NBER WORKING PAPER SERIES

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Alberto Alesina
Ignazio Angeloni
Federico Etro

Working Paper 8645
http://www.nber.org/papers/w8645

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
Cambridge, MA 02138
December 2001

We thank Robert Barro, Massimo Bordignon, Francesco Caselli, Chris Foote, Karina Firme, Greg Mankiw, David Laibson and participants in seminars at the Center for Financial Studies, University of Frankfurt, Catholic University of Milan and Harvard University for useful comments. Alesina gratefully acknowledges financial support from the NSF through the NBER. Etro is grateful to Robert Barro for encouragement and support and acknowledges financial support from Fondazione Luigi Einaudi. The views expressed herein are those of the authors and not necessarily those of the National Bureau of Economic Research or the affiliating institutions.

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NBER Working Paper No. 8645
December 2001
JEL No. F2, F42, H73, P16

ABSTRACT

We model an international union as a group of countries deciding together the provision of certain public goods and policies because of spillovers. The countries are heterogeneous either in preferences and/or in economic fundamentals. The trade off between the benefits of coordination and the loss of independent policymaking endogenously determines the size, the composition and the scope of unions. Our model implies that the equilibrium size of the union is inversely related to the degree of heterogeneity between countries and to the spectrum of common policies. Hence, there is a trade off between enlargement and deepening of coordination: a union involved in too many collateral activities will be favored by few countries, while a union which focuses on a core of activities will be favored by many countries. However the political equilibrium implies a bias toward excessive centralization and small size of the union. This bias can be corrected if there is a constitutional commitment of the union to centralize only certain policies.

Alberto Alesina
Department of Economics
Harvard University
Cambridge, MA 02138
and NBER
aalesina@harvard.edu

Ignazio Angeloni
European Central Bank
Frankfurt am Main
ignazio.angeloni@ecb.int

Federico Etro
Department of Economics
Harvard University
Cambridge, MA 02138
and NBER
fetro@nber.org

1 Introduction

Historically, the nation state concentrated most of the authority in every policy domain. In recent decades, however, we observe a more complex picture characterized by two phenomena: first, the demand for more autonomy (if not secession) at a *sub*national level; second, the creation or strengthening, at the *supra*national level, of country unions whihc assume certain policy prerogatives and harmonize them across the whole membership.

The increasing integration of the world economy is (at least in part) responsible for both developments. On the one hand, as argued by Alesina, Spolaore and Wacziarg (2000), in an integrated world economy small countries can prosper because their market is the world. On the other hand the increasing integration leads to more spillovers, externalities, need for policy coordination and, in more extreme cases, supernational jurisdictions. Examples include regional trade agreements like Mercosur or Nafta, Currency unions like the French Franc zone, military alliances, like NATO. Other examples of unions include associations of countries with broader mandates like WTO or the UN. The most striking example is perhaps the European Union which, especially after the Maastricht Treaty, has substantially broadened its supranational mandate. An important political debate is now mounting in Europe on what the functions of the Union should be, and where the boundaries between Union's and national prerogatives should be placed, in light particularly of the prospective entry of a long list of applicants, especially from central and eastern Europe. Several

observers (Alesina and Wacziarg (1999), and especially, Alesina, Angeloni and Schnuknet (2001)) have pointed out several inconsistencies between the scope of the European Union and its enlargement. Related issues concerns what the WTO should do (see Bagwell and Staiger (2001)) or the role of the UN.

This paper examines the political-economy of multi country unions. It examines, in particular, what are the forces which determine the equilibrium size and composition of unions, and discusses issues of optimal and equilibrium attribution of prerogatives between the union and the member countries. The core of our model, and the element that in our view is central to the political economy of all unions (including the United States), is the existence of a tension between the heterogeneity of individual countries' preferences and the advantage of taking certain decision in common, i.e. of centralizing certain budget decisions, harmonizing certain policies, enforcing defense of borders.

Our results shed light on current policy debates. First, the size of spillovers between countries and the heterogeneity between their preferences or their economic fundamentals determines endogenously the size of the union and its composition. Even if multiple equilibria can arise because of strategic complementarities in the choice to join the union, under mild conditions all of these equilibria are characterized by countries with similar preferences, and the size of the union increases when the heterogeneity between countries is reduced or the spillovers increase.

Second, the size of the union is inversely related to the spectrum of common

policies which are centralized at the union level. That is, for given heterogeneity, in equilibrium one obtains either small unions that coordinate a lot, or large unions in which very few functions are merged.

Third, and this is probably our most original result, we find that the political equilibrium implies a *bias toward excessive centralization and small size of the union*, unless there is a constitutional commitment of the union to centralize only certain policies. The source of this inefficiency is a time-inconsistency problem: once the union is formed, a majority of members will want to increase the policy prerogatives of the union, and the expectation of this induces many countries to step back from the beginning. Therefore this results underscore the necessity of specifying ex ante a clear mandate for the union in a Constitutional stage.

Finally, the new members most likely to be admitted are those with preferences similar to the status quo. If new member(s) would substantially change the median of the union, a majority would block the admission, despite the positive externality that the new entrants may bring. Moreover, if the union has a redistributive role, "poor" countries applying for admission would be rejected, while rich countries willing to join would be welcomed.

The paper is organized as follows. Section 2 describes the basic model. Section 3 characterizes the equilibrium size of unions and discusses issues of enlargement. Section 4 discusses the trade-off between the number of policy prerogatives which are centralized and the size of the unions. Section 5 introduces

heterogeneity in economic fundamentals (productivity) instead of heterogeneity in preferences between countries. The last section concludes.

2 The Model

Consider a group of N equally sized countries with the population size normalized at 1. For the moment we assume that economic fundamentals (including income) are the same in all the countries, while preferences differ across countries. In Section 5 we allow for differences in economic fundamentals.

The utility function for the representative individual of country i is:

$$U_i = c_i + \alpha_i H(g_i) \tag{1}$$

where g_i is the per capita and total level of government spending in country i, c_i is private consumption which enters linearly in the utility function for simplicity and $H_g(\cdot) > 0$, $H_{gg}(\cdot) < 0$. The parameter $\alpha_i > 0$ captures how much the representative individual of country i values public consumption relative to private consumption: we will refer to α_i as the preference of country i and we assume that these parameters are observable and, without loss of generality, that countries are ordered such that $\alpha_1 \leq \alpha_2 \leq \cdots \leq \alpha_{N-1} \leq \alpha_N$.

If N countries form a union all together, the representative individual in member country i has the following utility function:

$$U_i = c_i + \alpha_i H(g_i + \beta \sum_{j=1, j\neq i}^{N} g_j) \tag{2}$$

where $\beta \in [0,1]$ captures the spillover effects from other countries' government spending on the "home" country.[1] Thus, we assume that membership in the union is a necessary condition for receiving some externalities, which are zero if a country is out. This is a simplifying assumption that can be extended by allowing some or all of the outsiders to be affected (positively or negatively) by the externalities of the union.[2]

One can interpret g_i as a public good, such as infrastructures and public investment (*fiscal unions*) or defense (*military unions).* We may also view the public good in a broader sense. For instance, one can think of *custom unions* or *free trade agreements*, where the benefits derive from the coordination of trade policies between the union's members and with the external countries while the "tax" (or the "cost") is the loss of an independent trade policy.[3] One can also think of one public good as a common currency. In this case, joining *currency unions* may bring the benefits of easier trade, commitment to low inflation, etc.; the cost would be the loss of monetary independence.[4] Another possible interpretation for our model would be in terms of risk sharing and redistribu-

[1] When $\beta = 1(0)$ we are in the case of a pure public good at the union (national) level.

[2] See Etro (2001) for this extension.

[3] For a recent general discussion see Bagwell and Staiger (1999, 2001).

[4] See Mundell (1960) and Alesina and Barro (2002).

tion between federated countries (*fiscal federalism*).[5] The bottom line is that a union improves some technology for public good provision and/or provides some credible commitment to a better policy. Notice that, while many policies are characterized by positive spillovers between countries (*prosper-thy-neighbor* policies), like the one directly considered here, other policies have negative spillovers (*beggar-thy-neighbor* policies). The spirit of our model would remain unchanged if we directly considered this second class of policies - for instance, by assuming $\beta < 0$.

We assume that income (y) is exogenously given and equal for everyone in every country. Each country has a balanced budget, therefore $g_i = t_i \in (0, y)$ where t_i are the lump sum taxes raised in country i.[6] Using the government budget constraint, we then have

$$U_i = y - g_i + \alpha_i H(g_i + \beta \sum_{j=1, j\neq i}^{N} g_j) \tag{3}$$

Consider first the decentralized equilibrium, in which every country acts independently in the union, taking as given the spending of all the other countries. The first order conditions for a maximum in country i imply:

$$\alpha_i H_g(g_i + \beta \sum_{j\neq i} g_j) = 1 \tag{4}$$

[5] See Persson and Tabellini (1996a, 1996b), Alesina and Perotti (1998) and Oates (1999) on the political economy of fiscal federalism.

[6] We could extend the model to distorsive taxation without changing the qualitative results (see also section 5).

Let's call the solution of the system of N equations (4) as $g^n(\alpha_i)$ where n stands for Nash equilibrium, which is inefficient because countries do not take into account the effect of their choice on the other countries. Due to the free-riding problem, $g^n(\alpha_i)$ is decreasing in the size of the externality β, and $\partial g^n(\alpha_i)/\partial \alpha_i > 0$.

Consider now the case in which the union centralizes the decision on public expenditure. Let's start from the first best policy. Since all countries have the same population and the same exogenous income, it is reasonable to focus on an utilitarian union. This would choose different public expenditures for each country so as to maximize the sum of their utilities; the optimality conditions for each country i are:

$$\alpha_i H_g(g_i + \beta \sum_{j \neq i} g_j) = 1 - \beta \sum_{j \neq i} \alpha_j H_g(g_j + \beta \sum_{k \neq j} g_k) \tag{5}$$

which is another system of N equations, with solution $g^*(\alpha_i)$ again increasing in α_i, but higher than $g^d(\alpha_i)$ for each α_i.

The first best policy requires that the union dictates a different policy for each country and that the policy preferences of every country are known and verifiable. This seems highly unrealistic especially if information about countries' preferences are not verifiable.[7] Moreover, transfers or decision rules which are country-specific and contingent on the country's preferences (and on its spillovers with other countries) may be difficult to be politically supported in a

[7] For a specific discussion on this point in a related two countries model with asymmetric information and distorsive taxation, see Bordignon, Manasse and Tabellini (2001).

world of otherwise identical countries. For this reason we assume that a policy decided at the union level has to be the same for every country and cannot be contingent to the countries' preference parameter α. In particular, we focus on the simplest institutional rule, majority voting, and we study the determination of the equilibrium size of the union.[8]

2.1 Political Equilibrium

Let us consider the one-country-one-vote rule, which is reasonable since for the moment we are assuming that all the countries have equal size. Define α_m as the median α_i. Note that given the structure of preferences we can apply the median voter theorem: the solution of this majority voting problem is the policy most preferred by the "voter" (i.e. by the country) with the median α. This is because the differences in preferences between members is confined to one parameter which enters linearly in the utility function and single peakedness holds. Thus the level of spending chosen by the union g_m solves the following first order condition:

$$\alpha_m H_g\{g_m[1+\beta(N-1)]\} = \frac{1}{1+\beta(N-1)} \tag{6}$$

We summarize the features of the political equilibrium provision of public good in the following proposition:

[8] Alesina, Angeloni and Etro (2001) investigate holding the size of the union constant different solutions for the organization of the union

Proposition 1. *The political equilibrium provision of public goods increases in α_m and it decreases (increases) with the size of the union and of the spillovers if the elasticity of the marginal utility of public goods is higher (lower) than unity, while, under unitary elasticity we have size-independence.*

First of all, note from (6) that $g_m(\alpha_m)$ is increasing in α_m, because:

$$\frac{dg_m}{d\alpha_m} = \frac{g_m}{\alpha_m}\left(\frac{1}{\theta\{g_m[1+\beta(N-1)]\}}\right) > 0 \tag{7}$$

where $\theta(g) = -H_{gg}(g)g/H_g(g) > 0$ is the usual index of relative concavity, while the comparative statics with respect to the size of the externality β, and the size of the union N are ambiguous:

$$\frac{dg_m}{d\beta(N-1)} = \frac{g_m}{[1+\beta(N-1)]}\left(\frac{1-\theta\{g_m[1+\beta(N-1)]\}}{\theta\{g_m[1+\beta(N-1)]\}}\right) \tag{8}$$

Hence, the political equilibrium provision of public goods decreases (increases) with the size of the union and of the spillovers if and only if $\theta\{g_m[1+\beta(N-1)] > (<)1$.

The ambiguous effect of an increase in spillovers on the union policy choice is due to the usual substitution and income effects. But the same argument holds, more surprisingly for an increase in the number of members. This will be relevant when we will examine the creation of a union and the entry of a new country. Even if this new country is strictly in favor of a small government and it will increase votes in this direction inside the union, its entry could end up determining a bigger size government: this can happen if the concavity

of the function $H(\cdot)$ is not too strong. The intuition is that in this case the substitution effect (more public goods because they produce more spillovers) more than compensates the income effect (more consumption because we have already a lot of spillovers). Also the opposite could happen: the entry of a country in favor of a big government could end up reducing the size of it the concavity of $H(\cdot)$ is strong enough.[9]

Finally, remember that the political equilibrium is inefficient. However, we cannot exclude that the median country and some countries around it may prefer the political equilibrium solution to the utilitarian optimum: if these countries were the majority in the union we would have a majority in support of it and so an extreme form of *status quo bias* inside the union.

3 The Creation of the Union and its Enlargement

In this section we characterize the equilibrium size of a union. We begin by an "initial stage" of union formation in which we have M potential members. The set of "potential members" is composed of countries that can join the union, without an approval of the existing union members. We want to characterize the size of the union $N \leq M$ and its composition. In this formation stage

[9] This result holds for any non separable utility function, but the cut-off is lower than unity if public and private goods are complements.

every potential member has the right to join the union, without approval of the union members. We then analyze a second stage. After the union is formed we discuss issues of "enlargement" of the union, in which new members are admitted only if approved (by majority rule) by the members of the union.

3.1 The Equilibrium Size of the Union

Consider now a set of potential members (M) of a union which provides the spillovers described in the basic model of the previous section. We do not impose any structure on the distribution of the preferences except for a strictly technical one. Given $\alpha_i \in [\alpha_{\min}, \alpha_{\max}]$ for any i, we will assume:

A.1: $\alpha_{\max} < 2\alpha_{\min}$.

Assumption A.1 amounts to an upper bound on the heterogeneity of the preferences between countries (indeed it can be rewritten as $\alpha_{\max} - \alpha_{\min} < \alpha_{\min}$). More discussion of this assumption is later.

Any country i who decides not to participate to the union will not benefit from the spillovers, but it will be able to choose independently its own public expenditure so as to maximize (1). The solution is an expenditure $g^o(\alpha_i)$ satisfying the first order condition:

$$\alpha_i H_g(g^o) = 1 \tag{9}$$

with $\partial g^o(\alpha_i)/\partial \alpha_i = -\frac{H_g(g^o)^2}{H_{gg}(g^o)} > 0$ and $g^o(\alpha_i) = y$ for any $\alpha_i \geq \frac{1}{H_g(y)}$. This autonomous choice, which is clearly independent from the policy of the union,

provides utility:

$$U_i^{out} \equiv y - g^o(\alpha_i) + \alpha_i H(g^o(\alpha_i)) \tag{10}$$

Let us define a union (α_m, N) as a group of N countries with median α_m. The utility of country i if in a union (α_m, N), is:

$$U_i^{in}(\alpha_m, N) \equiv y - g_m(\alpha_m) + \alpha_i H\{g_m(\alpha_m)[1 + \beta(N-1)]\} \tag{11}$$

Define as $\alpha'(\alpha_i, \alpha_m, N)$ as the new median of the same union when a previously outsider country i joins to it. We are now ready for a formal definition of an equilibrium union (EU).

Definition 1. *An equilibrium union* $(\alpha_m, N)^{EU}$ *is a union composed of* N *members with a median voter characterized by* α_m*, such that 1) the union policy is chosen by the union by majority voting,* 2) *for each country* i *joining the union, the following condition holds:*[10]

$$U_i^{in}(\alpha_m, N) > U_i^{out} \tag{12}$$

and 3) for each country k *outside the union, the following condition holds:*

$$U_k^{in}(\alpha'(\alpha_k, \alpha_m, N), N+1) \leq U_k^{out} \tag{13}$$

[10] We assume with no loss of generality that if a country is indifferent it chooses not to join.

The first equilibrium condition says that every member must be better off inside the union than outside. The second condition assures that none of the countries outside the union would prefer to enter in it, taking into account both the induced change of the median and the increase in spillovers due to the augmented size of the union.[11]

This equilibrium concept generally implies multiple equilibria. There are two dimensions of multiplicity. One is that, for given size of the union (i.e., holding N fixed) there would be different possible equilibria with different median. The second dimension is that holding α_m constant there might be multiple equilibria with different sizes. In fact, no country would want to join a small union by itself, but, because of "strategic complementaries," a group of countries may find it in everybody's interest to join the same small union.

We can deal with the second type of multiplicity by using the notion of the *coalition-proof equilibrium* ($CPEU$). Under this equilibrium concept, not only unilateral deviations, but all multilateral deviations (which are internally consistent) have to be non profitable (see Benheim, Peleg and Whinston, 1987). To formalize this concept we need to extend our definition of $\alpha'(\cdot)$ to multicountry entry: $\alpha'(\Gamma, \alpha_m, N)$ is the new median of the union (α_m, N) after a set $\Gamma(S)$ of S previously outsider countries joins to it.

[11] Since this is an equilibrium condition, the outsider does not take into account the possibility that other countries may want to exit the union in consequence of its entry or to enter contemporaneously: other countries's strategies are taken as given.

Definition 2. *A coalition-proof equilibrium union* $(\alpha_m, N)^{CEU}$ *is an equilibrium union such that 4) in the set of the countries outside the union, there is not a subset of* S *countries* $\Gamma(S)$ *such that:*[12]

$$U_k^{in}(\alpha'(\Gamma, \alpha_m, N), N + S) > U_k^{out} \quad \forall\ k \in \Gamma(S) \tag{14}$$

For a given median, we will show that a coalition-proof equilibrium union is the largest size equilibrium union. While the coalition proof notion eliminates multiplicity of equilibria with the same median, it does not eliminate the possibility of multiple equilibrium unions with different medians. In other words, a union biased toward low provision of public good and another biased toward high provision may be both coalition-proof equilibria if and only if they have different median countries. In any case, all these possible equilibrium unions have in common the same properties and comparative statics. Since we are not interested in studying multiple unions, we focus on the case in which in equilibrium we only have one $CPEU$, with median α_m.

We now investigate the properties of this union.[13] We begin with the following:

[12] We should also state that there are no coalitions of members who would like to exit all together, but this is clearly guaranteed by the requirement for the CEU to be an EU, which implies that no single member would like to exit: and there is no further gain from exiting together with others.

[13] All the following analysis will make use of a family of functions of net gain from participating to the union, defined as the difference between staying into the union and outside of

Lemma 1. *The net gain from participating to a union $\Delta(\alpha, \beta)$ is a concave function in the preference parameter α which has positive value only for a closed set of values of α.*

Proof: see the Appendix.

This lemma establishes the pattern of gains from adhesion to a union. Under a condition derived in the Appendix, which is satisfied as long as the median country of the union has a low enough α_m, the lemma establishes the non monotonicity of these gains, which are positive only for intermediate values of the preference parameter. The result holds for any functional form of the utility function and independently from the distribution of preferences.

In the rest of the paper, however, we will adopt the following assumption:

A.2: The index of relative concavity of the function $H(g)$, is $\theta(g) \geq 1/2$.

Assumption A.2 sets a lower bound on the elasticity of the marginal utility of public goods. Remembering the comparative statics of the political equilibrium provision of public goods in (8), this assumption is consistent with a provision which is decreasing, constant or weakly increasing in spillovers and number of

it. Each function $\Delta(\alpha, \cdot)$ is parameterized by the number of other countries joining the union and its median country, and it is expressed as depending on a generic value of preference parameter α and on the spillover size β.

However, we remind that in our model there is only a finite number of preference parameters $\cdots \leq \alpha_1 \leq \alpha_2 \leq \cdots \leq \alpha_{M-1} \leq \alpha_M$.

countries. Assumptions A1 and A2, are sufficient to guarantee an intuitive result:

Lemma 2. *Under A.1-2, when a country k outside a union enters in it, utility from staying in the union is increased for the new member k and for any country i on the same side of the median m as the new member:*

$$U_i^{in}(\alpha'(\alpha_k, \alpha_m, N), N+1) > U_i^{in}(\alpha_m, N) \quad \forall\ i \lesseqgtr m \text{ if } k \lesseqgtr m$$

Proof: see the Appendix.

This lemma derives from the fact that a new entrant increases the total spillovers and moves the median of the union toward its own preferences,[14] and it makes clear how strategic complementarities exist between countries: the participation of one country to the union increases the payoff of a set of other countries from participating to the same union.

We can now derive our first result on equilibrium unions, which holds independently from the actual distribution of preferences:

Proposition 2. *Under A.1-2, a) an equilibrium union is composed by countries with contiguous preferences: for a given equilibrium union, there exists a compact set of preferences around the median such that all and only all countries*

[14] Only in the special case of size-independence, these are the only effects. In general, there is a third effect which may work in the opposite direction, because the greater number of members affects the union policy in an ambiguous way even if the median country was the same. See the Appendix for the more general argument.

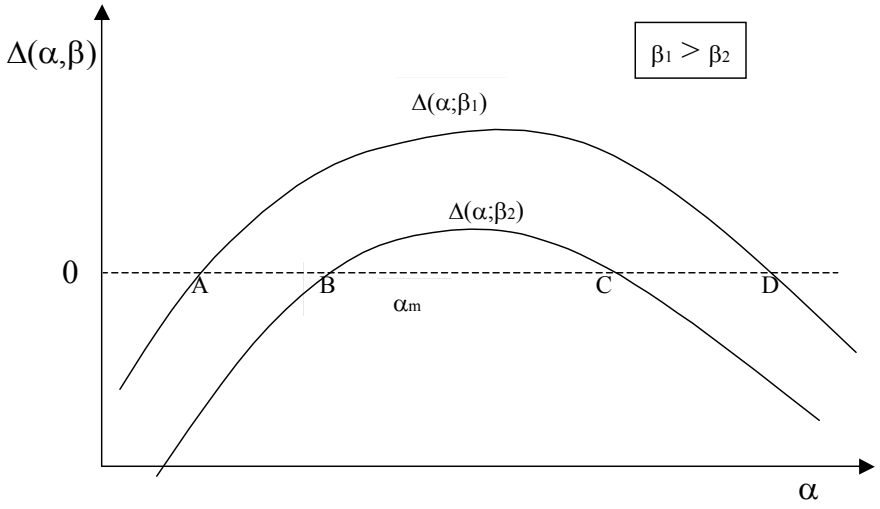
with preferences in this set belong to the union; b) the equilibrium size of the union is weakly increasing in the size of the spillovers; c) for a given median, the only coalition-proof equilibrium union is the largest equilibrium union.

Proof: see the Appendix.

The point of this proposition is that the *EU* is formed by countries with similar preferences. According to part a), the distance from the median in terms of the parameter α is the key determinant concerning the decision of joining or not. The more spread out is the distribution of the α the larger the fraction of countries that would be worse off in the equilibrium union. If preferences are very similar, instead, most countries benefit from the internalization of the spillover effects, on net. Moreover, part b) shows that, for a given distribution of α, the larger is β the larger the fraction of countries that benefit from the union, since the loss of spillover effects outside the union is more relevant. In other words, the equilibrium size of the union is determined by a trade off between the spillover benefits and the costs of having to agree on the same policy, which in this case boils down to a choice of public expenditure.[15] Large unions are possible when heterogeneity is low and externalities high and the other way

[15]This has some similarity, but important difference to the trade off between economy of scale and costs of heterogeneity which determines the optimal size of a country in Alesina and Spolaore (1997). There are two key differences. First, the trade off here is not between scale and heterogeneity. Second, here we are considering unions between large entities (countries) as opposed to "unions" between atomistic agents. Voting issues and equilibrium concepts are therefore quite different.

around. We illustrate part b) in figure 1, where we show the net gains from participating to a union (α_m, N) under two different spillovers, β_1 and $\beta_2 < \beta_1$. The net gain increases in the spillover for all countries. Hence, if (α_m, N) is an EU under spillovers β_2, it means that there are N countries in the set $[B, C]$, but if there are countries in the set $[A, B] \cup [C, D]$, there must be an EU of size greater than N when spillovers are β_1.



Net gains from the Union and spillovers

Assumptions A.1 and A.2 are only sufficient for results a) and b): what we need is that preferences between countries are not too heterogeneous and the elasticity of the marginal utility of public goods is not too low. Otherwise we cannot exclude equilibrium unions which do not include countries with intermediate preferences between those of some other members, and that the size of the union shrinks when spillovers rise. The reason is that if these countries enter in the union, the increase in the number of members may change the policy in

such a way to make the outside option better than to stay in the bigger union! These paradoxical results could happen under two circumstances. The first is the case in which the substitution effect induced by a change in the number of countries on the median country choice is particularly strong (for instance if public and private consumption are nearly perfect substitutes): in this case when the entrant is a country k with $\alpha_k \leq \alpha_m$, a bias of the new political equilibrium toward high public expenditure (induced by the increase in the number of participants when $\theta(\cdot)$ is low)[16] may be counterproductive for countries far enough from the median. The second case is the one in which preferences are highly dispersed after the median: in this case when the entrant is a country k with $\alpha_k \geq \alpha_m$, a bias of the new political equilibrium toward low public expenditure (induced by the increase in the number of participants when $\theta(\cdot)$ is high) may be counterproductive for countries far enough to the right of the median.

Result c) of Proposition 6 tells us that only the largest EUs for each median are robust to the coalition-proof refinement. Note that the largest EU is the only Pareto-efficient union for each median, hence EUs can be Pareto-inefficient, but $CPEU$s are always Pareto-efficient.

3.2 Enlargement

We now examine the issue of union enlargement. That is we ask the question: now that a union is formed, when will it admit, by majority rule, a new member?

[16] Remember that $\frac{dg_m}{dN} > 0$ when $\theta < 1$.

First of all, only countries with externalities with union members would be admitted, otherwise their only effect in the union would be to change the median, and at least 50 per cent of the members would object to that.

If a country provides a positive externality to the existing members, then its potential entry has two effects. One is to increase utility by virtue of the internalized externality. The second effect is to change the median voter in the union. If the potential entrant is exactly at the preexisting median, which therefore remains unchanged, then it would be unanimously accepted,[17] since it brings a positive effect for everybody with small enough policy changes - under our regularity assumptions A.1 and A.2. If the median changes, then each existing union member may or may not be better off. Consider the admission of a country k, and suppose that the new median $\alpha'(\alpha_k, \alpha_m, N)$ is at distance ε from the old one, α_m.[18] In this case, first of all we can use the general result established in Lemma 2: it implies that all the union members on the same side of the old median as country k would be in favor of the new entrant, as long as this does not imply the exit of previous members. By continuity, there exists an ε so small that even at least a member of the union on the other side of the old median would vote in favor of the new entrant and noone of the other countries decides to exit. This is because the change in the median is so small that does not eliminate, on net, the gain due to the rise in spillovers, and it does not

[17] This is a simple consequence of Lemma 2.

[18] Notice that this includes the case in which the new median is actually the entrant.

induce exit. Clearly there cannot be an admission with contemporaneous exit of a previous member: otherwise spillovers would not increase, but the median would change, making impossible a majority in favor of the entrant.

We make more precise this argument in the following proposition:

Proposition 3. *Under A.1-2, an equilibrium union will accept a new member if and only if the change in the median after entry is small enough.*

Proof: see the Appendix.

We showed that countries very close to the current median of the union are more likely to be accepted. However, for countries not immediately contiguous to the median, acceptance is unrelated to their exact position: what matters is just the distance between the current median and the nearest member of the union on the same side of the candidate entrant. If this is too big, no admissions can be implemented. Hence our model rationalizes a form of *status-quo* bias in union reforms. Note that the spirit of our result goes through if the admission of more countries together is allowed and all these countries are on the same side of the median. Obviously, when a group of candidate members is partly on one side and partly on the other side of the median, group admission is easier, because spillovers increase a lot and the median does not change a lot. Finally, if there are equal numbers of candidates on both sides of the median, the median is not going to change and the increase in spillovers strongly acts in favor of the admission.

After a new member enters, the median changes. Therefore the subsequent decisions about other members would be taken by a different median.[19] In a multi-period setting, the decision about one member to be admitted today will take into account that this will change the median voter that tomorrow will have to decide about new members.[20] This discussion captures the fact that often certain countries are in favor of expanding the union in certain "directions" and other members are opposed.

The general point we want to make in this section is that members of a union tend to favor the entry of new countries with similar preferences to their own. In our model "preferences" are captured by the level of government spending. In reality, preferences may differ in other dimension, such as the composition of spending or certain types of public policies like regulation, defense, etc. Also the difference may be not in the preference side but in the production side. If the existing and potential members have different level of income, then one would

[19] For a somewhat related discussion see Alesina and Grilli (1992) for the specific case of entry in a monetary union.

[20] More formally, immagine a multiperiod version of our model with discounting and a finite number of possible candidates. In each period the admission of a new member is decided under majority voting. This situation depicts a dynamic game with complete information. Even if the game's tree may be quite complex, we know that the subgame perfect equilibrium implies a unique outcome for this game (except for trivial multiplicity in some subgames). Hence, given an initial union, it is possible to forsee the long run equilibrium union and also its formation path. It is easy to prove that a new country will be admitted in every period until the long run equilibrium is achieved and that this long run equilibrium must be an EU as previously defined.

have to consider not only difference in preferences but also the redistributive flows from one country to the other.[21]

4 The Trade-off between Size and Scope of the Union

Suppose now that we have two policies, which consist of the provision of two different types of public goods, with low and high spillovers. That is the utility function is now:

$$U_i = y - (g_i^1 + g_i^2) + \alpha_i H(g_i^1 + \beta_1 \sum_{j \neq i} g_j^1) + \alpha_i H(g_i^2 + \beta_2 \sum_{j \neq i} g_j^2) \qquad (15)$$

where the superscripts 1 and 2 identify the two different public goods, and of course the budget constraint is now $g_i^1 + g_i^2 = t_i$. Suppose $\beta_1 > \beta_2$. The union can now choose to centralize the provision of both policies or of only one. If both policies are decentralized there is no union. To formalize this, let us define with $U_i^G(\alpha_m, N)$ the utility of country i joining a union producing the set of public goods G - which in this simple case may be $(1,2)$ or (1) or (2)-, when there are N members in the union and the median voter is characterized by α_m, and with U_i^G the utility from the decentralized production of the same set of goods.

[21] See Alesina and Wacziarg (1999) and section 5 below for some discussion of this case.

We can now extend our previous definitions of a union. According to the voting procedure in the union, different results may arise. The common and realistic assumption is that only after the creation of the union, its members decide which policies to centralize, and which levels to provide for each public good. We will discuss two different kinds of equilibria, characterized by the following alternative rules:

Rule A. *The provisions of each public good are chosen by majority voting.*

Rule B. *The policies to centralize are chosen by majority voting and, subsequently, for each voted policy, the provisions of each public good are chosen by majority voting.*

The difference between rule A and B is that the latter allows a two step decision: first which policy to centralize, and than how much of the public good to choose. Given these rules $X = A, B$, we define the X equilibrium union as follows.

Definition 3. *A X-equilibrium union* $(\alpha_m, N, G)^{X|EU}$ *is a union providing a set of public goods* G*, composed of* N *members with a median voter characterized by* α_m*, such that:*

1) *rule X applies;*

2) *for each country i joining the union, the following condition holds:*[22]

[22]Obviously, the utility from the production of goods not in the equilibrium set Ω is the same if in or out of the union, hence it does not affect the set of equilibrium conditions.

$$U_i^G(\alpha_m, N) > U_i^G \tag{16}$$

and 3) for each country k between the countries outside the union, the following condition holds:

$$U_k^G(\alpha'(\alpha_k, \alpha_m, N), N+1) \leq U_k^G \tag{17}$$

Definition 4. *A coalition-proof X equilibrium union* $(\alpha_m, N, G)^{X|CEU}$ *is an X equilibrium union such that 4) in the set of the countries outside the union there is not a subset of S members* $\Gamma(S)$ *such that:*

$$U_k^G(\alpha'(\Gamma, \alpha_m, N), N+S) > U_k^G \quad \forall\ k \in \Gamma(S) \tag{18}$$

Again we focus on the qualitative properties of the equilibria which hold independently from the actual distribution of preferences. We will omit the proofs of the results of this section, because they are straightforward applications of Lemma 1 and 2, thanks to the quasi-linearity of preferences.

Proposition 4. *Under A.1-2, a) an A equilibrium union is composed by countries with contiguous preferences and it produces all public goods; b) for a given median, the only coalition-proof equilibrium union is the largest equilibrium union.*

This proposition shows that if Rule A is adopted, both policies are centralized. This is a case of a relatively "small" but highly centralized union.

An interesting feature of this equilibrium is that it is possible that a majority of members would prefer to centralize only good 1, the high spillover good, even though, in an A-equilibrium this does not happen. We call this a "centralization bias" in the union. In other words we have a sort of *time-inconsistency* problem: once the union is formed, the median extend excessively its powers, and the expectation of this induces too many countries to step back from the beginning.

A simple way to illustrate this problem is shown in figure 2, where we indicate with $\Delta(\alpha, N; \beta_1, \beta_2)$ the net gains from participating to a union $(\alpha_m, N, (1,2))$ which provides both public goods, with $\Delta(\alpha, N; \beta_1, 0)$ those from the union $(\alpha_m, N, (1))$ and with $\Delta(\alpha, N; 0, \beta_2)$ those from the union $(\alpha_m, N, (2))$. Note that:[23]

$$\Delta(\alpha, N; \beta_1, \beta_2) = \Delta(\alpha, N; \beta_1, 0) + \Delta(\alpha, N; 0, \beta_2)$$

as we show graphically in figure 2. The immediate consequences is that the range of preferences for which $\Delta(\alpha, N; \beta_1, \beta_2) > 0$ is strictly smaller than the one for which $\Delta(\alpha, N; \beta_1, 0) > 0$. Now, suppose that $(\alpha_m, N, (1,2))$ is an A equilibrium union; this means that in the set $[B, E]$ in figure 2 there are N countries, with the median somewhere in the subset $[C, D]$ (which is consistence with its preference for the centralization of all the goods). All the countries in the set $[B, C] \cup [D, E]$ would actually prefer to centralize just good 1. Moreover, in a union with

[23] This simple decomposition is possible because of our assumption of a quasi-linear utility.

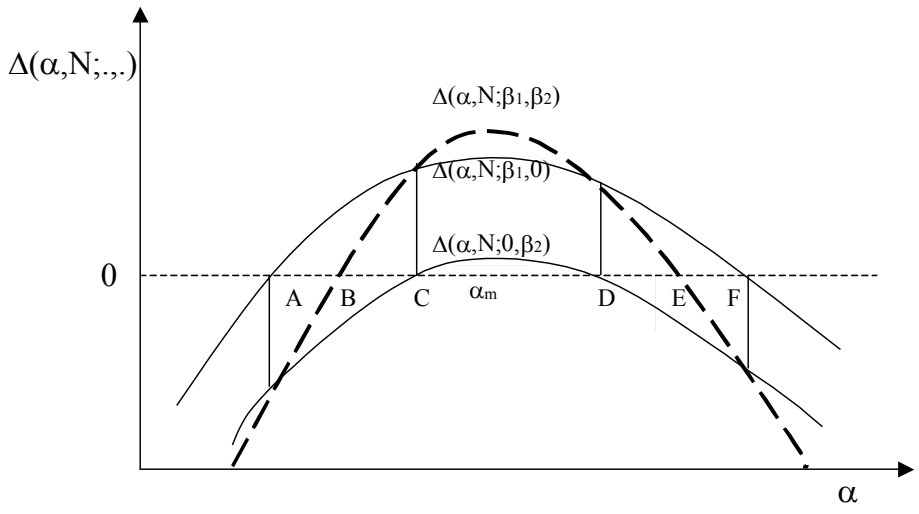


Figure 1: Complete centralization in A-Equilibrium Union

centralization just of good 1, all the countries in the set $[A, B] \cup [E, F]$ would like to join the union, so as to create a bigger union (which may also make every country better off because of the increase in spillovers).

Let us now consider the different political process in which, after the union is created, countries vote on the set of goods to centralize G, and finally on the amount of each good from this set to provide: this is the rule B. In figure 2 it is clear that our A equilibrium union cannot be a B equilibrium union as long as there is a majority of the members voting for $G = (1)$ - that is, there are more countries in the set $[B, C] \cup [D, E]$ than in the set $[C, D]$.

We can derive the following result:

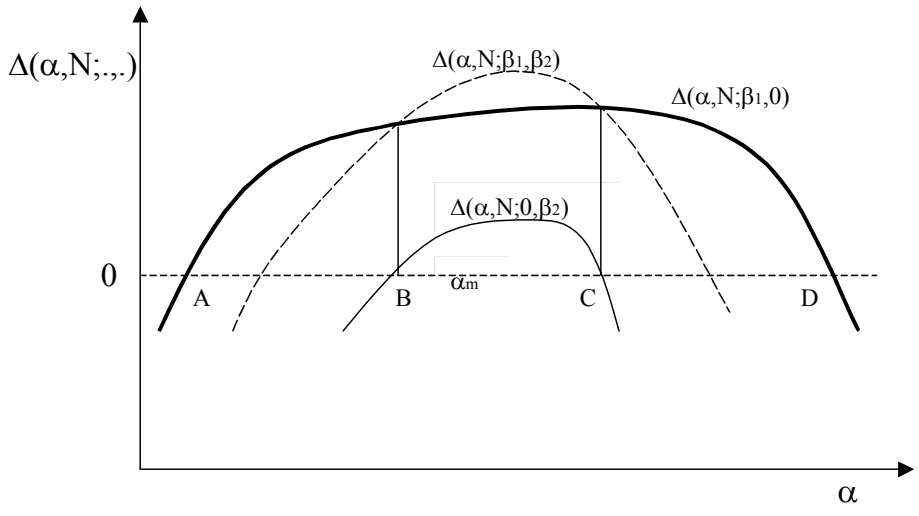


Figure 2: Decentralization in B-Equilibrium Union

Proposition 5. *Under A.1-2, a) an B-equilibrium union is composed by countries with contiguous preferences to produce at least the public good with highest spillover; b) in the class of equilibrium unions with a given median, a higher equilibrium number of countries must be associated with an equal or smaller set of public goods provided; and c) for a given median, the only coalition-proof B-equilibrium union is the largest B-equilibrium union.*

In figure 3 we show a possible $B \mid EU$ with decentralization of the low spillover good and an increased size of the union. In this case $(\alpha_m, N, (1))$ is a $B \mid EU$ as long as N countries are in the set $[A, D]$, a majority of which are in the subset $[A, B] \cup [C, D]$, which means that a majority votes to centralize just

policy 1. Part a) of the Proposition illustrates this point.

Part b) of Proposition 5 shows that the larger the set of policies that are centralized, the lower the expected membership of the union because the larger is the set of potential disagreement, and the institutional environment determines if the union is going to be a small and centralized one or a big and decentralized one.

This kind of multiplicity is interesting because it can describe a lively argument of discussion inside the European Community before the creation of the Euro or other union level initiatives as well: the debate between enlargement and deepening of the union. Note that the spirit of our results would hold under a more general utility function, but if the two public goods were complements there would be a bias toward small and centralized equilibrium unions, while if they were substitutes there would be a bias toward big and relatively decentralized equilibrium unions.

Finally, part c) of Proposition 5 shows that whenever for a given median there exists an equilibrium union providing only the high spillover good, then the coalition proof equilibrium union with this median must be unique and provide only the high spillover good.

Propositions 4 and 5 deliver a useful result in evaluating the economic consequences of different institutional environments inside the union:

Corollary 1. *Under A.1-2, in coalition-proof equilibrium with a given median, rule B implies unions of size weakly bigger than rule A and it is preferred*

by at least a majority of countries.

This is equivalent as saying that a strong commitment of the union to centralize only a limited set of policies - those with the strongest spillovers between members - can incentivate the creation of a bigger union. The result does not implies simple welfare comparisons. However, it can be verified that there could be situations in which rule B strictly dominates rule A, that is, its adoption makes all countries at least as well off and at least one of them strictly better off - because of the increase in the size and in the spillovers -, while the opposite can never be true!

4.1 Discussion

4.1.1 Multiple Goods

The previous results can be easily extended to the case of $F > 2$ goods. Suppose that the utility function of country i is now:

$$U_i = y - \sum_{k=1}^{F} g_i^k + \alpha_i \sum_{k=1}^{F} H(g_i^k + \beta_k \sum_{j \neq i} g_j^k) \tag{19}$$

Without loss of generality suppose that $\beta_r > \beta_s$ if $r > s$. Propositions 4 and 5 continue to hold. In particular, rule A implies again complete centralization for all F goods and small size of the union because of the dynamic inconsistency problem discussed previously. Rule B implies that if a union chooses to coordinate policy s, it will coordinate all the policies on the left of s, that is with

higher spillovers.

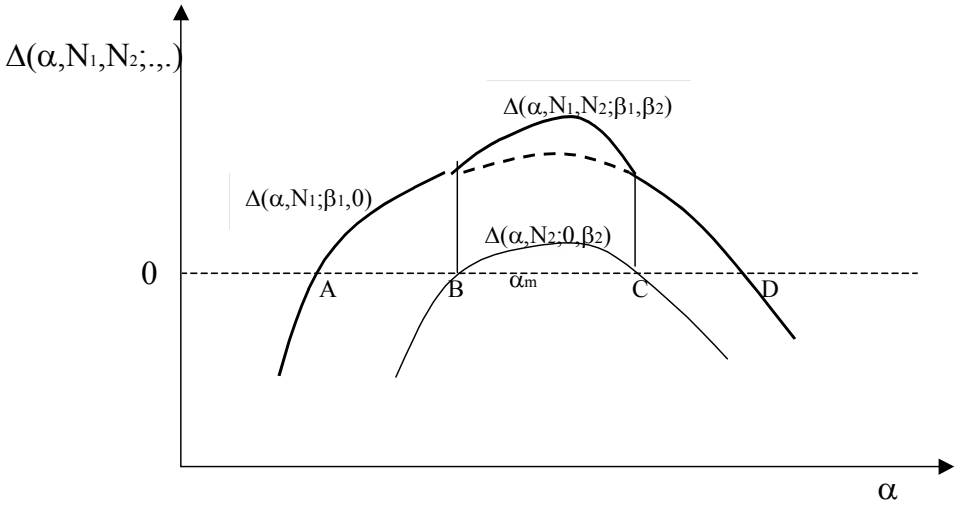
Suppose now that the difference between the public goods is not only on the level of spillovers, but it is also a *difference on the distribution of the preferences*, that is the utility function is now:

$$U_i = y - \sum_{k=1}^{F} g_i^k + \sum_{k=1}^{F} \alpha_i^k H(g_i^k + \beta_k \sum_{j \neq i} g_j^k) \tag{20}$$

The complete centralization result under rule A goes through, even if now different policies may be characterized by different medians.

The trade-off between size and scope of the union which underlies the equilibrium under rule B is still present, but which of the goods is centralized or not depends now also on the distribution of the α. Suppose for simplicity that all distributions have the same median, α_m. Given our assumption, the median voter in the union would choose the same level of all goods. If the distribution of, say α^1 has a lower standard deviation, than, say α^2 then, *ceteris paribus*, more countries are better off centralizing good 1 than centralizing good 2. More precisely, the number of countries willing to join the union is higher if good 1 is centralized and good 2 is not than if the opposite combination holds. This

induces again a bias toward big unions centralizing only few policies.



Enhanced cooperation in a union a la carte

4.1.2 Unions "à la carte"

An alternative institutional arrangement is one in which different members of the union merge different policies. This arrangement would allow to coordinate those policies with high spillovers and low disagreement, and also allow for subgroups of countries with more similar preferences to coordinate more policies and the other way around. By adding an element of flexibility this arrangement clearly moves the union closer to the first best type described in Section 2. Figure 4 illustrates a possible equilibrium configuration for a union à la carte with two policies. In the set $[A, D]$ there must be N_1 countries which centralize the high spillover policy 1, while in the subset $[B, C]$ there must be N_2 countries which centralize just policy 2. Correspondingly, the total net gain is given by

the function $\Delta(\alpha, N_1, N_2; \beta_1, \beta_2)$ depicted in bold.

The advantage of a "union à la carte" would be enhanced in the use of different spillover effects. That is, consider the following generalization of the utility function:

$$U_i = y - \sum_{k=1}^{F} g_i^k + \sum_{k=1}^{F} \alpha_i^k H(g_i^k + \sum_{j \neq i} \beta_{ij} g_j^k) \tag{21}$$

So in this case we have a total of F goods with different degree of externality across countries. For instance the values of the β may depend on the distance between two countries on the similarity of their economic structures. This suggests that one could observe a union in which different members coordinate at different levels. That is a "core" may adopt common polices on many, or all goods. Others may coordinate only a fraction of goods within the largest externalities. In Europe, for instance, some countries have adopted the Euro, others have not; some countries have eliminated border checks within the union, others have not. Presumably, implementation costs may become very large if this is pushed to an extreme diversification.

5 Redistributive Politics in the Union

Until now we have abstracted from a genuine redistributive purpose in the union and we have ignored distortions in taxation, because we considered exogenous and equal income for each country. If countries are heterogenous in income,

poor countries have a natural preference toward an higher redistribution or an higher provision of public goods financed by the union. However, in the real world, redistribution is costly because taxes are distorsive.

We focus on labor income taxation and heterogeneity in the average productivity between countries. We assume that labor is immobile across countries and income is endogenous, and we study the choice of the income tax rates.[24] The union collects the revenue and provides a common level of the public good in each country.

For simplicity let us consider the case of zero income effects (on labor supply) and let's assume every differences in preferences setting $\alpha_i = \alpha$ for every i:

$$U_i = w_i(1 - t_i)l_i + V(h_i) + \alpha H(g_i + \beta \sum_{j \neq i} g_j) \tag{22}$$

where h_i is leisure, l_i is working time chosen by the representative agent of country i to maximize utility under the constraint $h_i + l_i = 1$, in function of the income tax rate t_i and the wage rate w_i with $w_1 \leq w_2 \leq ... \leq w_N$ and median w_m, while the function $V(h)$ satisfies $V_h(h) > 0$, $V_{hh}(h) < 0$, and the weak regularity condition $V_{hhh}(h) \leq 0$, which will be sufficient (but not necessary) to guarantee the applicability of the median voter theorem in this set-up. First of all, we define the labor supply as the function $l_i = L(w_i, t_i)$ which satisfies the

[24] In doing so, we of course ignore an important issue in taxation policies in a federation: tax competition with mobile factors. For a discussion of this and related issues see Oates (1999) and for recent results Perotti (2001).

first order condition:

$$w_i(1-t_i) = V_h(1-l_i)$$

with $L_w(w_i,t_i) = -\frac{(1-t_i)}{V_{hh}} > 0$, $L_t(w_i,t_i) = \frac{w}{V_{hh}} < 0$ and $L_{tt}(w_i,t_i) < 0$ because of our assumptions. Define $y_i = w_i L(w_i,t_i)$ as the gross income in country i, which is clearly increasing in w_i, and $\varepsilon(y_i) = -\frac{t_i L_t(w_i,t_i)}{L(w_i,t_i)} < 1$ as the elasticity of substitution of income (and labor supply as well) with respect to the tax rate.

Under decentralization of the decisions, each country would choose its own tax to maximize (22) without spillovers ($\beta = 0$) under the budget constraint $g_i = t_i w_i L(w_i,t_i)$, and countries with less elastic labor supply would decide for an higher tax.

In a union (w_m, N), the budget constraint is:

$$g = \frac{\sum_{i=1}^{N} t_i w_i L(w_i,t_i)}{N}$$

An utilitarian first best union (w_m, N) would choose country specific taxes t_i so as maximize the sum of utilities of all countries, internalizing the spillovers between countries and adopting equalization of the elasticities of substitution for all countries, which implies again higher taxation for countries with lower elasticity of the labor supply, but with efficient public expenditure.

If instead we adopt our basic model of a "rigid union," the median country chooses the tax rate t to maximize:

$$U_m = w_m(1-t)L(w_m,t)+V(1-L(w_m,t))+\alpha H\left[[1+\beta(N-1)]\frac{\sum_{i=1}^{N} t w_i L(w_i,t)}{N}\right]$$

and the political-economic equilibrium tax rate $t_m(w_m)$, and hence the equilibrium expenditure $g_m(w_m) = t_m(w_m)\bar{y}$ (where $\bar{y} = \frac{\sum_{i=1}^{N} y_i}{N}$ is average income in the union), are defined by:[25]

$$\alpha H_g\{g_m[1+\beta(N-1)]\} = \frac{\left(\frac{y_m}{\bar{y}}\right)}{[1+\beta(N-1)]\,[1-\varepsilon(\bar{y})]} \tag{23}$$

where $\varepsilon(\bar{y}) = -t[\sum_{i=1}^{N} w_i L_t(w_i,t)]/\bar{y}N$ is the elasticity of substitution of the average income with respect to the tax rate across all the countries of the union.

The tax rate and hence the political-economic equilibrium provision of the public good are properly defined by (23) as decreasing in y_m and so in w_m, a point which is not surprising according to the political economic theory of redistribution of Roberts (1977) and Meltzer and Richard (1981), which is here extended to inter-country redistribution and through public goods instead of transfers. Notice that (23) includes two new terms. At the numerator there is a redistributive component which is just given by the ratio between average income in the median country and in the union: the higher is the former compared to the latter, the lower is the political-economic provision of public goods

[25] Our assumptions imply that:

$$\frac{\partial \varepsilon(y_i)}{\partial t} = -\frac{[L_t(w_i,t) + tL_{tt}(w_i,t)] - tL_t(w_i,t)^2}{L(w_i,t)} > 0$$

which guarantees that single-peakedness in preferences holds. To verify this note that the favourite tax of a country with productivity w_i, let us say $t_i(w_i)$, satisfies:

$$\frac{dt_i(w_i)}{dw_i} = \frac{L(w_i,t)/\,[1+\beta(N-1)]}{\left\{H_{gg}\,[1+\beta(N-1)]\,[1-\varepsilon(\bar{y})]^2\,\bar{y}^2 - H_g\bar{y}N\varepsilon(\bar{y})/t - H_g\frac{\partial\varepsilon(\bar{y})}{\partial t}\right\}} < 0$$

under the approximation that $\partial\bar{y}/\partial y_i \sim 0$.

because richer countries favor less redistribution. At the denominator there is an efficiency term: the more elastic is the labor supply of the average income country, the more distorsive is taxation and, hence, the lower should be the provision of public goods. Distorsive taxes create a bias toward lower public expenditure: indeed, in case of lump sum taxation or completely inelastic labor supply, the efficiency term would disappear ($\varepsilon(\bar{y}) = 0$), leaving us with the only redistributive effect.

Summarizing, the richer is the median country the smaller should be the redistributive role of the union, but nevertheless the model is consistent with a process of increased activism on the part of the union as long as the median country income increases less than the average one or, in other words, when the median income is lower than the average one, if inequality between countries is increasing in the union.[26]

How would be the equilibrium union in a world with income heterogeneity and distorsive taxes? The spirit of our previous results would be unaffected. Under some regularity conditions it can be shown that an equilibrium union is composed by countries with intermediate productivity or all the countries with productivity below a cut-off and that a new member will be accepted only if its productivity is high enough.[27]

[26] The literature on inequality, redistribution and growth makes a similar point in a closed economy context (see Alesina and Rodrik, 1994 and Persson and Tabellini, 1994).

[27] A similar point is made by Bolton and Roland (1997) and by Persson and Tabellini (2000) in a two region model: the rich region may decide to secede from the poorer to avoid the burden

The homogeneity in economic fundamentals is clearly reflected in the composition of the European Union and in the doubts of the richest European countries to join it.[28] On the other side, almost all the poor Eastern European countries have candidate themselves to enter the European Union and our model may help to explain the future gradual extension of the European Community to the Eastern European countries, whose income is only slowly converging to the Western standards. Indeed, the group of the next countries to be admitted, the so called "*ins*" (according to the "Agenda 2000", ratified in July 1997, Cyprus, Slovenia, Czech republic, Hungary, Estonia and Poland) are the richest between the Eastern European countries. The official estimates on the enlargement to the "ins" group imply that the current members will have to raise their average contribution to the European Community budget from 10% to 20% (see Nava, 2000): clearly, the economic incentives for this enlargement must be in the hidden economic spillovers that the new countries will provide.

6 Conclusions

We modeled a Union as a heterogeneous group of countries deciding together on the provision of certain common goods or policies, that affect them all. Our

of redistribution. Instead, in our multicountry model with spillovers between countries, wealth distribution affects the size and composition of the union.

[28]The three richest European countries (Norway, Switzerland and Iceland) do not belong to the European Union: obviously many other factors that have nothing to do with our redistributive argument are relevant.

model captures key features of all unions, in particular the tension between heterogeneity of preferences and the advantage of taking certain decision in common. It highlights that a trade-off arises between size and scope of the union: a union involved in too many activities will be favored by few countries and this will imply small spillovers between them, while a union which focuses on a core of activities will be favored by many countries and will raise many positive externalities between them in those activities. The institutional environment determines the equilibrium outcome, and we have shown that under certain conditions we observe a *bias toward excessive centralization and small size of the union.* This is due to a time-inconsistency problem: once the union is formed, the politics naturally tends to spread its power in all the possible activities, and the expectation of this induces many countries to step back from the beginning.

We 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. Obviously one would need to impose qualified majorities to change ex post the Constitution.

An interesting area for future research focuses on the relationship between the size of countries and the size of unions between countries. Recent history seems to have been characterized, especially in Europe, by a contemporaneous existence of *centrifugal forces* (regional autonomy in most Western European

countries and the break-up of some Eastern European nations) and of *centripetal forces* (the tendency to delegate policies to supernational entities like the European Union). These two apparently conflicting forces may have a natural interconnection: the raising benefits from adhesion to unions may contemporaneously reduce the equilibrium size of nations.[29] Separatism within nations and delegation of policies to supernational entities could well be shown, by future research, to be complementary parts of the same process.

[29]Notice that three of the newly admitted countries in the European Union - Estonia, Czech Republic and Slovenia - derive from three break-ups of nations - URSS, Czechslovack and Jugoslavia.

7 Appendix

Proof of Lemma 1.

For a given union (α_m, N) and spillovers β, we can define the net utility of staying into it for the country with preferences α_i as the function:

$$\begin{aligned}\Delta(\alpha_i,\beta) &\equiv U_i^{in}(\alpha_m,N) - U_i^{out} = \\ &= \alpha_i\left[H\{g_m(\alpha_m)[1+\beta(N-1)]\} - H(g^o(\alpha_i))\right] - [g_m(\alpha_m) - g^o(\alpha_i)]\end{aligned}$$

Using the envelope theorem we have:

$$\begin{aligned}\Delta_\alpha(\alpha,\beta) &= H\{g_m(\alpha_m)[1+\beta(N-1)]\} - H(g^o(\alpha)), \text{ and} \\ \Delta_{\alpha\alpha}(\alpha,\beta) &= -H_g(g^o(\alpha))\frac{\partial g^o(\alpha)}{\partial \alpha} < 0\end{aligned}$$

which shows concavity in α. Moreover, $\Delta(0,\beta) < 0$ and $\Delta_\alpha(0,\beta) > 0$. This and the fact that $\Delta(\alpha_m,\beta) > 0$ and $\Delta_\alpha(\alpha_m,\beta) > 0$ (which derives from a simple revealed preference argument) imply the existence of a cut-off $\alpha_l(\beta) < \alpha_m$ such that $\Delta(\alpha_l,\beta) = 0$ and $\Delta_\alpha(\alpha_l,\beta) > 0$. We can have two alternative cases.

In the first case, we have:

$$H\{g_m(\alpha_m)[1+\beta(N-1)]\} > H(y)$$

and the function $\Delta(\alpha,\beta)$ is always positive, increasing and with slope approaching a constant for $\alpha \to H_g(y)^{-1}$ and equal to this constant there on. Hence, $\Delta(\alpha,\beta) > 0$ for any $\alpha \in (\alpha_l, \infty)$.

If instead the median country of the union has a low enough α_m so that:

$$H\{g_m(\alpha_m)[1+\beta(N-1)]\} \leq H(y)$$

it follows that $\Delta_\alpha(\alpha,\beta)$ equals a negative constant for $\alpha \geq H_g(y)^{-1}$, which implies that $\Delta(\alpha,\beta) < 0$ for α high enough. It follows the existence of a unique value $\hat{\alpha} > \alpha_m$, defined by $H\{g_m(\alpha_m)[1+\beta(N-1)]\} = H(g^o(\hat{\alpha}))$ such that $\Delta_\alpha(\alpha_i,\beta) \gtreqless 0$ if and only if $\alpha \lesseqgtr \hat{\alpha}$.[30] This and the concavity of $\Delta(\cdot)$ imply that there must exist an other cut-off $\alpha_u(\beta) > \alpha_m$ such that $\Delta(\alpha_u,\beta) = 0$ and $\Delta_\alpha(\alpha_u,\beta) < 0$. Hence $\Delta(\alpha_i,\beta) > 0$ for any $\alpha_i \in (\alpha_l,\alpha_u)$. **Q.E.D.**

Proof of Lemma 2.

We need to show that, for any $i \leq m$ when $k \leq m$, and for any $i \geq m$ when $k \geq m$ we have:

$$U_i^{in}(\alpha'(\alpha_k,\alpha_m,N),N+1) > U_i^{in}(\alpha_m,N)$$

The effects induced by entry are to move the median of the union towards the entrant, and to increase the number of members, which has an ambiguous effect on the union policy. However, to prove the claim it is sufficient to show that both effects are going in the right direction.

[30] As a collateral result, we have proved that the maximum gain from the equilibrium union is not obtained by the median country, but from some country with preferences more biased toward big governments than the median country. Moreover there is an intervall to the right of α_m in which any country benefits from the union more than the median country.

Let us consider the effect of a change in the number of countries for a given median. Using (6) and (8), we have:

$$\begin{aligned}\frac{\partial U_i^{in}(\alpha_m, N)}{\partial N} &= \frac{\beta g_m(\alpha_m)}{[1+\beta(N-1)]} + \{\alpha_i H_g(\cdot)[1+\beta(N-1)]-1\}\frac{\partial g_m}{\partial N} = \\ &= \frac{\beta g_m(\alpha_m)}{[1+\beta(N-1)]}\left[1-\left(\frac{\alpha_i-\alpha_m}{\alpha_m}\right)\left(1-\frac{1}{\theta(\cdot)}\right)\right]\end{aligned}$$

whose sign is always positive under our assumptions.

To verify this assume first that $k \geq m$ and consider any country $i \geq m$. From A.1 it follows that $\alpha_i - \alpha_m < \alpha_m$ for any i and m. When $\theta(\cdot) < 1$ we have $\left(\frac{\alpha_i-\alpha_m}{\alpha_m}\right)\left(1-\frac{1}{\theta(\cdot)}\right) < 0$, and when $\theta(\cdot) \geq 1$ we have $\left(\frac{\alpha_i-\alpha_m}{\alpha_m}\right)\left(1-\frac{1}{\theta(\cdot)}\right) \in [0,1)$ because it is the product of two numbers between 0 and 1.

Assume now that $k \leq m$ and consider any country $i \leq m$. In this case $\alpha_m - \alpha_i > \alpha_m$ for any i and m. When $\theta(\cdot) < 1$ we have $\left(\frac{\alpha_i-\alpha_m}{\alpha_m}\right)\left(1-\frac{1}{\theta(\cdot)}\right) \in [0,1]$ because it is the product of two negative numbers with absolute value between 0 and 1 (here we use assumption A.2, which implies $\left|1-\frac{1}{\theta(\cdot)}\right| < 1$), and when $\theta(\cdot) \geq 1$ we have $\left(\frac{\alpha_i-\alpha_m}{\alpha_m}\right)\left(1-\frac{1}{\theta(\cdot)}\right) \in (-1,0]$ because it is the product of two numbers with absolute value between 0 and 1.

Let us finally consider the effect of a change in the median for a given number of countries:

$$\begin{aligned}\frac{\partial U_i^{in}(\alpha_m, N)}{\partial \alpha_m} &= \frac{\partial g_m(\alpha_m)}{\partial \alpha_m}\cdot[\alpha_i H_g\{g_m(\alpha_m)[1+\beta(N-1)]\}[1+\beta(N-1)]-1] \\ &= \left(\frac{\alpha_i-\alpha_m}{\alpha_m}\right)\frac{\alpha_m}{g_m(\alpha_m)}\theta(\cdot)\end{aligned}$$

where we used (6) and (7) in the second line. But $\alpha'(\alpha_k, \alpha_m, N) \lessgtr \alpha_m$ if and

only if $\alpha_i \lessgtr \alpha_m$, hence:

$$sgn\left\{(\alpha'(\alpha_i,\alpha_m,N)-\alpha_m)\frac{\partial U_i^{in}(\alpha_m,N)}{\partial \alpha_m}\right\} = sgn\left[\alpha_i-\alpha_m\right]^2 > 0$$

Q.E.D.

Remark. As it is evident from the proof of Lemma 2, what we really need for it and the following propositions to hold is that:

$$\left(\frac{\alpha_i-\alpha_m}{\alpha_m}\right)\left(1-\frac{1}{\theta(\cdot)}\right) < 1$$

which implies:

$$\alpha_{\min} > \alpha_m\left(\frac{1-2\theta(\cdot)}{1-\theta(\cdot)}\right) \text{ whenever } \theta(\cdot) < 1$$

and:

$$\alpha_{\max} < \alpha_m\left(\frac{2\theta(\cdot)-1}{\theta(\cdot)-1}\right) \text{ whenever } \theta(\cdot) > 1$$

Obviously, A.1 and A.2 are only sufficient conditions for this to hold.

Proof of Proposition 2.

Consider the case of Lemma 1 in which $H\{g_m(\alpha_m)[1+\beta(N-1)]\} \leq H(y)$ and $\alpha_l(\beta)$ and $\alpha_u(\beta)$ are defined as the preferences for which the utility from staying in a union (α_m, N) is the same as the utility from staying out of it. First we will show that these values are the lower and upper bounds such that all and only all the countries $i \in (l,u)$ belong to the equilibrium union - part a) - and then we will show that $\partial\alpha_l(\beta)/\partial\beta < 0$ and $\partial\alpha_u(\beta)/\partial\beta > 0$ - part b). The proof is analogous when $H\{g_m(\alpha_m)[1+\beta(N-1)]\} > H(y)$.

a) Suppose that a country $k \in (l,u)$ does not belong to the equilibrium union. Notice that from Lemma 2 $U_k^{in}(\alpha'(\alpha_k,\alpha_m,N),N+1) \geq U_k^{in}(\alpha_m,N)$. Because of this and the fact that $\Delta(\alpha_k,\beta) > 0$, it follows:

$$U_k^{in}(\alpha'(\alpha_k,\alpha_m,N),N+1) - U_k^{out} > U_k^{in}(\alpha_m,N) - U_k^{out} = \Delta(\alpha_k,\beta) > 0$$

This contradicts the fact that $(\alpha_m,N)^{EU}$ was an equilibrium union.

Now suppose that a country $k \notin (l,u)$ belongs to the equilibrium union. Since $\Delta(\alpha_k,\beta) \leq 0$ by construction, it is clearly better for the country to stay out. Again, this contradicts the fact that $(\alpha_m,N)^{EU}$ was an equilibrium union.

b) The cut-offs $\alpha_l(\beta)$ and $\alpha_u(\beta)$ are defined in Lemma 1 by the function:

$$[H[g_m(\alpha_m)(1+\beta(N-1)] - H(g^o(\alpha))] = \frac{g_m(\alpha_m) - g^o(\alpha)}{\alpha}$$

Total differentiation with respect to α and β, and repeated use of (6) and (9) provide:

$$\frac{d\alpha}{d\beta} = -\frac{g_m(\alpha_m)(N-1)}{[1+\beta(N-1)]\,\Delta_\alpha(\alpha,\beta)}\left[1 - \left(\frac{\alpha-\alpha_m}{\alpha_m}\right)\left(1-\frac{1}{\theta(\cdot)}\right)\right]$$

whose sign, under A.1-2, is the opposite of the sign of $\Delta_\alpha(\alpha,\beta)$ - the proof of this follows the one in Lemma 2. Since $\Delta_\alpha(\alpha_l,\beta) > 0$ and $\Delta_\alpha(\alpha_u,\beta) < 0$, $\alpha_l(\beta)$ is decreasing in β and $\alpha_u(\beta)$ is increasing.

c) This is immediate after recognizing that each CEU is an EU. Indeed, for a given median and for a given EU there is always a set of outsiders $\Gamma(S)$ with S even, such that (14) holds, unless the EU is the largest size EU with the same median. **Q.E.D.**

Proof of Proposition 3.

We will prove that an equilibrium union $(\alpha_m, N)^{EU}$ accepts any new member k if and only if $\mid \alpha'(\alpha_k, \alpha_m, N) - \alpha_m \mid < \bar{\epsilon}$ for some $\bar{\epsilon} > 0$.

Define $\epsilon \equiv \alpha'(\alpha_k, \alpha_m, N) - \alpha_m$ and assume that $\alpha_k > \alpha_m$ so that $\epsilon > 0$ (the argument is symmetric in the opposite case). Country 1 will not exit from the union after entry of country k if and only if $U_1^{in}(\alpha'(\alpha_k, \alpha_1, N), N+1) > U_1^{in}(\alpha_1, N)$, that is if and only if ϵ is lower than a cut-off $\hat{\epsilon}$ defined by:

$$[H[g_m(\alpha_m + \hat{\epsilon})(1 + \beta N)] - H(g^o(\alpha_1))] = \frac{g_m(\alpha_m + \hat{\epsilon}) - g^o(\alpha_1)}{\alpha_1}$$

Now consider the median country m. This country will support k's admission if and only if $U_m^{in}(\alpha'(\alpha_k, \alpha_m, N), N+1) > U_m^{in}(\alpha_m, N)$, that is if and only if ϵ is lower than a cut-off $\tilde{\epsilon}$ such that:

$$[H[g_m(\alpha_m + \tilde{\epsilon})(1 + \beta N)] - H\{g_m(\alpha_m)[1 + \beta(N-1)]\}] = \frac{g_m(\alpha_m + \tilde{\epsilon}) - g_m(\alpha_m)}{\alpha_m}$$

The claim follows setting $\bar{\epsilon} = \min(\hat{\epsilon}, \tilde{\epsilon})$. **Q.E.D.**

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