MAJORITY RULES AND INCENTIVES*

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A club's majority rule defines the number of members that must approve a policy proposed to replace the status quo. Since the majority rule thus dictates the extent to which winners must compensate losers, it also determines the incentives to invest in order to become a winner of anticipated projects. If the required majority is large, members invest too little because of a holdup problem; if it is small, members invest too much in order to become a member of the majority coalition. To balance these opposing forces, the majority rule should increase in the project's value and the club's enforcement capacity but decrease in the heterogeneity in preferences. Externalities can be internalized by adjusting the rule. With heterogeneity in size or initial conditions, votes should be appropriately weighted or double majorities required.

I. INTRODUCTION

Consider a club whose members might undertake a joint public project. According to the club's majority rule, the project can only be undertaken if approved by a fraction m of the members. A member's valuation of the project depends on how much she has invested in advance. How are the incentives to invest related to the majority rule? Which rule should the club select in order to encourage optimal investments?

While this problem is quite general, it might be best motivated by the European Union. The EU applies different majority rules to different political issues: while international treaties require unanimity, policies on the common market are made according to "qualified majority rules," and a simple majority is sufficient for implementation. Moreover, the EU has changed its voting rules several times during its history.[1] On June 18, 2004, the member countries agreed to the *Treaty Establishing a Constitution for Europe.* The Constitution is based on a proposal by the European Convention (established for this purpose), and it is supposed to be ratified over the next two years, in some countries by referenda. If ratified, the Constitution will substantially alter

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1. Hix [2005] provides a detailed overview of the existing voting rules, while Miller [2004] surveys the rules in a historical context.

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the way the EU makes collective decisions. Several issues that required unanimity in the past, may soon be made by a qualified majority (examples are policies related to security, justice, immigration, and external relations). Moreover, the definition of a "qualified majority" is supposed to decrease from 72 to 65 percent. Whether the member countries end up ratifying or renegotiating the Constitution, the debate raises the questions of why different majority rules are necessary, and what are the optimal rules.

To answer these questions, we must understand how majority rules affect economic policies. A typical project in the EU is to liberalize the common market. Quite soon, we might see additional directives on the liberalization of public utilities, such as electricity, telecommunications, mail, and transport. While the telecoms market is now quite liberalized, much remains to be done in the electricity market. The obstacles for further liberalization are domestic: CEPR [1999] criticizes member countries for having different standards, bad market institutions, public ownership, and state aid. To make liberalization in the EU a success, it is crucial that each country pay the cost of modernizing its industry. While this would certainly make a member more competitive, the member also risks being held up by other members who are less prepared for liberalization, as they might require compensation. On the other hand, by not preparing at all, a member risks being neglected if a sufficiently large majority prefers to proceed with liberalization nevertheless. What determines such strategic concerns, and how do they, and thus the incentives to invest in public projects, depend on the majority rule?

As a framework for studying such problems, this paper provides a three-stage model of collective decision-making. At the constitutional stage, members of a club select a majority rule. At the investment stage, each member makes some noncontractible investment, which thereafter affects her private valuation of the anticipated public project. Her value may also be affected by the other members' investments, and by individual and aggregate shocks. At the legislative stage, a majority coalition is formed, which proposes a set of side payments and whether the project should be implemented. The proposal is executed if approved by the required majority.

Solving the game by backward induction, we can derive the legislative outcome, equilibrium investments, and the optimal majority rule. Since side payments are available, the winners can compensate the losers and the project will be implemented if and only if it is socially efficient ex post—whatever is the majority rule. This resembles the Coase Theorem, and it suggests that the main function of majority rules may not be to select the right projects. To reduce the amount of compensation, however, the majority coalition will consist of members who place a relatively high value on the project.

This raises two strategic concerns at the investment stage. On the negative side, investments reduce bargaining power. The winners of the project become very eager to see it implemented and, in equilibrium, they are expropriated or must compensate those benefiting less. This is a multilateral holdup problem which discourages investment. On the positive side, investments increase a member's probability of becoming a member of the majority coalition of winners. This is valuable, since it is the majority coalition that has the political power to determine the distribution of surplus, while the minority is neglected and expropriated. If the majority rule is small, political power is very beneficial, since few losers need to be compensated and a large minority can be expropriated. To improve the chances of becoming a member of the majority coalition, each member invests a lot. If the majority rule is large, political power is less attractive, the holdup problem dominates, and members invest less.

The implications of the model are clear: incentives to invest decrease in the majority rule. This generates a status-quo bias if the majority requirement is large—not because it is then hard to make enough members approve—but because underinvestment makes few projects worthwhile to implement. Since incentives also depend on other factors that may influence the value of political power, it is shown that investments increase in the project's value and the club's enforcement capacity but decrease in the ex post heterogeneity in preferences. Moreover, how much a member invests also depends on its size and initial conditions, as these factors influence the chance of gaining political power.

These results imply unambiguous normative recommendations. To induce the optimal incentive to invest, the majority rule should balance the concern for bargaining power and the desire to obtain political power. To do this, the majority rule must increase in the project's value and the club's enforcement capacity, but decrease in the heterogeneity. Externalities related to the investments can be internalized by adjusting the rule. Thus, the model justifies the practice of using different rules for different issues, and that the rules may evolve over time. Moreover, to induce all members to invest optimally, more votes should be allocated to large members and to members that are initially badly prepared. The weights should be less than proportional to size, however, and they may be substituted by a double majority rule system.

By emphasizing the effect on incentives, the model raises a host of new questions. Traditionally, the literature on majority rules ignores incentives by taking individual values as exogenous. The literature dates back to Rousseau [1762], contrasting unanimity to rules requiring smaller majorities, and Condorcet [1785], advocating the simple majority rule as the best way of aggregating information. More than a century ago, Wicksell [1896] advocated unanimity as the only rule guaranteeing Pareto improvements. However, Buchanan and Tullock [1962] argued that the majority rule should trade off the costs of expropriating the minority (emphasized by Wicksell) against "decision-making costs," which increase with the majority rule. They did not, however, clarify what these decision-making costs were. Recently, and more formally, Aghion and Bolton [2003] take the winners' wealth constraints into account and minimize the costs of expropriating the minority, subject to the budget constraint, in order to derive the optimal majority rule. A similar trade-off is studied by Aghion, Alesina, and Trebbi [2004], who in addition, point to the *costs* of compensating losers.[2] Some transaction costs are typically required in this literature, since otherwise, the Coase Theorem holds and the majority rule becomes irrelevant for the selection of projects. Moreover, all these papers assume that the individual values are exogenous.

Incentives to prepare for public projects are certainly studied elsewhere in the literature, but mostly in bilateral settings. Suggested institutional remedies include appropriate ownership [Grossman and Hart 1986],[3] authority [Aghion and Tirole 1997], and the choice of status quo [Aghion, Dewatripont, and Rey 1994]. In international contexts, the importance of the holdup problem

2. Other aspects of the majority rule are also studied. An early strand of literature surveyed by Enelow [1997] emphasizes Condorcet cycles, and argues that the majority rule should be sufficiently large to prevent cycles. Barbera and Jackson [2004a] examine majority rules that are stable and induce agents to select themselves as a decision rule. Maggi and Morelli [2004] observe that majority rules must be enforced and derive the best enforceable majority rule. The literature is far too large to survey in this paper—instead see Chapters 4–8 in Mueller [1989].

3. Hart and Moore [1990] study optimal ownership in a multilateral holdup problem.

is recognized by, e.g., McLaren [1997] who shows how prior adjustments to trade liberalization may dramatically reduce a country's bargaining power. Wallner [2003] similarly suggests that potential entrants to the EU face a holdup problem since they must undertake reforms prior to acceptance. The present paper contributes to the literature on the holdup problem by showing how multilateral holdup problems can either arise or be mitigated, depending on the particular majority rule.

The effects of political institutions on incentives are discussed by several recent papers. Persson and Tabellini [1996] study how regional moral hazards depend on whether interregional distribution is decided by voting or bargaining. Anderberg and Perroni [2003] argue that the majority's power to choose taxes induces agents to imitate the majority. Relative to unanimity, majority voting can support an equilibrium where a small majority saves, because it is then time-consistent for the members to select a small tax on capital. In connection with incentives, the particular choice of majority rule is, to my knowledge, only discussed by Persico [2004]. He focuses on searching which increases information on the project's common value. The probability of becoming a pivotal voter determines the incentives to search for such information. These incentives are vastly different from the incentives to invest in private values, as studied here.

The paper is organized as follows. The next section presents a simple model of collective decisions. Section III solves this game by backward induction in order to solve for equilibrium investments and the optimal majority rule. This workhorse model is then employed to discuss externalities, and heterogeneity in size and initial conditions. A crucial assumption in the model is that the members use side payments to compensate and expropriate. Without side payments, Section V shows that the results are turned "upside-down." The results are more robust to the remaining assumptions, however, and Section VI suggests how the model can be extended in various ways. The paper ends with a brief conclusion in Section VII.

II. The Basic Model

Let a club be a set I of members. On day 0, the constitutional stage, the members select a majority rule $m \in (0,1]$, defining the fraction of members that must approve a policy proposed to replace the status quo. The unanimity rule, for example, is defined by $m = 1$, while $m = ½$ is the simple majority rule. Since all members are identical at this stage, they all prefer the same majority rule.

On day 1, the investment stage, each member $i \in I$ makes some noncontractible investment x_i at the private cost $c(x_i)$. The function c is increasing, strictly convex, and continuous differentiable. Such investments are likely to increase i's benefit—or reduce i's cost—of a particular public project that may be undertaken on day 2. Formally, after the investments have been chosen, member i's net value of the project is drawn to be

$$v_i = x_i + \epsilon_i + \theta,$$

where ϵ_i and θ are some individual and aggregate shocks, respectively. The ϵ_i's are independently drawn from a uniform distribution with mean zero and density $1/h$,

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

If all members invest the same amount, the realizations of the ϵ_i's determine the heterogeneity in preferences. If I is finite, the distribution of the ϵ_i's can take many forms, making the analysis quite complex. To simplify, let there be a continuum of members, $I \equiv [0, 1]$, 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.

The state parameter θ measures the average value of the project without investments. θ may be negative, since it includes the cost of the project. Together with the investments, the realization of θ determines whether the project is worth implementing on day 2. To arrive at explicit solutions, also let θ be uniformly distributed,

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

a is the expected average value of the project (without investments), and σ measures the variance in the aggregate shock (the variance of θ is $\sigma^3/12$).

After the members' values have been observed by everybody, the legislative stage begins on day 2. It is useful to divide this in three: the coalition formation stage, the negotiation stage and the voting stage. First, the majority coalition is formed. In line with

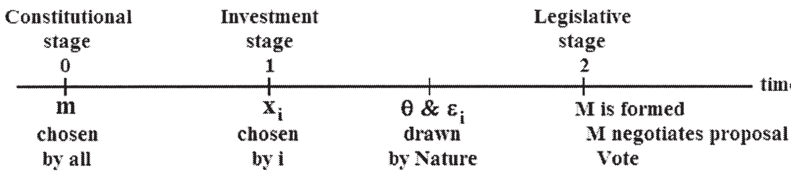

FIGURE I
Timing of the Game

Riker [1962], I assume that an initiator (or president), randomly drawn from I, selects a *minimum winning coalition* $M \subset I$ of mass m to form the majority. Second, the members of M negotiate a political proposal. All members of the majority coalition must agree before the proposal is submitted for a vote, and I will let the outcome be characterized by the Nash Bargaining Solution.[4] A proposal specifies whether the project should be implemented and, in either case, a set of transfers or taxes t_i. As frequently suggested, there may be some transaction costs related to such taxation. To simplify, I follow Aghion and Bolton [2003] who let a fraction λ of the taxes imposed on the minority $N \equiv I \backslash M$ be deadweight loss. The budget constraint is then $\Sigma_{i \in M} t_i = -\Sigma_{i \in N} (1 - \lambda) t_i$. However, since I let $\lambda \to 0$, the results of the model will not hinge on this particular kind of transaction cost. Third, the vote takes place. Two conditions must be met for the proposal to be implemented. Crucially, it must be approved by a mass m of members. Otherwise, all members receive the status quo payoff of zero (added to their sunk cost of investment $c(x_i)$). The majority coalition M can therefore dictate the policy to some extent. However, there is a lower boundary $-r$ for the minority's utility, because the proposal must be *accepted* by *all* members: no member should prefer to cheat or "break" the rules to avoid implementing the project. If that should happen, the status quo would be maintained, but deviators would receive their reservation utility $-r$. Thus, r might be interpreted as the penalty for refusing to implement the public project. In some cases, r might be a constitutional parameter, limited in order to protect minorities. In the EU, for example, the Luxembourg Compromise of 1966 allows a country to veto a proposal if it threatens its "vital" interests. In

4. That only M can make political proposals might reflect what Baron [1989] labels "coalition discipline." Without such discipline, he argues, the mass of M is likely to be larger than m. This is indeed proved by Groseclose and Snyder [1996].

other cases, r might be limited by the club's enforcement capacity. If the club's enforcement capacity is created by repeated interaction and trigger strategies, where deviation today terminates cooperation forever (as in Maggi and Morelli [2004]), then r reflects a member's present value of continued cooperation. For any of these interpretations, the project is implemented if and only if a member's payoff,

$$u_i = v_i - t_i,$$

is positive for a mass m of members, and larger than $-r$ for all.

III. The Basic Results

This section solves the game by backward induction to derive its unique subgame-perfect equilibrium. As a benchmark, observing the first-best outcome is worthwhile. Social efficiency is defined by the sum of utilities, or equivalently, as a member's expected utility. At the legislative stage, executing the project is optimal if and only if the project is "good," meaning that its total value is positive:

$$\int_I v_i di = \theta + x \geq 0, \tag{1}$$

where x denotes average investment.[5] Under the optimal selection rule (1), the optimal effort level at the investment stage is determined by

$$\max_x E \int_{-x}^{a+\sigma/2} (\theta + x + \epsilon_i) \frac{d\theta}{\sigma} - c(x) \Rightarrow c'(x^*) = q(x^*), \tag{2}$$

where q is the probability that the project turns out to be good ex post. This probability is increasing in x, and is written as

$$q(x) \equiv \int_{-x}^{a+\sigma/2} \frac{d\theta}{\sigma} = \frac{1}{\sigma}(a + x) + \frac{1}{2}$$

if the calculated $q(x) \in [0, 1]$, which is the most interesting case. The second-order condition is $\sigma c''(x^*) \geq 1$, which I assume to be fulfilled.

5. For this and similar integrals to be defined, v_i is assumed to be piecewise continuous in i.

III.A. Majority Rule Irrelevance

This subsection solves the legislative stage by deriving equilibrium taxes, whether the project will be implemented or not, and the coalition formation. To maximize its surplus, any majority coalition M will ensure that all members of the minority $N \equiv I \backslash M$ receive exactly their reservation utility of $-r$. This is achieved by setting the taxes such that

$$t_i = v_i + r \ \ \forall\, i \in N$$

if the project is proposed, and by setting $t_i = r \ \forall\ i \in N$ otherwise. Thus, the majority coalition is taxing a minority member more if v_i is large, since i is then more willing to accept the proposal. That a larger value v_i leads to a higher tax t_i may be interpreted as a loss of bargaining power, and it completely nullifies the positive direct effect on i's utility: for $i \in N$, $u_i = u_N = -r$, notwithstanding v_i.

Thus, when transaction costs are negligible, the total revenue shared by the majority is

$$\theta + x + r(1 - m) \tag{3}$$

if the project is undertaken, and

$$r(1 - m) \tag{4}$$

otherwise. The allocation of this surplus is determined by multilateral negotiations within the majority coalition. If the negotiations fail, the status quo remains. Though it might not be obvious how to define the bargaining game with a continuum of players, I let the outcome be characterized by the Nash bargaining solution for a finite number of players.[6] This outcome coincides with the Shapley value when all coalition members have veto power,

6. Nash's axiomatic theory for bilateral bargaining extends unchanged to multilateral situations. Since the default outcome gives zero utility for all, the Nash bargaining outcome follows from maximizing the Nash product

$$\max_{\{t_i\}_i} \prod_{i \in M} (v_i - t_i) \text{ subject to } \sum_{i \in M} t_i = -\sum_{i \in N} (1 - \lambda) t_i$$

and subject to

$$v_i - t_i \geq -r \ \ \forall\, i \in N,$$

if the number of members was finite and their utilities were transferable. This ensures that all agents in the majority coalition receive the same utility $v_i - t_i$. Utilities are transferable within the coalition only if there are negligible transaction costs in transferring surplus within the majority. This is also assumed by Aghion and Bolton [2003].

and it is a likely outcome of noncooperative bargaining.[7] It ensures that all members of the majority coalition receive the same surplus, $u_M = [\theta + x + r(1 - m)]/m$ if the project is undertaken, and $u_M = r(1 - m)/m$ otherwise. This is achieved when coalition members with large v_i's subsidize coalition members with lower v_i's:

$$t_i = v_i - u_M \;\; \forall\, i \in M.$$

Intuitively, a coalition member with a high value v_i has correspondingly low bargaining power, since she is eager to implement the project. Other members are then able to hold up i by requiring side payments to accept the project. As was the case for minority members, majority members lose bargaining power when v_i is large, and this negative effect neutralizes the positive direct effect on i's utility: for $i \in M$, $u_i = u_M$, notwithstanding v_i.

Will the majority coalition propose the project? By comparing (3) and (4), they will propose the project if and only if $\theta + x \geq 0$, which exactly coincides with the social optimal condition (1). The majority coalition expropriates the minority in any case, and it captures the project's entire value if it is implemented. Thus, the majority will only implement projects raising total welfare. That the selection of projects becomes efficient when transaction costs disappear indicates that the Coase Theorem has bite, even if only a fraction m of the members has political power.

Which coalition members will the initiator select? If the project is good ($\theta + x \geq 0$), *any* initiator prefers to form the majority coalition with the members having the highest possible values v_i's. These "winners" do not need to receive (much) compensation to approve the project, and they are instead willing to compensate the losers. To some extent, the winners' surplus could be expropriated even if they were excluded from the coalition, but a small part of these tax revenues would disappear as transaction costs. Thus, arbitrarily small transaction costs induce the initiator to select the winners as coalition members and the identity of

7. In general, there exist multiple subgame-perfect equilibria to multilateral bargaining situations. Krishna and Serrano [1996] allow each player to exit with its share of the surplus following some proposed allocation. Then, they obtain a unique equilibrium outcome coinciding with the multilateral version of the Nash bargaining solution when the discount factors between successive offers approach one (see their Theorem 1'). In this outcome, everyone receives the same utility if utility is transferable. A similar justification is provided by Hart and Mas-Colell [1996].

the initiator does not matter.[8] That the majority coalition will consist of the winners is simply assumed by Aghion and Bolton [2003], conjectured already by Axelrod [1970], and derived by Ferejohn, Fiorina, and McKelvey [1987] in a slightly different model. If the project is bad ($\theta + x < 0$), however, the project will not be implemented, and the majority's surplus is independent of the composition of the majority coalition. Suppose then that the initiator selects coalition members randomly, giving everyone zero expected utility.

PROPOSITION 1. Suppose that the transaction cost $\lambda \to 0$.

(i) All minority member receive their reservation utility, $u_i = -r \ \forall \ i \in N$.
(ii) All majority members receive the same utility, $u_M = \max\{\theta + x + r(1 - m), r(1 - m)\}$.
(iii) The project is undertaken if and only if it increases total surplus, $\theta + x \geq 0$.
(iv) If the project is undertaken, the majority coalition consists of the members with the highest value of the project, $M = \{i | v_i \geq v_m\}$, where

$$v_m \equiv \theta + x + h\left(\frac{1}{2} - m\right). \tag{5}$$

Proof of Proposition 1. Since the members will make the same investment x on day 1 (proved in the next section), their values on day 2 will be uniformly distributed on $[\theta + x - h/2, \theta + x + h/2]$, where the $(1 - m)$ fractile is defined by (5). Let J take the value 1 if the project is undertaken, and 0 otherwise. (ii) follows from the Nash Bargaining Solution, so the initiator's problem can be written as

$$\max_{\{t_i\},J,M} u_M$$

subject to

$$\begin{aligned} u_M &= \frac{1}{\|M\|}\left[\int_M Jv_i \, di + \int_N t_i(1 - \lambda) \, di\right] \\ u_i &= Jv_i - t_i \geq -r \ \ \forall i \in N \\ \|M\| &= m. \end{aligned} \tag{6}$$

8. The initiator herself may of course have a low value of the project, since she is randomly drawn from the entire population, but her size is negligible.

(i) and (iii) follow directly, and (iv) follows as u_M is larger if for $v_i > v_j$, $i \in M$ and $j \notin N$, than vice versa (for $\lambda > 0$). QED

Note that while the majority requirement m determines the majority coalition's size and its payoff u_M, m is irrelevant for the selection of project. This contrasts the earlier literature by Wicksell [1896], Buchanan and Tullock [1962], and Aghion and Bolton [2003], emphasizing such a relationship. But the fact that side payments can be used to invalidate the majority rule might not surprise practitioners in, e.g., the European Union. In the Uruguay round, a liberalization of the Common Agricultural Policy was rejected, despite the fact that France, as the single opponent, could not formally block the reform. Similarly, the Single European Act was implemented despite the fact that the United Kingdom, which opposed the reform, could have vetoed it. Instead, the United Kingdom was compensated to accept it.[9] While the majority rule appears to be irrelevant for the selection of projects, I will now show that it is crucial for the members' incentives to prepare.

III.B. Equilibrium Investments

When member i decides how much to invest x_i in order to increase her value v_i of the project, she realizes that a larger v_i affects her utility $u_i = v_i - t_i$ in three ways. First, there is the direct effect (de), holding t_i constant. If the project is implemented, it is certainly better to be prepared:

$$\text{(de)} \qquad v_i = x_i + \epsilon_i + \theta.$$

But the tax is not constant: it will depend on v_i. Notwithstanding whether i is a minority or majority member, a high v_i reduces i's *bargaining power* (bp), and t_i increases correspondingly:

$$\text{(bp)} \qquad t_i = \left\{ \begin{array}{l} v_i + r \text{ if } i \in N \\ v_i - u_M \text{ if } i \in M \end{array} \right\}.$$

This a multilateral holdup problem which discourages investments. As a third effect, whether i becomes a minority or a majority member also depends on v_i. A high v_i might increase i's *political power* (pp) since, as argued above, a high v_i makes i a more attractive coalition partner, and less likely to be neglected as a minority member. Since i's value will be uniformly distrib-

9. For discussions of these cases, see George and Bache [2001].

uted with mean $\theta + x_i$ and density $1/h$, i realizes that the probability of becoming a majority member increases in her investments:

(pp) $$p(x_i) = \Pr(v_i \geq v_M) = \left\{ \begin{array}{ll} 0 & \text{if } m + (x_i - x)/h < 0 \\ m + (x_i - x)/h & \text{if } m + (x_i - x)/h \in [0, 1] \\ 1 & \text{if } m + (x_i - x)/h > 1 \end{array} \right\}.$$

Member i's problem is therefore

(7)

$$\max_{x_i} \int_{-x}^{a+\sigma/2} (v_i - t_i) \frac{1}{\sigma} d\theta - c(x_i) \text{ subject to (de), (bp), and (pp).}$$

Since i's problem depends on the average investment level x, there might be multiple equilibria where, for example, no one invests because then the project may never be worthwhile to implement. Moreover, that (pp) is nonconcave suggests that there can also be asymmetric equilibria, where some members surrender their chances of becoming majority member by not investing at all. Such asymmetric equilibria become important when the members are heterogeneous in subsection IV.C. For now, let us focus on the unique, symmetric equilibrium, which will exist when the shocks (h and σ) are sufficiently large.

PROPOSITION 2. Equilibrium investment $\hat{x}$ is given by (8), and it decreases in the majority rule m and the ex post heterogeneity h, but increases in the club's enforcement capacity r and the project's value a, if $m < 1$. If $m = 1$, $x = 0$.

(8) $$c'(\hat{x}) = (a + \hat{x} + \sigma/2)(a + \hat{x} + \sigma/2 + 2r)/2hm\sigma.$$

Proof of Proposition 2. Suppose that p and q are interior. The first-order condition of (7) becomes

(9) $$c'(\hat{x}_i) = q(x)(Eu_M - u_N)/h = q(x)(\tilde{v} + r)/hm,$$

$$\text{where } q(x) \equiv \int_{-x}^{a+\sigma/2} \frac{d\theta}{\sigma} = \frac{1}{\sigma}(a + x) + \frac{1}{2}$$

is the probability of a good project if this $q(x) \in [0, 1]$, and

$$\tilde{v} \equiv E[\theta | \theta \geq -x] + x = \frac{1}{2}\left(a + x + \frac{\sigma}{2}\right)$$

is the expected value of a good project. The second-order condition is trivially fulfilled. Suppose that the equilibrium is symmetric, such that (9) can be written as (8). Then, (pp) implies that p is interior. Since both the left-hand side and the right-hand side of (8) increase in x, there may be multiple equilibria. If the left-hand side increases faster, there is at most one equilibrium, which is stable. This requires that

$$c''(x) > (a + x + \sigma/2 + r)/h\sigma m \quad \forall\, x > 0.$$

Such an equilibrium (interior for q) exists if the left-hand side of (8) is smaller (larger) than the right-hand side for $x = 0$ (x subject to $q(x) = 1$), requiring that

$$\sigma > -2a \quad \text{and} \quad c'(\sigma/2 - a) > (r + \sigma/2)/hm.$$

Since (pp) is nonconcave, there may also be asymmetric equilibria where a fraction $1 - \alpha$ of the i's invest zero because the benefit of investment is just equal to the cost:

$$qp(Eu_M - u_N) = c(\hat{x}) \Rightarrow c'(\hat{x})ph = c(\hat{x}) \Rightarrow ph/\hat{x} = c(\hat{x})/c'(\hat{x})\hat{x} < 1,$$

which cannot be fulfilled if $h > \hat{x}m$ (since the probability p of becoming a majority member, following $\hat{x}$, is larger than m if $\alpha < 1$). QED

Although the negative effect on bargaining power discourages investments, a member is encouraged to invest by the prospects of political power. If i becomes a majority member, she would receive her part of the total surplus, and enjoy $u_M = [\theta + x + r(1 - m)]/m$ instead of the minority's reservation utility $-r$. Thus, the larger is the value of political power, $Eu_M + r$, the greater are the incentives to invest. Investments are therefore larger if the majority rule m is small. There are two reasons for this: first, if m is small, a large minority $1 - m$ can be expropriated. Second, a small m means that just a few coalition members are sharing the entire surplus. Both these effects make the majority coalition better off, and a member invests more to increase her chances of becoming a coalition member. For a small m, the prospects of political power dominate the discouraging effect on bargaining power, and the members may invest too much. For a larger m, political power is not that attractive since the majority must compensate many losers, and the holdup problem tends to dominate. Then, members are likely to underinvest. If unanimity is required, such that $m = 1$, everyone would be included in the majority coalition, and the holdup problem ensures that investments are zero. In sum, investment decreases in the majority rule m.

Note that this leads to a status quo bias if m is large. When m is large, the holdup problem induces low investments, and few projects turn out to be worth implementing ex post (requiring $\theta + x \geq 0$). This is in stark contrast to the conventional wisdom (by, e.g., Buchanan and Tullock [1962]), arguing that the status quo bias under unanimity arises ex post because it is then difficult to get enough voters to approve. As Proposition 1 shows, this argument is false when side payments are possible.

As Proposition 2 states, investments increase in the enforcement capacity r. If r is large, then the minority is taxed more, and the revenues shared by the majority are greater. It is then more important to be a member of the majority coalition and the members invest more to increase this probability.

Investments will also increase in the project's expected value a. This is partly because a larger a implies that it is more likely that the project becomes good and worthwhile to implement. In addition, a higher valued project makes it more beneficial to be a member of the coalition that shares this value. To increase this probability, investment increases.

Finally, investments decrease in the ex post heterogeneity h. When h is large, the great winners of the project have a much larger v_i than the losers, and a member must invest quite a lot to substantially improve the chances of becoming a member of the winners' coalition. Investments become less effective in increasing political power (pp), and incentives to invest decreases.

In the EU, telecommunication and information technology clearly provides the highest value among public utilities (accounting for over 5 percent of Europe's GDP), while not giving any country a natural advantage. Recognizing a large a and low h, Proposition 2 predicts investments to be large. Indeed, this industry is the most advanced network industry in terms of domestic deregulation (see, e.g., CEPR [1999]). Future research ought to investigate whether the predictions above are supported by the evidence more generally. For now, however, we turn to the normative implications.

III.C. The Optimal Majority Rule

At the constitutional stage, the members should select the majority rule maximizing their expected utility, recognizing that the majority rule will affect the incentives to invest. To find the optimal majority rule, the equilibrium investment level $\hat{x}$ (9) should be compared with the socially optimal investment level x^* (2). While x^* is obviously independent of the majority rule m, $\hat{x}$ is not. As discussed above, a large majority rule m is likely to induce underinvestment since the holdup problem dominates, while a small m may lead to overinvestment since the members are racing for memberships in the majority coalition. These opposing forces are appropriately balanced if the majority rule makes $\hat{x} = x^*$. Comparing equations (9) and (2) reveals that this requires

$$m^* = (a + x^* + 2r + \sigma/2)/2h, \tag{10}$$

if the resulting $m^* < 1$.[10]

To balance the holdup problem with the incentive to gain political power, the majority rule should be larger in three instances. First, if the enforcement capacity r is large, the minority is heavily expropriated and it is very attractive to be a majority member sharing these revenues. Second, when the project's value a increases, it is possible to tax the minority more and the larger total surplus shared by the majority coalition makes political power more beneficial. Third, if the heterogeneity h is small, the members' values are closely concentrated. By investing just a little, i increases her probability of becoming a majority member greatly. Any of these changes make gaining political power more attractive or easy and the incentives to invest increase. To prevent overinvestments, the majority rule should increase.[11]

10. If the m^* defined by (10) is such that $m^* \geq 1$, implying that there is overinvestment for any $m < 1$, the optimal investment level x^* is not attainable by a pure (nonrandom) majority rule. The second-best is then either the majority rule $m = 1$, making $x = 0$ in equilibrium, or a marginally smaller majority rule which implements the $\hat{x}$ defined by $m = 1$ in (9). The latter is better if $q(\hat{x})\bar{v}(\hat{x}) - c(\hat{x}) \geq q(0)\bar{v}(0)$. If the individual shock ϵ_i has a bell-shaped probability density function, however, $\hat{x}$ approaches zero as m approaches 1. Then $m^* \in (0, 1)$ always applies. For this reason, I henceforth assume m^* to be interior.

11. The variance in the aggregate shock, σ, has an ambiguous effect on m^*. On the one hand, σ increases $\bar{v}$ given x, thus increasing m^*. On the other hand, q decreases in σ if $a + x > 0$, which in turn decreases x^* and thus m^*. If σ is large, the first effect dominates. If a is small, both effects are positive. Also a affects m^* through x^*, which reinforces its direct effect.

PROPOSITION 3. The optimal majority rule m^* (10) increases in the project's value a and the club's enforcement capacity r, but decreases in ex post heterogeneity h.

The proof follows directly by comparing (9) and (2). In a slightly different political model, the majority rule might be bounded below by one-half in order to prevent cycles. The simple majority rule will then be second best for a wide range of parameters.

Proposition 3 has clear normative policy implications for the optimal majority rules. If the club's enforcement capacity r is large, then the majority rule should be larger, somewhat substituting for the poor minority protection. Political issues of small average values a but large heterogeneities h should be taken by small majority rules.

Skeptics of the EU might not expect it to apply the optimal rules. Still, it is worthwhile to cast a quick look at the existing rules. The Common Agricultural Policy and the structural funds are characterized by distribution and resemble zero-sum games, where the heterogeneity in preferences typically is large. Such decisions can currently be made by a qualified majority. International agreements, however, are package deals likely to spread the benefits more evenly, and they are typically (according to economists) of large average value. In line with Proposition 3, such decisions are indeed made by a larger majority rule in the EU (actually by unanimity). Less important issues (which are likely to have low values) can, as the theory recommends, be made by a simple majority. As the EU expands, heterogeneity is likely to increase and the optimal majority rule should thus decrease. This fits the recent history as well as the Convention's current proposal.[12]

IV. EXTENSIONS

Since the basic model above is quite simple, it raises a host of new questions. For the same reason, the model is a useful starting point for various extensions. This section introduces externalities and heterogeneity in size and preferences. As shown below, this typically creates problems unless the majority rule is modi-

12. See Miller [2004] for a brief history of voting rules applied by the EU, including the Draft Treaty establishing a Constitution for Europe. For details on the current rules, see Hix [2005].

fied and the votes are appropriately weighted. Other possible extensions are briefly discussed in Section VI.

IV.A. Externalities

So far in the analysis, one member's investment affects her own value only. More generally, a member's value of the project might depend on other members' actions as well. For example, if country i modernizes and succeeds in creating a more competitive sector, it may affect the neighboring country j's value of liberalization. If j expects to import services from i, j's value of trade liberalization might increase when i becomes more efficient. If instead i and j are competing in a third market, j's value of liberalization might be reduced when i becomes more competitive. To capture such effects, let individual values be determined by

$$v_i = \theta + (1 - e)x_i + ex + \epsilon_i,$$

where e reflects a positive (negative) externality of private investment if $e > (<)0$. The coefficients are normalized such that the social value of investments is the same as previously, and the optimal level of investment is still defined by (2).

Private investments are only undertaken to the extent that they affect private values. If e is positive, then i only captures a fraction $(1 - e)$ of the total direct effect of i's investment. This may lead to underinvestment. To motivate sufficient investments, the prospects of political power must become more attractive. This can be done by reducing the majority rule, since this decreases the number of losers that must be compensated, and the surplus for each majority member increases. If the externality is negative, then members are likely to overinvest. A larger majority rule is then required to discourage investments. In either case, the first-best investment level can be achieved by adjusting the majority rule. It turns out that the optimal majority rule is modified to

$$m_e^* = (1 - e)(a + x^* + 2r + \sigma/2)/2h. \tag{11}$$

PROPOSITION 4. The optimal majority rule m_e^* (11) decreases in the externality e, and it induces members to internalize the externality.

Proof of Proposition 4. It is easily shown that member i's optimal investment level, corresponding to (9), is modified to

$$c'(\hat{x}_i) = (1 - e)q(\tilde{v} + r)/hm, \quad (12)$$

where q and $\tilde{v}$ are as defined in subsection III.B. Equalizing (2) and (12) proves Proposition 4. QED

This result suggests that political issues, characterized by positive externalities of countries' investments, should be decided by a smaller majority rule. Interestingly, the common market in the EU was the first area where qualified majority voting was applied. According to the Single European Act, environmental issues, for example, can be decided by a qualified majority according to Article 100a, or by unanimity according to Article 130s. The latter applies to environmental issues in general, while the first applies to issues related to the common market. Environmental policies are then likely to have spillover effects through trade in addition to cross-border pollution.

IV.B. Heterogeneity in Size

In the basic model, all members were identical at the investment stage. For most applications, however, it is crucial to recognize that the members vary in size. In the European Union, for example, political debates quite often separate large (e.g., Germany and France) from small (e.g., Belgium and Denmark) nations. While the size of a small member is normalized to one, suppose a fraction k of all members to be of size $z > 1$. The total population is thus $P \equiv 1 - k + kz$. To simplify, assume that the following per capita measures are independent on size: the value of the project, reservation utility, and cost of investment. That the reservation utility is the same per capita indicates that the per capita benefit from continuing cooperation is the same for all, or that a member failing to implement an approved project faces a fine proportional to its size. In this subsection and the next, I simplify by assuming that θ is known.

If the project is implemented, the total utility of a large member is $u_i^z = zv_i - t_i$ (its per capita utility is $v_i - t_i/z$). Should it become a minority member, a large member's per capita utility becomes $-r$, implying that the tax must be proportional to its size: $t_i = z(v_i + r)$. Should it instead become a majority member, a large member negotiates with one voice like small members, and ends up with the same utility u_M, implying that $t_i = zv_i - u_M$. This follows from the Nash Bargaining Solution, and it suggests that a large country has a lower per capita bargaining power. This is actually a well-known feature: for example, Wallace [1989, p. 202] reports on the European Union *that small parties often do disproportionately well out of coalition bargaining.*[13]

Whom will the initiator select as majority members? Consider, first, the one-member-one-vote principle. The majority rule then requires that the number of members who approve must be sufficiently large. If π_1 and π_z denote the mass of small and large members that approve the project, respectively, this condition can be written as

$$\pi_1 + \pi_z \geq m. \tag{13}$$

The cost of inviting a large member to the coalition, instead of expropriating it as a minority member, is $u_M + zr$. The cost of inviting a small member, by contrast, is only $u_M + r$. Hence, with equal voting weights, small members will be strictly preferred as coalition partners, as it is more beneficial to expropriate the large members. If $m < 1 - k$, the initiator does not need to include *any* large members in her coalition, and large members lack incentives to invest as they cannot gain political power in any case. If $m > 1 - k$, the initiator will include *all* small members in her coalition, and small members lack incentives to invest as they are certain of gaining political power.

Consider, next, giving large members proportionally more voting power (the one-share-one-vote principle). The majority requirement is then that the population of the members who approve, relative to the total population, must be sufficiently large:

$$(\pi_1 + z\pi_z)/P \geq m_P. \tag{14}$$

The alternative to inviting one large member is then to invite z small members, which costs $z(u_M + r)$. Thus, large members are strictly preferred as coalition partners, as it is cheaper to negotiate with one large member instead of z small. If $m_P < k/P$, small members do not invest as they can never gain political

13. This contrasts with the result of Snyder, Ting, and Ansolabehere [2005], who find that a voter's payoff is proportional to her voting weight. In their model, all voters participate in multilateral negotiations, and a fraction of the votes must approve the proposal. The model above, instead, fits a situation where the majority coalition is formed first, before the majority members negotiate a proposal that must be approved by all the coalition members. Then, the weights will not determine a coalition member's payoff (only the probability of becoming a member).

power. If $m_P > k/P$, large members do not need to invest as they always will be included in the majority coalition.

Fortunately, there are two ways out of this dilemma. The first is to make the initiator indifferent between inviting a small and a large member that both value the project highly. While small members still have one vote, suppose that a large member has w votes. The initiator is indifferent if the cost of including one large member is the same as the cost of inviting w small members: $u_M + zr = w(u_M + r)$. Thus, w should be a *weighted average* of the principle one-member-one-vote, and the alternative proportionality (one-share-one-vote) principle:

$$w = zr/(u_M + r) + u_M/(u_M + r). \tag{15}$$

Only under such weights do all members have incentives to invest. If the enforcement capacity r increases, or u_M decreases (for example, because the remaining projects become less valuable), the weights should be more proportional to size.[14]

The second solution is to force the initiator to include both small and large members in the coalition. This can be ensured by using the double majority rule system combining (13) and (14), if m and m_P are set such that both conditions bind in equilibrium. This requires that

$$m < m_P P < mz. \tag{16}$$

Moreover, for small and large members to face the *same* chance of becoming majority members, it is required that $m_P = m$.

PROPOSITION 5. To ensure that both small and large members have incentives to invest,

(i) the voting weights (15) should be regressive in size; or
(ii) a double majority rule system should satisfy (16).
(iii) For small and large members to face the same prospects of political power, $m = m_P$.

14. Of course, members disagree over such weights in isolation, as demonstrated by Spain's and Poland's opposition in 2003 to the new constitution. With side payments available at the constitutional stage, however, the optimal constitution is the expected outcome. Thus, the *Financial Times* states on December 15, 2003 [p. 4], that "Mr. Schröder will now hope German threats of financial retribution will force Spain and Poland to back down when treaty talks finally resume." Indeed, Spain and Poland did back down during the Spring of 2004.

Proof of Proposition 5. (i) follows from the text above. (ii) is proved by first requiring (13) and (14) to be satisfied with equality. This implies that

$$\pi_1 = \frac{mz - m_P P}{z-1}$$

and

$$\pi_z = \frac{m_P P - m}{z-1}.$$

Requiring $\pi_1 > 0$ and $\pi_z > 0$ proves (ii). (iii) is proved by solving

$$\frac{\pi_1}{1-k} = \frac{\pi_z}{k} \Rightarrow \frac{mz - m_P}{(z-1)(1-k)} = \frac{m_P - m}{(z-1)k}.$$

QED

The European Union is indeed using regressive voting weights currently,[15] while the United States is using a double majority system where both the House and the Senate must approve policies. The European Convention suggested using a double majority rule system as well, setting $m = 0.5$ and $m_P = 0.6$, thus favoring large countries. Interestingly, the Irish presidency of the EU recently recommended that $m = m_P = 0.55$, though the present text states that $m = 0.55$ and $m_P = 0.65$. A problem with the double majority rule system is that countries of intermediate size will be least preferred as coalition partners. They will therefore not have an incentive to invest and will be worse off. This might explain why the medium-sized countries in the EU (Spain and Poland) have strongly opposed the proposed double majority system.[16]

15. Actually, the existing system is much more complex than weighted votes. For a decision to be made, there are requirements for the number of (weighted) votes, the number of countries, and the associated size of the population. In most cases, however, only the first of these will bind [Baldwin and Widgren 2003].

Barbera and Jackson [2004b] provide another explanation for regressive voting schemes. In their model, a large country represents a more heterogeneous population, such that its average preference is less extreme. This would be of no importance for the optimal weights if there were side payments, however.

16. Even if both small and large countries are motivated to invest, they will not necessarily invest optimally. The problem of large members is

$$\max_{x_i} \int_{-x}^{a+\sigma/2} [p(x_i)u_M - (1-p(x_i))rz] \frac{d\theta}{\sigma} - zc(x_i) \Rightarrow,$$

$$c'(\hat{x}_i) = \frac{q}{h}\left(\frac{u_M}{z} + r\right),$$

IV.C. Heterogeneity in Preferences

In the simple model, all members were assumed to be identical at the investment stage. This does not characterize Europe very well. Some countries are simply more likely to gain from a certain project than others, notwithstanding domestic investments. This may reflect previous policies, such as the United Kingdom's privatization effort under Margaret Thatcher. Alternatively, it reflects differences in natural conditions, which might explain Scandinavia's protectionistic stance in agricultural politics. Thus, even at the investment stage, some countries may be certain to gain and become a majority member, while others may certainly lose and become minority members if some project were to be implemented. If such members cannot influence their political power at the legislative stage, the holdup problem induces them to prepare too little.

Let individual values be given by

$$v_i = \theta + a_i + x_i + \epsilon_i, \tag{de$'$}$$

where the a_is are known by everybody (and distributed according to some cdf F) at the time when the x_is are chosen. The average a_i can be normalized to zero. This modification of the model may be interpreted as an alteration of the timing, where *some* of the individual shock is revealed *before* investments are chosen.

At the legislative stage, the majority coalition will, as above, offer the minority their reservation utility only, share the total surplus equally and implement only good projects. This coalition consists of the m members most in favor of the project: $M = \{i \in I | v_i \geq v_m\}$ for some v_m.[17] If the project turns out to be good, i's probability of obtaining political power is

which is smaller the larger is z. The reason is that a majority member does not receive a payoff which is proportional to its size. An earlier version of this paper discussed alternative legislative rules, and showed how all members would have first-best incentives to invest if a member's probability to be represented politically were proportional to its size. However, if the number of members n was finite, then the holdup problem would not be complete as each member could expect $1/n$ of its investments. Large members could then have larger incentives to invest.

17. v_m is implicitly defined by the requirement that the mass of agents i subject to $v_i \geq v_m$ must equal m: $m = \int_{i \in [0,1]} \int_{v_m - a_i - \hat{x}_i}^{h/2} (d\epsilon_i/h)\, dF(a_i)$.

(pp′) $p(x_i, a_i)$

$$= \left\{ \begin{array}{ll} 0 & \text{if } (a_i + x_i + h/2 - v_m)/h < 0 \\ (a_i + x_i + h/2 - v_m)/h & \text{if } (a_i + x_i + h/2 - v_m)/h \in [0, 1] \\ 1 & \text{if } (a_i + x_i + h/2 - v_m)/h > 1 \end{array} \right\}.$$

As previously, i's problem on day 1 is given by (7), where (de) and (pp) are replaced by (de′) and (pp′). If h is large enough, the solution to this problem can be characterized as follows.

PROPOSITION 6. There exist three values $a_A < a_B < a_C$ such that

(i) only members with $a_i \in [a_A, a_B]$ invest the same positive amount $\hat{x}$;
(ii) members whose $a_i \in (a_B, a_C]$ invest less, and less if a_i is large;
(iii) extreme members whose $a_i < a_A$ or $a_i > a_C$ do not invest.

Proof of Proposition 6. The individual maximization problem gives the solution:

$$\begin{array}{ll} x_i = 0 & \text{if } a_i < a_A \\ c'(x_i) = c'(\hat{x}) \equiv q(\tilde{v} + r)/mh & \text{if } a_i \in [a_A, a_B] \\ x_i = h/2 + v_m - a_i & \text{if } a_i \in (a_B, a_C] \\ x_i = 0 & \text{if } a_i > a_C, \end{array}$$

where the critical values $a_A < a_B < a_C$ are defined by

$$a_A \equiv \frac{hc(\hat{x})}{q(Eu_M - u_N)} - \hat{x} - \frac{h}{2} + v_m$$

$$a_B \equiv \frac{h}{2} + v_m - \hat{x}$$

$$a_C \equiv \frac{h}{2} + v_m.$$

$x_i = \hat{x}$ if and only if x_i is interior. For $a_i > a_B$, x_i is determined by $p(x_i, a_i) = 1$ as a corner solution. For $a_i > a_C$, $p(0, a_i) = 1$, and $x_i = 0$ is optimal. Since (pp′) is not concave, we must check for the alternative $x_i = 0$, which is preferred if $a_i < a_A$. Finally, $a_A < a_B$ if $c(\hat{x})/q(Eu_M - u_N) < 1 \Leftrightarrow c(\hat{x})/c'(\hat{x})h < 1$, which always holds if $h > \hat{x}$ since c is convex ($c(\hat{x}) < c'(\hat{x})\hat{x}$). Clearly, the result also holds for unknown θ. QED

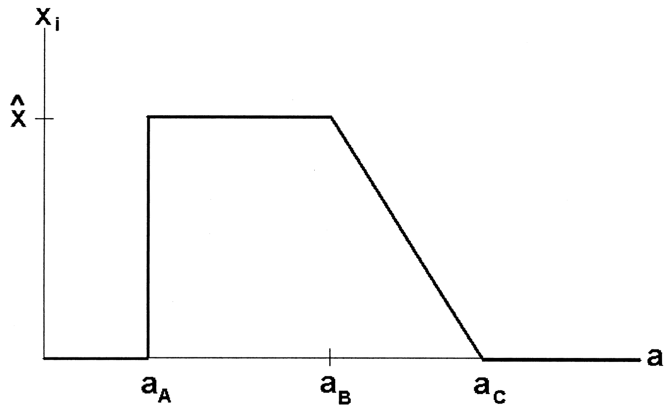

FIGURE II
Investments Depend on Initial Conditions

Member i invests $\hat{x}$ only if i's initial value a_i is in the intermediate interval $[a_A, a_B]$. If i's a_i is lower than a_A, i does not find it worthwhile to invest to have a chance to become a majority member at the legislative stage. In any case, her chances will be quite small. Having surrendered all chances of political power, i has no incentive to invest since the majority will expropriate her entire surplus. If $a_i > a_B$, i is certain of becoming a majority member even if i does not invest as much as $\hat{x}$. An investment of $v_m - a_i + h/2$ is sufficient to ensure that i will become a majority member, even if i should be hit by a negative shock ϵ_i. The larger is a_i, the less i needs to invest to guarantee political power. If $a_i = a_C$, i does not need to invest at all: it is certain that i is a majority member anyway. For $a_i \geq a_C$, therefore, i does not invest.

This is not a very desirable situation. The first-best implies that *all* members should invest until the marginal cost equals the marginal social value. I will now show that these problems can, in principle, be solved using the same instruments as when the members are of different size. The problem above is that members with large (small) a_is are too (un)attractive as coalition partners. But as discovered in the previous section, attractiveness can be modified by voting power. By giving more (less) voting power w_i to a member with small (large) a_i, all members find it worthwhile and necessary to invest in order to gain political power. Indeed, the optimal weights can be characterized as follows:

$$w_i = (\gamma - \lambda a_i)\kappa, \text{ for any } \kappa > 0, \text{ where} \tag{17}$$
$$\gamma \equiv (\tilde{v} + r)(1 - \lambda)/m + h\lambda m/2.$$

PROPOSITION 7. By giving more voting power to members that are initially badly prepared (17), all members invest optimally.

Proof of Proposition 7. With the transaction costs introduced in Section II, the per capita surplus of the majority is, from (6),

$$\frac{\int_M v_j \, dj + \int_N (v_j + r)(1 - \lambda) \, dj}{\int_M dj},$$

if $\theta \geq x$. Thus, the per vote, per capita cost of moving a marginal i from N to M is

$$\frac{\int_M v_j \, dj + \int_N (v_j + r)(1 - \lambda) \, dj - [v_i\lambda - r(1 - \lambda)] \int_M dj}{w_i \left[\int_M dj \right]^2}.$$

In the first-best equilibrium, everyone invests the same x, which requires that everyone must have a chance to become a majority member. If this chance is equal for all i, then $\int_M a_j \, dj = \int_N a_j \, dj = 0$, and M consists of the m fractile with the highest ϵ_i, implying that $\int_M \epsilon_j \, dj = hm(1 - m)/2$, $\int_N \epsilon_j \, dj = -hm(1 - m)/2$ and, $\epsilon_i = h(1/2 - m)$ if i is a marginal member. Since the majority members are of all types, $\int_M dj = m$, and $\int_N dj = 1 - m$. Letting $\tilde{v} \equiv x + \theta$ and $v_j = \tilde{v} + \epsilon_j$, the cost above can be written as

$$\frac{(\tilde{v} + r)(1 - \lambda) + h\lambda m^2/2 - a_i\lambda m}{w_i m^2},$$

which must be the same for all a_i. Setting this equal to an arbitrary positive constant $1/\kappa m$, the optimal weights become (17). For each i, $i \in M$ if $x_i + \epsilon_i$ is sufficiently large, making i's optimal x_i independent of a_i, and thus first-best if just m is appropriately chosen. QED

There are, as in the previous section, alternatives to adjusting the weights of votes. Suppose that there are a large number of members with initial condition a_i. If the constitution required the proposal to be approved by some members of any type a_i, the initiator would prefer to collude with those that have performed best in their group. Then, all members would be motivated to invest. For example, if some of the members have $a_i = \underline{a}$ and the rest have $a_i = \bar{a}$, requiring that a proposal be approved by a fraction m of each type gives the same result as in Section III.

V. Majority Rules without Side Payments

Crucial in the analysis above is the assumption that members may use side transfers to compensate and expropriate. As argued in the Introduction, such side payments can be facilitated by issue linkages or redefining the project, and they are likely to appear in contexts such as the EU. In other contexts, however, members might not be able to use side payments. So what about majority rules and incentives? This section solves the game above, all extensions included, for the case without side payments. The outcome is contrasted with the results above. This comparison is useful both to understand the limits of the results and to shed light on controversies in the literature.

The model is almost the same as in Sections II–IV, only the legislative game is different. Now, each policy proposal can only specify whether the project is to be implemented; all transfers are bound to be zero. If the initiator loses from the project, she would prefer a coalition of other losers to ensure that the project is not proposed and the vote will never take place. Assume, however, that at least one alternative can be suggested by the other members (citizen initiative). Then, a member who gains from the project proposes to implement it, and the final vote will be decisive. With these simple changes, the main results of the paper change dramatically.

Proposition 8. Suppose that side payments are unavailable.

(i) The ex post selection of projects hinges on the majority rule: a project is more likely to be implemented the smaller is m.
(ii) Whatever is the majority rule, incentives are first-best, unless there are externalities.

(iii) If preferences are symmetrically distributed, the simple majority rule is optimal.

Proof of Proposition 8. Assume that $v_i > -r\ \forall i$ (otherwise, the status quo will remain). As before, projects should be undertaken if $\theta \geq -x$ and optimal investment x^* is given by (2). The project will actually be approved if the fraction of is whose $u_i \geq 0$ is larger than m. If the $(a_i + \epsilon_i)$s are distributed according to the cdf G, independent of i's size,[18] this condition can be written as

$$1 - G(-\theta - x) \geq m \Rightarrow \theta \geq \hat{\theta} \equiv -G^{-1}(1 - m) - x.$$

For a given x, (i) follows. If the $(a_i + \epsilon_i)$s are symmetrically distributed (around the mean which is normalized to zero), then, optimally, $G^{-1}(1 - m) = 0 \Rightarrow m = ½$, proving (iii). At the investment stage, a large country's problem is

$$\max_{x_i} \int_{\hat{\theta}}^{a+\sigma/2} z u_i \frac{d\theta}{\sigma} - zc(x_i)$$

subject to

$$u_i = (1 - e)x_i + ex + \theta + a_i + \epsilon_i.$$

A small country's problem is obtained by setting $z = 1$. Independent of size, the first-order conditions become

$$c'(x_i) = (1 - e)q,$$

where

$$q = \int_{\hat{\theta}}^{a+\sigma/2} \frac{d\theta}{\sigma}.$$

The second-order conditions are trivially fulfilled. A comparison with (2) concludes the proof. QED

This result should not come as a surprise: without transfers, only the first, direct, effect of the investments affects i's utility. Bargaining power cannot be exploited, and political power has no return. Investments are then optimal for any majority rule, size, and initial conditions. Externalities, however, cannot be internalized.

18. Voting weights with respect to size is then unimportant, since both small and large countries will have the same distribution of values (if they make the same investments).

Moreover, without side payments, the Coase Theorem does not suggest that the selection of projects is optimal. The winners cannot compensate the losers, so the selection of projects will hinge on the majority rule. Thus, the majority rule should be chosen in order to induce the right selection of projects. When preferences are symmetrically distributed, winners win as much as losers lose, and requiring the former group to be larger than the latter makes $m = ½$ optimal. This resembles May's [1952] Theorem.

When side payments are not possible, the result justifies the emphasis on the selection of projects by the earlier literature, e.g., Rousseau [1762], Buchanan and Tullock [1962], and Aghion and Bolton [2003]. As shown by the latter contribution, the selection also depends on the majority rule if side payments exist, as long as there are substantial transaction costs. Then, the optimal majority rule is likely to depend on the form and size of these transaction costs, and Mueller [1989, p. 105] suggests that this explains controversies in the literature. Still, the present paper suggests that this literature is missing something important when values are simply exogenous. By comparing Propositions 1–7 with Proposition 8, the effect of side payments is isolated. The good news is that the selection of projects is always efficient—whatever the majority rule. The Coase Theorem extends since the winners can simply compensate the losers. The bad news is that the incentives may not be optimal—they hinge on the particular majority rule. Introducing side payments increases investments if the majority is small, while they reduce investments if the majority is large.[19] Instead of ensuring the right selection of projects, the majority rule should be set such that incentives are optimal. Then, even externalities can be internalized. However, the majority rule should also reflect other aspects of the political system (such as its enforcement capacity r), and it should vary across policy issues (with different values and heterogeneity). Moreover, heterogeneity in size or initial conditions distort incentives, unless votes are appropriately weighted or double majorities required.

19. Similarly, side payments typically reduce incentives to reveal private information under unanimity, since revealing a high value reduces the bargaining power. In such settings, Harstad [2004] derives conditions under which side payments are detrimental to total welfare.

VI. Robustness and Research Agenda

In a simple way, the basic model showed how the members' investments for anticipated public projects hinge on the voting rule employed. Section IV discussed how the model can be extended in order to take account of externalities, heterogeneity in size, and initial conditions, and derived the votes' optimal weights. Still, the framework raises a host of new questions. Though it is beyond the scope of this paper to investigate them all, this section lines up some issues that deserve more attention.

To keep the model tractable, a number of simplifying assumptions were made. One was that both individual and aggregate shocks were uniformly distributed. This allows us to derive explicit solutions simply. However, this assumption could easily be relaxed. If, instead, the distribution of shocks were bell-shaped, the parameters h and σ should be replaced by the shocks' relevant densities. The main modifications would be that (i) investments would gradually approach (instead of jumping to) zero as $m \to 1$, (ii) the optimal majority rule would always be interior (<1), and (iii) the investment, as a function of the initial condition a_i (Figure II), would be bell-shaped.

Another simplifying assumption was to let the members be a continuum. With a finite number n of members, a large number of configurations for the ϵ_is could materialize, but investigating them would illuminate little. One difference, however, would be that the holdup problem would not be as severe as above, since each member could expect $1/n$ of the value it created. But as $n \to \infty$, $1/n$ decreases, and the optimal majority rule should decrease to prevent underinvestment. Note that this is in line with the EU's evolution: as the number of members grows, the majority rule decreases. Moreover, the holdup problem would affect large countries less, as they constitute a larger fraction of the total population. This could mitigate the large countries' underinvestment problem, mentioned in subsection IV.B.

Although I have analyzed two kinds of heterogeneity, it has been assumed that each member had the same per capita reservation utility $-r$. With individual r_is, it appears that members with large r_is would be excluded from the coalition as they could be heavily expropriated as minority members. But suppose that failure to agree in the majority's negotiations could lead to a breakdown of the club, giving each member its reservation utility $-r_i$. Then, a member with large r_i would have low bargaining power inside the coalition as well as outside. Just as above, the majority coalition would consist of the members with the largest v_is.

A more fundamental change would be to allow for other kinds of incentives. If, for example, preferences were private information, the members' may signal their values strategically: but while announcing a small value may increase a member's bargaining power, it could also make her a less likely member of the majority coalition. Investigating how majority rules can be set in order to reveal information is an interesting question for future research. A similar trade-off arises if the members can strategically delegate their bargaining and voting power to some representative with different preferences. On the one hand, a member might want to delegate to a representative with a somewhat lower value of the anticipated project, since such a representative will have more bargaining power in negotiating how the side payments should be allocated. On the other hand, a more reluctant delegate would be a less likely member of the majority coalition, so the expected political power would be lower. Using a similar model to the one above, Harstad [2005] studies how delegation depends on the majority rule. Interestingly, it turns out that delegation is sincere exclusively under the optimal majority rule presented under Proposition 3.

Perhaps the most interesting extensions are related to the political system. Above, the legislative game was quite stylized and simple. Harstad [2005] shows how the incentives (to delegate and invest), as well as the optimal majority rule, depend on the stability of the majority coalition, the power of the initiator (or president), and a bicameral system. But much remains to be done. What would happen if the minority members could make amendments? If they could bribe majority members? Or if members can opt out and free-ride on the coalition's project? My conjecture is that all these changes would make the minority better off, and the majority rule should be smaller to ensure sufficient incentives. Overall, future research should investigate how incentives depend on alternative political institutions, besides the majority rule, and how the details of the political systems are related.

Even if the model is simple, it provides clear empirical implications: investments depend on the majority rule, the enforcement capacity, the project's value, its heterogeneity, a country's size, and its initial condition. Although the results are related to some well-known features of the EU, much more ought to be done in order to investigate whether these predictions hold in reality. The European Union, with its various majority rules across issues as well as time, ought to provide ample empirical evidence. For example, are countries preparing more for deeper European integration (requiring a qualified majority) than for liberalization with third countries (requiring unanimity)? If we find support for these predictions, the normative recommendations for the optimal majority rules follow by deduction. That is, if the telecoms sector is liberalized fastest because of its highest value, then liberalization of other public utilities should be taken by a smaller majority rule. But until we know better, it would be interesting to study whether such normative statements also hold as positive predictions. The concluding discussions in subsections III.C and IV.B suggested so, but obviously a great deal remains to be done.

Though the EU has been the leading example in the paper, the model is general and applies to many contexts. In Alesina and Drazen [1991] stabilization is delayed because the initiator must bear the lion's share of the stabilization costs, perhaps because she is better prepared for stabilization. Anticipating this, no region will have strong incentives to prepare for stabilization in the first place. Applying Proposition 3, the solution is a lower majority rule. Then, stabilization can be implemented without compensating all ill-prepared regions, and incentives to prepare increases. Also corporate governance provides applications: collective decisions by shareholders are typically taken by some majority rule. The project under consideration may be the firm's investment or production strategy [DeMarzo 1993], or to act upon a takeover bid [Grossman and Hart 1988; Harris and Raviv 1988]. In advance, shareholders may affect their valuation (or risk aversion) of the project by hedging or other kinds of investments. Incentives to do so will depend on the majority rule, and this should be set such that incentives are optimal. This context raises new questions, besides those investigated in this paper. For example, since the preferred majority rule will depend on the owner's risk aversion, the chosen majority rule will affect equilibrium ownership, not only incentives.

VII. Conclusion

Motivated by the seminal debate over Europe's future constitution, this paper takes a new look on how to make collective decisions in general, and how to choose majority rules in particular. While the earlier literature takes individual values of the project as exogenous, I find that incentives to influence these values depend critically on the majority rule in place. When side payments are available, the majority rule should be set such that these incentives are optimal. The model has clear empirical implications for how investments to prepare for public projects depend on the majority rule, the enforcement capacity, the project's value, its heterogeneity and a country's size and its initial condition. Equally stark are the model's normative implications for the optimal majority rule and the weights that should be allocated to different votes. As a first step, the model is quite simple, and leaves several questions open for future research. In particular, the empirical implications ought to be tested, and applying the model to alternative contexts may require it to be modified. For example, the majority rule may affect other kinds of incentives (delegation and revelation of private information), and the incentives may also depend on other aspects of the political system.

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