THOUGHTS ON THE NATURE OF VETOES WHEN BARGAINING ON PUBLIC PROJECTS

Norbert Schulz

What is a veto? Usually a veto is connected to a proposal. A veto can prevent the proposal from being carried out. If the proposal has some positive value to an agent it is not in his interest to veto. This poses the question what positive value means. This in turn calls for a comparison with some alternative. Often this is the status quo. If the proposal yields higher value according to the preferences of an agent when compared to the status quo there will be no veto. But this refers to a take it or leave it situation. Even if one agent is better off with the proposal when compared with the status quo he might oppose to the proposal if there is a better alternative available in his view. If after rejecting the proposal he and others have a right to suggest another version of a proposal, he will do so.

In principle the situation is then one of bargaining. Consider therefore for a moment the bargaining about the division of a cake of fixed size among two agents. If the status quo gives the lowest possible utility for both agents any take it or leave it proposal will be accepted by both agents at least as long as the proposal specifies a positive share for both of them. If one agent can reject the proposal and suggest another he does not necessarily accept the offer. In the context of a potentially infinite number of bargaining rounds a specific equilibrium occurs (Rubenstein (1982)). This is due to the fact that any agent can veto the proposal made by the other agent and make a counter proposal in the next round. This leads to a more lenient choice of the share claimed by the first proposer. If this share is too high the other agent will not accept. Note that the result of the bargaining process is a Nash equilibrium of the underlying game. If we ask the question which proposal will be accepted , i.e. which one is not confronted by a veto of at least one agent, in a bargaining process, it is thus natural to look at a Nash equilibrium of the "proposal game".

In the following we will direct our attention to cost sharing of a public project. Note that as long as the project size is fixed we could apply the noncooperative bargaining approaches just outlined. For simplicity let V be the value of the public project to each of the two agents. Let the cost be 1. Denote by x_i the share which i covers. Then the payoffs can be written as $V - 1 + 1 - x_1$ for agent 1 and $V - 1 + 1 - x_2$ for agent 2. Agent 1 tries to minimize x_1 which is the same as to say he tries to maximize x_2. Rearranging the names of the agents gives the same structure as the original bargaining game for the division of a fixed sized cake.

The contributions to the literature concerning this problem without any deficits in information have assumed an infinite number of bargaining rounds. Indeed looking at the one shot variant of the game yields a continuum of Nash equilibria. If one agent offers a share this proposal perfectly determines the other agents best response: the remaining share. In a one period context the share implicitely proposed by the opponent is the maximizing choice given the share of the opponent. This fact drives the multiplicity of equilibria. In our context the cake is not fixed. It is the size of the public project which is variable. Therefore an agent being confronted with a proposal for financing the project has the option to propose a different sized project. For example if the current proposal appears to impose too much cost on one agent he will not accept and propose a smaller sized project. This provides an idea to model the result of a bargaining process: It is a Nash equlibrium of the proposal game. As long as a proposition is made as to who has to finance how much an agent will not accept it, if given the proposed contributions of the remaining agents his own proposed contribution does not maximize his payoff. In this case, he will make a counteroffer. Or stated inversely: an agent will accept a proposal of contributions iff his own proposed contribution is his best response to the proposed contributions of the remaining agents. A Nash equlibrium is often described as a situation where no agent has an incentive to deviate unilaterally. An incentive to deviate is an incentive to impose a veto. Hence, it is indeed quite natural to model the "veto-free" result of a bargaining process as a Nash equilibrium. In such an equilibrium the agents do not coordinate their incentives. Therefore this may lead to Pareto inferior solutions.

Comparing with the Chen/Ordeshook paper this view of a proposal game is quite different. In their context each proposal survives potential vetoes if it is Pareto superior. This not so in our approach. A Pareto superior proposal may be blocked by some agent because given the contributions of the remaining agents he can improve his situation by a different proposal.

Consider a situation where some committee consisting of representatives of n regions have to decide on the level of a public good. Suppose that the public good influences the utility of the residents of all regions alike and that the chances of being reelected are the higher the higher this utility is. The committee has a budget R which it can spend on the public good or for favors to special interest groups. Favors to the latter increase the chances of being reelected as well. Suppose that without the public good regions would distribute the budget equally among themselves. Hence, each region is "entitled" to a share R/n.

A proposal for the public good consists of levels of contributions x_i of the representatives for this good. These contributions are no longer available for favors to special interest groups. The utility of a representative can than be written as

$$\theta_i u(\sum_{i=1}^{n} x_i) + v(\frac{R}{n} - x_i),$$

where u denotes the aggregate utility of residents derived from the public good. This can be taken as measure of the potential of voters for the representatives. As each representative is only elected by the local residents only fraction of the total potential is relevant in his decision making. This is denoted by θ_i. v denotes the utility derived from serving special interests, e.g. in order to solicit support for an election campaign. Both u and v are assumed to be concave.

Suppose that a certain proposal is made with respect to the size of the public good, X. To make things simple suppose that the contributions of all regions are always equal, although this can be derived as a result, if θ_i does not depend on i. This can be interpreted as a situation where X is subtracted from the total budget R and the rest of the budget can be spend on favors.

The central assumption is: a representative will veto against such a proposal, if the own contribution is not maximizing his utility given the contributions of the remaining regions. If his maximizing contribution is smaller he will argue for a reduced size of the public good and vice versa. The maximizing size is characterized by the following first order conditions:

$$\theta u'(x_i + \frac{n-1}{n} X) - v'(\frac{R}{n} - x_i) = 0,$$

where we have assumed that all representatives are identical in terms of θ. Therefore no proposal has a chance of being passed, which does not satisfy

$$\theta u'(X) - v'(\frac{R}{n} - \frac{X}{n}) = 0 \tag{1}$$

By concavity of u and v the left hand side is a decreasing function of X. If X = 0, we assume that the left hand side is positive:

$$\theta u'(0) > v'(\frac{R}{n})$$

Hence, it is assumed that it is more helpful winning an election if some means are spend on the public good rather than spending all money on interest groups. Likewise we assume that spending all money on the public good is worse than spending at least some on favors:

$$\theta u'(\frac{R}{n}) < v'(0).$$

This implies that the first order condition has exactly one solution, X^{nc}. Incidentally, it is the Nash equilibrium of the contribution game, where each representative simultaneously proposes a contribution.

Using the implicit function theorem, the solution of (1) is decreasing in *n*:

$$\left(\theta u''(X) + \frac{1}{n} v''(\frac{R-X}{n})\right)\frac{\partial X}{\partial n} + v''(\frac{R-X}{n})\frac{R-X}{n^2} = 0$$

Therefore, an increasing number of representatives leads to a lower level of public goods.

The utility level of a representative is therefore

$$\theta u(X) + v(\frac{R-X}{n}),$$

where *X* denotes the solution of (1). Now suppose, that the representatives collude. This means that they would try to maximize this expression by their choice of *X*. Then the first order condition is

$$\theta u'(X) - \frac{1}{n} v'(\frac{R-X}{n}) = 0 \qquad (2)$$

which by comparing with (1) yields a higher solution, X^c. Hence, the egoistic concerns of the individual representatives harm the provision of the public good. Given that the other representatives contribute according to (2) a specific representative will veto such a level as it is higher than the one that maximizes his utility.

If the proposal comes from outside the committee any proposal above X^c will be blocked by the committee, if the representatives recognize their joint power . Note that X^c is decreasing in *n* (apply the implicit function theorem to (2)). If the egoistic concerns of the representatives cannot be coordinated, any proposal above X^{nc} will be vetoed by some member of the committee.

Given the complete symmetry of representatives, abolishing the unanimity rule and opting for a majority rule would not change anything as long as symmetric contributions are used. The interests of all representatives are symmetric. If one has a reason to veto, each representative has one too. However, if representatives are different, e.g. in terms of θ_i, this will turn out differently. The intuition is quite clear: A low θ_i means that the public good is not that important to the representative. Given a right to veto he will only accept a quite low size of the public good. In a majority vote this can be overturned. Note however, that in the case of asymmetric representatives contributions have to be asymmetric as well (just look at (1)). This implies that a proposal would not only specify the size of the public good but also a financing scheme. This could be the case, if the project is proposed by a central government together with a proposal to finance it out of federal state finances.

Rather than elaborating on this idea at the present stage I would like to extend the analysis on a project of a different type. Here the contributions of the regions are in kind rather than purely financial. What I have in mind is e.g. a system of highways. If one region makes a highway available, this also increases the value of the highway of another region. This implies that the contributions are complements to each other rather than substitutes as in the situation above. I want to test whether the conclusions derived above are robust in this sense.

Suppose that the proposal consists in contributions for each region x_i and that it generates utility

$$u(x_1, x_2, \ldots, x_n),$$

where u increases in each argument, is concave, and has positive mixed second partial derivatives. Assume also that u is symmetric in the sense that the first partial derivatives are equal for all i if evaluated at a common level of $x_i = x$, $i = 1, 2, ..., n$.

As above suppose the interests of representatives can be modelled as

$$\theta_i u(x_1, x_2, \ldots, x_n) + v(\frac{R}{n} - x_i).$$

Again suppose that a representative will vote against any proposal, if given the contributions of the remaining representatives the proposal does not correspond to the maximizing choice of x_i . This choice is characterized by the first order condition

(3) $$\theta \frac{\partial u}{\partial x_i}(x_1, x_2, \ldots, x_n) - v'(\frac{R}{n} - x_i) = 0 ,$$

where we concentrate on the symmetric case: θ does not depend on *i*. It is therefore sensible to concentrate on symmetric solutions:

(4) $$\theta \frac{\partial u}{\partial x_i}(x, x, \ldots, x) - v'(\frac{R}{n} - x) = 0$$

Differentiating with respect to *x* gives

$$\theta \sum_{j=1}^{n} \frac{\partial^2 u}{\partial x_i \partial x_j} + v''(\frac{R}{n} - x) .$$

Assuming that the sum of second partial derivatives is negative, which is consistent with the concavity assumption, implies that the left hand side of (4) is decreasing in *x*. Imposing similar assumptions as above yields a unique solution of (4)

Suppose now that the regions are not represented by one representative each but by a smaller number. Suppose that *k* regions are represented by one representative and that there are *m* of them. So *km* = *n*. Suppose that the utility of such a representative is

$$\theta_i u(x_1, x_2, \ldots, x_n) + v(\frac{kR}{n} - \sum_{i \in k} x_i) .$$

This implies the first order conditions

$$\theta \frac{\partial u}{\partial x_i}(x, x, ..., x) - v'(k\left(\frac{R}{n} - x\right)) = 0 ,$$

if we concentrate again on the symmetric case. The left hand side decreases in *x* and increases in *k*. Hence a higher number of *k* yield a higher value of *x*. In this sense, the result obtained above is robust. A smaller number of potential vetoes yields a higher supply of the public good.

What happens, if all *n* representatives coordinate? Then the first order conditions are

$$\theta \sum_{j=1}^{n} \frac{\partial u}{\partial x_j} - v'(\frac{R}{n} - x) = 0 .$$

As by assumption the derivatives are all equal this yields:

$$\theta \frac{\partial u}{\partial x_i} - \frac{1}{n} v'(\frac{R}{n} - x) = 0$$

This parallels (2) exactly. Hence coordination leads to a higher provision of the public good. The same holds true if only *m* representatives coordinate. Their coordinating equilibrium would be characterized by

$$\theta \frac{\partial u}{\partial x_i} - \frac{1}{n} v'(k\left(\frac{R}{n} - x\right)) = 0 .$$

From this it follows that *x* increases in *k*.

Finally note that the results do not depend on the status of strategic subsitutes versus complements. Note also that the above results generalize the results on the underprovision of public goods. As has been suggested at least since Olson (1965) an increasing number of agents enhances the problem of underprovision of public goods. The above analysis supports this view. It should be noted, however, that such a result is dependent on the alternative use of funds relative to contributions to a public good and on the structure of preferences. For differing results with respect to the impact of group size on the problem of underprovision see e.g. Cornes and Sandler (1984).

References:

Chen, Yan and Peter C. Ordeshook (1998): Veto Games: Spatial Committees under Unanimity Rule, *Public Choice*, vol. 97, pp. 617-643

Cornes, Richard and Todd Sandler (1984): Easy Riders, Joint Production, and Public Goods, *Economic Journal*, vol 94, pp. 580-598

Olson; Mancur (1965): *The Logic of Collective Action*, Harvard University Press

Rubinstein, A. (1982): Perfect Equlibrium in a Barganining Model, *Econometrica*, vol 50, pp.97-109