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Policymakers' Coalitions and Stabilization Policies in the EMU

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A highly integrated area like the EMU features a large amount of interactions between the participating countries. In this context the interactions of monetary and fiscal policies are a crucial issue. This paper focuses on how coalitions among policymakers are formed and discusses their effects on the stabilization of output and price. We emphasize the role played by the institutional design of "cooperation forums" (as, e.g., the *ECOFIN*). If the coalition formation game is played without communication among the policymakers, full cooperation is an unlikely outcome. On the other hand, if policymakers can communicate, full cooperation becomes a possible equilibrium, while the complete non-cooperative solution is, in general, not a stable equilibrium. This supports the view that institutions for discussions can play a crucial role in achieving international cooperation even when these institutions are not endowed with enforcement powers.

Keywords: macroeconomic stabilization, EMU, coalition formation, linear quadratic differential games

JEL classification: C70, E17, E58, E16, E63.

1 Introduction

Since the start of the Economic and Monetary Union (EMU) on January 1st, 1999, experience has been accumulating on the functioning of monetary and fiscal policy in this new framework of macroeconomic policy design in the European Union. Monetary policy has been delegated to a supra-national authority, the European Central Bank (ECB), with a complex framework of objectives, policy instruments and decision

making procedures. According to the Maastricht Treaty, the ECB should safeguard price stability in the EMU and – subject to the condition that it does not interfere with price stability – promote economic growth in the union. Its policies are, therefore, directed at controlling economic developments of the EMU economy as a whole rather than on individual countries. The design of fiscal policies in the EMU is subject to the set of constraints on national fiscal policy imposed by the Stability and Growth Pact (SGP). According to the SGP, excessive deficits are to be avoided and are subject to sanctions. However, it is expected that the introduction of the EMU increases the need for macroeconomic policy cooperation due to the various interactions and externalities from national macroeconomic policies and the limits imposed on flexibility of macroeconomic policymakers.

To study the effects of policy cooperation in the EMU we analyze in this paper the impact of three alternative policy regimes in a stylized dynamic model of the EMU: (i) non-cooperative monetary and fiscal policies, (ii) partial cooperation, and (iii) full cooperation. Both symmetric and asymmetric settings, where countries differ in structural characteristics, policy preferences and/or bargaining powers, are considered. We assume that the EMU consists of two (blocks of) countries where the ECB is responsible for monetary policy and where its primary goal is to achieve price stability in the euro-area and to promote output stabilization as long as price stability is not endangered. The governments of the two (blocks of) countries determine fiscal policy in their countries such that output is stabilized under the restriction that no excessive deficits occur and that prices do not fluctuate too much. The objectives of each player that is involved are captured by a welfare function which it wants to optimize. Hence, it is natural to model the policy coordination problem as a linear-quadratic (LQ) dynamic game in which each player is looking for the strategies that optimize her welfare.

In this paper, policymakers facing a stabilization problem play a two-stage game. In the first stage – the coalition game – they decide non-cooperatively whether or not to sign an agreement about policy-coordination after an asymmetric price shock has been observed. In the second stage – the stabilization game – they play the non-cooperative Nash game, where the policymakers who sign the agreement play as a single player sharing a common loss function. This paper is organized as follows. The next section summarizes the related literature. Section 3 outlines the model. Section 4 discusses the different equilibria used for

determining the emerging endogenous coalitions. Section 5 solves the game numerically and presents five numerical simulations to illustrate our basic findings. Section 6 concludes.

2 Literature Review

Most issues concerning decision making procedures, coalition formation, voting power and rent sharing inside EU institutions have already been analyzed extensively in the literature. Voting power and coalition formation in the Council of Ministers are studied in Widgrén (1994), who calculated power indices to analyze the balance of power in the Council. Similar studies are performed by Laruelle and Widgrén (1996), Hosli (1996), Bindseil and Hantke (1997), and Levinsky and Silarsky (1998). Several papers have studied the effects of coalition formation in an optimal currency area or monetary union formation, but mainly in static frameworks (e.g., Kohler, 1998). Alesina and Grilli (1993) develop a formal model in the setting of a "multispeed" European Monetary Union, where countries differ in their emphasis on the objective of price stability relative to that of full employment (i.e., degree of conservativeness). Full and partial cooperation among the institutions (e.g., governments, central bank, and workers' associations) in a monetary union has been analyzed by Demertzis et al. (1999), and Acocella and Di Bartolomeo (2001). Demertzis et al. (1999) illustrate that, at least when (output or inflation) shocks are symmetric, national governments make the largest gains by imposing strong forms of accountability, e.g., inflation targeting. However, it has been observed that these gains come at the expense of the ECB and those whose preferences are aligned with the ECB. Accountability can therefore go too far, although some degree of accountability is always desirable for everyone.

Analyses of stabilization policies and coalition formation in a monetary union in a dynamic setting are more rare, even if the importance of considering dynamic adjustments in the analysis of stabilization policies is clear. Hughes Hallett and Ma (1996) find – but they do not consider a monetary union – that asymmetries tend to increase the scope for policy-cooperation. The asymmetric cases in their paper display larger gains for all players from cooperation than in the symmetric base scenario. Engwerda et al. (1999) have recently introduced a new dynamic approach suitable to investigate the effects of macroeconomic policies in the EMU (see also Engwerda et al., 2002). Their model applies the dynamic model of international policy interactions of Turnovsky et al. (1988), and Neck

and Dockner (1995) to a monetary union. Using this basic setup Engwerda et al. (2002) have analyzed macroeconomic stabilization among three players (two countries and the ECB). They only partially confirm Hughes Hallett and Ma's (1996) results, in the sense that the Hughes Hallett and Ma's results are confirmed except for the case of asymmetric bargaining powers among players. In this case, it was observed that the stronger the asymmetry in the bargaining powers the less probable policy-cooperation and coalitions become since policies will be biased towards the needs of the stronger player(s) and the smaller players are less likely to stay in such "asymmetric" coalitions. Engwerda et al. (2002) find that the introduction of a fiscal transfer mechanism among countries deteriorates the internal stability of the economies but considerably reduces welfare costs. The investigation in Engwerda et al. (2002) is extended to the more complex context of partial coalitions by van Aarle et al. (2001). The sustainability of a certain type of coalitions and its implications for the optimal strategies and the resulting macroeconomic adjustment were seen to be highly sensitive to the initial settings of the preferences and the structural model parameters. They found that cooperation is often efficient for the fiscal players. On the other hand, it was shown that full cooperation of all three players does not always induce a Pareto improvement for the ECB, and that a governments' coalition often implies a considerable loss for the ECB compared to the non-cooperative and full cooperative cases. In the cases in which the ECB cooperates with one government against the other, it often gains a considerable Pareto-improvement but both governments loose. Therefore, in the experiments made in that paper a kind of dualism arises between the cooperative solutions and the non-cooperative one. Our paper extends van Aarle et al. (2001) by considering how coalitions are formed (i.e., their self-enforcing properties) for different European coordination institutions and van Aarle et al. (2002) by introducing foreign inflation spillovers and fiscal transfers.

3 A Simple Dynamic EMU Model

In this paper, the EMU economy is represented by a dynamic two-country EMU framework. The model consists of the following equations:

$$y_1(t) = \delta_1 s(t) - \gamma_1 r_1(t) + \rho_1 y_2(t) + \eta_1 f_1(t) \ , \tag{1}$$

$$\dot{p}_1(t) = \xi_1 y_1(t) + \mu_1 \dot{p}_2(t) \ , \tag{2}$$

$$y_2(t) = -\delta_2 s(t) - \gamma_2 r_2(t) + \rho_2 y_1(t) + \eta_2 f_2(t) \ , \tag{3}$$

$$\dot{p}_2(t) = \xi_2 y_2(t) + \mu_2 \dot{p}_1(t) \ , \tag{4}$$

$$s(t) = p_2(t) - p_1(t) \ , \tag{5}$$

$$f_1(t) = g_1(t) - z(t) \ , \tag{6}$$

$$f_2(t) = g_2(t) + z(t) \ , \tag{7}$$

where y_j denotes real output in country j (defined in terms of deviations from the equilibrium output, i.e., the output gap), s competitiveness of country 2 vis-à-vis country 1, $r_j \equiv i_E(t) - \dot{p}_j(t)$ the real interest rate, p_j the general price level, g_j the real fiscal deficit, f_j the net government expenditures in country $j \in \{1,2\}$, and i_E the common nominal interest rate. The variable $z(t) \equiv \epsilon(y_1(t) - y_2(t))$ is an automatic fiscal transfer from the country that has a higher output to the country with a lower output[1]. All variables are in logarithms, except for the interest rate that is in perunages. Variables are expressed in deviations from the long term equilibrium (balanced growth path) that has been normalized to zero, for simplicity. A dot above a variable denotes its time derivative. (1) and (3) represent aggregate demand as a function of competitiveness, the real interest rate, output in the other country and net government spending. (2) and (4) point to Phillips-curve (or short-run aggregate supply) relations that relate domestic inflation to output and foreign inflation. The first variable measures the effect of demand-pull inflation, the second variable the pass-through of foreign inflation through imported goods. (5) defines competitiveness as the intra-EMU price differential. Net government spending is defined in (6) and (7) as the gross fiscal deficit minus/plus the fiscal transfer paid to/received from the other country.

The fiscal policymakers are assumed to have intertemporal objective functions:

$$L^i(t_0) = \frac{1}{2} \int_{t_0}^{\infty} \{\alpha_i \dot{p}_i^2(t) + \beta_i y_i^2(t) + \chi_i g_i^2(t) \pm \varkappa_i z^2(t)\} e^{-\theta(t-t_0)} dt \tag{8}$$

for $i \in \{1,2\}$. We assume that the fiscal authorities control their fiscal policy instrument $g_i(t)$ so as to minimize a quadratic loss function which features domestic inflation, output, fiscal deficits, and the transfers that

1 See also Engwerda et al. (2002).

increase losses of one country and reduce the losses of the other one[2]. Preference for a low fiscal deficit reflects the costs of excessive deficits. In this way, the fiscal stringency requirements of the Stability and Growth Pact can be included into the analysis. In particular, a high value of χ_i can be interpreted as a strict implementation of the Stability and Growth Pact where countries perceive high costs to incurring (higher) deficits and, therefore, prefer fiscal deficit smoothing. In both cases the total cost to be minimized is a discounted sum of the costs incurred at each period, with θ denoting the discount rate.

The ECB cares about aggregate inflation, aggregate output and smoothing of interest rates:

$$L^E(t_0) = \frac{1}{2}\int_{t_0}^{\infty} \left\{\dot{P}^2(t) + Y^2(t) + \chi_E i_E^2(t)\right\} e^{-\theta(t-t_0)} dt \ , \tag{9}$$

where $\dot{P}(t) := \sum_{i=1}^{2} \alpha_{iE}\dot{p}_i(t)$, $Y(t) := \sum_{i=1}^{2} \beta_{iE} y_i(t)$.

From the structural form of the model, we derive the reduced form by solving for $y_1(t)$, $y_2(t)$ and $\dot{s}(t)$:

$$y_1(t) = b_1 s(t) - c_1 i_E(t) + a_1 g_1(t) + d_1 g_2(t) \ , \tag{10}$$

$$y_2(t) = -b_2 s(t) - c_2 i_E(t) + d_2 g_1(t) + a_2 g_2(t) \ , \tag{11}$$

where $k_i \equiv +\epsilon\eta_i - \gamma_i w_i$, $l_i \equiv \rho_i + \epsilon\eta_i + \gamma_i \mu_i w_j$, $w_i \equiv \frac{\xi_i}{(1-\mu_i\mu_j)}$, $a_i \equiv \frac{\eta_i k_j}{(k_i k_j - l_i l_j)}$, $b_i \equiv \frac{\delta_i k_j - \delta_j l_i}{(k_i k_j - l_i l_j)}$, $c_i \equiv \frac{\gamma_i k_j + \gamma_j l_i}{(k_i k_j - l_i l_j)}$, $d_i \equiv \frac{\eta_j l_i}{(k_i k_j - l_i l_j)}$, and

$$\dot{s}(t) = \phi_4 s(t) - \phi_1 g_1(t) + \phi_2 g_2(t) + \phi_3 i_E(t) \ , \tag{12}$$

where $s_0 \equiv s(0)$, $\phi_i \equiv a_i u_i - d_j u_j$, $\phi_3 \equiv c_1 u_1 - c_2 u_2$ and $\phi_4 \equiv -(u_2 b_2 + u_1 b_1)$, $u_i \equiv w_i - \mu_i w_j$, for $i, j \in \{1,2\}$ and $i \neq j$. (12) – a first-order linear differential equation – represents the dynamics of the model. The initial value of the state variable, s_0, measures any initial disequilibrium in competitiveness. Such an initial disequilibrium in competitiveness could

2 The formula $\pm\varkappa_i z^2(t)$ in the intertemporal objective function means that fiscal transfer increases the loss of the country with higher output (contributor) and decreases the loss of the country of the lower output (recipient). Therefore, the sign of this expression depends on the circumstances. In the simulation presented in this paper (case 5), country 1 is a payer, where country 2 is a recipient.

be the result of differences in fiscal policies in the past or some initial demand or supply side disturbance in one country.

Defining $x^T(t) \equiv [s(t),\ g_1(t),\ g_2(t),\ i_E(t)]$, the objectives of the policymakers can be written as:

$$J^i(t_0) = \frac{1}{2}\int_{t_0}^{\infty} \{x^T(t) M_i x(t)\} e^{-\theta(t-t_0)} dt \quad i \in \{1,2\} \ , \tag{13}$$

$$J^E(t_0) = \frac{1}{2}\int_{t_0}^{\infty} \{x^T(t) M_E x(t)\} e^{-\theta(t-t_0)} dt \ , \tag{14}$$

where $M_i \equiv \left(\alpha_i w_i^2 \ +\beta_i \pm \varkappa_i \epsilon^2\right) \cdot m_i^T m_i \ +\left(\alpha_i \mu_i^2 w_j^2 \pm \varkappa_i \epsilon^2\right) \cdot m_j^T m_j +$ $\left(\alpha_i w_i \mu_i w_j \ \mp \varkappa_i \epsilon^2\right) \cdot m_i^T m_j \ +\left(\alpha_i w_i \mu_i w_j \mp \varkappa_i \epsilon^2\right) \cdot m_j^T m_i + \chi_i e_{(i+1)}^T e_{(i+1)}$ for $(i = \{1,2\})$ and $M_E \equiv d_{1E} m_1^T m_1 + d_{2E} m_2^T m_2 \ + d_{3E} m_1^T m_2 + d_{3E} m_2^T m_1$ $+\chi_E i_E^2(t)$ with $d_{iE} \equiv w_i^2 \left[\alpha_{iE} + \alpha_{jE}\mu_j\right]^2 + \beta_{iE}^2$ for $(i = \{1,2\})$, and $d_{3E} \equiv w_1[\alpha_{1E} + \alpha_{2E}\mu_1] w_2[\alpha_{2E} + \alpha_{1E}\mu_1] + \beta_{1E}\beta_{2E}$; $e_l \in L\mathbf{R}^4$ is defined as the unit row vector with the l-th entry equal to 1 whereas the remaining values are equal to zero; $m_1 \equiv [b_1, a_1, d_1, -c_1]$ and $m_2 \equiv [-b_2, d_2,$ $a_2, -c_2]$. Henceforth, for reasons of convenience, we assume that $t_0 = 0$ and $\theta = 0$[3].

For each coalition Ω that the players can form, the problem that policymakers face in the stabilization game can be summarized as the minimization of the following loss functions:

$$J^C = \frac{1}{2}\int_0^{\infty} \left\{ \sum_{i \in \Omega} \tau_i x^T(t) M_i x(t) \right\} dt \ , \tag{15}$$

$$J^S = \frac{1}{2}\int_0^{\infty} \{x^T(t) M_j x(t)\} dt \quad \forall j \notin \Omega \tag{16}$$

with respect to the policy instruments and subject to (12) (J^C for the cooperative (where the τ_i sum to 1) and J_j^S for each of the non-cooperative policymakers).

In the case of open-loop strategies, the solution of that problem consists of the following optimal controls:

3 If θ differs from zero, the model could easily be solved following the same procedure used in this paper after a simple transformation of variables, that is, transforming $x(t)$ into $e^{-\frac{1}{2}\theta t} x(t)$ and substituting ϕ_4 by $\phi_4 - \frac{1}{2}\theta$ (for further details, see Engwerda et al., 2002).

$$\begin{pmatrix} f_1(t) \\ f_2(t) \\ i_E(t) \end{pmatrix} \equiv \Psi_{(\Omega)} s(t) \quad . \tag{17}$$

Then, using the above optimal controls, we obtain the corresponding players' optimal costs:

$$J^i_{(\Omega)} = \frac{1}{2}(1 \ \Psi^T_{(\Omega)}) M_i \begin{pmatrix} 1 \\ \Psi_{(\Omega)} \end{pmatrix} \frac{s_0^2}{2\psi_{(\Omega)}} \tag{18}$$

for $i = \{1, 2, E\}$. In (18) $\Psi_{(\Omega)}$ is the vector mapping the state into the optimal controls and $\psi_{(\Omega)}$ is the adjustment speed of the closed-form system $\dot{s}(t) = -\psi_{(\Omega)} s(t), s(0) = s_0$ that determines the evolution of each equilibrium. It is defined as the highest negative eigenvalue of the dynamic system; this eigenvalue is computed together with the optimal strategies according to the algorithms reported in the appendix of van Aarle et al. (2002).

4 Concepts of Endogenous Coalition Formation

The monetary union implies a mix of a centralized monetary policy and a decentralized fiscal policy. This inevitably invokes coordination procedures (Bayer, 1999). However, there are many possible levels of coordination and also many ways to implement them. For fiscal policy coordination, for example, one can distinguish coordination between fiscal authorities, in order to prevent regional spillovers, and coordination between the fiscal authorities and the monetary authority, in order to arrive at an optimal macro-policy mix (Bayer et al., 1998). Obviously, the real cooperation among the institutional players strongly depends on the institutional characteristics of the monetary union (see, among others, Visco, 1998; Bayer, 1999; Durand, 1999, and Winkler, 1999).

In our model, we will study different equilibrium concepts, where each equilibrium concept can be interpreted as some institutional setting of the EMU. Three equilibrium concepts will be considered: the coalitional Nash Equilibrium Concept (CNE), the Sequential Negotiation Equilibrium Concept (SNE), and the Farsighted Coalitional Equilibrium Concept (FCE). Algorithms to derive these cases were worked out elsewhere.[4]

4 The detailed description of the algorithms can be found in Di Bartolomeo et al. (2003).

Below we will provide an informal discussion of these concepts. For formal definitions we refer to Di Bartolomeo and Plasmans (2001) and the references in that paper.

A CNE is an equilibrium concept based on a short-horizon vision of the participating players. That is, each player only looks at the instantaneous consequences of her actions. The players decide, simultaneously, in a one-shot game whether they want to form a coalition or not. After all players have made their decision, the equilibrium is established. The decision whether or not to join a coalition is based on three points: (1) whether the coalition is *profitable* (i.e., the loss the player incurs by joining the coalition is less than the loss she incurs if all players play non-cooperatively); (2) whether the coalition is *internally stable* (i.e., the loss the player incurs by staying in the coalition is less than the loss she incurs if she would defect from the proposed coalition, i.e., there is no incentive to leave the coalition); (3) whether the coalition is *externally stable* (the loss of each non-coalition member must be higher than the loss of the same policymaker if she decides to share her loss function with those of the other cooperating policymakers – i.e., there is no incentive to join the coalition). Due to the stability properties this (CNE) equilibrium concept is self-enforcing.

Opposed to the myopic CNE equilibrium concept is the FCE equilibrium concept, where it is assumed that players can completely foresee the reaction of other players to their actions. In particular, it assumes that each player will consider the reactions of the other players if she defects from a coalition, e.g., the grand coalition can be an FCE equilibrium even if it violates the stability condition. This situation can occur if the grand coalition is profitable but unstable and the resulting partial coalitions are not stable either, so that ultimately a fully non-cooperative situation would result. In the FCE equilibrium concept players take these considerations into account and base their ultimate decision on an evaluation of all these scenarios.

The SNE is a hierarchical equilibrium concept. That is, there is a rule of order according to which it is decided which player is next in line to propose a coalition group – a set of at least two players. Each player of the proposed coalition group may react, according to the same rule of order, on this proposal. The first player of the coalition group who rejects the proposal is entitled next in line to submit a proposal of another coalition. If all prospective members of the coalition group accept the proposal, the coalition group is formed and all members of that group withdraw from the negotiations. When either all agents have left the game, no coalition group

is proposed anymore or a coalition group is proposed that has already been proposed in a previous round, the SNE is reached.

The CNE equilibrium concept is probably the closest to the current institutional setting of the EMU, since it stresses the decentralized decision making of the involved players. The FCE equilibrium can be viewed to represent an institutional framework where a lot of information circulates among EU-policymakers. Finally, the SNE mechanism emphasizes the role played by single countries in the negotiation for achieving a coordination agreement, e.g., that with the temporary EU president country. Other recent examples where the SNE equilibrium concept seems to be an appropriate tool in modeling are the design of the European Monetary System, which was driven by the German economic policy, and the European Unionization process that was based on the axis formed by Germany and France. In this paper, we consider all possible priority schemes, that is, both the situation where one country is the leader and the central bank acts as a follower and the situation where the central bank is the leader and the countries are next in the decision making tree are feasible.

5 Insights from Numerical Simulations

5.1 Scenarios and Parameterization

In this section, we will use simulations of the analytical model presented in Sect. 3 to derive a number of basic insights on policymaking in the EMU that can be gained from our approach. Underlying the simulations is a baseline set of model parameters that seem plausible from various empirical and simulation studies. In the symmetric benchmark model the following structural parameter values are assumed: the semi-elasticity of the demand for domestic output with respect to the real interest rate, γ, equals 0.1, the elasticity of the demand for domestic output with respect to the competitiveness, δ, equals 0.25, the elasticity of the demand for domestic output with respect to the foreign output, ρ, is 0.3, the elasticity of the demand for domestic output with respect to the net government expenditures, η, is 0.8, the Phillips curve coefficient, ξ, is 0.15, and the foreign price spillover elasticity, μ, is assumed to be 0.1.The policymakers' bargaining powers are assumed to be equal (i.e., $\tau = \frac{1}{3}$) and the intertemporal discount factor, θ is 0.05. In the baseline, there are no fisal transfers, i.e., $\epsilon = 0$. The initial state of the EMU economy is assumed to be at $s_0 = 0.05$ (implying an initial disequilibrium of 5% in competitiveness between the two countries).

In the simulation examples we focus on aspects of coalition formation, policymakers' priorities and on the bargaining power distribution. We assume that both governments' priority is real output stabilization while the ECB is mainly concerned about price stabilization. The following preference weights in the policymakers' objective functions are assumed: $\alpha_{1,2} = 1$, $\alpha_{1,2,E} = 2.5$, $\beta_{1,2} = 2.5$, $\beta_{1,2,E} = 1$ and $\chi = 1$[5]. Example 1 considers the symmetric benchmark model. In Examples 2 and 3, the effects of asymmetric fiscal preferences and asymmetric fiscal policy transmissions in the EMU are analyzed. In Example 2, country 2 has higher unit costs associated with real government expenditures than country 1 ($\chi_1 = 1, \chi_2 = 2.5$). In Example 3, country 1 is assumed to have a lower output gap elasticity of the government expenditures ($\eta_1 = 0.7$) than country 2 ($\eta_2 = 0.9$). In Example 4, the consequences of asymmetric bargaining positions are considered instead of symmetric bargaining powers: a scheme that makes country 1 more powerful is considered $\tau^C = \{3/6, 1/6, 2/6\}$, $\tau^{12} = \{3/4, 1/4\}$, $\tau^{1E} = \{3/5, 2/5\}$, $\tau^{2E} = \{1/3, 2/3\}$. In Example 5, the effects of a fiscal transfer system are analyzed by assuming $\epsilon = 0.3$. Outcomes are computed for all five different equilibria outlined in Sects. 3 and 4: *NC* is the non-cooperative equilibrium, *C* is the full cooperation equilibrium, and the other cases are partial cooperative equilibria ((1,2) refers to the fiscal coalition, and (1,*E*) and (2,*E*) are the coalitions between the ECB and the first and second countries, respectively).

Table 1 reports the resulting losses in the five simulation examples introduced above and analyzed in detail in the following subsections. There are five horizontal boxes, each of which consists of four lines: the (optimal) costs of the first country, the second country, and the ECB, respectively (J_1, J_2, J_E), and the smallest absolute eigenvalue, ψ, of the corresponding closed-form system measuring the adjustment speed.

5.2 A Symmetric EMU

From the horizontal box (1) of Table 1, we see that both the grand coalition and the fiscal coalition are profitable and stable CNE, SNE and FCE equilibria[6]. In these cases countries pursue a less active fiscal policy than in

5 Please note that preferences parameters of the ECB are squared as in expression (9).

6 More formally, CNE = SNE = C, F and the Feasible Coalitions set of FCE consists of C and F.

Table 1. Cost functions (multiplied by 1.000)

		NC	C	(1,2)	(1,E)	(2,E)
(1)	J_1	0.6205	0.5471	0.5471	0.5999	0.6379
	J_2	0.6205	0.5471	0.5471	0.6379	0.5999
	J_E	0	0	0	0.0128	0.0128
	ψ	0.0491	0.0582	0.0582	0.0492	0.0492
(2)	J_1	0.4877	0.5262	0.4977	0.4689	0.5403
	J_2	0.8804	0.6977	0.7245	0.8446	0.8676
	J_E	0.0460	0.0046	0.0097	0.0261	0.0621
	ψ	0.0552	0.0638	0.0636	0.0572	0.0538
(3)	J_1	0.7421	0.6050	0.6194	0.7319	0.7286
	J_2	0.5104	0.4987	0.4838	0.5484	0.4895
	J_E	0.0145	0.0013	0.0031	0.0277	0.0133
	ψ	0.0494	0.0587	0.0586	0.0485	0.0506
(4)	J_1	0.6205	0.4561	0.4108	0.5999	0.6286
	J_2	0.6205	0.6719	0.8061	0.6379	0.6098
	J_E	0	0.0250	0.0791	0.0128	0.0033
	ψ	0.491	0.0601	0.0618	0.0492	0.0491
(5)	J_1	0.5049	0.4457	0.4457	0.4876	0.5212
	J_2	0.4516	0.3530	0.3530	0.4617	0.4360
	J_E	0	0	0	0.0099	0.0111
	ψ	0.0460	0.0537	0.0537	0.0462	0.0460

the non-cooperative case, because a higher degree of policy activism in one country increases the adjustment burden for the other country. In the cooperative cases, the fiscal authorities internalize these spillovers in their decision making on fiscal strategies. This also implies that the cooperative cases display larger output gap fluctuations. The internal adjustment speed of the model is faster under cooperative policymaking, as witnesses the faster adjustment of the state variable, the price differential $s(t)$ under cooperation.

Figure 1 displays the resulting adjustments in the non-cooperative case (solid lines) and the full cooperation case (dashed lines) that coincides in this symmetric benchmark with the fiscal coalition.

The initial shock amounts to a perfectly anti-symmetric shock, as it affects both countries in an exactly opposite manner. If countries are symmetric in their structural parameters and policy preferences, as is the case here, we see that the adjustments are also anti-symmetric and that the instrument of the ECB, which has only a symmetric impact, remains unchanged. The only exception (not shown) to this would be the two coalitions of the ECB and an EMU country. In these cases the ECB is

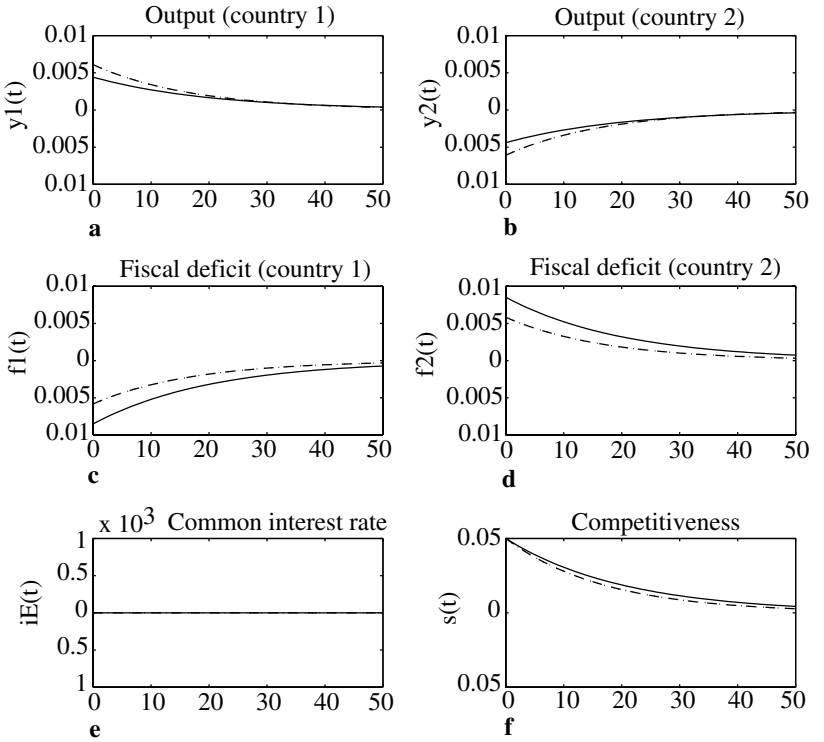

Fig. 1. The symmetric EMU ___ *NC* – – – *C* ..... (1,2)

cooperating with the country in that coalition and its instrument is partly targeted to the benefit of that country, i.e., a positive interest rate in the $(1, E)$ case and a negative interest rate in the $(2, E)$ case. Since we had already excluded these cases as unstable outcomes, they have been left out from Fig. 1.

5.3 Asymmetric Fiscal Preferences

The results on the symmetric case in the previous section were straightforward: (fiscal) policy coalitions are sustainable equilibria in symmetric settings and the monetary policy of the ECB is basically irrelevant since it is not active. We now consider the introduction of asymmetries in the preferences of the fiscal policymakers and see how that affects the outcomes. In this example, the symmetric benchmark setting of case 1 is assumed, except that country 2 now puts a stronger

weight on deficit stabilization than country 1 ($\chi_1 = 1, \chi_2 = 2.5$). Such a difference could reflect a difference in the extent to which countries are restrained in fiscal flexibility by the SGP, e.g., if countries differ in their initial fiscal deficits, the SGP will have a differential impact on fiscal flexibility: if country 2 had a deficit of 2 percent in the past whereas country 1 had a zero deficit, then the SGP will involve a potentially stronger restriction for country 2 than country 1.

Table 1, box (2) shows the losses in this case. The first best strategy of the ECB and of country 2 is the grand coalition. Country 1, that has a higher degree of fiscal flexibility, is now less willing to cooperate with the more constrained country 2. The fiscal inflexibility of country 2 will imply that not much can be gained from cooperating with it, and country 1 will be seriously constrained if it cooperates with the inflexible country 2. In this case, cooperation would imply that its policies will be partly designed to alleviate the adjustment burden of its inflexible partner. Country 1's first best strategy is cooperation with the ECB, whereas its second best is non-cooperation. Compared to the baseline case, the effects are fairly dramatic: the equilibrium of the game shifts from a cooperative to the non-cooperative equilibrium because coalitions are no longer stable (the CNE = *NC*).

Since the *NC*-solution is Pareto-inferior with respect to the (1,*E*) coalition for all players, it is interesting to look for different mechanisms that support coordination. The inefficiency that emerges is related to the mechanism considered in the coalition formation. Different mechanisms may eliminate it. A mechanism that determines the rules of the coalition formation process is the institutional cooperative design where policymakers act (Ecchia and Mariotti, 1997). Using the algorithm of the SNE mechanism, the resulting equilibrium will be the fiscal coalition $(1, 2)$. Using the algorithm of the FCE, the set of Rational Feasible Coalitions consists of $\{C, (1, 2), (1, E)\}$ and the ultimate choice of the regime depends on exogenous determinants. However, a mechanism which implies the FCE requires more information than one that supports the SNE or the CNE. For instance, the FCE is not compatible with a central bank that is not transparent or with an environment where credible information about the state of the economies of the Member Countries is not available. If the same member states have to provide information about their economy, they can try to use this information strategically, and therefore, the FCE may not characterize such a situation (a similar observation can be made for information provided by the ECB).

This example shows that, even when coordination gains are present, cooperative solutions do not necessarily emerge as an equilibrium of the game. Different institutional setups imply different equilibria. Therefore, rules, procedures and available information are sometimes crucial to improve cooperative solutions and to raise the welfare of all the policymakers avoiding free-riding behavior.

The consequences for the adjustment dynamics are seen in Fig. 2.

The anti-symmetric adjustment dynamics disappear now. The lack of fiscal adjustment in country 2, as a consequence of its policy inflexibility, actually enhances adjustment in country 1. Country 1, in other words, would prefer a strict interpretation of the fiscal stringency criteria to be applied to country 2. Aggregate EMU output is negative, inducing a drop in the interest rate of the ECB. In that sense the ECB would prefer a loose SGP for country 2 as the fiscal inflexibility of that country lies at the root

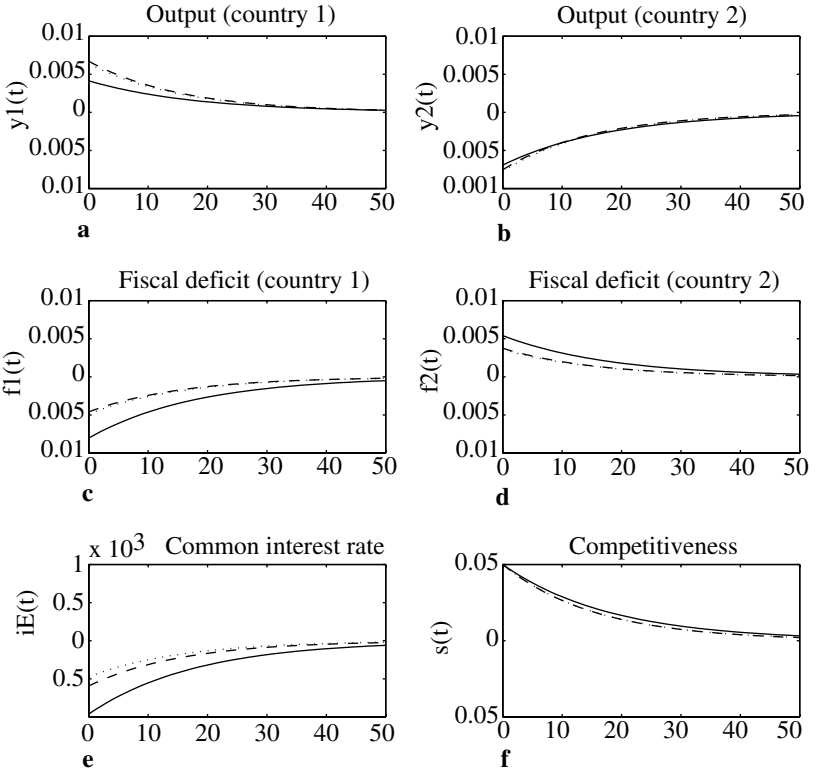

Fig. 2. Asymmetric fiscal preferences ___ *NC* – – – *C* ..... (1,2)

of the drop in EMU output and the associated consequences for the ECB. Country 1 is harmed in its adjustment by this low interest rate policy and will therefore be opposed to cooperation between the ECB and country 2.

5.4 Asymmetric Fiscal Policy Transmission

Differences in the transmission of monetary policy and fiscal policies are likely to prevail under EMU. In this example, we analyze the consequences of such differences in fiscal policy transmission. To do so, assume that the first country has a lower output elasticity of the government deficit ($\eta_1 = 0.7$) than the second country ($\eta_2 = 0.9$). Table 1, box (3) shows the losses in this case.

It shows that the (1,*E*) coalition is not profitable, whereas the grand, the fiscal, and the (2,*E*) coalitions are. However, none of these three coalitions is stable. When the grand coalition is considered, both governments have an incentive to leave the coalition; when the fiscal coalition is considered, the first country has an incentive to leave the fiscal coalition and the ECB has an incentive to join this coalition[7]; and when the (2,*E*) coalition is considered both players have an incentive to leave it. Therefore, the CNE turns out to be a very inefficient non-cooperative solution. Hence, the institutional setup that supports the CNE implies a coordination failure since the losses of the non-cooperative CNE equilibrium are higher than in the case of full cooperation. Considering the setup associated with an FCE, where more information is available to the policymakers, the grand coalition turns out to be the equilibrium because each government, facing the decision of leaving the coalition, forecasts that the gain of the decision of leaving is an illusion, since the other government and the ECB will follow her decision driving the economy to the unfavorable non-cooperative solution.

The result of the SNE is the fiscal coalition. In fact, the first government and the ECB, as first proponents, have an incentive to propose the grand coalition, but the second government has an incentive to reject and to propose the fiscal coalition. Given this rejection of the grand coalition, country 1 agrees with the fiscal coalition proposal, which is her second-best choice. Hence, moving from a symmetric fiscal policy setting to an asymmetric fiscal transmission case can have significant consequences for policymaking.

7 Hence, the fiscal coalition is neither internally nor externally stable.

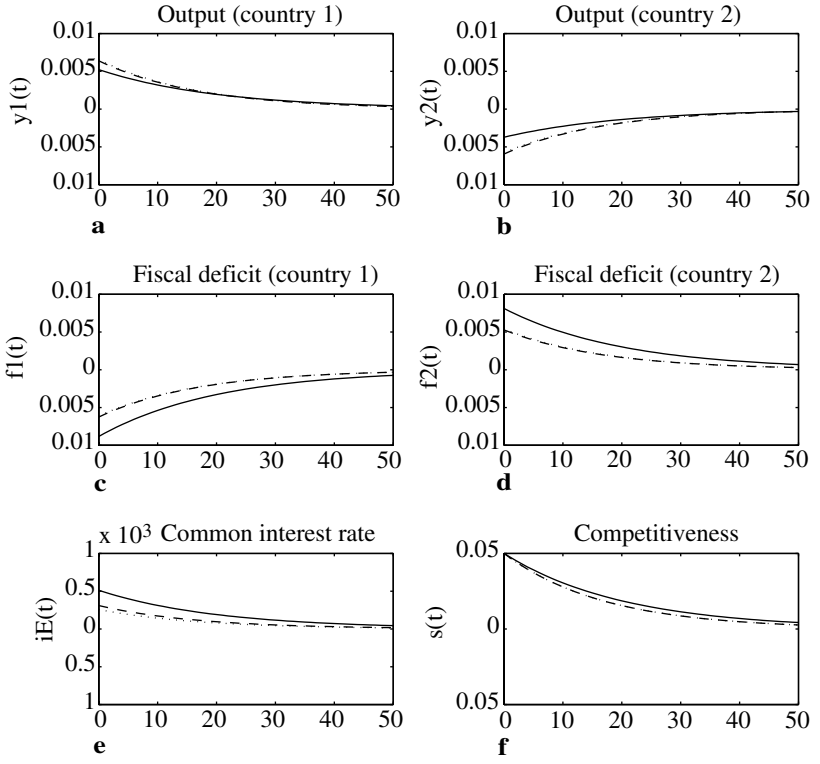

Fig. 3. Asymmetric fiscal transmission ___ *NC* – – – *C* ..... (1,2)

Figure 3 gives the resulting adjustments under non-cooperation, the grand coalition and fiscal cooperation.

Although fiscal asymmetry has strong consequences for the coalition formation, the effects on dynamic adjustments in the model are not very strong if compared to the symmetric benchmark case. Adjustments are no longer (perfectly) anti-symmetric and the grand coalition and fiscal coalition no longer coincide as the ECB will react differently in both cases. Concerning outcomes under non-cooperative policies with asymmetric fiscal transmissions, various effects come to our attention: country 2 faces a somewhat lower adjustment burden in the output gap as it will be more effective in stabilization given that its economy is more sensitive to fiscal adjustment. This, at the same time, imposes an externality on country 1, which would have benefited from slower adjustment in country 2 and less stabilization there. Also, the ECB is affected by the asymmetric setting: in

all three cases its policies are targeted at facilitating adjustment in country 2, while at the same time retarding adjustment in country 1. Since the ECB reacts to aggregate output and inflation, we know from the positive interest rate that aggregate output and inflation are positive, which is consistent with the slower adjustment in country 1 than in country 2.

Asymmetric monetary policy transmission is also likely to occur in the EMU, but due to space constraints, we do not elaborate this issue further. Moreover, it has already received a considerable amount of attention in the literature (see, e.g., van Aarle et al., 2002).

5.5 Asymmetric Bargaining Powers

This example considers the case of the symmetric baseline, but introduces asymmetric bargaining powers. In coalition settings, the bargaining power distribution of the players is an important element: they determine to which extent the players' preferences will be represented in coalition's policymaking. To gather more insight into the effects of the bargaining power distribution on coalition formation and policymaking, we consider in this example that bargaining powers equal the following scheme: $\tau^c = \{3/6, 1/6, 2/6\}$, $\tau^{12} = \{3/4, 1/4\}$, $\tau^{1E} = \{3/5, 2/5\}$, $\tau^{2E} = \{1/3, 2/3\}$, implying that, in a coalition, country 1 has three times as many votes as country 2 and 1,5 as many votes as the ECB, whereas the ECB has two times as many votes as country 2. By definition, the non-cooperative equilibrium is unaffected by a change in bargaining powers in coalitions.

Comparing the results of horizontal box (4) in Table 1 with those of the symmetric benchmark case in horizontal box (1), we observe that the introduction of asymmetric bargaining powers crucially changes outcomes. In fact, in box (4) no coalition is profitable and the CNE, FCE and SNE are, therefore, the non-cooperative solution. In general, the asymmetry of bargaining powers tends to increase the costs of the country with the smaller bargaining power as its importance in a coalition is reduced, while it tends to decrease the costs of the other country. This effect can change a cooperative situation (as that depicted by line (1)) in one where only the non-cooperative solution is an equilibrium (as in line (4)). To put it in a general way: more asymmetric bargaining powers reduce the likelihood of coalitions – and, therefore, of policy cooperation – as policies will generally be biased toward the needs of the stronger player(s), and the smaller players are less likely to stay in such "asymmetric"

coalitions. This last result differs from that found in Hughes Hallett and Ma (1996) in analyzing the full cooperation problem. We stress that the consideration of asymmetries in the bargaining power has a different effect on the need for cooperation than the asymmetries in the model structure.

There are several effects on the adjustment of the EMU economy. In particular, the stronger bargaining power of country 1 tilts the adjustments toward the needs of country 1 in the case of coalitions. Country 2 is forced to reduce its fiscal deficit and the ECB to tighten monetary policy, compared to the symmetric baseline. Since the coalitions are unlikely to be stable, the non-cooperative regime is the only outcome, and the main effect of asymmetric bargaining weights, therefore, is the reduction of the scope for policy cooperation if compared to symmetric bargaining weights.

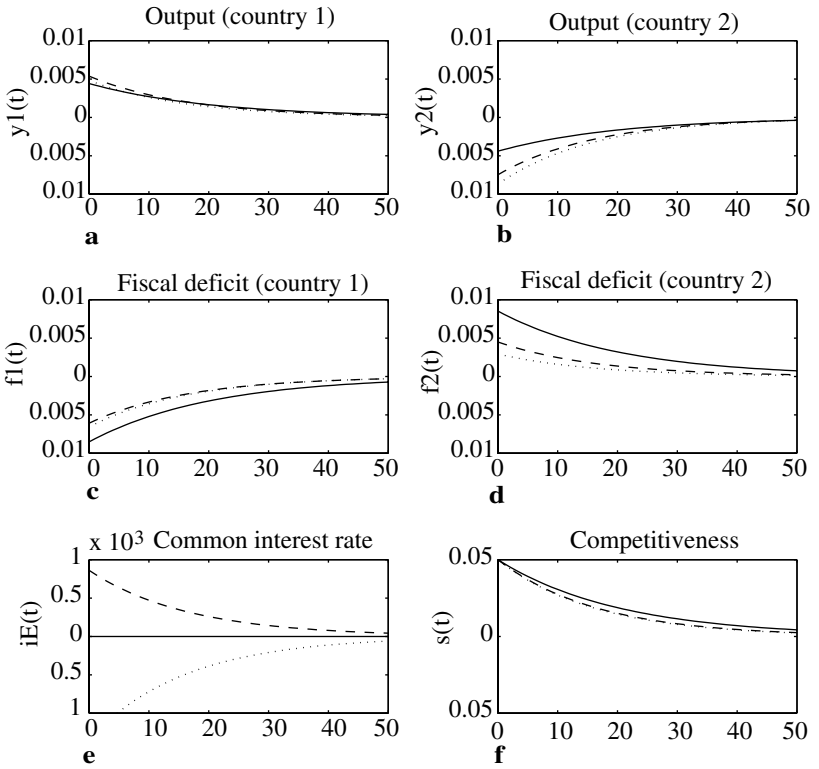

Fig. 4. Asymmetric bargaining weights ___ *NC* – – – *C* ..... (1,2)

5.6 Fiscal Transfers

In the model we have also built in the possibility of a system of automatic fiscal transfers that aims at reducing output (gap) divergences in the monetary union. The introduction of such a mechanism alters the working of the model and, therefore, the adjustments and incentives that the different players face in a fundamental way. In this final example, we take a closer look at the effects of such a fiscal transfer system. We set the fiscal transfer parameter ϵ at a value of 0.3 and assume that fiscal transfers are weighted in the loss functions equally as net deficits, i.e., $\varkappa_1 = \varkappa_2 = 1$.

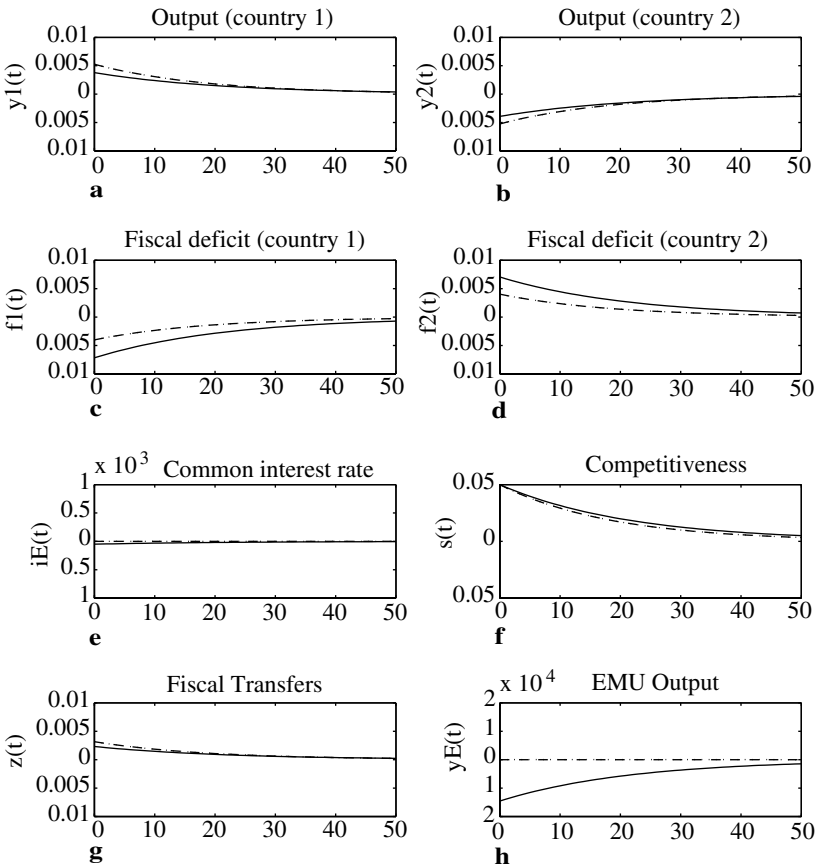

Fig. 5. Introduction of a fiscal transfer system ___ *NC* – – – *C* ..... (1,2)

The resulting losses of the players and the adjustments are given in Table 1, box (5) and in Fig. 5.

Fiscal transfers are effective in reducing the output fluctuations caused by the initial shock, as shown by the lower output and deficit adjustments if compared to the baseline setting without transfers, both in the non-cooperative and cooperative cases. The grand coalition and fiscal coalition again coincide as in the baseline case and these are also, as in the baseline case, profitable and stable equilibria (therefore CNE=SNE=FCE=C, F)[8]. Transfers are higher in these cooperative cases than in the non-cooperative case, due to the higher output differential that is maintained. As in the baseline case, the ECB is not active in any equilibrium apart from the cases where it would form a coalition with one country only, but these are unstable equilibria. It is, therefore, indifferent here whether a transfer system is introduced. This conclusion would no longer necessarily hold if asymmetric structures or policy preferences are present. As seen earlier, these will have an impact on adjustments on the aggregate EMU level and thereby on the interest rate. The ECB in that case will also be affected by the transfer system.

6 Conclusion

This paper studies the interaction of monetary and fiscal policies in the monetary union in the context of coalition formation among policymakers. This issue is of special importance in a highly integrated economic area as the EMU, characterized by various externalities from national macroeconomic policies, which interact with the common monetary policy. The paper analyzes how coalitions are formed under different institutional settings and discusses the effects of coalition formation and policymakers' bargaining powers distribution on economic policies.

To study the effects of coalition formation, we compare the impact of three alternative policy regimes in a stylized dynamic model of the EMU: (i) non-cooperative monetary and fiscal policies, (ii) partial cooperation, and (iii) full cooperation. Both symmetric and asymmetric settings, where countries differ in structural characteristics, policy preferences and/or bargaining power, are analyzed.

Numerical examples are used to study the interaction of monetary and fiscal policies in the monetary union. The symmetric benchmark

8 See Footnote 6.

case, where the countries are equally weighted in the ECB's loss function and symmetric values for the structural model parameters are used, is used as a starting point. Afterwards, we consider asymmetries in fiscal policy preferences, fiscal policy transmissions, asymmetric bargaining powers and the introduction of an automatic fiscal transfer mechanism. In this way our analysis contributes to the important discussion about the effects of a monetary union in the case where countries differ in their structural characteristics, as it takes place in the EMU. Contrary to the common belief that asymmetries tend to increase the scope for policy cooperation, we observe that asymmetries increase the need for such policy coordination only in some specific cases. In addition, asymmetries tend to reduce the stability of potential coalitions of policymakers. First, we observe that the grand coalition is an equilibrium only in the symmetric case, i.e., when governments' preferences are symmetric. Also, fiscal cooperation is often efficient for the fiscal players: the fiscal players' cooperation (against the ECB) often leads to a Pareto improvement for them. The non-cooperative Nash equilibrium is rarely the outcome so that arguments can be found that EMU increases the need for macroeconomic cooperation. On the other hand, in asymmetric cases, full cooperation does not induce a Pareto improvement for the ECB, while the governments' coalitions imply a loss for the ECB compared to the non-cooperative and full cooperative cases. Such a situation implies a stability problem for the grand coalition since the governments or the ECB often have an incentive to deviate from it. Furthermore, the high cost of the partial coalitions between the ECB and only one government finally leads to the non-cooperative solution that often implies the highest losses for the players.

The results obtained in the analysis of the different mechanisms of coalition formation show the importance of international institutions, that enable communication among various actors. The numerical examples show that, when the coalition formation game is played without communication among the policymakers, full cooperation is often impossible or limited. On the other hand, when policymakers are enabled to communicate, full cooperation (as well as partial cooperation between a subset of policymakers) becomes a possible equilibrium, while the complete non-cooperative solution is generally not a stable equilibrium. This provides a broad support for international institutions that can play a crucial role in achieving international cooperation even when these institutions are not endowed with enforcement powers.

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