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Bidding Game Valuations of Congestion Costs in Winter Sports Areas

Philip B. Halverson
Utah State University

BIDDING GAME VALUATIONS OF CONGESTION COSTS

IN WINTER SPORTS AREAS

by

Philip B. Halverson

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INTRODUCTION

During the last three decades, there has been a significant growth in the outdoor recreation industry. In 1969, there were 17.6 million visits to national parks, and by 1978, that number had increased to 283.1 million (Gregory, 1972; U.S. Dept. of Commerce, 1979). Similarly, visits to national forests grew from 5 million in 1925 to over 147 million in 1965 (Clawson and Knetsch, 1966).

There are many factors that would account for such a strong, steady increase in outdoor recreation participation. One of the most obvious reasons would be the post-World War II "baby boom". Such a large increase in the U.S. population has undoubtedly increased the number of recreators. Increasing worker productivity has not only provided additional disposable income, but has also provided more leisure time. Thus, individuals may work less and have more money and time with which to recreate. A more subtle factor may be that increasing urbanization has raised levels of psychological and emotional stress which in turn has created a demand for outdoor experiences as a means of "getting away from it all". (Clawson and Knetsch, 1966).

Despite recent increases in wilderness acreage (providing a defacto increase in outdoor recreation acreage), the growth in acreage has not kept pace with the growth in demand. It is primarily land that is used to produce outdoor recreation services. From 1950 to 1978, total national park acreage increased only 36% while national forest acreage has remained relatively unchanged for some time.

It is now clear that the demand for outdoor recreation has grown
faster than its supply, or more correctly, the resources that produce
its supply. This imbalance would not pose too great a problem if the
scarce resources used to produce outdoor recreation services were allo-
cated efficiently by some type of mechanism. In an economy such as
ours this would imply the use of a market-type allocation scheme with
prices as the rationing agent. However, outdoor recreation services
are typically provided by the public sector at low, or zero, cost to all
consumers. To many, outdoor recreation is considered a merit good and
as such should be provided freely to all those wishing to consume it.

The lack of a market for outdoor recreation services creates some
allocation problems. On the supply side, without market pricing, it
is difficult for producers to determine the values placed on these ser-
vices by individuals. Hence, it is hard to determine if economically
efficient quantities of resources have been devoted to producing
various recreation services.

On the demand side, an artifically low, or zero, price usually
results in over consumption (i.e., quantity demanded exceeds quantity
supplied) of a resource, or the services it provides. For outdoor
recreation, overconsumption is most noticible when there is congestion
at a recreation site.

Defined for outdoor recreation, congestion occurs when the addi-
tion of one more individual at a recreation site results in a decrease
in utility for those already at that site. When congestion occurs and
to what extent it affects an individual's experiences depends on the

site. For example, one would be more apt to experience high visitation at a national park than at a wilderness area. However, the utility loss suffered by consumers of wilderness areas who face even small amounts of congestion may be greater than the utility loss of a national park consumer facing congestion. This is due to the basic differences in expectations that each consumer places on a specific site, and/or activity.

Congestion is not only a function of numbers of people. There are increasing numbers of different types of recreators such as; hikers, skiers, and bird watchers. Conflict between two or more different user groups has increased with the growth of outdoor recreation demand. Birdwatchers may be "disturbed" by hikers, cross-country skiers may be "bothered" by snowmobilers, or vice-versa, and so on.

NATURE OF THE PROBLEM

As a (quasi) public good, outdoor recreation resources are not rationed by prices, as are private goods. The demand for outdoor recreation has grown to the point where congestion encounters are commonplace. In order that they may provide a quality recreation experience to individuals resource managers should know the extent of the the congestion costs which consumers suffer. Only then will managers be able to achieve congestion reduction and/or prevention through the development of a pricing scheme, increasing the resources devoted to outdoor recreation, or a combination prices and resources increases.

This study examined the congestion/conflict problem in Logan Canyon, Utah. In this recreation area there appears to be considerable antagonism between cross-country skiers and snow-machine riders. Those of the former group continually express (publicly) their dissatisfaction with having to recreate near or along side snowmobilers. The latter group feels that as taxpayers, they should be free to recreate wherever they wish.

This study had two objectives:

1. To examine any conflict between cross-country skiers and snowmobilers in the Logan Canyon Recreation Area (LCRA).

2. To test the relative merits of travel-cost and bid game methodologies as suitable methods for estimating congestion impacts.

REVIEW OF LITERATURE

Travel cost methodology

Much of the early research on outdoor recreation benefit estima-
tion was developed by Marion Clawson. He is generally credited with
being the first to use the travel costs to a recreation site as price
proxies in the estimation of demand curves for recreation resources
(Clawson, 1959).

Clawson's procedure for estimating a demand curve involves a two
stage process. First, data on travel costs are gathered, usually
through a survey, for different distance zones from the site. These
costs are then regressed against levels of use. The resulting func-
tion is what Clawson calls.. "a demand curve for the entire recreation
experience." Included in this curve, in addition to site specific
benefits, are any benefits generated by the jointly consumed variables
such as travel itself, food, and lodging.

To isolate the site specific demand curve requires one more step.
Using the function obtained in stage one, which assumed nominal or
zero entry fees and similar utility functions for "average" users for
each zone, changes in use rates can be extrapolated from the functions
for hypothesized entry fees which yield a demand curve for the
specific recreation opportunity.

Several assumptions are made when using the Clawson approach.
Income, tastes, and the marginal utility of income for all users are
all assumed to be constant. Individuals are also assumed to respond
to a change in travel or entry costs in the same manner as any other
price change. They may consume more or less recreation as prices vary,

rather than seek political redress. Finally, time costs for individuals from different distance zones are considered insignificant, as are congestion levels for the sites where the estimations are made.

Travel cost valuation schemes have proved to be popular due to their simplicity. Such methods have also been subject to considerable research aimed at exposing their strengths and weaknesses, both empirical and theoretical.

Cesario and Knetsch (1970) questioned the assumption of constant time costs between distance zones. They felt that ignoring time costs differentials generates a downward bias in the demand function. To avoid this, they suggested the use of a time cost tradeoff function to correct the demand curve. However, they also recognized the high degree of correlation between time and distance, which makes the estimation of a tradeoff function more art than science, given current statistical procedures. They warned that a corrected demand curve may be no more accurate than the original.

Sinden (1974) also objects to treating time costs as constant. Furthermore, he argues, bias is generated when tastes and an individual's marginal utility of income are assumed to be unchanging. Sinden recommends empirically estimating individuals' utility functions using estimated indifference curves. This method can allow for changes in time costs, tastes, etc... Demand curves can then be derived from the utility functions.

Congestion is another problem affecting the estimation of outdoor recreation demand curves. The increase in congestion encounters has piqued researchers' curiosity as to how congestion impacts affect

benefits accruing to recreation sites and has been the subject of extensive study. Part of this research has examined the effects of congestion when using travel cost methods of benefit estimation.

McConnell and Duff (1976) have developed a model which indicates that under conditions of excess demand, travel cost methods underestimate the benefits accuring to the site by using standard utility maximazation procedures and incorporating travel costs into the recreators budget constraint the appropriate demand curve can be generated:

$$\text{MAXIMIZE} \quad L = U(X_1;X_2) - \phi[X_1[t(d)+Px_1] + P_2X_2 -I]$$

where;

X_1 = the number of trips to the site

X_2 = all other goods

$t(d)$ = round trip travel and transfer costs for a trip of length d.

Px_1 = entrance price of site, if any

Px_2 = composite price for all other goods

I = money income

Maximizing L with respect to X_1 yields the first order condition:

$$\partial U/\partial x_1 = \phi[t(d) + Px_1]$$

This first order condition implies an ordinary, per capita demand curve for X_1 of the form:

$$X_1 = f[t(d)+Px_1]$$

where the income argument is dropped for convenience.

The benefits accruing to any individual that is r_1 miles from the site can be found by calculating the individual's consumer surplus:

$$CS_i = \int_0^{\tilde{P}-t(r_1)} f[P+t(r_1)]dp$$

Note that $\tilde{P}-t(r)$ is the maximum amount a recreator will pay in fees and travel costs (i.e., the intercept of the demand curve on the price axis).

Estimating total site benefits requires the aggregation of all recreators' consumer's surplus (CS_i) across distance zones:

$$CS_r = \int_0^{\tilde{r}} L(r)\int_0^{\tilde{P}-t(r)} f[P+t(r)]dpdr$$

where;

$$L(r) = \text{population density at distance } r$$

Since the equation for total consumer surplus (benefits) for the site is a monotonic transform of individual consumer surplus, anything that underestimates individual CS will underestimate aggregate CS.

The development of the above expression for total site benefits requires three simplifying assumptions:

1) Tastes do not vary with distance from the site.

2) No utility is derived from travel or transfer spending.

3) Individual's react identically to changes in $t(r)$ or Px_1.

McConnell and Duff show that congestion causes behavior that violates assumption number 3 and hence, results in an underestimation of site benefits.

If it is assumed that recreation managers will limit site use
when visitation exceeds some level, K, then individual's will not be
certain as to their likelihood of admittance. Thus, their consumption
decisions are based upon perceived demand (X^*), not actual demand.
The recreator still faces travel and entrance costs, and the addi-
tional uncertainty with respect to entry. The problem becomes:

$$\text{MAXIMIZE} \quad U(\mu X_1; X_2) - \varphi[(\mu p + t(d))X_1 + Px_2X_2 - I]$$

where;

μ = the probability of the recreator gaining entry
based on perceived excess demand.

All other variables are defined as before. The resulting first order
condition is:

$$\partial U/\partial X_1 = \varphi[px_1 + t(d)/\mu]$$

which implies a demand function of the form:

$$\mu X_1 = f[t(d)/\mu + Px_1]$$

All that needs to be examined is the change in demand resulting
from a change in either travel or entrance costs.

$$1) \quad \partial \pi X_1/\partial t(d) = f^1[t(d)/\mu + Px_1]/\mu$$
$$2) \quad \partial \pi X_1/\partial Px_1 = f^1[t(d)/\mu + Px_1]$$

Clearly, there is a difference between these two expressions. Figure
(1) shows this difference graphically. The slopes of d_1 and d_2 are
given by equations 1 and 2 respectively.
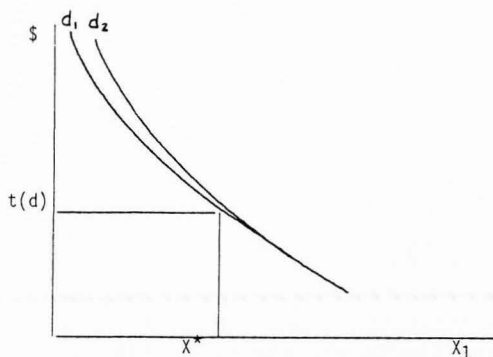
Fig. 1. Divergence of Recreation Demand curve slopes under
conditions of excess demand.

Curve d_1 is more elastic due to the uncertainty of being admitted.
When travel costs increase, recreators reduce consumption partly
because price went up and partly because they may not be admitted. The
demand curve estimated using the travel costs methods is d_1. There-
fore, when congestion is present at a site, benefits will be underesti-
mated when using travel cost methods. McConnell and Duff suggest that
the demand function should be corrected by a factor of u.

It should be noted that McConnell and Duff's model applies only to
controlled access recreation areas such as Yellowstone National Park.
Open access areas must be examined using other models (see Cicchetti
and Smith, 1973).

Wetzel (1977) has also shown that congestion will cause a downward
bias in travel-cost demand curves, but for reasons different from those
of McConnell and Duff. Wetzel objects to holding congestion levels
constant when estimating demand curves. The following is a brief pre-
sentation of the Wetzel model.
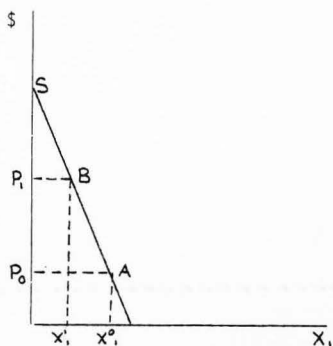
Fig. 2. Loss of welfare due to a price increase.
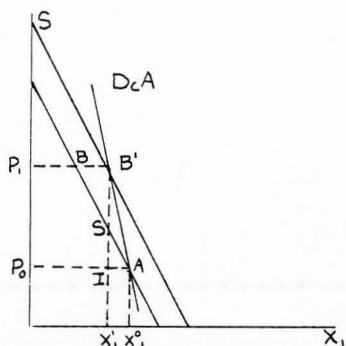
Fig. 3. Gain in welfare due to a price induced congestion decrease.

Figures 2 and 3 represent typical site demand curves estimated with travel cost techniques. Travel costs are assumed to vary only with distance, hence the term price refers to entry fees. In figure 2, a rise in price from P_0 to P_1 will cause use of the facility to decrease from X^0 to X_1^1. Before the price change, site benefits were P_0AS. The price rise results in a decrease in benefits equal to the area CAB, leaving total site benefits of P_0CBS. Thus, Wetzel points out, the assumption of constant congestion levels necessitates a loss of social welfare whenever there is a price increase.

Fig. 3 illustrates the case of variable levels of congestion. If the price of entering a recreation area rises from P_0 to P_1, recreators will move along S from A to B. This decrease in consumption implies that congestion has also lessened somewhat. A decrease in congestion will cause S to shift outward to S' and so consumption will be at B'. The remaining consumers will consume more with a congestion decrease.

The increase in benefits is given by the area SS'BJ and the social loss due to a price increase is AIJ. In this case, a net loss in social benefits will occur only if AIJ exceeds SS'BJ and there is no appropriate reason why it would (or would not). Repeated applications of the above procedure will trace out a new demand curve, D_{CA}. Embodied in this curve are the effects that different congestion levels have on use rates. Freeman (1976) calls this type of curve a congestion-adjusted demand curve. The congestion adjusted curve is less elastic than a standard travel cost curve, generating an under-estimation of site benefits when congestion levels are held constant.

Wetzel asserts that there are two effects that must be taken into consideration when estimating site benefits: (1) McConnell and Duff's effect resulting from the possibility of exclusion, and (2) the price induced effect postulated by Wetzel. Both effects result in underestimated site benefits.

In response to the theoretical and empirical problems associated with travel - cost methods in general, and congestion impacts in particular, Pajooyan, (1978) as well as Deyak and Smith (1978) have constructed analytical models for outdoor recreation using Becker's (1971) household production function (HPF) theory. HPF models of consumer behavior treat individuals differently than conventional methods. Instead of being consumers of final goods and services, households are assumed to purchase intermediate products and combine them with various time inputs to produce commodities for final consumption.

The implications of HPF theory as applied to outdoor recreation are twofold; (1) demand curves can be estimated using observed data

rather than possibly biased data, and (2) the implicit prices (values)
for recreation and congestion can be determined. These values can be
shown to be the marginal costs of producing a recreation commodity and
a congestion reduction commodity, respectively. The Pajooyan model is
presented below.

Recreationists are assumed to have utility functions of the form,

$$U = \mu(R,C,Z)$$

where;

> R = the recreation commodity produced by
> households.
>
> C = a congestion reduction commodity.
>
> Z = all other goods.

and,

$$\frac{\partial U}{\partial R} > o \; ; \; \frac{\partial U}{\partial C} > o \; ; \; \frac{\partial U}{\partial Z} > o$$

When individuals encounter congestion at a site, they are assumed
to produce C by combining variables such as time, gasoline, and car
services, in order to reduce the effects of the congestion, that is
they recreate at some other site or at another section of the initial
site.

Since R, C, and Z are assumed to be procuded by households, their
production functions are given by

$$R = r(X_R \; ; \; T_R)$$
$$C = c(X_C \; ; \; T_C)$$
$$Z = z(X_Z \; ; \; T_Z)$$

where;

X_i = goods and services required to produce i, i = R,C,Z.

T_i = time inputs necessary to produce i, i = R,C,Z.

The arguments of the recreator's demand function are defined through utility maximization. Since commodity prices are not observable, a two-stage procedure is used; stage one yields the recreators budget constraint, and in stage two utility is maximized subject to the generated budget constraint.

Stage one

For any household (or individual), a cost minimization problem can be written as:

$$\text{MINIMIZE} \quad i \overset{3}{\underset{=1}{\sum}} P_{Xi} X_i + W \overset{3}{\underset{i=1}{\sum}} T_i$$

$$\text{S.T.} \quad V(X,T) - V = 0$$

where;

P_{Xi} = the market price of input X_i i = R,C,Z

W = wage rate

X = goods input vector = $[X_R, X_C, X_Z]$

T = time input vector = $[T_R, T_C, T_Z]$

V = produced commodity vector = $[R,C,Z]$

The first order conditions are

$$P_{Xi} - \lambda \, V_{Xi} = 0 \qquad i = R,C,Z$$

$$W \;\; - \lambda \, T_i = 0 \qquad i = R,C,Z$$

$$V(X,T) - V = 0$$

The first order conditions imply the following demand curves for X_i and T_i.

$$X_i = X^i(P_{Xi};W;V_i)$$

$$T_i = t^i(W;P_{Xi};V_i)$$

Substituting X_i and T_i into the original cost function (assuming no joint production) yields

$$C(P_X,W,X) = C^r(P_{XR},W,R) + C^c(P_{XC},W,C) + C^z(P_{XZ},W,Z)$$

The implicit, or shadow, prices of R,C,Z are given by their marginal costs

$$\pi_R = MC_R = \frac{\partial C}{\partial R} = \frac{\partial C^r}{\partial R} = \pi^r(P_{xr},W,R)$$

$$\pi_C = MC_C = \frac{\partial C}{\partial C} = \frac{\partial C^c}{\partial C} = \pi^c(P_{xc},W,C)$$

$$\pi_Z = MC_Z = \frac{\partial C}{\partial Z} = \frac{\partial C^z}{\partial Z} = \pi^r(P_{zr},W,Z)$$

The budget constraint can now be written as

$$\pi_r \cdot R + \pi_c \cdot C + \pi_z \cdot Z = \overline{Y}$$

where;

$$\overline{Y} = Y + T_i \cdot W \quad \text{(full income constraint)}$$

$$Y = \text{disposable income}$$

Stage two

The individual's utility function is now maximized subject to his/her budget constraint:

$$\text{MAXIMIZE } U = \mu(R,C,Z)$$

$$\text{S.T.} \quad \pi_R \cdot R + \pi_C \cdot R + \pi_Z \cdot Z = Y$$

First order conditions of the maximization are:

$$U_i - \lambda \pi_i = 0 \qquad i = R,C,Z$$

$$\pi_R R + \pi_C C + \pi_Z Z = \overline{Y}$$

where;

U_i = the marginal utility of the ith commodity, $i = R,C,Z$

λ = the marginal utility of income

The first order conditions generate a demand curve for recreation that has the implicit prices of a reacreation commodity, a congestion reduction commodity, and income as arguments. The commodity Z can be dropped for convenience, since it is assumed constant.

$$D_R = d(\pi_R, \pi_C, \overline{Y})$$

$$= d(MC_R, MC_C, \overline{Y})$$

The marginal cost arguments can be exactly specified by assuming some form of production function (Cobb-Douglas, CES, etc) and performing the necessary calculations. For his empirical work, Pajooyan assumed a Cobb-Douglas production function:

$$D_R = kMC_R^{\partial} MC_C^{B} \overline{Y}^{T}$$

$$= k\pi_R^{\partial} \pi_C^{B} \overline{Y}^{T}$$

Using an econometics procedure that was found to yield statisti-
cally consistant results, the demand function's parameters were found
to be:

$$D_R = 1.42 \ \pi_R^{-1.38} \ \pi_C^{-1.74} \ \gamma^{1.27}$$

$$= 1.42 \ MC_R^{-1.38} \ MC_C^{-1.74} \ \gamma^{1.27}$$

The "prices" of the recreation and congestion reduction commodi-
ties are to be calculated using observed data, for the purchases of
gas, food, and equipment, and time allocation. Using these data with
an appropriate production function and cost minimizing procedure can
yield reliable estimates of the marginal costs of producing R and C.

Also of significant interest is the fact that the HPF model
allows a determination the value which recreators place on various
levels of congestion by observing the various amounts of the conges-
tion reduction commodity produced by recreators in response to conges-
tion. Large quantities of C would indicate overconsumption of a
particular site (or under allocation of resources to that site).
The absence of C production would clearly indicate that site use
rates had not yet reached levels at which additional expense would
be incurred to avoid congestion.

Consumer surplus

An often used measure of welfare is consumer surplus (CS). CS
is defined to be the area under a consumer's demand curve, so that
increases in expenditure due to congestion will serve to shift the

demand curve to the right (increase), and yield an increase in CS. Conversely, recreators may reduce expenditures by decreasing the number of days devoted to recreation which would yield a decrease in CS.

To arrive at consumer surplus values it is necessary to calculate the area beneath the demand curve between two points (prices) of reference. This amounts to integrating the demand between the reference points which in this case were the recreator's observed price for that trip and a maximum price greater than all observed prices, i.e., the intercept of the demand curve on the price axis CS is defined as:

$$CS_i = \int_{P_0}^{P_1} D(P_1 I_0) \, dP.$$

where:

$D(P_1 I_0)$ = a recreator's demand curve as a function of prices and current income

P_1 = observed price

P_0 = maximum price

Contingency-valuation methodology

In contrast with travel-cost valuation models, which yield indirect estimates of the benefits individual's receive from a good or service, contingency valuation (bid-game) methods involve direct estimates of consumers' willingness-to-pay for a good or service by the individuals themselves. The use of contengency valuation, or bid-game, techniques usually entails creating a hypothetical situation designed to elicit personal estimates of willingness-to-pay or willingness-to-be-compensated for a change in the provision of a good

or service. Whether payment or compensation quantities are desired depends on initial property right assignments. To summarize, when contingency valuation methods are used to elicit willingness-to-pay responses, what is sought is the amount of money income an individual is willing to give up in order to prevent (or achieve) a utility decrease (increase).

It is apparent that contingency valuation methodology relies on a subjective assessment of value by individuals. This fact gives rise to several problems, both theoretical and empirical. There has been considerable controversy as to whether bid-game responses are based on equivalent variation (EV) or compensating variation (CV).

An individual's bid can be defined as:

$$1) \quad e(P_1;v(P_1;I_0))-e(P_0;v(P_1;I_0)), \text{ if EV-based}$$

and

$$2) \quad e(P_1;v(P_0;I_0))-e(P_0;v(P_0;I_0)), \text{ if CV-based}$$

where:

$v(P;I)$ = the indirect utility function expressing an individual's utility level at prices P and income I.

$e(P;v(P;I))$ = a function relating expenditures necessary to maintain utility $v(P;I)$ at prices P.

The expenditure necessary to maintain the utility level given by $v(P;I)$ at prices P and (money) income I_0 is I_0. Hence, equations 1) and 2) above can be rewritten as:

3) $I_0 - e(P_0; v(P_1; I_0))$

4) $e(P_1; v(P_0; I_0)) - I_0$.

A Hick's compensated demand curve (for any good or service) is:

$$\frac{\partial\, e(P; v(P; I))}{\partial\, P}$$

this implies:

$$EV = \int_{P_0}^{P_1} \frac{\partial e(P; v(P_1; I_0))}{\partial\, P}\ dP$$

and

$$CV = \int_{P_0}^{P_1} \frac{\partial e(P; v(P_0; I_0))}{\partial\, P}\ dP$$

Freeman (1976) has shown that for an environmental quality variable, Q, the marginal willingness-to-pay for a change (increase) in Q is given by:

$$W = -\frac{\partial e(P; Q; u)}{\partial\, Q}$$

this implies:

$$EV = \int_{Q_0}^{Q_1} \frac{\partial e(P^0; Q; u^1)}{\partial\, Q}\ dQ$$

and

$$CV = \int_{Q_0}^{Q_1} \frac{\partial e(P^0; Q; u^0)}{\partial\, Q}\ dQ$$

where:

$$U_1 = V(P_1; Q_1; I_0)$$

$$U_0 = V(P_0; Q_0; I_0).$$

There is a clear, theoretical difference between EV and CV based responses, but Willig (1976) has shown that when a commodity consumes only a small part of the individual's budget and the income elasticity is small, EV approximates CV. Specifically the relationship is:

$$EV - \frac{\varsigma CS^2}{2I} = CS = CV + \frac{\varsigma CS^2}{2I}$$

where:

ς = income elasticity of demand

CS = consumer surplus for the ordinary demand curve

I = income

now that, since CS falls between EV and CV, it can be used as an estimate of either. However, a study done by Bishop and Heberlein (1979), compared actual market transactions for goose hunting permits, with bids and found willingness-to-pay bids significantly lower and willingness-to-sell bids much higher than the market surplusses. They suggest using willingness-to-pay (EV) bidsas a lower bound and willingness-to-sell (CV) bids as an upper bound on value.

The nature of bid-game methodology raises the question of strategic behavior, or purposeful bias. Due and Friedlaender (1977) recognize two obvious incentives for individuals to distort their answers. The hypothetical nature of the bid-game usually means that no payment is required. Individuals are given the incentive to bid according to what they would like to see done, not how they might behave in the market place. The converse of this possibility is also

true. The chance that a large enough bid may increase current use costs provides ample incentive for downward bias.

Brookshire, et al. (1976) have shown that individuals may attempt to impose their "true" bid on all other respondents by trying to shift the mean bid upward or downward, depending on the situation. For the case of environmental improvement, a strategically behaving "environmentalist" would bid high while a strategically behaving "non-environmentalist" would bid low, even if their respective true willingness-to-pay or sell were similar.

In contrast to Bishop and Heberlein, Brookshire, et al. (1976) feel that zero, or near zero, bids may be more an expression of dissatisfaction with the game than strategic bidding. Furthermore, they argue, bias may be absent when respondents feel that their bids will have little effect in reality. It may be the case that when individuals have little or nothing to gain by lying, they respond accurately.

In addition to strategic behavior, Freeman (1979) cites other potential sources of bias. The possibilities include: (1) attitudes respondents possess toward the vehicle of payment, (2) innaccuracies as a result of apathy, (3) bid starting point bias, and (4) personality conflicts between interviews and respondents.

Though the reasons for viewing bid-game results with suspicion are valid, several studies seem to indicate that if bias is present, it may not be significant. Randall, et al. (1974) have found that if the bid-game is careful to project credibility and realism, then bias should not be a problem. As evidence, they cite the similarity of the results of their study with the results of other studies examining the

same type of problem (valuing air quality/pollution abatement), but using different valuation methods.

Bohm (1972) provides additional credibility to bid-games by finding no significant differences between the results of five different bid-game formats for television in Sweden. Bohm states that by positing several possible payment schemes and not choosing one until all bids are collected will provide enough uncertainty regarding the game and outcome to prevent simple strategic behavior.

The usual procedure in contingency valuation methodology is to collect bids, aggregate them into a social willingness-to-pay function and use this function to measure the social welfare surrounding the proposed change(s). This requires interpersonal comparisons of utility between respondents (Sinden, 1974). Such comparisons are more art than science and can produce innaccurate results. Furthermore, the aggregate bid curve is dependent upon the initial distribution of income. However, Brookshire, et al. (1976), have shown that when income effects and the postulated welfare changes are small, the aggregate curve will provide a valid measure of social welfare.

There are obviously problems using a bid-game to value a non-market priced resource. This does not imply that such methods should be considered worthless. While contingency valuation techniques may not provide exact answers, they can at least give insight and direction to the problem of study. Their continued use will no doubt generate methodological refinements that which eliminate some, if not all, of the aforementioned problems.

THE EMPIRICAL STUDY

This study included winter recreators in the Logan Canyon Recreation Area (LCRA).

Since a secondary data source containing information relavent to this study does not exist, it was necessary to gather the required information using a survey (appendix A contains a copy of the survey questionaire). No attempt was made to generate a random sample of respondents due to the fact that the population of recreators is, for the most part, unknown. Instead, individuals were interviewed while in the various parking sites found throughout the LCRA.

Though several kinds of recreation occurs in the LCRA during the winter months, the majority of the people are engaged in either cross-country skiing or snowmobile riding. This is reflected in the breakdown of the survey. Two-hundred and twenty-one usable surveys were collected; ninety-two from snowmobilers, one-hundred-twenty-eight from cross-country skiers. One survey each for a dogsledder and a snowshoer were collected but not used in the analysis.

The survey data had four primary purposes: 1) to cursorily examine socioeconomic characteristics of recreators, 2) to provide information allowing the estimation of demand curves, consumers surplus values, and Pajooyan's congestion reduction commodity for each recreation activity, 3) to generate, via a bid game, willingness-to-pay responses regarding motorized/non-motorized recreator conflict; 4) to facilitate and compare the estimation of recreators' consumer surplus based on travel-cost demand curves and bid games.

Between the two groups, there were significant differences in various socioeconomic factors. More than one-half (53.9%) of the skiers interviewed were students. Of the remaining skiers, 38% were craftsmen/operators. More snow machine riders (30.4%) fell in the craftsmen/operator category. Far fewer snowmobilers were students or professionals (13% each).

The income distribution was also quite different. Although the mean income for both groups was approximately $17,000, income for cross-country skiers was concentrated in the lower current income levels. Over three fourths (77.8%) of skiers' incomes were less than $15,000, with 32.8% receiving less than $5,000 per year. Most (62%) snowmobilers had incomes in the $10,000 to $25,000 range.

Finally, many more snowmobilers were raising children, 73.9% vs. 20.6$ for the skier group. It was beyond the scope of this project to explain respondents' behavior using a socioeconomic analysis. It is worth noting however, that the differences between the two recreation groups are significant, and that there was little or no crossover between the groups.

Consumers' surplus estimation

The demand curves used in the calculation of CS values were derived using the Clawson technique outlined earlier. First, a demand curve for "the entire recreation experience" was estimated by regressing visitation rates against price (travel cost). The "general" curve contains site benefits as well as the benefits accruing to travel, food, lodging, etc... To arrive at a demand curve for the site, which

will yield site specific CS estimates, one more step was taken. For the general (step-one) curve, it was assumed that price was equal to (TC + fee) with the fee set equal to zero. The site specific (step-two) curve is estimated by: (1) assuming an increase in fees imposed, (2) substituting the non-zero fee into the recreator's demand function, (3) noting the changes in quantities of recreation demanded due to a fee increase, and (4) regressing quantity demanded against fees. Repeated application of this procedure will trace out a demand curve for the site exclusion of travel, food, and miscellaneous benefits.

Survey data was found to vary little from respondent to respondent. Thus, sufficient data points were available from every particular site in the LCRA to estimate statistically significant demand curves, so the estimation was made for the LCRA as a whole. This procedure should not be too alarming upon closer inspection, since the LCRA possesses a high degree of homogeneity among its recreation areas. In fact, many "sites" are not unique, but are simply different entry points to a large area. Travel costs were estimated using round trip mile traveled multiplied by the Utah State Uinversity operating expense for the type of vehicle driven.

The possible effects of excluding time values were mentioned earlier; however, since time quantities for travel to the LCRA for most respondents are low and estimation of time values is complicated and inexact, any bias introduced here is possibly small enough to ignore.

In order to compare CS and bids it was necessary to estimate demand curves (functions) for each type of recreator. Using ordinary

least squares regression procedures yielded general recreation demand
curves of the for:

$$D;_s = 6.70 + 00006 \ I - .04P^* \ (R^2 = .04)$$
$$(.92) (1.98)$$

$$D;_x = 3.67 + 000009 \ I - .17P^* \ (R^2 = .03)$$
$$(.46) (1.8)$$

(*significant at the .05 level)

where:

D^1_s = stage-one demand (days) by snowmobilers

D^1_x = stage-one demand (days) by cross-country
skiers

I = money income

P = travel and on-site costs

Durbin-Watson statements indicates no autocorrelation. CS estimates
can be expressed as the the integral of the demand curves:

$$CS^1_{si} = 6.71 \ P + .00006 \ I \cdot P - .02P^2 \int_{P_0}^{P_1}$$

$$CS^1_{xi} = 3.67 \ P + .000006 \ I \cdot P - .085P^2 \int_{P_0}^{P_1}$$

where:

CS^1_{si} = step-one consumer surplus for
snowmobiler i

CS^1_{xi} = step-one consumer surplus for cross-
country skier i

P_1, P_0 = are as defined previously

Appendix (B) contains recreators' consumer surplus values for the entire recreation experience. The total consumer surplus for snowmobilers (ζ CS_i) was $47,317.00. Average consumer surplus (total CS/snowmobilers) equaled $514,00. For cross-country skiers, an average surplus of $23.00.

In order to isolate the benefits being produced by the site itself, a pair of step-two demand curves were estimated using their respective step-one curves. One should note that these step-two curves are aggregate demand curves. The demand curves are:

$$D_S = 610.81 - 4.84P \quad (R^2 = 96\%)$$
$$D_X = 354.23 - 11.63 \ P^2 \quad (R^2 = 85\%)$$

As before, consumer surplus is found by integrating the demand curves with respect to price. For these aggregate curves however, only one integration was performed on each curve, from Po = o to P1 = a maximum price. This procedure yields the total consumer surplus being produced by the site. The estimates of total consumer surplus are expressed by:

$$CS^2{}_S = 610.81 \ P - 2.42P^2 \ \Big|_0^{126}$$

$$CS^2{}_X = 354.23 \ P - 5.81P^2 \ \Big|_0^{15}$$

where:

$CS^2{}_S$ = step-two consumer surplus for snowmobilers

$CS^2{}_X$ = step-two consumer surplus for cross-country skiers

the maximum price is $126.00 for snowmobilers and $15 for cross-country skiers.

For step-two demand, total CS for snow-mobilers and cross-country skiers was $38,440 and $2,696.00 respectively. Average CS for snowmobilers was approximately $418.00 and $21.00 for cross-country skiers.

As was expected, there was a noticable, though not substantial, difference between step-one and step-two CS. This implies that for the sites in question, most benefits are generated by the sites themselves and not from incidental activities. The large differences in CS between snowmobilers and cross-country skiers was primarily due to the costs faced by each group.

The problems noted earlier imply that demand curves CS would tend to undervalue their respective commodities. If this is the case, then all figures presented here can be viewed as lower bounds. It is not known how much downward bias is present if any; however, bias would have to be substantial to necessitate a change in the conclusions that are to be drawn from the study.

Production of C

The Pajooyan model of recreator behavior when faced with congestion, allows for a new method of examining congestion effects. It is assumed that in the face of congestion recreators will combine various inputs at their disposal and produce a "congestion reduction commodity" in an effort to reduce the effects of congestion of their recreation experience. The higher the quantity (of encounters) or quality (intensity) of the congestion, the larger the amount of C produced. No C production implies no congestion encounters.

It was assumed that any recreator not recreating at his/her favorite site, or preferred site, due to congestion at that site, is producing some quantity of C by moving to the site currently used.

Out of the sample of 221 respondents, only three had chosen to relocate due to congestion at their originally chosen site. While many recreators were not at their favorite site, more often than not their choice was based on a desire for variety or better snow conditions.

The calculation of the congestion reduction commodity, C, was straightforward. The distance between a recreator's preferred, but congested, site and the site actually used was multiplied by 2 (implying round trip distance). The resulting quantity was then multiplied by the recreator's travel costs per mile, a function of the type of vehicle driven.

Using mileage figures obtained by the survey, the three cost of "C" produced was calculated to be:

$$\$1.86 = C_1$$
$$\$1.10 = C_2$$
$$\$0.39 = C_3$$

Since time costs were impossible to determine and CPM can only be considered averages, C_1, C_2, C_3 should be viewed as lower bounds. However, even as a lower limit, the almost total lack of C procuction tends to indicate a lack of significant congestion in the LCRA.

Bid-game

The bid-game portion of the survey consisted of three questions. Respondents were told that the posited situations were purely

hypothetical in an effort to reduce strategic bidding. Respondents were asked to answer "yes" or "no" to an initial bid amount. Yes responses resulted in larger and larger bids until a "no" response was encountered. An initial no response would result in a lowering of the amount asked until a "yes" response was encountered.

Two questions in the survey, numbers one and three, were designed to obtain estimates of general and site specific recreation values respectively. Question 1 asked how much recreators were willing to pay to recreate at the site under current consumption. The respondent could either pay or move to another site with no fee.

Question 3 added the stipulation that all other reasonably attainable sites were posing the same fees as the site in the bid game. Recreators could pay to use the site being consumed or move and pay at any other site. These questions dealt with recreation substitutes and were part of another study.

The bid game concerned with congestion effects was contained in question (Q2). (Q2) attempted to assess the congestion cost complied by the public versey regarding the rights of motorized vs. non-motorized recreators in the LCRA. If this conflict is significant, then members of either group should be willing to part with some of their resources in an attempt to exclude members of the other gourp. (Q2) asked how much individuals were willing to pay to keep the site they were presently using free of the other type of recreator.

Examination of the (Q2) bids (Appendix B) revealed a marked difference in the responses of the cross-country skiers and snowmobilers.

Roughly seventy per-cent of the snowmobilers sampled bid zero for
"skier abatement". Total willingness-to-pay (i.e., the sum of all
bids) was $80.96. The average bid with excluded skiers was $0.88,
with a standard deviation of 1.60, and variance of the average bid for
the existing atraction was $0.85, which is not statistically signifi-
cantly different from the exclusion use bid to 2.56.

Responses for the skiers were more frequently non-zero and larger
in magnitude than those of the snowmobile group. Only 29% claimed
they would not pay to exclude snowmobilers. For this group, total
willingness-to-pay was $254.72. The skiers' average bid was $1.99.
The standard deviation and variance for this group were 1.72 and 2.98
respectively. For cross-country skiers, the average bid for the exis-
ting condition was $0.92 which was much different the the exclusive
bid. A t-test showed difference in the mean bids ($.88, $1.99) of
each group, and the two bids by the snowmobilers to be statistically
different. Even with the divergence of bids it was surprising to
examine the bids of the skiers. Much of the joy of cross-country
skiing is touted as being in the quiet and solitude of the outdoors.
This serenity can easily be shattered by the noise associated with
only one snow-machine. Therefore, it is reasonable to assume that
skiers would be willing to pay a relatively great deal for a guaran-
teed uninterupted recreation experience. However, roughly one third
of the sample refused to offer a non-zero, let alone large, bid. Even
the non-zero bidders taking part in this study did not seem as anxious
to pay as large an amount as might be expected if intergroup conflicts

(congestion) are viewed as being serious. It is clear, however, that the results support the conclusion that congestion extremitities are primarily one-way for the two groups. Cross-country skiers perceive the absence of snowmobilers as a signigicant improvement in that the bids increases significantly. Snowmobilers are apparently indifferent.

There were relatively large numbers of respondents from both groups who bid zero. Although an attempt to ascertain whether or not the respondent who bid zero was truly at the margin or simply protesting their payment scheme was made, it was simply not possible to be certain about the meaning of zero bids. Known protest votes were disregarded, but strategic zero voting was hard to detect. It can only be assumed that any strategic behavior here is insignificant.

The procedures used seemed to be in general agreement with respect to congestion effect. The production of the congestion reduction commodity was infrequent and both groups tended to bid low or zero for the exclusion of the other. The conclusion drawn is that congestion, be it among or between these two groups, is simply not a significant problem in the LCRA.

Two observations were made regarding total consumer surplus and the bids related to the total experience. Willig (1976) states that for commodities requiring expenditures which are a small portion of income and possessing reasonably small incomes elasticities, consumer surplus should approximate equivalent variation as a measure of welfare recall that this difference is equal to $(\varsigma CS^2/2I)$. Consumer

surplus values in this study were consistently higher than any of the bids (see Appendix B). Since CS for the site was an aggregate number, any comparison between site generated CS and bids bias to be done using total (sum) or average figures. Regardless of the methods used in comparison, the bids were a small fraction of CS.

The most obvious reason for the disparity between CS and bids is the proportion of income spent in the participation of each activity. Snowmobile riders incur relatively large costs in the purchase of snowmachines, trailers, and accessories. Since the average snowmobiler's income was in the lower-middle region, these high initial costs along with the high travel and on site costs probably had an effect of the magnitudes of the elicited bids. While the costs involved with activity of cross-country skiing were considerably lower, so too were the incomes of those engaging in that activity. The second observation was concerned solely with the bids. When examined along with an average individual demand curves (not the aggregate, site specific curve), there was a striking similarity between the averrage bids for each group and the intercept of their respective demand curves on the price axis. This results suggest that bid games, which use pricing such as entry fees, may produce not an equivalent variation measure of welfare but rather the individuals reservation price (i.e., the maximum price/quantity point or an individuals demand curve). Further, research is clearly indicated.

The results of the bid game should be examined with one additional problem kept in mind. Several studies indicate that hypothesied

behavior does not always correspond with actual behavior (Schuman and Johnson (1976); Bishop and Heberlein (1976)). Also, while this empirical bias may often be present, Brookshire, et al. (1976) and Cicchetti and Smith (1976) feel that it is normally less than the bias associated with compensating-variation based bids of welfare changes. The general conclusion is that EV based bids should be viewed as a lower bound welfare change since empirical and theoretical source of bias all tend to undervalue the item in question.

Conclusions

The general conclusion made in light of this study is that congestion in the LCRA has not reached a significant level. The implication for public policy makers is that restricting use of the various areas in the LCRA to one activity or another is not justified in terms of congestion. The resources that could be used in the implimentation and maintenence of such a policy would be better used elsewhere.

Two significant problems have also been identified through this study:

1) Consumer surplus may not be an appropriate measure of welfare for these kinds of activities unless income elasticities and the activities relative importance in the individuals budget are more accurately specified.

2) Bid game questions worded in the manner of this survey may not provide an equivalent compensation measure of welfare change, but rather, an individuals maximum reservation price.

SUMMARY AND CONCLUSIONS

The purpose of this study was to evaluate the congestion problem in the Logan Canyon Recreation Area using valuation techniques developed through earlier research. An analytical model based on Becker's (1971) household production theory provided the justification for the estimation of congestion costs based on observed recreator data. This cost can be measured by calculating the added cost of recreating at a site other than the recreator's first choice. The contigency, or bid-game, method of valuing non-market priced resources (and externalities) was also utilized.

A survey was administered to cross-country skiers and snow machine riders in the Logan Canyon Recreation Area in an attempt to examine congestion effects among, and between these two groups. The survey was designed to obtain information necessary for the estimation of recreation demand curves, consumer surplus, and the calculation of the congestion reduction commodity. In addition, a bid-game was conducted which asked cross-country skiers how much they were will to pay to exclude snowmobilers and vice-versa.

Travel-cost based demand curves were estimated for the recreator's entire recreation experience. From these curves, one each for snowmobilers and cross'country skiers, demand curves for the site were estimated. Integration procedures were performed on both sets of curves resulting in consumer surplus estimates. As expected, the consumer surplus estimates from the site specific demand curves were of a smaller magnitude than those from suing the general recreation

curves. The difference between both measures of individual welfare seemed significant, if not substantial. Given the tendency for travel cost demand curves to underestimate site benefits, all consumer surplus estimates were viewed as lower bounds.

Further analysis of the survey results showed three (out of a possible 221) instances of C production. C_1, C_2, and C_3 were calculated to be $1.86, $1.10 and $0.39 respectively. The exclusion of time costs implies that these amounts undervalue C somewhat.

Bid game results were somewhat one sided, as was expected. Skiers were more willing to pay to exclude snowmobilers with 72% of the skiers offering non-zero bids. The mean bid for skiers was $1.99. Compared to a $0.92 congested bid. Roughly seventy-percent of the snowmobilers sampled bid zero for the elimination of skiers at their sites. The mean bid for this group was $01.88, compared to a $0.85 congested bid. The individual congested effect is indicated.

The bids were found to differ significantly from consumer surplus estimates. This difference implied that consumer surplus may not be an approximation appropriate of welfare gains or losses for these kinds of activities unless efforts are made to specify the relationship of these activities in the individuals budget more fully.

Also observed during this study was a tendency for the bids to be much closer to the individuals maximum reservation than to the surplus price. Asking the willingness to pay in daily, or per use, terms likely does not yield a equivalent compensation measure of individual welfare.

Due to infrequent, small quantities of congestion reduction commodity production and relatively low bids for exclusion suggests that exclusion policies for winter recreation activities should be carefully reviewed in the Logan Canyon Area or perhaps elsewhere. Downward bias was assumed to be insignificant for the bids. The establishment through further research of an upper bound may provide additional insight on the question of bias. Another option, although probably more costly, would be a study using the methods of Bishop and Heberlein (1979), and Bohm (1972). The uncertainty of outcomes coupled with actual cash payments should be enough to eliminate any bias from the results.

Research aimed at determining the type of questions that are sure to elicit equivalent variation based bids is also suggested by this study.

Finally, if consumer surplus is to be used in studies similar to this one, a model that determines the relationship of CS and equivalent variation based bids would be very useful.

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APPENDIXES

Appendix A

WINTER RECREATION QUESTIONNAIRE

Hi! I am collecting information for a Utah State University study on winter sports in Logan Canyon. The results from this study can be used for recreation planning by State and Federal agencies. My questionnaire will only take a few minutes. None of the information you give us can be traced to you, and therefore is confidential. The results come from all our interviews taken together. We are especially interested in finding out how you feel about this area (ID the area from maps).

Interviewer identify if: Snowmobiler _____
                               Snowshoer _____
                               Cross-Country Skier _____
                               Other _____

Also, get respondent to identify general use area on map (if possible).

1. Is this your first trip to this area?
   1. Yes (if yes, go to 5)
   2. No

2. How many years have you been coming to this area?

   _____

3. About how many trips a year do you make to this area?

   _____

4. Is this the area you like most?
   1. Yes (if yes, go to 6)
   2. No (go to 5)

If no, to Question 1 or 4:

5. Where is the area you like most? (Identify on map, if possible, or ask mileage from current site) _____
   (go to 8)

If yes, to Question 4:

6. If there another area you would prefer but didn't use for some reason?
   1. Yes
   2. No (go to 9)

If yes, to Question 6:

7. Where is the area you would prefer? (Identify on map, if possible, or ask mileage from current site) _____

8. Why did you not go to your most preferred area?
   1. Too many snowmobilers (estimate how many, if possible)
   _____
   2. Too many cross-country skiers(estimate how many, if possible)
   _____
   3. Regulations at the site (specify) _____
   4. Facilities at the site (specify) _____
   5. Other (describe) _____
   _____

9. How many in your party including yourself? _____

10. Is yours a family or non-family group?
    1. Family (go to 12)
    2. Non-family (go to 11)

11. Do you share trip expenses?
    1. Yes
    2. No

12. What type of vehicle did you travel in?
    _____

13. Where do you live?

    City _____

    State _____

    Zipcode _____ (get all zips if possible)

14. How long have you lived there? _____

15. How long did it take you to get her from your home?
    _____ hrs. (to nearest quarter hour)

16. How many days do you expect to be at this area? (overnight is 2 days) _____ days (if 1 day go to 19) (if more than 1 day go to 17)

17. Is this area the only recreation site you intend to visit on this trip?
    1. Yes (go to 19)
    2. No   (go to 18)

18. What are the other areas you will visit for this kind of reacreation? (list)

_____

_____

19. What expenditures have you made for this trip in addition to your travel cost?

_____ fuel for on site activities
_____ food
_____ lodging
_____ other

20. As you know, planning and development of winter recreation areas is a costly activity. The agencies involved have little idea how people value these winter recreation areas and we are going to get some idea of this value.

Try to place yourself in the situation I am going to describe. This is a hypothetical situation, and it does not mean there are plans for a permit to use this area. We are only interested in how you and other recreators value areas of this type.

Suppose that this area were closed to access except by purchase of a daily permit which would be sold to each person for entry and the money used to provide for maintenance and patrol of the area (similar to a ski resort). If such a permit cost $_____, would you pay for one? If the permit cost $_____? $_____? What is the maximum you would pay? $_____.

If the area were designated for use only by (snowmobilers or cross-country skiers, which ever the activity to be participated in), would you pay $_____ for the permit (same as maximum above). Would you pay $_____? $_____? What is the maximum you would pay? $_____.

Suppose that all other sites were also under a permit system, and that these permits cost $5.00 each. What would you be willing to pay for a permit on this site?
$ _____ $ _____ $ _____.

If no, why would you not buy this permit? _____

_____

_____

Finally, I would like to ask you a couple of questions about yourself, if you don't mind. None of this information can be traced back to you.

21. What kind of job do you (a head of household) have? (include student)

Head of household: _____
Spouse, or other persons: _____

22. Please indicate the number on the card corresponding to the highest level of school you (or head of household) have completed:

1. grade 0-8
2. some high school
3. grade 12 (high school graduate)
4. some college or additional training
5. college or technical school degree
6. post graduate degree

23. What was you annual family income before taxes in 1979? (identify group)

1. 0 - $5,000
2. $5,000 - $10,000
3. $15,000 - $20,000
4. $20,000 - $25,000
5. $25,000 - $30,000
6. $30,000 - $40,000
7. above $40,000

24. Do you have children? If yes, how many in each age class?

Years of age

0 - 5	_____
5 - 10	_____
10 - 15	_____
15 - 20	_____
20 +	_____

25. Do you have any comments you would like to make about this area? (Use other side of page for answer.)

Thank you for your cooperation. This study should be completed by the end of 1980. If you are interested in the results, or have any questions, you can call or write Dr. John Keith, Department of Economics, Utah State University, Logan, Utah 84321.

Starting Price

1.00	3.00	5.00	10.00	20.00
.90	2.75	4.75	9.50	18.50
.80	2.50	4.50	9.00	17.00
.70	2.25	4.25	8.50	15.50
.60	2.00	4.00	8.00	14.00
.50	1.75	3.75	7.50	12.50
.40	1.50	3.50	7.00	11.00
.30	1.25	3.25	6.50	10.00
.20	1.00	3.00	6.00	
.10			5.50	
0			5.00	

Why would you not want to buy such a pass? _____

_____

_____

_____

_____

_____

What is the maximum price at which you would be willing to buy such
an annual pass?

$ _____

Appendix B

SNOWMOBILERS

Travel Cost	CS step 1	B1	B2	B3
24.82	394.804	0.0	3.5	5.0
23.82	400.681	3.0	3.0	5.0
5.39	516.160	0.0	0.0	5.0
6.39	509.545	0.0	0.0	5.0
21.03	515.363	4.0	4.0	4.0
11.92	473.690	2.0	2.0	4.0
7.84	646.617	0.0	0.0	0.0
43.04	372.989	0.0	0.0	0.0
13.92	530.671	0.0	0.0	0.0
12.92	607.833	2.0	2.0	2.0
12.64	609.943	0.0	0.0	0.0
18.43	499.990	0.0	0.0	0.0
18.82	430.667	0.0	0.0	0.0
16.70	613.633	0.0	0.0	0.0
10.16	628.777	0.0	0.0	0.0
29.41	368.340	7.0	7.0	7.0
49.60	334.303	1.5	1.5	3.0
17.62	539.154	0.0	0.0	0.0
31.18	476.945	0.0	0.0	3.0
17.62	471.726	1.5	1.5	1.5
12.35	506.248	5.0	5.0	5.0
18.43	533.461	3.0	3.0	3.0
10.70	553.075	0.0	0.0	5.0
18.92	496.705	0.0	0.0	0.0
18.92	496.705	0.0	0.0	0.0
23.92	495.563	0.0	0.0	0.0
16.70	511.663	0.0	0.0	1.0
15.29	555.678	0.0	0.0	1.0
13.47	691.093	1.0	1.0	1.0
11.08	586.085	0.0	0.0	3.0
2.81	609.723	0.0	0.0	0.0
16.86	510.578	0.0	0.0	0.0
16.76	579.200	0.0	0.0	0.0
21.66	478.516	0.0	0.0	0.0
17.29	575.294	2.0	2.0	2.0
11.29	548.939	0.0	0.0	1.0
9.29	563.016	0.0	0.0	0.0
24.21	493.595	0.0	0.0	1.0
15.29	555.678	0.0	0.0	0.0
6.35	621.094	3.0	3.0	0.0
11.29	584.552	0.0	0.0	2.0
14.06	599.271	1.0	1.0	1.0
15.39	589.348	0.0	0.0	3.0
19.06	529.051	0.0	0.0	5.0
19.06	529.051	0.0	0.0	0.0

Travel Cost	CS step 1	B1	B2	B3
14.45	492.359	0.0	0.0	0.0
16.96	611.637	0.0	0.0	1.0
18.96	563.062	0.0	0.0	1.0
17.88	436.416	5.0	5.0	5.0
21.22	448.783	0.0	0.0	0.0
20.44	549.490	5.0	5.0	5.0
85.19	167.867	5.0	5.0	5.0
15.64	553.182	1.5	2.0	5.0
5.82	662.326	4.0	4.0	5.0
16.14	703.336	0.0	0.0	0.0
7.16	504.479	3.5	3.5	3.5
22.84	502.923	0.0	0.0	0.0
25.95	622.323	0.0	0.0	5.0
127.04	11.719	5.0	5.0	5.0
39.27	423.219	0.0	0.0	5.0
18.82	564.083	0.0	2.0	5.0
58.93	378.192	0.0	0.0	1.0
53.33	416.579	0.0	0.0	5.0
15.25	555.964	0.0	0.0	0.0
10.24	664.093	0.0	0.0	1.0
127.04	11.719	3.0	3.0	3.0
22.19	475.032	0.0	0.0	2.0
8.37	606.034	1.0	1.0	1.0
6.77	580.980	3.0	3.0	3.0
51.37	430.311	2.0	2.0	0.0
11.00	479.570	0.0	0.0	5.0
10.00	486.000	0.0	0.0	5.0
17.25	575.589	0.0	0.0	0.0
18.25	501.199	0.0	0.0	0.0
21.43	512.602	0.0	0.0	0.0
23.00	501.830	0.0	0.0	2.0
19.27	494.365	0.0	0.0	2.0
31.27	446.714	0.0	0.0	2.0
18.00	536.480	0.5	0.5	1.0
30.00	495.000	0.0	0.0	0.0
8.15	772.163	0.0	1.0	3.0
12.30	506.581	0.0	0.0	0.0
8.20	534.215	0.0	0.0	1.0
12.30	541.891	0.0	0.0	1.0
15.21	590.686	0.0	0.0	0.0
5.31	703.725	0.0	0.0	0.0
20.98	515.708	0.0	0.0	0.0
17.14	440.967	0.0	0.0	3.0
11.17	549.779	0.0	0.0	0.0
12.20	542.587	0.0	0.0	0.0
20.19	488.237	0.0	0.0	2.0
17.19	440.658	0.0	0.0	2.0

CROSS-COUNTRY SKIERS

Travel Cost	CS step 1	B1	B2	B3
8.68	16.478	3.5	5.0	3.5
3.10	28.558	5.0	5.0	5.0
4.20	25.178	0.0	3.0	0.0
9.32	13.568	0.0	4.0	3.0
5.40	24.373	3.0	4.5	3.5
4.74	23.595	1.0	1.0	1.0
6.74	18.161	2.0	2.0	2.0
6.74	18.161	2.0	2.0	2.0
6.74	18.161	1.0	1.0	1.0
5.72	24.318	0.0	2.0	0.0
4.21	25.149	3.0	5.0	3.0
3.18	28.305	0.0	0.0	5.0
1.16	35.019	0.0	4.0	0.0
1.16	35.019	3.0	3.0	5.0
5.91	25.918	1.5	2.0	1.5
7.91	16.067	2.0	5.0	2.0
2.16	31.608	0.5	1.0	1.0
10.08	13.961	0.0	3.0	3.0
6.57	20.255	1.0	1.0	1.0
6.57	20.255	1.0	1.0	1.0
6.82	18.776	0.0	3.0	0.0
3.80	28.291	0.0	1.0	3.0
3.58	28.986	0.0	0.0	1.0
3.58	28.986	0.0	1.0	3.0
5.31	21.977	1.0	3.0	2.0
3.25	29.063	0.0	0.0	0.0
3.25	29.063	0.0	0.0	0.0
4.87	24.127	0.0	1.0	1.0
3.87	26.171	0.0	1.5	1.0
5.00	22.850	3.0	3.0	3.0
5.00	23.750	0.0	0.0	0.0
9.25	15.848	2.0	3.5	2.0
9.25	15.848	2.0	3.5	2.0
5.82	24.892	0.0	0.0	3.0
4.31	38.818	0.0	0.0	3.5
4.32	25.753	0.0	0.0	1.0
5.23	23.090	0.0	2.0	0.0
2.66	29.967	0.0	2.0	1.0
2.66	30.972	0.0	2.0	1.0
9.70	14.122	3.5	3.5	3.5
8.70	13.496	3.5	3.5	3.5
5.04	24.533	0.0	0.0	0.0
5.04	24.533	0.0	0.0	0.0
3.32	27.865	0.0	2.0	3.0
4.04	25.657	0.0	0.0	3.0
4.04	25.657	0.0	0.0	3.0