

DO GOVERNMENTS SPEND TOO MUCH?

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THERE is a substantial body of economic theory devoted to optimal provision of public goods and to optimal taxation. There is also a considerable literature on the positive theory of majority voting processes. However, contemplation of efficiency of democratic decision making has, with a few exceptions, remained the preserve of political speechwriters and contestants in junior high school essay contests.

The starting point for this analysis is one of the exceptional works, *The Interpretation of Voting in the Allocation of Resources*, by Howard R. Bowen (6). In this remarkable article, Bowen states conditions that imply the existence and Pareto efficiency of majority voting equilibrium. While the conclusion of Bowen's theorem is striking, the assumptions are very strong and a bit difficult to interpret. Here we attempt to explain and extend the Bowen result.¹ We then offer some speculations on possible reasons why majority voting might lead to inefficient provision of public goods.

The Bowen Theorem and an Extension

Let there be n individuals, a single public good, and a single private good. Preferences of each individual i are represented by a differentiable strictly quasi-concave utility function $U^i(X_i, Y)$ where X_i is i 's consumption of private good and Y is the amount of public good produced. Individual i has an initial wealth of W_i units of private good. Public good can be produced at a constant unit cost of c units of private good. Letting the private good be the numeraire, suppose that individual i is taxed to pay the fraction $t_i > 0$ of the total cost of the public good. Thus if Y units of public good are produced, he will have the amount $X_i = W_i - ct_i Y$ of wealth left for private consumption.

Conditional on this system of taxation, his preferences over amounts of public goods are represented by the induced utility function, $\bar{U}^i(Y) = U^i(W_i - ct_i Y, Y)$. If U^i is strictly quasi-concave in X_i and Y , then \bar{U}^i is strictly quasi-concave in Y . A strictly quasi-concave function of a single variable is single-peaked in the sense of Duncan Black (5). Let Y_i^* be the (unique because of single peakedness) value of Y which maximizes $\bar{U}^i(Y)$ on the interval $\left[0, \frac{1}{c} \sum_i W_i\right]$ of feasible outputs of Y . Let \bar{Y}^* be the median of the Y_i^* 's. Then it follows from Black's results on single peaked preferences that \bar{Y}^* is the unique amount of public good supply that is stable under pairwise majority voting. Thus an interesting case can be made for \bar{Y}^* as the natural outcome of a democratic public decision process.

We call the allocation of resources that results from such a process a *Bowen equilibrium*. Thus for the model under consideration, we define a Bowen equilibrium as follows.

Definition

Let $t_i > 0$ be the tax share and $W_i > 0$ be the wealth of individual i and let $\sum_i t_i = 1$. Let Y_i^* maximize $U_i(W_i - t_i c Y, Y)$, let $\bar{Y}^* = \text{median } Y_i^*$ and let $X_i^* = W_i - t_i c \bar{Y}^*$. Then the allocation $(X_1^*, \dots, X_n^*, \bar{Y}^*)$ is the *Bowen equilibrium* corresponding to the tax share distribution (t_1, \dots, t_n) .

Theorem 1 (Bowen)

In the model described above, if median M.R.S. $_{YX_i}(\bar{Y}^*) = \text{mean M.R.S. }_{YX_i}(\bar{Y}^*)$, and

$t_i = \frac{1}{n}$ for each i , then Bowen equilibrium is Pareto optimal.

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Proof:

Strict quasi-concavity of U^i implies that $M.R.S._i(Y)$ is a monotone decreasing function of Y . Therefore, where $Y_i^* = \bar{Y}^*$ is the median of Y_1^*, \dots, Y_n^* it must be that $\frac{c}{n} = M.R.S._i(\bar{Y}^*) = \text{median } M.R.S._i(\bar{Y}^*) = \text{mean } M.R.S._i(\bar{Y}^*)$. Therefore $\frac{c}{n} = \frac{1}{n} \sum_{i=1}^n M.R.S._i(\bar{Y}^*)$ and $c = \sum_{i=1}^n M.R.S._i(\bar{Y}^*)$. But this is just the "Samuelson necessary condition" (Samuelson (13)) for efficient supply of public goods. When U^i is quasi-concave, the Samuelson conditions are sufficient as well as necessary for Pareto optimality. It follows that the allocation $(X_1^*, \dots, X_n^*, Y^*)$ is Pareto optimal where $X_i^* = W_i - \frac{c}{n} \bar{Y}^*$ for each i .

Q.E.D.

The novel assumption for the Bowen theorem is, of course, the assumption that the mean of the marginal rates of substitution at \bar{Y}^* is equal to the median of these rates. The most natural way of establishing such a condition appears to be to assume that the distribution among individuals of marginal rates of substitution given the amount of public goods and the tax system is symmetric.

Suppose for example that utility functions take the "transferrable utility" form

$$U_i(X_i, Y) = X_i + a_i f(Y)$$

where $f'(\cdot) > 0$ and $f''(\cdot) < 0$ and where the a_i 's are symmetrically distributed throughout the population. Then (except for corner solutions) if tax shares are identical, Y_i^* will depend positively on a_i and will be independent of wealth. In fact where $\bar{a} = \text{median } a_i$, $\text{median } M.R.S._i(\bar{Y}^*)$

$$= \bar{a} f'(\bar{Y}^*) = \frac{c}{n}. \text{ On the other hand, mean } M.R.S._i(\bar{Y}^*) = \frac{1}{n} \sum_{i=1}^n a_i f'(\bar{Y}^*) = \bar{a} f'(\bar{Y}^*)$$

where $\bar{a} = \frac{1}{n} \sum_{i=1}^n a_i$. Therefore the symmetry condition for Bowen's theorem is satisfied if and only if $\bar{a} = \bar{a}$.

The above example has the peculiar feature that the income elasticity of demand for the public good is zero. This makes symmetry of the type demanded by Bowen more plausible than it might otherwise seem. If demand for the public good is income elastic, then it follows that where everyone in the community pays the same tax rate and shares the same amount of public good the wealthier one is (*ceteris paribus*) the higher will be his marginal rate of substitution between public and private good. Since in most communities, wealth is not symmetrically distributed, it seems unlikely that the marginal rates of substitution will be distributed symmetrically. For example, it is not difficult to show that where utilities all take the same log linear form:

$$U_i(X_i, Y) = \ln X_i + a_i \ln Y$$

the Bowen symmetry condition will hold if and only if $\text{mean } W_i = \text{median } W_i$ if $\text{mean } W_i > \text{median } W_i$ as is the case in most communities, then it can be shown that a Pareto improvement can be made from \bar{Y}^* by increasing the amount of public goods.

This example suggests that efficiency might be served by picking a tax schedule that depends positively on wealth. In fact as we demonstrate elsewhere (4) if preferences are represented by log linear utilities,

$$U_i(X_i, Y) = \ln X_i + a_i \ln Y$$

where the a_i 's are symmetrically distributed and uncorrelated with the W_i 's, and and if $t_i = \frac{W_i}{\sum W_i}$ for each i , then regardless of the distribution of wealth a Bowen equilibrium is Pareto optimal.

The idea of adjusting tax rates so as to achieve appropriately symmetric marginal rates of substitution is closely related to Lindahl's notion of arranging tax

prices so that citizens agree unanimously on the appropriate level of public goods. Lindahl equilibrium has been shown to exist for a rich class of economies (2), (9). If taxes are set to be Lindahl tax rates, then quite trivially Bowen's symmetry conditions are satisfied. Consequently the level of public goods chosen by majority rule (in fact by unanimous consent) will be the Lindahl equilibrium quantity and will be Pareto optimal.

If, as in the example above, preferences are log linear and taxes are proportional to wealth, then it is not hard to show that, regardless of the distribution of wealth, there would be unanimous agreement about the level of public goods expenditure if preferences were also identical. In addition, we claim that a Bowen equilibrium with tax shares proportional to wealth will be Pareto optimal even if the parameters a_i differ, so long as the a_i 's are symmetrically distributed and uncorrelated with wealth.

This example suggests a simple generalization. Suppose the population is partitioned into a number of types of individuals. Types are distinguished by their wealth and certain other observable differences. Different persons of the same type have the same wealth but may differ in other, possibly nonobservable, characteristics so that their preferences for public goods may differ. Suppose that within each type the marginal rates of substitution for the public good are symmetrically distributed. Now consider the hypothetical economy in which all persons of the same type are assumed to have the same marginal rate of substitution schedule, namely the mean of such schedules for persons of their type in the *actual economy*. For this hypothetical economy, given reasonable assumptions, a Lindahl equilibrium exists. This Lindahl equilibrium assigns a tax share to each type, in such a way that, given his tax share, the individual of that type who has the mean (and, because of the assumed symmetry), also the median intensity of demand for the public good within his group obtains in equilibrium exactly the quantity of public good that he desires. It is not hard, therefore, to see that if the Lindahl shares from

the hypothetical economy are assigned in the actual economy, the Lindahl equilibrium quantity of public goods from the hypothetical economy will be a Bowen equilibrium quantity for the actual economy. Furthermore, it can be shown that the Bowen equilibrium thus obtained is Pareto optimal. A detailed demonstration is found in (4).

We call an allocation of the type described above a pseudo-Lindahl equilibrium. In general, as we have shown, Bowen equilibrium is not Pareto optimal. As is well known, the informational requirements for computation of Lindahl equilibrium appear to be unreasonable if not impossible. A promising middle ground is a pseudo-Lindahl equilibrium, which is Pareto optimal but does not require detailed knowledge of individual preferences but rather knowledge of average preferences for each type. It is unreasonable to hope to obtain and use detailed knowledge of the preferences of each individual as would be necessary to implement a true Lindahl equilibrium. Not only would the cost of obtaining and using so much information be prohibitive, but there is also the so-called "free rider problem," namely if individuals are aware that the information they reveal will affect their taxes, they in general will have an incentive to distort the truth. However, the task of estimating average preferences for large groups is much less formidable. For example, preferences of relatively small samples from each group could be used to make such estimates. If the samples are small relative to the population a good deal of resources can be expended on studying them and on insulating sample members from incentives to lie. For detailed discussions of these issues, see Bergstrom (4) and Kurz (8).

Toward a Theory of Boondoggles and Missed Opportunities

The analysis of the previous section suggests two possible reasons that a government might spend an inefficient amount on public goods. These are

- (i) The median voter does not get what he wants.

- (ii) The median voter gets what he wants but the marginal rates of substitution of voters are asymmetric.

There are a number of reasons why, even in democracies, we might see imperfections of type (i). Recent contributions of Niskanen (11), Romer and Rosenthal (12) and Denzau and MacKay (7) present interesting analyses of a community in which bureaucrats are able to exploit a certain amount of monopoly power. Thus the bureaucratic suppliers, who wish to increase the size of the public sector may be able to manipulate the submission of fiscal questions to the electorate in such a way as to force voters to make "all-or-nothing" choices. Thus in contrast to the Bowen theory wherein the median competitive demand for public goods is selected, these theories suggest that a larger amount, namely the median "all-or-nothing" demand would be chosen.

Another explanation of type (i) is suggested by recent experience with the property tax. In many states, including California and Michigan, popular elections have traditionally approved millage rates of property taxation which are to stand for a considerable length of time. These states also require frequent reassessment of property to maintain a fairly constant ratio of assessed to market value. Thus when the price of residential property relative to other goods increases substantially as it has in many places, there is windfall revenue for governments in excess of that which voters intended. The remedy for this situation would seem to be much simpler than the rather drastic bill passed in California or even the relatively mild bill passed in Michigan. All that would be required is to have the voters decide not on a millage rate but on an annual real revenue for their governments. This could be paid for out of property tax just as before and property could be continually reassessed in proportion to market value. Millage rates would simply be adjusted to maintain a level of real purchasing power for the government that is agreed on by voters.

A third possibility is that voters, knowing that individually they have little in-

fluence, find that it is not worthwhile to become well informed before voting. Thus a vote is only a poor indicator of what one's true interest would be if he took the time to study the situation thoroughly. This argument is less persuasive than it might seem at first appearance since there is a "law of large numbers" that applies to medians just as it applies to means. Thus if individuals make independent and unbiased, even if highly inaccurate, estimates of how much public goods they want and if there are many voters, the median vote is very likely to be very close to the outcome if everyone voted his self interest accurately. This analysis is presented in more detail in Bergstrom and Goodman (1). Of course if there is a systematic bias to individual misperceptions then these may have an important effect on the outcome even in large communities.

We next consider the efficiency of majority voting in providing public goods when the distribution of benefits is highly asymmetric. Sheer arithmetic would suggest that a project that provides a great deal of benefit for a small number of persons and no benefits for most people would be defeated by majority vote if paid for out of general revenue regardless of whether the value of benefits exceeds its total cost. Similarly we would expect that a project that provides small benefits to each of many persons and seriously harms a few would succeed whether or not the value of benefits exceeds the value of costs. It is then a bit surprising that a major concern of critics of democratic government is the ability of intensely concerned special interest groups to pass appropriations for "boondoggles" or to pass tariff legislation despite nearly universal agreement among experts that such legislation is socially inefficient. Of course a worthwhile project that benefits only a few people can gain wide approval or at least wide indifference if it is agreed that the project will be paid for mainly by its beneficiaries. Alternatively such projects can gain approval as part of a "package" of legislation that offers several special interest groups projects to their liking. This may take the form of either an explicit omnibus bill or of informal "vote

trading" in a legislative body.

Even though such arrangements can be made, it remains a bit of a mystery how true "boondoggles" can make their way through the legislative process. Perhaps this is a consequence of an inherent instability in the determination of income distribution in democracies. As is well-known, the game in which income is distributed by majority vote does not have a core. Thus it might be argued that boondoggles are a consequence of manipulation of the agenda in a series of elections where there are cyclical majorities. Though this notion has some appeal, it leaves one to wonder why such manipulation would not be performed with purely redistributive programs which would not involve the dead weight loss associated with a project whose costs exceed its benefits.

Here we explore an alternative view. Suppose that the political system is at an equilibrium as far as purely redistributive legislation is concerned. That is, the tax codes and the distribution of wealth are such that any change that is purely redistributive will be defeated. (This might be true despite the absence of a core for the majority voting game, if for example, voters recognize that further change would lead to cyclical redistributions in which they are as likely to do badly as to do well.) If a project is proposed that is inefficient in the sense that the cost of the project exceeds its total value to the gainers, then no matter how its costs are divided among the taxpayers, there would always be some purely redistributive proposal that would be better for everyone than the project and its proposed method of finance. But we have assumed that any such purely redistributive proposal would be defeated. It seems, therefore, that in order to explain the creation of boondoggles, we have to argue either that there does not exist an initial equilibrium with respect to pure wealth distribution or alternatively that an inefficient project may succeed in the political process even though a Pareto superior redistribution would be defeated.

I will try to argue that where a project returns large benefits to a small portion

of the population and small costs to a large portion of the population, the project may receive majority support even though a pure redistribution of wealth that is better for everyone than the project would fail. The reason that this might be the case is the following. A pure redistribution is relatively easily understood and voters can fairly accurately ascertain their self interest before voting. A complicated project involving real resources is much less easily understood. Since most individual voters have little at stake, it is not individually rational for them to become well-informed about the workings of the project. The small number of individuals who will greatly benefit will find it in their interest to spend resources on misleading voters about their self-interest and on rewarding sympathetic members of the legislature. Another way of looking at the situation is to notice that the larger group faces a much greater internal "free rider" problem with respect to the production of information than the smaller group. Thus the majority will be less well-informed than the intensely concerned individuals of the minority. We might then expect a number of inefficient but plausible sounding projects with a concentrated group of beneficiaries to pass. On the other hand, it would also be expected that voters would be aware that special interest groups are frequently going to try to trick them. One reasonable response on the part of a voter who wishes to economize on information is to vote against almost all such projects. Such conservatism would reduce the number of boondoggles, but it might also lead individuals to vote against projects that they would favor if they truly understood them. Thus we would expect that where there are many boondoggles, there are also many "missed opportunities" of projects which if appropriately financed and properly understood would receive nearly unanimous approval.

This paper has not produced a decisive answer to the question of its title. In fact the question may be ill-posed. One would, after all, be surprised if the answer were anything other than, "Yes, on some things, but too little is spent on other things." Perhaps this analysis will be of some

assistance in identifying which things are which.

FOOTNOTES

¹The analysis of Bowen's theorem and its extension is carried out in more formal detail in Bergstrom (4).

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