

International Policy Coordination with Economic Unions

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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 within some examples of policies which create spillovers between countries. A union is more likely to emerge when policies are characterized by strategic complementarity: 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 substitutability of the policies, the union may even be unfeasible because it would excessively increase the free riding of the outsider countries. 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.

1 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 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 (2001,a, AAE hence on)¹, 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

¹Related political economy investigations of the creation of unions of countries are studied by Besley and Coate (2000) and Brou and Ruta (2001).

independent policymaking endogenously determines the size and the composition of unions. 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.

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 paradigm is still prevailing (see Alesina and Barro, 2002)

The second criticism to the argument by AAE (2001,a) 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. We imagine a world where national policies induce spillovers on all the other countries in the same way if they are independent or they belong to a union. 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, we 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. We show that the same trade-off found out in AAE (2001,a), 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.

We 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,² 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, we show that *a union is more likely to emerge when policies are characterized by strategic complementarity: in this*

²See Cooper and John (1988).

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 substitutability of the policies, the union may even be unfeasible because it would excessively increase the free riding of the outsider countries. Despite it is difficult to argue which actual policies are characterized by strategic complementarity or substitutability in the real world, and examples in either directions are available for monetary and trade policy - which are the main focus of international unions -, this classification seems relevant for an understanding of international policy coordination.

Moreover, we 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 we believe that a more systematic investigation of the equilibrium determination of unions in a multicountry world would deserve more attention in the future.

The paper is organised as follows. Section 2 introduces the general model. Section 3 solves it in an example of prosper-thy-neighbor policy and section 4 does the same for an example of beggar-thy-neighbor policy. Section 5 discusses the results and it draws the conclusions.

2 The Model

The simplest context in which coordination of economic policies and creation of economic unions between countries can be studied is a three countries world. Suppose that each country $i = 1, 2, 3$ can implement a policy by choosing the variable z_i . The benefits of the policy depend also on the choices of the other countries according to the function $g^i(z_1, z_2, z_3)$ with $g_i^i \equiv \partial g^i / \partial z_i > 0$ and $g_{ii}^i < 0$. 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:

$$U_i(z_1, z_2, z_3) = g^i(z_1, z_2, z_3) - z_i$$

We will consider two kind of economic policies:³

Prosper-Thy-Neighbor (HTN) Policies: $g_j^i > 0$ and $g_{jj}^i < 0$ for any $i \neq j$.

Beggar-Thy-Neighbor (BTN) Policies: $g_j^i < 0$ and $g_{jj}^i > 0$ 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 both keynesian and neoclassical models.⁴ In the class of BTN policies we can think of strategic trade policy - domestic protectionism is welfare

³The expression Beggar-Thy-Neighbor is quite known and was introduced by Robinson (1937); the expression Prosper-Thy-Neighbor is borrowed by Corsetti and Pesenti (2001).

⁴For a strategic analysis on international fiscal policy see, for instance, Turnovsky (1997, Ch. 8).

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 country⁵ - and international capital income taxation.⁶ The cases of monetary and exchange rate policies are more debatable. According to traditional theories monetary expansions and devaluations are the typical BTN policies,⁷ but more recent theories claim the possibility of complementary components in these interventions.⁸ Concerning defense policy, it is clear that defense is a PTN policy toward allied countries and a BTN policy toward enemies.⁹

We will discuss separately the two kind of policies. However, in both cases the decentralized equilibrium, the first best and the equilibrium when two countries join in a union are characterized from the same systems of equations.

⁵See Johnson (1953-4) and Rodriguez (1974) on traditional models, Brander and Spencer (1984, 1985), Eaton and Grossman (1986), Helpman and Krugman (1989) on new trade theories, and Bagwell and Staiger (1999, 2001) for a more general model on strategic trade theory. See Wong (1995, Ch.12) for a survey.

⁶The classic reference is Hamada (1966).

⁷For a strategic analysis on international monetary policy see the classic paper by Hamada (1976) and the survey by Persson and Tabellini (2000, Ch.18) on the more recent literature.

⁸In particular see Obstfeld and Rogoff (1995) and Barro and Tenreyro (2000). Corsetti and Pesenti (2001) give the most updated discussion and show the possibility of a “Beggart-Thy-Self” monetary expansion in this class of models!

On currency unions see the classic reference Mundell (1961) and, for a more recent approach, Alesina and Grilli (1991) and Alesina and Barro (2001, 2002).

⁹For a recent investigation in this environment see Spolaore (2000).

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

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

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

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

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:¹⁰

$$\begin{aligned} g_1^1(z_1^u, z_2^u, z_3^u) + g_1^2(z_1^u, z_2^u, z_3^u) &= 1 \\ g_2^1(z_1^u, z_2^u, z_3^u) + g_2^2(z_1^u, z_2^u, z_3^u) &= 1 \\ g_3^3(z_1^u, z_2^u, z_3^u) &= 1 \end{aligned}$$

We 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

¹⁰Notice 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 verifiability of the countries' objective functions. AAE (2001,a) 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 (2001,b) and Besley and Coate (2000) discuss in detail different institutional ways in which this compromise can be taken within a given union.

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:

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

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

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

It is clear that heterogeneity in preferences has the same role in favor of union creation as in AAE (2001,a). However, in absence of a commitment to adopt the policies decided by the union as a sovranational entity, a one shot game of this general model, no union would be created! 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 and 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:

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

where U_i^{kd} is the per period payoff for player i when adopting the best uniperi-

odal deviation from the equilibrium path - assuming that the other countries follow their equilibrium strategies. This condition can be rewritten as:

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

Heterogeneity between countries can make easier to sustain a union between two countries with contiguous preferences than the first best coordination. This is important because it tells us that the main results on equilibrium unions by AAE (2001,a) do not completely fail in the absence of their assumption of spillovers just between union members and not with the outsider countries.

Moreover, as long as an increase in the number of members of the union makes everybody better off (which is true if heterogeneity is small enough), 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.¹¹ 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 (2001,a) and based on heterogeneity costs. Notice that multiple equilibria could emerge because of non monotonicity of $\delta(N)$.

The features of the union and the conditions under which it is sustainable depend not only on the kind of policy we examine - if PTN or BTN - but also

¹¹Notice that this argument generalizes to more than three countries.

on the kind of interdependence between countries' policies. In particular it is crucial the distinction between:

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

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

To advance in our understanding of dynamic unions, we will now assume extreme homogeneity between countries with $g_i(\cdot) = g(\cdot)$ for all i .¹² It is easy to show that under SS, the policy chosen by the union members move toward efficiency, but the outsider's policy moves in 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 SC, 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.*

This paper will not provide a general characterization of the issue at hand. This formidable task is left for future research. What we are able to do is to

¹²Notice that in AAE (2001,a) the trade-off between heterogeneity of political preferences and internalization of spillovers determines endogenously the equilibrium size of a union, which, by the way, is typically smaller than the optimal one. In that model there are not spillovers from countries outside the union. We could put together the two issues in a more realistic model, but we prefer to separate the two issues. AAE (2001,a) focuses on the trade off between costs of heterogeneity and benefits from spillovers, this paper focuses on costs of outsiders' free-riding and benefits from internalization of externalities.

characterize the equilibrium outcomes in the case of a specific example in which all the three countries share a same objective function:

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

and to derive some interesting conclusions from this example.

3 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. Consider the functional form:

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

It can be verified that PTN holds since the marginal benefit of foreign investment is $g_j^i(z_1, z_2, z_3) = \beta / (z_i + \beta \sum_{j \neq i} z_j) > 0$ and SS holds since the marginal benefit of domestic investment is $g_i^i(z_1, z_2, z_3) = 1 / (z_i + \beta \sum_{j \neq i} z_j) > 0$ and the effect of foreign investment on this is $g_{ij}^i(z_1, z_2, z_3) = -\beta \cdot (g_i^i)^2 < 0$. So, a more active foreign policy makes less productive domestic investment and this substituibility 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, $z_i^e = 1$, and the decentralized equilibrium investment, $z_i^n = \frac{1}{1+2\beta} < z_i^e$, 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 2.¹³

Solving the related system we obtain:

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

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

which implies zero investment from 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:

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

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

We are now ready to provide some results:

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

¹³Notice 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.

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 substitubility, the union is created if and only if 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:

$$\Delta(\beta) = \begin{cases} \ln(1 + \beta) - \frac{\beta}{(1+2\beta)(1-\beta)} & \text{if } \beta < 1/2 \\ \ln(1 + \beta) - \frac{2\beta}{(1+2\beta)} & \text{if } \beta \geq 1/2 \end{cases}$$

It is easy to check that $\Delta(0) = 0$ with $\Delta'(0) > 0$, $\Delta''(\beta) < 0$ for $\beta < 1/2$, $\Delta(1/2) < 0$ with $\Delta'_-(1/2) < 0$ and $\Delta'_+(1/2) > 0$, $\Delta(1) > 0$ 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 substitubility, 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:

$$\begin{aligned} \Delta_3(\beta) &= \frac{1}{1+2\beta} - \left(1 - \frac{\beta}{(1+2\beta)(1-\beta)}\right) & \text{if } \beta < 1/2 \\ &= \ln(2\beta) + \frac{1}{(1+2\beta)} & \text{if } \beta \geq 1/2 \end{aligned}$$

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

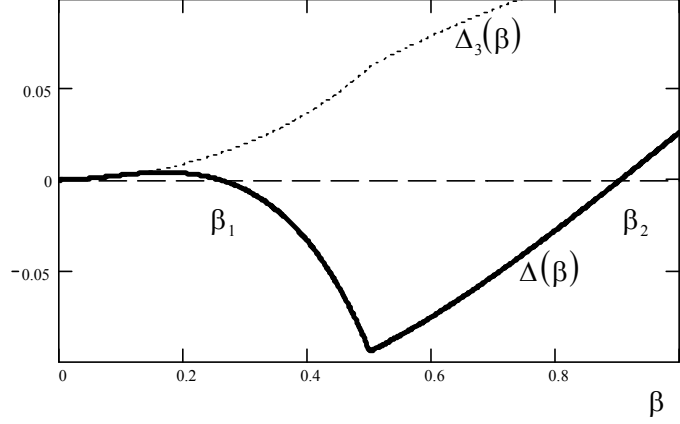


Figure 1. Net gains from the Union for insiders and outsiders

Result 4. Under PTN policy with strategic substitubility, 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:

$$\begin{aligned} \Phi(\beta) &= \frac{1 + \beta}{(1 + 2\beta)(1 - \beta)} - \ln(1 + \beta) - 1 \text{ if } \beta < 1/2 \\ &= \ln(2\beta) - \ln(1 + \beta) + 1 \text{ if } \beta \geq 1/2 \end{aligned}$$

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 substitubility, a country outside a union does not want to join it to form a three country union and implement the first best coordination.

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:

$$\begin{aligned}\Omega_3(\beta) &= \frac{2\beta}{(1+2\beta)(1-\beta)} - \ln(1+2\beta) \text{ if } \beta < 1/2 \\ &= \ln(2\beta) - \ln(1+2\beta) + 1 \text{ if } \beta \geq 1/2\end{aligned}$$

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.

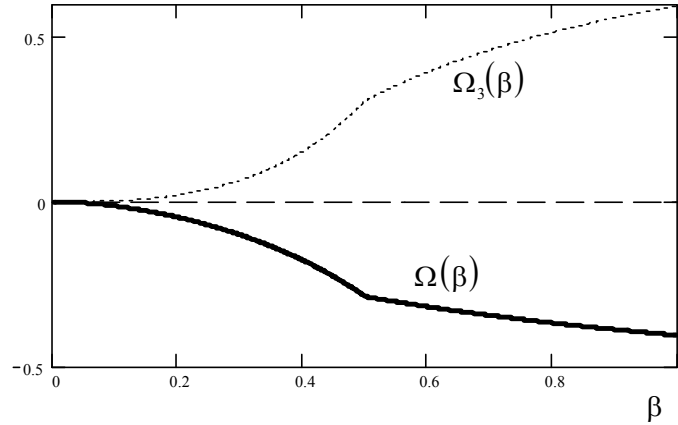


Figure 2. Difference between Union and First Best utility

3.1 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.

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, 2001,a or in Besley and Coate, 2000). 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 investment 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 resistance 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 resistance of unions to enlarge, but because of resistance of outsider countries to enter in them.*

3.2 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 arises 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 horizon 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:

$$U^{ed}(\beta) = \left\{ \begin{array}{ll} -(1 - 2\beta) & \text{if } \beta < 1/2 \\ \ln(2\beta) & \text{if } \beta \geq 1/2 \end{array} \right\}$$

It follows that efficiency is sustainable iff:

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

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:

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

which provides the net gain:

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

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

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

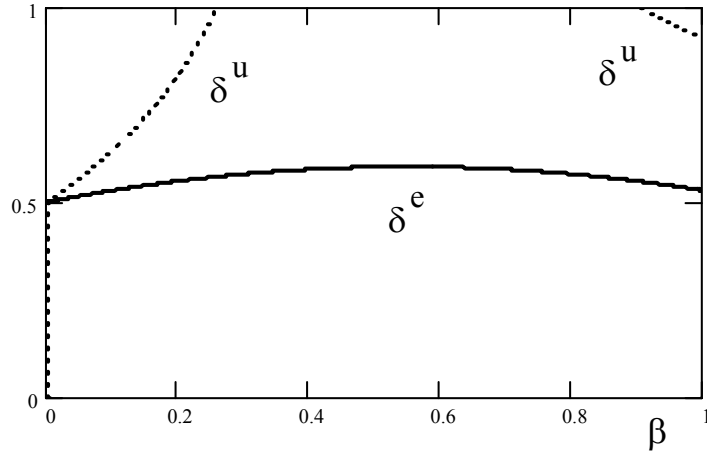


Figure 3. Sustainability of the Union vs First Best

It can be verified that $\delta^u(\beta)$ 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 substitutability, 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.

4 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:

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

To check that BTN holds, notice that $g_j^i(z_1, z_2, z_3) = -\omega / \left(z_i - \omega \sum_{j \neq i} z_j \right) < 0$, while SC holds since $g_i^i(z_1, z_2, z_3) = 1 / \left(z_i - \omega \sum_{j \neq i} z_j \right) > 0$ and the cross effect is $g_{ij}^i(z_1, z_2, z_3) = \omega \cdot (g_i^i)^2 > 0$.

In this case, $z_i^e = 1$, $z_i^n = \frac{1}{1-2\omega} > z_i^e$, 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:

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

Net gains under this environment are $U^{iu}(\omega) = U^i(z_1^u, z_2^u, z_3^u)$ or:

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

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

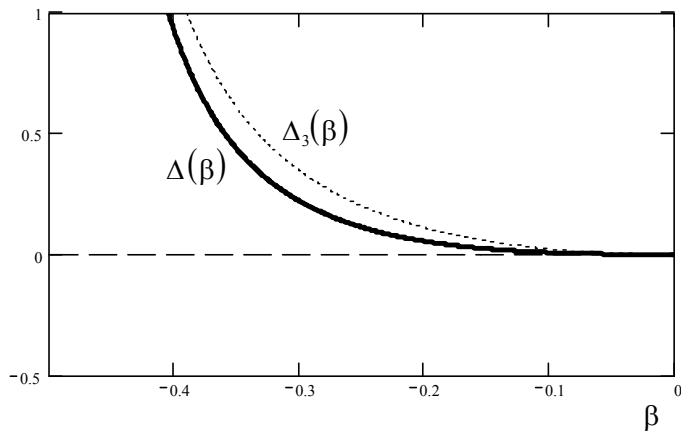


Figure 4. Net gains from a Union for insiders and outsider

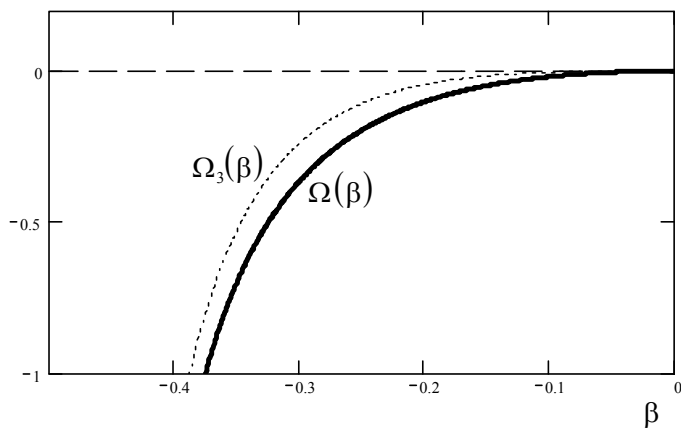


Figure 5. Difference between Union and First Best utility

Much of our previous result are changed because the policy under considera-

tion 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, a country outside a union always wants to join it to form a three country union and implement the first best coordination, and the union's members agree.

Now all countries would prefer to enlarge the union to the outsider so as to achieve the first best: this result is shown in figure 5. In this case gradualism is a feasible way toward international policy coordination.

4.1 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:

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

which implies the net gain:

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

It follows that efficiency is sustainable if and only if:

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

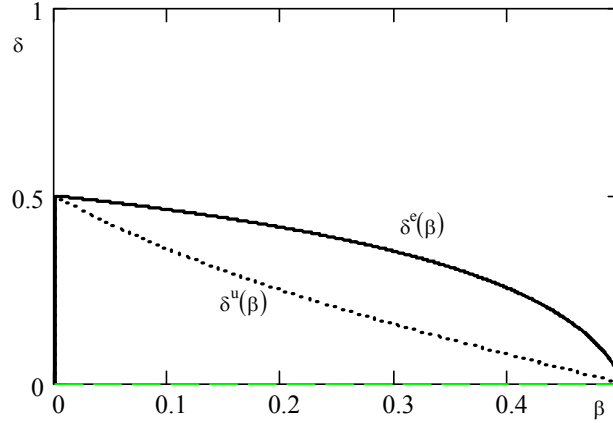


Figure 6. Sustainability of Union vs First best

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 iff:

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

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.

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 (2001,a) and based on the trade-off between heterogeneity costs and benefits from coordination.

5 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 Alesina, Angeloni and Etro (2001,a,b) in a related investigation. I have shown that a union is more likely to emerge when policies are characterized by strategic complementarity: 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 substitutability 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 substitutability is a crucial issue in understanding international policy coordination. Both possibilities can emerge from micro-founded theoretical models of monetary and trade policy, hence to discriminate between strategic complementarity and substitutability of monetary and trade policy remains an important empirical issue which should be addressed in future research.

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