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Flexible Integration? Mandatory and Minimum Participation Rules

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Abstract

For a club such as the European Union, an important question is whether a subset of the members should be allowed to form "inner clubs" and enhance cooperation. Flexible cooperation allows members to participate if and only if they benefit, but it leads to free-riding when externalities are positive. I show that flexible cooperation is better if the heterogeneity is large and the externality small, but that rigid cooperation is the political equilibrium too often. Both regimes, however, are extreme variants of a more general system combining mandatory and minimum participation rules. For each rule, I characterize the optimum and the equilibrium.

Keywords: Integration; enhanced cooperation; coalitions; free-riding

JEL classification: *D*71; *F*53

I. Introduction

How should European integration proceed? After years of negotiations, on June 18, 2004, the member states agreed on a Constitution for Europe, thereby defining new rules for collective decision-making. But some countries have already rejected the constitution in referendums, and it is uncertain whether it ever will be implemented. If not, it is probable that a core group of countries will proceed with deeper integration alone, leaving other members behind at the status quo. Critics argue that this will lead to dissolution of the EU at worst, or a division between first-rate and second-rate members at best. Supporters, however, argue that such an approach is the only way of solving the conflict between enlargement and deepening cooperation; see e.g. Alesina, Angeloni and Etro (2005).

Whether a subset of members should be allowed to form "inner clubs" is a general question, not limited to the European example. In this paper I investigate whether flexible cooperation is better than the alternative rigid approach, in which either all or none of the members participate. A simple

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model is set up with linear payoff functions. A member may benefit or lose from participating in the inner club, but its contribution is always beneficial to the other members. The advantage of flexible cooperation is that participation can be limited to those and only those that benefit from it. However, since one member's participation has positive externalities on other members, a free-rider problem arises in which too few members will join the inner club. For this reason, flexible is better than rigid cooperation if and only if the heterogeneity is large and the externality small. This optimal regime, which maximizes total welfare, is then compared to the "political equilibrium". After member-specific preference shocks are realized, a majority of the members prefer rigid cooperation too often compared to what is optimal. It is thus necessary to agree on flexibility "behind the veil of ignorance", i.e., before the members know their individual costs of participation.

Flexible and rigid integration are both special cases of a more general regime, characterized by a "mandatory participation rule" and a "minimum participation rule". If the size of the participating subgroup is larger than under the mandatory participation rule, then participation is mandatory for everyone. If the size is just smaller, then participation is voluntary. Since mandatory participation is capable of mitigating the free-rider problem, the threshold should decrease in the externality but increase in the heterogeneity. Typically, the optimal mandatory participation rule is a super-majority rule, thus rationalizing the extensive use of super-majority requirements in political situations. Nevertheless, a simple majority rule is always the political equilibrium outcome. Once again, mandatory participation will occur too often compared to what is optimal, unless the members are able to commit to the best rule in advance.

The minimum participation rule states that no subgroup of smaller size is allowed to participate by itself. If the subgroup is just larger, however, participation is voluntary. Although the rule may appear odd when externalities are positive, the minimum participation rule mitigates free-riding when a member's participation is necessary to meet the threshold. Thus, the minimum participation rule should increase in the externality but decrease in the heterogeneity. There may be no political equilibrium for this rule, however, which confirms the finding that the rules should be determined in advance, before the individual preferences are in conflict.

Minimum participation rules are common, particularly for environmental agreements. Barrett (2003) lists 297 environmental treaties, where only nine do *not* specify a minimum participation threshold. The Kyoto Protocol, for example, was valid only if at least 55% of the polluters ended up ratifying the treaty. If Russia had chosen not to ratify the treaty, the Kyoto Protocol would have been invalid according to the rules. Russia was thus pivotal for implementing the treaty, and unable to free-ride on the other participants.

Returning to the European Union, its current Treaty (Article 43) does set forth conditions for when "enhanced cooperation" is allowed. The subgroup should, for example, be open to all and respect the rights of non-participants. The subgroup must also include at least eight member states. Moreover, for most types of policies, mandatory participation is attained if supported by a qualified majority. Thus, the functioning of the EU is indeed characterized by a pair of mandatory and minimum participation rules.

The literature that compares flexible and rigid cooperation is small. Dewatripont *et al.* (1995) argue in favor of more "flexible integration", defined by a "common base" in which all members must participate, and "open partnerships" where only a subset participates. The internal market should be a part of the common base, while the currency union should be an open partnership. Thygesen (1997) suggests the opposite, and claims that some asymmetry and discrimination may be necessary in order to encourage more members to participate. Berglöf, Burkart, Friebel and Paltseva (2006), on the other hand, argue that the possibility of forming open partnerships may be exactly what motivates outsiders to join, since they are assumed to suffer from a negative externality otherwise. Bordignon and Brusco (2006) provide one of the few formal analyses of whether flexible is better than rigid integration. The problem with flexible integration, they argue, is that the participants may coordinate on standards that do not take into account the utility of outsiders and future potential members. Only if they can commit to a standard that takes these preferences into account should flexible integration be allowed. This paper, in contrast, takes free-riding to be the major drawback of flexible integration. Rigid cooperation is an extreme way of dealing with this problem; defining mandatory and minimum participation rules is generally better.[1]

There are only a few papers on mandatory participation rules, or "federal mandates". Crémer and Palfrey (2000, 2006) argue that such mandates are too strict in the political equilibrium. The intuition is related to the insights provided in my model. With its focus on majority thresholds, this paper also contributes to the large literature on majority rules, including e.g. Buchanan and Tullock (1962), Gersbach and Erlenmaier (2001), Aghion and Bolton (2003) and Harstad (2005). These papers assume that some kind of side transfers is possible between the members. Elsewhere I have argued that the members may want to prohibit side transfers since these could lead to conflicts and delay when preferences are private information; see Harstad (2007). Thus, this paper abstracts from side payments, although information is complete. A super-majority rule, in this context, is optimal

[1] The paper is also related to the large literature on whether regional trade agreements are a stepping stone or a stumbling block for global free trade; see e.g. Bhagwati (1991, 1993), Burbidge, DePater, Myers and Sengupta (1997) and Aghion, Antras and Helpman (2006).

if and only if no members are prohibited from participating in inner clubs.

The literature on minimum participation rules is small as well. With a finite number of members, Black, Levi and de Meza (1993) estimate the effect of the rule by numerical simulations, while Rutz (2001) assumes all members to be identical. Both contributions take the rule as exogenously given and predict that it will bind in equilibrium. In this paper, however, I allow for aggregate shocks and, then, the rule may not bind. Carraro, Marchiori and Oreffice (2004) also endogenize the rule, but they abstract from heterogeneity and aggregate shocks. Barrett (2003) summarizes some of this literature, and suggests that the minimum participation rule may also be a coordination device.

A quite simple model is set up in Section II. It is then used in Section III to compare flexible and rigid cooperation, deriving the best regime as well as the political equilibrium. It is shown in Section IV that both flexible and rigid cooperation are special cases of another regime which combines mandatory and minimum participation rules. For both thresholds, the optimum and the political equilibrium are derived. With these results in mind, Section V reviews the Treaty of the European Union, while Section VI concludes.

II. A Simple Model

Consider a union with a set of members I, and a public good. Although many contexts fit the model, the members may well be interpreted as districts or countries. The public good could be interpreted as reducing pollution. For each member, contributing to the public good is a binary decision. Contributing entails costs as well as benefits, and the *net* benefit to member $i \in I$ from her own contribution is given by:

$$v_i = v - \epsilon_i - \theta,$$

where v is a constant, while ϵ_i and θ are some local and global cost (or benefit) shocks, respectively. The parameter v measures the expected net benefit to member i from her own contribution and this parameter can therefore be negative as well as positive.

The local cost parameters ϵ_i reflect that the members may be heterogeneous with respect to their benefits or costs of participating. To simplify, I assume that the ϵ_i's are independently drawn from a uniform distribution with mean zero and density $1/h$:

$$\epsilon_i \text{ i.i.d. } \sim U\left[-\frac{h}{2}, \frac{h}{2}\right].$$

Let there be a continuum of members in the union, $I \equiv [0, 1]$, such that the distribution of the ϵ_i's is deterministic and uniform on $[-h/2, h/2]$.

Then, h measures the *ex post* heterogeneity in values. If we order the i's according to increasing ϵ_i's, then

$$v_i = v + h/2 - hi - \theta.$$

The global shock θ captures the aggregate uncertainty and variance related to the costs and benefits of public good provision. To arrive at explicit solutions, let θ also be uniformly distributed:

$$\theta \sim U\left[-\frac{\sigma}{2}, \frac{\sigma}{2}\right].$$

That both θ and the ϵ_i's have a mean of zero is without loss of generality, since the means could in any case be captured by the constant v.

Since contributing is a public good, all other members benefit if i contributes. Let $e > 0$ denote the positive externality on the other members, if i contributes. The parameter N measures the fraction of contributing members. Thus, i's utility is $v_i + eN$ if she participates herself, while it is eN if she does not. In the working paper version, the externality on non-participants is allowed to be less, possibly negative; see Harstad (2006). Since the results are very much the same, I only briefly discuss this possibility later on.

The rest of the paper investigates how participation can best be induced in a simple way. The derived optimal participation rules would actually also be an equilibrium, if the participants could agree to the rules behind the veil of ignorance, i.e., before time t_ϵ in Figure 1. Then, it would not matter whether $t_\epsilon < t_\theta$ or $t_\epsilon > t_\theta$.

Sometimes, however, the members have a fairly good idea of their preferences relative to those of the others, even before the participation rules are determined. To capture this situation, one may suppose that the rules are determined after time t_ϵ but before time t_θ. Then, different members will disagree on the rules. If a Condorcet winner exists, it beats all the alternatives in a pairwise vote, and it may thus be labeled the political equilibrium. Throughout the analysis, the political equilibrium is derived and contrasted to the optimal rule.

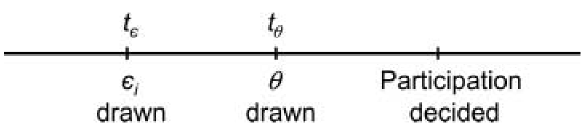

Fig. 1. Timing of events

III. Flexible vs. Rigid Cooperation

The model is analyzed under flexible cooperation and rigid cooperation, before comparing the two. For each case, I derive both the optimal rule and the political equilibrium.

Flexible Cooperation

Under "flexible cooperation", any subcoalition of I may form an "inner club" and participate by contributing to the public good. Thus, participation is voluntary, or "flexible". Although some members (whose $v_i \geq 0$) may actually benefit from contributing, too few participate since the positive externality is not taken into account.

The first proposition states the optimal number of participants, and contrasts this to the actual number under flexible cooperation. Whenever only a fraction $N \in (0,1)$ of the members participates, then the set of participants should optimally be all $i \in [0, N]$, since these are the members benefiting the most (recall that the i's are ordered according to increasing ϵ_i's). Throughout the analysis, this will also be the equilibrium.

Proposition 1. *(i) The optimal number of participants is given by (1). (ii) In equilibrium, the number of participants is given by (2).*

$$N_*(\theta) = \left\{ \begin{array}{ll} 1 & \text{if } \eta_\theta(e) > 1 \\ \eta_\theta(e) & \text{if } \eta_\theta(e) \in [0, 1] \\ 0 & \text{if } \eta_\theta(e) < 0 \end{array} \right\} \tag{1}$$

$$N_F(\theta) = \left\{ \begin{array}{ll} 1 & \text{if } \eta_\theta(0) > 1 \\ \eta_\theta(0) & \text{if } \eta_\theta(0) \in [0, 1] \\ 0 & \text{if } \eta_\theta(0) < 0 \end{array} \right\}, \tag{2}$$

where

$$\eta_\theta(e) \equiv (v + h/2 - \theta + e)/h.$$

Proof: (i) Taking the externality into account, i should participate if

$$v_i + e \geq 0 \Rightarrow i \leq \frac{v + h/2 - \theta + e}{h}.$$

(ii) When participation is voluntary, however, member i participates if

$$v_i \geq 0 \Rightarrow i \leq \frac{v + h/2 - \theta}{h}. \blacksquare$$

Both the optimal and the equilibrium numbers of participants are smaller if θ, the cost parameter, is large. For any θ, however, the equilibrium number is smaller than the optimal number of participants, since the externality e is positive. With flexible cooperation, too few will contribute.[2]

Rigid Cooperation

Here "rigid cooperation" means that either everyone or no one has to contribute. This decision is taken by voting, where the majority requirement is given by some rule $m_R \in (0, 1]$. Thus, if at least a fraction m_R of the members wants to participate, then everyone has to participate.

If member i could decide, she would prefer everyone to participate if $v_i + e - \theta \geq 0$. Member i does not decide, however, unless she is the pivotal voter, $i = m_R$. Therefore, the project will be approved if $v_m + e = v + h(\frac{1}{2} - m_R) + e \geq \theta$. The larger is the majority rule m_R, the less likely it is that the project will be approved.

Proposition 2. *(i) Under rigid integration, the best majority rule is $m_R = 1/2$. (ii) $m_R = 1/2$ is also the political equilibrium.*

Proof: Given m_R and ϵ_i, i's expected utility is given by:

$$\begin{aligned} u_i^R &= \int_{-\sigma/2}^{v+h/2-hm_R+e} (v + h(1/2 - i) + e - \theta) \frac{d\theta}{\sigma} \\ &= (v + h(1/2 - i) + e + \sigma/2)^2/2\sigma - (h(m_R - i))^2/2\sigma. \end{aligned} \tag{3}$$

Thus, i has single-peaked preferences over m_R with a maximum at $m_R = i$. $m_R = 1/2$ is therefore a Condorcet winner. Integrating over all the u_i's gives:

$$u^R \equiv \int_I u_i di = (v + e + \sigma/2)^2/2\sigma - (h(m_R - 1/2))^2/2\sigma,$$

which also has a maximum at $m_R = 1/2$. ■

If $m_R = 1/2$, the public good is provided if the number of winners preferring it is at least as large as the number of losers. That the optimal majority rule is $m_R = 1/2$ follows from the assumption that the costs (the ϵ_i's) are symmetrically distributed, such that the benefit to the winners is comparable to the cost of the losers. The result is thus similar to May's (1952) Theorem.

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[2] Note that if $h < e$ and $\theta < v + h/2$, then all members benefit if everyone participates, instead of only N_F. But such a coalition may not be stable, since any subgroup of the grand coalition, $\forall j \in [0, N']$, $N' < 1$, also has incentives to form, and this is preferable for $i > N'$.

Each member would, naturally, like to dictate the participation decision herself. Therefore, after time t_ϵ, each member i prefers $m_R = i$, and has single-peaked preferences over m_R: the closer is m_R to i, the better. Low-cost members (low i) prefer a small majority rule, such that projects can be easily approved, while high-cost members (large i) prefer a super-majority requirement, making the public good less likely to be approved. The Condorcet winner $m_R = 1/2$ is the political equilibrium.[3]

Rigid cooperation means that high-cost members may be required to participate even if they do not want to, or low-cost members may be prohibited from participating even if they would benefit from doing so. This is the cost of rigid cooperation.

Flexible or Rigid Cooperation?

While flexible cooperation leads to free-riding and too few participants, rigid cooperation treats everyone the same no matter whether they benefit or lose from participating. Since the preferences in each case are already derived, it is easy to compare the two regimes. For the comparison, assume $m_R = 1/2$ under rigid cooperation, since this is the optimal rule as well as the political equilibrium.

Proposition 3. *(i) Flexible cooperation is better than rigid cooperation if and only if (4) holds. (ii) Flexible cooperation is the political equilibrium if and only if (5) holds.*

$$h/e \geq \sqrt{12} \tag{4}$$

$$h/e \geq \sqrt{32}. \tag{5}$$

Proof: I prove (ii) first. Let $\theta_i = v + h(1/2 - i)$ denote the θ where i wants to participate under flexible cooperation. Thus, $\theta_1 = v - h/2$ and $\theta_0 = v + h/2$. Given ϵ_i, i's expected utility is:

$$\begin{aligned} u_i^F &= \int_{-\sigma/2}^{\theta_1} (v_i + e)\frac{d\theta}{\sigma} + \int_{\theta_1}^{\theta_i} (v_i + eN_F)\frac{d\theta}{\sigma} + \int_{\theta_i}^{\theta_0} eN_F\frac{d\theta}{\sigma} \\ &= (v + h(1/2 - i) + \sigma/2)^2/2\sigma + e(\theta_1 + \sigma/2)/\sigma + eh/2\sigma \\ &= (v + h(1/2 - i) + \sigma/2)^2/2\sigma + e(v + \sigma/2)/\sigma. \end{aligned}$$

[3] In the model, therefore, the optimal m_R coincides with the political equilibrium. Note, however, that if the costs (the ϵ_i's) were *not* symmetrically distributed, the political equilibrium would still be $m_R = 1/2$, although this may no longer be optimal. This suggests that the simple majority rule may be the political equilibrium too often.

The difference to u_i^R under rigid integration (3) (when $m_R = 1/2$) is:

$$\begin{aligned}
&-e^2/2\sigma - e\left[v + h(1/2 - i) + \sigma/2\right]/\sigma + e\left(v + \sigma/2\right)/\sigma \\
&\quad + \left(h(1/2 - i)\right)^2/2\sigma \\
&\quad = h^2 i^2/2\sigma - h(h - 2e)i/2\sigma + (h/2 - e)^2/2\sigma - 2e^2/2\sigma, \qquad (6)
\end{aligned}$$

which is a U-shaped function with a minimum at $i = 1/2 - e/h$. Thus, member $i = 1/2 - e/h$ benefits the least from flexible cooperation, while the more extremely low or large i's benefit the most from flexibility. The two indifferent i's are given by:

$$i = (h/2 - e \pm e\sqrt{2})/h.$$

If $h/e > 2 + 2\sqrt{2}$, both indifferent i's are $\in (0, 1)$, and there is a majority for flexible cooperation if the difference between the two i's is less than 1/2:

$$2\sqrt{2}e/h \leq 1/2 \Leftrightarrow h/e \geq \sqrt{32}.$$

If $h/e < 2 + 2\sqrt{2}$, there is always a majority for rigid integration.

Proof of (i): Integrating (6) over all the i's gives:

$$h^2/6\sigma + h(2e - h)/4\sigma + (h/2 - e)^2/2\sigma - e^2/\sigma = \left(h^2/12 - e^2\right)/2\sigma,$$

which is positive if $h/e \geq \sqrt{12}$. ■

Quite intuitively, Proposition 3 states that if the heterogeneity h is large, then flexible cooperation is better than rigid cooperation. The members are then too different to all be required to do the same. If the externality e is large, however, then flexible cooperation leads to free-riding and too few will participate in equilibrium. Then, it is beneficial to force everyone to participate, despite the heterogeneity, and rigid cooperation is best.

After the ϵ_i's are realized, the members disagree over whether cooperation should be flexible or rigid. In particular, the moderate members prefer rigidity, while both the low-cost and the high-cost members prefer flexibility. The intuition is the following: (i) While a very low cost is always beneficial, it is particularly beneficial under flexibility, since then the low-cost members may participate even if they are in a minority. (ii) While a very high cost is always detrimental, it is of less importance under flexibility, since then the high-cost members may always opt out. Hence, the utilities u_i are convex in i under flexibility, as illustrated in Figure 2.

Whenever the moderate members are in the majority, rigid cooperation is the political equilibrium. This is the case when the heterogeneity h is small, since then most members are "moderate", and when e is large, since then forced participation is more beneficial for all. However, as illustrated in Figure 2, the moderate members benefit less from rigidity than the extreme

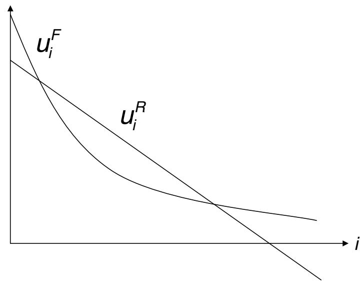

Fig. 2. Utilities under the two regimes

members lose (since u_i is convex in i under flexibility). Thus, rigidity may be the equilibrium even if flexibility is optimal. In fact, this situation will occur for all parameters such that $h/e \in (\sqrt{12}, \sqrt{32})$. To ensure sufficient flexibility, the members must commit to the rules "behind the veil of ignorance", i.e., before time t_ϵ.

Note that the expected value of participation, v, has no effect on the choice of regime. The reason is simply that a larger v shifts the cut-off states, the θ's, upward by the very same amount, regardless of whether cooperation is flexible or rigid.

Proposition 3 presumed that $m_R = 1/2$ under rigid cooperation. In reality, a larger majority is often required in political settings, for various reasons. Since $m_R = 1/2$ is optimal, a larger majority rule makes the rigid regime worse, and thus flexibility relatively better.

Corollary 1. *The larger is* $|m_R - 1/2|$ *under rigid cooperation, the better is flexibility compared to rigidity.*

IV. Flexibility and Rigidity Combined

Flexible cooperation turned out to be flawed because too few will participate, while rigid cooperation is flawed because it treats heterogeneous members the same way. Thus, it may be better to somehow mix the two regimes.

Consider the more general participation rule (m, n). The "mandatory participation rule" m is a threshold such that if at least m members would like to participate, then everyone has to participate. The "minimum participation rule" n is another threshold such that if less than n members would like to participate, then no one is allowed to participate. If the size of the subgroup is smaller than m but larger than n, then the subgroup participates while the rest do not.

Note that if $(m, n) = (1, 0)$, the regime is flexible and just as studied above. If, instead, $m = n$, the regime is rigid, in the sense defined in Section III. Thus, the two regimes considered above are both special cases of the more general regime (m, n). Moreover, in the working paper version, I show that *any* symmetric and monotonic participating mechanism (a mapping from the set of votes to the set of participants) is characterized by a pair (m, n) where $m \geq n$; see Harstad (2006, Proposition 5).

In the next two subsections I study the optimal m and n. Each is analyzed separately, for two reasons. First, they are of independent interest. In some cases, it may be unconstitutional to deny members the right to produce public goods on their own, implying that $n = 0$. This is the case, for example, in the model of Crémer and Palfrey (2000). Thus, I begin by studying the optimal m given $n = 0$. In other cases, it may be impossible to force members to provide public goods against their will, implying $m = 1$. This is the case for international environmental agreements, for example, though most such agreements still have minimum participation rules $n > 0$. In the second subsection I therefore focus on the optimal n given $m = 1$.

The second justification for studying m and n separately is that the optimal thresholds may actually be independent of each other. Suppose that in some state of the world, $\theta', N_F(\theta') \in (n, m)$. Then, the first-order conditions for m and n are independent, and their optimal levels are just as derived below. The last paragraph of this section presents the condition for this to be the case.

Mandatory Participation Rules

Here, participation is flexible in that everyone can choose to contribute. Participation is rigid, however, in the sense that if there is a sufficiently large majority preferring everyone to participate, then participation is mandatory. One interpretation of this regime may be that it is standard and rigid, with the modification that no one can be prohibited from contributing.

Since flexible integration leads to free-riding and too few members, $m < 1$ may be good since it forces free-riders to participate. However, if the heterogeneity is large, then $m < 1$ implies that some members with very high costs are forced to participate, even when this is socially suboptimal. We may thus expect a low m to be optimal if the externalities are large, while a larger m is better when the heterogeneity is large. This intuition is indeed correct.

Proposition 4. *(i) If $h/e < 2$, $m = 1/2$ is optimal. Otherwise, it is optimal to set $m \in (1/2, 1)$ according to (7), thus increasing in h but decreasing in e.*

(ii) In the political equilibrium, $m = 1/2$.

$$m = 1 - \frac{2e\,(h-e)}{h^2} \in (1/2, 1). \tag{7}$$

Proof: (i) Let θ'_m represent the θ making $i = m$ indifferent between approving (forcing everyone to participate) and disapproving. If i disapproves, participation is voluntary and N_F is the equilibrium outcome. Member $i = m$ is indifferent when:

$$v + h/2 - mh - \theta'_m + e = eN_F\,(\theta) = e\left(\frac{v + h/2 - \theta'_m}{h}\right) \Leftrightarrow \tag{8}$$

$$mh - e = \left(\frac{h-e}{h}\right)\left(v + h/2 - \theta'_m\right) \Leftrightarrow$$

$$\theta'_m = v + h/2 - h\left(\frac{mh-e}{h-e}\right).$$

If $mh - e < 0$, $\theta_m > \theta_0$ and $N_F(\theta)$ in (8) should be replaced by 0. Then, $m = 1/2$ is optimal, as discussed above. Thus, suppose $mh > e$. Let $u^N(\theta)$ denote the aggregate utility when N members contribute,

$$u^N(\theta) = N(v + e + h/2 - \theta) - N^2 h/2.$$

Select any $\theta' \in (\theta'_m, \theta_0]$ and integrate social welfare over $[\theta_1, \theta']$ (for $\theta > \theta'$, welfare is independent of m):

$$\int_{\theta_1}^{\theta'_m} u^1\,(\theta)\,\frac{d\theta}{\sigma} + \int_{\theta'_m}^{\theta'} u^{N_F}\,(\theta)\,\frac{d\theta}{\sigma},$$

where

$$u^{N_F}(\theta) = \left(\frac{v + h/2 - \theta}{h}\right)e + \left(\frac{v + h/2 - \theta}{h}\right)^2 h/2$$

is the social welfare under flexibility. It is worthwhile to increase m (and thus decrease θ'_m) as long as $u^{N_F}(\theta'_m) > u^1(\theta'_m)$, which requires:

$$\left(\frac{v + h/2 - \theta'_m}{h}\right)^2 h/2 + \left(\frac{v + h/2 - \theta'_m}{h}\right)e > v + e - \theta'_m \Leftrightarrow$$

$$\left(\frac{mh-e}{h-e}\right)^2 h/2 + \left(\frac{mh-e}{h-e}\right)e > \left(e - h/2 + (mh-e)\left(\frac{h}{h-e}\right)\right) \Leftrightarrow$$

$$\left(\frac{mh-e}{h-e}\right)^2 h/2 - \left(\frac{mh-e}{h-e}\right)(h-e) + h/2 - e > 0 \Leftrightarrow$$

$$1 + \left(\frac{mh-e}{h-e}\right)^2 - 2m > 0.$$

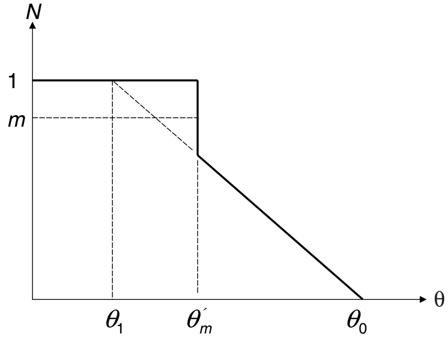

Fig. 3. The number of participants under a mandatory participation rule

The LHS is a U-shaped function in m which equals zero at $m = 1$ and at some $m < 1$, given by (7). Thus, the second-order condition holds only at the latter. Under this m, it is easily shown that the condition $mh > e$ is equivalent to $h > 2e$. Part (ii) can be derived as in the preceding subsection, and the intuition for it is the same as before. ■

When $h < 2e$, the heterogeneity is so small that there is never any voluntary participation under the optimal majority rule, and the situation is just as above under rigid cooperation. This explains why $m = 1/2$ is optimal whenever $h/e \leq 2$.

When $h > 2e$, it is optimal that $m > 1/2$, i.e., that the majority rule is larger than under rigid cooperation. Intuitively, any majority rule should balance the low-cost members' gains from mandatory participation by the high-cost members' losses. When participation is not prohibited, low-cost members can always choose to participate, so their gain from mandatory participation is lower for each θ. Since protecting the high-cost members becomes relatively more important, $m > 1/2$. Thus, when participation is not prohibited, a super-majority rule is optimal.

The larger the externality, the worse the free-rider problem, and the smaller m should be. If the heterogeneity is large, however, forced cooperation is very detrimental to high-cost members, and a large m is optimal. Note, however, that m should always be strictly less than 1. Intuitively, when m is large, participation is mandatory only when most members so prefer. For this to be the case, the aggregate cost shock θ must be quite small. Then, high-cost members do not suffer that much from participation and their sacrifice is less than the positive externality from contributing.

This regime dominates both of the regimes in the preceding section. Flexible cooperation is just a special case, where $m = 1$. As already indicated, $m < 1$ is always better. Compared to rigid cooperation, allowing participation (even when a minority participates) is a Pareto improvement for everyone. Thus, the present regime is socially better compared to both flexible and rigid cooperation.

However, Proposition 4 states that in the political equilibrium, the mandatory participation rule is always $m = 1/2$. The intuition is the same as before: every member $i \in [0, 1]$ prefers to be pivotal, i.e., that $m = i$. $m = 1/2$ is thus the Condorcet winner. Hence, in equilibrium, there is too often mandatory participation, compared to what is optimal. In other words, there is too much rigidity and too little flexibility in the political equilibrium, thus complementing the conclusion of Proposition 3 above. To achieve sufficient flexibility, the rules should be determined behind the veil of ignorance, i.e., before time t_ϵ.

Minimum Participation Rules

The minimum participation rule is represented by $n \in [0, 1]$, as in Black *et al.* (1993). The rule says that no subcoalition of size less than n can cooperate alone. As discussed in the introduction, such minimum participation rules are normal for environmental agreements, where the externality is likely to be large. In such settings, $m = 1$ (since no country can be forced to participate), so let $m = 1$ for now.

A minimum participation rule may appear odd when there are positive externalities from those who participate, particularly if the heterogeneity is large, such that some low-cost members benefit considerably from participating. However, by requiring n to participate, other members realize that they cannot free-ride and that they may be pivotal for any participation to take place. This mitigates the free-rider problem, suggesting that n should be positive when externalities are positive and large. The following proposition shows that this intuition is correct.

Note that when n binds, the participation game is a game of "chicken" and there are multiple equilibria, some in which a high-cost member finds it necessary to participate because a low-cost member does not. To simplify, I focus on the best of these equilibria, assuming that the low-cost members do participate.

Proposition 5. *(i) If $h/e > 2$, $n = 0$ is optimal. If $h/e < 2$, the optimal n is given by (9), thus decreasing in h but increasing in e. (ii) Preferences are not single-peaked in n, and a Condorcet winner for n might not exist.*

$$n = \min\left\{\frac{2e(2e - h)}{(h - e)^2 + e(2e - h)}, 1\right\}. \tag{9}$$

Proof: (i) θ_n denotes the θ when the constraint n binds,

$$n = N_F(\theta) = \left(\frac{v + h/2 - \theta_n}{h}\right) \Leftrightarrow \theta_n = v + h/2 - nh.$$

For θ such that $N_F(\theta) < n$, $i = n$ realizes that she is pivotal for any cooperation to take place. Let θ'_n denote the θ that makes her indifferent:

$$v + h/2 - hn - \theta'_n + ne = 0 \Leftrightarrow \theta'_n = v + h/2 - n(h - e).$$

Select any $\theta' \in [\theta_1, \theta_n)$ and integrate social welfare from θ' (for $\theta < \theta'$, welfare is independent of n):

$$\int_{\theta'}^{\theta_n} u^{N_F}(\theta)\frac{d\theta}{\sigma} + \int_{\theta_n}^{\theta'_n} u^n(\theta)\frac{d\theta}{\sigma}. \tag{10}$$

The derivative of (10) w.r.t. n is positive whenever

$$\frac{\left(u^{N_F}(\theta_n) - u^n(\theta_n)\right)}{\sigma}\frac{\partial\theta_n}{\partial n} + \int_{\theta_n}^{\theta'_n} \frac{\partial u^n(\theta)}{\partial n}\frac{d\theta}{\sigma} + \frac{u^n\left(\theta'_n\right)}{\sigma}\frac{\partial\theta'_n}{\partial n} > 0.$$

$u^{N_F}(\theta_n) = u^n(\theta_n)$, but the second and third terms can be written:

$$\begin{aligned}
&\int_{\theta_n}^{\theta'_n} (v + e + h/2 - \theta - nh)\frac{d\theta}{\sigma} - \frac{n(e + nh/2 - ne)}{\sigma}(h - e)\\
&\quad = e^2/2\sigma - (e - ne)^2/2\sigma - n(e + nh/2 - ne)(h - e)/\sigma\\
&\quad = ne(2e - h)/\sigma - n^2[e^2 + (h - 2e)(h - e)]/2\sigma\\
&\quad = ne(2e - h)/\sigma - n^2[e(2e - h) + (h - e)^2]/2\sigma.
\end{aligned} \tag{11}$$

If $h > 2e$, the derivative is negative for all n. If $h < 2e$, however, (11) is zero under (9). The second-order condition holds for this n, and it is the argmax of (11).

(ii) Suppose $i > n$:

$$u_i = \int_{-\sigma/2}^{\theta_1} (v_i + e)\frac{d\theta}{\sigma} + \int_{\theta_1}^{\theta_i} (v_i + eN_F)\frac{d\theta}{\sigma} + \int_{\theta_i}^{\theta_n} eN_F\frac{d\theta}{\sigma} + \int_{\theta_n}^{\theta'_n} en\frac{d\theta}{\sigma}$$

$$\frac{\partial u_i}{\partial n} = \int_{\theta_n}^{\theta'_n} e\frac{d\theta}{\sigma} + \frac{en}{\sigma}\frac{\partial\theta'_n}{\partial n} = e^2 n/\sigma - en(h - e)/\sigma = en(2e - h)/\sigma,$$

which is positive whenever $h/e < 2$. For $i < n$:

$$u_i = \int_{-\sigma/2}^{\theta_1} (v_i + e)\frac{d\theta}{\sigma} + \int_{\theta_1}^{\theta_n} (v_i + eN_F)\frac{d\theta}{\sigma} + \int_{\theta_n}^{\theta'_n} (v_i + en)\frac{d\theta}{\sigma}$$

$$\begin{aligned}
\frac{\partial u_i}{\partial n} &= \int_{\theta_n}^{\theta'_n} e\frac{d\theta}{\sigma} + (en + v + h/2 - hi - \theta'_n)\frac{\partial\theta'_n}{\sigma\,\partial n}\\
&= e^2 n - (h(n - i))(h - e),
\end{aligned}$$

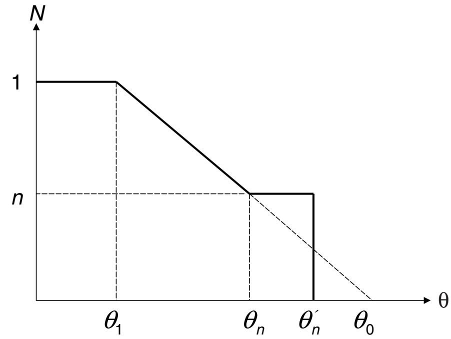

Fig. 4. The number of participants under a minimum participation rule

which is positive if $h/e < 1$ or if

$$i > n - \frac{e^2 n}{h(h-e)}.$$

Thus, if $h/e < 1$, everyone (except for i's marginally larger than n) wants n to increase marginally. Otherwise, almost everyone wants n to increase, except for the smallest i, i.e., the lowest-cost members. ■

It is optimal to have a minimum participation rule $n > 0$ if h is small and e large. The effect of such a rule is that it forces all $i \le n$ to participate for any contributions to take place. Thus, free-riding is somewhat mitigated. This is more beneficial if the externality is large, and less costly if the heterogeneity is small, thus explaining why n increases in e but decreases in h. If $h/e \ge 2$, $n = 0$ is optimal.

There may be no political equilibrium for n, however. The reason is that if the minimum participation rule increases a marginal amount to, say, n, every $i > n$ benefits from this when $h < 2e$ (as shown in the proof). Many members $i < n$ benefit as well, so that a majority is likely to prefer such a marginal increase in n. Member $i = n$, however, loses considerably, because she becomes pivotal for cooperation and can no longer free-ride on the other members' contributions. The flip-side of this is that if the members consider reducing the rule from n to n', every $i \in (n', n)$ may benefit, and this may be a majority if the downward shift in n is large. Thus, while there is a majority supporting a marginal increase in n, there may also be a majority supporting a large reduction in n, implying that there is no Condorcet winner for n.

There is an additional reason why $n > 0$ may not be politically viable. If the members have a possibility to renegotiate n after time t_θ, then no $n > 0$ is renegotiation-proof. As soon as $\theta \in (\theta_n', \theta_0)$, such that the rules preclude certain members from participating, then every $i \in I$ prefers that n is reduced, to make it possible for the low-cost members to contribute. If Russia, for example, had not signed the Kyoto Protocol, thereby making it non-binding according to the rules, the other signatories could have had an incentive to renegotiate the protocol by relaxing the minimum participation rule. Thus, for such a rule to have any effect, the members must be able to commit to not renegotiate.

Although m and n are studied separately above, they can obviously be combined. If m and n are sufficiently different, such that for some θ', $N_F(\theta') \in (n, m)$, then the first-order conditions for m and n are independent of each other. This is evident from the proofs of Propositions 4 and 5 which, respectively, integrate utilities to and from some $\theta' \in (\theta'_m, \theta_n)$. The first-order conditions for m and n are thus independent and exactly as described above, if just:

$$\theta'_m < \theta_n \Rightarrow mh - n(h-e) > e \quad \text{if } h > e.$$

In such an equilibrium, Propositions 4 and 5 continue to hold. This will be the case if h is large and e small. If this condition does not hold, however, no subcoalition of size strictly between n and m will ever form. The joint optimization of m and n can proceed in a way similar to that above, but it will be somewhat more complicated.

V. The EU Treaty Reviewed

The future of European integration is fiercely debated. After some of the member states rejected what others regarded as the next European Constitution, the question is whether a subgroup of the members should be allowed to go further than others. This is the idea of flexible integration, and this question motivated the analysis of this paper.

Currently, the Treaty of the European Union does allow enhanced cooperation between a subset of the member states, under certain conditions. It should, according to Article 43 (j), be open to all members, should they wish to participate. Moreover, Article 43 (f) states that enhanced cooperation must "not constitute a barrier to or discrimination in trade", and it should, according to Article 43 (h), "respect the competences, rights and obligations of those Member States which do not participate therein". For this reason, the externalities in the model have been assumed to be positive.[4]

In a simple model where flexibility and rigidity could be compared, it turned out that flexibility is better than rigidity if the heterogeneity is

[4] The possibility of negative externalities on non-participants is analyzed in the working paper version of this paper; see Harstad (2006). There is then another rationale for the minimum participation rule: to prevent a large majority from being harmed by the inner club.

large and the externality small. Since enlargement of the union is likely to increase heterogeneity, a larger union should allow for more flexibility. Such flexibility must be committed to in advance, however, since after the heterogeneity between the member states has materialized, a majority of the countries tend to support rigidity too often compared to what is optimal.

The extensive use of qualified majority voting in the EU makes it possible for a sufficiently large majority to impose participation on the other members, even if Article 43 would allow them to cooperate alone. Such a "mandatory participation rule" combines aspects of flexible and rigid cooperation, and it is better than both, as the analysis shows. Moreover, this majority requirement should indeed be a super-majority, exactly as practiced in the EU. This qualified majority rule should, according to the analysis, increase in the heterogeneity but decrease in the externality. After the heterogeneity between the members is realized, however, the majority of countries prefers a simple majority rule, thus imposing mandatory participation too often compared to what is optimal. Again, the constitutional rules should be determined behind the veil of ignorance to avoid excessive rigidity.

As one of the requirements for enhanced cooperation, Article 43 (g) states that at least eight members have to participate. Such minimum participation rules are also common for environmental agreements, where the externality is often large. The minimum participation rule may mitigate free-rider problems, as the analysis shows, but the optimal threshold varies from one policy to the next. In particular, the threshold should be larger if the externality is large, but smaller if the heterogeneity is large. When the heterogeneity between the countries is realized, however, there may be no minimum participation rule that beats every other alternative in a pairwise vote. This underlines, once again, the importance of committing to the rules in advance, before a conflict of interest has materialized.

VI. Concluding Remarks

The analysis in this paper shows that flexible cooperation is better than the rigid one-size-fits-all approach if the externality is small and the heterogeneity large. Both regimes, however, are special cases of the combination of mandatory and minimum participation rules. If the heterogeneity increases, the mandatory participation rule should increase while the minimum participation rule should decrease, thus allowing for more flexibility. If the externality increases, however, the mandatory participation rule should decrease while the minimum participation rule should increase, thereby mitigating the free-rider problem.

Although the model is motivated by conditions in the European Union, it can be applied to many other contexts. Should the labor standards in a firm, for example, be applied only to union members or to everyone? How does the answer to this question depend on the number of employees that are members of the union? Or, to take another example: should representatives of a political party vote according to the party's majority decision, and which majority threshold should be used to decide this? By introspection, these questions raise dilemmas similar to those analyzed above, although the model may need to be modified. Thus, alternative contexts should motivate extensions of the model in future research.

Technically, the analysis stopped short of pointing out any possible interaction between mandatory and minimum participation rules. If the two thresholds are close, such that the number of participants is never strictly between them, then the optimal thresholds should be determined jointly, not separately as done above. Furthermore, since the two thresholds are unable to induce the first-best number of participants, future research should analyze other institutional details that could improve upon mandatory and minimum participation rules.

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