A CALCULUS OF EFFICIENCY FOR PUBLIC GOODS: THE CASE OF PUBLIC OUTDOOR RECREATION

by

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ABSTRACT

Title of Thesis: A Calculus of Efficiency for Public Goods: The Case of Public Outdoor Recreation

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The characteristics of public outdoor recreation as a public good are ascertained. A cost-benefit analysis is applied which ensures efficiency, while allowing for the pecuniary and technological externalities that exist in the development of outdoor recreation resorts.

A total willingness to pay technique is utilized to approximate the consumer's valuation of benefits from recreation. Essential to the technique is the derivation of total willingness to pay curve which parallels the demand curve for private goods. Total willingness to pay is used instead of consumer's surplus, because the latter is associated with a market price which is not determined for public outdoor recreation.

Since the total willingness to pay curve is a function of income distribution, once derived, the curve can be adjusted to rid the analysis of income distribution bias. The adjustment helps achieve equity in the allocation of recreational resorts.

Fort Frederick State Park provided a case of application for the technique. A sample survey conducted in the Fort was the basis for the

derivation of a total willingness to pay curve. The curve shows the relation between expenditures incurred, in time and money, to visits at Fort Frederick. The rates of growth for expenditures, income and population were the basis for the simulation of the total willingness to pay up to the year 2000. Integration of the areas under the simulated demand curves was an approximation of the future willingness to pay or benefits derived from recreational experience at the Fort.

After dividing the discounted value of benefits by the estimated costs of developing the Fort, a benefit-cost ratio was obtained, which was a quantitative endorsement in favor of the development of Fort Frederick.

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Gulalay, my wife, and my parents have made contributions whose calculations I will not attempt.

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CHAPTER I

INTRODUCTION

The economics of recreation[1] is the economics of leisure time. Whereas economics so far has concerned itself with that aspect of time in which man is productive, the economics of recreation will study man at his leisure. It is important to ponder the reasons which have made recreation a subject for study in economics. One reason could be the scarcity as evidenced both in time and the recreational facilities available. When man was living in the wilderness, both time and space in which he could roam were free goods and as such economics had nothing to contribute.

Although the rise in productivity has increased leisure time, the number of activities that one can engage in have also risen by leaps and bounds. Leisure is a scarcity in abundance. Today's urban dweller can scarcely find either the time or the space in which to spend that time. It is safe to say that man was pressed for time before he was pressed for space. The outcome of this lag in the scarcity of the two factors in the field of economics can perhaps be seen in the fact that the concept of opportunity cost of labor has been with us a little longer than the available tools in the area of economics of recreation.

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[1] Recreation, here, means outdoor recreation.

Another reason giving rise to the study of leisure and recreation can perhaps be found in the fact that much of today's working environment is divorced of both the environmental calm and temporal serenity that were associated with working conditions of less technical intensity. An agrarian society is less tense because work is mixed with leisure and also the environment is conducive to recreating. Today, the division of labor, as intense as it is, has compelled man to seek recreation in its own right, and economics, with a usual lag in response, has turned to study it as a subject.

Whereas the Greeks prized creativity and considered the devotion of leisure time to intellectual contemplation as the ultimate good,[2] modern man takes refuge into leisure and recreation from all that surrounds him including intellectual contemplation. The economics of recreation has the full backing of this reorientation in outlook.

The Problem

Although the development of most of the state parks took place in the 1930's, recently there has been a resurgence of interest in the development of forests and parks. Whereas in the 1930's, the main purpose in the development of recreational facilities was to increase

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[2]Robert J. Daiute, "Methods for Determination of Demand for Outdoor Recreation," Land Economics, (August, 1966).

employment, today's efforts stem from the plight of urban congestion, a concern for ecological equilibrium, and the preservation of historic and scenic sights, all of which are of an aesthetic nature.

The availability of funds, for the purposes intended, however, does not guaranteee their optimal and equitable allocation. Hence, the need for an economic evaluation of recreational projects becomes urgent. Such analysis must pass the test of efficiency and be amenable to the bio-psychological urge for which recreation is needed.

Objectives

With these remarks about recreation in mind, and especially considering the greater importance of recreation in society as technology and specialization increase, and as income, population pressure, and lesiure time also increase, the objectives of this study are:

(1) To ascertain the attributes of outdoor recreation as a public good.

(2) To explore the causes of market failure in outdoor recreation. And as a corollary to show the ineffectiveness of fees as a rationing device in the use of recreational facilities.

(3) To develop a method of analysis for the assessment of recreation as a public good.

   (a) To discern the internal and external costs and benefits associated with outdoor recreation.

   (b) To evaluate those benefits and costs.

(c) To elaborate on the relation of efficiency to equity in developing public outdoor recreation resorts.

(d) To quantify the relations between population and income on the use of recreational facilities.

(4) To analyze Fort Frederick State Park as a recreational resort as an example of the application of the methods developed.

Methodology

This study is divided into three phases: The theoretical, the analytical and the applied phase.

The theoretical phase is largely an attempt to level the grounds on which outdoor recreation will be seen as a public good, with the implication that public decision making should prevail over those arrived at through the market. To achieve that purpose the literature on externalities or public goods is brought to bear upon the nature of outdoor recreation.

The analytical phase is an exploration of cost-benefit analysis through the use of consumer's surplus and the total willingness to pay in an effort to achieve efficiency in the production of public goods at large, and in recreation goods in particular.

The applied part is an analysis of Fort Frederick as a public recreation resort. Through the use of a sample survey and attendance data which were available, a demand curve, or better called a total

willingness to pay curve, is derived for the use of Fort Frederick. The area under the curve is integrated to see whether the expenditures by the users exceeds the cost incurred in the development of the fort. Finally, some suggestions are offered for achieving equity in addition to efficiency in planning for recreation.

CHAPTER II

PUBLIC GOODS AND THE MARKET FAILURE IN THEIR EVALUATION

Introduction: The Dichotomy of Private and Public Goods

The essence of the controversy of private goods versus public goods, is to define the area of public responsibility in the economic life of a community. Public goods are produced and distributed through political institutions. It is the market that bears the task of production and exchange of private goods. Our predictions about the supply and demand for private goods are close approximations of reality only to the extent to which the assumptions made about the underlying market structure are correct. In the analysis of public goods, however, a market structure does not exist. Since public goods, as the name indicates, entail concern for a large number, each merits a separate study on its own rights.

The public good that is the aim of this study is public outdoor recreation. This Chapter is to establish the basis on which outdoor recreation is a public good. As such the Chapter is not an in depth study of the theory of public goods. The more specific objective of the Chapter is to unravel the implications of categorizing recreation as a public good on the method of analysis that is pursued for the evaluation of recreation.

Before analyzing the nature of public goods, however, let us look at the evolution of thought with regard to theorizing on public goods.

The field of economics is replete with the analysis of markets and theories of supply and demand for private goods. Public goods, on the other hand, have received less attention at the theoretical level. In fact it was the European writers who had taken the initiative in the theoretical analysis of the public goods.[1] Perhaps this theoretical lead by the European authors is predicated by the socialization of many industries that have taken place in Europe.

Among the American writers who have taken up the task of theorizing about public goods, two views are discernible:

(1) The view that public goods are a case of market failure and as such requires collective intervention.[2]

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[1]Allen Peacock and R.A. Musgrave, ed., Classics in the Theory of Public Finance, (London: Macmillan, 1958).

[2]The proponents of this view include Paul A. Samuelson. See his three essays entitled, "The Pure Theory of Public Expenditures", "Diagramatic Exposition of a Theory of Public Expenditures," and "Aspects of Public Expenditure Theories," in The Collected Scientific Papers, ed. by Joseph E. Stiglitz, II (Cambridge, Massachusetts: The M.I.T. Press, 1966), 1223-1239,; another proponent of this view is Mancur Olson, Jr. See his The Logic of Collective Action, (Cambridge, Massachusetts: Harvard University Press, 1965), and Mancur Olson, Jr., and Richard Zeckhauser, "The Efficient Production of External Economies," American Economic Review, (June, 1970). The theme of market failure in the presence of externalities and the need for collective action in the face of externalities is recurrent in the three articles by Samuelson and the ones written by Olson. A passage from the last article by Olson which reflects the notion of this recurrent theme is quoted, which can be advantageously compared with that of footnote 3.

Continued on next page.

(2) The view that the existence of public goods does not call for collective action and that the market can still be entrusted with the task of allocation of resources.[3]

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[2]Continued. "Thus, whether external economies or external diseconomies are at issue, independent market adjustments will in general be inefficient in two distinct ways, only one of which has been properly understood. When there are externalities of either kind, it will not only be true that independent adjustment in a free market will lead to production at a level that is not Pareto optimal, but also that the method of production of the external economy or the effort to combat the external diseconomy will in general be inefficient. In other words, the location of the needed efforts will not be in accord with the principles of comparative advantage. It follows that, contrary to the impression created by the recent literature, what we have is a new idea about how resources should be allocated in the presence of externalities, and an additional argument for collective intervention in markets with externalities."

[3]For a support of this view see: James M. Buchanan and M. Kafoglis, "A Note on Public Goods Supply," American Economic Review, (June, 1963). In addition, see the following three articles: James M. Buchanan and William Craig Stubblebine, "Externality," Economica, (November, 1962); Richard Coase, "The Problem of Social Cost," Journal of Law and Economics, (October, 1960); and O.A. Davis and A. Whinston, "Externalities, Welfare and the Theory of Games," Journal of Political Economy, (June, 1962). All three articles are summarized by Ralph Turvey in "On the Divergence Between Social and Private Cost," Economica, (August, 1963). Turvey summarizes the main conclusions of those articles as follows:

"The first is that if the party imposing external diseconomies and the party suffering them are able and willing to negotiate to their mutual advantage, state intervention is unnecessary to secure optimum resource allocation." i.e., imposing a tax is unnecessary.

"The second is that the imposition of a tax upon the party imposing external diseconomies can be a very complicated matter, even in principle, so that the a priori prescription of such a tax is unwise."

Toward Defining Public Goods

In the absence of a concrete definition, insight can be gained by looking at the controversies that have surrounded the attempts to define public goods.

Samuelson in his first article[4] on public goods defined "collective consumption goods" as those "which all enjoy in common in the sense that each individual's consumption of such a good leads to no subtraction from any other individual's consumption of that good." In mathematical notation (consistent with his second article)[5] X_2, a collective consumption good is defined as:

$$X_2 = {}^{1}X_2 = {}^{2}X_2$$

where superscripts 1 and 2 stand for the two consumers of the collective good.

A "private consumption" good is defined as that "which can be parcelled out among different individuals . . . according to the relations,"

$$X_1 = {}^{1}X_1 + {}^{2}X_1$$

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[4] Paul Samuelson, "The Pure Theory of Public Expenditures," Review of Economics and Statistics, (November, 1954).

[5] _____, "Diagramatic Exposition of a Theory of Public Expenditures," Review of Economics and Statistics, (November, 1955).

where the subscripts stand for the private good and the superscripts indicate the individual consumers.[6]

Although Samuelson's original formulation is of enough generality to encompass both the production and the consumption side of public goods, his further elaboration has been limited to the consumption side only.

Samuelson's definition of public goods, however, is rather rigid. Critics were fast to draw attention to the rigidity of his definition. The gist of their criticism is best summarized by Samuelson himself:

> "Is it factually true that most--or any!--of the functions of government can be properly fitted into your extreme category of public good? Can education, the courts, public defense, highway programs, police and fire protection be put into this rigid category of a public good available to all? In practically everyone of these cases isn't there an element of variability in the benefit that can go to one citizen at the expense of some other citizens?"[7]

To this criticism he "fully agrees," but does not allow the critics to draw their proper conclusions from his concession. In his words:

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[6] A remarkable duality, noted by Samuelson, about the two goods is the following: "Private goods whose totals add--such as $X_1 = X_1^1 + X_1^2$ --lead ultimately to the marginal conditions of simultaneous equality--such as $MC = MRS^1 = MRS^2$. Public goods whose totals satisfy a relation of simultaneous equality--such as $X_2 = X_2^1 = X_2^2$ lead ultimately to the marginal conditions that add--such as $MC = MRS^1 + MRS^2$." op. cit., 1955.

[7] op. cit., 1955.

> "However, to say that a thing is not located at the South Pole does not logically place it at the North Pole. To deny that most public functions fit into my extreme definition of a public good is not to grant that they satisfy the logically equally-- extreme category of a private good. To say that your absence at a concert may contribute to my enjoyment is not to say that the elements of public services can be put into homogeneous additive packages capable of being optimally handled by the ordinary market calculus."[8]

Between the North Pole and the South Pole the distance is immense; there is ample room for things to fall in. It is no wonder that in many of the writings externalities both in consumption and production, and goods that exhibit increasing returns to scale have not been distinguished from public goods.[9] Let us see if this lack of distinction which puts them all in one category is justified.

Externalities and Public Goods

As already indicated, some writers do not make a sharp distinction between the cases of externalities and the public goods. As a matter of fact the term "public bad" and external diseconomies are used synonymously. Indeed, another definition of public good offered by Samuelson, namely that "any good with the property of entering into two or more person's preference functions simultaneously," very closely resemble the definition offered by Scitovsky for external economies in consumption.

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[8] Samuelson, 1955, op. cit.

[9] For example, in the following sentence from Olson, 1970, op. cit. "Consider a case in which there are two relevant alternative ways to produce a given external economy or collective good," p. 515.

> "The individual person's satisfaction may depend not only on the quantities of products he consumes and services he renders but also on the satisfaction of other persons."[10]

The difference between externalities and public goods (or bads) is one of degree rather than one of kind. It is the degree of externalities that determines the publicness of a good.

In the following two examples where the externalities are somewhat bucolic in nature public intervention may not be called for and the divergence between the social and private marginal costs may go unheeded: (1) Where a beekeeper and an apple grower are closely situated, the bees feed upon the essential apple nectar from the blossoms and subsequently produce honey. Thus, the production of honey not only involves the labor of the beekeeper but also the availability of apple blossoms and accordingly, the level of apple production. The production of an additional unit of apples may entail one more unit of labor and its cost will be the wage rate. Since an additional unit of apples entails more apple nectar, which goes in the production of honey, the wage rate is an understatement of the value of an additional unit of apples.[11] Or, (2) In the case of Salton Sea, in Southern California, a tremendous input of fertilizers from the many farms provide the fishery with a high level of nutrients.

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[10]Tibor Scitovsky, "The Two Concepts of External Economies," The Journal of Political Economy, (April, 1954).

[11]The example, originally offered by Meade, is given by C.E. Ferguson, Microeconomic Theory, (Homewood, Illinois: Richard D. Irwin, Inc., 1969), p. 462.

The farmers, in this case, pay for the fertilizer and the fishermen enjoy part of the benefit free of charge.[12]

On the other hand, when the degree of externalities may be technological, as in the case of smog and pollution (public bads), and/or the external effects are of importance to the society as in the case of elimination of syphillis or decreasing crimes by providing recreational facilities (to the extent that that correlation can be established),[13] then public intervention is called for on the grounds of those externalities. Thus, it is "the 'external effect' basic to the very notion of collective consumption goods,"[14] that calls for collective intervention.

Public Goods and Indivisibilities

Indivisibilities could occur either in consumption, or production, or perhaps in both.

The cases of production indivisibilities are also called increasing or decreasing returns to scale as opposed to a case where constant returns to scale might prevail. With increasing returns to scale, average cost declines over the relevant range. This is likely to lead via economic warfare, to monopoly and monopoly price. Even if the

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[12]Larry Tombaugh, "External Benefits of Natural Environments," in Recreation Symposium Proceedings, by Northeastern Forest Experiment Station, United States Department of Agriculture, Upper Darby, Pennsylvania, 1971, p. 73.

[13]More on this point in Chapters III and IV.

[14]Samuelson, op. cit., 1954, p. 389.

situation does not lead to monopoly it nonetheless leads to market failure.[15]

If indivisibilities occur in consumption, however, providing one more individual with the consumption of the good in question may cost zero. That is, MC does not exist, and the market failure repeats itself. Hence, providing one more person with the opportunity for outdoor recreation, or the opportunity to go to school, or to be protected against a foreign attack, or to benefit from viewing a landing on another planet, or the safety provided by police patrol of an area, etc., etc., are cases where the additional costs are zero.

Yet, in almost all of these cases "it is in the selfish interest of each person to give false signals, to pretend to have less interest in a given consumption activity than he really has."[16] Put differently, ever since Wicksell, it has been recognized that any attempt to get consumers to reveal their preference regarding public goods is bound to fail. That the rational thing for any individual consumer to do is to understate his demand, in the expectation that he would thereby be relieved of part or all of his share of the cost without affecting the quantity obtained.[17]

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[15]Ferguson, op. cit., p. 463. Also see Samuelson, op. cit., 1955, p. 335.

[16]Samuelson, 1954, op. cit., pp. 388-389.

[17]A.R. Prest and R. Turvey, "Cost-Benefit Analysis: A Survey," Vol. III of Surveys of Economic Theory by American Economic Association and Royal Economic Society, (3 volumes; London: Macmillan, 1966), p. 168.

The difference between separately marketable goods and such collective goods can be shown as in Figures 1 (a) and 1 (b).

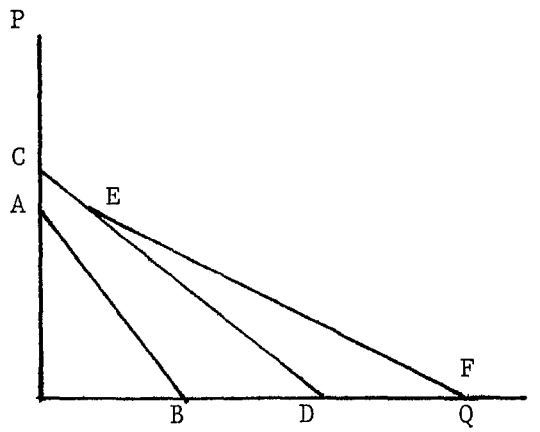

Figure 1(a). Private Goods

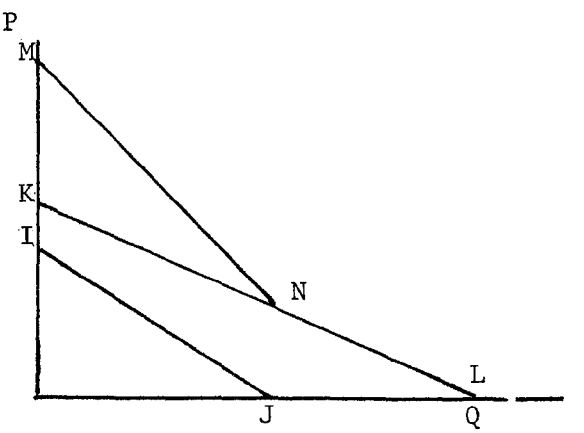

Figure 1(b). Public Goods

The aggregation of the individual demand curves is done by horizontal summation in case of private goods (AB + CD = CEF), the aggregation is obtained by vertical summation in the case of public goods (IJ + KL = MNL).

The vertical summation in the latter case reflects the fact that though individuals may differ in their marginal valuation of a given quantity of a commodity, they all consume the same amount, in that each unit is consumed by all of them.

In the case of private goods price is constant and the consumers differ in quantities they consume--total quantity is the sum of individual quantities. In the case of public goods quantity is constant and not subject to variation, it is logical for individual

preferences to be reflected in their marginal valuation, the sum total of which can be obtained by vertical summation of the demand curves.

The relevance of this discussion for our purpose is that where commodities are supplied at zero prices or at non-market clearing prices like in charging fees for entrance to a recreation resort, which bears no relationship to consumer preferences, the market fails to exist, let alone its failure to signal prices for arriving at investment decisions.

Criteria for Defining Public Goods: A Synthesis

Public goods are of varied nature. As has been seen, different causes account for their existence. Such being the case a set of criteria, can do a better job of distinguishing public goods than a concrete definition that is likely to leave out several categories as undefined. Yet the set of criteria, offered here, is by no means exhaustive. The categories of public goods is perhaps best left open-ended; for several of them have been added to the list recently, and who knows how the list will fare in the future.

a. The "non-exclusion" criterion: The meaning that a public good once provided, its use by one person does not interfere with its use by another person.

b. The "jointness in supply" criterion: meaning that the cost of providing the good for one additional person (MC) is zero.

c. The "merit want" criterion: meaning that the consumption of a good (or the avoidance of a bad) rests on the merits intrinsic in the good.

Up to the point of capacity limitation, the use of public outdoor facilities by one person does not "exclude" another party from enjoying its benefits. By the same token the cost of providing space for the inclusion of one more person in recreational activities is zero. In addition, the biological and psychological needs for recreation are indications of the merits in engaging in those activities.

All these reasons are compelling enough to heed public provisions for the availability of the recreation resorts.

The evaluation of public goods can be discussed briefly now that the basis for recognition of public goods has been established.

Evaluation of Public Goods: Consumer's Surplus Replaces Marginalism

As in establishing the causes of market failure in the case of public goods, the calculus of efficiency for private goods is also rendered obsolete for public goods. It is obvious that marginalism (MC = MR) has been the accepted criterion for achieving efficiency and maximizing utility at the same time. However, when indivisibilities and externalities prevail the use of the above

criterion is either inappropriate or impossible. As Myint[18] noted as far back as 1948, in such cases the consumer's surplus enables one to determine whether or not a particular good should be abandoned or a new one introduced. In a nutshell, economic analysis requires that marginalism to give way to consumer's surplus technique, in cases of public goods. The next Chapter is a detailed analysis of techniques for evaluating public goods.

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[18]See E.J. Mishan, "A Survey of Welfare Economics, 1939-59," in Volume I of Surveys of Economic Theory by the American Economic Association and Royal Economic Society, (3 volumes; London: Macmillan, 1966), pp. 195-196.

CHAPTER III

COST-BENEFIT ANALYSIS: A CALCULUS OF EFFICIENCY FOR PUBLIC GOODS

Introduction

This is the last of the theoretical chapters which are aimed at preparing the grounds for economic analysis of outdoor recreation.

Chapter II was a discussion of public goods and of the market failure in their efficient production and consumption. The present Chapter explores cost-benefit analysis as a technique for achieving efficiency in the production and consumption of public goods. The Chapter compares the nature of efficiency in private and public goods, discusses the enumeration and evaluation of costs and benefits, analyzes the question of criteria and the rate of discount, and finally explores the relation of consumer's surplus and option demand to cost-benefit analysis.

Efficiency Criteria in Private and Public Goods

In the production of a private good efficiency is achieved when the marginal cost of production is equated with the marginal revenue. Whereas MC reflects technical efficiency[1], the MR is a measure of individual preferences: hence, the idea that what is technically efficient should be humanly desirable is the theoretical rationale behind this

[1]Cost curves as the inverses of production curves, trace the path of maximum efficiency.

notion of efficiency. Thus, when individuals cast their dollar votes for the production of certain goods which satisfy their tastes, they have also decided upon the allocation of resources for production.

In the case of public goods equating MR and MC is impossible. The "jointness in supply" and the "non-exclusion" characteristics of public goods is another way of stating that for public goods MC and MR do not exist.[2] The need for another criterion for efficiency in the case of public goods is thus apparent.

The task of arriving at a concrete criterion for the evaluation of public good, however, is plagued by the inherent illusiveness of the concept of public goods.

The categories of goods included under this name are numerous. They include all the cases of market failure, and market fails for a variety of reasons. Thus, it is difficult to find common attributes, which are essential for purposes of analysis, among the goods whose existence is due to varied reasons.[3] The two attributes of "jointness in supply" and "non-exclusion" are good enough for distinguishing public goods, but do not help in their analysis.

The application of a concrete criterion of efficiency for goods which are of such an illusive nature is logically inconsistent. It is only logical that the criterion should vary as the characteristics of the goods change. A case by case study of public goods is not only

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[2]This point is elaborated upon in Chapter II.

[3]See Chapter II.

palatable on this ground but also on the grounds that the benefits from them inure to a wide class of individuals.

Cost-benefit analysis as a technique for evaluation is well suited for the assessment of public goods. The technique shares the same illusive nature as is attributable to public goods. There are as many cost-benefit analyses as there are applications of the technique.

In economic evaluation of public goods, it is important that one takes a long view, in the sense of looking at repercussions in the farther as well as nearer future and a wide view, in the sense of allowing for side effects of many kinds. Put differently, one must enumerate and evaluate all relevant costs and benefits in the case of public goods. The technique that performs this task of enumeration and evaluation of costs and benefits, in an exhaustive manner, is called cost-benefit analysis. It differs from the profitability criterion used for the assessment of private goods by entrepreneurs only in this exhaustive sense. The entrepreneur goes about the enumeration and evaluation of his business venture in a selective manner. True to his pursuit of cost minimization, he not only tries to minimize the cost in quantity but also in categories. For example, safety standards and devices which will decrease harmful emissions in automobiles, are two categories of costs that have been avoided by the car industry. This calculus of efficiency for public goods, cost-benefit analysis, attempts to minimize the cost by evaluating the alternatives, and not by neglecting certain categories of costs.

Speaking differently, while decision rules of the theory of the firm aim at profit maximization, decision rules of benefit-cost analysis

seek to maximize "public benefits" or "general welfare" within the area of responsibility. Because of this exhaustive search for costs and benefits, in the area of public resource development there is no substitute for cost-benefit as a technique of analysis.[4]

Another important difference between cost-benefit analysis and the profitability calculation of a private entrepreneur is that the entrepreneur actually sells the output and buys the inputs in the market. Therefore those who receive the benefits of the investment actually pay the costs incurred. On the other hand, the general cost-benefit approach does not require that the beneficiaries pay any or all of the costs. In cost-benefit analysis, so long as the benefits incurred are greater than the costs, it is of minor importance as to who the recipients of the benefits are or who bears the cost.

Measuring of Benefits and Costs

Generally costs and benefits are divided into four categories: (1) Primary benefits and costs, (2) Secondary benefits and costs, (3) Externalities, and (4) Intangible benefits and costs. These four categories of benefits and costs are not as distinct as they appear to be. For example, the line drawn between intangibles and externalities is not very clear. Nor is the distinction between primary and secondary benefits (or costs) very obvious.

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[4]S.V. Ciriacy-Wantrup, "Philosophy and Objectives of Watershed Development," in Economics and Public Policy in Water Resource Development, ed. by Stephen C. Smith and Emery N. Castle, (Iowa State University Press, 1965).

Externalities can in turn be divided into two groups of real and pecuniary. Externalities are considered real when they result in shifts in production possibility curves. Pecuniary externalities give rise to side-effects via prices of products and factors. In essence pecuniary externalities result in shifts in costs and revenue curves. A few examples will suffice to clarify these definitions. Zvi Griliches estimated the social rate of return on hybrid corn to be 700 percent.[5] However, as he is the first one to point out, the hybrid corn has had external effect on the development of hybrid sorghum and hybrid poultry. These effects were probably felt in two ways: (1) the research in hybrid corn, provided short cuts which resulted in reducing the time span in which the research in sorghum and poultry bore fruit, (2) the spectacular success of hybrid corn helped reduce farmer's resistance to new technology and thus accelerated the rate of production of those crops. In technical language, one can say that the development of hybrid corn caused shifts in the production possibility curves for sorghum and poultry. Those shifts are examples in real external economies.

An example of real external diseconomies is when construction of a reservoir by the upstream authority of a river basin necessitates more dredging by the down stream authority. An example of pecuniary external economies would be when the improvement of a road leads to greater profitability of the garages and restaurants on the road, employment of more labor by them, higher rent payments to the relevant landlords,

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[5]Zvi Griliches, Research Costs and Social Returns: Hybrid Corn and Related Innovations," The Journal of Political Economy (Oct. 1958), pp. 419-431.

etc.[6] The effect of the first kind (technical) is real, the effect of the second type is of a distributional and transfer nature. On the above grounds, real externalities should be included and the pecuniary should be excluded from the calculation in cost-benefit analysis.

A needed modification in these generalizations about the exclusion of pecuniary benefits and costs is when there is unemployment. In a situation of unemployment the benefits occuring to the unemployed resources cannot be considered merely distributional. When an increase in employment is not at a cost of reduction of employment elsewhere, the gain in employment should be included in the benefits.

The distinction between primary and secondary benefits or costs is not very clear either. Arthur Mass [7] has perhaps made the best analytical distinction between primary and secondary benefits. To him the word benefit (and the word cost) has no meaning in itself, but only in association with an objective; and the objectives are either economic efficiency or objectives other than economic efficiency. The benefits (and costs) associated with economic efficiency are primary and those associated with other than economic efficiency are secondary.

The use of an example will best illustrate the meaning of primary and secondary costs and benefits. In the case of irrigation

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[6] A. Prest and Ralph Turvey, "Cost-Benefit Analysis: A Survey," Surveys of Economic Theory, Vol. III by American Economic Association and Royal Economic Soc. (London: MacMillan, 1966). p. 160.

[7] Arthur Maass, "Benefit-Cost Analysis: Its Relevance to Public Investment Decisions," Quarterly Journal of Economics, (May, 1966), 208-209.

water the primary benefit is the value obtained by working out what the water is worth to farmers as the excess of the value of the increased output which the irrigation makes possible. The primary cost is the cost of the dam in terms of land, labor, capital and raw material, plus the cost of all the farmers' increased inputs. The secondary benefits may include the increase in employment (assuming that unemployment exists prior to the project's construction). The secondary cost is any medical or training cost that might be needed in order to make the labor force employable. Those who are in favor of strict economic efficiency as an objective will exclude the secondary benefits and costs from their calculation in cost-benefit analysis. Ciriacy-Wantrup, and Prest and Turvey[9] are in favor of their exclusion. Arthur Maass[10] is in favor of their inclusion. The author finds it hard to find arguments in favor of economic efficiency as the sole objective in project evaluation.

Enumeration of Benefits and Costs

Cost-benefit analysts agree that purely pecuniary benefits should not be allowed for, but that all others (internal or external, direct or indirect, tangible or intangible) should ideally be included.[11] The next important question is how should they be measured? At this point Musgrave's distinction between the intermediate social good (a

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[8] op. cit., page 19.

[9] op. cit., page 161.

[10] op. cit., page 211

[11] Prest and Turvey, op. cit.

good which enters into the production of further output), and final social goods (which is ready for consumption) is of assistance in differentiating the cases that are measurable from the ones that are not.[12]

It was noted in Chapter II that in the case of social goods since their use by any one consumer does not interfere with that by another--that is, they are non rivals in consumption, it would be inefficient to make consumption contingent on price payment, even where exclusion could be readily applied. Thus, entrance fees are inappropriate for an uncrowded park--people will pay the fee and still come in large numbers. The fact that exclusion cannot be frequently applied, or at great cost only, further strengthens the conclusion that the auction system of the market is not available to evaluate the benefits. A political process is needed, and this involves tax and expenditure determination through the voting system.

Such is the case for social goods of the final or consumer goods type, some examples of which are public parks and other recreational resorts, or the T.V. spectacle of moon-landing. In all the cases of final public goods, the costs can be measured but the benefits will have to be stipulated. This stipulation of benefit will differ from one good to another. In the case of outdoor recreation, the stipulation of benefits is carried out by measuring the cost of the complementary private goods, one component of which is travel cost. This problem is specifically

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[12]Richard A. Musgrave, "Cost-Benefit Analysis and the Theory of Public Finance," Journal of Economic Literature, (September, 1969), p. 800. This section has greatly benefitted from Musgrave's article.

dealt with in the final chapters of this study. Even if the evaluation of benefits is arbitrary--when all methods of evaluation fail--it is still better than no evaluation. The analysis may provide a test for how high evaluation must be to justify the outlay.

In the case of intermediate public goods, goods that go into the production of other public or private goods, however, the situation is more manageable. Here, usually the benefits are reflected in price change, or are made calculable with reference to price. Thus, the benefits from the development of hybrid seeds[13] and the benefits from irrigation may be measured in terms of increased agricultural output; flood control results in cost-saving since damage to capital assets or resources is avoided;[14] better roads reduce automotive costs and save trucking time, which can be valued;[15] public health measures reduce remedial care costs;[16] investment in education raises earning power,[17] and so forth.

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[13] An excellent example of cost-benefit analysis of investment in the development of hybrid corn is by Zvi Griliches, "Research Costs and Social Returns: Hybrid Corn and Related Innovation," The Journal of Political Economy, (October, 1958).

[14] John V. Krutilla, "An Economic Approach to Coping With Flood Damage," Water Resources Research, (Second Quarter, 1966).

[15] H. Mohring, "Land Values and the Measurement of Highway Benefits," Journal of Political Economy, (June, 1961).

[16] Herbert E. Klarman, "Syphilis Control Programs," in Measuring Benefits of Government Investment, ed. by Robert Dorfman (Washington, D.C.: Brookings Institute, 1963).

[17] B.A. Weisbrod, "Education and Investment in Human Capital," Journal of Political Economy, Supplement (October, 1962).

The intermediate social goods have the same characteristics of non-exclusion[19] as have the final goods. But the non-exclusion, here, pertains to producers rather than consumers. Since an intermediate public good enters the production of a final private good--the irrigation water is used by many farmers--the benefits of such a good can be measured in terms of the market price of this final private good. Because evaluation does not pose great problems in the case of intermediate social goods, their cost-benefit analysis has been most successful, some examples of which have already been cited.

Limitations of Cost-Benefit Analysis

Although cost-benefit analysis is best suited for the analysis of public goods, by necessity it draws upon a variety of traditional sections of economics whose subject of investigation has been mainly private goods. This reliance upon the traditional economics is heaviest in the case of final public goods where costs and benefits are arcane. The result is that cost-benefit analysis provides no substitute for the basic problem of evaluation in the case of final social goods. All it can do is to expedite efficient decision-making after the basic problem of evaluation is solved.

In a social investment it is quite possible for the costs to be borne by one group and the benefits enjoyed by another--social investment is often an instrument of income distribution. But cost-

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[19] Or non-rival, in Musgrave's terminology, op. cit.

benefit analysis as a calculus for that investment is incapable of measuring the costs and the benefits that are intrinsic in the redistribution. This blindness of cost-benefit analysis to income redistribution should be enough of a warning signal to the applicant. Otherwise what may be achieved by this instrument of efficiency may be totally undesirable because of inequity.

If investment decisions are large relative to a given economy, and the constellation of relative prices and outputs are likely to change as a result of them, the standard technique of cost-benefit analysis is likely to fail, and some general equilibrium technique would be more suitable. This shortcoming occurs because costs and profits are calculated on the basis of prevailing constellation of input and output prices. A change in the constellation of prices makes it virtually impossible, because of uncertainty, to attach values to costs and benefits. Thus, a project of the size of Aswan Dam is likely to have profound effect on the structure of prices, which makes it impossible for costs and benefits of the project to be measured.

Criteria in Cost-Benefit Analysis

An investment, be it private or social, yields its output through time. If the undertaking is a highway, the output is found by estimating the number of passenger-car miles, truck miles, and bus miles to be traveled on it in each year. If the investment is in public parks for recreational use, the output is the attendance that the park will receive on an annual basis, etc. In general, regardless of the nature of investment, there will be a time during which it will yield its fruits.

We have already discussed the problems concerning the evaluation of the yields and the costs that are associated with them. In this section our major task is how to compare the costs and benefits which occur over time.

Among the many criteria that have been proposed for evaluating the profitability of investment projects, the payback, the discounted present value and the internal rate of return will be discussed in this section.

The Payback, Payout, or Payoff Period

The payback period is a practical rule of thumb criterion, and because of this, it is widely used. However, it is the least acceptable of all the criteria by economists.

Payout period is the number of years which is required to accumulate earnings sufficient to cover the costs of a project. In the more sophisticated version, the costs and returns are discounted to find the payback period of a project.

The main shortcomings of this criterion lies in the fact that the earning capacity of an investment may far exceed its payoff period. Under this criterion, a short-lived investment with a short payoff period is preferable to an investment that has a longer payoff but at the same time a longer life.

In the less sophisticated version of this criterion, the time pattern of receipts and costs are not considered. A project with higher return in the beginning is not differentiated from one with lower returns during that period.

The Present Value Criterion

The present value criterion states that a project should be undertaken when the present value of its benefit stream is greater than the present value of its cost stream. Since the benefits and costs of an investment are spread over time, the use of present value makes comparable benefits and costs which accrue at different points in time. The process of discounting in the use of present value is a process of adjusting future benefits and costs in order to give them an appropriate weight before adding them up.

If $(b_1, b_2, \ldots, bn)$ is a stream of benefits and $(c_1, c_2, \ldots, c_n)$ represents a stream of costs, then their respective present values are as follows:

(1) Present Value of Benefits = $\sum_{t=0}^{n} \frac{b_t}{(1+i)^t}$ for t = 1, 2, ..., n.

(2) Present Value of Costs = $\sum_{t=0}^{n} \frac{c_t}{(1=i)^t}$ for t = 1, 2, ..., n.

In the above formulas i stands for discount rates and t indicates periods of time. Equation (1) reduces future benefits to their present worth, and equation (2) does the same thing to the costs. The amount to which future benefits and costs are reduced depends on two things, the rate of discount and how far into the future those values lie. A zero rate of discount implies equal weighting of benefits and costs through time. A positive discount rate implies that benefits and costs in future are weighted less than those occuring at present or

close to it. The larger the discount factor the greater will be the reduction in the streams of benefits and costs. A negative discount factor carries the obvious implication that the future benefits and costs are worth more than those of the present.[20]

The Internal Rate of Return

Criterion can best be stated in terms of its formula, using the same symbols as before:

$$\sum_{t=0}^{n} \frac{b_t}{(1+r)^t} = \sum_{t=0}^{n} \frac{c_t}{(1+r)^t} \qquad (3)$$

The internal rate of return r, has replaced i in equations (1) and (2), and is the only unknown in this formula. It is the rate of discount which equates the present value of the streams of benefits to that of costs.

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[20] We have mentioned all the three possibilities of the rate of discount (zero positive and negative) for the sake of logical continuity. In practice the rate of discount is positive. This practice is based upon two reasons, one of which is a value judgement and the other one is objective and conveys technical efficiency. (1) That present benefits are preferred to equal future benefits, especially if they are sufficiently removed in time, is a value judgement. (2) That a given investment must be compared with other investments also capable of yielding deferred benefits. If there exists an alternative investment capable of yielding a benefit of, say, 1.10 units of benefit a year hence for a present cost of 1 unit, then the given investment, to be justified, must be capable of yielding at least as much. This proposition is a straight-forward statement of technical efficiency and is independent of any value judgement as to time preference.

According to the internal rate of return criterion, a project is viable if its internal rate of return exceeds an appropriate rate of social discount.[21]

The internal rate of return measures the internal profitability of an investment,[22] and it is only by the condition that it should exceed an appropriate interest rate that it finds its linkage with the outside world, i.e., the capital market.

Sometimes, the internal rate of return is not differentiated from the marginal efficiency of investment or capital, and the two names are used synonymously.[23]

James Ramsey[24] distinguishes between the internal rate of return and the marginal efficiency of capital and traces their confusion to as far back as Keynes. According to Ramsey, in competitive equilibrium--when investment is pushed to the point where the marginal efficiency of capital equals the interest rate--the internal rate of return and the marginal efficiency of capital have the same value. But when firms are facing discrete investment projects--when investment cannot be pushed, except incidentally, to the point where the marginal efficiency of capital equals the interest rate--the marginal efficiency and the

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[21]The social rate of discount will be discussed in the following section.

[22]William J. Baumol, Economic Theory and Operations Analysis, Englewood Cliffs, New Jersey: Prentice Hall, 1965), p. 440.

[23]Ibid., pp. 439, 440, 441, etc.

[24]Ramsey, James B. "The Marginal Efficiency of Capital, the Internal Rate of Return, and Net Present Value: An Analysis of Investment Criteria," Journal of Political Economy, September/October, 1970.

internal rate will differ. This result is due to the fact that firms are unable to vary their level of investment expenditures continuously. Since cost-benefit analysis is a technique of evaluation in cases of other than competitive equilibrium, the marginal efficiency of capital is ruled out as an acceptable criterion.

Comparison of Present Value and Internal Rate of Return

The payoff period as a criterion completely lacks academic respectability.[25] Economists have not voiced a unanimous opinion on the remaining two, i.e., the present value and the internal rate of return. Baumol has called the internal rate of return a "contrived bit of flunmery,"[26] and Seagraves has come to its defense and against the use of present value criterion.[27] It must be stated, however, that the two criteria are not completely separate and with equal time span the ranking of projects with either of the two criteria amounts to the same thing.[28] That is the reason that no author, while favoring one, has rejected the other completely.

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[25] Turvey, op. cit., p. 93.

[26] Baumol, op. cit., p. 444.

[27] J. A. Seagraves, "More on the Social Rate of Discount," Quarterly Journal of Economics, (August, 1970), p. 435.

[28] James Ramsey, op. cit., p. 1017.

We have already seen that the internal rate of return is free from the choice of an interest rate but the present value is dependent upon the selection of an interest rate. This distinction has led Turvey to conclude, erroneously, however, that the internal rate of return "enables us to choose between investments without using a discount rate, either explicitly or implicitly. Hence the criterion is wrong so long as we continue to value an immediate gain more than an equal but more remote gain."[29] A look at the formula (3) for the internal rate of return will make it abundantly clear that discounting is involved in the process of finding the internal rate of return, only the rate of discount is chosen in such a way as to make "the present value of the series of annuities given by the returns expected from the capital-asset during its life just equal to its supply price."[30]

As we can see in the case of internal rate of return, the rate at which future costs and returns are discounted is not optional--is an unknown to be found--but the future costs and benefits are subject to discounting.

The argument favoring the use of present value rests on the following points:

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[29] Op. cit., p- 97.

[30] John Maynard Keynes, The General Theory of Employment, Interest and Money, (New York: Harcourt, Brace and World, Inc., 1964).

a. The equation for the internal rate of return is an nth degree polynomial and may have as many as n roots or solutions. The implication being that we may not end up with one internal rate of return but with n rates of return. This situation arises when some figures in the income stream are negative, i.e., losses have incurred. Many authors have tried to come up with a solution but as Seagraves, Ramsey and Baumol show, their attempts have been doomed to failure.

An illustration of this failure is provided by the following diagram. The abscissa in Figure 2 measures the rates of discount (i) and the ordinate measures the net present value (v).[31]

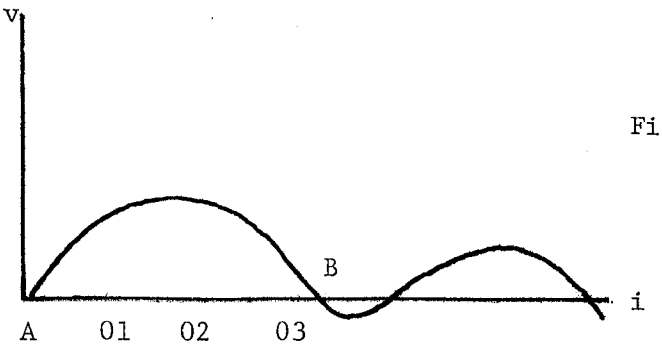

Figure 2.

The net present value curve has several points of intersection with the ordinate implying that there are several (not just one) rates of discount which equate the present value of stream of benefits and costs.

$$^{31}v = \sum_{t=0}^{n} \frac{b_t - c_t}{(1+i)^t} \quad \text{for } t = 0\ 1\ \ldots\ n$$

t is periods of time, b is benefits, c is cost and i is the discount rate.

b. The calculation of the internal rate of return rests on the assumption that all the flows of receipts are reinvested. Ralph Turvey[32] has likened the use of the internal rate of return to the realization of a "Stalinist maximand", where time preference and social discount rates are irrelevant and a grim determination sees to it that all the surpluses are ploughed back to ensure the realization of the largest stock of assets at the end of economic horizon. When it is not certain whether all the surpluses will be ploughed back, then the use of the internal rate of return is not justified.

c. In the case of mutually exclusive projects, the internal rate of return and the present value give conflicting answers. Figure 3 shows two mutually exclusive projects a and b. As before the abscissa shows rates of discount and the ordinate is the net discounted value of returns. At an interest rate of R percent, project a has a greater present value (RT is greater than RS), but project b has a greater internal rate of return (OB is greater than OA). If the objective is to increase the wealth of the enterprise then the greater present value does just that and project a is the one to choose.

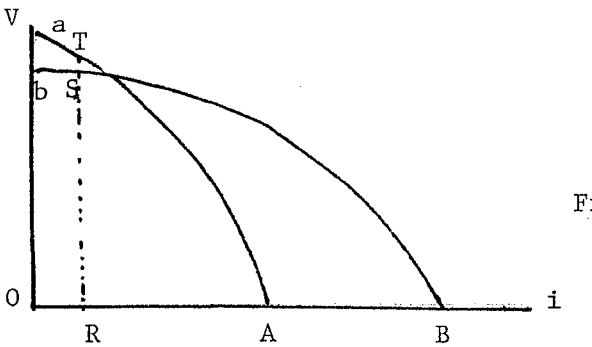

Figure 3.

[32] Turvey, op. cit., p. 96.

d. Where there are limitations to the borrowing ability, i.e., where capital is rationed, by definition there is not a unique rate of interest but several of them. In such a case the availability of more funds is conditioned upon the payment of higher interest. Since the application of the internal rate of return presupposes one rate of discount for comparison, the existence of several rates of discount makes the application of internal rate of return impossible. As for present value, Baumol has suggested the use of integer programming to counter the problem of multiplicity in the rates of discount.[33]

Problems Surrounding the Selection of a Discount Rate

An act of investment requires the allocation of current resources, which have alternative productive uses, to an activity whose benefits will accrue in the future. To add up the benefits, one must establish rates of exchange between benefits at different times, that is, weights to be assigned to the benefits before adding them together. The same procedure must be followed for costs.

We have already noted the reasons behind the establishment of such rates of exchange. The brief discussion here is on whether these rates of discount or exchange should be different for private goods versus public goods. Put differently, what is the difference between the social and private time preference?

Pigou in his The Economics of Welfare[34] was the first one to claim a difference between the private and social time preference, and

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[33] op. cit., pp. 448-453.

[34] (London: Macmillan, 1932), pp. 24-30.

attribute the difference to the "defective telescopic faculty" on the part of the individuals. This deficiency in foresight will result in inadequate provisions for the welfare of unborn generations. The up-shot of this line of argument is that social rate of discount must be smaller than the private rate of discount.

As a corollary to this line of reasoning, social discrimination and the cries of the minorities can be interpreted as having resulted from the lack of foresight on the part of past generations. Thus, many remedial investments like urban renewal, the establishment of educational institutions for Blacks or Indians, low cost housing, etc., can be discounted at smaller rates of discounts, than the one used in similar investments for affluent Whites or other social investments which are not of remedial nature.

The opposite view that there ought to be no difference between the social and private time preference is expressed by many. William Baumol, after a change of heart,[35] has joined Marglin Eckstein and Tullock in arguing that an increase in investment constitutes a redistribution of income from present to future generations. They further argue, that this redistribution has had the opposite result of what might be called a Robin Hood effect; it has taken from the poor and given to the rich. Simply stated, their argument can be concluded as saying: "Why should I give up part of my income to help support someone else with an income several times my own."[36]

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[35]William J. Baumol, "On the Social Rate of Discount," American Economic Review, September, 1968, p. 799.

[36]Ibid., p. 800.

It is true that an act of investment involves a redistribution of income from present to future generations, but among the future generation some receive a lions share of this income and some none. In other words, the present inequities in the distribution of income are perpetuated, and at times even worsened, by this intragenerational transfer of income. If the judgement that inequities call for remedial actions is accepted, then the case is made for the application of a lower rate of discount in investments which are of remedial nature.

Fritz Machlup[37] is of the opinion that the case for public investment should be made by full accounting for all social benefits, and not by lowering the rate of discount. But it is worth mentioning that the extra benefits in remedial investments are mostly of an intangible nature--providing more education opportunities for Blacks adds to national unity--which does not reflect itself in a cost-benefit ratio. A lower rate of discount is the only way to attach importance to these benefits. Hence, under this line of thinking, the rate of discount for two recreational facilities, one in a strictly White neighborhood and one in a Black neighborhood, should be lower for the latter.

Other cases where a lower rate of discount commands itself is in infrastructure in the lesser developed countries. Unless a major restriction in current consumption is enforced and a sacrifice is made,

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[37]Comments on Weisbrod's paper. op. cit., p. 157.

stagnation may prevail and the future generations will be as impoverished as the present.[38]

Even if an agreement is reached on the general promise that the social rate of discount must be lower than the private rate of discount, the amount by which the social rate of discount should be lower and the multitude[39] of private rates with which it should be compared still pose problems. To tackle this problem is like "trying to unscramble an omelet and no one has yet invented a uniquely superior way of doing it."[40]

Risk and market imperfections are generally offered as the main elements behind the existence of multiple rates in the market sector.[41] One way of coming up with one rate which will represent a market rate of return is to take a particular rate and make the appropriate adjustments in it. Seagraves has taken the corporate bonds and adjusted it for the elements of risk, taxes, savings by consumers and inflation. We can do no better than to present his method here:

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[38]This case is also recognized by Baumol, op. cit., p. 801.

[39]Time deposits and government bonds, for example, yield different rates of return.

[40]Prest and Turvey, op. cit., p. 172.

[41]Kenneth J. Arrow, "Criteria for Social Investment," Water Resources Research, First Quarter, 1965. p. 1-8.

"Adding Up Separate Effects.--When one combines these separate adjustments, positive ones for risk and taxes, and negative ones for savings by consumers and inflation, what is the resulting social rate of discount? Again, to avoid argument, let us assume a range for Class A corporate bond yields from 6.7 to 7.2 per cent at the beginning of 1969. Corporate, rather than treasury, bond yields are used because the income from treasury bonds is not taxed in some states.

Basic factors affecting the social rate of discount	Social rate of discount	
	Lower limit	Upper limit
	(percentages)	
Yield on Class A corporate bonds	6.7	7.2
Risk premia for government portfolios	+2.0	+4.0
Corporate profit and property taxes	+4.3	+6.0
Marginal productivity of capital	13.0	17.2
Adjustment for added savings	-1.5	-1.5
Social rate of discount in money terms	11.5	15.7
Adjustment for expected inflation	-3.5	-1.5
Social rate of discount in real terms	8.0	13.2

I am not saying that this is the best way to calculate the social rate of discount. Hargerger's suggestions for handling taxes and added savings merit attention. The matters of risk premia and expected inflation deserve more study. The above ranges 12-16 per cent in money terms, and 8-13 per cent in real terms, probably cover the social rates of discount that most economists would have recommended to our government in 1968 and 1969. My own estimate in February, 1969 was 7.2 per cent for bond yields, plus 3

> per cent for risk, plus 4.3 per cent for taxes, less 1.5 per cent for the lower rate earned on added savings, less 3 per cent for expected inflation, which results in a real social rate of discount of 10 per cent. As of December, 1969, with bond yields of about 8.7 per cent quite common and the expected rate of inflation unchanged, I would have to adjust my estimate of the social rate of discount up to 11.5 per cent."[42]

Perhaps the application of several rates of discount is the most rational course of action to follow. It certainly gives the decision maker a wider range of choice and reduces the analysts subjectivity in having to choose one rate of discount.

Consumer's Surplus and Cost-Benefit Analysis

Consumer's surplus is an ideal tool for measuring the benefits in terms of increased volume when it is brought about by a difference in preproject and post project prices. Figure 4 presents the consumers surplus for a commodity which has experienced a reduction in price from P_o to P_1. Thus, in the example cited previously, the development of hybrid corn caused the supply curve to shift down (from S_o to S_1) which lowered the price from P_o to P_1. The total gain to the society, measured in terms of consumer surplus, is the area P_oMNP_1.

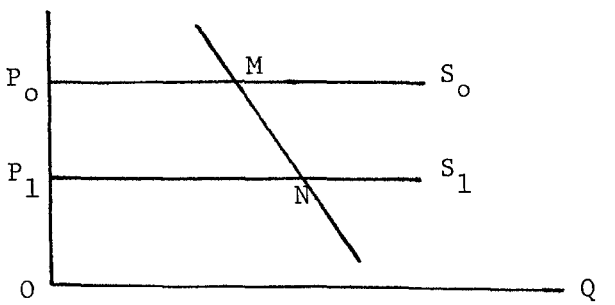

Figure 4.

[42] Seagraves, op. cit.

Although used frequently, economists have not been at ease with the use of consumer's surplus. The source of this uneasiness is a set of assumptions upon which the notion of consumer's surplus rests. These major assumptions can be briefly stated as follows:

(1) Consumer's surplus analysis is valid only when the marginal utility of real income is constant. A constant marginal utility of real income means that the quantities of money paid for a commodity are assumed to be proportional to the quantities of satisfaction derived from it.

(2) Consumer's surplus analysis does not take account of changes in income distribution caused by the action or actions being analyzed. In other words, the income effect is assumed away.

(3) Consumer's surplus analysis is partial equilibrium in nature, and does not take account of the general-equilibrium consequences of the actions whose effects are being studied. A corollary of this assumption is that the demand for a particular commodity is independent of prices and quantities of other goods.

Based on the above assumptions, consumer's surplus stems from the basic premise that value in use is greater than value in exchange, and the difference is measured by consumer's surplus. While the value in exchange is determined by the market, the value in use is determined by one's willingness to pay that amount beyond which he will forego consumption of the commodity in question. Only a monopolist can extract from an individual the total amount which he is willing to pay for a commodity. That is why the consumer's surplus has always been associated with the existence of a first degree monopoly; that which will enable one to capture the consumer's surplus.

The measurement of the consumer's surplus for the purposes of making decisions about social investments is not necessarily tied to any attempt to recapture some or all of these surpluses or benefits through taxes or a system of charges. In social investments all attempts are focused on the quantification of consumer's surplus as a measure of a project's worth to the consumers. All practical approximations of consumer's surplus are, in one form or another, of the area under the demand curve as the price drops from its preproject to its post-project level. In our analysis of recreation, we will attempt to measure the benefits which accrue to the consumers from a recreational facility. However, first we will have to make sure that the notion of consumers surplus is cleared of some of the theoretical objections that it has entailed thus far.

Professor Harberger[43] finds that most of the objections raised against the consumer's surplus are cases of misplaced emphasis; most of the objections raised against the consumer's surplus can be more strenuously raised against the concept of GNP and other national product accounts, yet the notion of consumer's surplus has received a far lesser degree of acceptance than that which has been given the concepts of a national account.

Harberger in his article finds that the concept of consumer's surplus incorporates a greater degree of subtlety of economic analysis than does national income methodology. Here we will confine ourselves with the basic conclusions which Harberger has derived:

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[43]Arnold C. Harberger, "Three Basic Postalates for Applied Welfare Economics," Journal of Economic Literature, September, 1971.

(a) The constancy of the marginal utility of income is not essential for the validity of consumer's surplus measure of welfare.

(b) That the consumer's surplus does not take account of changes in income distribution caused by an action, although correct, need not bother us. This is because of the fact that many actions, suited for cost-benefit analysis, have infinitismal effects on income distribution.

(c) The claim that consumer's surplus analysis is partial-equilibrium in nature is totally invalid on a theoretical level.

(d) That consumer's surplus analysis though valid for small changes, is not so for large changes is refuted on several grounds all of which involve mathematical derivations, which we have not bothered to discuss here.

The notion of consumer's surplus is crucial in measuring the benefits from outdoor recreation. Before applying it we had to rid the notion from some of the theoretical objections raised against it. It should be further noted that the expenditure on recreation is usually a small percentage of one's total income, so that even if the marginal utility of income changes, the change is negligible.

Option Demand

The notion of option demand[44] is closely associated with that of consumer's surplus, and that is the reason for the brief

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[44] For its original statement, see Burton Weisbrod, "Collective-Consumption Services of Individual Consumer's Goods," Quarterly Journal of Economics, August, 1964, pp. 471-477.

discussion of it here. Option demand is the demand by certain individuals who may not desire a good now, but who would be willing to pay (option price) for the option of being able to acquire the goods, at a given price, in the future. In effect, option demand is consumer's surplus measured in the future.[45] In the case of individuals who are certain about their demand for a good in the future, the option price and the expected consumer's surplus are the same thing.[46] For this paper, it will be assumed that consumer's surplus includes option demand, and the latter will not be measured separately.

Conclusions

Public goods do not lend themselves to generalization quite as readily as do private goods. The economics of public goods are largely unexplored due to the above difficulty. Hence, in analyzing public goods, it is best to study each good separately. In addition, since the benefits from public goods inure to large groups of people, their case by case study is even more essential.

Cost-benefit analysis is ideally suited for this case by case study of public goods, whereby it is best to enumerate and evaluate all the costs and benefits associated with a 'public good,' or with a 'public bad,' as the case might be.

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[45] Professor Olson privately said that the option demand boils down to consumer's surplus.

[46] Charles J. Cicchetti and A. Myrick Freeman, III, "Option Demand and Consumer Surplus: Further Comment," Quarterly Journal of Economics, (October, 1971).

While it is true that no two economists studying one subject will come up with the same conclusions, the dissimilarity of results is evermore critical in cost-benefit analysis. For here the avenues for individual biases to creep into an analysis are many. The enumeration and evaluation of benefits and costs, the imputation of benefits and costs (in cases of lack of market evaluation or adjustments in those evaluations as the circumstances might call for), and the choice of the rate of discount, all are avenues for subjectivity. Whereas, the internal rate of return criterion bears a hedge against the last source of bias (namely the choice of the discount rate), the analyst has ample opportunity to select his own rate of discount for the criterion that is most favored for cost-benefit analysis--the present value criterion.

As for the choice of a criterion, the analyst is further cautioned that the ultimate decision for the preference of one criterion over the other cannot be made in abstraction. Hence, the nature of the maximand and the relevant constraint will have to be considered. When the objective is the maximization of the present value, the use of the present value is indispensible; but when the objective is the maximization of the rate of growth of assets and all the flows of receipts are reinvested as they accrue, then the use of the internal rate of return is needed.

While social investments serve as instruments of income distribution, cost-benefit analysis is poorly equipped to analyze the costs and benefits of such distributions. The analyst will do well to be informed of this blind eye of his instrument.

The objective in a cost-benefit analysis is to come up with a measure of the worth of a social investment from the point of view of the consumer. Consumer's surplus presents itself as a good measuring rod of consumer's willingness to pay. Since consumer's surplus will be a basic tool for the assessment of benefits from recreation, its use is justified and is not subjected to major theoretical objections.

Now being equipped with some tools of analysis, they will be brought to bear upon the economic analysis of recreation which is discussed in the ensuing chapter.

CHAPTER IV

THE NATURE OF BENEFITS AND THEIR MEASUREMENT IN PUBLIC OUTDOOR RECREATION

Definition of Outdoor Recreation

Outdoor recreation in this study encompasses a whole host of activities, which include picnicking, fishing, sightseeing, canoeing, pleasure walking or riding, and camping, etc. They are activities that take place in the outdoors for the purposes of pleasure and relaxation; as such they are the antithesis of work or activities which are for the pursuit of a gainful trade.

The Need for Recreation

The need for recreation is a biological one. It is perhaps best expressed by a leading authority in the field.

> "As an illustration of the kind of problem we are creating for ourselves in our new mood of independence from natural restrictions, let us take one which we share with the rest of the animal kingdom, at least the other vertebrates with whom we have most in common so far as bodily structure and needs are concerned. Success in living and survival requires not only nourishment but beautiful co-ordination of senses, nervous system and muscles. Call it play, recreation or training, the activity of cat, beaver, colt or bird is not all given to the search for food. Much of it is spontaneous activity that helps these animals keep in shape for more serious

> business. Man is no exception. Where inclination and common sense fail to convince us, we have statistics as well as the word of psychiatrists and eminent heart specialists to prove it. A host of penalties ranging from delinquency through mental sluggishness to unnecessary physical disabilities, plague us in almost exact proportion to the lack of proper facilities for wholesome recreation.
>
> Sound recreation must be both physical and mental. It also requires space, space that is suitable not only in area but in quality. The present wholesale movement from city to suburb is mute evidence for the need and craving for elbow room, despite the burden it imposes in the way of tiring and hazardous daily travel to and from work. Nor is there any compulsion upon the developers who profit immensely by building of the suburbs to set aside suitable and generous areas for recreation. In their eagerness to get the most out of every square foot of land, they often bulldoze out every tree that might soften the starkness of mass housing and level off any irregularities of surface that might add a bit of interest and relief. If there is a point at which private business becomes a matter of public concern, it is being daily exceeded in unplanned and irresponsible urban sprawl."[1]

Coming as it does from an emminent ecoglogist, the argument not only defines the need for recreation but also heeds public responsibility toward its fulfillment. The latter point is important enough to warrant further discussion.

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[1]Paul B. Sears, Where There is Life: An Introduction to Ecology, New, revised edition, (New York: Dell Publishing Company, Inc., 1970), pp. 24-25. Emphasis added.

Recreation as a Public Good

The rationale for considering outdoor recreation at a park or the utilization of natural resources as a public good is primarily due to its "jointness in supply." The meaning of this phrase is that providing one man with an opportunity to engage in recreational activity in a park at the same time provides others with that same opportunity. The fact that fences can be built or that actual or potential users can be identified in no way subtracts from the fact that the additional costs (marginal costs) of supplying the good to additional users is zero; and therefore outdoor recreation is a public good not because of the demand side of the market but because of the fact that a facility or natural resource is either provided or not in large indivisible lumps.[2] This lumpiness is the major cause of market failure in recreation. It renders the collection of charges commensurable to the benefits derived impractical if not impossible. For example, collection of charges for the scenic product consumed by Sunday afternoon pleasure walk along the C&O Canal towpath, might be futile or at best an expensive endeavor. As a result, non-fee or non-market priced usage is commonly associated with most forms of outdoor recreation.[3]

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[2]Charles J. Cicchetti, Joseph J. Seneca, and Paul Davidson, The Demand and Supply of Outdoor Recreation (New Jersey: Rutgers--The State University, 1969), pp. 35-36.

[3]E. Boyd Wennergren, "Valuing Non-Market Prices Recreational Resources," Land Economics, (August, 1964), p. 304.

The prevalent notion that certain services should be provided without charge can also be attributed to the meritorious[4] nature of those services. Recreation is no different from public education in this nature--everyone stands to gain from living in an educated as well as healthy community. Perhaps the zero price for the use of outdoor recreational facilities is a recognition which society has given to the meritorious qualities of outdoor recreation. Its use has been encouraged by making it available free of charge.

Another important aspect of some outdoor recreation is the "learning by doing" phenomenon. This means that recreation is not demanded until supplied, which may entail a high fixed cost. Thus, it is unlikely to expect the private producers to supply them unless induced by a subsidy or given a tax advantage.[5]

The high fixed cost of outdoor recreational facilities is a compelling economic force for the private operators to use the facilities in maximum use;[6] this maximum use of facilities may well mean over use or a long-run deterioration of the area, physically or in terms of satisfaction per unit of use or both.

To categorize recreation as a public good is to subtract the role of the market in its production and utilization. We have seen that several factors combine to favor the public ownership of outdoor

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[4]Richard Musgrave, The Theory of Public Finance: A Study in Public Economy (New York: McGraw-Hill Book Company, 1959), p. 13.

[5]Cicchetti, et al op. cit., p. 37.

[6]Marion Clawson and Jack L. Knetsch, Economics of Outdoor Recreation (Baltimore: Johns Hopkins Press, 1966), pp. 180-181.

recreational resorts. Summarily, these factors are: the indivisible nature of the product, recreation as a "merit want," the high fixed cost and the deterioration in quality if left to private business. The prevalence of zero price for outdoor recreation does not mean, however, that recreation is a free good, and that the income constraint has been lifted from its consumption. Recreation, like any other good, competes for consumer's income. Consequently, some form of economic constraint is operative in establishing consumption levels of even non-market priced recreational facilities. The task before us is to clarify the form of this economic constraint on the consumer's income. Before doing this, however, we have to see, what, if anything, intrinsic in the nature of recreation as a good, sets it apart from other goods. Or more specifically, are the benefits from recreation comparable to benefits from other goods.

Arguments Against the Measurement of Benefits from Recreation

It is a commonplace thought that the enjoyment of recreation is an escape from all the mundane aspects of life. As such a refuge, into aesthetic values of recreation do not lend themselves to quantification and any attempt to measure the benefits from recreation is doomed to failure.[7]

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[7]On these grounds "the United States Forest Service has refused to place dollar values on recreational use of forests under its jurisdiction. The Forest Service has been able to live with this policy, however, only because it need not resort to dollar comparisons to justify its programs." Andrew H. Trice and Samuel E. Wood, "Measurement of Recreation Benefits," Land Economics (August, 1958), p. 4.

But a moment of reflection will make it clear that there are aesthetic values embedded in varieties of goods, reading of a good book, listening to music, reclining on a rocking chair next to a fireplace, etc. Yet, in all these cases we have paid a price, a market determined price, for those goods for the sheer purpose of deriving those aesthetic values from them. Why should recreation be treated differently?

Perhaps one would argue that recreation is an intangible good and all the goods mentioned so far are tangible. This again should not bother us, for there is a striking similarity between, say, the purchase of a book and the taking of a trip to a recreation resort. Some income will have to be foregoine, in one case equal to the price of a book, in another equal to the expenditure that will make the trip possible. The area of recreation resort parallels the tangibleness of the book. And finally the enjoyment of reading the book matches the derivation of the aesthetic value from recreation.

With all the similarity that can be struck between recreation goods and other goods still the evaluation of recreation goods has been at the heart of the problem in the economics of recreation. But the element that is responsible for complicating the valuation of recreation goods is not the associated aesthetic values, rather it is the lack of conventional market pricing.[8]

Most writers have considered recreation as belonging to the realm of public goods and have pointed to the problem of the failure of the

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[8]Boyd Wennergren, op. cit., p. 304.

market to determine the value of recreation.[9] In Chapter II, we saw how the market failure called for public intervention both on the grounds of efficiency and equity. The failure of the market also necessitates the use of other techniques for the evaluation of benefits from recreation. But the establishment of benefits should take precedence over the use of techniques.

Benefits from Recreation

There is no hard and fast rule for measuring the benefits from recreation. Some have attached benefits to every phase of a recreational activity,[10] and some others have held the view that

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[9]See Cicchetti et al, op. cot., pp. 36-39; Herbert H. Stoevener and William G. Brown, "Analytical Issues in Demand for Recreation," JFE (December, 1967), pp. 1296-98; John Krutilla and Jack Knetsch, op. cit., p. 66; Leonard Merewitz, "Recreation Benefits of Water R Resource Development," Water Resources Research (Fourth Quarter, 1966), p. 632-35; Jack Knetsch, "Economics of Including Recreation as a Purpose of Eastern Water Projects," JFE (December, 1964), p. 1153; and David W. Seckler, "On the Uses and Abuses of Economic Science in Evaluating Public Outdoor Recreation," Land Economics, (November, 1966), pp. 490-94.

[10]Marion Clawson divides these phases into anticipation, travel to, on site, travel back, and recollection. See Marion Clawson, Land and Water for Recreation, (Chicago: Rand McNally & Company, 1963), pp. 39-43. Also Marion Clawson and Jack Knetsch, op. cit., pp. 33-35.

since benefits from recreation are in direct and indirect forms, they always outweigh the costs that incur as in the development of a recreational facility.[11]

For purposes of recognition, one may classify the benefits from recreation into three categories:[12]

a. The direct benefit of recreation is the enjoyment, physical or mental, which a person derives from his leisure time activity undertaken in a relatively non-urban environment characterized by nature setting.

b. Much in the same view as expressed by Paul Sears,[13] an investigation by the National Institute of Mental Health showed that outdoor recreational experiences confer a unique and long-lasting psychic benefit on the participants because of taking place in a natural environment.

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[11]This has been the case with evaluations carried out by the Bureau of Reclamation. The Bureau staff customarily estimates costs of recreational developments and then assigns an equal amount to primary recreational benefits. Then each of the benefits, primary and secondary, is in turn considered to be equal to the costs of development. In this way benefits are twice the costs for all projects and they are all equally attractive:

$\frac{B_i}{C_i} = 2$ for i = 1, 2, . . .n number of projects. See Trice and Wood, op. cit., pp. 205-206.

[12]A great many of these points are brought up by Ruth P. Mack and Summer Myers, "Outdoor Recreation," in Measuring Benefits of Government Spending, (Washington, D.C.: Brookings Institution, 1966), pp. 74-75.

[13]op. cit., p. 25.

c. The intangible benefits of recreation accrue to a nation as a whole. These benefits are of three sorts: (1) the third party benefits which result from the advantage to all people, whether or not users of outdoor recreation, of living in a country where more than fewer people are educated in the ways of the out-of-doors. Here again, the benefits rest on the assumption that the enjoyment of outdoor recreation is meritorious, just as the enjoyment of good books, art, music, or any sort of extension of one's capacity to appreciate the fullness of life. (2) There is the conservation aspects of an outdoor recreation resource which can also include the preservation of historic, scientific, scenic, and aesthetic values. (3) The lack of recreational activities is said to have caused an increase in delinquency, and other crimes.

Almost all the intangible benefits are affecting parties other than the ones experiencing outdoor recreation. As such, the

intangible benefits are externalities in consumption that stem from outdoor recreation.

In conclusion it must be stated that while the direct and indirect benefits accrue to the consumer, the externalities are benefits that incur largely to parties other than the consumer.

Appreciation in land value has been noted as another benefit from recreation. With regard to the rise in land value, Clawson writes:

> Full evaluation of the economic worth or value of the product of recreation areas needs to take account of not only the user's benefits of visitors, also the possible increment in land values resulting from the influence of such areas. . . . The total direct economic value of public recreation areas is the sum of the two sets of values: (1) the user benefit or the value's which people receive from visits that involve travel to the area, and (2) the values capitalized in land near the recreation area.[14]

Jack Knetsch[15,16] and Schutjer and Hallberg[17] have expressed similar views about the inclusion of the rise in value of land, due to

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[14]Marion Clawson and Jack Knetsch, op. cit., p. 222.

[15]Jack L. Knetsch, "The Influence of Reservior Projects on Land Values," JFE (February, 1964), pp. 240-241.

[16]_____, Economics of Including Recreation as a Purpose of Eastern Water Projects," JFE (December, 1964), p. 1151

[17]W.A. Schutjer and M.C. Hallberg, "Impact of Recreational Development on Rural Property Values," AJAE, (August, 1966), p. 573.

its close proximity to a recreation resort as an additional benefit from recreation.

While one may find merits in knowing the extent to which the value of land rises due to the development of recreational resorts, the inclusion of such increments as part of recreational benefits is hardly justified. As has been noted by Musgrave,[18] Prest and Turvey[19] the external effects of a public investment that are of a pecuniary nature and present themselves via prices of products or factors should not be added (subtracted) as benefits (costs) of a project. For one thing any net difference in prices or the increments in rents and land values is simply a reflection of the benefits of more activities being undertaken, etc.; and it would be double counting if they were included too. Another reason disfavoring the inclusion of such increments in benefits is that they do not accrue to the recreationist, and as such are of a transfer nature and find their place in the pockets of those who own the land. If anything, the appreciation in land value may work as an inducement for land developers who, in the words of Paul Sears, "in their eagerness to get most out of every square foot of land, . . . often bulldoze out every tree that might soften the starkness of mass housing and level off any irregularities of surface that might add a bit of interest and relief."[20]--hardly a benefit to recreationists.

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[18] op. cit., p. 799.

[19] op. cit., p. 160.

[20] Paul Sears, op. cit., p. 25.

Measuring the Benefits from Recreation

So far we have discussed the benefits from recreation in a somewhat objective manner, i.e., we have tried to assess those benefits in terms of fulfilling the biological and psychological needs of man. How a recreationist, a recipient of those benefits, views them is a question that has not been answered.

A consumer is not in the habit of categorizing the merits of a good. In order to establish a trade-off between a good and his income, the consumer has to lump the benefits that he can attribute to the good. In case of recreation, since its consumption is time intensive, this trade-off has to be established not only with income but also with time.[21] To appraise the benefits of recreation from the point of view of the consumer is tantamount to measuring his willingness to pay for them in terms of his income and time. Such a willingness to pay, needless to add, is a reflection of total payment for all the benefits that recreation inures to the consumer--the total of direct and indirect benefits.

In Chapter III, we saw that consumer's surplus was a viable tool for the measurement of willingness to pay for the usefullness of a good. In assessing the willingness to pay for recreation we want to use the notion of consumers surplus, with one important proviso, however.

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[21]The notion that the consumption of recreation is constrained both by income and time has important bearing on the demand curve for recreation, a point which will be considered when we discuss the demand for recreation.

Consumer's surplus is a measure of value in use vis-a-vis value in exchange. It is important to distinguish between the two measures in private or marketable goods. But in public goods, as in the case of recreation, the lack of a market determined price, renders the notion of value in exchange meaningless.

As can be seen in Figure 5, the market price of P_o has divided the area under the demand curve (up to quantity consumed, Q_o) into value in use (consumers surplus) which is the triangular shaded area, and the value in exchange which is the rectangular shaded area. For public goods, such a division of the total area under the demand curve cannot be had for there is no market determined price.

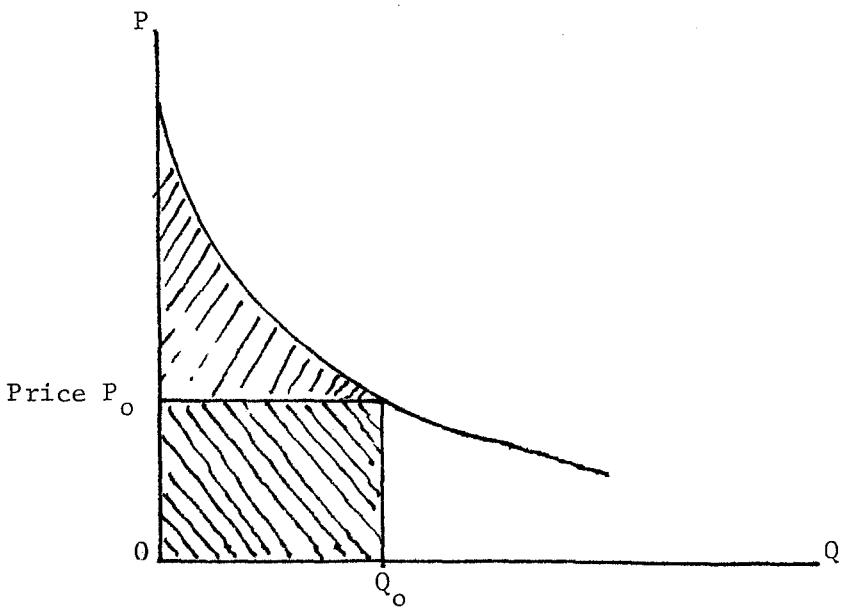

Figure 5.

The above implication of the non-existence of market price has not been carried through in some of the otherwise brilliant work in the area of public goods. Thus, Cicchetti et al.,[22] in their assessment of mass demonstrations have divided the area under the demand curve for participation into two, similar to the one demonstrated in Figure 5, and have called one the value in use and the other the value in exchange.[23]

An entrance fee may be suggested as a price that divides the area under the demand curve between the consumer's surplus and the value in exchange. The objections to this suggestion are two. (1) A zero price is associated with a majority of public recreational resorts in the United States, and (2) What is more important, if a fee is set, it is set arbitrarily and as such cannot measure the value in exchange in the sense that a market determined price does.

The nature of emendation that suggests itself for the use of consumer's surplus in assessing the willingness to pay for recreation should be obvious now. We are dealing with total benefits from recreation and need to measure how much in total the consumer is willing to pay for it. Consumer's surplus is only a measure of partial willingness to

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[22] op. cit., p. 720.

[23] Similar objections can be raised about the work done by David Seckler, op. cit. In large part these applications result from efforts to simulate the market for private goods in the case of public goods.

pay.[24] The total area under the demand curve for recreation measures the willingness to pay in toto, of course, for the benefits that accrue to the recreationist himself. The external benefits occurring to third parties are not quantified by the total area under the demand curve. All efforts to measure these external benefits, which are mostly associated with public goods, have foundered on the rocks.[25] As a last resort the suggestion is offered that these intangibles be extended recognition by applying a lower rate of discount in the case of goods that impart these externalities.

Demand Curve for Recreation

It is important to bear in mind that demand, in the usual sense, the relation between quantities and the market price of a commodity, does not apply to recreation. The basic flaw in the definition when applied to recreation is brought about by the lack of a market which has caused the absence of a price. Without this conventional measure of economic value, we are left with the problem of developing surrogate variables which would simulate the market in determining the value of recreation. It is perhaps illuminating to see how these surrogate variables were developed by different economists and the changes they have seen through time.

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[24] See the definition of consumer's surplus in Chapter III.

[25] Prest and Turvey, op. cit., p. 168.

Professor Hotelling was the first to suggest the use of travel cost as a measure of willingness to pay for recreation. While this suggestion was made in 1949, an elaboration of Hotelling's views was carried out by Andrew H. Trice and Samuel E. Wood in the August, 1958 issue of Land Economics. In a paper presented at a meeting of the Taylor-Hibbard Club on January 13, 1959, at the University of Wisconsin, Marion Clawson applied Hotellings idea to four national parks.[26] Ever since numerous other writers have used similar methods in deriving demand curves for different recreational facilities.

As Cicchetti and others rightly point out, the travel cost method of estimation is a special case of a general gravity model of social interaction. The model has been used to estimate the demand function for transportation, communication, tourism and perhaps mostly for recreation. "In these models the independent variable V_{ij} is the number of visits, trips, or messages from source i to destination j. The variable V_{ij} is held to be a function of some gravity variables representing the attraction potential, e.g. population N for i and j; other socioeconomic variables S for i and j and distance D, taken to be a surrogate of the cost of overcoming the separation between source

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[26]There is hardly a paper on outdoor recreation or related fields that does not cite Clawson's Methods of Measuring the Demand for and the Value of Outdoor Recreation (Washington: Resources for the Future Reprint 10), 1959. Clawson has been the most prolific writer in the field. See the Bibliography.

and destination. A general statement of such a model is:

$$(4) \qquad V_{ij} = \frac{AN_i^a \; N_j^b \; S_j^c \; S_j^d \; U_{ij}^e}{D_{ij}^f}$$

where A is a constant and U_{ij} is a random error term."[27]

Of course, each area of use will necessitate some revision in the model. For recreation the majority of studies have found travel costs, population and income as the explanatory variable for visits to recreation spots. Let us now turn to a discussion of each of these variables.

Travel Cost

Recreation is time intensive in its consumption. This unique feature of recreation subjects the consumption of recreation to a time constraint in addition to the usual constraint which is income. Thus, in overcoming distance, one incurs two expenditures, one in time and one in terms of the usual travel expenses. However, the two expenditures are highly correlated, which makes it difficult to separate their effects statistically. The argument is in favor of measuring the two expenditures jointly. But before they can be added, it is necessary that expenditure in terms of time be translated into monetary terms. The question is what is the accounting price for a unit of travel time? In addition, the distance travelled calls for accounting prices for mileage as a unit of distance.

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[27] op. cit., Cicchetti et al, p. 719-720.

Accounting price[28] for distance traveled.--Attaching a price per mile traveled is a subjective matter and depends on the judgement of the analyst. Table 1 (column 2) is a list of the mileage cost used for different studies.

Table 1. Accounting Prices for Distance and Time

(1) Author(s)	(2) Mileage Cost	(3) Time Cost
Cicchetti, Freeman III, Haveman and Knetsch	5.5¢ per person per mile = 22¢ per mile per auto	$1.00
Clawson	10¢	Not Used
Trice and Wood	6.5¢	Not Used
Jack Knetsch	5.16¢	Not Used
Leonard Merewitz	5.16¢	86¢
Herbert Mohring	$2.19 per 35 miles per hour	$1.55-$2.80
Joe Stevens	6¢	Not Used

Note: See the bibliography for sources.

In deriving the demand curve for recreation in Fort Frederick, in the next chapter, a travel cost of 5¢ per mile will be used. Although this is a minimum figure as compared with those in column 2 of Table 1, our intention in using it is to arrive at a lower estimate of benefits to recreationists.

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[28]Some authors apply the name shadow pricing to stipulation that are called for in the absence of market determined prices or in spite of them. We prefer to leave the name shadow prices to dual variables that are arrived at by the use of simplex method in linear programming.

Accounting price for time spent.--Finding an accounting price for the time spent in recreation, or any non-income generating activity, is plagued by many problems. At the heart of the problem is the fact that the economics of time is largely unexplored.[29] Economists cannot be blamed for this; exploration by other disciplines has not fared too well in the pursuit of this endeavor either.

A look at Table 1 shows that although the accounting prices for distance and time are both conjured up by the analysts, the latter has resulted in a greater degree of conjecturism. As can be seen in Column 3 of the Table, some authors have dispensed with the use of an accounting price for time (or have used a zero price for it) and among the rest the difference is rather significant. Different reasoning may lead one to attach either a very high price to leisure time or neglect it completely.

One can argue, on the side of a high price, that leisure time is not for sale. People need leisure to charge their batteries, so to speak, in order to be productive in their working time. If one tries to bribe them off their leisure, they must come up with lucrative propositions.

On the other side of the spectrum, one can argue in the face of unemployment, present almost everywhere, that the opportunity cost of leisure time is zero. However, it can be said that it might be true that for some, leisure can be evaluated at zero price, there are still others who will get paid, very highly at times, to sacrifice their leisure.

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[29]Gary S. Becker, "A Theory of the Allocation of Time," The Economic Journal, (September, 1965), pp. 493-517.

Another argument in favor of a positive price for leisure results from the fact that invariably all individuals can perform income saving activities, or activities that raise their productivity. Activities such as repairing one's car, television, etc., or furthering one's knowledge through reading a book, talking to an expert, watching television. In a nutshell, no phase of human experience is without a value.

In this study, minimum wage is applied as an accounting price for time spent in recreation, travelling or otherwise. Only sleeping time is evaluated at a zero price.

Income

The ability to choose one's residence is determined mainly by income. To the extent that one lives in a scenic surrounding, one may not find it necessary to frequent a recreational resort for its scenic beauty. But at the same time outdoor recreation is a package of several activities like picnicing, fishing, sightseeing, canoeing, pleasure walking, camping, etc., all of which require ample open space in addition to scenic beauty.

The urban, rural, suburban and slum division is a locational approximation of income distribution. So, income determines location, which was the first variable suggested by many for measuring one's willingness to pay for an outdoor recreational activity.

In addition, it is rightly argued that the much vaunted rationing function of the price system is as much or more a matter of the structure

of income distribution as of the marginal utility of commodities.[30] To put it differently, were income distribution more uniform, demand curves for most goods would be flatter as shown in Figure 6. The three demand curves while all belonging to a hypothetical commodity reflect three different levels of income distribution, the flattest belonging to the most uniform level of distribution. Thus, the slope and position of a statistical demand curve for recreation or any other good is largely a function of income distribution. As such, benefits calculated as the area under a demand curve for recreation is also biased with regard to income distribution. Since willingness to pay is synonymous with willingness to give up income, at a high cost to the user, the users of a given recreational facility are wealthier than the users of the same facility at a lower cost. Thus, a recreational resort built in a poor community may not meet the efficiency criteria (benefits should exceed cost) and the one built in a wealthy community may meet the criteria solely on the basis of income difference and not the desire for recreation. If the demand curve of the former could be shifted up or of the latter could be shifted down to allow for the difference in income distribution, then both resorts may pass the test in the same way.

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[30] David W. Sickler, "On the Uses and Abuses of Economic Science in Evaluating Public Outdoor Recreation," Land Economics (November, 1966), p. 488.

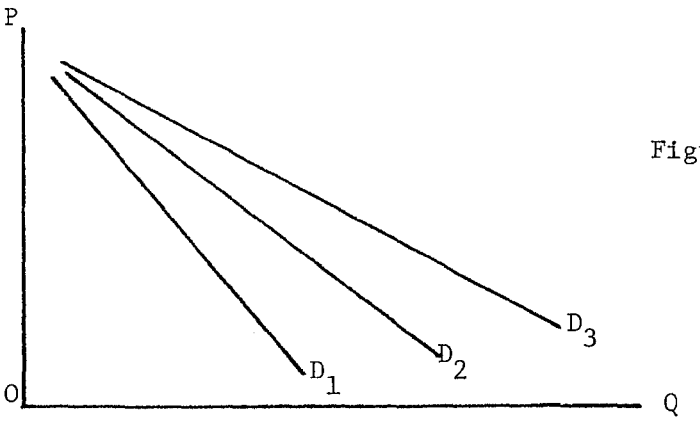

Figure 6.

At any rate, it is important to include the income variable in deriving a demand curve for recreation. In the study of recreational demand for Fort Frederick, the per capita income of the county from which the visits originated is included in the analysis.

Population

The significance of population as a variable which significantly affects the demand for recreation can hardly be questioned. It is population that causes congestion and hence induces the people of the area to seek recreation out-of-doors. On the other hand, a sparsely populated community such as found in rural communities, may not find it necessary to frequent recreational resorts often. Partly because of their surroundings and partly because of the nature of work, mostly farming, that occupies them.

The inclusion of population variable in a demand function also shifts the demand curve to the right. But here no adjustment is necessary since a rightward shift in the demand curve due to a higher population is justified.

The population of the counties which were the origin of visitors to Fort Frederick are included in the analysis of recreation of the area.

Summary and Implications

The nature of the demand curve for recreation that suggests itself is:

$$(5) \qquad V_{ij} = f(E, P_i, Y_i)$$

Equation (5) is a demand function for recreation in the implicit form where visits (V_{ij}) from origin i to a recreational resort j is a function of travel expenditures (E), population of the area (P_i) and income of the area (Y_i). One expects a negative sign to be associated with E and positive signs with P_i and Y_i.

The integration of the area under the demand curve thus derived should give us a measure of an area's worth as a recreational resort.

It is important to bear in mind, that the area under such a demand curve is a proxy measure for two categories of direct and indirect benefits only. The third party benefits, also called the intangible benefits, are not measured by the area under this demand curve. They are left out of our calculations, and to that extent the calculations are an understatement of the recreational benefits.

CHAPTER V

THE RECREATION BENEFITS FROM FORT FREDERICK STATE PARK: AN APPLICATION

Introduction

Although most state parks owe their existence to the Great Depression when federal funds were used by states to embark upon major park and recreation projects,[1] their greater use is in large measure due to the prosperity and higher productivity that the American economy has experienced after World War II. It is also noteworth that the paid vacation is a post-World War II phenomenon. The rise in expenditure on recreation has also been rapid in recent years, amounting to approximately $11 billion in 1960.[2]

In Maryland, over 9,000,000 visitors attended the 45 authorized state parks in 1970; a 200 percent increase from 1966.[3] This rapid increase in attendance in state parks is the reason behind state

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[1]As a result of such activities, by 1940, almost all states had some form of state park system. See Marion Clawson, Land and Water For Recreation, (Chicago: Rand McNally & Company, 1963), p. 23.

[2]Ibid., p. 109

[3]Department of Forests and Parks, Maryland State Parks: Action Program for Development, (Revised July, 1971), p. 2.

authorities' decision to develop all of the 47,000 plus acres of land in state parks, of which only 2,000 acres is already developed.

Fort Frederick State Park is one of the 45 state parks in Maryland. The restoration of the Fort took place in 1931, and ever since is used as a recreation resort. It is located in Washington County on a rather narrow strip of land that borders Virginia, West Virginia and Pennsylvania. As such it is a tourist attraction for visitors who appreciate the historical significance[4] and enjoy recreational activities in the area.

In addition, Fort Frederick is located on the C&O Canal to which the U.S. Government has also turned its attention in terms of developing the Chesapeake and Ohio Canal National Historical Park.

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[4]The Fort was built in 1756 in an effort to protect the settlers against the French and the Indians.

Mr. Coulter, Deputy Secretary, Maryland Department of Natural Resources has described Fort Frederick as follows:

"It is one of the original forts. A program which is heavily supported by the local population is included in the park program. That is, they actually reenact, during times of the year, some of the scenes and some of the things that happened at that park. A plan for the park has been laid out. This is rather high in the priority of the state for acquisition. A total of 3,420 acres are within the take line. About 2,900 of these acres are scheduled to be acquired. In other words, about 500 acres, the fort itself, has been acquired, and we are acquiring other land." Hearings before the Subcommittee on Parks and Recreation, United States Senate 91st. Congress, Second Session on S. 1859 and H.R. 19342 (December 15, 1970), p. 66.

It is not yet determined whether the development of Fort Frederick will be a joint effort, or whether it will be carried out by the United States or the State of Maryland alone. But the increased attention is all the more reason for an economic analysis of the worth of the fort to the visitors concerned. The fort, in addition to its historic significance, attracts visitors for picnicing, fishing, camping, and other outdoor recreational activities.

The method of analysis developed so far will be applied to Fort Frederick. A paradigmatic presentation, contained in the following section, will clarify the methodology that has been followed.

A Methodological Overview

A paradigmatic presentation of the applied part can be done through the use of the three dimensional diagram in Figure 7. The time span of the figure is denoted by several dates. The origin of the figure is marked 1756 the date in which Fort Frederick was built, 1931 is the year in which it was restored and used as a recreation resort. Nineteen forty-seven to 1971 mark the period over which the attendance record for the use of Fort Frederick is available; 1972 to 2000 is the period for which a projection of the trend of attendance has been made.

The triangles in the figure show the demand curves for recreation for the dates indicated. The base of the triangles measure the yearly visits to Fort Frederick by recreationists, the altitude of the

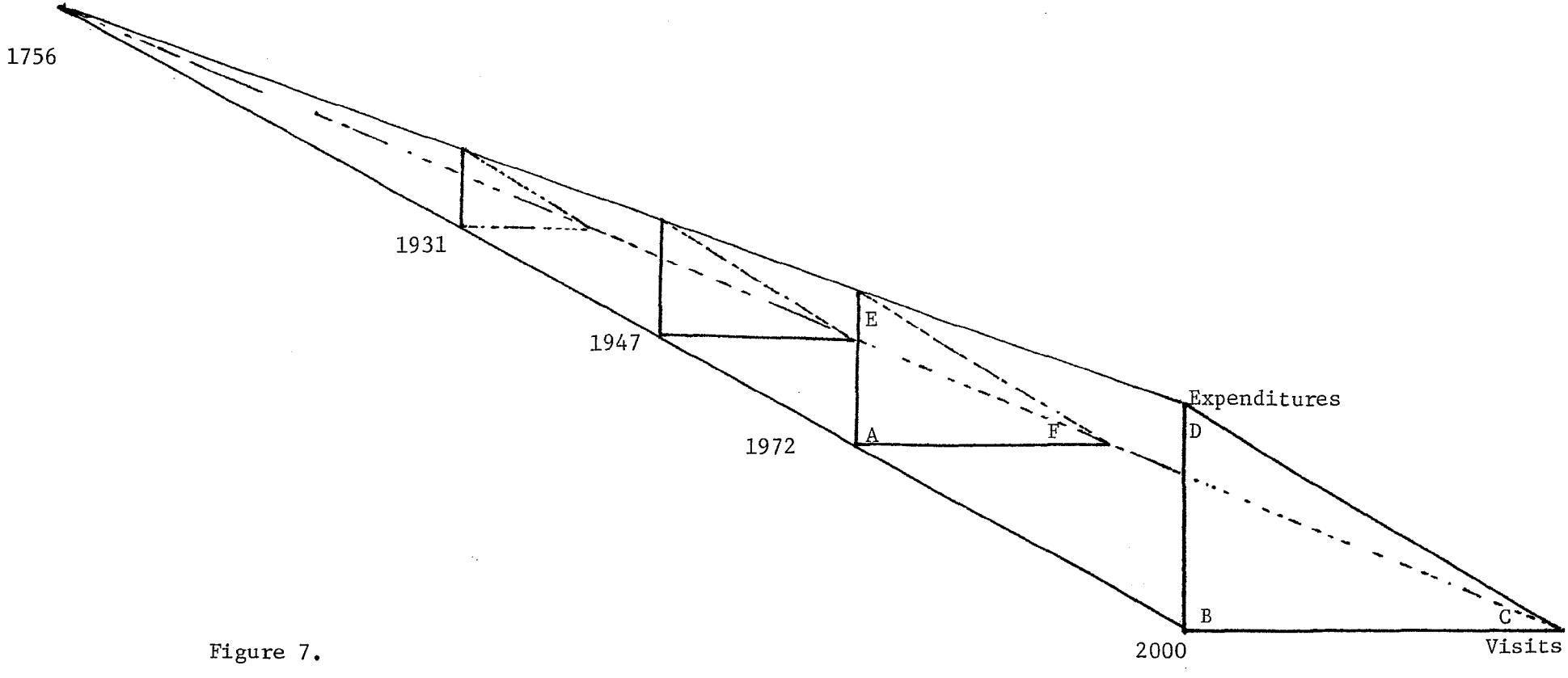

Figure 7.

triangles measure the expenditures in time and otherwise incurred by the recreationists. The objective is to measure the areas under the demand curves for years 1972-2000--the equivalent of measuring the volume of the prism-like figure ABCDEF. As can be seen in the figure, measuring the volume of the prism requires calculation into the future which is unknown. But we do know something about the past and the present. What we do know, with certain degree of accuracy is the area of the triangle AEF for 1972. Through a sample survey of visitors, it was possible to translate the projected attendance figure for 1972 into a recreation demand curve. Thus, given the area of the triange and a rather strong assumption that the past attendance and expenditure patterns will continue into the future, the task of measuring the volume of the prism is set. The volume of the prism, lest one forgets, is an approximation of the stream of benefits of Fort Frederick to the consumers.

The stream of benefit, thus obtained, will have to be collapsed into one figure, to be used in the calculation of benefit-cost ratio. That is when the figures are discounted and their present value is found for 1972.[5]

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[5]See Chapter III on the rationale for discounting.

A Projection of Attendance

On the basis of data available[6] from 1947 to 1971, a projection of attendance was made. Several regressions were run. Equation (6) was chosen on the basis of its high coefficient of correlation and the highly significant coefficients for the independent variables. In the equation, A indicates attendance and t stands for time. The figures below the coefficients are their standard errors.

$$(6) \quad A = .24 - \underset{(299.27)}{3413.45t} + \underset{(.153)}{1.76t^2}$$

$$R^2 = .92$$

Column 2 in Table 2 contains the actual data up to 1971, and column 4 is the projected attendance figures for the years 1972-2000, based upon equation (6).

By applying the formula for geometric mean the rate of increase in the attendance is found to be 6 percent per year.[7] In terms of Figure 7, the 6 percent annual rate of growth means that the abscissa of each year's triangle is 6 percent larger than that of the preceding year.

The anticipated rise in attendance, due to the bicentenial celebration, is not reflected in the projected figures in column 4. It is likely that a greater number of people will visit the Fort than the figure for

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[6] The data were obtained through the courtesy of the Department of Forests and Parks.

[7] The growth rate = $\sqrt[n-1]{A_n/A_1}$ where A_1 stands for attendance in year one (1947) calculated to be 26712, A_n is attendance in year 1971 which is calculated to be 110297. So, $(110297/26712)^{1/24} = (4.12912)^{1/24} = 1.060$.

Table 2. Actual and Projected Visits to Fort Frederick

(1) Years	(2) Actual Attendance	(3) Years	(4) Projected Attendance
1947	21,988	1972	113,824
1948	26,281	1973	117,354
1949	32,911	1974	120,888
1950	32,591	1975	124,425
1951	33,187	1976	127,965
1952	36,593	1977	131,510
1953	35,240	1978	135,057
1954	42,055	1979	138,609
1955	44,202	1980	142,164
1956	71,264	1981	145,722
1957	47,236	1982	149,284
1958	45,819	1983	152,849
1959	39,972	1984	156,418
1960	40,677	1985	159,991
1961	68,943	1986	163,567
1962	77,953	1987	167,146
1963	71,134	1988	170,729
1964	90,020	1989	174,316
1965	N.A.	1990	177,906
1966	N.A.	1991	181,499
1967	N.A.	1992	185,096
1968	N.A.	1993	188,697
1969	102,793	1994	192,301
1970	95,345	1995	195,909
1971	110,520	1996	199,520
		1997	203,135
		1998	206,753
		1999	210,374
		2000	214,000

1976 indicates. The attendance may also be higher for the years thereafter, because of the publicity that the Fort may receive.

To establish the relationship of visits to expenditures, a sample survey was conducted. The next section is a discussion of the survey which was the basis for deriving a demand curve.

The Nature of the Sample Survey

The method of deriving a demand curve for recreation, developed in Chapter IV, requires information on the origin of visits and the expenditures in terms of time and distance travelled. However, the information available on Fort Frederick, or any of the 45 state parks in Maryland, is limited to the total annual visits to the parks over a range of 10 to 20 years. Hence, it was necessary to know the distance which the visitors travelled, and the time they spent to get to their desired spot. In addition to the distance, one needs to know the origin of visitors in order to determine the population and the income of those areas.

In order to obtain information on the distance travelled, time spent, and the places of origin of the visitors to Fort Frederick, a sample survey was conducted over a two-day period (a Saturday and a week day). The size of the sample surveyed was close to 420 people. The visitors in the sample came from 17 counties in five different states--Maryland, West Virginia, Virginia, Pennsylvania, New Jersey, and the District of Columbia. Thus, altogether there were 18 sources from which the visits originated.

Although sampling over a longer period of time would have captured other sources of origin, the 18 sources of origins, obtained thus far, were enough for our purposes. Sampling the visitors over a longer period, most likely during their summer vacation, would pose the problem of dividing the distance travelled over the number of recreation

spots that the vacationers would likely visit. Time spent on travel would also have to be divided among the many spots that were visited.

In the month of June, the time that the present survey was conducted, the multiplicity of recreation spots attended by visitors did not arise, or it can be safely assumed to have been minimum. This is not to claim, however, that the sample is the best that could be conducted. The intention here is illustration first and accuracy second.

That the observed pattern of visits in the sample is exemplary of the annual visits to Fort Frederick, is an assumption implicit in this research. However, the nature of the assumption is common to all the studies that generalize from the observed to the unknown.

Derivation of a Demand Curve for Recreation in Fort Frederick

In the previous chapter the following equation was used as an implicit demand function for recreation.

$$(5) \qquad V_{ij} = F(E, P_i, Y_i)$$

When applied to Fort Frederick, V stands for the 17 counties and the District of Columbia (i.e., i = 1, 2, ... 18) from which visits to Fort Frederick (j) originated. The independent variables E, P_i and Y_i are expenditures, population, and income, in that order, which are elaborated upon below.

Expenditures

The expenditure on recreation was calculated on the following basis.

(7) $E = 2M(\$.05)\ (.25) + 2TT\ (\$1.60) + ST\ (\$1.60).$

Where M is miles travelled (from i to j), TT is travel time and ST is stay time.

As indicated by the first term in equation (7) the two way travel distance was evaluated at 5 cents per mile. Since the average number of people per car was found to be 4, the total cost of round trip was divided by 4 to arrive at travel cost per person.

The second term in the equation is the round trip travel time, evaluated at $1.60 or minimum wage per hour. The stay time, excluding the sleeping time, was also evaluated at $1.60 per hour.

Population

The population data consists of the number of poeple in the counties from which the visits originated. The inclusion of population in the demand equation is to reflect the differences in visits that will be caused by the size of population alone. For example, from two areas that are equal in distance from Fort Frederick, the difference in the number of visits may be caused by the difference in population. Hence it is expected that population and visits are positively related.

Income

Two communities with equal distance and equal population may also differ in their visits to Fort Frederick by their income. Income can also be hypothesized to have positive relation to visits.

Expenditures were gathered through the use of the sample survey described in the previous section. The income and population data used were obtained from General Population Characteristics: 1970 Census of Population.[8]

Table 3 is a summary of the data used in the derivation of a demand curve for Fort Frederick. The column headings are symbols used for variables in the demand equation.

Several forms of demand equations were attempted. The selection of the equation used for the analysis of benefits to the consumers rests upon: (1) the level of significance of the coefficients of the variables in the equation, and (2) the contribution that the number of variables, on the one hand, and the different specification of the variables, on the other hand, made to the multiple correlation coefficient, R^2.

Equation (8) chosen on the basis of the above criteria, was used as the demand function for recreation in Fort Frederick.

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[8]U.S. Department of Commerce, Bureau of Census, General Population Characteristics: 1970 Census of Population, (October, 1971).

Table 3. Data Used in Derivation of the Demand Curve

County and State	V Visits	E Expenditures	P Population	Y Income
Washington, Md.	23,819	14.70	103,824	2,838
Frederick, Md.	1,873	11.88	84,927	2,900
Prince Georges, Md.	1,338	21.14	660,567	3,742
Allegany, Md.	3,746	10.77	84,044	2,584
Howard, Md.	1,606	12.45	61,911	3,836
Anne Arundel, Md.	4,014	14.16	297,539	3,362
Baltimore, Md.	7,226	23.88	621,077	3,965
Montgomery, Md.	23,548	20.86	522,809	5,188
Morgan, W. Va.	2,141	4.62	8,557	2,132
Clarke, W. Va.	535	9.75	8,102	3,080
Fairfax, Va.	6,958	20.27	455,021	5,452
Stafford, Va.	535	15.40	24,587	2,631
York, Pa.	1,338	17.40	272,603	3,209
Wayne, Pa.	535	13.20	29,581	2,360
Franklin, Pa.	268	14.70	100,833	2,619
Lebanon, Pa.	6,155	48.82	99,665	2,990
Morris, N.J.	2,676	53.50	387,454	4,134
District of Columbia	24,621	33.40	756,492	4,273

Source: Visits and Expenditures were obtained through a sample survey conducted in Fort Frederick. Population and income were taken from the General Population Characteristics: 1970 Census of Population.

$$(8) \quad \ln V = \underset{(.016)}{-1.41 \ln (E + .8)} + \underset{(.03)}{2.10 \ln Y} + \underset{(.0063)}{.53 \ln P} - 11.62$$

$$R^2 = .91$$

$$D\text{-}W = 2.062$$

In the equation all the variables are in natural logs. All the coefficients are significant at above 90 percent. As was expected, the visits are inversely related to expenditures and directly related to population and income. The Durban-Watson statistics (2.062) indicates zero auto correlation and the existence of homoscedasticity, implying that the coefficients obtained for E, Y, and P are reasonably good measures of the relation of those variables to V.

Now that equation (8) is found to be a good approximation of how visits to Fort Frederick are affected by the travel expenses, population and income in the places of origin, let us turn to a quantification of the relationship to find total willingness to pay by the consumers.

Integration of the Area Under the Demand Curve as a Measure of Total Willingness to Pay

The theoretical grounds for integrating the area under the demand curve as a measure of willingness to pay was already discussed in Chapters III and IV. The following form of equation (8) matches the original form suggested in equation (4) in Chapter IV.

$$(9) \quad V = \frac{Y^{2.1} \quad P^{.53}}{(E + .8)^{1.41} \quad e^{11.62}}$$

All the terms are familiar in equation (9) except for e which is the number 2.7818.

The addition of .8 to expenditure variable in equation (8) needs some explanation. The original form of equation (8) without the .8 added was found to be:

$$(10) \quad \ln V = \underset{(.52)}{-1.35\ E} + \underset{(1.04)}{2.10\ Y} + \underset{(.22)}{.54 \ln P} - 11.96$$

where the values in parentheses are the standard errors as before and the R^2 was .65. In this form of the equation, as with any equation estimated in the logs, the demand curve is asymptotic to both axes. As such, the area under the curve is infinity--can one imagine the willingness to pay for recreation at Fort Frederick, signified by the area, to be even greater than the GNP of the country!

As shown in Figure 8, the addition of a number to E, (.8 in this case) has shifted the V-axis intercepting the demand curve at point B. This technique defines the area under the demand curve. But, it leaves the area of the rectangle $0V_oBC$ out of calculation, the omission calls for an adjustment in terms of adding the area of the rectangle to the rest of the area under the curve.

The demand curve being asymptotic to the E-axis poses no problem, since the integration is carried out to the maximum value of expenditures.

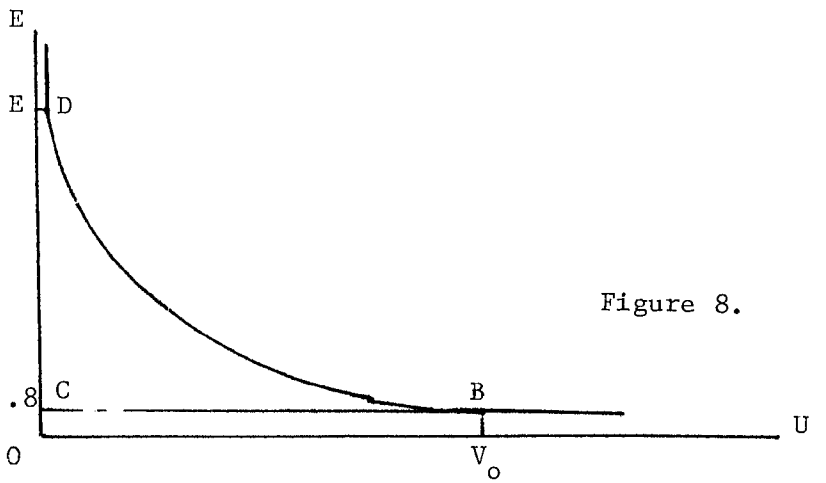

Figure 8.

The value obtained from the integration of equation (8) amounting to $1,103,689 is the area under the demand curve for 1972. Dividing the figure by the number of visits in 1972 gives $9.69 as the per capita expenditure in terms of miles travelled, and time spent on a recreation trip to the Fort. Given the fact that time is not valued in some of the other studies, the figure compares favorably with $8.00 per visit given by Clawson.[9]

Given certain assumptions about the rate of annual change in the independent variables in equation (8), the areas under the demand curves for the entire period 1970-2000 can be estimated. Hence, population was assumed to grow at 1.4 percent.[10] Income was computed to grow at 2 percent.[11] The rate of growth for expenditure on recreation was found to be 7 percent.[12]

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[9] Land and Water for Recreation, op. cit., p. 109

[10] Maryland State Parks Action Program for Development, op. cit., p. 6.

[11], [12] See Appendix I.

The Benefit-Cost Ratio for Fort Frederick

The value of the area under demand curves, which is a measure of total willingness to pay for visits to Fort Frederick, is shown for years 1970-2000 in column (1) of Table 4. Putting it differently, the column is the area of the triangles shown in the three dimensional diagram in Figure 7. Since willingness to pay is a proxy for the benefits derived from recreation at Fort Frederick, column (1) is also a stream of benefits from recreational experience at Fort Frederick.

A column of costs is required before a benefit-cost ratio can be calculated. The cost figures are partly arrived at through assumption and part were obtained from the Maryland State Parks Action Program for Development. The figures should serve as an illustration in an effort to arrive at a benefit-cost ratio, expected of any such studies. Thus, a budget of $100,000 is assumed for the maintenance and salary of the personnel at Fort Frederick, column (3), Table 4. Added to this cost is the cost of developments in column (4) of Table 4.

The stream of benefits and cost will have to be added in order to calculate a benefit cost ratio. But since the benefits and the costs are spread and do not occur at one point in time their simple addition poses a problem. Values over time are not commensurable and therefore cannot be added. A dollar today is valued more than a dollar a year from today. Hence, discounting is used for correcting the influence of time on the streams of benefits and costs.

Table 4. Estimation of Willingness to Pay and the Costs Incurred in the Development of Fort Frederick

Years	(1) Estimated Willingness to Pay	(2) Present Value of Willingness to Pay	(3) Assumed Annual Cost	(4) Project Cost	(5) Present Value of Total Cost (3+4) Discounted
1970	953,399		100,000		
1971	1,025,795		100,000		
1972	1,103,689	1,003,253	100,000		90,900
1973	1,187,497	981,347	100,000	974,592	888,043
1974	1,277,670	959,913	100,000	80,951	135,948
1975	1,374,690	938,913	100,000		68,300
1976	1,479,077	918,358	100,000	2,551,527	164,338
1977	1,591,391	898,181	100,000	1,334,373	809,560
1978	1,712,234	878,547	100,000		51,310
1979	1,842,252	859,410	100,000		46,650
1980	1,982,144	840,429	100,000		42,400
1981	2,132,658	822,139	100,000		38,550
1982	2,294,601	804,028	100,000		35,040
1983	2,468,842	786,573	100,000		31,860
1984	2,656,314	769,002	100,000		28,960
1985	2,858,021	752,516	100,000		26,330
1986	3,075,045	735,858	100,000		23,930
1987	3,308,549	719,940	100,000		21,760
1988	3,559,784	704,125	100,000		19,780
1989	3,830,096	688,651	100,000		17,980
1990	4,120,934	673,772	100,000		16,350
1991	4,433,858	658,871	100,000		14,860
1992	4,770,543	644,500	100,000		13,510
1993	5,132,795	630,307	100,000		12,280
1994	5,522,554	616,317	100,000		11,160
1995	5,941,909	603,103	100,000		10,150
1996	6,393,108	589,444	100,000		9,220
1997	6,878,569	577,111	100,000		8,390
1998	7,400,894	563,948	100,000		7,620
1999	7,962,881	551,827	100,000		6,930
2000	8,567,542	539,755	100,000		6,300
Total		21,710,036			2,658,409

Since 10 percent rate of discount is the maximum that has been used in cost-benefit analysis studies, it was chosen as the basis for calculation in this study. Column (2) and (5) in Table 4 are the present values of the benefits and costs associated with Fort Frederick. The sum of column (2), $21,710,036, is the present value of the benefits from Fort Frederick from 1972-2000. A similar value for the cost is $2,658,409, as shown in Table 4. The division of the former figure by the latter gives a very favorable benefit-cost ratio of 8.16, which means that the benefits are about eight times greater than the costs, remembering that costs used were arrived at by assumption.

Concluding Remarks and Implications

Let us see how the methods developed in Chapters II, III, and IV have affected the application carried out in this Chapter.

Market Failure

At the beginning it was established that public outdoor recreation being a public good is a case of market failure, and as such no market determined price was to be found for it. As a corollary of absence of price, in the economic analysis of recreation, it was found that the technique of consumer's surplus had to replace the methods of marginalism. Furthermore, consumer's surplus, because of its association with a price, was not entirely suited for the analysis intended here. It was made obvious that since a recreation spot attracted visitors from

the nearest to the farthest distance, the entire area under the demand curve was of interest rather than that which existed beyond a certain line drawn parallel to the quantity axis.

Another point with regard to the market failure was that there was no need for a market to be resurrected. A good many authors,[13] after deriving a demand curve for recreation, in methods similar to the one here, have made an attempt to simulate the market, by varying "prices" to deduce the number of visits. This, as is pointed out, [14] is a statistically dubious technique, and of no consequence for the analysis.

Criteria in Cost Benefit Analysis

Since no flows of receipts are present to be reinvested in a recreational project the use of internal rate of return is not appropriate. The present value criterion is justified and is used in this analysis, even though the benefits all accrue to the recreationist.

The 10 percent rate of discount applied to the streams of benefits and costs is fairly high. But if the application of a higher rate favors the development of a project, the application of lower rates make it

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[13] Clawson and Knetsch, for example.

[14] See Prest and Turvey, op. cit., p. 192.

even more favorable. Thus, the need for applying several rates, suggested as helpful to the decision maker, is eliminated.

An outdoor recreation resort does not pose the problem of obsolescence, which makes the calculation of the length of life a critical issue. Hence, the choice of 29 years for discounting purposes implied is purely arbitrary.

The capacity limitation which is a critical issue in the analysis of recreation, however, does not seem to arise in the 29 years considered. The total annual attendance in the projection shown in Table 2 is 214,000 in the year 2000, whereas the projected annual capacity estimated by the Maryland State Parks is 267,108.

Externalities

The categories of external benefits as reflected in a reduction in crime attributed to recreation is hardly the case with regard to Fort Frederick. Location is the main factor here. The distance of Fort Frederick makes it hardly accessible to the poor urban communities in Washington, which is alleged to experience a higher rate of crime.

The other category of external benefits implicit in the fact that an area is conserved in natural beauty is left out in this calculation. The calculation reflects natural benefits to the extent that this aspect is appreciated by the people who visit the area.

External diseconomies are likely to appear in over-crowded outdoor recreation in terms of quality deterioration of the environment. But over-crowdedness and the intensity of use are more prevalent in private than public outdoor recreation, because the private operators "are under constant pressure to increase the intensity of recreation use in their area."[15]

Applications

The methods used for Fort Frederick were largely illustrative in nature. With better samples of costs and expenditures on visits, the technique could be very useful for decision making with regard to the development of the 45 state parks in Maryland or other states for that matter.

Although, in such larger applications, both the supply side and the demand side merit consideration, as is pointed out by Cicchetti et al[16] and Seneca.[17]

The important bearing that this study has on achieving efficiency in resource allocation in recreation is as follows:

The income and population variables are highly significant in the demand equation (8). Both variables bear positive signs, and are demand

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[15] Clawson and Knetsch, op. cit., p. 178.

[16] The Demand and Supply of Outdoor Recreation, op. cit.

[17] "Water Recreation, Demand, and Supply," Water Resources Research (December, 1969).

shifters. The significance of that statement is that the higher the income and the population of an area the farther to the right the demand curve will be shifted. Whereas the shift due to larger population can be justified, the shift brought about by income is worth pondering.

Assuming an average per capita income of $1,000 (which is not unreasonable for some of the areas of the states) the area under the demand curve for 1970 will amount to $122,423 compared with $953,399 for an average income of $3,377. Thus, the size of income determines the location of the curve.

If the method is applied for decision making purposes, an adjustment in the demand curves is called for to arrive at a balanced distribution of recreational facilities on the basis of merits from recreation and not the income of the population.

Recreation is categorized as a public good not on the grounds of market failure entirely, but also on the grounds that profitability calculus is not amenable to the basic biological needs that man has for recreation. The urgency of this need should override the ability or even willingness to pay in decisions with regard to public outdoor recreation.

APPENDIX I

APPENDIX I

EXPENDITURES FOR RECREATION AND EXPENDITURES FOR WHEEL GOODS AND DURABLE SPORTS EQUIPMENT, 1909-62

Year	Personal consumption expenditures for recreation ($ million) (1)	Disposable personal income ($ billion) (2)	Recreation expenditures as percentage of disposable personal income (per cent) (3)	Gross national product, per capita, 1929 prices ($) (4)	Personal consumption expenditures for sports equpt., etc. ($ million) (5)	Expenditures on sports eqpt., etc. as percentages of disposable income (Per cent) (6)
1909	860	26.6	3.2	608		
1914	1,000	29.6	3.4	632		
1919	2,180	63.3	3.4	710		
1921	2,055	60.2	3.4	660		
1923	2,620	69.7	3.8	766		
1925	2,835	73.0	3.9	781		
1927	3,120	77.4	4.0	817		
1929	4,331	83.1	5.2	857	219	0.26
1930	3,990	74.4	5.4	772	172	0.23
1931	3,302	63.8	5.2	721	159	0.25
1932	2,442	48.7	5.0	611	110	0.23
1933	2,202	45.7	4.8	590	93	0.20
1934	2,441	52.0	4.7	639	118	0.23
1935	2,630	58.3	4.5	718	136	0.23
1936	3,020	66.2	4.6	787	171	0.26
1937	3,381	71.0	4.8	846	210	0.30
1938	3,241	65.7	4.9	794	210	0.32
1939	3,452	70.4	4.9	847	228	0.32
1940	3,761	76.1	4.9	916	254	0.33
1941	4,239	93.0	4.6	1,040	314	0.34

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1942	4,677	117.5	4.0	1,147	306	0.26
1943	4,961	133.5	3.7	1,245	271	0.20
1944	5,422	146.8	3.7	1,327	323	0.22
1945	6,139	150.4	4.1	1,293	400	0.27
1946	8,621	160.6	5.4	1,179	809	0.50
1947	9,352	170.1	5.5	1,149	972	0.57
1948	9,808	189.3	5.2	1,189	980	0.52
1949	10,122	189.7	5.3	1,147	847	0.45
1950	11,278	207.7	5.4	1,233	878	0.42
1951	11,704	227.5	5.1	1,295	904	0.40
1952	12,257	238.7	5.1	1,317	994	0.42
1953	12,892	252.5	5.1	1,349	1,093	0.43
1954	13,256	256.9	5.2	1,309	1,174	0.46
1955	14,220	274.4	5.2	1,366	1,397	0.51
1956	15,161	292.9	5.2	1,368	1,575	0.54
1957	16,082	308.8	5.2	1,368	1,760	0.57
1958	16,842	317.9	5.3	1,315	1,883	0.59
1959	18,309	337.3	5.4	1,359	2,017	0.60
1960	19,524	350.0	5.5	1,365	2,138	0.61
1961	20,533	364.4	5.6	1,369	2,224	0.61
1962	21,555	385.3	5.6	1,436	2,386	0.62

Source: Marion Clawson and Jack Knetsch, Economics of Outdoor Recreation (Baltimore: Johns Hopkins Press, 1971), p. 318.

Rates of Growth for Income and Expenditures on Recreation

The rate of growth in come from column (4) = $(1,434/608)^{1/40} = 1.02$

The rate of growth in expenditures on recreation from column (1) = $(21,555/860)^{1/40} = 1.07$

APPENDIX II

APPENDIX II

The data gathered through a sample survey are contained in the following table. Column (1) is the number of observations, column (2) is the name of the counties from which the visitors came, column (3) is the distance travelled, column (4) is the number of people in a party of visitors, column (5) is the travel time to Fort Frederick, and column (6) is the total stay period for visitors.

APPENDIX II - DATA FROM THE SAMPLE SURVEY

(1) Observations	(2) County Name	(3) Distance Travelled (miles)	(4) Number of People in the Party	(5) Travel Time	(6) Stay Time
1	Washington, Md.	25	3	30 min.	12 hrs.
2	"	26	3	30 min.	12 hrs.
3	"	16	5	25 min.	8 hrs.
4	"	50	4	60 min.	62 hrs.
5	"	18	4	45 min.	8 hrs.
6	"	25	3	30 min.	60 hrs.
7	"	25	4	30 min.	2 hrs.
8	"	10	2	35 min.	8 hrs.
9	"	30	2	4 hrs.	30 min.
10	"	16	50	25 min.	4 hrs.
11	"	20	5	30 min.	48 hrs.
12	"	12.5	2	15 min.	10 hrs.
13	"	20	2	35 min.	10 min.
1	Frederick, Md.	25	2	45 min.	20 min.
2	"	30	5	30 min.	8 hrs.
1	Pr. Geo., Md.	70	2	2 hrs.	1/2 hr.
2	"	75	3	2 hrs.	24 hrs.
1	Allegany, Md.	50	3	1 1/2 hrs.	1 hr.
2	"	60	3	2 1/2 hrs.	0 hr.
3	"	42	1	1 1/4 hrs.	8 hrs.
4	"	65	2	1 1/2 hrs.	4 hrs.
1	Howard, Md.	75	6+	3 hrs.	1 hr.
1	Anne Arundel,	90	6	1 5/6 hrs.	5 hrs.
2	Md. "	90	3	1 3/4 hrs.	2 hrs.
3	"	90	6	1 5/6 hrs.	5 hrs.

APPENDIX II - DATA FROM THE SAMPLE SURVEY (Continued)

(1) Observations	(2) County Name	(3) Distance Travelled (Miles)	(4) Number of People in the Party	(5) Travel Time	(6) Stay Time
1	Baltimore, Md.	110	4	2 hrs.	1 hr.
2	"	100	1	2 hrs.	24 hrs.
3	"	90	6+	3 hrs.	1/2 hr.
4	"	90	4	2 hrs.	48 hrs.
5	"	100	4	2 hrs.	48 hrs.
6	"	90	5	1 1/2 hrs.	24 hrs.
1	Montgomery, Md.	75	3	2 hrs	24 hrs.
2	"	75	3	1 1/4 hrs.	12 hrs.
3	"	75	4	1 1/2 hrs.	36 hrs.
4	"	70	15	1 1/2 hrs.	15 min.
5	"	75	2	1 1/4 hrs.	24 hrs.
6	"	62	4	1 1/2 hrs.	24 hrs.
7	"	60	2	1 1/2 hrs.	12 hrs.
8	"	50	8	3 hrs.	48 hrs.
9	"	75	2	1 1/4 hrs.	2 hrs.
10	"	60	4	1 1/2 hrs.	2 hrs.
11	"	60	6	1 1/2 hrs.	3 hrs.
12	"	50	2	3 hrs.	1 hr.
13	"	80	1	N.A.	1 hr.
14	"	63	2	1 1/3 hrs.	48 hrs.
15	"	100	6+	2 hrs.	8 hrs.
16	"	70	3	1 1/2 hrs.	1 hr.
17	"	90	4	2 hrs.	2 1/2 hrs.
18	"	65	3	1 1/2 hrs.	10 hrs.
19	"	60	11	1 1/4 hrs.	24 hrs.
1	Morgan, W. Va.	25	4	25 min.	1 hr.
1	Clarke, W. Va.	70	2	1 1/2 hrs.	2 hrs.
1	Fairfax, Va.	85	2	2 1/2 hrs.	36 hrs.
2	"	100	4	1 1/2 hrs.	1 1/2 hrs.
3	"	75	3	1 1/2 hrs.	8 hrs.

APPENDIX II - DATA FROM THE SAMPLE SURVEY (Continued)

(1) Observations	(2) County Name	(3) Distance Travelled (Miles)	(4) Number of People in the Party	(5) Travel Time	(6) Stay Time
4	Fairfax, Va.	80	3	1 1/2 hrs.	11 hrs.
5	"	90	2	1 1/2 hrs.	10 hrs.
6	"	N.A.	1	1 1/2 hrs.	3 hrs.
7	"	70	2	1 1/4 hrs.	1 hr.
8	"	80	3	2 hrs.	2 hrs.
9	"	70	1	2 1/2 hrs.	48 hrs.
10	"	90	3	1 1/2 hrs.	1 hr.
11	"	90	2	1 1/3 hrs.	12 hrs.
1	Stafford, Va.	100	2	3 hrs.	15 min.
1	Lebanan, Pa.	200	5	2 hrs.	48 hrs.
2	"	200	5	2 hrs.	48 hrs.
3	"	100	8	2 1/2 hrs.	48 hrs.
4	"	150	5	3 hrs.	48 hrs.
1	York, Pa.	70	5	3 hrs.	4 hrs.
1	Wayne, Pa.	40	2	1 hr.	5 hrs.
1	Franklin, Pa.	35	1	1 hr.	5 hrs.
1	Morris, N. J.	200	6+	6 hrs.	48 hrs.
2	"	265	2	5 1/4 hrs.	2 hrs.
1	District of Col.	90	2	2 hrs.	5 hrs.
2	"	75	2	2 hrs.	5 hrs.
3	"	75	4	1 1/2 hrs.	2 hrs.

APPENDIX II - DATA FROM THE SAMPLE SURVEY (Continued)

(1) Observations	(2) County Name	(3) Distance Travelled (Miles)	(4) Number of People in the Party	(5) Travel Time	(6) Stay Time
4	District of Col.	75	1	1 1/4 hrs.	2 hrs.
5	"	80	2	1 1/4 hrs.	4 hrs.
6	"	80	2	1 1/4 hrs.	5 hrs.
7	"	90	4	2 hrs.	8 hrs.
8	"	90	2	3 hrs.	4 hrs.
9	"	70	2	1 1/2 hrs.	1 hr.
10	"	70	6+	1 1/2 hrs.	24 hrs.
11	"	105	6+	3 hrs.	6 hrs.
12	"	110	6+	2 hrs.	N.A.
13	"	90	4	1 1/2 hrs.	1 hr.
14	"	90	2	2 hrs.	1 1/2 hrs.
15	"	90	4	3 hrs.	2 hrs.
16	"	80	2	2 hrs.	0
17	"	109	6+	5 1/2 hrs.	2 hrs.
18	"	80	1	2 hrs.	2 hrs.
19	"	70	2	1 1/4 hrs.	2 hrs.
20	"	75	3	1 1/2 hrs.	1 hr.
21	"	75	4	2 hrs.	1 hr.
22	"	80	2	1 1/2 hrs.	30 hrs.
23	"	80	3	1 1/2 hrs.	12 hrs.
24	"	70	2	2 hrs.	12 hrs.
25	"	80	1	1 1/2 hrs.	24 hrs.
26	"	90	2	1 1/2 hrs.	12 hrs.

APPENDIX III

APPENDIX III

Equation (8) in Chapter V was the best of approximately 30 equations that were tried for estimating the demand for recreation at Fort Frederick. Seven of the equations are listed below as a sample of different models and forms tested. In all of the equations the nomenclature is the same as in equation (8). Thus, V is visits, E is expenditures, P is population and ln is natural logs.

In equation (1) below, where P is used as a divisor of the dependent variable, the new dependent variable, visits per capita $(\frac{V}{P})$, is negatively related to Y. Although the coefficients are significant at about 90 percent, the negative relationship suggesting that as income increases one's recreational activity decreases, is open to question.

(1) $$\frac{V}{P} = \underset{(.00054)}{.0021\ E} - \underset{(.000007)}{.000016\ Y} + .14$$

$$R^2 = .74$$

$$D\text{-}W = 1.45$$

Equation (2) is equation (1) in logs form, with its R^2 lower than for equation (1), and where ln Y no longer has a significant coefficient.

(2) $$\ln \frac{V}{P} = \underset{(.48)}{-\ 1.11\ \ln E} - \underset{(.953)}{.0289\ \ln Y} - 6.45$$

$$R^2 = .42$$

$$D\text{-}W = .98$$

Equation (3) is the inverse of equation (1) where R^2 is very low and none of the coefficients are significant.

$$(3) \qquad V = \underset{(16809800)}{-\ 13056200}\ \frac{E}{P} + \underset{(37236)}{4937}\ \frac{Y}{P} + 6761.62$$

$$D\text{-}W = 1.676$$

$$R^2 = .1166$$

Equation (4) is the same as equation (10) of Chapter V, without the explanatory variable (P). Hence, the R^2 is lower than that for equation (10). Also note that ln Y is no longer significant; the coefficient does have a positive sign however. It should be pointed out that the omission of the variable population from equation (10), thus giving equation (4), the autocorrelation of residuals problem (equation (10) has D-W = 1.10) has increased as one would expect.

$$(4) \qquad \ln V = \underset{(.484)}{1.101}\ \ln E + \underset{(1.95)}{.0288}\ \ln Y + 10.87$$

$$R^2 = .42$$

$$D\text{-}W = .987$$

Equations (5), (6), and (7) are simple regressions of expenditures against visits. All have the same R^2, meaning that the simple transformation of the independent variable has only changed the coefficient for the variable, and has left the R^2 and the constant terms unaffected.

$$(5) \qquad \ln V = \underset{(.55)}{-\ 1.47}\ \ln E + 11.65$$

$$R^2 = .33$$

$$D\text{-}W = 1.472$$

$$(6) \qquad \ln V = \underset{(.278)}{-\ .738}\ \ln E^2 + 11.65$$

$$R^2 = .33$$

$$D\text{-}W = 1.472$$

(7) $$\ln V = \underset{(1.09)}{-2.95} \ln E^{1/2} + 11.65$$

$$R^2 = .33$$

$$D\text{-}W = 1.472$$

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