of regional presidents and directors.

Because there exists a unique π_i^* for every region that minimizes losses, the preferred choice of monetary regime for each region can be indirectly expressed in terms of the inflation rate the respective regime establishes. Each region would then prefer that regime that minimizes deviations of actual inflation from the loss minizing rate of inflation of region i, $\left|\pi_i^*-\pi_x\right|$ with $x \in \{m, D, C\}$. Consider the following example in Figure 1 where the preferred monetary policy of each region is depicted on a real line. The preferred solution of region i is π_i^* with i=1...5. The directorate's policy is denoted π_D which for simplicity is close to $\pi = 0$ because I assume that $b_D \to 0$. In this example, there are 5 regions in the monetary

union which implies $\pi_3 = \pi_m$. In this example regions 1 and 2 prefer $\pi_C \succ \pi_D \succ \pi_m$ whereas $\pi_m \succ \pi_C \succ \pi_D$ for countries 3-5, while the center's preferences are $\pi_D \succ \pi_C \succ \pi_m$. Clearly, there would never be a situation that would yield the council solution as a majority vote in this example, because the center would rather impose π_D whereas each single region would prefer its π_i^*. The council can probably can best be understood as a political compromise between a center, not strong enough to impose its preferred solution, and regional governments. The relative strength of the directors could either directly reflect the distibrution of relative political power among government and regions, but it might be additionally increased as some regions (in this case regions 1 and 2) prefer a stronger directorate, since this moves π_C closer to $\pi_{1,2}$. If some regions are more inflation averse than the directorate (Figure 2) the relative weight of directors would increase even more.

[Figures 1 and 2 around here]

The result that a council composed of presidents and directors will not be the preferred solution of a majority of regional and central government votes has important implications for the explanation of different institutional setups of central banks. That a council can best be rationalized as a compromise or bargain between a central government, that wishes a monetary policy conducted by directors, and regional governments, who prefer a monetary policy conducted by presidents, indicates that only federal states with strong regional representations will have such a central bank setup. Whenever central governments are strong vis-à-vis regional governments, such a political compromise is unlikely. In this case, the center would impose π_D.

Germany is a good example how such a political compromise came about when the German Bundesbank was created in 1957. After the second world war, the American occupation had created the so-called *Bank deutscher Länder* which was completely decentralized, being composed of state representatives only, without any directors appointed

by a central government. When the U.S. forces transferred power to the German governments, the question arose whether to preserve this structure or to change it to a more centralized setup (see Berger and de Haan, 1999). While the central government preferred a central solution, most of the German länder preferred a decentralized solution. An obvious compromise was the choice of a mixed system (which was still rejected by some länder, as Lohmann (1998) shows). A similar explanation could be advanced for the U.S. system, where strong federal states have been powerful enough to avoid a complete centralization of monetary policy, although losing relative influence over time.[6] Finally, a comparison between Figures 1 and 2 suggests that the different relative weights of center and regions in Germany and the U.S. might also be influenced by the distribution of regional preferences vis-à-vis the center. If some regions are even more conservative than the central body, this is likely to strengthen the relative weight of the center. This might be one explanation why in the U.S. the regional influence is less compared to Germany.

4.5. When Will There Be Changes in the Council Composition?

The number of regions that will support a council solution is, of course, a function of the relative weight the directors have vis-à-vis the presidents. The region closer to the directorate would prefer a high λ and vice versa. Now assume that the composition of the regional part of the council changes. This has been the case for Germany in the aftermath of unification of Western Germany with the former Eastern Germany. The country was enlarged (by 5 new states) and the same is about to happen if EMU should be extended, be it because some outs are admitted (like Greece in 2001) or others decide to join (like the UK, Denmark or Sweden). Depending on the economic structure, giving rise to different monetary

[6] See Eichengreen (1992) for an account concerning the power struggle among regional banks and the board, taking about 20 years to solve. See also White (1992) on the reasons for the peculiar setup of the Fed system.

preferences, the new territories could be either (randomly) distributed within the range of regions that have already been part of the monetary union, or they could be grouped outside this range. In particular, the extension of monetary union to a group of similar countries (like the East German states or Eastern European countries) would imply that they, in graphical terms, would probably be bunched at one end or even the same point on the line (see Figure 3).

[Figure 3 around here]

The implication of this extension of the monetary union is clear. First, it would imply that the median president would be different in comparison to the former one; it would probably be shifted towards a more expansionary position, given the assumption that the new states are assumed to prefer a more expansionary monetary policy. It would lead to a new $\tilde{\pi}_m$, implying also a new $\tilde{\pi}_C$. This would leave most of the older regions worse off because they would still prefer a more restrictive monetary policy. There are two ways they could counter this process. On the one hand, they could try to integrate the new territories into existing regional reserve banks which would prevent the median from shifting too much to the right. Or they might simply give the directorate of the new, larger, central bank more weight. This would keep the council's adopted policy π_C relatively close to its initial position.[7] The illustration in Figure 3 shows that the inclusion of the new member would shift π_m to $\tilde{\pi}_m$ and π_C to $\tilde{\pi}_C$. This would hurt a majority of the "old" members which have therefore an incentive to keep $\tilde{\pi}_C$ close to π_C by increasing the relative weight of directors in the council. Obviously, this would have to happen without the newcomers voting on this decision as well. In essence, the solution Germany has adopted upon integration of the East German regions is a combination of both (see Lohmann, 1998). Given that the economic structure of the

formerly communist regions was completely different from West Germany, it had to be feared that monetary policy would too much influenced by giving these regions full voting rights. Therefore, the West German länder and the central government reduced the number of regional central banks, from 11 (meant to be 16 if the East German länder had obtained full vote as well) to 9, and it has increased the relative weight of the directorate (from 9/11 to 8/9).[8]

5. The Case of a Supranational Monetary Union

5.1. Monetary Policy and Choice of Regimes

The same general idea that has been used above to derive which institutional setup of the central bank regions in a national monetary union will prefer can be used to consider the case of the European Monetary Union (EMU) or any other supranational monetary union. The difference here is, however, that countries must have an incentive to join the monetary union. This is in contrast to the case discussed above where regions are, *nolens volens*, part of a monetary union (at least if one abstracts from separatists movements which, in general, are not based on monetary considerations). Comparing the different institutional solutions for a supranational monetary union requires an additional step because participation of independent nations has to be ensured.

In the simple setup presented above, there is only one reason why a country might be willing to join an EMU. This is the case if the credibility problem in monetary policy is high, in other words, if the employment weight b_j is publicily known to be high which creates a strong inflation bias (see also Alesina and Grilli, 1993). Under what circumstances would a

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[7] Not completely because the average of shocks would change as well, thus prompting a different monetary policy from the directors. Only if $b_D = 0$ would the initial monetary policy of the directorate be preserved.

single country then be willing to join an EMU, and how far might this willingness be affected by the institutional structure of the European Central Bank (ECB)?[9]

Like in the regional case, the national monetary authority maximizes utility over an infinite horizon, where countries are indexed by j=1...J, with J being an odd number. Preferences are formulated as a loss function $\Omega_j = E_0\left[\sum_{t=1}^{\infty}\beta^{t-1}L_{j,t}\right]$ where $L_{j,t}$ is the per period loss function of the monetary authority. The loss function is specified as

$$L_j = b_j\left(n_j - k_j\right)^2 + \pi_j^2, \tag{15}$$

where b_j is the relative weight country j puts on the employment aim.

Employment in country j is given as

$$n_j = \alpha\left(\pi_j - \pi_j^e\right) + \varepsilon_j + \gamma_j\xi, \tag{16}$$

where ε_j is now a pure national shock with $E\left(\varepsilon_j\right) = 0$ and $E\left(\varepsilon_j^2\right) = \sigma_{\varepsilon_j}^2$. There is in addition a monetary union wide shock ξ with $E(\xi) = 0$ and $E\left(\xi^2\right) = \sigma_{\xi_i}^2$ that affects all countries in the EMU to a varying degree, $\gamma_j \geq 0$. Again, I assume that these are uncorrelated to national shocks $E\left(\varepsilon_j\xi\right) = 0$.

The national rate of inflation in this case is

$$\begin{aligned}\pi_j(N) &= \alpha b_j k_j - \frac{\alpha b_j}{1+\alpha^2 b_j}\left(\varepsilon_j + \gamma_j\xi\right) \\ &\equiv \alpha b_j k_j - \Gamma_j\left(\varepsilon_j + \gamma_j\xi\right)\end{aligned}, \tag{17}$$

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[8] These are the maximum number of directors and presidents that are stipulated in the Bundesbank law. De facto the number of directors has most of the time been below 9, and for sometimes extended periods regional presidential posts have been vacant.

where N denotes the case of nationally determined monetary policy. Using this expression in (15) describes losses under an independent monetary policy

$$\begin{aligned} L_j(N) = b_j\Big(&(\varepsilon_j + \gamma_j\xi) - \alpha\Gamma_j(\varepsilon_j + \gamma_j\xi) - k_j\Big)^2 \\ &+\Big(\alpha b_j k_j - \Gamma_j(\varepsilon_j + \gamma_j\xi)\Big)^2 \end{aligned} \quad . \tag{18}$$

If monetary policy would be determined by the national central bank presidents, which, per assumption, would only care for their own country (see von Hagen and Süppel, 1994, or Grüner, 1999), one could assume that in this case it would again be the median voter among the national presidents who determines the common monetary policy according to his or her preferences. This monetary policy would be $\pi_m = \alpha b_m k_m - \Gamma_m(\varepsilon_m + \gamma_m\xi)$ which determines the level of utility that country j could achieve under such a solution for the EMU. Losses would be

$$\begin{aligned} L_j(P) = b_j\Big(&(\varepsilon_j + \gamma_j\xi) - \alpha\Gamma_m(\varepsilon_m + \gamma_m\xi) - k_j\Big)^2 \\ &+\Big(\alpha b_m k_m - \Gamma_m(\varepsilon_m + \gamma_m\xi)\Big)^2 \end{aligned} \quad . \tag{19}$$

It is now straightforward to compare expected losses under monetary independence with expected losses under a presidential ECB council:

$$\begin{aligned} E\big[L_j(N) - L_j(P)\big] = &\left(1+\alpha^2 b_j\right)\left[\Gamma_j^2\left(\sigma_{\varepsilon_j}^2 + \gamma_j^2\sigma_\xi^2\right) - \Gamma_m^2\left(\sigma_{\varepsilon_m}^2 + \gamma_m^2\sigma_\xi^2\right)\right] \\ &-2\alpha b_j\left[\Gamma_j\left(\sigma_{\varepsilon_j}^2 + \gamma_j\sigma_\xi^2\right) - \Gamma_m\left(\sigma_{\varepsilon_j\varepsilon_m} + \gamma_j\gamma_m\sigma_\xi^2\right)\right] \\ &+\alpha^2\left[\left(b_j k_j\right)^2 - \left(b_m k_m\right)^2\right] \\ \equiv &\, G_j^{EMU}(P) \end{aligned} \quad . \tag{20}$$

---

[9] I only compare a fully independent monetary policy (a free float) with a full

I follow Alesina and Grilli (1993) here to express the gain country j has from joining the monetary union as $G_j^{EMU}(P)$ with (P) denoting the presidential regime under EMU. Like in the national case for region i, country j would benefit from a delegation of its monetary policy to the median country's president if the systematic component in its monetary policy is high (third term) and if itself has a tendency to stabilize shocks strongly (first term). Both lead to high inflation that could be reduced if the median president has less concern for employment. On the other hand, if country j is strongly affected by shocks, the stabilization role of monetary policy would suggest independent monetary policy (second term). However, this impact becomes less important if the variances of shocks between the median country and country j are of equal size. There is then no incentive to maintain an independent monetary policy. In this case, $G_j^{EMU}(P)$ is positive and country j could benefit from joining EMU.

Preferences of the monetary authority in the monetary union would be specified with regard to developments within the whole union. Although directors in the monetary union are subject to confirmation by participating member states, I assume here (following the statutes of the ECB) that they adopt a truly European perspective and disregard their native country's preferences. Let the preferences of the ECB directorate be given as

$$\Lambda_{ECB} = \left(N - \bar{k}\right)^2 + \pi^2, \tag{21}$$

with

$$N = \alpha\left(\pi - \pi^e\right) + \bar{\varepsilon} + \xi, \tag{22}$$

and $\sum_{j=1}^{J} \mu_j \varepsilon_j \equiv \bar{\varepsilon}$, $\sum_{j=1}^{J} \mu_j k_j \equiv \bar{k}$, $\sum_{j=1}^{J} \mu_j n_j \equiv N$, $\sum_{j=1}^{J} \mu_j \equiv 1$.

---

monetary union and disregard any intermediate case of exchange rate arrangement.

The directors-led ECB's monetary policy choice will be comparable to (8) and is given as $\pi_D^{EMU} = \alpha b_D \bar{k} - \Gamma_D(\bar{\varepsilon} + \xi)$. Using this in the utility function and comparing to national autonomy yields

$$
\begin{aligned}
E\left[L_j(N) - L_j(D)\right] = {} & \left(1+\alpha^2 b_j\right)\left[\Gamma_j^2\left(\sigma_{\varepsilon_j}^2 + \gamma_j^2\sigma_\xi^2\right) - \Gamma_D^2\left(\sigma_{\bar{\varepsilon}}^2 + \sigma_\xi^2\right)\right] \\
& -2\alpha b_j\left[\Gamma_j\left(\sigma_{\varepsilon_j}^2 + \gamma_j\sigma_\xi^2\right) - \Gamma_D\left(\sigma_{\varepsilon_i\bar{\varepsilon}} + \gamma_i\sigma_\xi^2\right)\right] \\
& +\alpha^2\left[\left(b_j k_j\right)^2 - \left(b_D\bar{k}\right)^2\right] \\
\equiv {} & G_j^{EMU}(D)
\end{aligned}
\tag{23}
$$

Similar to equation (20), monetary union becomes a preferred alternative if the inflationary bias is high in country j and average shocks and idiosyncratic shocks are sufficiently equal. In this case, almost the same stabilization is achieved with an ECB governed by directors and $G_j^{EMU}(D)$ is positive .

Clearly, the last possible solution is that the ECB is ruled by a council consisting of national presidents and some centrally appointed directors. As before, the rate of inflation chosen can be expressed as a weighted average of the rate preferred by presidents and that preferred by directors $\pi_C^{EMU} = \lambda\pi_m^{EMU} + (1-\lambda)\pi_D^{EMU}$. Using this in country j's loss function gives an incentive to join a council-governed monetary union if

$$
\begin{aligned}
E\left[L_j(N) - L_j(C)\right] = {} & \left(1+\alpha^2 b_j\right)\left\{\Gamma_j^2\left(\sigma_{\varepsilon_j}^2 + \gamma_j^2\sigma_\xi^2\right) - \left[\lambda^2\Gamma_D^2\left(\sigma_{\bar{\varepsilon}}^2 + \sigma_\xi^2\right) + (1-\lambda)^2\Gamma_m^2\left(\sigma_{\varepsilon_m}^2 + \gamma_m^2\sigma_\xi^2\right)\right]\right\} \\
& -2\alpha b_j\left\{\Gamma_j\left(\sigma_{\varepsilon_j}^2 + \gamma_j\sigma_\xi^2\right) - \left[\lambda\Gamma_D\left(\sigma_{\varepsilon_j\bar{\varepsilon}} + \gamma_j\sigma_\xi^2\right) + (1-\lambda)\Gamma_m\left(\sigma_{\varepsilon_j\varepsilon_m} + \gamma_j\gamma_m\sigma_\xi^2\right)\right]\right\} \\
& +\alpha^2\left\{\left(b_j k_j\right)^2 - \left[\lambda^2\left(b_D\bar{k}\right)^2 + (1-\lambda)^2\left(b_m k_m\right)^2\right]\right\} \\
\equiv {} & \lambda G_j^{EMU}(D) + (1-\lambda)G_j^{EMU}(P) \\
\equiv {} & G_j^{EMU}(C) > 0
\end{aligned}
\tag{24}
$$

A council may be preferred to national monetary policy if the inflationary bias is high and if the need for monetary stabilization for country j is somewhat between the rates set by the directorate and by national presidents respectively.

As argued at the beginning of this section, the choice of an institutional setup of a supranational monetary union is a more difficult task than in the national context. Whereas in the latter case only the regime must be chosen but participation of each region is ensured, this is no longer the case with the supranational monetary union. Every country has to be convinced to take part in the monetary union, and the number of participants may be changing depending on the type of institutional setup of the common central bank. As Alesina and Grilli (1993) have shown, it might be difficult to ensure participation. Since utility maximization by every country j would again imply a unique π_j^*, the gains from monetary union can be measured as a function of how much the implemented monetary policy differs from the country's preferred monetary policy. The further away the actual rate of inflation is from this preferred π_j^*, the smaller the gains from joining EMU would be, becoming eventually negative. These gains have been derived in equations (20), (23) and (24) and are depicted, for only 3 countries, in Figure 4.[10] Depending on the distribution of these $G_j^{EMU}(x), x \in \{m, D, C\}$ on the "inflation line", it can happen that particular countries would not join the monetary union under a particular regime when $G_j^{EMU}(x), x \in \{m, D, C\}$ is negative, as the example in Figure 4 demonstrates. One way to convince particular countries, if these are deemed important for the success of the monetary union, would be to adjust the relative weight λ so that participation is still beneficial for these countries. On the other hand, since the main advantage of participation is to reduce the inflation bias, it is rather unlikely that inflation averse countries that already have a low inflation bias can be convinced

[10] The shape and steepness of the $G_j^{EMU}(\cdot)$ curves would depend on the parameters chosen. See Alesina and Grilli (1993) for details.

by setting up a common central bank even if ruled by directors who are extremely inflation averse. For them to join, monetary union must have something different to offer to make participation attractive.

[Figure 4 around here]

These additional benefits can be seen in a common policy framework or closer trading ties (Wyplosz, 1997). If these additional benefits are important for country j, they could be added to the gains from monetary union that we have discussed so far. Assume that countries' preferences are now given as

$$G_j^{EMU}(x) + H(J), \tag{25}$$

for $x \in \{m, D, C\}$ where H(J) assumes that the benefits from participation are increasing in the number of countries that take part in the monetary union. The property of these benefits are assumed to be $H' > 0$, $H'' < 0$, with primes denoting derivatives with respect to J.

Adding these additional aspects would shift the $G_j^{EMU}(\cdot)$ curves as implied in Figure 5. Because of the fact that gains are larger when more countries are participating, there is, depending on the distribution of the $G_j^{EMU}(\cdot)$ functions, a tendency to bunch at some value, which would obviously determine π_C. Because of the additional gains from monetary union, depending on the fact that as many countries as possible participate, this additional influence would push countries together towards a common monetary policy, acceptable for all.

[Figure 5 around here]

5.2. Extension of the EMU

Like in the case of the extension of a national monetary union discussed above for Germany, the extension of EMU in particular to the Eastern European countries is likely to bring some changes to the institutional structure of the ECB. Although one might expect, for

political reasons, that each member state would insist on having a national representative on the council, this might prove to be no longer possible. For one reason, it would become ever more difficult to conduct business in a group of more than 20 central bankers (directorate and presidents). And it is also doubtful that members of the current monetary union would accept that the monetary policy would be influenced too much by newcomers. Of course, how much these new members would shift the median president's choice is not clear, but the fear that this might happen would probably already be enough that the inner circle of EMU countries would resist such a change. One way to do this would be to avoid that newcomers with too different economic structures enter the EMU at all (and this might be another reason for convergence requirements). A second solution would be that either countries are grouped together and have a common president presenting their case in the council, which would be similar to the solution Germany had chosen, or that council membership rotates among the national presidents, such as in the case of the U.S. federal reserve board. By restricting the number of national representatives to, say, 10 out of 20 or 25, the relative power of the directorate would again be strengthened.[11] Like in the German case, it is likely that current members change the institutional details of the ECB before the newcomers would have the right to vote on this decision.

6. Conclusion

The institutional setups of central banks differ widely across the world. Some are led by centrally appointed central bankers, whose declared task it is to care for the national economy as a whole. Others are led by a council that comprises in addition representatives from state governments (or national governments if the case of a supranational monetary

[11] This does not rule out that the strong states in the EU, like Germany or France, would not be compensated by de-facto permanant seats in the directorate. But by assumption

union such as EMU is considered). These regional representatives take care that the particular region's interests are well considered in the central bank's monetary policy. The different setups are certainly partly due to political reasons, because politically federal states like the U.S. or Germany that were built by formerly independent states are likely, for political reasons alone, to insist on representation in monetary policy decisions. But there are also good economic reasons, as this paper has argued, for a federal constitution of a central bank.

From an economic point of view, federalism makes most sense in a country that exhibits considerable economic divergences. If regions have strongly diverse economic structures, they are bound to be hit by asymmetric shocks, be they purely regional or national shocks that have very different impacts on the regions. In these cases, average values that would be taken into account by the directorate are probably not adequate for some regions. Homogeneous countries, in contrast, would not have need of a federal council. This would be one explanation why developing countries that depend very much on a particular good, or countries whose industrial structure is centralized in one city, usually have a monetary authority directed by centrally appointed bankers.

Heterogeneous countries, however, have good reason to select a central bank constitution that takes due account of regional developments in addition to pure national developments. Often, one would expect these countries to be relatively large countries, such as Germany or the U.S. And it would suggest that a monetary union adopts a federal solution for its common central bank. This could be amended by a directorate if the inflation bias is an additional reason for joining a monetary union for some countries. If the common central bank should be given a more conservative leaning, apart from the stabilization role of monetary policy, a directorate makes sense. Obviously, the relative weight of both should be

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of this model, those directors would lose their national preferences. Still, they might serve a useful political role within the member states.

a function of these two aspects. And, as this paper has made clear as well, this relative weight may change over time as more members are added to the monetary union.

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Figure 1:

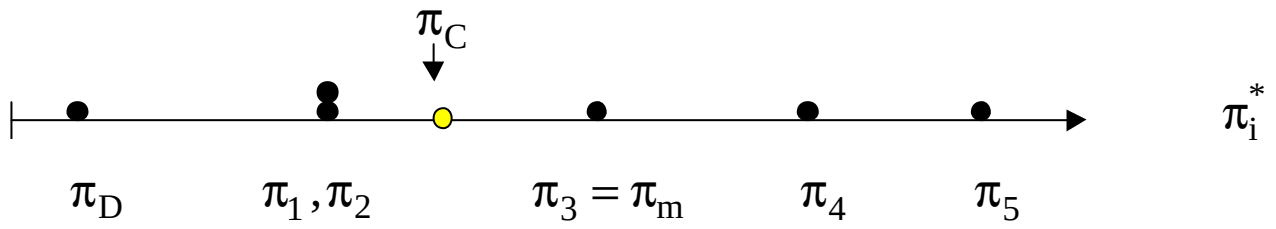
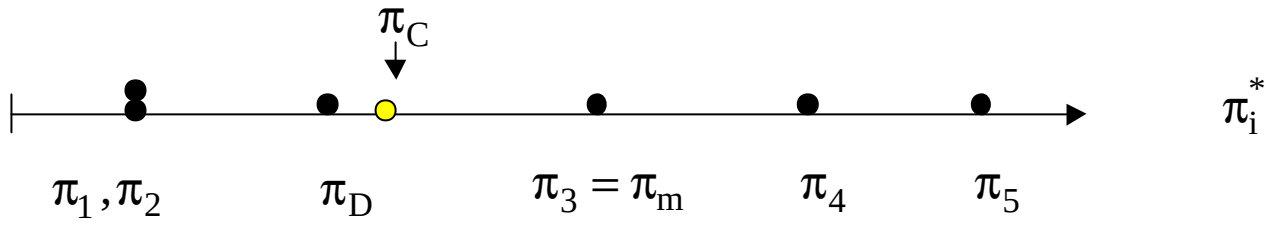


Figure 2:



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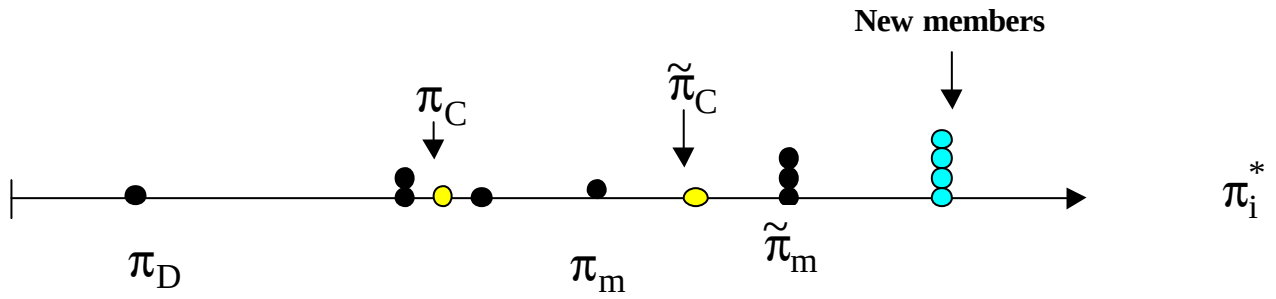

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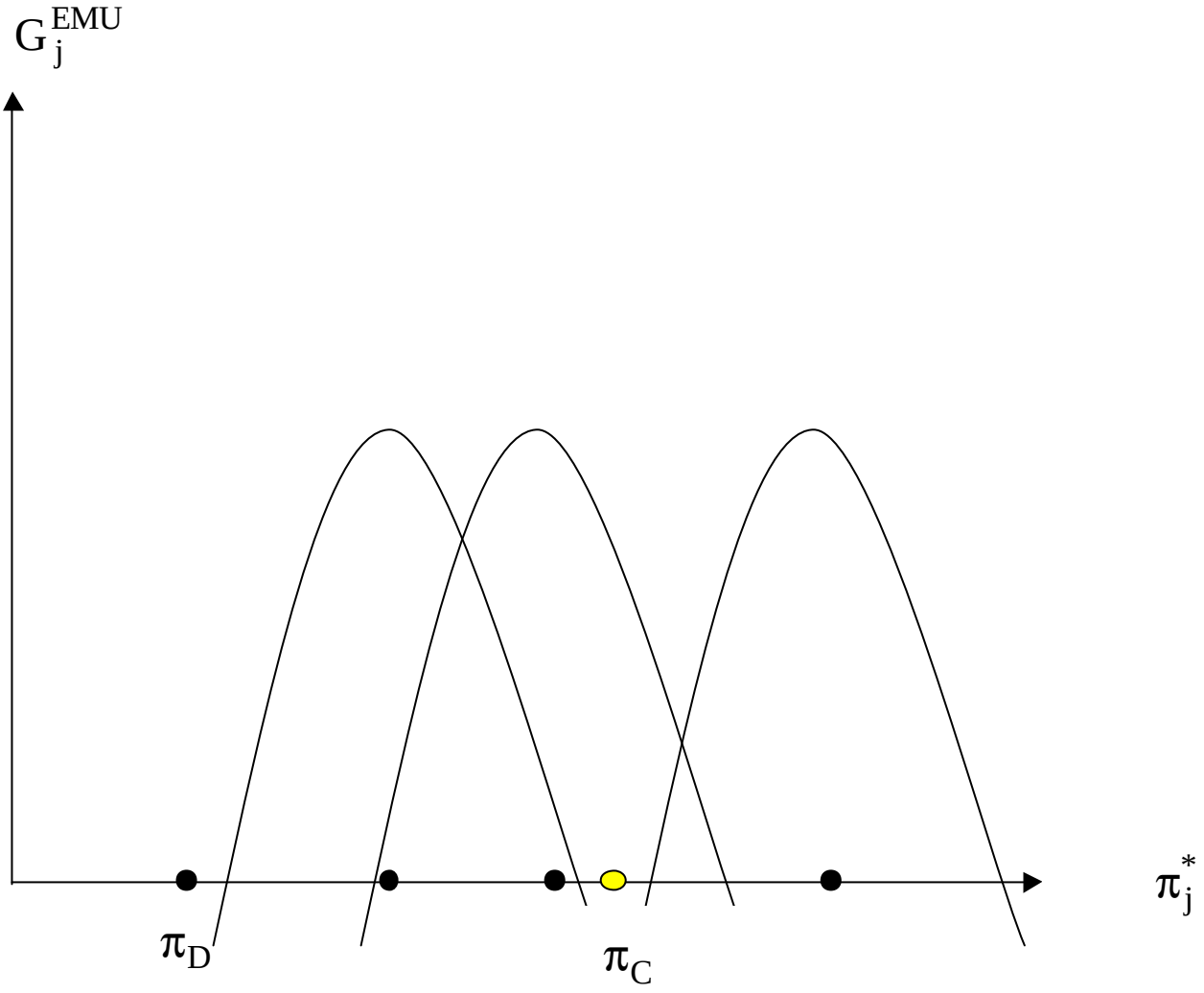
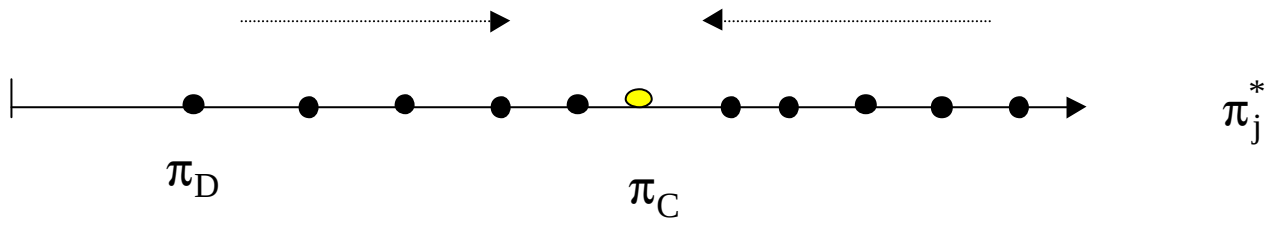
Figure 5: