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PUBLIC CHOICE can be defined as the economic study of nonmarket decision-making, or, simply the application of economics to political science. The basic behavioral postulate of public choice, as for economics, is that man is an egoistic, rational, utility maximizer.[1] This places public choice within the stream of political philosophy extending at least from Thomas Hobbes and Benedict Spinoza, and within political science from James Madison and Alexis de Tocqueville. It is separated from much of this earlier work on politics, however, by its use of the analytic tools of economics (see, however, Duncan Black [22, 1958, pp. 156–213]; James M. Buchanan and Gordon Tullock [42, 1962, pp. 307–22]; Edwin T. Haefele [84, 1971]; and Vincent Ostrom [143, 1971]).

Indeed, public choice's development as a separate field has been largely within the last three decades and in response to issues and needs arising elsewhere in economics. Starting with Abram Bergson's 1938 article [13, 1938] and spurred by Kenneth J. Arrow's 1951 book [3, (1951) 1963] a large literature has grown exploring the properties of social welfare or social choice functions.[2] It focuses on the problems of aggregating individual preferences to *maximize* a social welfare function or to satisfy some set of normative criteria. This research on optimal methods of aggregating preferences has naturally spurred interest in the properties of *actual* procedures for aggregating preferences via voting rules, *i.e.,* in public choice. The problem of finding a social choice function satisfying certain normative criteria turns out to be quite analogous to establishing an equilibrium under different voting rules. Thus, both Arrow's study [3, 1963] of social welfare functions and D. Black's seminal work on committee voting procedures build on the works of J. C. de Borda [24, 1781], M. de Condorcet [52, 1785], and C. L. Dodgson [61, 1876]. We discuss the most directly relevant parts of the social welfare function literature as part of normative public choice in *Part Two.*

[1] For detailed justification of this postulate in the study of voting see Anthony Downs [62, 1957, pp. 3–20]; James M. Buchanan and Gordon Tullock [42, 1962, pp. 17–39]; and William H. Riker and Peter C. Ordeshook [167, 1973, pp. 8–37]. Joseph A. Schumpeter's early use of the postulate also should be mentioned [178, 1950]. One of the curiosities of the public choice literature is the slight *direct* influence Schumpeter's work appears to have had. Downs claims that "Schumpeter's profound analysis of democracy forms the inspiration and foundation for our whole thesis," [62, 1957, p. 27, n. 11] but cites only one page of the book (twice), and this in support of the economic man assumption. Most other work in the field makes no reference to Schumpeter.

[2] For surveys see Amartya K. Sen [180, 1970] and Peter C. Fishburn [68, 1973].

The second development in economics fostering interest in public choice has been the work on market failures, again stemming from papers appearing in the '40's and '50's. This work centers on establishing conditions for efficient allocation in the presence of market failures and leads directly to the study of nonmarket procedures for revealing individual preferences in these situations. The public choice approach to nonmarket decision-making has been (1) to make the same behavioral assumptions as general economics (rational, utilitarian man), (2) often to depict the preference revelation process as analogous to the market (voters engage in exchange, citizens exit and enter clubs), and (3) to ask the same questions as traditional price theory (Do equilibria exist? Are they stable? Pareto efficient?). This part of the literature resembles positive economics so closely, that it is referred to here as positive public choice, although parts of it have normative implications. Positive public choice is reviewed in *Part One.*

Public choice and public expenditure theory share an ancestry in the work of the "Continental" writers on public finance (see Richard Musgrave and Alan Peacock [134, 1958]). Of particular importance here are the papers by Erik Lindahl [114, 1919] and Knut Wicksell [208, 1896]. Lindahl's paper has had the greater influence on public goods theory; Wicksell's on public choice and public finance. Wicksell's view of government as a *quid pro quo* process of exchange among citizens underlies Buchanan and Tullock's *Calculus of Consent* [42, 1962] and much of the positive public choice literature. Musgrave's influential separation of government activity into allocation and redistribution decisions is directly traceable to Wicksell [132, 1959]. In *Part Three,* we argue that this Wicksellian distinction constitutes the natural conceptual boundary between positive and normative public choice.[3]

Not surprisingly, given this background, many contributors to public choice have worked in or started from public finance. Despite this overlap, the amount of work on the interface between public choice and public finance remains small,[4] and little is said about it in this survey.

Along with the above intellectual developments, interest in public choice has undoubtedly been stimulated by the actual growth of the public sector. Between 1946 and 1974 total government (federal, state, and local) purchases of goods and services as a percentage of GNP in the United States increased from 13 to 22 percent, total government receipts as a percent of national income from 28 to 40. Regardless of the normative properties of the collective choice process, the mere magnitude of the public sector warrants study of its decision rules.

Part One: The Positive Theory of Public Choice

I. *The Reasons for Collective Choice*

Probably the most important accomplishment of economics is the demonstration that individuals with purely selfish motives can mutually benefit from exchange. If *A* raises cattle and *B* corn, both may benefit by exchanging cattle for corn. With the help of the price system, the

[3] This division of the literature also corresponds to a difference in views of the state as either an "organic" entity, or a union of individuals engaged in a *quid pro quo* exchange. The distinction was clearly drawn, and the subsequent development of the literature anticipated in 1949 by Buchanan [29, 1949] in an article that builds on Wicksell. See, also Buchanan's article [39, 1975, fn. 10].

[4] Exceptions are Buchanan's book [34, 1967] and articles by Kenneth V. Greene [83, 1970] and Alvin K. Klevorick and Gerald H. Kramer [104, 1973]. The general topic is reviewed and Wicksell's influence emphasized by Buchanan [39, 1975].

Matrix 1.

B→ *A*↓	DOES NOT STEAL	STEALS
DOES NOT STEAL	1 *A*(10-*cattle*, 9-*corn*) *B*(8-*cattle*, 6-*corn*)	4 *A*(6-*cattle*, 5-*corn*) *B*(10-*cattle*, 9-*corn*)
STEALS	2 *A*(10-*cattle*, 10-*corn*) *B*(5-*cattle*, 3-*corn*)	3 *A*(7-*cattle*, 5-*corn*) *B*(7-*cattle*, 5-*corn*)

process can be extended to accommodate a wide variety of goods and services.

Although often depicted as the perfect example of the beneficial outcome of purely private, individualistic activity in the absence of government, the invisible hand theorem presumes a system of collective choice comparable in sophistication and complexity to the market system it governs. For the choices facing *A* and *B* are not merely to trade or not, as implicitly suggested. *A* can choose to steal *B*'s corn, rather than give up his cattle for it; *B* may do likewise. But, unlike trading, stealing is at best a zero sum game. What *A* gains, *B* loses. If stealing, and guarding against it, detract from *A* and *B*'s ability to produce corn and cattle, it becomes a negative sum game. While with trading each seeks to improve his position and both end up better off, with stealing the selfish pursuits of each may leave them both worse off.

The example can be illustrated with strategy *Matrix* 1. Square 1 gives the allocations when *A* and *B* trade and refrain from stealing, square 3 when they steal and trade. Both are better off when they both refrain from stealing, but each is still better off if he alone steals (cells 2 and 4). Both may be induced to adopt the dominant stealing strategy with the outcome cell 3. Once there, both can become better off by tacitly or formally agreeing not to steal, providing the enforcement of such an agreement costs less than they jointly gain from it.

The agreement against stealing is necessary to achieve Pareto optimality. More generally, the collective act of establishing and enforcing laws and property rights is undoubtedly a necessary precondition for a system of voluntary exchange [44, Bush and Mayer, 1974; 37, Buchanan, 1975]. Problems of collective choice exist in all but a purely Hobbesian, anarchistic society and are coterminous with the existence of recognizable groups and communities.

A judicial system is a Samuelsonian public good in "that each individual's consumption leads to no subtraction from any other individual's consumption of that good" [175, Samuelson, 1954]. Nearly all public goods, whose provision requires an expenditure of resources, time, or moral restraint, can be depicted with a strategy box analogous to *Matrix* 1 [171, Runciman and Sen, 1965; 167, Riker and Ordeshook, 1973, pp. 296–300]. National defense is the collective provision of protection against external threats; laws and their enforcement against internal threats; fire departments against fires. Replace stealing with paying for an army, or a police force, or a fire department, and the same strategy choices emerge. Each individual is better off if all contribute to the provision

of the public good than if all do not, and each is still better off if he alone does not pay for the good.

A pure public good is characterized by indivisibilities in production or jointness of supply and the impossibility or inefficiency of excluding others from its consumption, once it has been supplied to some members of the community [132, Musgrave, 1959, pp. 9–12, 86; 90, Head, 1962]. The joint supply characteristic creates the potential gain from a cooperative move from cell 3 to 1. Given jointness of supply, a cooperative consumption decision is necessary to provide the good efficiently. If it took twice as many resources to protect *A* and *B* from one another as it does to protect only one of them, collective action would be unnecessary. The failure of the exclusion principle to apply provides an incentive for noncooperative individualistic behavior, a gain from moving from cell 1 to either cell 2 or 4. The impossibility of exclusion thus raises the likelihood that purely voluntary schemes for providing a public good break down. Together the properties of public goods provide the *raison d'être* for collective choice. Jointness of supply is the carrot, making cooperative-collective decisions beneficial to all; absence of the exclusion principle the apple tempting individuals into independent noncooperative behavior.

Matrix 1 depicts the familiar and extensively analyzed prisoner's dilemma. Despite the obvious superiority of the cooperative nonstealing outcome to the joint stealing outcome, the dominance of the stealing strategies ensures that nonstealing does not constitute an equilibrium. Nonstealing can be assured only through a joint, enforceable agreement. Such an agreement can be reached informally, through repeated plays of the game. Player *A* may induce player *B* not to steal, by not stealing himself. *A* can enforce this agreement by indicating by word or deed, that he will begin to steal as soon as *B* does. By so tying his behavior to *B*'s, the strategies reduce to a choice between cells 1 and 3, and the cooperative solution can emerge.

The appearance of cooperative solutions in prisoners' dilemma games has been found in experimental studies to depend on the number of players, and number of plays of the game [184, Siegel and Fouraker, 1960; 183, Sherman, 1971]. When the number of other players is small, it is easier to learn their behavior and predict whether they will respond to cooperative strategy choices in a like manner. It is also easier to detect noncooperative behavior and single it out for punishment, thereby further encouraging the cooperative strategies. When numbers are large, some players can adopt the noncooperative strategy, and either not be detected, since the impact on the rest is small, or not be punished, since they cannot be discovered or it is too costly to the cooperating players to punish. Thus, voluntary compliance with behavioral sanctions or provision of public goods is more likely in small communities than large [33, Buchanan, 1965]. Reliance on voluntary compliance in large groups leads to free riding by many individuals bringing about the under or nonprovision of the public good [141, Olson, 1965].

In the large, mobile, heterogeneous community a formal statement of what behavior is mutually beneficial (*e.g.*, how much each must contribute for a public good) may be needed, for individuals even to know what behavior is consistent with the general welfare. Given the incentives to free ride, compliance may require the implementation of individualized rewards or sanctions [141, Olson, 1965, pp. 50–51, 132–35].

Thus, democracy, formal voting procedures for making and enforcing collective choices, is needed by communities of only a certain size and impersonality. The

family makes an array of collective decisions without ever voting; a tribe perhaps only occasionally. A metropolis or nation state must make a great number of decisions by collective choice processes. Small stable communities may elicit voluntary compliance and contributions for collective decisions by merely publicizing them. Larger, more impersonal communities must establish formal penalties for asocial behavior and levy taxes (penalizing nonpayment) to provide for public goods.

The game theoretic underpinning of public choice, as represented by the prisoners' dilemma, and the different possibilities for arriving at the cooperative solution to this game have important implications for the selection of a set of democratic rules by a community as will become apparent as we examine the properties of these rules.

II. *Public Choice in a Direct Democracy*

This section explores the properties of various voting rules. These rules can be thought of as governing the polity itself, as when decisions are made in a town meeting or by referendum, or an assembly or committee of representatives of the citizenry. If the latter is assumed, the results can be strictly related only to the preferences of the representatives. The relationship between citizen and representative preferences is taken up later.

A. *The Unanimity Rule*

As we have seen, formal voting procedures are needed to provide public goods due to the incentives for violating voluntary, informal agreements—free-riding. Since *all* can benefit by conforming to the cooperative solution to the prisoners' dilemma, the obvious voting rule for public goods would seen to be unanimous consent.

Although all consume a public good, not all benefit to the same degree. A classic problem of public expenditure theory has been the description of processes for revealing individual preferences for public goods. Following Erik Lindahl [114, 1919], a number of writers have described variants of a Walrasian tâtonnement process for providing public goods.[5] One can easily formulate these procedures into a public choice process. Consider a world with two persons and one public good. Let *Figure* 1 depict the mapping of A and B's indifference curves from the private-public good space into public good-tax space [99, Johansen, 1963]. A's share of the public good's costs is measured upward along the vertical axis, B's share from top downward. A_1 and B_1 are A and B's utilities in the absence of any public good. For a specific quantity of public good, lower indifference curves imply lower tax shares and hence higher utility levels. If A_1 and B_1 intersect, the two individuals are better off under some sets of tax share–public good combinations. The tangency points for their indifference curves form a contract curve (CC^1) mapping the Pareto-possibility frontier (bounded by the zero public good level utilities implied by the initial endowments) into the public good–tax share space.

Now consider the following public choice process. An impartial observer proposes both a pair of tax shares for A (X) and B ($1-X$) and a quantity of the public good, Q_1. If this combination (F) falls within the eye formed by A_1 and B_1, both individuals prefer purchasing this quantity of public good at the given tax shares to no public good at all. Both will vote for it, if they vote sincerely. F now becomes the *status quo* decision and new tax share–quantity pairs are proposed. When a combination falling within the eye formed by A_2 and B_2 is hit upon, it is unanimously preferred to F. It now becomes the *status quo* and the process is continued until a point on CC^1 like G, is obtained. Once this occurs

[5] For a survey of this literature see Jean-Claude Milleron [123, 1972].

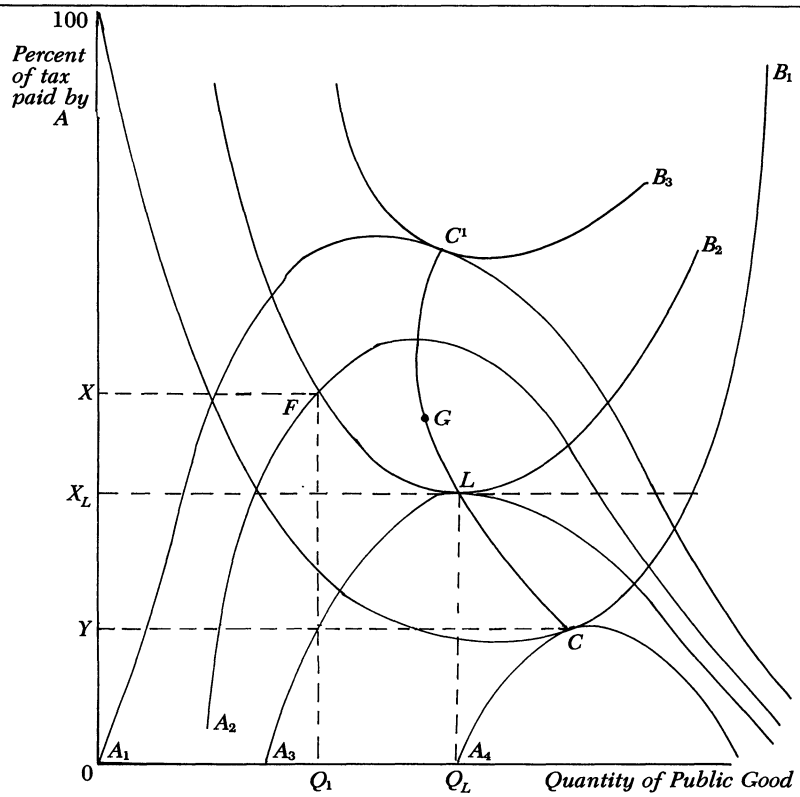

Figure 1.

no new proposal can be unanimously preferred, *i.e.*, can make both individuals better off, and the social choice has been, unanimously, made.

Under a slightly different procedure the Lindahl equilibrium can be achieved (see Donald R. Escarraz [66, 1967] and Steven Slutsky [186, 1975]). Suppose for tax shares X and $(1-X)$, the voters are asked to vote on all possible pairs of public good quantities. If both voters agree on a quantity of the public good that they prefer to all others at these tax shares, it is *the* unanimous collective choice. This will occur only if the two individuals' indifference curves are tangent to the tax line from X at the same point. If no such Q is found for this X, a new X is chosen, and the process repeated until an X and Q are found, which defeat all proposed quantities for the given X. This occurs in *Figure* 1 at L, the Lindahl equilibrium for the X_L and Q_L combinations.

The length and shape of the contract curve is determined by the initial endowments (determining A_1 and B_1) and the individual preferences. If the second voting procedure is selected, the equilibrium attained (L) will be independent of the specific sequence of tax–public good proposals (assuming L is unique). In contrast, given initial endowments and preferences, the final choice under the first procedure, G, is entirely dependent upon the order of public good–tax share proposals. Unless G and L happen to coincide, the equilibrium at G would be one in which both voters would prefer a different quantity of public good given their tax shares. Each is thus somewhat "frustrated" in that he is consuming either too much or too little of the public good *at his*

tax price for it. If this were thought unfortunate, one would prefer the second procedure leading to the Lindahl equilibrium at which all indifference curves are tangent to the tax shares line. On the other hand, if one preferred to have the entire range of the contract curve capable of selection by the voting process, one would prefer the first. As Martin C. McGuire and Henry Aaron have shown [119, 1969], however, no normative significance can be attached to any particular set of tax shares.

The unanimity rule leads to Pareto-preferred public good quantities and tax shares and is the *only* rule certain to do so, a feature that led Wicksell [208, 1896] and later Buchanan and Tullock [42, 1962] to endorse it. Two main criticisms have been made against it.

First, a groping search for a point on the contract curve might take considerable time [22, Black, 1958, pp. 146–47; 42, Buchanan and Tullock, 1962, chap. 6]. The loss in time by members of the community in discovering a set of Pareto optimal tax shares might outweigh the gains to those who are saved from paying a tax share exceeding their benefits from the public good. An individual, who was uncertain over whether he would be so "exploited" under a less than unanimity rule, might easily prefer such a rule rather than spend the time required to attain full unanimity. The second objection to a unanimity rule is that it encourages strategic behavior [22, Black, 1958, p. 147; 42, Buchanan and Tullock, 1962, chap. 7; 8, Barry, 1965, pp. 242–50; 176, Samuelson, 1969]. If A knows the maximum share of taxes B will assume rather than go without the public good, A can force B to point C on the contract curve, by voting against all tax shares greater than Y. All gains from providing the public good then accrue to A. If B behaves in the same way, the final outcome is dependent on the bargaining strengths of the two individuals. The same is true of other Lindahl-type equilibria.[6] Bargaining can further delay the attainment of the agreement as each player has to "test" the other's willingness to make concessions.

One also might object to an unanimity rule on the grounds that even if attained, the equilibrium depends on the bargaining abilities and risk preferences of the individiuals [8, Barry, 1965, p. 249; 176, Samuelson, 1969]. Such a criticism implicitly contains the *normative* judgment that the proper distribution of the gains from cooperation should *not* be distributed according to the individuals' willingness to bear risks. One can easily counter that they *should.* An individual who votes *against* a given tax share to secure a lower one risks under a unanimity rule not having the good provided at all. Voting in this manner expresses a low preference for the public good in much the same way as does voting against the tax share because it "truly" is greater than the expected benefits. Someone not willing to vote strategically might be said to value the public good higher. We return to the question of how the gains from cooperation *ought* to be shared in Part II.[7]

B. *The Optimal Majority*

The above considerations suggest that the time required to pass a bill increases with the size of the majority required to pass it. At one pole, stands unanimity under which any individual can block any agreement until he has one with which he is satisfied. At the other, each decides the issue alone, and no delay need occur as with a pure private good.

[6] See Musgrave [132, 1959, pp. 78–80]. The most rigorous discussion of this is by Jacques H. Drèze and D. de la Vallee Poussin, who show that honest revelation of preferences is a minimax strategy [65, 1971]. With less conservative strategists, honest revelation of preferences cannot be assured.

[7] At least two normative proposals for sharing these gains are dependent on the bargaining or risk preferences of the individuals (see John F. Nash [135, 1950] and R. B. Braithwaite [26, 1955]).

With a less than unanimous majority required to pass an issue, the possibility exists of individuals being worse off as a result of an issue's passage. If the issue is of the public good–prisoners' dilemma variety and there exist reformulations that could secure its unanimous approval, a less than unanimity rule can be said to impose a cost on those made worse off by the issue's passage. This cost is the difference in utility levels actually secured and those that would have been secured under unanimity [42, Buchanan and Tullock, 1962, pp. 63–91; 27, Breton, 1974, pp. 145–48]. The optimal rule is thus the one for which the expected gain in utility from redefining the bill to gain one more supporter just equals the expected loss in time from doing so.

Since these costs are likely to differ from issue to issue, one does not expect one voting rule to be optimal for all issues. *Ceteris paribus,* when opinions differ widely or information is scarce, large amounts of time may be required to reach consensus; and if the probable costs to opposing citizens are not too high, all might favor a less than full unanimity rule—if the identity of those bearing the costs was unknown *ex ante.* Issues for which large losses can occur are likely to require higher majorities (*e.g.,* Bill of Rights–type issues) [42, Buchanan and Tullock, 1962, pp. 111–16].

C. *Majority Rule*

The method of majority rule requires that at least the first whole integer above $\frac{n}{2}$ support an issue before it can be imposed on the community. Nothing we have said so far indicates why it should be the most frequently encountered voting rule. Indeed, a full treatment of majority rule requires a description of both its normative and positive properties. A number of the most recent and persuasive defenses of majority rule have been openly normative (*e.g.,* Kenneth O. May [116, 1952], Anthony Downs [64, 1961], Harvey Leibenstein [109, 1962], B. M. Barry [8, 1965, pp. 312–16], William J. Baumol [12, 1965, pp. 43–44], Douglas W. Rae [157, 1969], and M. J. Taylor [193, 1969]). In discussing majority rule, therefore, we consider both its normative and positive properties. Since Rae's arguments are most compatible with the discussion here, we focus on them.[8]

Rae approaches the question of choosing a decision rule in the same way as Buchanan and Tullock, from the point of view of an egoistic individual uncertain of his future tastes and position, and asks what rule minimizes the chances of a person supporting an issue that fails *and* opposing an issue that passes. The rule that accomplishes this automatically maximizes the converse of these twin goals. The only rule that does so is the majority rule as Rae [157, 1969] and Taylor prove [193, 1969].

If each issue promises an equal (or on average equal) change in utility, plus or minus, for each individual, this theorem becomes a plausible reason for an egoist, uncertain over future position, to favor majority rule. This equal intensity assumption is made explicitly by Rae [157, 1969, p. 41, fn. 6] and is implicit in other arguments favoring majority rule. The opposite assumption, that the losses of those opposing a decision by the majority may be greater than the losses of the majority when a non-decision is imposed by the minority, underlies the arguments against majority rule. This latter position arises from a view of the public choice process as one of revealing preferences for public goods. If the issue to be decided is one of providing a public good and if it is possible to devise a tax share–quantity combination that improves everyone's welfare, then it must be possible to obtain unanimous consent. If unanimity is not feasible,

[8] However, Rae explicitly rules out the legitimacy of such a comparison [157, 1969, p. 43].

the issue must involve more than merely the attainment of allocative efficiency, *i.e.*, it must involve redistributive considerations, and this takes it out of the set of decisions typically discussed by the positive public choice economists from Wicksell to the present in their discussions of the unanimity rule.[9] If one only seeks allocative efficiency through the provision of public goods, unanimity must be possible given enough time and in the absence of continually disruptive bargaining, and we are back to the cost of imposing a decision on some–cost of decision-time tradeoff. In the absence of these decision costs an individual need never support a pure public good issue that failed, or oppose one that passed. All issues that involve only allocative efficiency would eventually pass, and the normative significance of the Rae-Taylor theorem disappears.

Thus, if the Rae-type defense of majority rule does not rest entirely on considerations of time and bargaining costs, it must implicitly consider decisions with both allocative or redistributive aspects, or distributive aspects alone. Indeed, the assumption that the individuals opposing a bill have as much to lose from its passage as those favoring it have to gain, seems most plausible with respect to a simple redistributive bill. But why this should be true for a bill to build a school or penalize theft seems unclear. As a rule for achieving a *net* redistribution of wealth, majority rule, supported by the egalitarian assumption that the utility losses of the opponents equal the gains of the proponents, seems quite plausible. It is this difference in perspective that I think is at the heart of the debate over majority and unanimity decision rules.

TABLE I

	Issues			
Voters	*X*	*Y*	*Z*	*X*
1		>	>	<
2		>	<	>
3		<	>	>
Community		>	>	>

Unfortunately, if majority rule is limited to choosing among points lying on some generalized Pareto-frontier, a second problem arises: that of cycling.

D. *Cycling*

The possibility that an equilibrium does not exist under majority rule was recognized two hundred years ago by de Borda [24, 1781] and has been a major focus of the public choice literature beginning with Black [21, 1948] and Arrow [3, (1951) 1963]. Consider the following three voters with preferences over three issues as in TABLE I (> implies preferred). Each voter has transitive preferences, but the community does not. Pairwise voting leads to an endless cycle. Majority rule can select no winner nonarbitrarily.[10]

If *X*, *Y*, and *Z* are sequentially higher expenditures on a public good, then voters 1 and 3's preferences can be said to be single-peaked in the public good–utility space (see *Figure* 2). Voters 2's preferences are double-peaked, however, and herein is the cause of the cycle. Change 2's preferences so that they are single peaked, and the cycle disappears.

[9] "If any public expenditure is to be approved, . . . it must generally be assumed that this expenditure as such . . . is intended for an activity useful to the whole of society and so recognized by all classes without exception. If this were not so . . . then I, for one, fail to see how the latter can be considered as satisfying a collective need in the proper sense of the word", [208, Wicksell, (1896) 1958, p. 89]. D. Black limits his discussion of unanimity to international agreements, where redistribution (other than of the Harold M. Hochman and James D. Rodgers's Pareto-efficient kind [94, 1969]) is out of the question [22, 1958, pp. 140–55]. Buchanan and Tullock are positivist in approach.

[10] See Sen's discussion [180, 1970, pp. 68–77] of May's theorem [116, 1952]. May's theorem is more in the spirit of the Arrow welfare function taken up later.

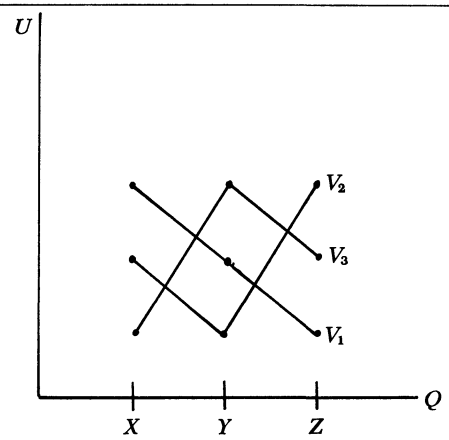

Figure 2.

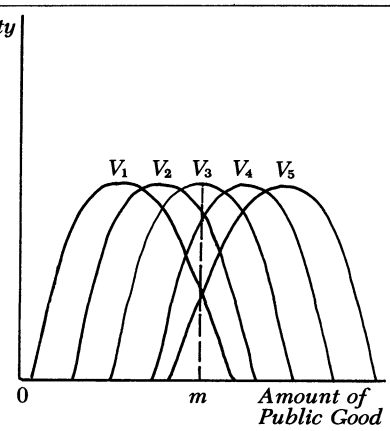

Figure 3.

One of the early important theorems in public choice was Black's proof that majority rule produces an equilibrium outcome when voter preferences are single-peaked [20, 1948].[11] If voters' preferences can be depicted along a single dimension, as with an expenditure issue, this equilibrium lies at the peak-preference for the median voter. *Figure* 3 depicts the single-peaked preferences for five voters. Voters 3, 4, and 5 favor *m* over any proposal to supply less. Voters 3, 2, and 1 favor it over proposals to supply more. The preference of the median voter decides.

If all issues were unidimensional, multi-peaked preferences of the type depicted in *Figure* 2 might be sufficiently unlikely that cycling would not be much of a problem. In a multidimensional world, however, preferences as in TABLE I seem quite plausible. Issues *X*, *Y*, and *Z* might, for example, be votes on whether to use a piece of land for a swimming pool, tennis courts, or a baseball diamond. Each voter could have single-peaked preferences on the amount to be spent on each activity, and a cycle could still appear over the issue of the land's use.

A great deal of effort has been devoted to defining conditions under which majority rule yields an equilibrium. Returning to *Figure* 3, we can see, somewhat trivially, that *m* emerges as an equilibrium because the other voters are evenly "paired off" against one another regarding any move from *m*. This condition has been generalized by Charles R. Plott, who proved that a majority equilibrium exists if it is a maximum for one, and only one, individual and the remaining even number of individuals can be divided into pairs whose interests are diametrically opposed [153, 1967]. This condition is obviously too restrictive to be very comforting.[12]

A second stream of literature has attempted to establish equilibrium conditions by placing restrictions on the preferences of the individuals voting as the single-peakedness condition does.[13] Not all of this literature is particularly relevant to public choice, since the conditions proposed often do not lend themselves to straightforward interpretations as single-

[11] Kramer has offered a rigorous proof [106, 1972], and Slutsky an existence theorem based on a generalization of the result to more than one dimension [187, forth.]. Kramer and Klevorick establish a similar result for local optima [108, 1974].

[12] Although when buttressed by additional assumptions, it may become more plausible. See Tullock [199, 1967], Arrow [4, 1969], and P. B. Simpson [185, 1969].

[13] For the most general statement of single-peakedness type conditions see Sen [179, 1966].

peakedness does, nor is it clear that they can be plausibly assumed to exist in reality.[14] One of the most relevant contributions is that of Gerald H. Kramer [107, 1973]. He makes the same assumptions about individual utility functions as usually encountered in economics, that they are quasi-concave and differentiable, and proves that "the only obvious condition on individual preferences which will ensure single-peakedness in two or more dimensions is the condition of complete unanimity of individual preference orderings." [107, 1973, p. 295]; (see also, J. Craven [55, 1971] and Slutsky [188, forth.]).

And so we return to a unanimity condition. Recalling that what we seek at this stage of the discussion is a voting rule to reveal individual preferences on public goods, the options would appear to be as follows. A unanimity rule might be selected requiring a, perhaps infinite, number of redefinitions of the issue until one that benefited all citizens was reached. While each redefinition might, in turn, be defeated until a point on the Pareto-possibility frontier had been reached, once attained no other could command a unanimous vote against it, and the process would come to a halt. The number of times an issue must be redefined before a passing majority is reached can be reduced by reducing the size of the majority required to pass an issue. While this "speeds up" the process of obtaining the *first* passing majority, it slows down, perhaps indefinitely, the process of reaching the *last* passing majority, *i.e.*, the one that beats all others. For under a less than unanimity rule, some voters are made worse off; this is equivalent to a redistribution of wealth from the opponents of a measure to its proponents. But, as with any pure redistribution measure, it is generally possible to redefine an issue transferring the benefits among a few individuals and thus obtain a new winning coalition. The Plott "perfect balance" condition ensures an equilibrium under majority rule by imposing a severe equal intensity assumption on the distribution of preferences, which ensures that any redefinition of an issue always involves symmetric and offsetting redistributions of the benefits, leaving the winning coalition intact. The Kramer "identical utility functions" condition defines the condition under which a redefinition of an issue is certain not to produce any redistribution effects.

The redistributive characteristics of less than unanimity rules explain the similarities between the proofs and conditions establishing a social welfare function and majority rule equilibria (or the impossibilities thereof). Both flounder on their inability to choose among Pareto-preferred points, *i.e.*, to handle the question of redistribution (see Sen [180, 1970, chaps. 5, 5*]).

Out of the frustration of seeking formal proofs for the existence of majority rule equilibria, a large number of studies have explored, using simulation techniques, the probabilities that cycles would occur in practice. If all possible preference orderings are assumed to be equally likely, the probability of a cycle occurring is very high.[15] As one introduces single-peakedness assumptions [137, Niemi, 1969; 204, Tullock and Campbell, 1970] or assumes simply that some rankings are more likely than others [209, Williamson and Sargent, 1967], the probability of cycles occurring declines.

[14] This literature is surveyed in K. Inada [97, 1969], Sen [180, 1970], Plott [154, 1971], and Taylor [194, 1971]. Slutsky examines the necessary and sufficient conditions for majority rule consistency and relates then to the collective choice process [188, forth].

[15] See M. B. Garman and Morton I. Kamien [77, 1968], R. G. Niemi and H. F. Weisberg [138, 1968], and F. Demeyer and C. R. Plott [59, 1970]. This literature is reviewed by Niemi [137, 1969] and Riker and Ordeshook [167, 1973, pp. 94–97].

TABLE II

Voters	Issues X	Y	Z
A	−2	−2	−3
B	5	−2	6
C	−2	5	−1

E. *Logrolling*

When voter preference intensities on each issue are not the same, the gains of a winning majority may be less than the minority's losses. To avoid this, "intense minorities" may engage in logrolling or vote trading.[16]

To understand the process, consider TABLE II. Each column gives the utility changes to three voters from an issue's passage; defeat produces no change. Assume first that only issues *X* and *Y* are being decided. If each is decided separately by majority rule, both fail. Voters *B* and *C* have much to gain from *X* and *Y*'s passage, however, and can achieve this if *B* votes for *Y* in exchange for *C*'s vote for *X*. Both issues now pass to *B* and *C*'s mutual benefit.

The existence of beneficial trades requires a nonuniform distribution of intensities. Change the two 5's to 2's and *B* and *C* gain nothing by trading. The equal intensity condition that guarantees majority rule's optimality would then also be satisfied, and it is this situation that proponents of majority rule have typically had in mind.

The numbers, as presented, depict the situation usually envisaged by logrolling's proponents. Without trading, the majority tyrannizes over the relatively more intense minority on each issue. Through vote trading these minorities express the intensity of their preferences, just as trading in private goods does, and thus improve the community's net welfare.

This result depends crucially on the total potential gains from voting being positive. Change the 5's to 3's or the −2's of *A* to −4's, and the same trades emerge as before. The sum of utilities for the community with trading is then negative, however. The pattern of trades depends only on the *relative* intensities of preferences of the voters. Since exchange increases the likelihood of the participants winning on their relatively more important issues, it *tends* to increase their realized gains. These increases *can* increase the utility gain for the entire community. Trading also imposes externalities on the nontraders, however [170, Rothenberg, 1969, p. 215; 194, Taylor, 1971, p. 344; 165, Riker and Brams, 1973]. If these are negative and large, they can outweigh the gains to the traders.

Tullock's argument that majority rule *with trading* can lead to too much government spending is of this type [197, 1959]. Let *X* be a road for farmer *B*, *Y* a road for *C*. If the gross gains to a farmer from an access road are 7 and the cost of 6 is shared equally, we have the figures of TABLE II. With these costs and benefits, total welfare is improved by logrolling. But a bill promising a gross gain of 5 at a cost of 6, equally shared, also passes. Such a bill lowers community welfare by excessively constructing new roads. The problem arises because under majority rule the two bills involve both allocation (the construction of roads with gross benefits of 5 at costs of 6) and the redistribution of wealth from *A* to *B* and *C*, and the latter is sufficient to pass them.

One important difference separating logrolling's critics and proponents is their views as to whether voting is a positive or negative (at best zero) sum game. If the latter, the game is obviously bad to begin with, and anything that improves its efficiency worsens the final outcome. The ex-

[16] The most extensive treatment of logrolling is by Buchanan and Tullock [42, 1962]. See also, Tullock [200, 1970].

amples logrolling critics usually cite are tariff bills, tax loopholes, and pork barrel public works. The best a community can hope for is the defeat of all these issues. The obvious reform is to eliminate logrolling [165, Riker and Brams, 1973].

Logrolling's proponents usually use parks, schools, defense and other public goods as examples of issues and view vote trading as a potential method for better revealing preference intensities and establishing an equilibrium. They suggest reforms to improve the trading process (*e.g.*, by introducing fungible votes) and/or eliminate its potentially negative side effects by restricting the issue set, in order to remove zero and negative sum games [197, Tullock 1959; 45, Coleman, 1966; 47, 1967; 48, 1970; 84, Haefele, 1971; 125, Mueller, 1971; 131, Mueller, Tollison, and Willett, 1975].

Logrolling can also be plagued by cycling, however. Indeed, when issues are decided in pairs, the same preference orderings that make trading attractive make cycles possible [145, Park, 1967; 17, Bernholz, 1974; 18, 1974]. If Z is added to the issues in TABLE II, the preference orderings become nearly the same as in TABLE I, and an intransitive social ordering exists ($X = Y > Z > X$). The only condition under which a potential logrolling situation cannot produce a cycle is when a unanimity rule is imposed [16, Bernholz, 1973]. Logrolling is also vulnerable to strategic behavior [124, Mueller, 1967].

The problems of cycling and strategic behavior are reduced if informal vote trading via forming coalitions is replaced with either formal markets for exchanging fungible votes [45, Coleman, 1966; 46, 1966; 124, Mueller, 1967; 211, Wilson, 1969; 128, Mueller, Philpotts, and Vanek, 1972] or by point voting, in which each voter allocates a stock of votes over the issue set [132, Musgrave, 1959, pp. 130–31; 48, Coleman, 1970; 98, Intriligator, 1973; 126, Mueller, 1973]. In the former case, the cycling problem is replaced by the possibility of multiple or nonstable vote-price equilibria;[17] under point voting it disappears entirely. The *normative* properties of an equilibrium rest on the ethical justification of the voting process itself, the initial distribution of votes, choices of issues, *etc.* [126, Mueller, 1973], as also is true of equilibria reached under private goods trading.[18] Both vote trading and point voting are vulnerable to individual strategic behavior, which can limit their attractiveness as procedures for revealing individual preferences [152, Philpotts, 1972; 126, Mueller, 1973].[19] Wilson's proof that, under certain assumptions, a citizen's optimal vote-trading strategy is "sincere" voting is comforting in this regard [211, 1969].

F. *General Fund Financing*

The most straightforward method for allowing voters to reveal their preferences for public goods would be to present each issue along with a tax formula for financing it, a procedure recommended by Wicksell [208, 1896]. While some expenditures are financed by "earmarked" taxes, most are financed out of general revenue.[20] For expenditures of this type, it is more realistic to view the voter as confronting two decisions: (1) the allocation of the total budget

[17] Robert Wilson has explored the existence of an equilibrium with logrolling using a game-theoretic framework [212, 1971; 213, 1971].

[18] The normative properties of vote trading can be enhanced by redistributing the initial stocks of votes in a manner analogous to redistribution of private wealth [130, Mueller, Tollison, Willett, 1974].

[19] Simple majority rule can be too, however. A voter who thought that sincere voting would produce an undesirable, majority winner might misstate his preferences so as to produce a cycle, trusting to chance, or a known procedure, to break the cycle in a more favorable way [192, Taylor, 1968; 67, Farquharson, 1969; 167, Riker and Ordeshook, 1973, pp. 97–99].

[20] Buchanan was the first to compare the properties of general fund and earmarked tax schemes [31, 1963]. His work has been extended by C. J. Goetz [79, 1968], Goetz and C. R. McKnew, Jr. [80, 1972], and E. K. Browning [28, 1975].

among competing expenditures and (2) the total budget's size. Replacement of direct voting on individual issues with this two-step procedure sufficiently complicates the decision process, however, so as to remove the direct relationship between voter preferences and the voting outcome. In general, one cannot predict the relationship between the level of government expenditures that would result under an earmarked taxing formula and under general fund financing. Nor can one predict, under general fund financing, the effect on expenditures of a change in voter preferences. The possibilities of indeterminate logrolling, and strategizing also exist [31, Buchanan, 1963; 79, Goetz, 1968]. The work in this area brings into serious question the possibility of adequately revealing individual preferences on public expenditures when general fund financing is employed.

III. *Public Choice in a Representative Democracy*

The presence of intermediaries between the citizen and the outcome of his vote raises new issues about the characteristics and efficiency of the voting process. The public choice approach assumes that representatives, like voters, are rational, economic men bent on maximizing their utilities. The latter is tied to their being elected, or more formally to their vote plurality over other candidates.[21] Downs was the first to explore the implications of these assumptions, and the literature has developed around and from the framework he built [62, 1957].

While many of the ideas in public choice have been developed in the context of a model of committees, the committees in mind are often assemblies of representatives, the coalitions parties. Many of the conclusions and problems discussed above carry over into the area of representative democracy. Thus, the median outcome, cycling, and logrolling all reappear.

A. *The Median Voter*

Harold Hotelling first presented a median voter theorem as an outcome of two-party representative democracy.[22] Hotelling depicted political opinion as lying along a single liberal-conservative dimension. If everyone votes for the candidate closest to his favored position, then the candidate choosing the optimal position of the median voter wins. The logic of the argument is the same as that demonstrating the victory of the *issue* favored by the median voter, for as Hotelling depicts it, there is only one issue to be decided: how far to the left or right the winning candidate will be.

The assumptions underlying the theorem are so unrealistic (one issue dimension, all individuals vote, two candidates) that it naturally led to extensive examination of the consequences of relaxing them. Two reasonable assumptions about abstentions are that: (1) candidate positions can be too close together to make voting worthwhile (indifference), and (2) the nearest candidate may still be too far away (alienation). Alienation raises the cost of moving away from a voter and *pulls* the candidate toward the peak of the voter distribution. If the distribution is unimodal and symmetric, alienation has no effect. If it is single-peaked and skewed, the optimal strategy is pulled toward the mode [51, Comanor, 1976]. If the distribution is multi-peaked, alienation *can* move the optimal strategies of the two candidates toward the separate modes. But, if weak, it also can either leave the median

[21] Other assumptions have been used, *e.g.*, vote maximization, but plurality maximization yields either the same or superior results [92, Hinich and Ordeshook, 1970].

[22] Hotelling's article could be regarded as *the* pioneering contribution in public choice [95, 1929]. It is both a direct application of economics to a political process and a clear intellectual antecedent of both Downs's and, more indirectly, Black's work. The argument is also found in Howard R. Bowen's classic paper [25, 1943].

outcome unchanged or produce no stable set of strategies [189, Smithies, 1941; 62, Downs, 1957, chap. 8; 58, Davis, Hinich, and Ordeshook, 1970; 120, McKelvy 1975]. A spreading out of candidates may also occur if elections are in two steps: competition for nomination within parties and then competition among parties. To win the party's nomination, the candidate is pulled toward the party median; the need to win the election pulls him back toward the population median. A Cournot strategy game results with equilibria generally falling between the party and population medians [2, Aranson and Ordeshook, 1972; 49, Coleman, 1971; 50, 1972].

The implications of relaxing the single dimension assumption of the Hotelling-Downs' model have been exhaustively examined.[23] The results of the previous section concerning the instability of majority rule equilibria carry over directly. The problem a candidate faces choosing a multi-dimensional platform that defeats all other platforms is the same as finding an issue in multi-dimensional space that defeats all other issues. To establish such equilibrium strategies, one must introduce highly restrictive assumptions, including single-peakedness (see Rae and Taylor [158, 1971] and Riker and Ordeshook [167, 1973, chap. 12]); when equilibria exist, they are at the mean [58, Davis, Hinich, and Ordeshook, 1970, pp. 439–43].

One can combine the assumptions of multi-modal distributions and alienation, and envisage a candidate presenting a platform of extreme positions on several issues and winning the support of a sufficient number of minorities to defeat another candidate taking median positions on all. When this happens, a minority that supports a candidate for the position he takes on a couple of key issues, regardless of his position on others, is essentially trading away its votes on the other issues [62, Downs, 1957, pp. 132–37; 198, Tullock, 1967, pp. 57–61; 27, Breton, 1974, pp. 153–55].

Unfortunately, the tendency for logrolling to produce cycles persists. Consider, again, the voter preferences in TABLE II. Suppose that two candidates vie for election on the three issues. If the first takes a position in favor of all three, the outcome that maximizes the net utility gains for all voters, he can be defeated by a candidate favoring any two issues and opposing the third, say (PPF), since two of the three voters always benefit from an issue's defeat. PPF can be defeated by PFF, however, and PFF by FFF. But all three voters favor PPP over FFF, and the cycle is complete. Every platform can be defeated.[24]

In a single election candidates cannot rotate through several platforms, and cycling is not likely to be evidenced. Over time it can be. To the extent incumbants' actions in office commit them to the initial platform choice, challengers have the advantage of choosing the second, winning platform. Cycling in a two-party system appears as the continual defeat of incumbants [62, Downs, 1957, pp. 54–62].[25]

[23] In addition to the single dimension assumption, the whole spatial approach to political issues has been challenged on methodological grounds [191, Stokes, 1963]. This literature is admirably reviewed and partially defended by Ordeshook [142, 1974].

[24] E. T. Haefele argues that *two-party* representative democracy both avoids cycles and maximizes voter utility gains [84, 1971]. The argument rests on questionable assumptions, however. Haefele depicts representative democracy as strategic manuevers between essentially monolithic parties. Their search for an optimal platform is described by a set of rules, which essentially seeks out the maximum possible utility gain, and not by a goal of winning. Haefele can thus conclude, from a matrix similar to TABLE II, that PPP is a stable winning platform [84, 1971, pp. 358–62]. I cannot see, however, why a party seeking victory would not choose PPF in response to another's PPP.

[25] Defeating the incumbent party appears so easy, that D. A. Wittman assumes parties are able to look beyond merely maximizing their votes and choose strategies that maximize their *expected* utility from being in office [214, 1973].

B. *Multiparty Systems*

An important determinant of the number of parties is the mode of representation [156, Rae, 1967; 198, Tullock, 1967, pp. 144–49]. A candidate guarantees himself a seat in a single member district by capturing 50 percent of the vote. This forces candidates to appeal to broad groups of voters and adopt positions near the median. If several representatives can be chosen from a district, candidates can "win" with fewer votes. Multiple representation thus *allows* for the existence of several parties.

Intuitively, one expects candidates in a multiparty system to spread out, and much of proportional representation's appeal comes from the expectation that they do [62, Downs, 1957, chap. 8; 198, Tullock, 1967, chap. 10; 131, Mueller, Tollison, and Willett, 1975]. The lure of the center is sufficiently strong, however, so that the stability of a set of spatially separated strategies cannot be demonstrated [92, Hinich and Ordeshook, 1970, pp. 785–88]. Full analysis of multiparty systems requires a game-theoretic approach, and has still to be developed (but, see James W. Lindeen [115, 1970]).

One interesting application of game theory is W. H. Riker's theory that all single and multiparty systems converge to two coalitions of equal size [164, 1962]. It assumes that politics is a zero sum game, as would occur, *e.g.,* if all issues involved basically zero sum redistributions of wealth. In such a game, the optimal strategy is to allow the opposing coalition to be as large as possible, while remaining a losing-paying coalition. Under majority rule this implies two coalitions of equal size.

If one views collective choice as a process for revealing preferences for public goods, Riker's depiction of politics as a zero sum game, would seem to be highly restrictive, for it implies that there are no *net* benefits from the passage of any bill, or the formation of any coalition. The theory has more apparent applicability, however, if one views politics as a dynamic process of redefining issues and coalitions. Suppose, reversing the steps presented above, a polity started with a public-good issue defined so that all participants benefit and unanimity could be forthcoming. If, however, only a simple majority were required to pass a bill, nearly half of the votes would be "wasted." It would be advantageous to some to redefine the bill so that others paid more for the good, and one could envisage a continual redefinition of the issue so as to benefit an ever-shrinking winning coalition until the coalition was just large enough to win. If this process consisted solely of changing the cost shares of the bill, allocational efficiency would be preserved, and only the distribution of income would be changed. If the transfers were made by expanding the quantity of the public good, forcing the losing coalition to cover a disproportionate share of the costs, one has Tullock's overexpenditure argument [197, 1959; 200, 1970]. If the transfers are made by adding additional public-good bills as riders, with the losers again paying a disproportionate share of the costs, one has the Riker and Steven J. Brams inefficient logrolling argument [165, 1973]. Thus, when issues and coalitions can be continually redefined, majority rule may convert positive sum prisoners' dilemma games into zero sum games, making Riker's analysis more general than first might appear. Combining the tendency of majority rule to result in redistribution with the median voter theorem leads to Director's Law, that redistribution in a democracy is from the tails of the income distribution to its center [190, Stigler, 1970; 202, Tullock, 1971].

C. *The Behavior of Voters*

When a consumer purchases a private good in the market his "dollar vote" leads

directly to the desired end. When a voter "purchases" a public good, however, the result of his vote is dependent on the actions of other voters and, in a representative democracy, on the process of representation. These differences create the potential for a large discrepancy between the behavior usually assumed of consumers and that characteristic of voters.[26]

Two aspects of citizen behavior have received considerable attention: information gathering and direct participation. The latter can range from simply voting to running for office. The voter's decision function can be represented as follows:

$$R = BP - C + D. \qquad (1)$$

Where R = the voter's reaction (vote, gather information),
B = the potential public-good benefits from the action,
P = the probability these benefits accrue if the action is undertaken,
C = the action's cost, and
D = private benefits complementary to the action.

(Refer to Downs [62, 1957, chaps. 11–14], Tullock [198, 1967, pp. 110–14], and Riker and Ordeshook [166, 1968]; and for a critique see B. M. Barry [9, 1970, pp. 13–19].)

In terms of information gathering, B represents the potential gain from picking the *best* candidate, P the probability that the citizen's choice matters, C the cost of gathering the information, and D its extra benefits (psychic income, status with peer group). Although B and P may change as information is acquired, it is plausible to assume they soon become constant. If D diminishes on the margin and C increases, then the utility from gathering political information is maximized by equating its marginal private benefits and cost. Political information's likely impact on election results does not affect its acquisition [198, Tullock, 1967, chaps. 6 and 7].

Similar arguments have been made about voting. If P is the probability of a single vote being decisive, then it obviously must be very small in a large constituency. To the extent that two-party competition brings candidate positions together, elections are close, raising P, but lowering the benefits from the best candidate's winning (B). Thus, B and P vary inversely and their product is probably small, implying again that participation's private returns and costs dominate. For most people the outcome of an election is a public good and political participation is vulnerable to free riding [141, Olson, 1965, pp. 86, 159–67]. The greater participation rates of high income and high education groups may be explainable on these grounds [71, Frey, 1971; 172, Russell, Fraser, and Frey, 1972; 196, Tollison and Willett, 1973]. The higher turnouts in close elections suggest that the lefthand-side variables are also important, however (see Riker and Ordeshook [166, 1968], Y. Barzell and E. Silberberg [11, 1973], and H. Rosenthal and S. Sen [168, 1973]).

On some issues a voter's benefits from electing one candidate over another may be very high. Tariffs, tax loopholes, a nearby bridge are examples of bills with large benefits for some voters. The costs of acquiring information about these bills is typically low. Thus, the probability of a citizen's voting for a candidate who supports issues promising special, narrow benefits for him may be much greater than for a candidate who supports "general interest" legislation with equal total benefits for the citizen [141, Olson, 1965, pp. 141–48]. This reinforces incentives to form coalitions of minorities, each lured to the polls by promises of legislation with special interest to them [62, Downs, 1957, chaps. 12 and 13; 198, Tullock, 1967, pp.

[26] Differences in behavior caused by the different nature of the *choices* facing voters and consumers were first discussed by Buchanan [30, 1954].

122–23, 142]. It can lead to overexpenditures on special interest bills [200, Tullock, 1970], and underexpenditures on general interest legislation [63, Downs, 1960].

IV. *Deciding the Quantities of Quasi-Public Goods*

For pure public goods, characterized by both nonexcludability and jointness of supply, a collective *voice* process for revealing preferences is required to achieve Pareto efficiency. For private goods, the entry and exit of buyers and sellers suffices. Between the poles of pure public and private goods lie a range of *mixed* goods, which one intuitively expects are most efficiently allocated by a mixture of exit and voice processes [93, Hirschman, 1970].

A. *Voting-with-the-Feet*

We examine first the consequences of dropping the joint-supply (economies of scale) property. Consider a public good with no production costs: the proportion of tulips in the public square (bulbs are free). If the dimensions of the polity coincide with the population, the preference revelation problem persists. Assume more than one polity can exist, however. Within any polity all must consume the same public good (flower bed), but there are no spillovers between communities. With this *limited* degree of exclusion, people can reveal their preferences by moving into the community providing the most desirable fraction of tulips. Considering only the whole percentile options, 101 communities suffice to achieve Pareto optimality. No ballots need be cast. All preferences are revealed through the silent voting-with-the-feet of individuals exiting and entering communities. A possibility first noted by Charles M. Tiebout [195, 1956].

The Tiebout model rests on a number of extreme assumptions [43, Buchanan and Wagner, 1970; 40, Buchanan and Goetz, 1972; 117, McGuire, 1972; 140, Oates, 1972; 151, Pestieau, 1974]. It is not clear, for example, how the initial options are presented to "voters," without some central auctioneer who establishes communities and informs the population of them, an assumption contradicting the decentralized spirit of the model [149, Pauly, 1970; 117, McGuire, 1972]. More serious are the consequences of introducing a second public good: the proportion of oaks in the square. This issue's resolution requires further separation of individuals into groups of identical preferences, now with respect to *both* flowers and trees. The number of communities needed to ensure Pareto optimality leaps to 101 squared. If the number of public goods is very large, one reaches a solution in which the number of communities equals the size of the population. Each community-individual becomes a polity with a basket of public-private goods (garden, woods) tailored to his own tastes [151, Pestieau, 1974].

Voting-with-the-feet achieves Pareto optimality by grouping individuals together in polities of homogeneous tastes. In the extreme, it satisfies Kramer's severe homogeneity of indifference map condition [107, 1973; 118, McGuire, 1974], through the imposition of a silent unanimity rule. It can realistically be assumed to come close to satisfying this goal when, relative to the size of the population, (1) the number of public goods is small, and/or (2) the number of distinct preferences for combinations of public goods is small. Since *the* task of public choice is the revelation of (differing) individual preferences for public goods, voting-with-the-feet, in part, solves the public choice problem by significantly limiting its scope.

B. *The Theory of Clubs*

Assume next that exclusion is possible, but addition of a new member lowers the average costs of a good, *i.e.,* there are

economies of scale. If average costs fall indefinitely, optimal club size is the entire population, and the traditional public good problem exists. If they eventually rise, either because scale economies are exhausted or from the additional costs of crowding, an optimal club smaller than the population may exist.

Buchanan was the first to explore the efficiency properties of voluntary clubs using a model in which individuals have identical tastes for public and private goods [32, 1965]. This assumption is important. As in the Tiebout model, it is inefficient to have individuals with differing tastes in the same club, for then some must consume a quantity of public goods different from that which would maximize their welfare. At a Pareto optimum each club has a membership with homogeneous tastes, and a unique public good quantity and club size exists at which the marginal benefits a club member receives from adding another equals the additional costs the extra member brings [32, Buchanan, 1965; 118, McGuire, 1974].

If the population is large relative to optimal club sizes, efficient allocation of these quasi-public goods through the voluntary association of individuals of homogeneous tastes can be envisaged. In such an equilibrium, each individual receives the same benefits as other members of his club, since efforts to discriminate will induce exit and the formation of new clubs. If optimal club sizes are large relative to the population, discrimination is possible, and stable equilibria may not exist. With an optimal club size of 2/3 of the population, for example, only one such club can exist. If it forms, those not in it have incentives to lure members away by offering disproportionate shares of the benefits gained from expanding the smaller club. But, the remaining members of the larger club have incentives to maintain club size and can attract new members by offering the full benefits of membership in the big club. No stable distribution of club sizes and benefits need exist (see Mark V. Pauly [148, 1967; 149, 1970]). Analytically the problem is identical to the cycling problem confronted earlier. The two farmers forming a winning majority constitute an optimal sized club, but the farmer left out has an incentive to try to form an optimal club too.

We thus are brought to a conclusion similar to the voting-with-the-feet model: The voluntary formation of clubs to allocate public goods is efficient only when the optimal club size is relatively small, *i.e.,* when the quasi-public goods have a limited degree of publicness. Despite this qualification, the voluntary formation of clubs is at least *conceptually* a more promising means for revealing individual preferences for public goods than voting-with-the-feet, for it does not require geographic proximity of club members.

C. *Voting-with-the-Feet in the Presence of Jointness of Supply*

When public goods are produced with economies of scale, it is even more unlikely that individual mobility suffices to achieve Pareto optimality. It is then necessary that there be "just the right number of individuals" with identical preferences to satisfy the optimality conditions for each public good.

Pareto optimality in a global sense requires that the incremental change in net benefits to the community an individual joins equal the incremental loss to the community he leaves

$$\sum_{i=1}^{n} \Delta U_A^i = \sum_{i=1}^{m} \Delta U_B^i. \qquad (2)$$

The change in utility of the n^{th} individual to join community A is his total utility from being in A (U_A^n), just as his loss from leaving B is his total utility in B, U_B^m. Equation (2) can thus be rewritten as

$$U_A^n + \sum_{i=1}^{n-1} \Delta U_A^i = U_B^m + \sum_{i=1}^{m-1} \Delta U_B^i. \quad (3)$$

In a world of pure competition without market failures, the marginal product of an individual is the same in all activities and areas, and the welfare of others is not affected by his location. All ΔU^i are zero except for the moving individual, and he naturally locates in his most favored community. With public goods present, the ΔU^i for individuals in a community are positive for an additional entrant, as its total costs get spread over a larger number of individuals. A new entrant thus confers positive externalities. With crowding, he can produce negative externalities. In either case, since the individual compares only his utility levels in the two communities and ignores the marginal effects of his move on others (the ΔU^i's in A and B), voting-with-the-feet does not, in general, produce Pareto optimality.[27]

Pareto optimality can be achieved through a combination of voting-with-the-feet and ballot. If the externalities for community A from in-migration were positive, it could offer a subsidy to newcomers equal to

$$\sum_{i=1}^{n} \Delta U_A^i,$$

and levy an identical tax on out migration. If B did the same, all individuals would be forced to internalize the external costs their moving entailed, and Pareto efficiency would be obtained [35, Buchanan, 1971; 40, Buchanan and Goetz, 1972]. Alternatively, a central authority could levy taxes and offer subsidies equal to the $\Sigma \Delta U^i$ terms [69, Flatters, Henderson, and Mieszkowski, 1974; 121, McMillan, forth.]

While these alternatives have identical efficiency outcomes, they differ both in spirit and equity properties. The former weds Tiebout's decentralized voting-with-the-feet with the theory of exclusive clubs to produce a decentralized solution to the population allocation problem. The enacting of such taxes and subsidies by local communities immediately provides communities favored by natural characteristics, population size, income, *etc.* with a valuable property right, which they exercise by taxing individuals outside of their community (*i.e.*, those who would have entered in the absence of the tax-subsidy scheme). The centralized solution vests the entire population with a property right in both communities and achieves allocational efficiency by taxing *all* members of the favored community to subsidize the disfavored community. In either case, the problems of ballot voting to reveal individual preferences again arise once the assumption of homogeneous preferences is dropped.

Despite these problems and qualifications, voting-with-the-feet provides a useful, perhaps essential substitute for the ballot, for those whose intensity of preference is significantly misstated by the latter.

V. *The Theory of Revolution*

When neither the ballot, nor the feet constitute adequate modes of expression, there is still Chairman Mao's barrel of the gun. Given its role in real world politics, one might expect more to be said about revolutions than has been. Gordon Tullock has, however, gotten the discussion underway [201, 1971; 203, 1974]. He proposes to explain a revolutionary's behavior with a model resembling the one used to explain voter behavior. If, R is a potential revolutionary's reaction, B the new government's public good benefits (possibly negative), P the probability that the individual's participation brings about success, D the private gains from participat-

[27] See Buchanan and Wagner [43, 1970]; Buchanan and Goetz [40, 1972]; M. L. McMillan [121, forth.]; and F. Flatters, V. Henderson, and P. Mieszkowski [69, 1974].

ing in the revolution, and C the private costs, we have equation (1').

$$R = BP + D - C \qquad (1')$$

If R is positive he participates in favor of the revolution, if negative against it. Since R can take on any value, the equation can also explain the degree of participation.

As with voting, one assumes that the typical citizen considers the fruits of the revolution a public good and the probability of affecting the outcome near zero and then makes his decision on the basis of the private gains and risks of participation. For most, this calculation will lead to apathy or occasional participation in a large rally; for a few, to commitment with the hope of a high position in the new regime.

While there are problems in extending the public choice paradigm to the study of revolutions, the theory fills an analytic gap in the literature. In a closed polity, an individual is always in danger of being "exploited" or "tyrannized" by a majority or minority of his fellow citizens. His choices in such situations are: to continue to rely on voice in the hope that outcomes change; to seek a new polity by migration; or to create a new one by revolution.

VI. *Empirical Public Choice*

An increasing amount of attention has been devoted in recent years to testing various hypotheses from the public choice literature. This work generally explores what might literally be called "political economy," *i.e.,* the two way causality between dollars and votes. One set of models focuses on the determinants of campaign expenditures and their immediate effects [53, Crain and Tollison, forth.]. There is now empirical evidence that dollars do buy votes [144, Palda, 1973; 207, Welch, 1974]. A second set of models tries to explain the level of the vote or government popularity as a function of what it does in office. So far these studies have related government popularity chiefly to macroeconomic variables, *e.g.,* unemployment and inflation rates [81, Goodhart and Bhansali, 1970; 105, Kramer, 1971; 73, Frey and Garbers, 1972; 122, Miller and Mackie, 1973; 54, Crain, Deaton, and Tollison, 1975].

Turning the causality around, one can try to explain the choice of government policy, level of expenditure, and level of economic activity, by the desire to win votes. The median voter hypothesis was one of the first used to explain government expenditures [7, Barr and Davis, 1966; 57, Davis and Haines, Jr., 1966], and a number of studies have either tested or employed this hypothesis [100, Kasper, 1971; 23, Borcherding and Deacon, 1972; 15, Bergstrom and Goodman, 1973; 155, Pommerehne and Frey, 1975]. More generally, Gavin Wright [215, 1974] and W. D. Nordhaus [139, 1975] have linked government macro policies and aggregate economic activity to party efforts to be reelected. The logical extension of this work is a full "politico-econometric" model integrating the economic and political "sectors" of society [74, Frey and Lau, 1968; 72, Frey, 1974]. Initial attempts to estimate one such model give promising results [76, Frey and Schneider, 1975].

This recent empirical work undoubtedly represents but the tip on an emerging iceberg. Space does not allow adequate review of even this tip, however. Fortunately, most of it is ably covered in the Bruno S. Frey and F. Schneider survey [75, 1975].

Part Two: Normative Theories of Public Choice

While one can speak of *the* positive theory of public choice based upon economic man assumptions, one must think of normative *theories* of public choice. For there

are many views of what the goals of the state *should be* and how to achieve them. This potential multiplicity of views has been the focus of much criticism by the positivists, who have argued for a "value free" discipline. For the bulk of economics, it might be legitimate to focus on explanation and prediction and to leave to politics the explication of society's goals. For the study of politics itself, *in toto,* to take this position is less legitimate. Thus, the interest in how the basic values of society are expressed through the political process arises. The challenge normative theory faces is to develop theorems about the expression and realization of values, based on generally accepted postulates, in the same way that positive theory has developed explanatory and predictive theorems from the postulates of rational egoistic behavior.

VII. *Rawls's Theory of Justice*

One of the most ambitious normative theories of choice is that of John Rawls [159, 1971]. His theory rests on the same rational, egoistic man assumptions as public choice and explicitly eschews assuming altruism [159, 1971, pp. 183–92].

Rawls compares participation in society with participation in a game of chance. Each individual is born to a generation, culture, social system, family, and set of personal attributes that largely determine his happiness. If he accepts this information as given, social choice consists entirely of attempts to reach the Pareto frontier and of struggles for position along it—the subject matter of *Part One.* If position in society is by chance, however, the distribution of these assets and resulting happiness may be arbitrary or unfair. By posing life as a game of chance, Rawls argues that individuals ought to adopt the position of a potential entrant rather than their actual positions, and consider the social institutions and distribution of assets that would emerge, if actual positions were unknown. The establishment of just institutions rests, in part therefore, on determining what information is *morally* relevant to a participant in the social contract uncertain of his specific position. To answer this question, individuals are asked to step behind a *veil of ignorance* and shed all knowledge of a specific nature [159, 1971, pp. 136–42]. From this *original position,* they choose the rules and institutions that constitute the social contract [159, 1971, pp. 11–22]. Since specific information about individuals is missing, the contract cannot favor any one individual or group. The rules are fair. From this springs the important notion of *justice as fairness.*

Rawls extends this idea to derive two principles as the core of the social contract: (1) "Each person is to have an equal right to the most extensive basic liberty compatible with a similar liberty for others" [159, 1971, p. 60], and (2) "social and economic inequalities are to be arranged so that they are both (a) to the greatest benefit of the least advantaged and (b) attached to offices and positions open to all under conditions of fair equality of opportunity" [159, 1971, p. 83]. The second involves a lexicographic ordering of states of the world according to the utility levels (primary goods bundles) of the worst-off citizens. Rawls also argues that the two principles themselves are lexicographically ordered, the first over the second [159, 1971, pp. 150–61, 175–83, 541–58]. Not surprisingly perhaps, given economists' fondness for trade-offs, these principles have come under attack.[28]

What is important to the theory of public choice, however, is not the principles Rawls arrives at, but the process by which he gets there [36 Buchanan, 1972]. To the

[28] See Arrow [5, 1973]; Barry [10, 1973]; S. S. Alexander [1, 1974]; P. Dasgupta [56, 1974]; Klevorick [103, 1974]; Mueller, Tollison, and Willett [129, 1974]; Mueller [127, 1974]; Musgrave [133, 1974]; A. K. Sen [182, 1974]; and J. C. Harsanyi [88, 1975]; for a defense, Buchanan [38, 1976].

extent that the ideas of justice as fairness, the original position, *etc.* have intuitive appeal, individuals might be led to make decisions as if they were behind a veil of ignorance. Rawls's theory as a contribution to normative public (social) choice thus has the potential of achieving the unanimous agreement sought in much of the literature. And, Rawls, in responding to his critics, has focused on justifying the process by which the principles are derived, more so than the principles themselves [160, 1974; 161, 1974].

VIII. *The Constitution as a Social Contract*

Buchanan and Tullock draw a distinction between the constitution, containing the basic decision rules of the polity, and the day-to-day decisions made [42, 1962]. The basic rules are assumed to change infrequently. Thus, in making a constitutional choice, an individual selects a rule that affects his welfare for a long time. He is, therefore, *assumed* to be uncertain about the impact of the rule upon him because he is uncertain about his specific position, tastes, *etc.*, in the future. Buchanan and Tullock thus assume, as a behavioral postulate, that individuals choose constitutional rules (out of rational self interest, given the uncertainty surrounding these long-run choices) by placing themselves in the envisaged positions of all future citizens [42, 1962, pp. 78–80, 95–96]. They describe a process of constitution-making quite analogous to Rawls's description of the social contract's formation. Although the tone of Buchanan and Tullock is clearly positivist, and of Rawls's normative, the similarities between the two approaches are so strong that they could be combined. That is, if one accepts Rawls's notion of justice as fairness and the Buchanan-Tullock assumption that individuals actually would make constitutional choices by weighing their impacts on all because of rational self-interest under uncertainty, actual constitutions formed under unanimity rules become just political contracts.

The degree to which individuals will evenly weigh the impact of a constitutional choice on all future citizens is obviously an open question. The long-run nature of these decisions certainly moves the individual calculus in this direction. A fully equal weighing of future utilities is doubtful, however, for it is difficult to envisage individual uncertainty over color of skin, sex, native tongue, and so on. On the other hand, to the extent that institutionalized discrimination is greatest against individuals with these easily recognizable characteristics, one has indirect evidence that just (nondiscriminatory) rules are chosen when real uncertainty over positions exists.

If there is not sufficient uncertainty at the constitutional stage to produce just rules, one might ask how the required uncertainty might be introduced into the process. While some possibilities come to mind [126, Mueller, 1973; 131, Mueller, Tollison, and Willett, 1975], the question has not received much attention. Indeed, despite its obvious importance in the theory of public choice, the constitutional stage itself has been essentially neglected. This is a pity, in my opinion, for it remains the most likely place both to obtain or approach the elusive unanimous agreement and to achieve an ethical underpinning to what otherwise are essentially amoral processes of collective choice.

IX. *The Constitution as a Social Welfare Function*

J. C. Harsanyi has also discussed the ethical appeal of assuming individuals are uncertain over future positions [86, 1953; 87, 1955] (see also William S. Vickrey [205, 1945; 206, 1960] and Harvey Leibenstein [110, 1965]). Building on a paper by John Marcus Fleming [70, 1952], Harsanyi proved that if both individuals and social

preferences satisfy the von Neumann and Morgenstern-Marschak postulates, and if each individual is indifferent between two states of the world implies social indifference between the states, then social welfare W is a weighted sum of individual utilities

$$W = \sum_{i=1}^{n} a_i U_i. \qquad (4)$$

This theorem is interesting in itself, for it creates a theoretical justification, from fairly weak postulates,[29] for the individualism and utilitarianism that underlie both the public choice and social welfare function literatures. Without a way to determine the a_i's, however, equation (4) is too general to be of much value. This welfare function can be given an ethical content if individuals choose the weights by assuming they have an equal probability of being any other individual in the society, *i.e.,* of being in his position, having his utility function, *etc.*[30] Such an equal weighting would emerge if individuals were uncertain about future tastes and positions, and if they adopted the principle of insufficient reason to assign probabilities. Again this uncertainty could be artificially created by mentally assuming a place in Rawls's original position, or be real, due to the long run nature of the decisions affecting social welfare. In either event, the equiprobability assumption achieves the same uniformity of opinion and unanimity of choice that Rawls and Buchanan and Tullock achieve by the use of uncertainty.

[29] See, however, P. A. Diamond [60, 1967], R. Wilson [210, 1968], A. K. Sen [180, 1970, pp. 142–44], and Harsanyi's reply [89, 1975].

[30] The issue of how cardinal utilities can be measured is also raised. See Harsanyi [87, 1955; 89, 1975], I. M. D. Little [113, 1957], Vickrey [206, 1960], A. K. Sen [180, 1970], and R. E. Goodin [82, 1975]. The importance of actually measuring cardinal utilities has probably been overstressed. If one thinks of interpersonal comparisons as being made to form a social contract or constitution, then the choices are of basic principles and rules (*e.g.,* freedom of speech) and thus involve fundamental wants and values common to all.

And, it allows the reinterpretation of the social contract and constitution as discussed in these works as collective choice embodiments of a social welfare function.[31]

X. *Real Valued Social Welfare Functions*

Having introduced social welfare functions, let us consider directly their relationship to public choice. We start with the Bergson-Samuelson social welfare function

$$W = W(z_1, z_2, \ldots),$$

where W is a real valued function of all variables (z_i's) that might affect social welfare [13, Bergson, 1938; 173, Samuelson, 1947]. The z_i's and W are chosen to represent the ethical values of society or of the individuals in it [173, 1947, p. 221]. The objective is to define a W and set of z_i's and the constraints thereon to yield meaningful first and second order conditions for a maximum W. The social welfare function literature has adopted the same assumptions about consumers, production functions, *etc.,* that underlie the bulk of economics and public choice [13, Bergson, 1938; 173, Samuelson, 1947]. Add to these the Pareto postulate, and a set of *necessary* conditions for the maximization of W is derived, which limit social choices to points along the generalized Pareto frontier. The collective choice process by which these conditions are fulfilled is not considered in the social welfare function literature.

To answer the knotty question of how one selects among the various possible

[31] The Harsanyi welfare function has been criticized by P. K. Pattanaik [146, 1968] and A. K. Sen [180, 1970], on the same grounds as its utilitarian predecessors, for not taking into account the distribution of utilities over all individuals. This criticism has been challenged in Mueller [126, 1973], Mueller, Tollison, and Willett [129, 1974], and Harsanyi [89, 1975].

Pareto points, additional assumptions are needed. And, it would appear, these must implicitly or explicitly involve cardinality and interpersonal utility comparisons [13, Bergson, 1938; 111, Lerner, 1944; 173, Samuelson, 1947; 174, 1967; 180, Sen, 1970, pp. 123–25; 89, Harsanyi, 1975]. These in turn imply the introduction of value judgments or ethical postulates, and the possibility arises of there being as many social welfare functions as individuals in the community. This spectre led most contributors to the "new welfare economics" to eschew interpersonal comparisons and confine their attention to deriving necessary conditions for a welfare maximum, to delineating the set of Pareto points.

To choose among these requires a set of ethical beliefs shared by the community, which converts the many possible social welfare functions into one [113, Little, 1957]. We have discussed attempts to accomplish this via the introduction of uncertainty over position. We turn to an alternative approach.

XI. *Arrow's Axiomatic Social Welfare*

A. *Postulates and Logic of the Proof*

Kenneth Arrow began his search for a social welfare function by stating five axioms, which he argued every social welfare function should obey [3, 1963].[32] These axioms reflect both value judgments and assumptions of individual and collective rationality. Together, they express some of the basic postulates underlying individualism, utilitarianism, and consumer-citizen sovereignty. Viewed in the context of public choice, these axioms might be regarded as stating the basic value judgments of the community as imbedded in the social contract or constitution [3, Arrow, 1963, pp. 104–105; 102, Kemp and Asimakopulos, 1952]. Briefly stated, they are:[33]

1. Unlimited Domain. All possible orderings of individual preferences are allowed.
2. The Pareto Postulate.
3. Transitivity. The social welfare function gives a consistent ordering of all feasible alternatives.
4. Nondictatorship. No individual enjoys a position such that whenever he expresses a preference between any two alternatives and all other individuals express the opposite preference, his preference is always preserved in the social ordering.
5. Independence of Irrelevant Alternatives. The social choice between any two alternatives shall not be affected by preferences over any other alternatives.

The theorem states that no social welfare function satisfies these five postulates. The logic of the proof runs as follows: The unlimited domain assumption allows any possible constellation of ordinal preferences. When a unanimously-preferred alternative does not emerge, some method for choosing among the Pareto-preferred alternatives must be found. The independence assumption restricts attention to the ordinal preferences of individuals for any two issues when deciding those issues. But, as we have seen in our discussion of majority rule, it is all too easy to construct rules that yield choices between two alternatives, but produce a cycle when three successive pairwise choices are made. The transitivity postulate forces a choice among the three, however. The social choice process is not to be left indecisive [3, Arrow, 1963, p. 120]. But with the information at hand (individual ordinal rankings of issue pairs) there is no

[32] Arrow's definition differs from the Bergson-Samuelson definition of a social welfare function [3, 1963, pp. 23-24].

[33] For full statements of the axioms and proof, see Arrow [3, 1963] and Sen [180, 1970, pp. 33–46]. Vickrey presents a slightly different, easy to follow proof [206, 1960].

method for making such a choice that is not imposed or dictatorial.

B. *Relaxing the Postulates*

The theorem's significance rests upon the weakness of its postulates. Most individuals will want to place more stringent normative constraints on the social choice process, and yet the above five postulates are already too severe. To avoid the impossibility result, even these must be relaxed.

Space precludes a complete review of all modifications of the postulates that have been made to produce either possibility theorems or new impossibility results.[34] Instead, we focus on modifications of particular relevance to public choice.

Relaxing unanimity and nondictatorship seems hardly worth discussing if the ideas of individualism and citizen sovereignty are to be maintained (but, see Little [112, 1952]). Nevertheless, the popularity of elitist theories of collective choice from Plato to the present indicates the attractiveness to many of abandoning this postulate. Worthy of special mention here is Hobbes's defense of monarchy. For Hobbes, there was one issue upon which all preferences are identical: life under anarchy was terrible and inferior to life under an unanimously-accepted dictator. If one made the other postulates part of the Hobbesian contract, one might construct a new defense of autocracy. And, of course, in practice the dictatorial solution to the uncertainties and deadlocks of social choice is very popular.

Transitivity can be relaxed, at the cost of a degree of arbitrariness or indecisiveness in the choice process. One might simply declare society indifferent to all choices along the Pareto frontier.[35] Any choice among them will be arbitrary, but perhaps fair. In practice, such rules favor the *status quo,* although there is no reason why they must [3, Arrow, 1963, pp. 118–20]. The *status quo* could be introduced as a choice along with new proposals with an equal likelihood of being chosen. Such a rule contains one set of implicit value judgments concerning the likely gains and losses from change; rules favoring the *status quo* contain another. If there is more general agreement concerning these decision rules than for transitivity, the problem is solved [101, Kemp, 1954].

We have already discussed a number of collective choice results that rely on a restricted domain assumption. Single-peakedness ensures that majority rule produces an outcome, namely the median, and single-peakedness along with the other four assumptions produces a social welfare function. In the context of a public choice process, single-peakedness implies strict restrictions on both the rules by which issues are selected and on the voters who decide them [187, Slutsky, forth.]. Issues must be of the one-dimensional variety—the number of guns, the number of school books; the voters cannot simultaneously consider both the number and kind of books. And their preferences must be single-peaked in this one dimension. If fate provides voters of this type, these issues can be resolved by majority rule without violating the other axioms, although we are still left with a plethora of multidimensional issues to resolve in some other way. If some individuals have multiple peaks, they must somehow be isolated and excluded from the community, or an impossibility result can emerge. More generally, ways of restricting membership

[34] A. K. Sen [180, 1970], P. K. Pattanaik [147, 1971], and P. C. Fishburn [68, 1973] all survey and extend this literature in important ways. See, also Riker [163, 1961], Rothenberg [169, 1961], Arrow [3, 1963, chap. 8], and Taylor [194, 1971].

[35] The weakest modification of this form is to replace transitivity with acyclicity, *i.e.* (xPy and yPz) $\rightarrow$ (xRz). But, this too introduces some arbitrariness [180, Sen, 1970, pp. 47–55].

in the polity to those with sufficiently homogeneous or complementary preferences to avoid the impossibility result can be considered. The theories of clubs and voting-with-the-feet describe processes by which such groups might form. In the absence of externalities across clubs (local communities), and perfect mobility, free entry, *etc.*, such a process might avoid the Arrow problem. But, as we have seen, when spillovers exist, some decisions must be made by the aggregate population, and the impossibility problem will appear here, even when "solved" in the smaller ones. In such circumstances homogeneity of preferences can be brought about only if individuals adopt, or already have, a common set of values [14, Bergson, 1954]. Appeals to reason, *à la* Kant, or uncertainty, *à la* Rawls and Harsanyi, are along these lines.

The independence axiom eliminates the possibility of strategic misrepresentation of preferences. When a social choice process is not perversely responsive to an individual's ranking of x and y, and depends on only his and other rankings of x and y, he can do no better than state his true preferences between them. If the outcome on x and y also depends on his ranking between y and z, however, he may be able to benefit from misstating one set of preferences if it increases his chances of winning on the other. This need not worsen the outcome of the social choice process, *e.g.*, as when positive-sum-game logrolling occurs. But it might. And, it does introduce an element of uncertainty and dependency on bargaining abilities that might be considered undesirable. The independence axiom excludes these possibilities.[36]

[36] Vickrey's speculation that immunity to strategy and the independence axiom are logically equivalent [206, 1960, pp. 517–19] has been rigorously proved by Allan Gibbard [78, 1973] and Mark A. Satterthwaite [177, 1975]. For additional discussion of this axiom see Bergson [14, 1954] and B. Hansson [85, 1973].

This axiom is stronger than it, perhaps, appears, and its relaxation provides a number of ways out of the paradox. By limiting the choice among any subset of issues to the information on individual rankings for the issues in that subset, it rules out all information with which one might cardinalize and interpersonally compare utilities [180, Sen, 1970, pp. 89–91]. Indeed, it was the desire to establish a welfare function that was not based upon interpersonal utility comparisons that first motivated Arrow [3, 1963, pp. 8–11, 109–11]. Once it is abandoned or relaxed, a number of voting rules can be considered. One is the rank order method of voting first discussed by J. C. de Borda [24, 1781].[37] Here the alternatives are allocated points, inversely to their rankings in individual preferences, and the alternative with the most points wins. Logrolling, literal vote trading, and point voting can reveal individual intensities on issues and can have attractive normative properties when restrictions are placed on the issues admitted to the decision set. These procedures are excluded by the independence axiom since their outcomes are dependent upon the specific (and full) set of issues proposed. Thus, abandonment of the independence axiom raises the importance of the process that selects the issues to be brought to a vote in a way its acceptance does not.

From a public choice perspective, relaxation of either the independence or unrestricted domain axioms appear to be the most appealing ways out of the paradox. Each in turn raises questions as to what issues are to be decided, who is to decide, and of those who decide, which preferences shall be weighed. Such choices directly or indirectly involve interpersonal utility comparisons and must rest on some

[37] This voting procedure is consistent with a possibility theorem, a weaker statement of the independence axiom, and the other four Arrow axioms [162, Ray, 1973].

additional value postulates, which if explicitly introduced would imply specific interpersonal utility comparisons. The latter cannot be avoided [13, Bergson, 1938; 14, 1954; 91, Hildreth, 1953; 102, Kemp and Asimakopulos, 1952; 180, Sen, 1970, pp. 123–125].

Part Three

XII. *Normative and Positive Theories of Public Choice Compared*

Rules for collective decision are needed, quite simply, because people live together. Their mere grouping into circumscribed geographic areas creates the potential and necessity for collective action. Some collective decisions can benefit all individuals involved; other decisions benefit some and harm others. These two categories correspond to the familiar distinction between moves from off the Pareto frontier to points on it, and moves along the frontier or to allocation and redistribution. Positive public choice, as positive economics, is most pertinent to decisions in the first group; normative welfare theory to decisions within the second.

The work on real-valued welfare functions indicates that if only the Pareto postulate is introduced, "normative" and positive theory lead to the same marginal conditions defining allocations along the Pareto frontier. The Arrow-type theorems imply further that to choose from among these allocations using a consistent, nondictatorial social choice rule, either restrictions must be placed on the preference domain or postulates introduced that directly allow interpersonal utility comparisons, *i.e.*, value judgments must be introduced.

As David Hume pointed out long ago, propositions concerning values cannot be derived from factual observations alone [96, 1941; 180, Sen, 1970, pp. 56–64]. Some intuitive conceptualization of right and wrong, of acceptable and unacceptable, is required. Thus, efforts to introduce values into collective choice in a nonarbitrary way become a search for a community's shared notions of justice and morality. Indeed, a community might easily be defined in terms of these shared values. Individualism, the Pareto postulate, the Arrow axioms, justice as fairness, and the golden rule are all essentially intuitive value statements, or notions of morality and justice. The social welfare function, or contract, or constitution embody and reflect these values.

Normative theory starts with the community and attempts to derive propositions based on its collectively held values. Treating the community as an "organic" body, as *the* starting point, follows logically from the necessity of there being a commonly held set of values for there to be any community. While consensual agreement on the underlying value postulates may be necessary, there is no logical reason why unanimity must emerge from this consensus as the social choice rule. Indeed, when choices are to be made from points along the Pareto frontier, unanimity cannot be the collective choice rule. The redistributive property of all less-than-unanimity rules thus makes them the logical choice for selecting among Pareto-efficient allocations. The down-playing of the unanimity rule in the normative literature is thus explained.[38]

If normative theory studies processes for revealing commonly held values regarding interpersonal utility comparisons, positive public choice studies processes for revealing intrapersonal utility comparisons. For the bulk of the positive literature analyzes the implications of various collective decision rules given individual preferences and (often implicitly) a common value system. Thus, positive public choice focuses on decision-making at the parlia-

[38] [3, Arrow, 1963, pp. 119–20; 8, Barry, 1965, pp. 323–24; 12, Baumol, 1965, pp. 43–44; 176, Samuelson, 1969; 180, Sen, 1970, pp. 24–26].

mentary or legislative stage under rules and values established in the constitution.

Given its focus on the revelation of *individual* preferences, much of positive public choice is implicitly, and sometimes explicitly as in the work of Buchanan and Tullock, in the contractarian tradition. If one starts with the individual, before the collective can be analyzed, it must, at least conceptually, be formed. The issues of which individuals make up the collective, what questions it can resolve, and what rights remain with the citizen must be faced. The positive literature's contractarian approach explains its emphasis on unanimous consent and Pareto optimality. If the polity is a union of individuals, who, conceptually, have the option of not joining, then unanimous agreement on basic choices is required. But unanimity can only be achieved under individualistic —egoistic—assumptions for Pareto moves. Thus, Pareto efficiency and unanimity become ineluctably linked. In a voluntary association of individuals, unanimity is, potentially, always possible; all moves are latently Pareto efficient.

The differences in starting points also explain the different approaches to the *status quo* apparent in the two literatures. The positivist works within a set of fixed rules and value consensus, and favors maintenance of the existing rules in the absence of clearly expressed preferences for change. The welfare theorist attempts to define the rules to be imbedded in an ideal (perhaps new) constitution and sees no reason to give previous rules preference.

The way constraints on the issue set are introduced is also revealing. When assumptions about the value consensus and domain of choice are made explicit in the positivist literature, they come at the beginning of the discussion. Given these assumed constraints, the positivist often evinces a lack of concern in, or downplays the importance of, the impossibility theorems (as, for example, Tullock [199, 1967]). A. K. Sen's impossibility theorem [181, 1970], is disturbing to a positivist, only in that it presumes that one individual's preference that another read a book the latter thinks distasteful would even enter into the social choice process [136, Ng, 1971; 150, Peacock and Rowley, 1972; 19, Bernholz, 1974]. The social welfare function texts, on the other hand, begin with an unlimited domain assumption and work back to consider restrictions on the set of admissable preferences, after deriving their impossibility results [3, Arrow, 1963, pp. 74–91; 206, Vickrey, 1960; 180, Sen, 1970, pp. 166–86]. The suggestion that basic agreement on some ends must be part of the collective choice process comes after the exploration of the infeasibility of not assuming such consensus.

Hopefully, this contrasting of perspectives clarifies the apparently differing conclusions and emphases of the two approaches. It, also, may explain the interest in Rawls. For Rawls's theory is at once individualistic-contractarian and overtly normative. The unanimous agreement of all citizens for all time becomes *the* social preference ordering of the community, through the homogenization of tastes that occurs as individuals pass through the veil of ignorance into the original position, in the same way Harsanyi derives a unique-unanimous social welfare function.[39]

In closing this comparison, some paradoxes and unresolved questions must be noted. Although the bulk of the positivist-contractarian literature discusses decision-making within an agreed social contract or constitution, the process by which this

[39] Some criticisms of Rawls are also revealing. Buchanan [36, 1972], the positivist-contractarian, objects to Rawl's extension of his theory of the social contract *process* to define actual outcomes of the process in terms of principles of justice. Welfare theorists Arrow [5, 1973], Sen [180, 1970, pp. 135–46; 182, 1974], and Harsanyi [88, 1975] criticize only the form the principles take.

agreement is reached is almost never discussed. Buchanan and Tullock's book on the *Logical Foundations of Constitutional Democracy* devotes only a few pages to the constitutional stage and here argues the plausability of assuming unanimity due to uncertainty over future positions [42, 1962]. Buchanan's recent book, although devoted to the social contract, does not discuss the *process* by which actual constitutions are drawn [37, 1975].

Nor does the social welfare function literature discuss how agreement is expressed on basic values, even though, under the present interpretation at least, this literature is directly concerned with the functional embodiment of these values. Quite to the contrary. Barry [8, 1965, pp. 242–45] and Samuelson [176, 1969] are openly critical of unanimity, even when applied to the constitutional stage. Arrow accepts an interpretation of the social welfare function as a constitution, but seems not to feel it is literally agreed upon by citizens. Instead, he sees the implications of the social welfare function research as guiding ethically neutral public officials when making policy decisions [3, 1963, p. 107]. But this interpretation reopens all of the old questions of value judgments, interpersonal utility comparisons, *etc.*, that the new welfare economics sought to avoid. Given Arrow's own results, it is clear that the policy maker cannot easily find a decision rule consistent with an obviously agreed upon set of normative axioms. New axioms must be found. But what (who?) guides the policy maker in this search, the economist? Unless there is a general consensus over the policy maker's or economist's choice of value postulates, the spectre of multiple social welfare functions reappears. But can the policy maker, or economist, determine if a consensus exists, and what it is, if it is not somehow literally expressed?

It is fitting that we close with this query. For the basic challenge facing a community is achieving a consensus or the dilemma of decision-making in its absence. Public choice has shed light on these issues, but much remains to be done. The positive literature is riddled with demonstrations of the instability, inefficiency, or irrationality of various voting outcomes; the normative literature by impossibility proofs. But this should be neither surprising nor particularly discouraging. Indeed, it is precisely because it deals with some of the oldest and toughest questions a community faces, that public choice attracts so many fine scholars. And for this reason, one can remain optimistic about the field's future growth and development.

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