PROBLEMS OF MAJORITY VOTING

Economists have devoted a great deal of thought to problems of governmental policy and, in particular, to the question of proper allocation of resources between the public and private sectors.[1] On the other hand, little attention has been given to the actual process of decision-making or to the type of policy likely to come out of the process.[2] It is the purpose of this article to discuss one particular method of making governmental decisions—majority voting—and to attempt to derive conclusions about its implications for resource allocation and government policy. It is hoped that the conclusions will be more realistic than current doctrine, which is based on an essentially economic view of what "ought" to happen.

Since it is impossible to talk about everything at once, the demonstration will be confined to certain features of the majority process. A number of other serious problems raised by the voting system will be disregarded. The most important of these concerns a series of difficulties and paradoxes in the voting process itself.[3] I will also disregard the fact that voters are frequently very poorly informed or even deceived in voting, the great oversimplification of issues necessary in order to reduce them to a form such that they can be determined by vote, and innumerable other possible limitations on the functional efficiency of the democratic process.

I shall consider the operation of majority rule under two different restrictions: logrolling (i.e., vote-trading) permitted and logrolling not permitted, starting with the latter. Since logrolling is the norm, discussion of the non-logrolling case must start with consideration of the institutional structure which eliminates logrolling. The standard referendum on a simple issue is the best example. The voter cannot trade his vote on one issue for votes on oth-

1. See Julius Margolis, "The Economic Evaluation of Federal Water Resource Development," *American Economic Review*, 49 (March, 1959), 69–111, for a review of some of the recent literature on the subject.

2. Pioneers have begun to appear. See Anthony Downs, *An Economic Theory of Democracy* (New York: Harper & Bros., 1957), and Duncan Black, *The Theory of Committees and Elections* (Cambridge: Cambridge University Press, 1958).

3. See Black (*op. cit.*) for a comprehensive view of the difficulties discovered to date.

ers because he and his acquaintances represent too small a part of the total electorate for this to be worth the effort involved. Further, the use of the secret ballot makes it impossible to tell whether voting promises are carried out. In these circumstances the voter will simply vote in accord with his preferences on each individual issue.

The contrary case, logrolling permitted, occurs under two circumstances. First, it occurs where a rather small body of voters vote openly on each measure; this is normally to be found in representative assemblies, but it may also be found in very small "direct democracy" units. Under these circumstances trades of votes are easy to arrange and observe and significantly affect the outcome. It is probable that this fact is one of the major reasons for the widespread use of representative democracy. The second type of logrolling, which may be called implicit logrolling, occurs when large bodies of voters are called on to decide complex issues, such as which party shall rule, or a complex set of issues presented as a unit for a referendum vote. Here there is no formal trading of votes, but an analogous process goes on. The "entrepreneurs" who offer candidates or programs to the voter make up a complex mix of policies to attract support.[4] In doing so, they keep firmly in mind the fact that the voter may be so interested in the outcome of some issue that he will vote for the party which supports it, although the party opposes him on other issues. This implicit logrolling will not be discussed further.

In the system in which logrolling is not permitted, every voter simply indicates his preference, and the preference of the majority of the voters is carried out. The defect, and it is a serious one, of this procedure is that it ignores the various intensities of the desires of the voters. A man who is passionately opposed to a given measure and a man who does not much care but is slightly in favor of it are weighted equally. Obviously, both could very easily be made better off if the man who felt strongly were permitted to give a present to the man who had little preference in return for a reversal of his decision. The satisfaction of both would be improved, and the resulting situation would, on strictly Paretian grounds, be superior to the outcome of voting that weighed their votes equally. By way of illustration it is conceivable that a proposal to send all Negroes to Africa (or all Jews to Israel) would be passed by referendum. It would have not the slightest chance of passing Congress because the

4. This problem is discussed in a paper presented by Julius Margolis at Public Finances: Needs, Sources, and Utilization: A Conference of the Universities—National Bureau Committee for Economic Research, held April 10 and 11, 1959, at Charlottesville, Virginia.

supporters of these two minorities would be willing to promise to support almost any other measure in return for votes against such a bill. In the absence of vote-trading, the support for it might reach 51 per cent, but it would not be intense, at least in the marginal cases, and hence the trading process would insure its defeat.

Even voters who are more or less indifferent to a given issue may find their votes on it counting as much as those of the most highly concerned individuals. The fact that a voter votes normally proves that he is not completely indifferent, but many voters are motivated to vote on referendum issues more by a sense of duty to vote than by any real concern with the matter at hand. Under these circumstances even the tiniest preference for one side or the other may determine the issue. Permitting the citizens who feel very strongly about an issue to compensate those whose opinion is only feebly held can result in a great increase of the well-being of both groups, and prohibiting such transactions is to prohibit a movement toward the optimum surface.

Note that the result under logrolling and under non-logrolling differs only if the minority feels more intensely about the issue than the majority; if the feeling of the majority is equal to or more intense than the minority, then the majority would prevail both with and without logrolling. It is only when the intensity of feeling of the minority is enough greater than that of the majority so that they are willing to make sacrifices in other areas sufficient to detach the marginal voters from the majority (intense members of the majority might make counteroffers if they wished) that the logrolling process will change the outcome.

As an introduction to logrolling, let us consider a simple model. A township inhabited by one hundred farmers who have more or less similar farms is cut by a number of main roads maintained by the state. However, these roads are limited-access roads, and the farmers are permitted to enter the primary network only at points where local roads intersect it. The local roads are built and maintained by the township. Maintenance is simple. Any farmer who wishes to have a specific road repaired puts the issue up to vote. If the repairing is approved, the cost is assessed to the farmers as part of the real property tax. The principal use of the local roads by the farmers is to get to and from the major state roads. Since these major roads cut through the district, generally there are only four or five farmers dependent on any particular bit of local road to reach the major roads.

Under these circumstances the referendum system would result in no lo-

B   A   B′

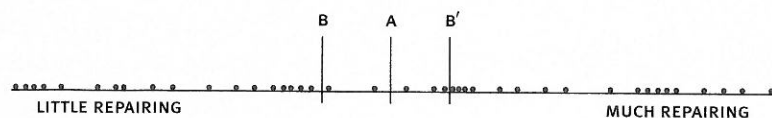LITTLE REPAIRING   MUCH REPAIRING

FIGURE 1

cal roads being repaired, since an overwhelming majority would vote against repairing any given road. The logrolling system, however, permits the roads to be kept in repair through bargains among voters. The bargaining might take a number of forms, but most of these would be unstable, and the "equilibrium" involves overinvestment of resources.

One form that the implicit bargain among the farmers might take is this: each individual might decide, in his own mind, the general standard that should be maintained. That is, he would balance, according to his own schedule of preferences, the costs of maintaining his own road at various levels of repair with the benefits to be received from it and reach a decision as to the point where the margins were equal. He could then generalize this decision: he could vote on each proposal to repair a given road in the same way as he would vote for repairs on his own road. If every voter followed this rule, we would find a schedule of voting behavior such as that illustrated in Figure 1. Each mark on the horizontal line represents the standard of one voter for maintenance of all roads. If a proposal for repairing a given road falls to the left of his position, he would vote for it; if it falls to his right, against. If each road has at least one farmer whose preference for road repairs falls to the right of the median (*A* in Fig. 1), then a proposal for repairs would be made as soon as a given road fell below his preferred degree of repair, and successive further such proposals as the road gradually deteriorated. When it reached the median level, a repair proposal would pass; hence all roads would be repaired at the median preference.

Although this result would not be a Paretian optimum, it would be possible to argue for it in ethical terms. In fact, I believe that this is the result that most proponents of democracy in such situations have in the back of their minds. In any event, I intend to use this result, which I shall call "Kantian," as the "correct" result with which I shall contrast what actually happens. Since my Kantian result differs from the "equal marginal cost and marginal benefit" system used by most economists in this field, it is incumbent on me

to explain why I use it. The reason is simple—it is the best I can do. I have been unable to find any system of voting which would lead to a social matching of costs and benefits at the margin.

If the farmers generally followed this policy in voting, then any individual farmer could benefit himself simply by voting against all proposals to repair roads other than his own and voting for proposals to repair his road at every opportunity. This would shift the median of the schedules slightly so that his taxes would be reduced or his road kept in better-than-average repair. If the other farmers on his road followed his example (we shall call farmers who follow this rule "maximizers"), they would be able to shift the standards of repair so that the roads on which they lived would be repaired at level *B′* while reducing the standard of repair on other roads to *B*. Since the largest share of the cost of keeping their road up falls on other taxpayers, while the largest share of their taxes goes for the repair of other roads, this change would be greatly to the advantage of the maximizers and greatly to the disadvantage of the Kantians.

If the farmers along another road also switched to a maximizing pattern, this would bring the level of road-repairing on the two maximizing roads down toward about that which would prevail under the Kantian system, while still further lowering the standards on the Kantian roads. However, it is likely that the two groups of maximizers could benefit by forming a coalition in order to raise the standards of road maintenance on their own roads.

Let us consider the situation of an individual maximizer debating whether or not to enter such a coalition. Since he will pay only about 1/100th of the cost, practically any proposal to repair his own road is to his benefit. If, however, in order to obtain support for some repair project on his own road, he must also vote for the repair of another road, then he must also count the cost to him of this other repair project as part of the cost of his own road. In weighing the costs and benefits, he must consider not only the tax cost to himself of the repair of his own road but the tax cost of the other repair job which he must vote for in order to get his road done. In the particular case we are now discussing, when the farmers on all the roads except two are still Kantian, this would put few restraints on feasible projects, but it would still have to be considered. However, as more and more Kantians become tired of being exploited by the maximizers and switch to a maximizing pattern of behavior, this consideration would become more and more important.

Let us now examine a rather unlikely, but theoretically important, special case. Suppose that exactly 51 of our 100 farmers were maximizers, while 49

were Kantians. Further suppose that all the maximizers lived on certain roads while all the Kantians lived on others. Under these circumstances the Kantians clearly would never get their roads repaired, but the level of repair on the maximizers' roads presents a more difficult problem. In order to simplify it, let us assume (plausibly) that they are maintained on a high enough level so that all the Kantians vote against any project for further repair. Under these circumstances it would be necessary to obtain the votes of all the maximizers for each repair project. A farmer considering whether he wants to have his road repaired must consider the whole cost, including the taxes he must pay in order to repair the roads of the other parties to the bargain. He can, however, simply compare his own marginal benefits and costs, and this requires no knowledge of anyone else's utility. He need only decide whether the total bargain is to his advantage or not.[5]

Note, however, that, while no roads leading to the Kantian farmers' houses will be repaired, they are required to contribute to the repair of the roads leading to the houses of the maximizers. Thus part of the cost of the road-repair projects will be paid by persons not party to the bargain, and, since the maximizers only count the costs to themselves of their votes, the general standard of road maintenance on the roads on which they live should be higher than if they had to count also the cost of maintaining the roads on which the Kantians lived. Under such conditions, where virtue so conspicuously is not paying, it seems likely that at least some of the Kantian farmers would decide to switch to a minimizing policy. For simplicity, let us assume that all of them do this at once. Since they would still be in a minority, their change of policy would not immediately benefit them, but surely they could find two of the original maximizers who would, in return for very good maintenance, desert their former colleagues. It is again obvious that the new majority would be susceptible to similar desertions; a permanent coalition of 51 farmers for the purpose of exploiting the remaining 49 could thus not be maintained. In terms of game theory any combination of 51 voters dominates any other size of combination, but no combination of 51 dominates all other combinations of 51.[6]

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5. In practice the problem of getting the unanimous agreement of 51 persons might be insoluble. Since we are now only discussing a rather unlikely special case, we can ignore the point. Alternatively, the reader can assume that there are 53 or 54 maximizers, and those who set their terms too high can simply be left out.

6. In the "Theory of the Reluctant Duelist" (*American Economic Review*, 46 [December, 1956], 909–23), Daniel Ellsberg contends that game theory really only applies to "reluctant"

The outcome is clear. Each farmer would enter into bilateral agreements with enough farmers on other roads to insure that his own was repaired. He would then be forced to count as part of the cost of getting his road repaired the cost (to him) of repairing the roads of the other 50 farmers. These bilateral agreements, however, would overlap. Farmer A (more precisely the farmers on road A) would bargain with Farmers B, . . . , M. Farmer M, on the other hand, might make up his majority from Farmer A and Farmers N, . . . , Z.

Counting the cost to himself of the maintenance of his road in terms of support for other road-repair projects, each farmer would consider only those projects for which he voted. Thus his expenditure pattern would count the tax payments of 49 voters as a free gift. The natural result would be that each road would be maintained at a level considerably higher and at greater expense than is rational from the standpoint of the farmers living along it. Each individual behaves rationally, but the outcome is irrational. This apparent paradox may be explained as follows: each voter pays enough in support for repair of other roads to equalize the benefit he receives from the repair of his own road. But his payments counted under this system include only part of the road-repair jobs undertaken.[7] There are others which are the result of bargains to which he is not a party. Taken as a group, the road-repair projects for which he votes represent a good bargain for him, but other *ad hoc* bargains to repair other roads will also take place. He will vote against these, but, as he will be in the minority, he will have to pay for them. The result is a sizable loss to him.

Any farmer following any other course of action will be even worse off. A Kantian farmer, for example, would never have his own road repaired but would pay heavy taxes for the support of repair jobs on other roads. The whole process will proceed through elaborate negotiations; the man who is the most effective bargainer will have a considerable advantage, but the general pattern will be less than optimal for all parties.

This seems a rather unsatisfactory result, and we should consider whether there are not ways of improving it. First, however, I should like to discuss

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players. Our case is a particularly pure example. The voter must "play the game" by entering into bargains with 50 of his fellows, even though this leads to rather unsatisfactory results, simply because any other course of action is even worse.

7. The fact that he is taxed for other roads not part of his bargain reduces his real income and hence, to some extent, reduces the amount of road-repairing he would wish to consume.

certain possible objections to my reasoning.[8] It may be said that the maximizers are behaving wickedly and that ethical considerations will prevent the majority of the population from following such a course. Ethical systems vary greatly from culture to culture, and I do not wish to rule out the possible existence somewhere of an ethical system which could bar logrolling, but surely the American system does not. Under our system logrolling is normally publicly characterized as "bad," but no real stigma attaches to those who practice it. The press describes such deals without any apparent disapproval, and, in fact, all our political organizations bargain in this fashion.

A second argument asserts that each farmer in our community would realize that, if he adopted a maximizing policy, this would lead all other farmers to do the same. Since the "maximizing equilibrium" is worse for all[9] the farmers than the "Kantian median," each farmer would, on the basis of cold selfish calculation, follow the Kantian system. This argument is similar to the view that no union will force its wage rate up because each union realizes that such action will lead other unions to do the same, the eventual outcome being higher prices and wage rates but no increase in real income. There seems to be overwhelming empirical evidence that men do not act this way. In addition, the argument contains a logical flaw: this is the observation that, in any series of actions by a number of men, there must be a first one. If this can be prevented, then the whole series can be prevented. This is true, of course, but there also must be a second, a third, etc. If any one of these is prevented, then the whole series cannot be carried out. If all our 100 farmers would refrain from a maximizing course of action because each one felt that his personal adoption of such a course would lead to a switch to the "maximizing equilibrium," then, if one of them had done so, we could construct an exactly similar argument "proving" that no 1 of the 99 remaining farmers would follow his example. But if this second argument is true, then the first is false; and hence the chain of reasoning contains an inconsistency.

I turn now to possible methods of improving the results. Could the members of a community somehow enter into an enforceable bargain under which they act according to the Kantian model? In the very narrow special case of

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8. James Buchanan kindly permitted me to present this paper before his graduate seminar in public finance, and the objections made by some of the students tended to follow these lines.

9. Not necessarily for all. There might well be one or more farmers whose personal preference schedules called for a large enough investment in roads so that the "maximizing equilibrium" was preferable to the "Kantian median."

our model, it is at least conceivable that they could. It is possible that a clear, unambiguous formula for telling when a road needed repair might be agreed upon, and then the exact figures to be inserted in the formula determined by general voting. Probably even in our case this would not be practical, but the theoretical possibility must be admitted.

In the more general and realistic case where governmental units deal with a continuing stream of radically different projects, no such agreed formula would be possible. A formula which would permit weighing such diverse programs as building giant irrigation projects in the West to increase farm production, paying large sums of money to farmers in the Midwest to reduce farm production, giving increased aid to Israel, and dredging Baltimore's harbor is inconceivable. There could not, therefore, be any agreement on an automatic system of allocating resources, and this throws us back to making individual decisions with the use of logrolling.

This is by no means a tragedy. If it were possible to set up some system by present voting to determine future resource allocation, it is more likely that this determination would take a form favored by a simple majority of the voters than a form favored by the whole group unanimously. This is likely to result in a worse decision than that resulting from logrolling. The problem of intensity must also be considered. The Kantian system makes no allowance for the differential intensities of the voters' preferences. If the voters who wanted more resources spent on road-repairing felt more intensely about it than the voters who wanted less, then the Kantian system would not result in an optimum distribution of resources. Permitting logrolling would take care of this problem.

Requiring more than a simple majority would reduce the resources spent on roads, since more people would have to be included in each bargain, and the cost to each voter of repair to this road would consequently be increased. The larger the majority required, the more closely would the result approach a Pareto optimum. Practically, however, the difficulty of negotiating a bargain would increase exponentially as the number of required parties increased, and this might make such a solution impossible. The provision in so many constitutions for a two-house legislature, each house elected according to a different system, raises much the same issues.

Our next problem is to inquire to what extent the results obtained in our simple model can be generalized. It would appear that any governmental activity which benefits a given individual or group of voters and which is paid for from general taxation could be fitted into our model. It is not necessary

that the revenues used to pay for the projects be collected equally from all voters. All that is necessary is that the benefits be significantly more concentrated than the costs. This is a very weak restraint, and a very large number of budgetary patterns would fit it. If the taxes were collected by some indirect method so that individuals could not tell just how much they were paying for any given project, then this fact would accentuate the process. In the marginal case the individual might be indifferent about projects benefiting other people whose cost to him was slight and difficult to calculate.

One requirement of the process has not yet been emphasized. It is necessary that the voting on the various projects be a continuing process. A number of different projects or groups of projects must be voted on at different times. If all projects were inserted in a single bill to be accepted or rejected for all time, then 51 per cent of the voters could fix the bill permanently to exploit the remainder. In fact, of course, since government is a continuing process, our condition is fulfilled.

The process which we have been discussing can be generalized to cover other types of government activity. We shall start by generalizing it to cover other types of taxation-expenditure problems and then turn to other types of governmental problems. First, let us suppose that we have some governmental activity of general benefit, police work, for example, which is paid for by some general type of taxation. By reasoning paralleling that which we have done so far, we can demonstrate that special tax exemptions to special groups at the expense of the general efficiency of the police force would be carried on to a degree which would far exceed the Kantian median. Similarly, if a given sum of money is to be spent on two different types of governmental activity, one of which is of general benefit and one of which benefits a series of special groups, too much will be spent on the latter. Defense, for example, will be slighted in favor of river and harbor work.

The same reasoning can be applied to the tax structure. If a given amount of money had to be raised, we would expect it to be raised by general taxes that were "too heavy" but riddled by special exemptions for all sorts of groups. This would greatly reduce the effect of any general tax policy, such as progression, that had been adopted. This pattern appears to be very realistic. On the basis of our theory, we would predict general and diffuse taxes, riddled with special exceptions, and governmental functions of general benefit sacrificed in favor of the interests of particular groups. I see no great conflict between the prediction and reality.

To apply our theory generally to all types of governmental activity, how-

ever, we must radically generalize it. For any individual voter all possible measures can be arranged according to the intensity of his feeling. His welfare can be improved if he accepts a decision against his desire in an area where his feelings are comparatively weak in return for a decision in his favor in an area where his feelings are strong. Bargains between voters, therefore, can be mutually beneficial. Logically, the voter should enter into such bargains until the marginal "cost" of voting for something he disapproves of but about which his feelings are weak exactly matches the marginal benefit of the vote on something else which he receives in return. Thus he will benefit from the total complex of issues which enter into the set of bargains which he makes with other people. In making these bargains, however, he must gain the assent of a majority of the voters only, not of all of them. On any given issue he can safely ignore the desires of 49 per cent. This means that he can afford to "pay" more to people for voting for his measures because part of the inconvenience imposed by the measure will fall on parties not members of the bargains.

Unfortunately, the converse also applies. Bargains will be entered into in which our voter does not participate but part of the cost of which he will have to bear. As a result, the whole effect of the measures which result from his bargains and on which he votes on the winning side will be beneficial to him. But this will be only slightly more than half of all the "bargained" measures passed, and the remainder will be definitely contrary to his interest. The same would be true for the *average* voter under a pure referendum system. In fact, the whole problem discussed in this paper arises from the system of compelling the minority to accept the will of the majority.

Although this paper so far has been an exercise in "positive politics," the analysis does raise important policy problems, and at least some comment on them seems desirable. It seems clear that the system of majority voting is not by any means an optimal method of allocating resources. This fact should be taken into account in considering whether some aspect of our economy would be better handled by governmental or market techniques. On the other hand, these problems and difficulties do not materially reduce the advantage which voting procedures have over despotism as a system of government. The primary lesson would appear to be the need for further research. Majority voting plays the major role in the governments of all the nations in which the social sciences are comparatively advanced. It seems likely that careful analysis of the process would lead to the discovery of improved techniques and a possible increase in governmental efficiency.