AN ALTERNATIVE METHOD OF ASSESSING PREFERENCES FOR POTENTIAL GOVERNMENT GOODS[1]

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Introduction

The acceptance of benefit-cost analysis is so broad that it virtually defines the field of study concerned with the economic evaluation of extra-market goods. Because of this wide acceptance, debate has moved on to such issues as how to best measure benefits (Bradford) or how to apply them (Kalter) or which of several benefit measures is theoretically correct to use (Seckler). It is with some trepidation, therefore, that we suggest an approach to the assessment of preferences for publically-provided goods which is outside the benefit-cost framework. The approach is distinctive because it is budget-oriented rather than benefit-oriented. We believe it to be as promising as any other existing method when answers are desired to a particular type of public planning problem. One of the purposes of this paper is to support this contention. Another is to give a conceptual description of the suggested technique. Both of these aims depend ultimately, however, on a clear understanding of what we mean by "government good", by "public planning problem" and by "budget-oriented" method. It is with these definitions that we shall begin.

The proposed method is derivative from work done by the London-based Social and Community Planning Research group (Hoinville). Their work was recommended to our profession three years ago as a way to measure environmental goods (Pendse and Wyckoff).

One of the interesting aspects of this earlier work holds also for the proposed method: it is applicable both to goods which are common in consumption and to goods which have exclusive consumption rights. Thus, the usual distinction between public and private goods is not germane. Instead, the relevant dichotomy is between goods provided by government agencies and goods provided by private concerns. It is this simple distinction between type of supplier which is inherent in the use of the term "government good."

The type of government good under discussion is related to the Davis-Whinston definition of a Samuelsonian public good. Davis and Whinston introduce their notion through an allegorical example (pp. 361-362). In this example they suppose that government alters the market for bread so that payment is separated from the act of consumption. Accordingly, consumers pay for the bread in the morning at a government "revenue center" and obtain it later in the day from a "distribution center." As there is no communication between the two centers, payment and consumption are truly separate. Such a situation would obviously encourage a person to bypass the revenue center and to go directly to the point of distribution. It would also encourage those interested in the valuation of a publicly-provided good to tie that valuation directly to the good's consumption, instead of to the payment for the provision of the good. This kind of concept of a government good provides basic motivation for a benefit-cost analysis as it treats benefits as an entity separate from the costs of supply.

While many of the attributes of the Davis-Whinston notion are relevant to our concept of the public planning problem, one important difference exists between the two constructs. Davis and Whinston assume that revenue payments are voluntary and that knowledge of the revenues received is not available to the supply agency. We take the revenues to be generated from manditory tax payments and presume that an agency supplying government goods has a clear idea as to the size of its budget. Whenever the budget size limits the supply of government goods which an agency can provide, it becomes an important factor in the public planning problem.

Besides the interjection of the budget as a viable constraint, another assumption is axiomatic to the planning problem. This is the supposition that most public agencies function under enabling legislation which allows some discretion as to the kind of goods they will provide. Thus the Federal Extension Service decides to some degree which programs it will support, the Federal Anti-Trust Division decides within limits which cases it will prosecute, and the Maryland State Park Service decides with some political input, which park improvements it will implement. These agencies are consequently faced with a typical economic choice problem: since the tax revenues allocated to them are fixed by outside authority, the agencies can supply more of one kind of government good only if less of some other government good is provided. The problem of choosing which set of government goods to supply in this constrained situation is what we mean by the public planning problem.[2] Solution to it requires the formulation of a choice criterion and the allocation of the agencies budget among the potential goods in accordance with that criterion.

Any of several criteria could be used to make the choice among the potential government goods. The criterion that would be consistent with the benefit-cost framework, though, is maximization of an aggregate consumer utility (Sinden). This is so because the planning problem typically would be handled in a benefit-cost analysis by ranking the potential goods according to their relative excess of benefits over costs. The goods would then be supplied in the order of the ranking up to the point where the agency's budget is exhausted. Since benefits are aggregations (Bradford) or integrations (Seckler) of people's willingness-to-pay for the consumption of the agency's goods, the lexicographic ordering of benefit-cost comparisons implies a social utility maximization criterion.

The proposed way of dealing with the planning problem will also maximize an aggregated set of consumer preferences. However, it will be based on how people want the agency's budget to be allocated instead of how much they would be willing

to pay for the consumption rights to the government goods. The proposed method is consequently budget-oriented rather than benefit-oriented. In the limiting case of perfect knowledge, it and the benefit-cost approach should yield equivalent solutions. Lack of complete knowledge about the commodity set is the rule rather than the exception in actuality, however, and the likelihood of the two methods yielding equivalent results drops significantly when the omniscience assumption is violated. One reason for the difference in the results lies in the type of preference trade-offs intrinsic to each of the alternative methods. More will be said about this difference after the suggested method of solving the planning problem is introduced.

The Managerial Simulation Method

The elements of the defined planning problem are similar to those of the constrained utility maximization problem featured in the Theory of Consumption. Reference to this theoretical construct in the study of public goods has been made by Bradford, Hoinville and others, so its possible application to the planning problem has been considered. Surpisingly, however, only the "Priority Evaluator" technique of the Social and Community Planning Research group includes all of the elements of the formal theory, and this technique departs from the theoretical structure in the derivation of results. One possible reason for the perceived uselessness of the indifference curve and budget constraint construct has been suggested by the Davis-Whinston idea of a publicly-provided good. Other reasons can also be given, but they need to be weighed against a method which is founded directly on the constrained consumer-utility theory.

Solution of the constrained utility maximization problem requires three pieces of data

- a clearly defined commodity set
- a price for each commodity
- a given level of total expenditure.

This information is, of course, summarized into the theoretical expenditure constraint that forces preferences for private goods to be traded off whenever a utility-maximizing consumer derives his or her optimum purchase set. The key element which distinguishes this approach from benefit-cost methodology is the introduction of the budget constraint. Introduction of such a constraint into the deliberations of the potential consumer of a planned government good summarizes the supply side of the planning problem for that consumer, just as the expenditure constraint in the theoretical utility maximization problem summarizes the market and income situation facing the consumer of private goods.

The Priority Evaluator technique is unique among reported methods of solving the public planning problem in that it places an expenditure constraint on people's willingness to pay for government goods. This constraint is built into an interview device which portrays the relevant set of government goods. A respondent is asked to use the device to indicate his or her willingness to pay for the various goods in the constrained situation. Thus the Priority Evaluator technique is consistent with the Lindahl type of planning model in which the citizen respondent values the Government good (Malinvaud). But the mixture of budget and benefit elements in the method forces its users to rely on such unusual measures of results as relative indices (Hoinville) and "satisfaction ratios" (Pendse and Wyckoff) in order to solve the planning problem. Dissatisfaction with such results stimulated a search for a more purely budget-oriented method which would yield better planning solutions.[3]

We call the method which evolved from the search for a budget-oriented alternative the "Managerial Simulation" method. It is patterned quite closely upon the constrained consumer utility maximization problem of consumption theory. As a consequence, it is consistent with the "quantity-indicator" planning model postulated by Malinvaud as a counter-argument to the Lindahl model. The direct application of the indifference curve and budget constraint analysis to the planning problem implies that individual preferences should be expressed as optimal bundles of priced goods rather than optimal valuations of given quantities of goods. This is a primary difference between the suggested approach and benefit-cost methodology.

The Managerial Simulation method depends directly on the ability of the public agency with the planning problem to clearly specify the set of goods it can and will supply. Once specified, preferences for this set of goods are determined by a simulation of a managerial decision in a survey situation. The simulation casts the interview respondent in the psychological position of an agency director. In that role, he or she is to allocate the agency's budget among the potential alternative goods which the agency is prepared to supply. If the person acts as a manager with selfish ends -- so that he or she manipulates the budget to satisfy personal desires -- then the simulation is equivalent to solving the constrained utility maximization problem from which demand functions are formally derived. This equivalence establishes the relationship between the individual's allocation of the agency's budget and his or her personal preference for the potential good. A reasonable aggregation of the individual budget allocations into a community preference response will therefore constitute a solution to the agency's planning problem.

A managerial simulation must adequately inform the survey respondent about the agency's alternatives at the same time the person is making his or her allocative decision. As is shown by the Priority Evaluator technique, transmittal of this much information is best done via an interview device which is designed to teach the data to the person using it. In addition, a good device will stimulate a person's interest, be enjoyable to operate, and will conveniently summarize the individual's choices. The particular form of the device is important, but not critical, since the requisite information can be conveyed to the interview respondent in several ways.

In the formulation of the interview device, prices would be fixed and quantities variable. From the point of view of the planning problem, the prices in the budget constraint are the costs to the agency of providing the potential government goods. This is so because the agency is functioning as a non-profit producer of a commodity. Interview responses would therefore establish optimum levels of quantities to be supplied and the aggregation of these responses would be in the nature of a horizontal summation rather than a vertical summation of values.

Two types of horizontal aggregations are possible. One is founded on a simple one-vote-to-a-person principle in which each response is given equal weight. The other corresponds to the market demand concept embodied in the Marshallian summation of individual demand curves for a private good. The two types of aggregations are mutually exclusive and are directly dependent on the design of the interview device. Because this is so, further discussion of the procedures for the combination of managerial simulation survey results will be put off until a specific interview board is introduced.

Figure 1 is a photographic reproduction of an interview board used in a recently completed study of the Maryland State Park System.[4] The primary purpose of the Maryland study is to determine the mix of potential park improvements which would best satisfy park users. The device used in the study consists of an easily portable board with built-in slides and windows. Pictorial and written displays on the surfaces of the board contain the information which the respondent needs to make his or her response.[5] The writing gives the type and quantity of State-provided recreational facilities associated with each budget alternative. The pictures show the quality of the typical recreation site and indicate how the site and facilities interrelate.

Budget information is incorporated into two types of windows in the interview board. Percent-of-total-budget figures are presented in large windows at the left of the board. Small windows toward the board's center show the numbers of parks[6] which can be purchased at varying expenditure levels. As the slides in the board are pulled out, both windows operate. The left-hand side of the moving slide uncovers a background in the large window and the leading edge of the background indicates the increase in the percentage of the total budget being spent. At the same time, successively larger figures appear in the small window to show the increase in parks purchased. The board is constructed so that the figures in any given pair of large and small windows are related by the costs of the particular type of park. Total budget expenditure can be found in the presented board by adding the percentage figures in the large windows for the purchase alternatives. In order to force preference trade-offs, an individual being interviewed is instructed to set the board so that 100 percent of the budget is spent. The quantities associated with this setting are then recorded as the individual's solution to the agency's planning problem.

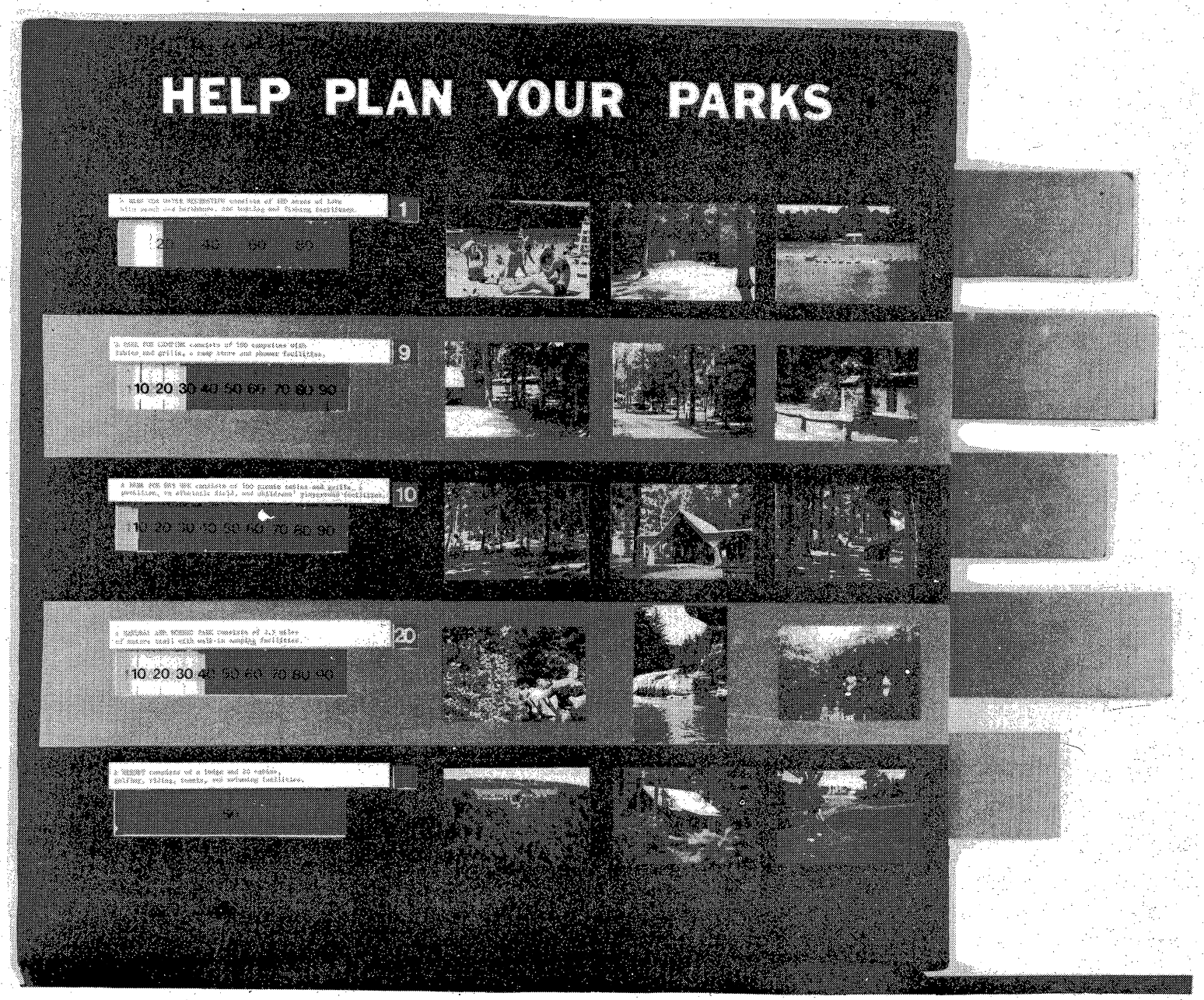

FIGURE 1: Front Side of Interview Board

The board design used in the Maryland Park survey turned out to be satisfactory. However this particular device might be modified in a number of ways. One possibility is to switch the budget percentages to the small windows and the quantities purchased to the large. Such a modification would be especially appropriate if cost economies or diseconomies are associated with particular goods, or if the commodity alternative is treated as a qualitative change in, say, an environmental factor. In this latter case, the pictures and descriptions would have to be arranged by quality and placed over the large window, which would be narrowed and elongated. The edge of the slide would then indicate the particular quality level chosen rather than the number of units

Since the interview board incorporates a given set of unit costs, modification of t device to allow for price variation is possible only if the simulation is repeated. This was accomplished in the Maryland study by utilizing the back of the interview boar One modification of the board which was not tried was the introduction of a "tax rebate" slide. This type of slide is intimately related to the type of aggregation performed on the survey results as its use leads to a solution of the planning problem which is consistent with the market-demand summation of individual purchases of private goods.

By the definition of the planning problem, levels of tax collection are exogenous to the choice of the desired government goods. However, a hypothetical tax rebate can be treated as an endogenous variable through use of the tax rebate slide. The amount of the rebate would be what the typical household would receive if a given percentage of the agency's budget was taken away and returned to the private sector. By using the rebate slides, the people being interviewed could relate their preferences for the potential government goods to their demand for for privately-purchased market goods. Thus the commodity set considered by the respondents would include both public and private goods and aggregation of the responses would correspond to a Marshallian type of horizontal summation.

The most simple of all aggregation criteria is the democratic principle of assigning each response an equal weight. This criterion seems appropriate for goods supplied by a public agency and paid for from tax revenues. One-person-one-vote aggregation is implicit in the interview device illustrated in Figure 1. Solution to the agency's planning problem can be found for either type of aggregation, however, by maximizing the sum of satisfied slide settings while remaining within the total budget. Derivation of the optimum plan for the Maryland Park Service was done with a simple linear program; other ways of doing the optimization are, or course, readily available. The end result is an optimum "mix" of levels of goods which solves the agency's planning problem and maximizes the satisfaction of a representative sample of the people for which the government good is provided.

Benefits or Budgets: A Comparison

The promise of a budget-oriented method depends in the end on how it compares to the various benefit-cost approaches. The managerial simulation survey is budget-oriented but it is also specific to the planning problem delineated earlier, hence a comparison between it and a benefit-cost analysis will be limited to the context of the economic choice problem. In this context, the comparison can best be drawn with reference to a three-dimensional commodity trade-off diagram, (See Figure 2). Two of the principal axes of the diagram would represent quantities of potential government goods. A solution to the planning problem would correspond to a point in this G_1 G_2 space. Introduction of benefit values into the diagram involves the introduction of a third orthogonal axis C. This third dimension is necessary because benefits are

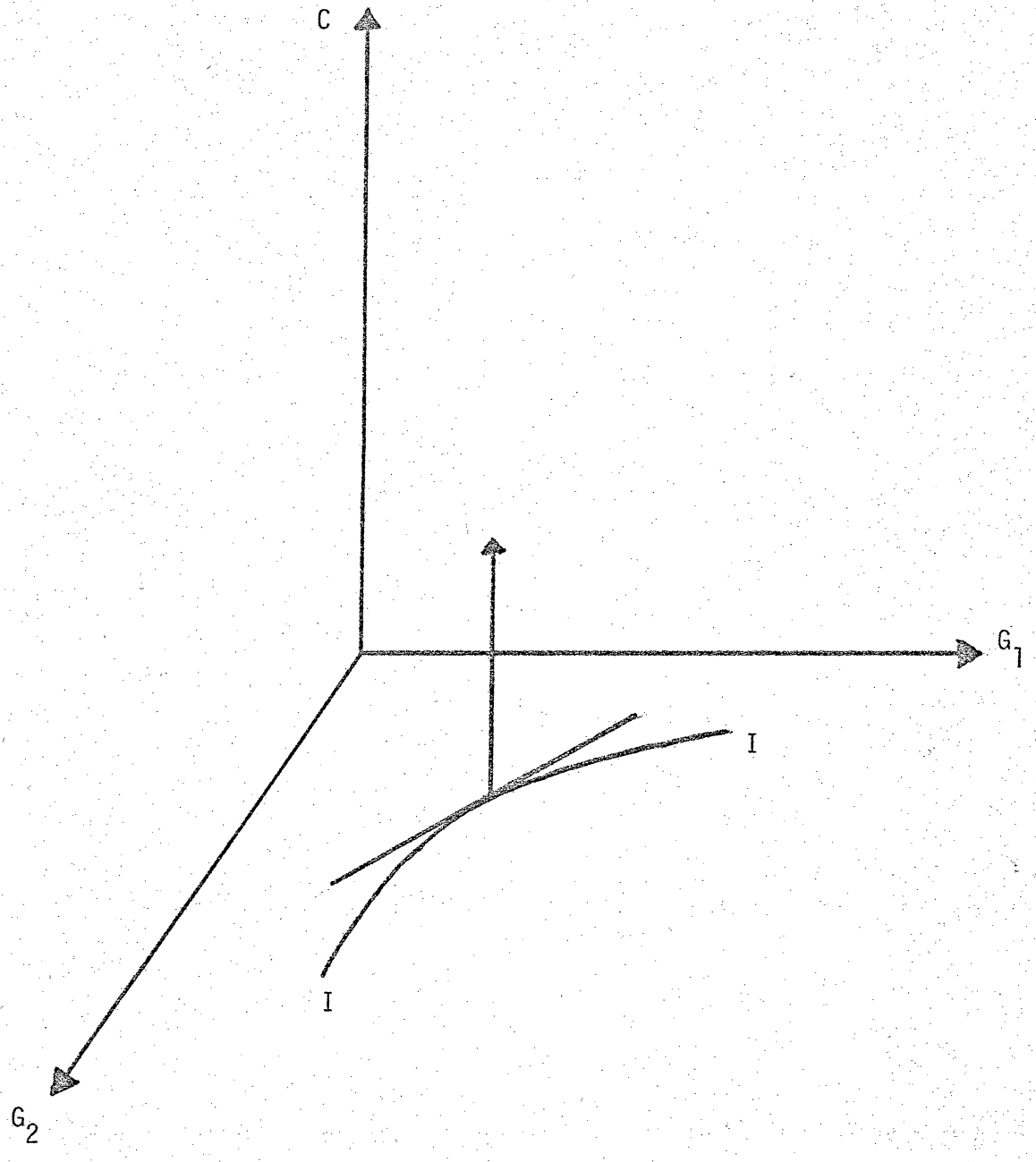

Figure 2: Commodity Trade-off Diagram

willingness-to-pay measures that are ultimately expressed in terms of foregone private purchases. Thus, a potential government good is valued not in terms of other government goods but rather in terms of a set of private or market goods. The third axis would have to measure this set of private goods if benefit values are to be included in the diagram.

Indirect user-demand approaches to the measurement of benefits, such as the travel cost technique, are affected by variance-of-axis problems when considered from the diagram's point of view. If the two benefit measures for the government goods are generated by different groups of people, or are taken at different times or in different places, private incomes are not likely to stay constant. As Seckler has noted, variation in income levels between users will affect benefit measures. Futhermore, the likelihood is small that the two groups of users involved in the determination of benefits for G_1 and G_2 would have the same universe of private goods in mind or that they would have experienced similar changes in the supplies of market goods available to them. Thus, each of the indirectly-determined benefit values is most probably based on a unique set of private commodities. This would mean that the scale of the third axis would vary as the different government goods were considered, making comparison of benefits difficult to accomplish.

A second variance-of-axis problem also occurrs when benefits are measured indirectly. Indirect benefit measures are actually computed for existing government goods and are then transferred to the potential goods when such values are needed in the planning process.[7] Some error will always be inherent in this transfer; if for no other reason, the carrying out of the plan will increase the number of existing goods and so decrease the marginal value of each competing unit.

The significance of the transfer error will depend primarily on the heterogeneity between the actual and potential goods, however. This heterogeneity problem can be interpreted in the framework of the diagram as an ambiguity in the definition of the G_1 and G_2 axes.

Two alternate methods of measuring benefits which avoid the variance-of-axis problems have recently been reported. One of these is the bidding game method developed by Davis and applied by Randall, Ives and Eastman. The other is Sinden's application of the Ramsey utility estimation model. Both applications involve surveys in which direct willingness-to-pay questions are asked. Moreover, the two studies are almost symmetrically opposed when viewed in the context of the planning problem. The bidding game deals directly with potential government goods but it does not explicitly consider trade offs between those goods. The Sinden study explicitly derives indifference curves but they are between existing rather than planne public goods. Thus neither of the two techniques are immediately applicable to the planning problem, but both appear readily adaptable into a kind of benefit-cost method which would be highly appropriate to the problem under consideration.

In the bidding game, the potential government good is directly defined to the survey respondent. Any ambiguity as to the meaning of the G_1 and G_2 axes in the conceptual diagram is consequently avoided. However, this way of avoiding the transfer-of-benefit problem between actual and planned goods means that respondents must give hypothetical answers about their preferences for the government good. The ability of the individual to respond accurately in such a situation depends on the person's prior experience, on how well the good is defined, and on the clarity of the role which the individual is expected to assume (Randall, Et. Al., p. 136). Hoinville believes this accuracy must ultimately be studied by correlating people's responses to their actual behavior (p. 48). As of yet, little is known about the magnitude of the error intrinsic in the response to hypothetical

questions or about the error inherent in the transfer of benefits from actual to potential goods.

If one were to picture an indifference curve in the G_1 G_2 space of the commodity trade-off diagram (curve II in Figure 2), the bidding game solution would correspond to a movement along a vertical arrow emerging from a point on the indifference curve and lying parallel to the private goods axis C. This is because the trade-off in the bidding game, at least as applied by Randall and co-workers, is strictly between a particular government good and the set of private goods. An obvious extension of the bidding game approach to the planning problem would involve a repetition of games involving first one government good and then the other. A "marginal rate of substitution" between the two government goods could then be derived as a ratio of marginal changes in the two bids in the same way a marginal rate of substitution is computed as a ratio of marginal utilities in indiffenence curve analysis. Such an extension would avoid a change of scale in the private goods axis and would consequently be free of all variance-of-axis problems.

The most noteworthy aspect of Sinden's study from the point of view of the planning problem is the explicit derivation of preference trade-offs between public goods. These trade-offs are a direct result of the application of the Ramsey utility estimation model to the study of public goods and, depending on how one classifies the Priority Evaluator technique, may be the only example of such relationships resulting from a benefit-cost study. The utility model can be put into the context of the trade-off diagram by converting utility into monetary terms. Sinden demonstrates how to make this conversion, as well as how to derive indifference curves between two government goods. Thus the utility estimation technique actually does what the bidding game technique might be extended to do. But utility estimation has only been done for existing goods and consequently can be directly applied to the planning problem only

if a transfer error is incurred. Potential goods could be inserted in the place of the actual goods in the Ramsey model to eliminate this error, but doing so might affect people's ability to solve the model. Consequently, use of the Sinden model for the planning problem has to be considered a promising possibility rather than a tried technique.

The bidding game and the utility maximization methods demonstrate that at least two benefit-cost techniques can bypass the definition-of-axis problem and yield preference trade-offs. But one difficulty still remains. Since the preference trade-offs are determined without reference to the agency's budget, they may represent the slope of the wrong indifference curve. This point was illustrated in the Maryland Park study by the inclusion in the interview device of a resort complex complete with an 18 hole golf course. The cost of the complex was estimated to be one-half of the Park Service's capital budget. When people were asked to choose the set of goods which the Park Service should provide, and they were not constrained by a budget, resorts often appeared in the chosen purchase set. When the same people were forced to stay within the total budget, very few resorts were included. Thus, just as an individual may prefer a Cadillac but buy a Ford, the amount of other government goods given up in order to get a particular public good can have a definite effect on people's preferences. For this reason, if no other, the budget-oriented methods compare well with the benefit-oriented solutions to the planning problem.

Footnotes

1/ Contribution Number 5097 of the Maryland Agricultural Experiment Station. The authors wish to acknowledge the excellent assistance given by Aldo Matteucci and Richard Marasco during the preparation of this paper.

2/ It should be noted that legislative bodies with the power of taxation do not fit the defined public planning problem as well as agencies in the executive branches of government. Tax revenue would have to be treated as a prior-specified parameter in order for the stated problem to apply to these legislatures.

3/ A more pragmatic concern is the 40 minutes (Pendse and Wyckoff) required to conduct an interview with the Priority Evaluator technique. Interviews would need to be significantly shorter in most field surveys, especially if the information is to be collected outside the home. In a recent managerial simulation survey, the average interview required 7-10 minutes.

4/ This study is described in Mr. Kirkley's Master's thesis. It will also be published in a forthcoming Agricultural Experiment Station Bulletin.

5/ For example, the title on the board -- Help Plan Your Parks -- suggests the role of a manager with selfish ends. The word "help" releases the respondent from the necessity of planning a park for all of the other park users.

6/ The term "park" was used in the written descriptions of the alternative goods instead of "park improvements" or "units". Increasing numbers of the latter two items were associated in the minds of the respondents with increasing congestion. "Parks", on the other hand, suggested facilities that were located on spatially-dispersed sites.

7/ Much of the work on the indirect approach to the valuation of public goods has come from the widespread interest in the estimation of demand functions for outdoor recreation sites. As Kalter points out (pp. 15-16), "The construction of such a demand function is obviously impossible because the required data will not exist for a proposed site. Thus what is usually desired is sufficient data on existing facilities with characteristics and quality factors similar to those being proposed (Ullman and Volk, 1962). The demand relationships can then be estimated for such locations and inferences made about the proposed site, assuming the relationships don't change over time or between sites and that the relevant socio-economic variables can be projected for use with coefficients derived from past experience (Clawson and Knetsch, 1966, p. 62 and Ch. 1)."

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