INTERNATIONAL POLICY COORDINATION WITH ECONOMIC UNIONS*

ABSTRACT

What are the effects of unions between countries on international policy coordination? What are the incentives to create unions between countries? Is gradualism a feasible way toward efficient international coordination? I answer to these questions through simple examples of policies which create spillovers between three countries. A union of two countries is more likely to emerge when policies are characterized by strategic complementariety: in this case, the creation of a union unambiguously shifts the equilibrium toward the first best because it reduces the scope for free riding of the outsiders. This makes also easier to sustain unions between two countries even if the coordination of all the countries is unfeasible. Under strategic substituibility of the policies, the union may be unfeasible because it would excessively increase the free riding of the outsider country. Moreover, the outsider may be so much better off than the members of the union that the former may have no incentives to join the union in a second stage, making impossible a gradualist approach to the first best coordination.

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Key words: international policy coordination, international unions, spillovers.

I - INTRODUCTION

Economic unions have typically the purpose to correct inefficiencies created by national policies with international spillovers. One is the case of *beggar-thy-neighbor (BTN)* policies, that is, policies with negative spillovers abroad: trade protectionism, competitive devaluations, monetary expansions, tax incentives for mobile factors are often regarded as examples of *BTN* policies. The other case is the one of *prosper-thy-neighbor (PTN)* policies, or with positive spillovers on the rest of the world: certain fiscal policy, investment in infrastructures and sovranational public goods are examples of *PTN* policies. Whenever international spillovers exist and policies are chosen independently by each country, the decentralized outcome is inefficient, and economic unions have margins to improve the welfare of each country. The logic consequence of this argument is that economic unions should be at the world level, or at least they

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should include all interdependent countries for each policy. Since this is not the case in virtually any policy, the natural question is what does determine the equilibrium size of unions in an interdependent world.

One rationale for the size of unions, advanced in Alesina, Angeloni and Etro (2001a, AAE hence on), is that countries differ in their favourite policies at both the national and union level, and choices within a union are political choices: hence, the trade-off between internalization of spillovers and loss of independent policymaking endogenously determines the size and the composition of unions[1]. This political economy argument requires strong heterogeneity between countries on the objective of the policy to centralize, and some intrinsic and exogenous benefit from the union creation[2].

On the first point we need to remark that there are cases in which countries would hardly disagree on what to do, but still small unions prevail. For instance, there is a quite general consensus that reducing protectionism around the world creates gains for all countries, but despite the efforts of the WTO, trade policy today is still driven by unions at the continental level (NAFTA, EU, Mercosur, APFTA, ...). Another example concerns currency unions: despite there are clear gains from adopting a same currency or dollarizing for small open economies especially when characterized by an highly inflationary history, the one-nation-one-currency paradigma is still prevailing.

The second criticism to the argument by AAE (2001a) is that the creation of a union is a Nash equilibrium in their model if and only if its membership provides benefits otherwise lost by independent countries: without these benefits there would always be incentives to deviate (that is exit from the union) and the only possible equilibrium would be the decentralized one without unions. Even if we believe that the creation of the union can provide benefits like stronger spillovers between members or scale economies in the provision of public goods, this exogenous assumption may be regarded as too restrictive for a general explanation of the size of unions.

This paper advances a different rationale for the endogenous determination of unions, which is immune from the previous criticisms. I immagine a world where

[1] This trade off is the starting point for related investigations on the political economy of unions which extend the AAE (2001a) model. In particular, Brou - Ruta (2001) develop a framework that deals with the choice of integration of two countries in a setting in which there is a strategic interaction between interest groups and politicians in the domestic arena and between governments at an international level. Wrede (2002) extends AAE (2001a) by considering a national policy with heterogeneity across countries and a supernational policy without heterogeneity but with spillovers across countries and allows for endogenous formation of countries and unions. Related political economy investigations of the creation of unions of countries are studied by Besley - Coate (2002), Dur - Roelfsema (2002), and Olofsgard (2001), who study strategic delegation of policymakers in a union.

[2] Hug (2001), and especially Tabellini (2002), and Mongelli (2002) apply these theoretical arguments to discuss the institutional development of the European Union. A more direct empirical analysis of the AAE model is presented in Alesina - Angeloni - Schukchnet (2001).

national policies induce spillovers on all the other countries in the same way if they are independent or they belong to a union[3]. As well known, in such a world, international policy coordination is beneficial and possible only if countries can commit to adopt the policies on which they coordinate or in a dynamic equilibrium through a reputational argument. In both cases, I investigate the properties of a union composed by a subset of countries versus the decentralized equilibrium and the first best obtained through coordination of the policies of all countries. I show that the same trade-off found out in AAE (2001a), namely between internalization of spillovers and heterogeneity costs as determinant of the size and composition of unions, is present under our different equilibrium concepts. But the interaction between union's members and outsiders creates new interesting results.

I suggest that a crucial feature in the determination of equilibrium unions is the kind of interdependence between policies of different countries. Reinterpreting a well known terminology[4], the policies of two countries are strategic complements if, when one country moves its policy toward the first best level, the other country does the same; the policies are strategic substitutes otherwise.

In the example developed in this paper, I show that *a union is more likely to emerge when policies are characterized by strategic complementariety: in this case, the creation of a union unambiguously moves the world equilibrium toward the first best because it reduces the scope for free riding of the outsiders. Under strategic substituibility of the policies, the union may even be unfeasible because it would excessively increase the free riding of the outsider countries*.

From an empirical point of view, it is possible to discriminate beggar-thy-neighbor policies from prosper-thy-neighbor policies, but it is much more difficult to say which policies are characterized by strategic complementarity or substituibility[5]. Nevertheless, this classification seems relevant for an understanding of international policy coordination, and it would deserve a deeper empirical look.

Moreover, I show the possibility that some paradoxical results may emerge: for instance, the outsider countries may be better off than the countries joining the union and they may also have no incentives to join the union in a second stage so that a gradualist way toward first best coordination is unfeasible. Despite these results do not necessarily correspond to general findings, they show interesting and non obvious possibilities, and I believe that a more systematic investigation of the equilibrium determination of unions in a multicountry world would deserve more attention in the future.

[3] The assumption that externalities take place across countries in the form of spillovers is standard. An alternative source of interdependence between national economic policies would be the one due to the existence of «club goods».

[4] See Cooper - John (1988).

[5] Moreover, as a referee has pointed out, empirical studies of international policy coordination typically find that the gains from cooperative policies are small (see McKibbin, 1997, and Von Hagen - Mundschenk, 2001).

The paper is organised as follows. Section II introduces the general model and discusses it. Section III focuses on a three countries case with two of them creating a union. Section IV solves the model in an example of prosper-thy-neighbor policy with strategic substituibility and Section V does the same for an example of beggar-thy-neighbor policy with strategic complementariety. Section VI discusses the results and it draws the conclusions.

II - THE MODEL

The most general model of international policy coordination is composed by N countries choosing a policy variable z_i with $i = 1, 2, ..., N$. The benefits of the policy of each country depend also on the choices of the other countries according to the function $g^i(z_1, z_2, ..., z_N)$ with $g^i_i > 0$ and $g^i_{ii} < 0$, where subindexes denote derivatives[6]. Without loss of generality we assume that the costs of this policy are linear in the choice variable z_i. Hence the net gain for country i is:

$$U_i(z_1, z_2, ..., z_N) = g^i(z_1, z_2, ..., z_N) - z_i$$

In general, we will consider two kind of economic policies[7]:

Prosper-Thy-Neighbor (PTN) Policies: $g^i_j > 0$ for any $i \neq j$.

Beggar-Thy-Neighbor (BTN) Policies: $g^i_j < 0$ for any $i \neq j$.

In the class of *PTN* policies we could recognize most of traditional fiscal policy, which plays the role of expansionary instrument both domestically and abroad in a large class of models[8]. In the class of *BTN* policies we can think of strategic trade policy – domestic protectionism is welfare enhancing for a given foreign policy in traditional Ricardian and Heckscher-Ohlin models and in the new trade theory, but foreign protectionism is welfare reducing in the domestic country[9] – and international capital income taxation[10]. The cases of monetary and exchange rate policies are more debatable. According to traditional theories monetary expansions and devaluations are the

[6] More in general, z_i may be a vector of policy variables, as in some versions of the model presented in AAE (2001a) or in its extension by Wrede (2002), but this paper will focus on the case of a single policy.

[7] The expression *Beggar-Thy-Neighbor* is quite known and was introduced by Robinson (1937); the expression *Prosper-Thy-Neighbor* is borrowed by Corsetti - Pesenti (2001).

[8] For a strategic analysis on international fiscal policy see, for instance, Turnovsky (1997, Ch. 8). The recent literature on the political economy of fiscal unions includes Bolton - Roland (1996, 1997) and Alvarez (2002), AAE (2001a) and Bordignon - Manasse - Tabellini (2001).

[9] See Johnson (1953-1954) and Rodriguez (1974) on traditional models, Brander - Spencer (1984, 1985), Eaton - Grossman (1986), Helpman - Krugman (1989) on new trade theories, and Bagwell - Staiger (1999, 2001) for a more general model on strategic trade theory. See Wong (1995, Ch. 12) for a survey.

[10] The classic reference is Hamada (1966).

typical *BTN* policies[11], but more recent theories claim the possibility of complementary components in these interventions[12]. Concerning defense policy, it is clear that defense is a *PTN* policy toward allied countries and a *BTN* policy toward enemies[13].

The features of the union and the conditions under which this is sustainable will depend not only on the kind of policy we examine – if *PTN* or *BTN* – but also on the kind of interdependence between countries' policies. In particular it is crucial the distinction between:

Strategic Sustituibility (SS): $g_{ij}^{i} < 0 \ \forall \ i \neq j$.

Strategic Complementarity (SC): $g_{ij}^{i} > 0 \ \forall \ i \neq j$.

In the general model outlined above, if each country acts independently, the equilibrium outcome is inefficient. The set of Pareto efficient policies is obtained by maximizing a weighted sum of all the net gain functions, but also unions including a subset of countries could improve the situation at least for their members. It is easy to show that under strategic substituibility, the policy chosen by the union members move toward efficiency, but the outsider's policy moves in the opposite direction, which makes the latter always better off, but also raise the possibility that the union is not welfare improving for its members. Instead, under strategic complementariety, the policies chosen by all countries move toward efficiency and the union is unambiguously welfare improving for all countries, but again the outsider is gaining more than the insiders. Because of these factors, *unions are more likely to be sustainable when they try to coordinate policies characterized by strategic complementarities*.

An equilibrium union is created when it is in the interest of its members to enter in it and it is not in the interest of the outsiders to enter in it. Clearly any union, included the union of all the countries – which is just the first best international policy coordination – is not an equilibrium outcome unless there is a credible commitment to such a coordination. The model of fiscal unions developed by AAE (2001a) adopts the particular net gain function:

$$U_i = \alpha_i H\left(z_i + \beta \sum_{j \neq i} z_j\right) - z_i \qquad \text{with } \beta \in (0,1]$$

where $H(\cdot)$ is an increasing and concave function, the parameter β represents the size of the spillovers, which are assumed to be of equal size for all the countries, and all the

[11] For a strategic analysis on international monetary policy see the classic paper by Hamada (1976) and the survey by Persson - Tabellini (2000, Ch.18) on the more recent literature.

[12] In particular see Obstfeld - Rogoff (1995) and Barro - Tenreyro (2000). Corsetti - Pesenti (2001) give the most updated discussion and show the possibility of a *Beggar-Thy-Self* monetary expansion in this class of models! On currency unions see the classic reference Mundell (1960) and, for a more recent approach, Alesina - Grilli (1992) and Alesina - Barro (2002).

[13] For a recent investigation in this environment see Spolaore (2000).

heterogeneity between countries is summarized by the country specific parameter α_i14. Moreover, AAE (2001a) assume that the union chooses a uniform policy for all its members by majority voting, and that countries outside of the union neither receive spillovers from the union's members or exert them on the other countries. Under these simplifying assumptions *a*) an equilibrium union is composed by countries with contiguous preferences around the median such that all and only all countries with preferences in this set belong to the union; *b*) the equilibrium size of the union is weakly increasing in the size of the spillovers; *c*) for a given median, the only coalition-proof equilibrium union is the largest equilibrium union. Moreover a status quo bias in the possibilities of enlargment of the union emerges since the enlargement is accepted by majority voting if and only if the change in the median after entry is small enough[15].

III - THE MODEL WITH THREE COUNTRIES

In this paper I will avoid the short-cut assumed in AAE (2001a) and I will study the more realistic case in which every country inside or outside the union receives spillovers from every other country and exerts spillovers on every other country. The simplest context in which coordination of economic policies and creation of economic unions between countries can be studied is a three countries world. So, from now on, I will assume $N = 3$. I will now describe the general systems of equations which characterize the decentralized equilibrium, the first best coordination and the equilibrium when two countries join in a union.

[14] This is crucial to apply the median voter theorem. An alternative specification used by Besley - Coate (2002) is:

$$U_i = \alpha_i \left[(1-\beta) H(z_i) + \beta \sum_{j \neq i} H(z_0) \right] - z_i \qquad \text{with } \beta \in (0,1]$$

while Dur - Roelfsema (2002) assume:

$$U_i = \alpha_i \left[H(z_i) + \beta \sum_{j \neq i} H(z_0) \right] - z_i \qquad \text{with } \beta \in (0,1]$$

[15] The main result by AAE (2001a) is however obtained by extending the model to multiple policies and by showing a bias toward excessive centralization and small size of the unions. We have a sort of time-inconsistency problem: once the union is formed, the median country extends excessively its powers, and the expectation of this induces too many countries to step back from the beginning. AAE (2001a) have emphasized a constitutional solution to this problem. The Constitution of the union should *ex ante* establish which prerogatives can and cannot be centralized. A constitutional commitment for the union to centralize only a limited set of functions could raise participation and enhance welfare for a majority or even for all. AAE (2001b) discuss how fiscal federalism between the union members with a system of pigouvian taxes or the delegation of decision power both at the union and country level – through the principle of subsidiarity, which gives priority to the country level, or federal mandates, which gives priority to the union level – can improve the outcome of the fiscal union with a uniform policy for all the members. These institutional rules help to limit the centralization bias.

Under decentralization the Nash equilibrium policies z_1^n, z_2^n and z_3^n satisfy the system:

$$g_i^i (z_1^n, z_2^n, z_3^n) = 1 \qquad \text{with} \quad i = 1, 2, 3$$

The first best maximazes the sum of net gains and implies the policies z_1^e, z_2^e, and z_3^e which satisfy the system:

$$g_i^1 (z_1^e, z_2^e, z_3^e) + g_i^2 (z_1^e, z_2^e, z_3^e) + g_i^3 (z_1^e, z_2^e, z_3^e) = 1 \qquad \text{with} \quad i = 1, 2, 3$$

Finally, let us consider the case in which countries 1 and 2 join in a union and decide the policy to maximize the sum of their net gains and playing Nash with country 3. The equilibrium policies z_1^u, z_2^u and z_3^u satisfy the system[16]:

$$g_1^1 (z_1^u, z_2^u, z_3^u) + g_1^2 (z_1^u, z_2^u, z_3^u) = 1$$
$$g_2^1 (z_1^u, z_2^u, z_3^u) + g_2^2 (z_1^u, z_2^u, z_3^u) = 1$$
$$g_3^3 (z_1^u, z_2^u, z_3^u) \backslash = 1$$

I want to investigate how the equilibrium with a union compares with the first best and the decentralized equilibrium and to establish what are the incentives to form the two-countries union, to stay out of it and to join it to form a three countries union. Let us define with U_i^e, U_i^n and U_i^u the utility for country i under first best coordination, decentralized equilibrium and union formation. Incentives to create the union exist only if:

$$\Delta_i \equiv U_i^u - U_i^n > 0 \qquad \text{for} \quad i = 1, 2$$

while the creation of the union is beneficial to the outsider country if and only if $\Delta_3 > 0$. The union can be the first step toward first best coordination if and only if:

$$\Omega_i \equiv U_i^u - U_i^e < 0 \ \forall \ i$$

In the absence of a commitment to adopt the policies decided by the union as a sovranational entity, a one shot game of this general model would not create any

[16] Notice that we are implicitly assuming that differentiated policies can be required for different members of the union. The implementation of such a mechanism would require observability and verificability of the countries' objective functions. AAE (2001a) have assumed out this hypothesis, so that the unions adopt the same policy for each country, which is a political compromise between the different countries' views. The benchmark case is the one in which countries vote on the union policy, but AAE (2001b) and Besley - Coate (2002) discuss in detail different institutional ways in which this compromise can be taken within a given union.

equilibrium union. To sustain a union in this case we need to introduce reputational considerations in an infinite horizon game with common discount factor $\delta \in (0,1)$. For the sake of simplicity, we will focus on trigger strategies – analogous results could be obtained with tit-for-tat strategies or adopting optimal punishment strategies (see Fudenberg - Maskin, 1986). By standard arguments, per period payoffs U_i^k for $i = 1, 2, 3$ and $k = e, u$ are sustainable in subgame perfect equilibrium with trigger strategies if and only if:

$$U_i^k \geq (1 - \delta)\, U_i^{kd} + \delta U_i^n \qquad \text{for } i = 1, 2, 3$$

where U_i^{kd} is the per period payoff for player i when adopting the best uniperiodal deviation from the equilibrium path – assuming that the other countries follow their equilibrium strategies. This condition can be rewritten as:

$$\delta \geq \delta_i^k \equiv \left[\frac{U_i^{kd} - U_i^k}{U_i^{kd} - U_i^n} \right] \quad \text{for } i = 1, 2, 3$$

again with $k = e, u$.

Since there is heterogeneity between countries in the objective function, it can be easier to sustain a union between two homogeneous countries rather than the first best coordination. This is important because it suggests that the main results on equilibrium unions by AAE (2001a) do not completely fail in the absence of their assumption of spillovers just between union members and not with the outsider countries. Despite heterogeneity introduces many interesting issues, some of which just outlined in AAE (2001a), this paper will not provide a general characterization of the creation of unions. This formidable task is left for future research.

What it is relatively easy to do even in a situation with many countries is to characterize the equilibrium outcomes under perfect homogeneity[17]. I will do it in a specific example, which is also a particular case of the specification adopted in AAE (2001a) and AAE (2001b).

[17] Under homogeneity between N countries, an increase in the number of members of the union makes everybody better off and the nature of the equilibrium union depends on a cut-off function $\delta(N)$ – above which a union with N members is sustainable – in a simple way. If countries are patient enough so that some cooperation is possible, cooperation between all countries realizes if $\delta'(N) > 0$, while a union between a smaller set of countries is created in equilibrium if $\delta'(N) < 0$. In this case the equilibrium number of countries N^* would be the greatest integer such that $\delta > \delta(N^*)$. This case provides a rationale for the endogenous creation of unions, which is complementary to the one advanced in AAE (2001a) and based on heterogeneity costs. Notice that multiple equilibria could emerge because of non monotonicity of $\delta(N)$.

IV - A «PROSPER-THY-NEIGHBOR» POLICY WITH «STRATEGIC SUBSTITUIBILITY»

Let us consider a *PTN* policy. For simplicity it is convenient to think of an investment in infrastructures which exerts spillovers abroad. Hence, let us consider the functional form:

$$g^i(z_1, z_2, z_3) = \ln\left(z_i + \beta \sum_{j \neq i} z_j\right) \qquad \text{with } \beta \in (0, 1] \quad \text{for } i = 1, 2, 3$$

where again the parameter β represents the size of the spillovers[18] and the choice variable are constrained to be positive ($z_i \geq 0$). It can be verified that *PTN* holds since the marginal benefit of foreign investment is $g^i_j = \beta / (z_i + \beta \sum_{j \neq i} z_j) > 0$ and *SS* holds since the marginal benefit of domestic investment is $g^i_i = 1 / (z_i + \beta \sum_{j \neq i} z_j) > 0$ and the effect of foreign investment on this is $g^i_{ij} = -\beta \cdot (g^i_i)^2 < 0$. So, a more active foreign policy makes less productive domestic investment and this sustituibility allows the outsider country to free ride and benefit from the union investment while reducing its own investment.

It is immediate to derive the first best investment, $z^e_i = 1$, and the decentralized equilibrium investment, $z^n_i = \dfrac{1}{1 + 2\beta} < z^e_i$, for $i = 1, 2, 3$, which imply the correspondent net gain functions:

$$U^e(\beta) = U_i(1, 1, 1) = \ln(1 + 2\beta) - 1$$

$$U^n(\beta) = U_i[1/(1 + 2\beta), 1/(1 + 2\beta), 1/(1 + 2\beta)] = -\frac{1}{1 + 2\beta}$$

Now let us consider the equilibrium with a union between countries 1 and 2. The union chooses $z^u_1 = z^u_2$ to maximize $\ln[z^u_1(1 + \beta) + \beta z^u_3] - z^u_1$[19], and taking z^u_3 as given, while the outsider country chooses z^u_3 to maximize $\ln[z^u_3 + 2\beta z^u_1] - z^u_3$ taking z^u_1 as given. Solving the system of the two first order conditions and taking into account the non-negativity constraints, we obtain:

[18] I assume a uniform size of spillovers across countries. As a referee has suggested, it would be interesting to study the effects of heterogeneity in this dimension.

[19] Notice that it does not matter if the union is constrained to choose the same investment for both its members or possibly different levels. The symmetry of the model would imply the same level of investment for both countries anyway.

$$z_1^u = z_2^u = \min\left(1, \frac{1}{(1+2\beta)(1-\beta)}\right)$$

$$z_3^u = \max\left(0{,}1 - \frac{2\beta}{(1+2\beta)(1-\beta)}\right)$$

which implies zero investment for the country outside the union whenever $\beta \geq 1/2$ and positive but decreasing in the size of the spillovers for $\beta < 1/2$. Net gains under this environment are $U_i^u(\beta) = U_i(z_1^u, z_2^u, z_3^u)$ or:

$$U_1^u(\beta) = U_2^u(\beta) = \ln(1+\beta) - \min\left(1, \frac{1}{(1+2\beta)(1-\beta)}\right)$$

$$U_3^u(\beta) = \left\{\begin{array}{c} \frac{2\beta}{(1+2\beta)(1-\beta)} - 1 \text{ if } \beta < 1/2 \\ \ln(2\beta) \text{ if } \beta \geq 1/2 \end{array}\right\}$$

We are now ready to provide some results:

RESULT 1. *Under PTN policy with strategic substituibility, the creation of a union increases investment in the countries forming the union and it decreases it in the outsider country.*

Proof. It is immediate to verify that $z^n \leq z_1^u = z_2^u \leq z^e$ and that $z_3^u \leq z^n$. *QED*

RESULT 2. *Under PTN policy with strategic substituibility, the union is created if the spillovers are very weak or very strong.*

Proof. We will prove that the union is created if and only if $\beta \in (0, \beta_1)$ or $\beta \in (\beta_2, 1)$ where $0 < \beta_1 < 1/2 < \beta_2 < 1$. The differences between net gain from creating a union and not creating it is given by the continuous function $\Delta(\beta) \equiv U_1^u(\beta) - U^n(\beta)$, or:

$$\Delta(\beta) = \left\{\begin{array}{c} \ln(1+\beta) - \frac{\beta}{(1+2\beta)(1-\beta)} \text{ if } \beta < 1/2 \\ \ln(1+\beta) - \frac{2\beta}{(1+2\beta)} \text{ if } \geq \beta \geq 1/2 \end{array}\right\}$$

It is easy to check that $\Delta(0) = 0$ with $\Delta'(0) > 0$, $\Delta''(\beta) < 0$ for $\beta < \frac{1}{2}$, $\Delta(\frac{1}{2}) < 0$ with $\Delta_-'(\frac{1}{2}) < 0$, and $\Delta_+'(\frac{1}{2}) < 0$, $\Delta(1) > 0$ with $\Delta'(1) > 0$. Hence there must exist the two cut-offs defined above such that $\Delta(\cdot) > 0$ if and only if β is very low or very high. This is clear from Figure 1. QED

RESULT 3. *Under PTN policy with strategic substituibility, the country outside the union is always better off when the union is created.*

Proof. The differences between net gains for country 3 when a union is created or not is given by the continuous function $\Delta_3(\beta) \equiv U_3^u(\beta) - U^n(\beta)$, or:

$$\Delta_3(\beta) = \frac{1}{1+2\beta} - \left\{1 - \frac{2\beta}{(1+2\beta)(1-\beta)}\right\} \text{ if } \beta < \tfrac{1}{2}$$

$$= \ln(2\beta) + \frac{1}{(1+2\beta)} \text{ if } \beta \geq \tfrac{1}{2}$$

which is always positive and increasing as shown in Figure 1. QED

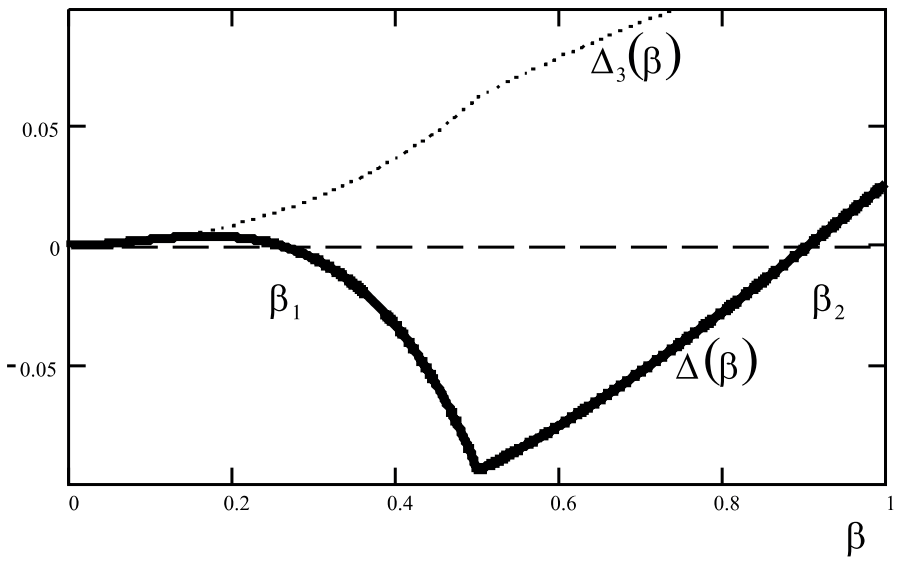

FIG. 1 - Net gains from the Union for insiders and outsiders.

RESULT 4. *Under PTN policy with strategic substituibility, a country prefers to be outside the union instead of inside it.*

Proof. Consider the function:

$$\Phi(\beta) \equiv U_3^u(\beta) - U_1^u(\beta) = \Delta_3(\beta) - \Delta(\beta)$$

or:

$$\Phi(\beta) = \frac{1+\beta}{(1+2\beta)(1-\beta)} - \ln(1+\beta) - 1 \text{ if } \beta < 1/2$$

$$= \ln(2\beta) - \ln(1+\beta) + 1 \text{ if } \beta \geq 1/2$$

It can be easily verified that this function is always positive for $\beta \in (0, 1)$. *QED*

Results 3 and 4 are illustrated in Figure 2, where we show both the net gain from union formation and decentralized equilibrium for the union's members and for the outsider country.

RESULT 5. *Under PTN policy with strategic substituibility, the members of the unions would accept the enlargement of the union to the outsider so as to implement the first best coordination, but the outsider country prefer to remain outside.*

Proof. Consider the difference between net gain for country 3 when a union is formed and first best net gain $\Omega_3(\beta) \equiv U_3^u(\beta) - U^e(\beta)$, or:

$$\Omega_3(\beta) = \frac{2\beta}{(1+2\beta)(1-\beta)} - \ln(1+2\beta) \text{ if } \beta < 1/2$$

$$= \ln(2\beta) - \ln(1+2\beta) + 1 \text{ if } \beta \geq 1/2$$

This is a continuous function which is always positive and increasing. QED

Result 5 is illustrated in Figure 2, where we show the difference between net gain from union formation and first best for the union's members ($\Omega_1(\beta) = \Omega_2(\beta) \equiv \Omega(\beta)$) and for the outsider country ($\Omega_3(\beta)$). While the former is negative and decreasing in the spillovers, the latter is positive and increasing in the spillovers.

4.1. *Intuitions*

In this example we obtained some counterintuitive results. We will now try to capture their intuitions and to understand what they depend on. First of all, the countries forming the union are going to internalize the spillovers created by their choices on each other and this induces an increase in their investment, toward the first best level: in our model, *the rationale for union formation is to internalize intercountry spillovers*. However Result 1 tells us that this internalization effect induces a reduction of investment from the outsider country. In other words, *the union increases free riding by outsider countries and the internalization effect is partially crowded out*. The point is that *when the policies are strategic substitutes the internalization effect of unions is dampened*, but, as we will see, if the policies are strategic complements it is multiplied: this result teaches us that the benefits created by a union for its members are larger if the scope of the union is a policy characterized by strategic complementarities between countries.

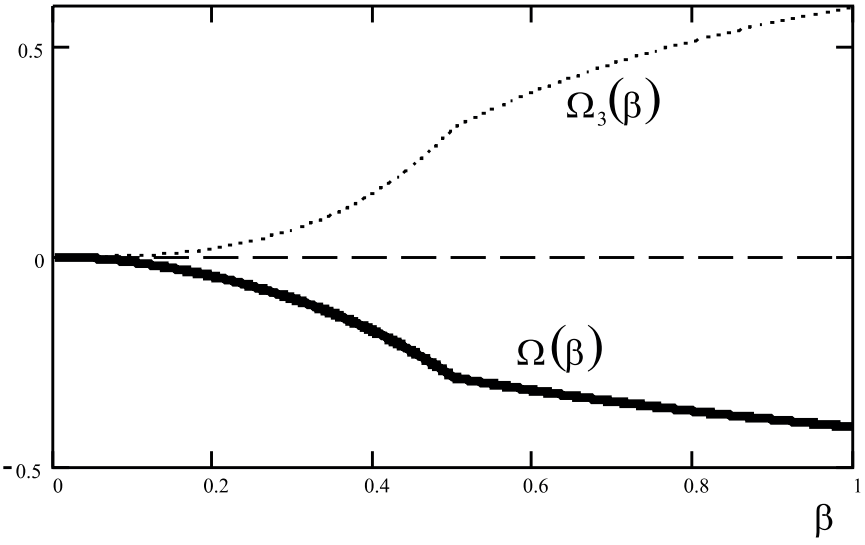

FIG. 2 - Difference between Union and First Best utility.

The second implication of our example is quite counterintuitive. One may think that higher spillovers would induce higher incentives to create a union (as, for instance, in AAE, 2001a, or in Besley - Coate, 2002). Instead, according to Result 2, the union members agree on the creation of the union only when international spillovers are very weak or very strong. This non monotonic result is the fruit of two effects going on. On one side the internalization effect is increasingly important when spillovers raise, but on the other side free riding by the outsider country is also higher. Indeed the inve-

stment of the outsider country decreases in the spillovers and only for very low spillovers it is high enough that the positive internalization effect induced by the union is not compensated by the outsider free-riding. Finally, investment by the outsider country cannot be negative and it is zero for very high spillovers: in this case any benefit from the outsider country is lost in the union; nevertheless, when spillovers are very high, the internalization effect more than compensates the complete free-riding of the outsider country. The bottom line is that *the gains from a union may change non monotonically when interdependence between countries increases*.

When a union is created, its members internalize their spillovers and increase their investment, hence it is not surprising that the outsider country is better off – also when the union members are worse off – as Result 3 establishes. However, what is more surprising is Result 4, according to which the outsider country gains always more than the union's members from the creation of the union. When some countries coordinate their policies, they partially give up to their free-riding chances and increase those of the other country. *The outsider country benefits both from the loss of independence of the members of the union and from its own increased free-riding possibilities.* This outcome has important implications if we think about the strategic decision to create a union. Even if everybody is better off when the union is created, all countries would like to be the outsiders: *a status quo bias may imply resistence to the creation of unions which are Pareto-efficient*.

Our last result is also more surprising. According to Result 5, the outsider country is better off in the equilibrium with a union than in the first best world. Obviously this implies that the union's members must be worse off than in the first best world. We may call this paradoxical result as the *union member's curse*. The main implication is that *a gradual approach to international policy coordination may be unfeasible, not because of resistence of unions to enlarge, but because of resistence of outsider countries to enter in them.*

4.2. *The repeated game*

Until now we have implicitly assumed that the members of the union could commit to implement the union policy. Obviously, without such a commitment the creation of the union would be impossible. In many policy issues, like trade policy or monetary policy, the lack of commitment is a serious issue. A well known solution to the problem raises when interaction between countries are repeated. The folk theorem tells us that some level of cooperation can be sustainable in subgame perfect equilibrium when the players are patient enough and the horizont is infinite – or finite with some probability of a future in each period. Building on this reputational argument, we will try to answer to a more subtle question: is it easier to sustain the efficient international policy coordination or the partial coordination with the union? As long as the latter can be sustained in equilibrium when the former cannot, we have a new rationalization for unions as instruments of policy coordination.

Let us consider an infinite horizon game where the stage game is the one described in the previous section and all countries have the common discount factor $\delta \in (0,1)$. For the sake of simplicity, we will focus on trigger strategies – analogous results could be obtained with tit for tat strategies or more robust equilibrium concepts.

By standard arguments, per period payoffs $U_i^k(\beta)$ for $i = 1, 2, 3$ are sustainable in subgame perfect equilibrium with trigger strategies if and only if for all countries:

$$U_i^k(\beta) \geq (1-\delta)\, U_i^{kd}(\beta) + \delta U^n(\beta)$$

where $U_i^{kd}(\beta)$ is the per period payoff for player i when adopting the best uniperiodal deviation from the equilibrium path – assuming that the other countries follow their equilibrium strategies. This condition can be rewritten as:

$$\delta \geq \left[\frac{U_i^{kd}(\beta) - U_i^k(\beta)}{U_i^d(\beta) - U^n(\beta)}\right]$$

First of all, we will check under which conditions the efficient solution for international policy coordination is sustainable. In this case, set $U_i^k(\beta) = U^e(\beta)$. Since on the equilibrium path all countries are investing $z_i^e = 1$, the best deviation is:

$$z = \arg\max \{\ln(z + 2\beta) - z\} = \max(0, 1 - 2\beta)$$

which implies the net gain:

$$U^{ed}(\beta) = \begin{Bmatrix} -(1-2\beta) \text{ if } \beta < \frac{1}{2} \\ \ln(2\beta) \text{ if } \beta \geq \frac{1}{2} \end{Bmatrix}$$

It follows that efficiency is sustainable if:

$$\delta \geq \delta^e(\beta) \equiv \left\{ \begin{bmatrix} \dfrac{2\beta - \ln(1+2\beta)}{\ln 2\beta + \dfrac{1}{1+2\beta}} \text{ if } \beta < \frac{1}{2} \\ \dfrac{\ln 2\beta + 1 - \ln(1+2\beta)}{\ln 2\beta + \dfrac{1}{1+2\beta}} \text{ if } \beta \geq \frac{1}{2} \end{bmatrix} \right\}$$

It can be verified that $\delta^e(\beta) \in [0.5, 0.62)$, and it is a U inverted function of the spillover parameter β, as shown in Figure 3.

Let us now consider the sustainability of the union. In this case we just need to check that none of its members would like to deviate – the outsider has nothing to

deviate from. Given the equilibrium strategies z_1^u, z_2^u and z_3^u, a deviating member would invest:

$$z = \left\{ \begin{array}{c} \arg\max \left\{ \ln \left[z + \beta + \dfrac{\beta\,(1-2\beta)}{(1+2\beta)\,(1-\beta)} \right] - z \right\} = 1 - \beta - \dfrac{\beta\,(1-2\beta)}{(1+2\beta)\,(1-\beta)} \text{ if } \beta < 1/2 \\ \arg\max \left[\ln (z+\beta) - z \right] = 1 - \beta \text{ if } \beta \geq 1/2 \end{array} \right\}$$

which provides the net gain:

$$U^{ud}(\beta) = \left\{ \begin{array}{c} \beta + \dfrac{\beta\,(1+2\beta)}{(1+2\beta)\,(1-\beta)} - 1 \text{ if } \beta < 1/2 \\ \beta - 1 \text{ if } \beta \geq 1/2 \end{array} \right\}$$

It follows that the union is sustainable if and only if:

$$\delta \geq \delta^u(\beta) \equiv \left\{ \begin{array}{c} \dfrac{[\beta - \ln(1+\beta)]\,(1+2\beta)\,(1-\beta)}{\beta^2\,(1-2\beta)} \text{ if } \beta < 1/2 \\ \dfrac{[\beta - \ln(1+\beta)]\,(1+2\beta)}{\beta(2\beta-1)} \text{ if } \beta \geq 1/2 \end{array} \right\}$$

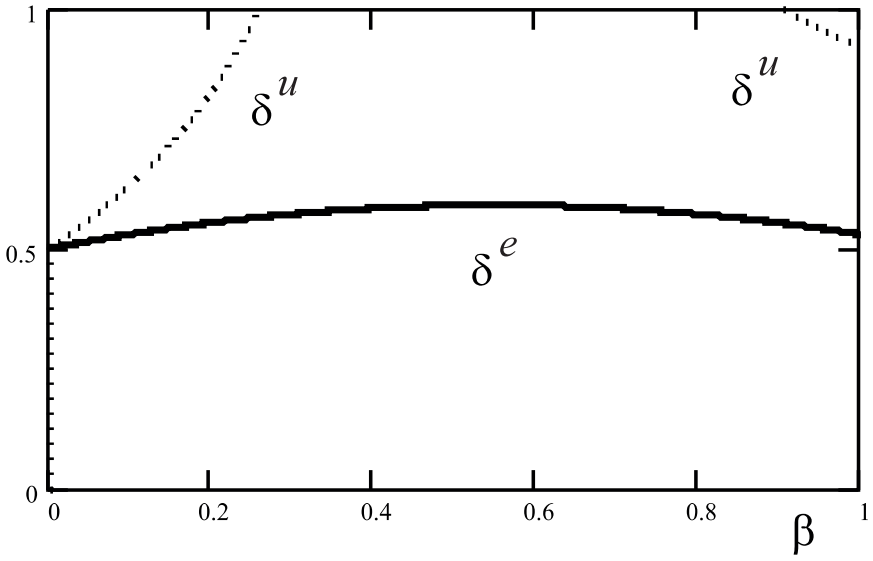

FIG. 3 - Sustainability of the Union vs First Best.

It can be verified that belongs to the unit interval only for very low or very high values of the spillover parameter: even if the gains from the deviation are lower for members of a two country union than for those of a world union, the all gains from the cooperation are quite small with respect to the decentralized equilibrium. Hence, as shown in Figure 3, the union is always more difficult to sustain than the efficient allocation in this example:

RESULT 6. *Under PTN policy with strategic substituibility, there are no discount factors for which in a infinite horizon game, the first best policy coordination is not sustainable, but a two country union is sustainable.*

V - A «BEGGAR-THY-NEIGHBOR» POLICY WITH «STRATEGIC COMPLEMENTARITY»

If we take our previous model with $\beta \equiv -\omega \in (-0.5,\ 0)$ we obtain a stylized model of *BTN* policy with strategic complementarity. In other words we assume the functional form:

$$g^i(z_1, z_2, z_3) = \ln\left(z_i - \omega \sum_{j \neq i} z_j\right) \quad \text{with } \omega \in [\,0,0.5) \quad \text{for } i = 1, 2, 3$$

To check that *BTN* holds, notice that $g^i_j = -\omega/(z_i - \omega \sum_{j \neq i} z_j) < 0$, while *SC* holds since $g^i_i = 1/(z_i - \omega \sum_{j \neq i} z_j) > 0$ and the cross effect is $g^i_{ij} = \omega \cdot (g^i_i)^2 > 0$.

In this case, $z^e_i = 1$, $z^n_i = \dfrac{1}{1-2\omega} > z^e_i$, for $i = 1,2,3$, which imply the correspondent net gain functions:

$$U^e(\omega) = U_i(1, 1, 1) = \ln(1 - 2\omega) - 1$$

$$U^n(\omega) = U_i[1/(1 - 2\omega), 1/(1 - 2\omega), 1/(1 - 2\omega)] = -\frac{1}{1 - 2\omega}$$

Now let us consider the equilibrium with a union between countries 1 and 2. Solving the related system we obtain:

$$z^u_3 = \frac{1 + \omega - 2\omega^2}{(1 - 2\omega)(1 + \omega)} > z^u_1 = z^u_2 = \frac{1}{(1 - 2\omega)(1 + \omega)}$$

Net gains under this environment are $U^{iu}(\omega) = U^i(z^u_1, z^u_2, z^u_3)$ or:

$$U_1^u(\omega) = U_2^u(\omega) = \ln(1-\omega) - \frac{1}{(1-2\omega)(1+\omega)}$$

$$U_3^u(\omega) = -\frac{1+\omega-2\omega^2}{(1-2\omega)(1+\omega)}$$

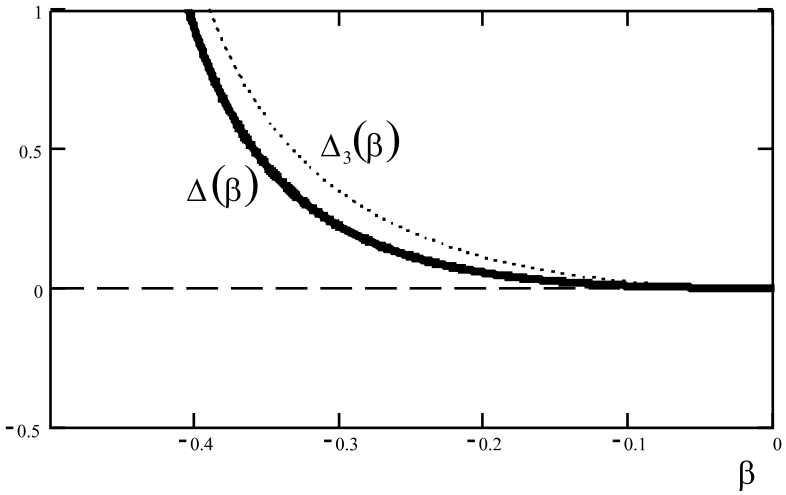

FIG. 4 - Net gains from a Union for Insiders and Outsiders.

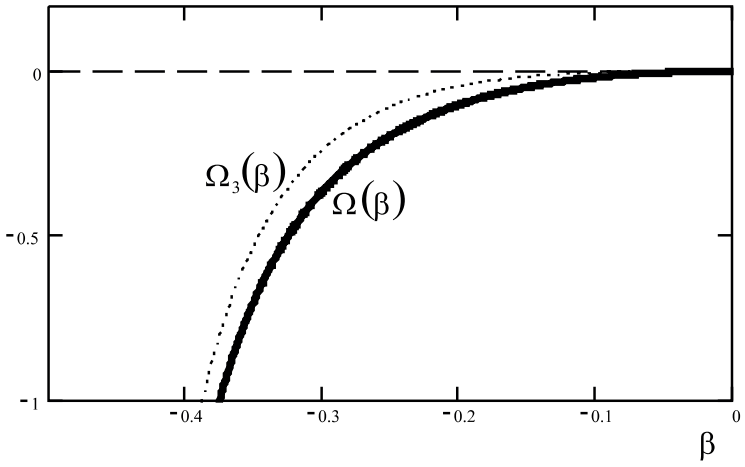

FIG. 5 - Difference between Union and First Best Utility.

Much of our previous result are changed because the policy under consideration exhibits strategic complementarity. In particular the union brings toward efficiency the policies of all countries:

RESULT 1'. *Under BTN policy with strategic complementarity, the creation of a union brings toward efficiency the policies of all countries.*

This is immediate since:

$$z_i^n = \frac{1}{1-2\omega} > z_3^u = \frac{1+\omega-2\omega^2}{(1-2\omega)(1+\omega)} > z_1^u = z_2^u$$

RESULT 2'. *Under BTN policy with strategic complementarity, the union is always created.*

RESULT 3'. *Under BTN policy with strategic complementarity, the country outside the union is always better off when the union is created.*

RESULT 4'. *Under BTN policy with strategic complementarity, a country prefers to be outside the union instead of inside it.*

Hence the union makes better off all countries, as Figure 4 shows. Every country still prefers to be outside the union instead of inside it.

RESULT 5'. *Under BTN policy with strategic complementarity, the members of the unions and the outsider would accept the enlargement of the union to the outsider so as to implement the first best coordination.*

5.1. *Intuitions*

In presence of strategic complementarities, as already shown, the creation of unions induces a shift of all the policies toward the first best, so that the benefit of a union between two countries are multiplied by the benefits of a smaller free riding of the outsider country. This implies that both the members of the union and the outsider country are better off when the union is created. Nevertheless, exactly as in the case of strategic substituibility, in this ex-ante-symmetric situation, it is better to be the outsider country rather than one of the members.

This result is not surprising since it is always due to the individual benefit of free riding when the others cooperate. The last result is however interesting, because it shows that gradualism is a feasible way toward international policy coordination under strategic complementariety of the policies: In this case, starting from an equilibrium with a union of two countries, the enlargment to the outsider would be accepted and it would be in the interest of the latter to enter in the union so as to implement the first best coordination: this result is shown in Figure 5.

5.2. *The repeated game*

Let us now consider the repeated game. Since on the efficient equilibrium path all countries are investing $z_i^e = 1$, the best deviation is:

$$z = \arg\max \left\{ \ln (z - 2\omega) - z \right\} = 1 + 2\omega$$

which implies the net gain:

$$U^{ed}(\omega) = -(1 + 2\omega)$$

It follows that efficiency is sustainable if and only if:

$$\delta \geq \delta^e(\omega) \equiv \frac{(1 - 2\omega)\left[-\ln(1 - 2\omega) - 2\omega\right]}{4\omega^2}$$

Let us now consider the sustainability of the union. In this case we just need to check that none of its members would like to deviate – the outsider has nothing to deviate from. Given the equilibrium strategies z_1^u, z_2^u and z_3^u, a deviating member would invest:

$$z = \left\{ \arg\max \left[\ln \left(z - \omega \frac{2 + \omega - 2\omega^2}{1 - \omega - 2\omega^2} \right) - z \right] = 1 + \omega \frac{2 + \omega - 2\omega^2}{1 - \omega - 2\omega^2} \right\}$$

which provides the net gain:

$$U^{ud}(\omega) = -1 - \omega \frac{2 + \omega - 2\omega^2}{1 - \omega - 2\omega^2}$$

It follows that the union is sustainable if:

$$\delta \geq \delta^u(\omega) \equiv \frac{(1 - 2\omega)\left[-\ln(1 - \omega) - \omega\right]}{\omega^2 (1 + 2\omega)}$$

Figure 6 illustrates the situation of this example, and motivates:

RESULT 6'. *Under BTN policy with strategic complementarity, there are always discount factors for which in a infinite horizon game, the first best policy coordination is not sustainable, but a two country union is sustainable.*

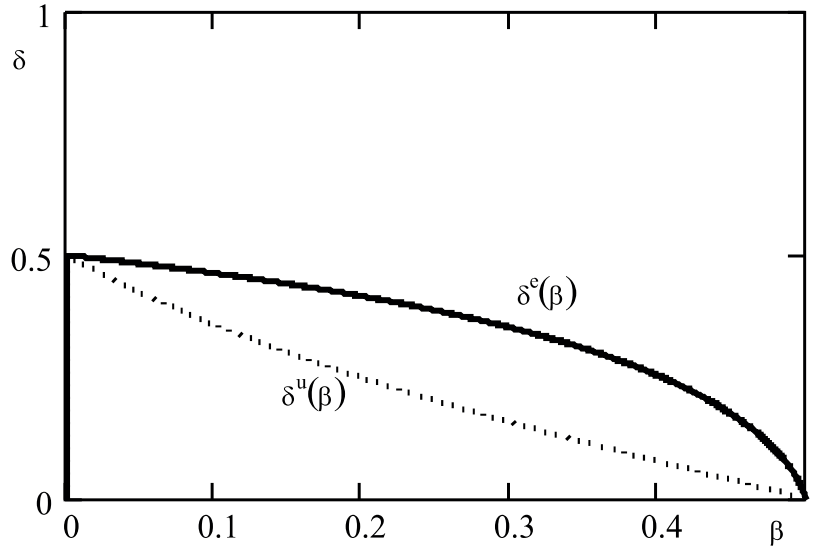

FIG. 6 - Sustainability of Union vs First Best.

In this case, strategic complementarities give rise to a new reason for union creation: the union is easier to sustain than the first best coordination, because it reduces incentives to deviate from the cooperative equilibrium. Hence, this model allows to rationalize the creation of small size unions even in absence of heterogeneity, that is when there are not political costs of adopting the first best coordination. This rationale for union creation is complementary to the one studied in AAE (2001a) and based on the trade-off between heterogeneity costs and benefits from coordination.

VI - CONCLUSION

In this paper we have discussed some theoretical rationales for the creation of international unions and the coordination of economic policy with intercountry spillovers. These rationales should be seen as complementary to those advanced in AAE (2001a) and AAE (2001b) in a related investigation. In my examples, I have shown that a union is more likely to emerge when policies are characterized by strategic complementariety: in this case, the creation of a union unambiguously moves the equilibrium

toward the first best because it reduces the scope for free riding of the outsiders. Under strategic substituibility of the policies, the union may even be unfeasible because it would excessively increase the free riding of the outsider countries. Moreover, I have shown the possibility that some paradoxical results may emerge: for instance, the outsider countries may be better off than the countries joining the union and they may also have no incentives to join the union in a second stage so that a gradualist way toward first best coordination is unfeasible.

More theoretical investigation on the endogenous formation of unions in a multicountry setting seems necessary. In the case of monetary policy, this issue seems quite relevant to understand the recent forces driving toward dollarization and the creation of currency unions. In the case of trade policy, the formation of trade blocks (like European Community, NAFTA, Mercosur, Pacific Free Trade Area) seems to be a quite consolidated process in search for convincing explanations. Modeling trade blocks in the way suggested in this paper may be particularly interesting because of the possibility of country-specific policies (which makes much richer the interdependence between union members and outsiders). A departure from the traditional two country models to explore this issue in a multicountry framework seems to be a fruitful line of research.

As we have suggested in this paper, whether these policies are characterized by strategic complementarity or substituibility is a crucial issue in understanding international policy coordination. Both possibilities can emerge from microfounded theoretical models of monetary and trade policy, hence to discriminate between strategic complementariety and substituibility of monetary and trade policy remains an important empirical issue which should be addressed in future research.

Finally, it would be interesting to study the relationship between the creation of unions and the creation of countries to rationalize the apparent existence of complementarities between the ongoing processes of break up of nations and creation of supranational unions. Alesina and Spolaore (1997) have started the literature on the equilibrium generation of countries in a word with heterogeneous preferences of the citizens and scale economies in the production of public goods, taking as given the latter. In Etro (2002), I have extended the model by endogenizing the political choice on the production of public goods, and hence on the necessary national taxation, at the country level. In both cases, an increase in the international spillovers induces an increase in the equilibrium number of nations (possibly associated with more taxation). As long as more international spillovers are also associated with higher incentives to create international unions, the two phenomena may have interesting complementarities.

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