A federal voting mechanism to solve the fiscal-externality problem

Thomas Piketty

Economics Department, MIT, Cambridge, MA 02139, USA

Abstract

Fiscal externalities arise whenever several countries choose independently some tax or regulation policy. This results into a severe loss for everybody if the taxed or regulated factor is very mobile (for example, this implies a bias toward little or no capital taxation if capital can move easily toward the lowest tax rate). Federalism would induce voters to internalize these externalities but implies full harmonization, which harms countries whose most-preferred policy is too far from the federal median (which may lead them not to enter the federation in the first place). We study a natural, intermediate mechanism between full independence and full federalism introducing flexible divisions of the surplus generated by the removal of these externalities: in the first stage, voting takes place in each country simultaneously in order to choose a federal policy; in the second stage, each country decides through voting whether to adopt the federal policy or to leave the federation, in which case it chooses its own policy and possibly pays a fixed cost to the remaining federation. Even if the fixed cost is null, the federal voting stage acts as a commitment device and softens the inefficiency of full independence by allowing voters to internalize the undesirable effects of federal break-up in stage 2. Moreover the fixed cost can be chosen so that situations where harmonization is desirable get self-selected. As a result, every country always benefits from entering this mechanism combining the benefits of common decision-making with those of flexibility.

1. Introduction

Consider the common situation where several sovereign nations have to choose independently some tax or regulation policy, i.e. taking as given the policies chosen by the other sovereign nations. If the tax base of these policies [1] is very mobile between these states, it is well-known (at least since Musgrave (1969) and Oates (1972)) that such a fiscal externality problem results into a substantial loss for each country. For example if international capital mobility is high, each sovereign state competes to attract capital and this results into a serious bias toward very little capital taxation, even if initially each state had a strong preference for high capital-income taxation (for example for redistributive reasons). [2] Many observers view this problem as particularly serious in the current EC context where economic integration implies continuously decreasing capital mobility costs:

> "(...) taxation of capital is important both for public good provision and redistribution, but non-cooperation leads to a world where capital will be exempt from tax" (Malinvaud, 1989).

This cross-frontier externality problem, which arises for a great variety of issues, has been addressed by a voluminous literature (see Section 2 for a quick survey). We argue in this paper that the few theoretical and normative solutions to this problem (such as Pigovian corrective taxation) which have been proposed by this literature are not satisfactory, [3] and we analyze a new solution to this old problem, based upon a simple but flexible voting mechanism of federal sovereignty sharing (hence the title).

The basic idea is the following. An easy way to remove a cross-frontier externality for a given policy is obviously to redefine the frontiers of the decision-making units, that is, to create a federation and to decide that the same policy for all countries will be chosen at the federal level. [4] The problem with this solution is that although this increases the size of the 'surplus' (the Pareto-inefficiency is removed) it allows for no flexibility in the distribution of this surplus between countries; that is, countries whose most-preferred policy is too different from that of the federal median voter may actually prefer not to enter the

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[1] Or, more generally, the production factors whose returns in a given country depend on the tax or regulation imposed by this country.

[2] There does exist a literature claiming that capital tax rates should vanish in the long-run (see e.g. Lucas, 1990), and who may therefore find some virtues to tax competition. These optimal tax results depend however on very strong assumptions, including the zero-productivity of public expenditures (see Jones et al. (1993) for an alternative viewpoint). In any case, fiscal externalities arise for a great variety of other tax and regulation policies (environmental and social norms for plants,....), and our proposed mechanism applies to all of them.

[3] Mostly because they are not informationally feasible (see Section 2 for a more precise discussion).

[4] This is the usual 'fiscal-federalism' solution proposed by public finance economists (see, e.g., Musgrave (1969) and Oates (1972)).

federation in the first place. [5] The problem therefore is to find a way to realize this surplus while distributing it so that every country benefits as compared to full independence. [6] This paper looks at what seems to us the simplest possible departure from full federalism to full independence (or conversely) and argues that this allows to gain on both sides by preserving the benefits both of common decision-making (cross-frontier externalities are internalized) and of flexibility (full harmonization is not imposed a priori).

The mechanism works as follows: in the first stage, a federal voting process takes place in order to choose a federal policy (i.e. the same policy for each country); that is, each country votes simultaneously over the set of tax policies, and the winner of the voting process is determined by the majority rule at the federal level. In the second stage, each country decides whether to enact the federal policy or to leave the federation (for the time of the legislature and only for this particular policy), in which case the country will have to choose independently its own policy (national political preferences are determined by national median-voters; this voting process can take place within the national groups of the Federal Parliament). Countries who have decided not to enact the federal policy pay a fixed cost μ to those enacting the federal policy. [7]

The point is that even if countries are allowed to leave the federal agreement at no cost (i.e. if $\mu = 0$), the mechanism always results into a Pareto-improvement (for the national median-voters, and thus for a majority in each country) of the non-cooperative equilibrium, [8] because the first stage of the mechanism acts as a commitment device for those countries which would be particularly hurt by the escalation of non-cooperative policy competition: in stage 1 the federal policy will always be chosen such that not everybody leaves in stage 2. That is, the federal voting stage induces voters to choose some 'federal statu quo' minimizing federal break-up and inefficiencies in stage 2.

However, this is in the interest of every country to commit to pay some positive fixed cost $\mu > 0$ to leave the federation: the reason is that if $\mu = 0$ there will always be at least at country willing to leave the federation in the second stage

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[5] That is, the equilibrium resulting from full federalism may be Pareto-efficient without Pareto-dominating the equilibrium resulting from full independence. We believe this simple logic explains a large part of the reluctance of governments to transfer any substantial policy area to a federal body when they are asked to (in particular in Europe).

[6] One mechanism would be federal voting over all possible vectors of national policies, so that voters internalize cross-frontier externalities and at the same time harmonization is not imposed. The point is that a voting process over such a multi-dimensional policy set would not admit any majority winner: it is in the very nature of voting that flexibility in surplus-sharing implies majority cycles and equilibrium non-existence. This is why we have to consider a more indirect mechanism.

[7] In general, μ may depend on the number of countries leaving the federation, or even on how 'far' one leaves; the point is that, although this would in general improve efficiency, these refinements are not necessary for the mechanism to be highly profitable.

[8] I.e. the equilibrium under full independence.

(since deviating is not costly and can only benefit to the deviator as long as there is no other deviator), even in the case where national median-voters have identical preferences in each country (whereas one would like the same optimal policy to be enacted in each country in such a situation). The point is that it is possible to find some $\mu > 0$ such that situations where the same policy for each country is desirable (if national median-voters are close to each other) and those where it is optimal to have different national policies (but not the competitive escalation of the non-cooperative equilibrium) get self-selected; this is because of the following straightforward incentive-compatibility property: the profitability of a deviation from a given federal tax policy increases with the distance between the federal policy and one's most preferred policy. Therefore everybody always benefits from setting a positive penalty for leaving the federal agreement.

Although we view the basic message of this paper as a normative one, note that the way many international negotiations are made has some similarity with this two-stage mechanism: [9] first, some international declaration or treaty is agreed upon (e.g., on environmental issues), and then national parliaments have to amend and ratify it if they want. In both cases, the important point is that when choosing an initial agreement that each party will have the right to adopt or to leave the agents take into account the effects on stage 2, and that this initial stage per se can be sufficient to induce significant cooperation, although its decision is not binding. [10]

The rest of the paper is organized as follows: Section 2 relates our contribution to the relevant literature and discusses alternative mechanisms; Section 3 presents a general, abstract model fiscal-externality model; Section 4 presents and analyzes the two-stage federal voting mechanism; Section 5 concludes. The reader already familiar with the literature may want to go directly to Section 3.

2. Relation to existing literature and other mechanisms

As mentioned above, the fiscal-externality problem has often been addressed by the economics literature.

Many authors propose a solution based on the (more or less) direct application of the principles of Pigovian corrective taxation (see Krelove (1992), Wildasin (1989) and subsequent references): "governments do not internalize that decreasing their tax rate has an impact on the capital stock available for other countries, so let's tax each unit of foreign capital attracted by each country in order to induce governments to internalize this externality and to implement the first-best" (it is equivalent to create a market for rights of tax base; see Krelove (1992)). The

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[9] I am grateful to David Cutler for this suggestion.

[10] This way of inducing cooperation may also be found in a number of cartel arrangements (I am grateful Drew Fudenberg for making this point).

problem with this solution is that it relies on the existence of a federal agency which has the power to set the tax rate for attracted capital and to enforce it, which requires both the national political preferences (to compute the optimal tax rate) and the amounts of foreign capital attracted by each country (to charge the tax) to be publicly verifiable. Such conditions seem very unlikely to be met in practice at the international and EC level: information about international capital movements is highly decentralized, and various actors (including governments) have little incentive to reveal it (the same is true, to a lesser extent, for national political preferences). Therefore this kind of 'solution' to the fiscal externality problem is of no use. What is needed is a fully decentralized mechanism [11] which does not require the existence of any 'central planner' observing the current parameters of the problem and setting the rules, but rather which works out 'automatically' for every parameter once it has been agreed upon ('a constitution').

As we already discussed, another common-sense solution to the fiscal-externality problem is full federalism. One may think that the induced harmonization is the cost to pay to get rid of the externality-driven inefficiency, as suggested by Malinvaud (1989) who seems to deny the right for countries with similar structures to have different views regarding taxation: "The right to tax differently can only be interesting when there are differences in economic and social structures". Unfortunately, the current EC political context is such that it is hard to imagine, say, a right-wing government willing to give up its sovereignty over any substantial policy area if the majority of member states is left-wing (and conversely, although a lonely left-wing government may want to make large concessions to avoid the non-cooperative escalation). This problem also arises in many situations involving local jurisdictions, and therefore we consider as a sine-qua-non constraint the requirement that the mechanism not only eliminates (or at least softens) the fiscal-externality inefficiency but also results into an improvement of the non-cooperative equilibrium for (the decisive majority of) every country, whatever the distribution of national political preferences. [12]

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[11] In the sense of the theory of mechanism design; see for example Moore (1992) for a survey. As Moore (among others) makes clear however, the mechanisms proposed by this literature are often unconvincing because they rely on complicated equilibrium structures and many doubtful tricks, although they readily require little information. In contrast, this paper looks at very simple, low information-intensive mechanisms (see below).

[12] It is interesting to note that the 'fiscal-federalism' solution to fiscal-externality problems (based on complete sovereignty transfers) have been put forward by authors who were clearly addressing the problem from a North-American perspective (Musgrave (1969), Oates (1972)): although complete sovereignty transfers are never an easy task, one can think to them as a possible solution in the US context, whereas this is clearly highly problematic in the current EC political context (especially regarding the general fiscal and redistributive policy). As Musgrave (1969) puts it: "What about differentials in redistributive objectives? (...) Only federal distributional goals matter". This may explain why the question of designing mechanisms which at the same time keep the practical feasibility of federalism and preserve national sovereignties has not been addressed by the literature (mainly North-American in this branch of public economics).

Apart from Pigovian corrective taxation and federalism, there are other natural ideas to remove the fiscal-externality inefficiency. For example, if it was possible to apply very strictly the residence principle of taxation at a reasonably low cost, this would do the job (as forcefully argued by Giovannini (1989) and Giovannini (1990)). However, many authors doubt that legal and non-legal international tax avoidance can really be controlled so strictly (see, for example, Gordon (1990)): company headquarters and, to a lesser extent, wealthy individuals can easily move within the EC. As argued, among others, by Persson and Tabellini (1992), "in practice, the source principle is the relevant principle for the corporate income tax, before and presumably after 1992". In any case, this could apply only to fiscal externalities strictly speaking, and not to the many cross-frontier externalities generated by environmental norms, social norms, regulation policy (unless we think of each single state as imposing these norms to all of its national plants located abroad, which seems hardly tenable).

Another straightforward 'solution' would be to consider that, after all, governments should realize that taking as given foreign policies when choosing their own tax rate results into an inefficiency and should therefore directly cooperate. Although this may sometime happen, many imperfections in the bargaining process (imperfect information,...) may prevent the emergence of an efficient bargaining outcome. Also, it makes a substantial difference for the credibility of cooperation whether it emerges from a stable voting mechanism (i.e. a federal constitution) instead of relying on day-to-day informal agreements between governments. This is especially true if one considers that public information about agreements carried out directly between bureaucrats is hardly perfect, and that this leaves room for opportunistic political parties to break such informal cooperation; as opposed to our mechanism which involves directly public opinions and relies entirely on democratic voting.

Finally, we are aware that we do not establish the optimality of our proposed mechanism within a wider class of 'acceptable' mechanisms. One could very well consider more complicated mechanisms with more than two voting stages where countries deciding to stay in the federation in stage 2 can 'renegotiate' through voting the federal agreement, and so on... We also note that the infinite replication of the static non-cooperative game can be sufficient to induce cooperation through the usual threats and counter-threats. [13] The main justification for looking at our proposed mechanism is its simplicity [14] and the fact that it is actually sufficient to induce the first-best if one uses it with fully-contingent transfers (see Section 4.3.).

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[13] As noted above, the fact that some of the relevant agents are short-lived and opportunistic may limit the efficiency of this kind of device.

[14] We do not offer a theory of 'simplicity', but we do note that most mechanisms proposed by the mechanism design literature are usually dismissed as overcomplicated and unusable.

3. A general model of cross-frontier policy externality

3.1. Definitions

We consider a set of countries $N = (1; \ldots; N)$; each country $n \in N$ is inhabited by a continuum of citizens $C(n) = [0; C(n)]$ (a 'country' could be a local jurisdiction).

Each nation $n \in N$ has to choose a uni-dimensional policy variable $t_n \in [0; 1]$ (say, a capital-income tax rate on domestic investments, or the toughness of the environmental or social norms that a plant located in country n has to respect). t_n affects not only its national welfare (how much revenue raised, how much public-good produced,...), but also the international movements of some production factor k (say, capital), and therefore the welfare of other nations.

Thus every citizen $i \in C(n)$ of every nation $n \in N$ cares not only about the national policy t_n but about the entire vector of national policies $(t_m)_{m \in N}$: his (reduced-form) preferences are represented by some utility function $U_{t(i),n}((t_m)_{m \in N})$, where $t(i) \in [0; 1]$ is an individual parameter characterizing completely citizen i's preferences: instead of modelling explicitly international investments of the factor k as a function of $(t_m)_{m \in N}$, we make directly some natural [15] assumptions on the reduced-form preferences:

A0. $\forall n \in N$, $\forall i \in C(n)$, $t(i) = \text{ArgMax}_{t \in [0;1]} U_{t(i),n}((t_m = t)_{m \in N})$.

A1. $\forall n,p \in N$, $n \neq p$, $\forall i \in C(n)$, $\forall (t_m)_{m \in N}$, if $t(i) \geq t_n$ then $\partial U_{t(i),n}((t_m)_{m \in N})/\partial t_p > 0$, and if $t(i) \leq t_n$ then $\partial U_{t(i),n}((t_m)_{m \in N})/\partial t_n < 0$

A2. $\forall n,p \in N$, $n \neq p$, $\forall i \in C(n)$, $\forall (t_m)_{m \in N}$, $\partial^2 U_{t(i),n}((t_m)_{m \in N})/\partial^2 t_n < 0$,

$\partial^2 U_{t(i),n}((t_m)_{m \in N})/\partial t_n \partial t_p > 0$,

$\partial^2 U_{t(i),n}((t_m)_{m \in N})/\partial t_n t(i) > 0$.

Assumption A0 is a definition: $t(i)$ is defined as citizen i's most-preferred policy in case he had the power to choose a common policy for every nation (i.e. $t(i)$ is the 'true' individual preference, excluding for the bias of international competition to attract the production factor k).

Assumption A1 says that as long as citizen i's most-preferred policy $t(i)$ is higher than the policy t_n adopted by his nation, citizen i is better-off if other nations increase their policy variable (this brings more of factor k into nation n,

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[15] See below for the kind model and/or justifications which would lead to these preferences.

and this positive effect could be counterbalanced by the negative effect on citizen i's own foreign investment only if nation n was already taxing too much according to citizen i). Conversely, as long as citizen i's most-preferred policy $t(i)$ is lower than the policy t_n adopted by his nation, citizen i is better-off if his nation lowers its policy.

Assumption A2 requires preferences to be concave with respect to one's national policy, and makes natural assumptions on cross-derivatives: the individual marginal benefit of having higher tax rates at home increases with foreign tax rates (since less marginal factor evasion arises in this case) and with one's most-preferred policy (almost by definition).

It is easy to check that these assumptions are satisfied for the capital-tax interpretation of the model where tax-revenue is used for purely redistributive transfers and individual preferences are entirely determined by individual capital stocks and mobility costs between countries (citizens with lower capital holdings prefer higher tax rates, and conversely; see Krelove (1992) and Persson and Tabellini (1992) for such models). In the general case with more complex political attitudes regarding the policy variable t (i.e. reflecting one's views about the policy, which may not be entirely correlated with one's wealth), we feel that these are natural assumptions (in effect, our results apply to any problem of cross-frontier externalities satisfying assumptions A0, A1 and A2).

In what follows we take the set of possible preferences $(U_{t,n^-}$ $((t_m)_{m \in N}))_{t \in [0;1], n \in N})$ as fixed, but we allow the distributions $(F_n(t))_{n \in N}$ of individual characteristics to vary with no restrictions ($F_n(t)$ is the mass of citizens living in country n and whose most-preferred policy is below t).

3.2. The non-cooperative equilibrium

The non-cooperative equilibrium results from full independence, i.e. each country takes as given foreign policies and enacts its best response. That is, the politico-equilibrium between these countries is defined as follows: in each nation $n \in N$ an election takes place, where citizens in country n take as given other nations' policies $(t_m)_{m \ne n}$; competition between opportunistic political parties leads to the election of the unique majority winner (i.e. of the unique policy which defeats every other policy in a binary majority contest; existence of such a policy is guaranteed by the uni-dimensionality of the policy set and concavity/single-peakedness of individual preferences); [16] that is, in equilibrium each country attempts to maximize the interest of its median voter, and the political process

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[16] The two-stage voting mechanism we consider next section would still be beneficial if we adopt another view of the political process (for example if we assume political parties are partisan and do not only maximize their election prospects when making policy proposals).

reduces to a non-cooperative game played between median voters. The outcome of this political process is straightforward:

Proposition 1. Whatever the distributions $(F_n(t))_{n \in N}$:

(i) *There exists a non-cooperative politico-economic (Nash) equilibrium* $(t_{nNE})_{n \in N}$, *defined by:*

$$\forall n \in N, \quad t_{nNE} = \text{ArgMax}_{t \in [0;1]} U_{t^*(n),n}((t_m = tm_{mNE})_{m \neq n}, t_n = t)$$

with $t^*(n)$ *defined by* $F_n(t^*(n)) = C(n)/2$.

(ii) *Moreover this equilibrium involves too little taxation:* $t_{NNE} < t^*(n) \, \forall n \in N$.

Proof. Existence follows from the first part of A2 (concavity of $U_{t,n}(.)$ with respect to t_n) and standard existence results (see e.g. Friedman (1989)). (ii) follows directly from the second part of A1 (best replies are always below one's most-preferred tax rate because of the tax-competition effect). CQFD.

Note that we could have considered a slightly different definition of the non-cooperative political equilibrium: assume that citizens are not voting directly over policies, but are voting to appoint one of them as the policy-maker (or, equivalently, a partisan political party); in that case electing a particular citizen to act as the policy-maker is a way to commit to a reaction function in the non-cooperative tax game which follows, and in such a situation the median-voter will choose to elect someone with more 'redistributive preferences' than himself so as to offset partly the bias toward little taxation. However, this effect does not offset completely the bias toward inefficiently low capital taxation (see Persson and Tabellini (1992)). Therefore we do not loose anything qualitatively by assuming that citizens vote directly over tax policies. [17]

4. The two-stage federal voting mechanism

4.1. Definitions

The two-stage voting mechanism is defined as follows: in the first stage, majority-rule voting takes place in every nation simultaneously in order to choose a federal policy t^*. [18] In the second stage, majority-rule voting takes place in each

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[17] As to why people go and vote despite their negligible importance, we do not have anything new to say. To make this behavior consistent in game-theoretic terms, say that the continuum economy we described so far is in fact a large finite economy and that there is some small uncertainty about $F_n(t)$ so that each voter thinks he has a small positive probability to be the decisive voter.

[18] We assume each nation is given the same weight in the federal voting process, although populations $C(n)$ may differ.
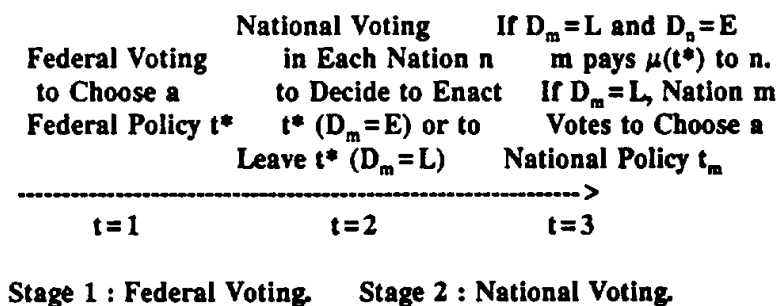
Federal Voting to Choose a Federal Policy t*	National Voting in Each Nation n to Decide to Enact t* (D$_m$=E) or to Leave t* (D$_m$=L)	If D$_m$=L and D$_n$=E m pays μ(t*) to n. If D$_m$=L, Nation m Votes to Choose a National Policy t$_m$
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t=1	t=2	t=3

Stage 1 : Federal Voting.   Stage 2 : National Voting.

Fig. 1.

country n separately in order to decide whether to enact the federal policy t^* or to leave the federation $(D_n = E$ or $D_n = L)$. If $P \leq N$ countries leave the federation and the other countries enact t^*, then each of these P countries pays $\mu(t^*, P)$ and each of the remaining nations receives $P\mu(t^*, P)/(N - P)$;[19] if $P = 0$ there are no transfers. The countries n which decided to leave the federation choose subsequently their own policy t_n.

To fix ideas in terms of existing institutions, say that the mechanism takes place entirely within a Federal Parliament: in stage 1 a Federal Parliament is elected, and the latter chooses through voting a federal policy t^*; in stage 2, each national group of the Federal Parliament votes separately in order to decide to enact or to leave t^*. Those leaving subsequently vote to choose their national policy.

The timing is summarized by Fig. 1.

We assume that sovereign countries can commit to this decision-making mechanism if they anticipate to benefit from it, exactly in the same way that real-world countries sometime commit to full federalism.[20]

Note that the game could be modified so as to make the transfer payment $\mu(t^*)$ depending on the policies t_m adopted by the nations leaving t^*; this would allow us to implement a first-best efficient tax structure. However, we want to show that our mechanism can be highly profitable even with very weak informational requirements, and since the national policy t_m chosen by a country leaving the federation may not easily be publicly verifiable, we do not consider this possibility. In fact, this mechanism is already profitable for everybody even if $\mu(t^*) = 0$, and this is what we first want to prove.

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[19] These transfers must be distributed in each country in such a way that they do not offset the existence of a majority winner and the decisiveness of the median voter; say for example that they are financed via the very policy instrument underlying our analysis. In what follows $\mu(t^*, P)$ will always denote the fraction of the transfers paid or received by the relevant median voter (when no confusion is possible).

[20] This commitment power can be due to some unmodeled repeated-relationship nature of the interaction between these countries.

4.2. The mechanism with $\mu(t^*) \equiv 0$

If $\mu(t^*) \equiv 0$, the effect of the two-stage voting mechanism is remarkably simple:

Proposition 2. *If $\mu(t^*) \equiv 0$, and whatever the distributions $(F_n(t))_{n \in N}$, there exists a Subgame-Perfect Nash Equilibrium for the two-stage voting game, and any of these SPE $(t_{nSPE})_{n \in N}$ strictly Pareto-dominates the non-cooperative equilibrium $(t_{nNE})_{n \in N}$, in the sense that each median voter (and hence a majority in each country) is strictly better-off: $U_{t^*(n),n}((t_{mSPE})_{m \in N}) > U_{t^*(n),n}((t_{mNE})_{m \in N})$ $\forall n \in N$.*

Proof. We solve the voting game by backward induction: for any t^* chosen at $t = 1$ and any vector $(D_n)_{n \in N}$ of Enact t^*/Leave decisions taken at $t = 2$, the period-3 subgame is a non-cooperative tax game played between the median voters of those nations P who decided to leave ($P = (n \in N$ s.t. $D_n = L)$), resulting into an equilibrium $(t_{nNE,P})_{n \in P}$ (existence is guaranteed by the first part of A2).

Next the period-2 subgame is a finite game played by the median voters of every nation: possible actions are E and L, and everybody anticipates that if a subset $P \subset N$ chooses L final payoffs will be $U_{t^*(n),n}((t_m = t^*)_{m \in N \setminus P}, (t_m = t_{MNE,P})_{m \in P})$ for nation n's median voter. As a finite game, this game admits at least one equilibrium [21] (see e.g. Friedman (1989)). Coming back to the federal election at $t = 1$, voters anticipate correctly that, depending on t^*, some nations may leave at $t = 2$. Citizens can always obtain a payoff at least as good than under non-cooperation: elect a t^* (say, $t^* = 100\%$) such that every nation leaves at $t = 2$). To prove that the majority of voters is always strictly better off in equilibrium, we just have to prove that there always exists some t^* such that in period-2 not everybody leaves and any SPE strictly dominates non-cooperation for every median voter.

We prove that a local improvement around the NE exists, although potential gains are much larger in general. Pick $n \in N$, $t^* = t_{nNE} + dt_n$, where $dt_n > 0$ is arbitrarily small. Then at $t = 2$, nation n will never choose to leave: assume that in some SPE all nations in $P \subset N$ leave; at $t = 3$, $t_{mNE,P} = t_{mNE} + dt_m$ for $m \in P$, with $dt_m > 0$ and arbitrarily small (we use part 2 of A2, i.e. $\partial^2 U_{t,m}(.)/\partial t_m t_n > 0$ for $m \neq n$). But since for any nation $m \in N$ $\partial U_{t^*(m),m}((t_{pNE})_{p \in N})/\partial t_q = 0$ if

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[21] Note that there may exist several subgame perfect equilibria at t = 2: for example if there are only two countries n = 1,2, and if t* is such that both median voters t*(n), n = 1,2, prefer ($t_n = t^*, t_m =$ ArgMax$_t U_{t^*(m),m}(t_n = t^*, t_m = t)$) to ($t_{NNE}, t_{MNE}$), then both ($D_1 = E, D_2 = L$) and ($D_1 = L, D_2 = E$) are equilibria at t = 2. Most multiple-equilibria cases will disappear when we introduce positive transfers ($\mu(t^*) > 0$).

$q = m$ (definition of a NE), and > 0 for $q \neq m$ (part 1 of A1), every median voter is strictly better-off in equilibrium.   CQFD.

Thus there are two key reasons why introducing a first stage of federal voting is profitable, even though each country can leave freely the federation: firstly, the federal voting stage acts as a commitment device to a reasonably high tax rate for those citizens and countries who want to avoid the dramatic escalation of tax competition; secondly, it induces voters (and hence political parties) in the first stage to realize that a complete break-up of the federal agreement in stage 2 may be undesirable, and therefore that it may be worth to elect a federal policy in stage 1 so as to avoid complete break-up in stage 2. The point is that one can always find some federal agreement t^* in stage 1 so as to avoid complete break-up in stage 2, i.e. such that at least one country prefers to stick to t^*.

Thus introducing two voting stages is beneficial because it allows to parametrize the eventual, non-harmonized policy structures $(t_n)_{n \in N}$ of stage 2 by the federal agreement t^* chosen in stage 1, whereas voting directly over $(t_n)_{n \in N}$ would result into equilibrium non-existence (because of multi-dimensionality). We believe this two-stage trick to achieve partial cooperation is used implicitly in many international negotiations, and ought to be used even more: for example this allows to reduce (possibly enormously) the bias toward little capital taxation at a very low informational cost: no federal agency has to intervene, nothing needs to be publicly verifiable (except voting).

However, one can easily do better by using the mechanism with a positive $\mu(t^*)$. The problem with setting $\mu(t^*) \equiv 0$ is that in equilibrium there is always at least one country deciding to leave the federation: as long as this can be done at no cost, it is always profitable to deviate if one is the only country to do so. If national political preferences are sufficiently close to one another, this can be very inefficient: in the extreme case where every country has the same most preferred policy $(\forall m, n \in M \ t^*(m) = t^*(n) = t^*)$, one would like every country to enact the federal policy in the second stage and the common optimal policy t^* to be elected in the first stage. This can be done by using the mechanism with a positive $\mu(t^*)$, without hurting national sovereignties.

4.3. The mechanism with $\mu(t^*, P) > 0$

If one sets $\mu(t^*, P) \equiv \infty$, then nobody ever leaves the federation, the mechanism is equivalent to full federalism, and some countries may prefer the non-cooperative equilibrium if national most-preferred policies are too heterogeneous (i.e. if the distributions $F_n(t)$ are too different). Therefore one must find $\mu(t^*, P) > 0$ small enough so that when a country is worst-off at t^* than under the non-cooperative equilibrium it decides to leave, but high enough so that no country deviates when national political preferences are sufficiently close. The reason why this is possible is the following incentive-compatibility property: the profitability to

deviate from a given t^* is an increasing function of the distance between t^* and one's most-preferred policy t_i; that is: [22]

$$\text{If } t(i) > t^*, \quad \partial \big(U_{t(i),n}\big(t_n = t(i)\big)\big((t_m = t^*)_{m \neq n}\big),$$

$$\big(t_m = t^*\big)_{m \neq n}\big) - U_{t(i),n}\big((t_m = t^*)_{m \in N}\big)\big)/\partial t(i) > 0,$$

$$\text{If } t(i) < t^*, \quad \partial \big(U_{t(i),n}\big(t_n = t(i)\big)\big((t_m = t^*)_{m \neq n}\big),$$

$$\big(t_m = t^*\big)_{m \neq n}\big) - U_{t(i),n}\big((t_m = t^*)_{m \in N}\big)\big)/\partial t(i) < 0.$$

where $t(i)((t_m = t^*)_{m \neq n})$ is $t(i)$'s best reply given $(t_m = t^*)_{m \neq n}$.

It follows that one can design transfer schemes $\mu(t^*, P)$ such that situations where harmonization is profitable for everybody and those where this is not so get self-selected by the mechanism: the crucial point is that such transfer schemes can be fixed ex ante with no prior knowledge of the distributions $F_n(t)$, and that they benefit to (a majority of voters in) every country whatever the distributions $F_n(t)$ of national political preferences.

For example in the case $N = 2$, one can define $\mu(t^*) = \mu(t^*, 1)$ as follows:

$$\mu(t^*) = \text{Min}\big(\mu_1(t^*), \mu_2(t^*)\big)$$

with

$$\mu_1(t^*) = \text{Min}U_{t(i),1}\big(t_1 = t(i)\big)\big(t_2 = t^*\big), t_2 = t^*\big) - U_{t(i),1}\big((t_n = t^*)_{n=1,2}\big)$$

under

$$t(i) = t^*(1); \quad t^*(1) \le t^* \le t^*(2);$$

$$U_{t(i),1}\big((t_n = t^*)_{n=1,2}\big) < U_{t(i),1}\big(t_{\text{NE}}(1), t_{\text{NE}}(2)\big)$$

and

$$\mu_2(t^*) = \text{Min } U_{t(i),2}\big(t_1 = t^*, t_2 = t(i)\big)\big(t_1 = t^*\big)\big) - U_{t(i),2}\big((t_n = t^*)_{n=1,2}\big)$$

under

$$t(i) = t^*(2); \quad t^*(1) \le t^* \le t^*(2);$$

$$U_{t(i),2}\big((t_n = t^*)_{n=1,2}\big) < U_{t(i),2}\big(t_{\text{NE}}(1), t_{\text{NE}}(2)\big).$$

By definition, these transfers are such that once a country is worse-off under full harmonization at t^* than at the non-cooperative equilibrium it will decide to leave the federal agreement; moreover the IC property above implies that $\mu(t^*)$ is larger than $U_{t^*,n}\big(t_n = t^*, t_m = t(i)\big)(t_m = t^*)\big) - U_{t^*,n}\big((t_p = t^*)_{p=1,2}\big)$ for $n = 1,2$ and $m \neq n$, that is, the transfers are large enough to deter all countries from leaving the federation in case the federal agreement coincides with their most-pre-

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[22] This property follows directly from the integration of part 3 of A2.

ferred policy (this is desirable for everybody to stick to t^* in such a case). This ensures that each country would always prefer to commit to pay a positive cost to have the right to leave the federal agreement. Note that in practice these costs need not take directly the form of financial transfers: the country leaving the federal agreement could be excluded from some other mutually-beneficial agreement. Again, we believe this kind of trick is actually being used implicitly in a number of international negotiations (possibly by exploiting the repeated-relationship nature of these negotiations).

Note that if we add the additional constraint that μ cannot depend on t^*, this may not hurt very much (set $\mu = \text{Min}_{t^* \geq 0} \mu(t^*)$); in general however, this is more efficient to use as much information as possible (note that the $\mu(t^*)$ defined above is increasing in t^*; therefore not allowing μ to depend on t^* may make full cooperation impossible to sustain in case t^* is too high).

Obviously the magnitude of the optimal $\mu(t^*)$ depends on mobility costs and more generally on the mobility of the factor. For example tax or regulation policies which do not involve any cross-frontier externality require $\mu(t^*) \equiv 0$ (and stage 1 is irrelevant): there is need to use the Federal Parliament only for those policies which entail a substantial tax-base mobility, such that capital-income taxation or environmental norms.

5. Concluding comments

Voting is well-known to be the most natural way to induce individual agents to internalize an externality: give to the agents the power to impose collective decisions to themselves, so that nobody takes any decision without taking into account the external effects imposed on other agents. [23] The problem is that voting also imposes full harmonization, which may not be desirable and, most of all, not acceptable by many parties so that non-cooperation perpetuates. This is because voting is an appropriate decision-making process only when the choice is to be made over relatively simple policy sets. This paper shows that a simple combination of federal and local voting in the form of a federal voting mechanism with exit rights ('Flexible Federalism') can be used to solve (or at least to soften) these difficulties: the benefits of cooperation are captured, and those of flexibility (the possibility of non-harmonization) are preserved.

Although we think that our mechanism can be an efficient and simple way to solve the fiscal-externality problem in the current EC context, there are reasons to be pessimistic concerning the likelihood of such a solution being implemented. Firstly, the EC Commission seems to be more concerned with the good effects of competition between jurisdictions in terms of public services provision than with

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[23] This seminal insight seems to be due to Wicksell (1896); see Musgrave (1987).

the bad ones (see Bureau and Champsaur, 1992). Secondly, the negotiations which lead in December 1991 to the Maastricht Treaty have shown the reluctance of national governments to transfer any substantial power to the European Parliament and their inability to understand that this can be highly profitable to everybody, including for the current minority.

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