

## OPTIMIZING MODELS OF PUBLIC DECISION MAKING

# Purposive Models of Legislative Behavior

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Although political scientists have studied Congress and other legislative bodies for many years, they have been relatively unsuccessful in developing a general theory of legislative behavior. Picking and choosing from the conceptual stores of sociology and psychology, political scientists have organized their research around concepts such as role, norm, integration, etc. Almost without exception the resulting partial theories are quite vaguely formulated, so that one cannot determine which propositions strictly derive from the theory. In other words, though we have good descriptive information about how certain legislatures work, we have a very limited set of theoretical propositions that can help to explain these workings. Still, some scholars appear to have excellent intuitions about how alterations in various internal or external institutions affect the operation of legislatures and their policy output. Thus, we believe there is a deeper understanding of legislative behavior than the lack of a theoretical superstructure suggests.

In recent years several developments have shown some promise of filling the theoretical gaps in the study of legislative behavior. First, game theorists and social choice theorists have begun to formulate abstract models of simple legislatures. Thus we now have a short but growing list of propositions about legislative behavior and policy making in certain highly simplified situations. Second, some empirical

researchers have gradually become aware that legislators are goal-seeking agents who choose from available strategic alternatives to further their ends. Some recent empirical work reflects this realization. Third, a number of scholars have been working to bridge the gap between highly abstract social-choice and game-theoretic models of legislatures on the one hand and detailed empirical studies of legislatures on the other. In this necessarily short review we will provide a brief survey of the work underlying each of these developments. The discussion which follows proceeds in stages from the abstract constructions of the game theorists to the more concrete descriptions of empirical researchers.

### I. Game Theory and the Legislative Process

Since the publication of *The Theory of Games and Economic Behavior*, several authors have proposed simple game-theoretic models of legislatures. In this section we describe the basic elements of such models and discuss the kinds of propositions they imply. Game-theoretic models typically have a set of *actors*, each of whom have *preferences* defined over a set of "alternatives" or "social states." These preferences are usually assumed to satisfy certain rationality properties. Subsets of the set of actors are called *coalitions* and coalitional preference is usually defined as follows: coalition is said to prefer  $x$  to  $y$  if and only if each of its members prefers  $x$  to  $y$ .

A principal notion in game-theoretic

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analysis of legislatures is the idea of coalitional power. One way to formulate this notion is as a characteristic function. The characteristic function is a mapping from coalitions into subsets of the alternatives, which specifies for each coalition in its domain the alternatives that coalition can enforce (S. D. Bloomfield and R. B. Wilson). Another way of conceptualizing coalitional power is a set of binary *effectiveness* relations, one for each coalition, which describe for each coalition its ability to determine the outcome of the legislative process on pairs. That is, if a given coalition is effective for  $x$  against  $y$ , then it can ensure that if the legislature is choosing between  $x$  and  $y$ ,  $x$  will be chosen. A game is simply the set of players and the set of alternatives together with a list of permissible or formable coalitions and some description of the powers of the formable coalitions.

The three elements introduced thus far (*preferences* held by the members, *formable coalitions*, and *powers* of each of the formable coalitions) enable us to make some statements about what a legislature will do when faced with particular choices. One can define a dominance relation as follows:  $x$  dominates  $y$  if and only if there is a permissible coalition that can ensure  $x$  and which prefers  $x$  to  $y$ . In the next section we will review the work of a number of scholars who have placed sufficient restrictions on the distribution of legislator preferences to ensure the existence of an undominated element. As is well known, however, without such restrictions many legislative institutions cannot be counted on to produce a dominance relation which has an undominated element. This has led some scholars to theorize about what will happen if no undominated element exists.

Several authors have developed solution concepts that allow one to make assertions about what will happen in games without undominated elements (G. Owen). Un-

fortunately, the solution concepts advanced thus far typically do not make very strong statements about the outcomes of a game. In many games of interest the solutions constitute a very large set relative to the set of possible outcomes.

As a result William Riker suggests that while we may be unable to predict what alternatives will be chosen in a given legislative situation, we may be able to make assertions about which coalitions will form and/or remain stable. He proposes a rule—the size principle—which asserts that in constant-sum games of perfect information only minimal-winning coalitions form. This principle has received careful attention from theorists (Robert Butterworth, Kenneth A. Shepsle 1974a, 1974b, Richard McKelvey), but its status as a theoretical proposition remains ambiguous. For, except in noncontroversial cases in which an undominated element exists, each alternative is dominated by some other, so that even if a minimal-winning coalition moves the legislative from  $y$  to  $x$ , another coalition could move the legislative from  $x$  to  $z$ . In general, one cannot expect coalitions to be stable. Perhaps Riker is using the notion of coalition formation in a somewhat different sense than is natural in a game-theoretic terminology. One might define a somewhat different concept of coalition formation and argue that even when the domination relation is cyclic only minimal-winning coalitions form. Recently McKelvey has shown that, if a certain restriction is placed on the payoff configurations that are admissible, a version of the size principle follows. As a descriptive principle, however, the condition McKelvey proposes is dubious.

A number of political researchers have conducted empirical studies to see how accurate the size principle is as a descriptive hypothesis. Some examples are those by David Koehler, Barbara Hinckley, and David Moore. None of these authors finds

a pronounced tendency for minimal-winning coalitions to form in legislative voting behavior. Thus, the size principle does not appear to describe legislative coalition formation, at least as measured in these studies. Nonetheless, despite its limited theoretical and empirical support, many scholars (of both theoretical and empirical inclinations) find the size principle intuitively appealing.

## II. Spatial Models of Legislatures

In spatial models of legislatures the set of alternatives is assumed to be a subset of Euclidean space, and each legislator is assumed to have a most preferred point within the subset. Legislator preferences may be positively monotonic in distance (Duncan Black), convex, and representable by a differentiable utility function (Charles Plott), convex (Judith Sloss), and/or separable (Gerald Kramer). The basic idea of this type of models is to provide conditions on preferences sufficient to ensure the existence of an undominated point in the set of alternatives.

Black proves that if preferences are convex (i.e., single peaked) in a one-dimensional Euclidean space and if each person votes for the alternative he prefers in each pairwise contest, then there is an alternative (the median position) that cannot be defeated in a pairwise majority vote. As is well known, if the dimensionality of the space exceeds one, convexity is no longer a sufficient condition for the existence of an undominated element.

Plott provides a set of sufficient conditions for the existence of an undominated element when the set of alternatives is a subset of an  $n$ -dimensional Euclidean space, and each voter has a concave, differentiable utility function on the set. Plott's condition roughly may be stated as follows. If there is an odd number of voters and they are arranged in a subset of Euclidean space in such a way that one

voter is located at an interior point,  $x$ , then  $x$  is an undominated point if and only if for each utility gradient pointing in a given direction there is another pointing in the opposite direction. Sloss generalized Plott's theorem to weaken the requirement that voters have differentiable utility functions. She requires only that voter preferences be quasi-transitive and satisfy a certain convexity property. In her work convex cones with "gradientlike" properties play much the same role as the gradients in Plott's theorem.

Kramer extends results of Black, A. K. Sen, and others to the case of a multidimensional space of alternatives by giving a class of sufficient conditions for the existence of an undominated element. He argues that the class of conditions which he and Plott provide are so restrictive they are "unlikely to be satisfied in practice except by care and lucky accident" (Kramer 1973, p. 296).

In another contribution Kramer (1972) shows that if legislators have convex and separable preferences over a subset of an  $n$ -dimensional Euclidean space, if motions to amend the status quo,  $x$ , can change the status quo in at most one component (i.e., issue) at a time, and if legislators vote for a motion if and only if they are made better off by its passage, then there exists a point which is undominated. That is, if legislators do not cooperate too extensively in making their voting decisions, the rules restricting the agenda may create undominated elements. Of course such procedural devices will be ineffective if legislators coordinate their voting strategies sufficiently. Nevertheless, such coordination may be costly enough that the conditions of the theorem are sometimes met in practice.

## III. Vote Trading

Some authors have suggested that vote trading is a desirable activity in legislatures and that it may lead to outcomes

socially superior to sincere voting outcomes (James Buchanan and Gordon Tullock). Numerous papers on vote trading have been published, but one finds a notable lack of consensus among their authors both on definitions and conclusions. The most important accepted result is the following: if any trade may occur among legislators, and if legislator preferences are separable, a point,  $x$ , is an equilibrium in the vote-trading process if and only if it is the outcome of issue-by-issue voting with no trades occurring. Of course the trading process may have no equilibrium. (See Koehler 1975, Peter Bernholz, Joseph Kadane, and Ferejohn 1974b.) The basic idea of the proofs is simply that if any coalition may be organized costlessly to carry out a trade, and if the ultimate decision rule is the method of majority decision, then informal or formal institutions may always be circumvented by an appropriately organized majority. Only to the extent that trades are costly to implement and to police can formal or informal institutions create undominated elements where none would exist under simple majority rule with sincere voting.

We think that this observation may be of considerable importance in understanding how an institution like the Congress works. The Congress is not merely a bicameral body with decisions in each house made by simple majority rule. Rather, there are a number of formal and informal institutions (the committees, the parties, the state party delegations, the leadership systems, the policy groups, etc.) which hold more or less regular places in the legislative process. The presence of such institutions makes some coalitions cheap to organize and others much less so. Differential organization costs may affect not only the existence of equilibria, but also the distributive consequences of policy outcomes (Ferejohn, 1974a). While little theoretical or empirical work has taken

place along these lines, it appears that members of certain institutions within the Congress have distinct advantages with respect to particular legislative outputs. The existence of regular distributional effects is difficult to explain without some notion that certain coalitions are more difficult to form than others (namely those that could upset the allocation in question).

#### IV. Models of the Committee Assignment Process

While legislation may be proposed and amended on the floor of either chamber of the Congress, in practice this almost never happens. Instead, a proposed bill is referred to a committee, which then decides whether the bill will be reported to the whole chamber and, if so, in what form. As a rule, few amendments are offered on the floor (although committee to committee variation is wide) and even fewer are successful. But although most of the policy output of the Congress is determined in committee, little attention has been devoted to incorporating the standing committee system into models of the Congressional process. Recently, however, theorists have focused on one aspect of the committee system—the assignment process. Using simple optimizing models they can successfully account for most of the available data about Congressional committee assignments. Unlike models which require only that legislators be rational agents (i.e., that they be maximizing *something*) the assignment models postulate a specific objective function which the Committee on Committees tries to maximize.

The assignment process operates as follows. Newly elected Congressmen and those dissatisfied with their current assignments submit requests to their party's Committee on Committees. These requests take the form of partial rankings of the committees of the House. The Committee

on Committees then meets to consider these requests and make the actual assignments. There are some formal restraints on assignments: all members must receive a committee; members may be placed on one exclusive committee, or on one semiexclusive and one nonexclusive committee, or on two nonexclusive committees. Additionally, the descriptive literature identifies various informal constraints on assignments: no freshmen on exclusive committees; reserved seats for certain states on certain committees; higher priority for nonfreshmen requesters than for freshmen.

In Shepsle's (1975) model of the assignment process, both the informal constraints and the ranking information about requests are omitted. Instead, Shepsle assumes that the Committee on Committees maximizes the number of requests satisfied. Using data only for freshmen requesters and for the Democratic Committee on Committees for four Congresses, Shepsle finds that this extremely simple model accounts for "most" of the assignments in the following sense: while it might be possible to satisfy a few more requests by rearranging assignments, the number of feasible assignments is so large and the search costs sufficiently high that the actual assignments seem a reasonable approximation to the optimum.

Michael Cohen's model employs a similar objective function. Interestingly, the Committee on Committees allegedly considers the committees in alphabetic order. After studying the consequences of various sequential assignment methods, Cohen concludes that quite different assignments would result if assignments were considered in other sequences.

The relatively good fit of the Shepsle and Cohen models suggests that committees are made up largely of self-selected members. Farm state Representatives migrate to Agriculture; Western Representatives gravitate to Interior. Given that the com-

mittees exercise a great deal of influence in writing legislation, the end result is a situation in which policy advocates write public policy for the whole Congress. In an interesting work William Niskanen examines the consequences of a system in which committees dominated by program advocates write legislation; he concludes that such a system has undesirable allocative properties. Ferejohn's (1974a) empirical study of Congressional policy making in the area of water resources supports Niskanen's conclusions.

### V. Models of Roll Call Voting

One of the most conspicuous aspects of legislative behavior is the roll call vote. The voting records constitute a happy hunting ground for statistically oriented political scientists, and a few models of the vote decision now exist.

Duncan MacRae first proposed a model of roll call voting. The model is theoretically quite ambitious: it attempts to integrate a spatial model of electoral behavior in the constituency with a spatial model of roll call voting in the legislature. Representatives do not simply take the median position of their districts in this model because their votes depend on their personal policy preferences, their electoral margins, and the overall "political complexion" of their districts, in addition to their constituents' approval and disapproval. Given the relative complexity of the model, general results are somewhat hard to come by.

In another contribution, Fiorina (1974) views Representatives as using their vote either to maximize their probability of reelection or to maintain it at some personally satisfactory level. In this model Representatives make decisions under uncertainty about the likelihood that their vote will elicit an electoral reward or punishment of a given magnitude. The homogeneity of a district's group structure emerges as critical in Fiorina's model. Op-

timal roll call voting strategies always exist in homogeneous districts, but not in heterogeneous districts. Other propositions in the model concern the effects of (1) variations in rewards and punishments stemming from votes, (2) the likelihood a vote will become a campaign issue, and (3) abstention.

In contrast, Jane Gilbert offers a decision-making-under-certainty model of Congressional roll call voting. She assumes Congressmen desire only 50 percent  $+\epsilon$  of the vote. In the model, this limited electoral objective frees them to cast other votes with party leaders in order to build up credit within the institution. The number of free votes Congressmen have depends on two dimensions of district heterogeneity: consensus and diversity (the former refers to agreement on a single roll call, the latter to agreement across a series of roll calls). Interestingly, Gilbert's conclusions about the effects of district heterogeneity directly contradict Fiorina's. In the Gilbert model, Congressmen wish to have diverse districts—they should be willing to ask state legislatures to redistrict them out of safe, homogeneous districts. This startling difference between the two models stems largely from the differing candidate-objective functions assumed. In Gilbert's model candidates strive to get only one vote more than a tie. If  $\epsilon$  were set higher, say 10 percent, the conclusions of the Gilbert and Fiorina models would be similar.

#### VI. Mainstream Political Science and Optimizing Models of Congress

Of the models thus far discussed, only a minority have been the creation of political scientists. As a discipline, political science has been influenced far more by sociology and social psychology than by economics. Research on Congress, in particular, is organized around concepts such as "role," "norm," and "socialization"

rather than "preference," "choice," and "maximization." But, very recently, mainstream Congressional scholars have given strong indications that they are broadening their collection of intellectual tools.

For example, Richard Fenno presents a large-scale comparative study of Congressional committees within the framework of a purposive analytical model. Fenno sees Congressmen as desiring reelection, good public policy, and institutional influence—different mixes for different Representatives. The committees, in turn, offer differing opportunities to satisfy these differing goals (e.g., Public Works or Interior are clearly more valuable for electoral purposes than Foreign Affairs). Fenno argues that Congressmen's goals affect the committee assignments they seek and, in conjunction with the political environment, the formal structure and informal procedures of the committees.

Other empirical works which show the utility of purposive models of behavior include James T. Murphy's analysis of the House Public Works Committee decision making, John F. Manley's study of the House Ways and Means Committee, Barbara Deckard's analysis of state delegations in the House of Representatives, David Rohde's and Shepsle's examination of committee requests in the House of Representatives, John Kingdon's excellent study of roll call voting decisions, and David Mayhew's interpretative review of the Congressional literature.

Empirical research on legislatures has yielded more than detailed descriptions of Congressional institutions, processes, and behavior. It also has provided a growing list of regularities which seem sturdy enough to bear close theoretical examination. Some of these observations are as old as the hills, but receive support from recent work as well: the work of the Congress is done in committees; committee decisions are seldom overturned on the floor; party

membership is the single most important predictor of roll call votes; certain committees (such as Appropriations and Ways and Means) are consistently more successful on the floor than are others (Education and Labor or Agriculture, for example). There are other such propositions which could be culled from an examination of the empirical literature. To a surprising extent these propositions appear to hold not merely in the House and Senate, but also in many state legislatures as well.

The existence of empirical regularities in a relatively wide variety of legislative situations (across time as well as cross-sectionally) is a challenge to theorists. What is it about legislative bodies that makes committee decisions tend to remain stable during floor consideration under simple majority rule? The empirical literature on Congress indicates not only that seemingly undominated alternatives exist, but that these alternatives regularly emerge as committee bills. The theoretical literature suggests that this is an extraordinarily improbable state of affairs. Surely we should search for an explanation of this phenomenon.

In our opinion, the theoretical literature on legislative bodies is sufficiently advanced that we may begin to hope for answers to the preceding kind of question. One would hope that over the next few years theorists will take the body of empirical research seriously enough to attempt to provide explanations for observed regularities, and simultaneously to provide a theoretical base for future empirical research.

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