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The University of Arizona M.S. 1985

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UNCERTAIN RECREATION QUALITY AND CONTINGENCY CONTRACTING: IMPLICATIONS FOR WILDLIFE VALUATION AND QUESTIONNAIRES DESIGN

by

Teik Ee Chong

A Thesis Submitted to the Faculty of the

DEPARTMENT OF AGRICULTURAL ECONOMICS

In Partial Fulfillment of the Requirements
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MASTER OF SCIENCE

In the Graduate College

THE UNIVERSITY OF ARIZONA

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This thesis has been approved on the date shown below:

_____ _____

Dennis C. Cory
Professor of Agricultural Economics

Dec. 16, 1985
Date

DEDICATION

To my wife

and

children

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ABSTRACT

Theoretical arguments have been advanced which support the proposition that the expected value of consumer surplus underestimates benefits accruing to the users of natural environments when the recreation quality is uncertain. In particular, an uncertainty premium should be added to the expected value of consumer surplus to fully reflect user benefits, a premium known as option value. The results of this research suggest that the concept of option value is a peripheral concern in the valuation of natural environments. The correctly specified uncertainty premium is derived and a questionnaire methodology is developed to estimate this premium for the case of wildlife resources in Cave Creek, Arizona.

CHAPTER 1

INTRODUCTION

Public outdoor recreation facilities are public goods.[1] They are also common properties.[2] No market exists for such goods in which buyers and sellers can conduct transactions with each other to reveal their preferences. If an individual is able to buy (enjoy) birdwatching in the South Fork of Cave Creek recreation area, all other individuals in the United States could do so because excludibility is impossible in public goods.

Individuals have little or no incentive to improve or even maintain the quality of natural environmental assets as most are self-interest motivated. Usually no agreement could be reached between those who caused deterioration to the natural environment and those who would "suffer" from it. The basic cause of the deterioration of these assets is thus blamed on the failure of "market" to deal efficiently with these public goods.

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1. Goods which are jointly consumed by more than one individual and are characterized by non-excludibility.
2. Resources which belong to all the members of a community who can each utilize the resources.

Many economists recommend that the remedy for such a "market" failure is government intervention. Government is urged to set up agencies to implement the environmental policies or incentives to safeguard the efficient utilization of these natural environmental assets. These incentives or policies are designed to make potential users aware that natural environmental assets are scarce resources.

The policies or incentives implemented or suggested by most economists are usually cost-related ones. Thus, it is necessary to develop methods to estimate the consumer's benefits from the consumption of these assets. Several methods had been proposed and tested.

This study, however, will be restricted to discussions on consumer's surplus, option price, maximum willingness-to-pay (fair-bet point) and their expected values respectively. The study focuses on option value (option price minus expected value of consumer's surplus) and option premium (difference between the expected values of fair-bet point and consumer's surplus).

Consumer's surplus, a traditional measure of consumer's welfare, was introduced by Jules Dupuit in 1844. Marshall (1930), Hicks (1943), Willig (1976) and others attempted to popularize, refine and establish the uses of the consumer's surplus. However, this concept is considered an insufficient measure when uncertainties arise from either supply or demand (Bishop 1982, Smith 1983).

Later, Weisbrod (1964) originated the notion of "option value" to accommodate uncertainty in the benefit measures. Further research had been carried out by other economists to refine the benefit measure on the consumption of natural environment under uncertainty.

Schmalensee (1972), Graham (1981), Freeman (1984) and others had come out with the appropriate definition of option value and benefit measures. Graham (1981) developed the willingness-to-pay locus, which indicates that fair-bet point and its expected value is the correct benefit measure under individual insurable risk. On the other hand, option price is the appropriate measure of benefit under situations of collective risk, if individuals are identical and specific project costs are given. But the assumption of collective risk may not hold true for uncertain users of the natural environment. The state probabilities may vary depending on individuals, so the expected value of fair-bet point is the only relevant benefit measure in risk-neutral decision making.

The primary objective of this study is to develop an efficient and practical instrument, preferably, a set of questionnaires which could enable researchers in future studies to contrast these three concepts of benefit measures so as:

1. to review and compare empirically the variation in techniques and concepts of three different benefit measures under the world of uncertainty,
2. to develop empirical methodologies to estimate the fair-bet point or the maximum willingness-to-pay by using the willingness-to-pay locus developed by Graham (1981), and

3. to exploit theoretically the relationship between the expected value of fair-bet point and consumer's surplus with the aim of setting bounds on the difference between these two measures .

CHAPTER 2

REVIEW OF THE LITERATURE

Measures of consumer-benefit have been one of the most controversial subjects in economics. For the historical perspective, it could be divided into two components, the consumer-benefit measures under the worlds of certainty and uncertainty. The studies on the consumer-benefit measures under certainty will be reviewed first. A review of the studies concerning the measures of consumer-benefit under uncertainty will then follow.

Consumer Benefit Measures Under Certainty

Early consumer-benefit measures focused merely on the concept of consumer's surplus to measure benefits under conditions of certainty. Jules Dupuit first defined consumer's surplus as it is known today as "the difference between the sacrifice which the purchase price he has to pay in exchange" (quoted in Currie, Murphy, and Schmitz 1971, p. 742). As suggested, the demand curve represents the willingness-to-pay curve. Thus, the triangle-like area enclosed by the demand curve and the price line measures the quantity of the consumer's surplus (refer Figure 1). His concept was concerned merely with the monetary evaluation of benefits associated with the single price change for public goods.

Alfred Marshall, in 1930, popularized the concept of consumer's surplus. He defined consumer's surplus (quoted in Currie, Murphy, Schmitz 1971) as "the excess of price (i.e., total expenditure) which he would be willing to pay for the thing rather than go without it, over that which he actually does pay" (p. 743). Apparently, his definition indicates that a consumer derives an additional satisfaction from being able to purchase a commodity at a specific price level. His concept deals with the excess of satisfaction afforded by consuming a commodity that makes consumers willing to forgo consuming other commodities. According to the definition, the triangle-like area under the demand curve and above the price line measures the "extra expenditure" in terms of increased satisfaction. He added the requirement of constant marginal utility of money under specific restrictions.[3]

On the other hand, Bishop (1943) held that either "extra expenditure" or the triangle-like area could be the appropriate measure of consumer's surplus depending on the specific situations even if the marginal utility of money is not constant. He argued that the marginal utility of money would never be constant, because when a consumer increases his money spent on a particular commodity, he decreases spending on all the other commodities. Thus, the marginal utility of the particular commodity would decline while the marginal utility of all

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3. The overall expenditure spent on the particular commodity should be a small fraction of the total expenditure, and there should be a small change in the quantities of other commodities.

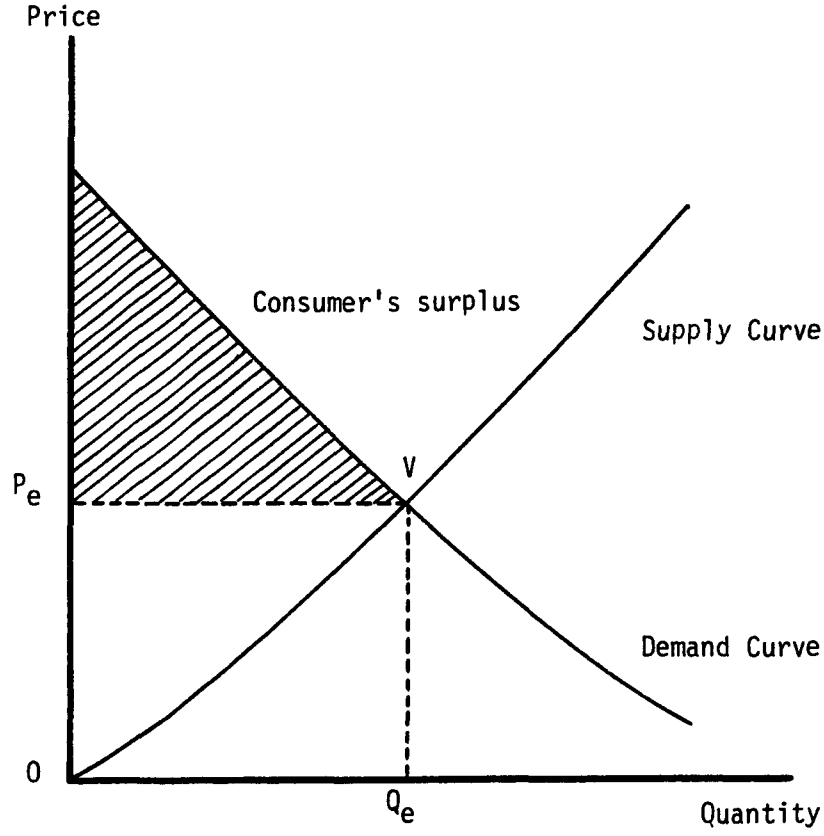

Figure 1. Theoretical Measure of Consumer's Surplus

the other commodities would increase. The change in total marginal utility derived from the consumption of all commodities would most likely offset the constancy of marginal utility of money. He concluded that "for small consumer's surplus, extra expenditure may be superior but that for large consumer's surplus the demand method is to be preferred" (p. 435).

The concept of consumer's surplus later was redefined by Hicks (1943). He used the ordinal system of indifference curve in his framework and defined consumer's surplus (quoted in Currie, Murphy, and Schmitz 1971) as "the amount of income variation that would leave the consumer on his original indifference curve following the introduction of the commodity at the particular price" (p. 745). Hick's concept of consumer's surplus is the gain which the consumer accrues as a result of a decline in price level which is measured in terms of money income.

He proposed four different measures of consumer benefit caused by an actual or proposed price change (as quoted in Currie, Murphy, and Schmitz, p. 746).

1. "Compensating variation" is the amount of compensation, paid or received, that will leave the consumer in his initial welfare position following the change in price if he is free to buy any quantity of the commodity at the new price.
2. "Compensating surplus" is the amount of compensation, paid or received, that will leave the consumer in his initial welfare position following the change in price if he is constrained to buy at the new price the quantity he would have bought at that price in the absence of compensation.
3. "Equivalent variation" is the amount of compensation, paid or received, that will leave the consumer in his subsequent welfare position in the absence of the price change if he is free to buy any quantity of the commodity at the old price.

4. "Equivalent surplus" is the amount of compensation, paid or received, that will leave him in his subsequent welfare position in the absence of the price change if he is constrained to buy at the old price the quantity he would have bought at that price in the absence of compensation.

Hicks introduced "Compensating and Equivalent" surpluses as additional alternative benefit measures. They are not frequently used in the evaluation of consumer's welfare in price changes because they are more restricted. Consumers are required to buy the same bundle of commodities as the initial situation. In reality, consumers or resource supplies are free to adjust and respond to market situations.

"Compensating" and "equivalent" variations are more commonly used. They are income adjustments that maintain the consumer at a particular level of welfare which he held before the price and income change. Compensating variation focuses on the initial welfare level while equivalent variation focuses on the subsequent welfare level which the consumer would obtain after the price or income change. For normal goods, if the price increases (unfavorable to consumers), ES<EV<CS<CV<CSS.[4] On the other hand, the inequalities reverse with a decline in price level (favorable to consumers). When the coefficient of a price change or welfare effect of the change is zero, then ES=EV=CS=CV=CCS.

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4. Equivalent Surplus (ES), Equivalent Variation (EV), Simple Marshallian Consumer Surplus (CS), Compensating Variation (CV), and Compensating Surplus (CSS).

Winch (1965) indicated that when using equivalent variation to estimate the consumer benefit, the income effect is assumed to precede the substitution effect. But the substitution effect is assumed to precede the income effect when using compensating variation to estimate the consumer's surplus. The only way to measure the effect of their simultaneous operation, as he suggested, is to follow them together over the relevant range of price change.

He argued that the concept of consumer's surplus by itself is of little significance to the welfare measure, because any policy change is going to affect a large group of people. Aggregation of changes in consumer's surplus involves interpersonal comparisons, while the welfare significance of any net change involves a value judgement.

Winch concluded that the Marshallian concept of consumer's surplus and its measure has its shortcomings. It required the constancy of marginal utility of money, and society has to attach the same level of utility for money in order to aggregate the consumer's surplus. However, Hicksian measures which rely on compensating variation does not measure the utility change in money. Instead, it measures the money-income change in money, the change in income measured being the amount necessary to offset a change in utility.

Currie, Murphy and Schmitz (1971) discussed the concept of economic (or consumer's) surplus and its use in economic analysis. They attempted to refine the theoretical concept of consumer's surplus in the framework of a perfectly competitive market.

They indicated the differences between the ordinary demand and Hicksian compensating demand curves. The former described the quantity of a commodity that a utility-maximizing consumer will demand at each price level. The latter shows the quantity of a commodity that a consumer will demand at each price level, assuming that his income is adjusted so that he remains on his original level of welfare (indifference curve). It also indicates the maximum price the consumer will be willing to pay for an additional unit of a commodity, assuming that he has already paid the respective maximum prices for each preceding unit.

The most meaningful measure of consumer's surplus is in terms of money, even though money expresses only the indirect utility. Currie et al. (1971) indicated that economists generally have to depend on recorded market behavior because the individual's preferences are unknown. Thus, the best benefit measures are the estimates of ordinary demand curves. The relevant area below the ordinary demand curve is exactly the compensating variation, or any of the other three Hicksian measures, provided the income effect is zero. If the income effect is close to zero, it is still a reasonable measure of benefit.

In the attempt to suggest the basis for a concensus and to clear the persistant doubts on consumer's surplus, Harberger (1971) delineated three postulates (p. 785).

a) the competitive demand price for a given unit measures the value of that unit to the demanders;
b) the competitive supply price for a given unit measures the value of that unit to the supplier;
c) When evaluating the net benefits or costs of a given action (projects, program or policy) the cost and benefits accruing to each member of the relevant group (e.g., a nation) should normally be added without regard to the individual(s) to whom they accrue.

In addition to the postulates, he listed the underlying criticisms of consumer's surplus (p. 786).

(i) Consumer-surplus analysis is valid only when the marginal utility of real income is constant.
(ii) Consumer-surplus analysis does not take account of changes in income distribution caused by the action(s) being analyzed.
(iii) Consumer-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.
(iv) Consumer-surplus analysis, though valid for small changes, is not so for large changes.
(v) The concept of consumer surplus has been rendered obsolete by revealed-preference analysis.

Specifically, he considered criticisms i, ii, and v first. He stated that agreeing on these three postulates constitutes a methodology with less severe defects than national income methodology. He compared the forces of objection to both consumer's surplus and national income methodologies. In the analysis, if one can accept gross national product as an index of welfare, then one is more likely to accept consumer's surplus as a welfare measure of a project.

Harberger argued that the assumption of marginal utility of real income is unnecessary for the validity of consumer's surplus as a measure of welfare. The benefits and costs in most applications of consumer-surplus analysis involved only a small fraction of a normal year's growth in gross national product.

According to him, the distributional impacts from one activity are small compared to the impacts resulting from all activities. He cited a case where consumer-surplus analysis was parallel with revealed preference which results in Harberger's denial of criticism v. A coal miner who suffered from silicosis voluntarily resigns a higher paid job in the mine to take up a lower paid clerking job in a grocery store. The change of job reduced the national income, but it is more likely to improve his welfare level.

Harberger (1971) noted that Hotelling, Hicks and Meade have derived the consumer-surplus analysis in a general-equilibrium framework. All these measures of welfare change are consistent with the postulates. As for the criticism iv, he dealt with it by using the Taylor expansion. Under the postulates suggested by Harberger, there is no doubt that consumer-surplus analysis is a reasonable tool in benefit-cost analysis for measuring welfare change.

Willig (1976), like Harberger (1971), attempted to determine when the consumer's surplus is a valid tool to use in welfare economics. He established the procedures in which consumer's surplus can be used to estimate compensating, and equivalent variations as measures of consumer welfare under specific conditions.

Just, Hueth and Schmitz (1982) and Willig (1976) reached a similar concensus. They argued that for a single price change, if the income effect is small and the income elasticity divided by 2 is less than 0.05 in absolute value, then the use of consumer's surplus as an

estimate of either compensating, and equivalent variations will cause an error of 5%.[5]

A more realistic case is where the change in consumer's surplus is within a reasonably small fraction of the total income. For other goods, where income elasticity is small, the change in consumer's surplus has to be very big fraction of the total income in order to give rise to a large error.

Just, et al. (1982) established the estimates for both the compensating and equivalent variations with specific requirements as prescribed:

$$C = \Delta S - (n/2m)(\Delta S)^2$$

$$= \Delta S - e|\Delta S|$$

$$E = \Delta S + (n/2m)(\Delta S)^2$$

$$= \Delta S + e|\Delta S|$$

where C and E are the compensating and equivalent variations,

ΔS is the change in consumer's surplus,

$n = (\Delta q/\Delta m)(m/q)$ is the income elasticity,

q and m are quantity and real income,

Δq, Δm are changes in quantity and real income, and

$e = |nS/2|$, the error term.

---

5. The error term, $|e| = |nS/2| < 0.05$, where n is income elasticitty, S is the consumer's surplus. Income elasticity, $n=(\Delta q/\Delta m)(m/q)$ where Δq is change in quantity, Δm is change in real income, q is the quantity, m is real income.

Willig's (1976) empirical studies showed that the error of approximation would be very insignificant under the specific conditions which he prescribed for the case of single price change. He claimed that the error in such a case would often be overshadowed by error involved in estimating the demand curve. The result does not depend upon the constancy of marginal utility of income as suggested in the earlier studies.

Both Willig (1976) and Just, et al. (1982) concurred that consumer's surplus is a good estimate of welfare measure under certain conditions. Just, et al. (1982) mentioned two of the reasons why the change in consumer's surplus is an appealing measure of consumer benefits: "(1) it represents the sum of cost differences as price is continuously reduced from p_0 to p and (2) it gives the change in what the consumer is willing to pay over that which is actually paid, with the price change if the demand curve is a marginal willingness-to-pay curve" (p. 73).

Cory, Gum, Martin and Brokken (1982) established that Laspeyres and Paasche variations are good measures of consumer welfare because less information is needed for calculations. They developed the guidelines which required less information than those developed by Willig (1976), and Just, et al. (1982) for using Laspeyres and Paasche variations. These measures are more desirable for measuring the change in the consumer welfare because they can be easily calculated in empirical studies.

Cory, et al. (1982) defined Laspeyres variation as "the exact change in income required to allow the purchase of the original quantity of all goods after prices have changed" (p. 715).

Cory, et al. (1982) compared five measures of welfare change as a result of declining price,[6] and illustrated that LV<CV<CS<EV<PV.[7] LV and PV bound CV, CS, and EV. On the other hand, LV and CS bound CV, PV and CS bound EV. All the inequalities are reversed for an increase in price.

By using the bounding properties of both Laspeyres and Paasche variations, the guidelines for approximating consumer welfare was established as follows:

1. Place observable bounds on the percentage error of approximating CV with either CS or LV,
2. place observable bounds on the percentage error of approximating EV with either CS or PV,
3. require no information about consumer's income or income elasticities, and
4. Establish conditions under which the easily understood LV and PV measure of welfare change can be reported to policy maker.

They assumed that the demand function is linear over the range of considerations and derived the following equations that

1. $(CS - LV)/CS < \lambda$ when $|\Delta Q| < 2\lambda/(1-\lambda)Q_0$,

2. $(PV - CS)/(CS) < \lambda$ when $|\Delta Q| < 2\lambda/(1-\lambda)Q_0$,

---

6. Single price change situation only.
7. LV = Laspeyres Variation
   CV = Compensating Variation
   CS = Marshallian Consumer's surplus
   EV = Equivalent Variation
   PV = Paasche Variation

CS = Marshallian Consumer Surplus,

LV = Laspeyres Variation,

PV = Paasche Variation,

λ = Specific percentage error selected,

ΔQ = Change in quantity demanded due to price changes and,

Q_0 = Original quantity demanded.

For every value of λ, LV and PV will be within λ% of CS whenever the change in quantity demanded is less than 10% of the original demand. LV and CS bound CV (PV and CS bound EV) for a single price decrease. It follows that whenever $\Delta Q = 10Q_0$, CS and LV will be within λ% of CV. Moreover CS and PV are within λ% of EV. LV and PV can be used to estimate CV and EV respectively, in cases where quantity demanded changes by less than 10% of the original demand.

If the quantity changes that result from a price change are known, equation 1 and 2 can be used to calculate the upper bound on the associated percentage of error. PV and LV or CS can be approximators of CV or EV. These calculations require only price and quantity change. No information of income and income elasticity are required.

Cory, et al. (1982) concluded that PV and LV calculations is a pragmatic approach to the applied policy analysis. They maintained that it is a quick and inexpensive computation that can provide a range within which lies the actual value of the change of consumer welfare.

Consumer-Benefit Measures Under Uncertainty

In 1964, Burton A. Weisbrod incorporated uncertainty in the benefit-cost analysis. He introduced the concept of "option value" in the theoretical analysis. According to him, there may be an additional kind of benefit that should be added to the consumer's surplus in measuring benefits of public goods under demand uncertainty.

Weisbrod (1964) elaborated that, "Option value" is the amount of money the economic men who anticipate visiting a park, but are uncertain of their visits, would be willing to pay for the option to guarantee them of their future access. His claim shows that consumer's surplus by itself is insufficient to measure the benefit of public goods when the demand is uncertain.

Millard Long disagreed with the concept suggested by Weisbrod. Long (1976) argued that "option value" was identical to the expected value of consumer's surplus. It can be used in place of consumer's surplus, not in addition to it. He concluded that Weisbrod's "option value" was only a new name for the user benefits that were already being used in the standard techniques of benefit-cost analysis.

Lindsay (1969) in "Option Demand and Consumer's Surplus," attempted to justify the concept of "option value" suggested by Weisbrod. He pointed out that Long's criticism was inappropriate because he neglected Weisbrod's assumption of uncertainty. Linsay emphasized that " ... options are of value by definition only where uncertainty exists" (p. 345). Option value is a premium paid to

protect the potential user from demand uncertainty because "Option demand exists for future-not present-goods" (p. 345).

Weisbrod's introduction of option value has stimulated ideas and critique. Krutilla (1967) suggested that people may value an environmental asset though they are uncertain whether they will personally use it in the future. He discussed the importance of conservation where he introduced the notion of "option demand" (p. 780).

> This demand is characterized as a willingness to pay for retaining an option to use an area or facility that would be difficult or impossible to replace and for which no close substitute is available. Moreover, such a demand may exist even though there is no current intention to use the area or facility in question and the option may never be exercised. If an option value exists for rare or unique occurrence of nature, but there is no means by which a private resource owner can appropriate this value, the resulting resource allocation may be questionable.

Byerlee (1971) attempted to show the relationship between consumer's surplus and "option value" (as defined by Weisbrod 1964). He incorporated the modified Von Neuman-Morgenstern utility function in his framework of study. According to him, "... consumer surplus is how much money a consumer would pay for the right to continue to buy at the current price something that he is now buying or intends with certainty to buy in the future" (p. 524). He included in his analysis the cost (loss) that one would incur if he purchased the option but did not exercise it, and the loss if he did not purchase the option and found it not available when demanded later.

He concluded that option demand is a good estimate of the consumer's surplus under uncertainty. To include both the option demand

and consumer's surplus in the benefit evaluation would be double counting.

Cicchetti and Freeman (1971) specified "option" as "option price" to clear the confusion. They defined option price as the maximum amount of money an individual would be willing to pay to preserve the option when he is uncertain about the demand.

They concurred with Weisbrod and Lindsay's insight. When an individual is risk averse, option value[8] exists separately from the consumer's surplus under uncertainty in a conventional setting of diminishing marginal utility of income. Option value exists where the future demand is uncertain. Even the certain potential users would be willing to pay a premium (option value) to eliminate the uncertainty in the supply if he is risk averse.

Cicchetti and Freeman (1971) showed that option values arise not only from uncertainty of the future demand of the commodity, but also uncertainty of its availability. Option value is positive if the option price exceeds the expected value of consumer's surplus. They suggested the relationship of option value and expected value of consumer's surplus with changing probability of demand as shown in Figure 2.

The linear function in Figure 2 is the relationship between the expected value of consumer's surplus and the probability of demand. The

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8. Cicchetti, Charles J., and Freeman, A. Myrick III (1971) defined option value as being a willingness to pay in excess of consumer's surplus.

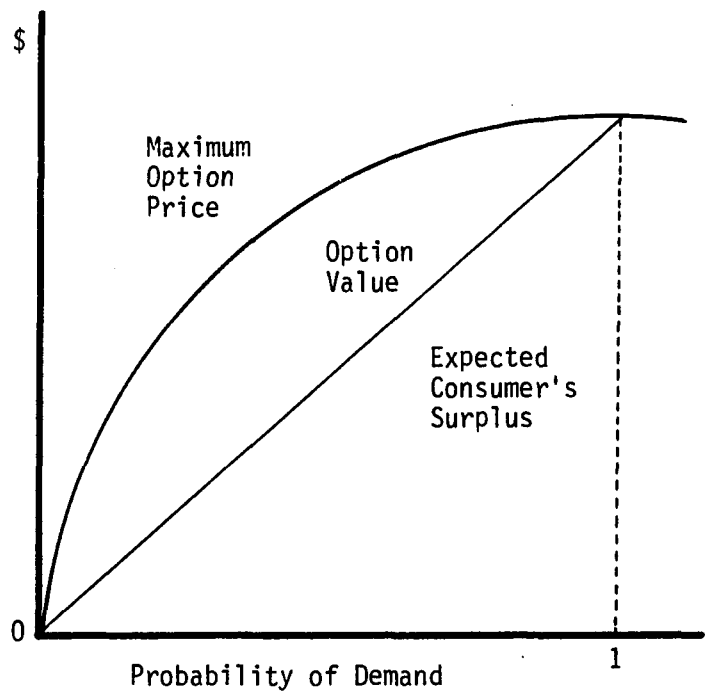

Figure 2. Option Value and Probability of Demand

maximum option price function (nonlinear) lies above the linear function. The vertical difference between them is the option value as a function of probability demand. Option value is small when the probability of demand is close to 1. It is also a small percentage of the expected consumer's surplus. At the middle and low probabilities of demand, option value is large relative to the expected consumer's surplus. The use of only consumer's surplus of the expected number of users will result in an underestimate of the benefit if there is a large number of low probability demanders. Thus, it should include the option value in the benefit measures when certainty exists.

An extensive review of Schmalensee's (1972) "Option Demand and Consumer's Surplus: Valuing Price Changes under Uncertainty" indicates that option value depends on the preferences of the individual and circumstances that exist. He used a "timeless" framework in the study. Under plausible assumptions, the option value could be either positive, zero or negative for risk averse individuals since markets for contingent claims on income and taste do not exist.

Schmalensee (1972) concluded that when tastes are the source of uncertainty, the expected value of consumer's surplus should be the best available estimate for the sum of option prices.

Arrow and Fisher (1974) tested the possibility that the existence of the option value for a risk-neutral individual may lead to a similar situation. They agreed that option value is different from the consumer's surplus. Even for the risk-neutral individual, their

differences may be very significant. Their analysis shows that the initial insights of Weisbrod and Lindsay are correct.

Schmalensee (1975) reviewed the work he did in 1972. He stated that the normal procedure for estimating the future user benefits is to estimate the current demand and project it into the future. The only practical course of action is to assume the option value is zero because it is indeterminate theoretically, and impossible to determine empirically. Most future benefit estimates seem to reflect the user benefits rather than the option price.

Bohm (1975) rejected Schmalensee's state-preference approach. He argued that Schmalensee's approach is not applicable when the future preference is uncertain. The option price is not identical to the "expected consumer's surplus" under risk neutrality.

Bohm (1975) however, agreed that option value may be positive or negative for risk averse individuals in the case of uncertain future preferences. The option value is zero for the individual who is risk neutral. He disagreed with Schmalensee's definition of risk aversion because Schmalensee assumed the utility to be identical in all states of the world.

According to Bohm (1975), the applied research should seek to measure the option price rather than the expected user benefits. "The option price is therefore the only measure of the benefit side of the investment that can conceivably be determined - ..." (p. 736).

Mishan (1975) delineated that optional demand arises from two different purposes of willingness-to-pay. The first is the optional demand that arises from willingness-to-pay by potential users who are uncertain about their future demand. They are willing to make some contribution to reserve the option open for future uses. The second optional demand arises from the willingness-to-pay by those people who are not concerned themselves for future demand, but just want to make sure the goods continued to be available to community or nation. He expressed that this measure of willingness-to-pay as an index of benefit is appropriate in the cost-benefit analysis for public goods such as recreation facilities.

Graham's (1981) "Cost Benefit Analysis under Uncertainty" indicates that he sought to define the appropriate measure of benefit in the presence of uncertainty. He used the Von Neumann-Morgenstern theorem, as extended by Jack Hirschleifer, to develop the willingness-to-pay locus.

This locus illustrates precisely the expected value of the fair-bet point (expected willingness-to-pay), not the option price, is the correct measure of benefit involving individual insurable risk because it has the highest expected value of all possible points on the willingness-to-pay locus (when the fair market for contingent claims exist). Graham's suggestions are consistent with the argument of Bohm (1975). Both agreed that option price, not the option value, is the appropriate benefit measure because "Whether or not option price exceeds

the expected value of surplus is largely irrelevant to the evaluation of risky projects" (p. 716).

Graham (1981) concluded that the only relevant choice of benefit measure has to be either the expected value of willingness-to-pay or the option price. He favored the former when individual insurable risk is concerned "... if individuals are alike, then option price measure benefits in cases of collective risk while expected willingness-to-pay (the expected value of the fair-bet point) measures benefit in cases of individual insurable risk" (p. 721).

Greenley, Walsh and Young (1981) set up a two-time period Henry Mathematical model to test the option value empirically with the specific assumptions prescribed. They commented that the option to use the environment in the future has been preserved free of cost. Option value is a free by-product as long as the user benefit to preserve environment exceeds the opportunity cost of preservation.

Their study provides an empirical test of Weisbrod's (1964) suggestion that "option value" and other preservation values should be added to the aggregate consumer's surplus in order to measure the total benefit. In the absence of such a measure, resources would be allocated insufficiently.

Bishop (1982) attempted to provide an exposition of option value to clarify the issue and argument on the concept with reference to Schmalensee's (1972) study. He criticized Schmalensee's claim that the option value could be positive, zero or negative for a risk averse

individual under specific assumptions. He believed strongly that no one could be very optimistic about measuring the option value and it would be valuable to interpret the user benefit.[9] If the option value is positive, user benefit by itself as a benefit measure will understate the total benefit because the customers also have their option values. On the other hand, the user benefits alone will overstate the total benefits if the option value is negative.

According to Bishop (1982), the supply side option value is relevant to many natural resource environmental issues. He commented that Cicchetti and Freeman (1971) did not further develop the idea of option value under supply uncertainty. He claimed that under specific assumptions, the option value is unambiguously positive when the demand is certain but the supply is uncertain.

Bishop (1982) clarified the definition of option value and option price. Option price is the "... maximum amount that the consumer in question would be willing to pay in 1982 for an option to visit the park in 1983 (p. 3). OV = OP-E(CS).[10] He criticized Weisbrod (1964) on the "option value" because it was not clear whether Weisbrod was referring to option price or option value.

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9. User benefits are benefits directly derived from actually using the facilities. It is not the possible benefits derived from holding options, knowing that the resource exist.

10. (OV) option value, (OP) option price and E(CS) expected value of consumer surplus.

In addition, Bishop (1982) commented that Cicchetti and Freeman (1971) made an "... unsatisfactory assumption" (p. 5) by assuming that indifference curves which are tangent to the same budget line have the same level of utility. The assumption violated the basis of microeconomic theory. Schmalensee's (1972) analysis is insufficient for it considered only the risk associated with not buying the option. Not purchasing the option will result in the goods not available when demanded later. "However there is also risk associated with buying the option: having paid the option price, the option may turn out to be useless" (p. 10).

The consumer's surplus by itself is an incomplete measure of benefit of natural resources where either the future demand or supply is uncertain. This measure alone will understate the total consumer benefits from maintaining the resource by an amount equal to the option value where future demand is certain but future supply is uncertain. On the other hand, option value depends on the diminishing marginal utility of income, which would be less than the expected value of consumer's surplus.

Bishop (1982) concluded that he is still less optimistic about whether option price estimate could be divided into option value and expected consumer surplus because (p. 14)

> where future demand is uncertain either because preferences themselves are conditional or income is stochastic, the conclusion regarding inadequacy of consumer surplus is equally valid but the direction fo the error is not clear without detailed information about the conditional utility functions themselves.

Smith (1983) reviewed the conceptual foundations on the argument of option value. He suggested that the apparent contradictory conclusions of earlier studies are basically the reflection of differences in studies of the behavioral decision process in the comparative evaluation. These discrepancies in the past evaluations of option value are derived from two different analytical frameworks. The first difference is the measure of option price in the use of the "timeless" versus "time sequenced" approaches to accommodate the uncertainty in the individual decision making. The second difference is the failure to appreciate, within the "timeless" framework, the complications introduced by state specific utility function.

It seemed fair to conclude that in both frameworks, the option value is positive for risk averse individuals in measuring benefit of unique, irreplaceable natural resources. The implicit presumption that the expected user benefit will undertate the value of unique, irreplaceable natural resources is reasonable. He concluded that the practical measurement of option price would require a time sequenced framework.

Freeman (1984) attempted to determine a priori sign of option value.[11] He tried to judge whether the magnitude of the option value would affect the benefit-cost analysis. He clarified that (p. 2)

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11. Option value is option price minus expected value of consumer's surplus, or the difference between the maximum willingness to pay and expected value of consumer's surplus.

> A "contract" that eliminates supply uncertainty is a form of option. Option price is the maximum willingness-to-pay for this contract on the understanding that if the option is not purchased the individual would be excluded from purchasing the good if he later demanded it.

Uncertainty about prices of goods may result in the supply uncertainty. Uncertainty about income, preferences, and either prices of complementary or substitute goods may give rise to demand uncertainty. When the state-dependent preferences are the sources of demand uncertainty, specific results about the option value require specific assumption(s) about the way in which the utility functions are related.

Freeman (1984) used the willingness-to-pay locus developed by Graham (1981) to demonstrate the possible signs of option values under different cases of uncertainties. It is often possible to determine the sign of option value in a particular situation by judging how the marginal utilities of income varies in different states of the world. For risk averse individuals, the option value is usually positive. A realistic model is where the demand uncertainty is caused by some exogenous factors other than price and income which affect the marginal utility of income, and the attitudes of individuals toward risk in all states of the world. He concluded that the option value could be a significant composition of total willingness-to-pay for an individual who is highly risk averse in cases of low probability in demand and large expected consumer's surplus.

Boyle and Bishop (1985) indicated that "Option value is an adjustment to the monetary measure of welfare to reflect the uncertainty consumers face when future states of the world are unknown" (p. 2). "Option price" consists of option value and expected value of Hicksian consumer's surplus. It is the maximum amount of money that an individual would be willing to pay in order to guarantee the availability of the environmental asset in the future. Option value, a component of the option price may be positive, zero or negative. They suggested that " ... option value is not merely a concept related to the potential for consumptive use of a resource, but rather is a result of uncertainty whenever it occurs in the choice problem" (p. 9). Option value has given economic credence to the fact that the potential users of a resource can place a monetary value on the resource even when they are uncertain about their demand.

Cory and Saliba (1985) argued to the extent that expected utility theory constitutes an adequate characterization of rational behavior under uncertainty, and to the extent that social decision making should be risk neutral with respect to evaluating natural environments, it follows that:

- the expected value of fair-bet contingency contracting is the correct welfare measure of benefits to an uncertain user of a natural environment;
- option value is a peripheral concept in the economics of natural environments since option price does not reflect the

correct welfare value of user benefits;

and

- second-best arguments centered around project financing do not constitute a compelling argument for the use of option price as a benefit measure. In exceptional circumstances, risk-averse social decision making may require state-independent payments, making option price an appropriate second-best measure. In the vast majority of cases, risk neutrality will require an evaluation of fair-bet contingency contracting. The existence or nonexistence of contingent claims markets is irrelevant to the argument.

CHAPTER 3

THEORETICAL FRAMEWORK OF ANALYSIS

The theoretical concept supporting this study will be reviewed in this chapter. However, the sources of uncertainty involved in this framework need to be identified first. The review of benefit measures of natural environmental assets under uncertainty will then follow.

Identification and Description of Uncertainties Involved in the Theoretical Framework

For a given period of time, a birder faces uncertainties in two stages as indicated in the tree diagram in Figure 3. At the first stage, a birder encounters the uncertainty which has two outcomes, whether to go to Cave Creek or otherwise. The question about the willingness-to-pay are assumed to be asked at the entrance of Cave Creek. This assumption eliminates the outcome of not going to Cave Creek and screens out those who do not go to Cave Creek.

The second stage is the situation confronted by a birder at Cave Creek. He first anticipates the uncertainty of whether the bird will show up in Cave Creek or otherwise. In this hypothetical situation, we assumed that the bird -- the main attraction -- shows up so that there is an incentive for the birders to visit the recreation area. This assumption eliminates the uncertainty that the bird does not show up.

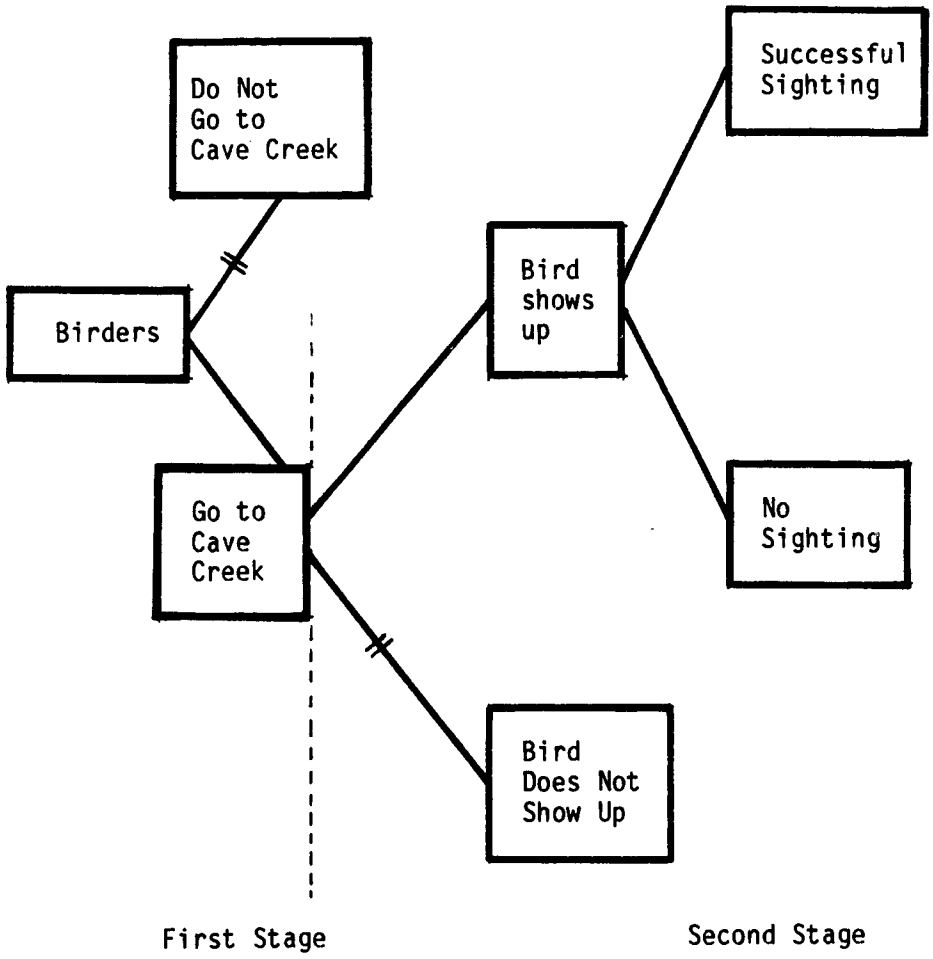

Figure 3. Tree Diagram for Uncertainties

With the assumptions that the birder is at Cave Creek and the bird does show up, his uncertainty is reduced to only one event with two possible outcomes, successful sighting or otherwise. The uncertainty about sighting the birds depends on three factors:

1. The competency and accuracy of the individual birders,
2. the weather in Cave Creek, and
3. the time and location (spot) in the Cave Creek area that the bird can be sighted.

We assume that all birders are identical. Thus, the first factor is eliminated. The birders are furnished with the same information about the bird and the same equipment. They also have acquired the basic skills required to be competent and accurate birders. The second factor can be eliminated without much difficulty because weather forecasters can predict the weather in Cave Creek with high accuracy. The only major factor that contributes to the main source of uncertainty in this framework is the third factor. Further-more, South Fork of Cave Creek is not a small area for a birder to go about in search of the rare bird. As long as the bird shows up in Cave Creek, there is still a chance that a birder will sight it even though the odds are not clearly defined. In consultation with experienced and professional birders, the probability that this bird being sighted can be expressed in various ways. In the questionnaires, " ... seen by four out of every five birders ..." or " ... sighted by two of the last five

birders ..." are used to state the probability of sighting. The first statement refers to an 80% chance of sighting and the second expression refers to a 40% chance of sighting for a given time period. Thus, it is assumed that this is a case of collective risk[12] where every identical birder has an equal probability of sighting the bird in the Cave Creek area.

Benefit Measures of Natural Environmental Assets Under Uncertainty

The sources of uncertainty have been identified in the first part of this chapter. Two states of the world which the respondents (birders) encounter are the states of successfully sighting the bird in Cave Creek or not sighting the bird.

The benefit measures in this framework requires the identification of all the possible contingent pairs of payment which the individual is willing to pay to guarantee his access to Cave Creek, assuming that the bird shows up in the South Fork of Cave Creek recreation area.

Let $\overline{U}$ be the expected utility of the individual without access to the Cave Creek recreation area and Π_S, Π_F = probability of state of successful

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12. The situation where individuals are often assumed to be identical; they have identical utility function equal endowment of real income. The state probabilities must be the same for all individuals.

sighting or no sighting,

U_S, U_F = utility in the two states,

Y_0 = income, identical in both states for each individual birder,

C_S, C_F = payment in two states,

1, individual gains access to Cave Creek recreation area and 0 otherwise, and

$\pi_S + \pi_F = 1$.

The basic assumption in this framework is that the individual's utility is a function of income and the accessibility to outdoor recreation and the quality of that recreation. It is assumed that access to the Cave Creek recreation area will increase the utility of the individual. The access to the Cave Creek recreation area with a successful sighting of the bird increases the utility of the individual even more. This assumption can be summarized in the direct utility approach as in Figure 4.

Consumer's Surplus as a Benefit Measure

When consumer's surplus is used as a benefit measure, payment is state dependent. When the bird is sighted, payment is collected, and $C_S > 0$; otherwise, no payment is required, $C_F = 0$.

By definition of consumer's surplus (CS),

$$\bar{U} = \pi_S U_S(Y_0 - CS, 1) + \pi_F U_F(Y_0 - 0, 1) \quad (1)$$

Expected value of consumer's surplus,

$$E(CS) = \pi_S(CS) \quad (2)$$

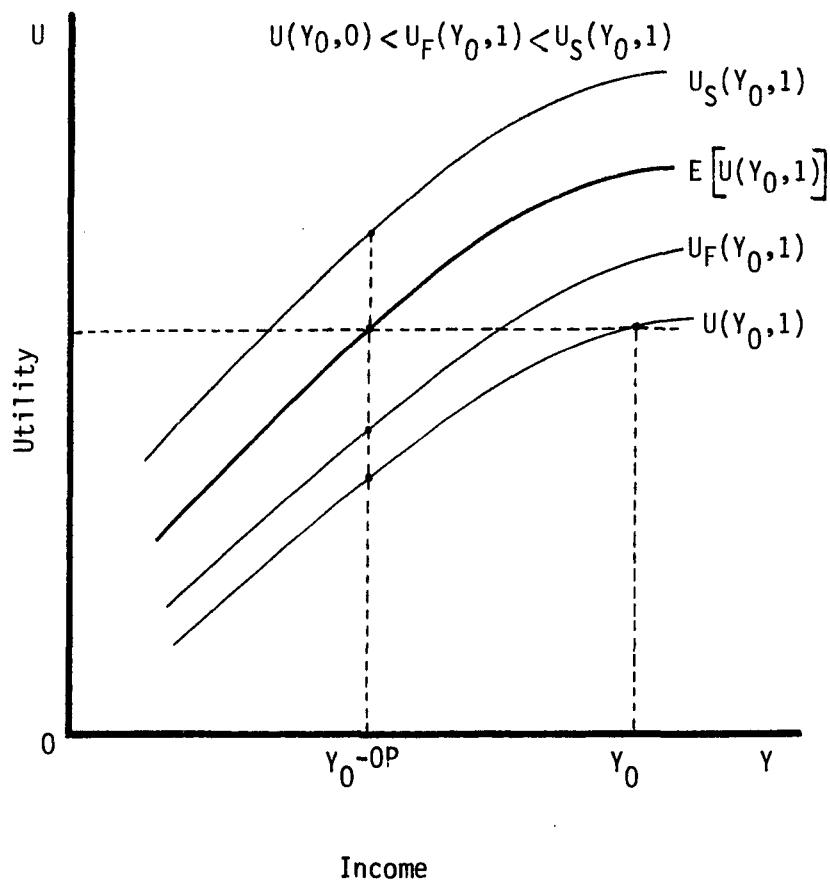

Figure 4. Utility Function with Uncertainty

Equation (1) shows that by contracting the contingent pair of payment (CS, 0), the individual will not be worse off than $\bar{U}$, yet he will be access to Cave Creek.

Option Price as a Benefit Measure

Option price (OP) is the maximum state-independent payment which the individual would be willing to pay to insure his access to the Cave Creek recreation area regardless of whether he will have a successful sighting of the bird or not. Option price is defined by the following condition:

$$\bar{U} = \pi_S U_S(Y_0 - OP, 1) + \pi_F U_F(Y_0 - OP, 1) \quad (3)$$

Expected value of option price,

$$E(OP) = \pi_S OP + \pi_F OP \quad (4)$$

$$= (\pi_S + \pi_F)OP$$

$$= OP$$

The individual who contracts the contingent payment pair of (OP, OP) such as in Equation (3) will again be guaranteed his right to access to Cave Creek without making him worse off than E(CS).

Willingness-to-Pay (Fair-Bet Point)
as a Benefit Measure

Another pair of contingent payment, as developed by Graham (1981) as fair-bet point or the willingness-to-pay, is (C_S, C_F). If an individual has sighted the bird successfully, the payment is C_S. If he has not sighted the bird, the payment is C_F. This pair of contingent

payments satisfied the expected utility of U as given in equation (2) and (3).

$$\bar{U} = \pi_S U_S(Y_0 - C_S, 1) + \pi_F U_F(Y_0 - C_F, 1) \quad (5)$$

Expected value of fair-bet point

$$E(fb) = \pi_S C_S + \pi_F C_F$$

This locus ensures that the expected utility is identical when payments are made and an individual gains access to Cave Creek and when he does not make any payment and he is denied access to Cave Creek ($\bar{U}$). The willingness-to-pay locus indicates that an individual is indifferent between making any pair of the contingent payments on the locus, which guaranteed his access to Cave Creek, and not making any payment and being disallowed access to Cave Creek.

The Case of Individual Insurable Risk

For the individual who has diminishing marginal utility of income, that is the risk averse person, the willingness-to-pay locus is concave to the origin.[13] The willingness-to-pay locus for an uncertain individual is illustrated in Figure 5.

For a given probability of being in the two states for the individual, the expected values of contingent pairs of payments (CS, 0),

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13. Slope of willingess-to-pay locus is given by $dC_S/dC_F = (\partial U_S/\partial Y_S)\pi_S/(\partial U_F/\partial Y_F)\pi_F$.

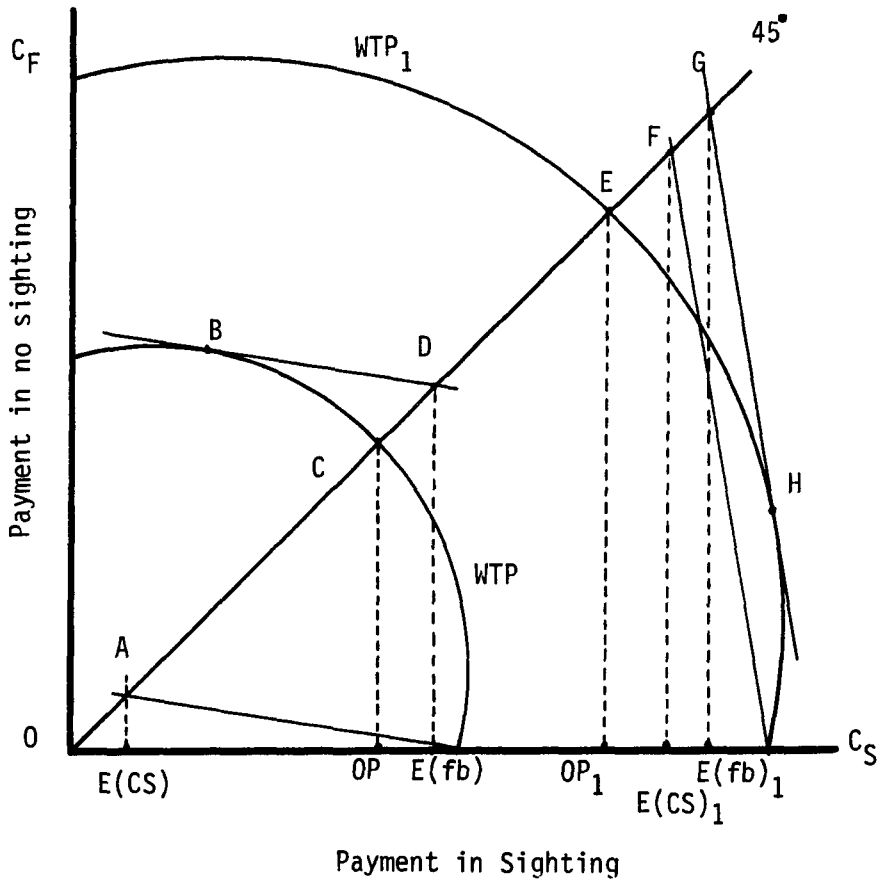

Figure 5. Different Benefit Measures of Natural Environmental Asset

(OP, OP) and (C_S, C_F) are E(CS), OP, and E(fb)[14] respectively.

In such a case, OP>E(CS), which implies that option value is positive. Option value could be positive, zero or negative depending on the relevant situations (Schmalensee 1972 and Bishop 1982).

The correct measure of benefit stated by Cory and Saliba (1985) is the maximum willingness-to-pay (fair-bet point) which involves the process of identifying the pair of contingent payments that has the maximum expected value under situations of individual insurable risk.[15] Figure 5 shows that fair-bet point which occurs at point B is the correct benefit measure because it has the highest expected value (at point D) as compared to option price (point C) and consumer's surplus (point A). At point B, the negative slope of the willingness-to-pay locus (WTP) is equal to the ratio of the state probabilities, that is Π_S/Π_F.

To measure the total benefit generated by the natural environmental asset, it is necessary to aggregate the individual benefit estimates across the entire population of the potential users. The aggregation process is shown in Figure 5. The fair-bet point of the second user occurs at point H on WTP_1 where the slope of the WTP_1 equals the ratio of the probabilities faces by the second user. A comparison

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14. Expected value of contingent pair of payment (C_S,C_F) is equal to $\Pi_S C_S + \Pi_F C_F$. A line passing through any of the contingent payment with slope of $-\Pi_S/\Pi_F$ gives all possible combination with the same expected value.

15. State probabilities vary across potential users.

of points E, F and G indicates that the expected values of fair-bet point, not the consumer's surplus, or option price is the correct benefit measure.

The total benefits in this case are the sum of all the expected values of the fair-bet points. Aggregating either all of the option values, or all of the expected values of consumer's surplus, will always understate the total benefit of the environmental asset. Thus, option value is comparatively less essential in valuing the natural environment under the individual insurable risk.

The Case of Collective Risk

With collective risk, individuals are often assumed to be identical; they have identical utility functions and equal endowment of money income. Collective risk also requires that the state probabilities to be invariant across all individuals.

The willingness-to-pay locus for an individual i under collective risk is shown in Figure 6. Point A is the fair-bet point and the corresponding expected value for the individual i is $E(fb)_i$. The other pair of contingent payments which occurs at point B is the option price, and the expected value is OP_i. The aggregation of the total benefits for collective risk would be the multiplication of the number of identical potential users who each generates the willingness-to-pay (fair-bet point) and option price on the willingness-to-pay locus, WTP_i to determine the points F and G on WTP respectively. The aggregate

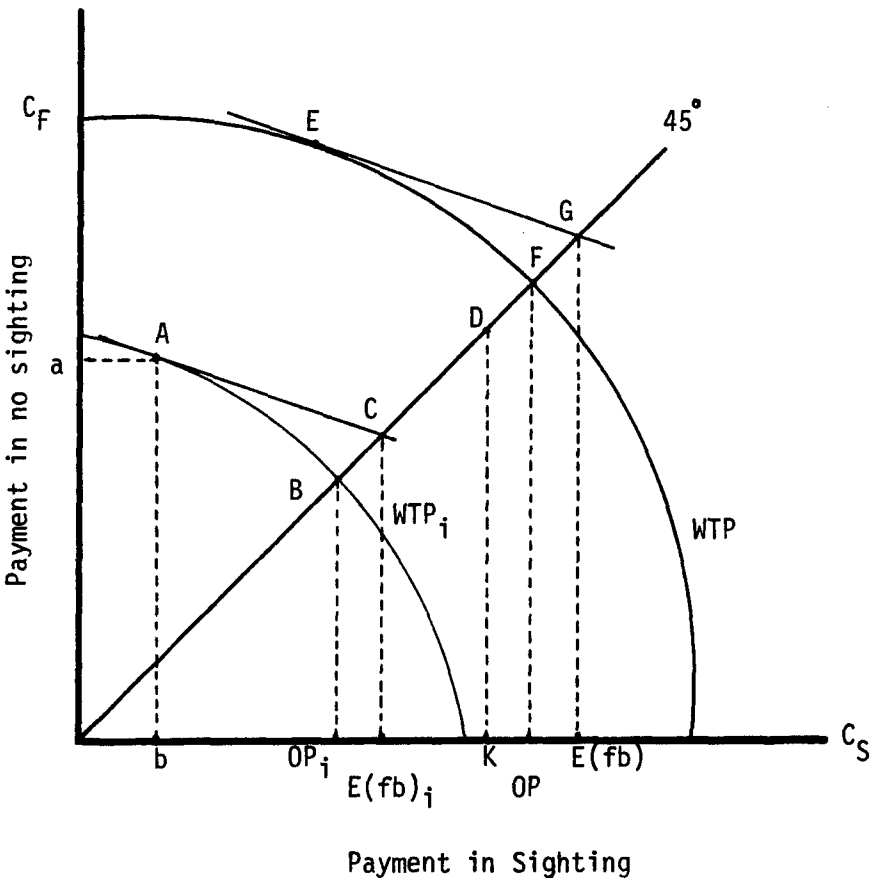

Figure 6. Benefit Measures of Natural Environmental Asset under Collective Risk.

measure of option price is $OP = N.OP_i$ and the aggregate measure of expected value of fair-bet point is $E(fb) = N.E(fb)_i$, where N is the number of identical potential users.

If the project has a total cost of K dollars and state-independent probabilities are known with certainty, option price is the best benefit measure under collective risk (Graham 1981). The aggregate expected value of fair-bet point is not the correct benefit measure because these contingency payments will not cover the full cost of the project if only one state is realized.[16] Hence, option price is the largest state-independent aggregate payment and the only appropriate benefit measure of the project. This payment ensures a Pareto efficient risk distribution. The collection of payment OP_i from all potential users will make the marginal rate of substitution for contingency payments equal across all individual potential users.

Cory and Saliba (1985) pointed out that the assumption of collective risk may not necessarily hold for uncertain users of the natural environment because the state probability often varies across individuals. Assumption of identical preferences may not hold because each individual has a different level of risk tolerance and acceptance.

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16. $E(fb) = N.(\Pi_S a + \Pi_F b)$ for estimating aggregate benefit in collective risk when two states are realized. If only one state is realized, i.e. sighting state, the aggregate benefit measure according to fair-bet point is $N(\Pi_S a)$; $N(\Pi_S a + \Pi_F b) > N(\Pi_S a)$, which is insufficient to cover the project cost of K dollars.

Thus, the expected value of fair-bet point is still the best benefit measure for the decision makers who are risk neutral.

CHAPTER 4

METHOD OF DATA COLLECTION AND DESIGN OF QUESTIONNAIRES

Type of Data Used

Once the objective of the study is defined and specified clearly, the research effort is concentrated on collecting data. Basically, data used for research can be divided into categories, primary and secondary data.

Secondary Data

The secondary data have some time and cost advantages over the primary data. If the required information is available in the form of secondary data, the researcher would need to go the library, identify the proper sources and extract the desired information. The whole process should not take more than a few days and would incur very little monetary cost.

Primary Data

Primary data is the information that must be collected from a field survey. The collection of primary data involves lengthy and costly processes such as:

a. designing and pretesting the questionnaires,

b. identifying the respondents,

c. training of field interviewing staffs,

d. checking data to ensure accuracy of data gathered and collected, and

e. coding, punching and tabulating the data collected.

A conservative time estimate for performing these processes would be two to three months. Also, the moneray cost of the field survey would involve higher expenses and wages than required in collecting secondary data.

Justification for Using the Primary Data

Even though secondary data have the time and cost advantages over primary data, secondary data rarely solve the specified problems of research. They seldom fit perfectly into the problems or objectives defined for the specific study. If they fit, they would be sufficiently poor to render any significant impact to the research.

Three sources of the ill fit of secondary data to the defined problems or objectives are:

1. units of measurement,

2. class definitions, and

3. publication currentness.

There is no readily available data that can be used for the study to develop empirical methodologies to estimate the fair-bet point. Also data are lacking to explore theoretically the relationship between

the fair bet and expected surplus, in order to set bounds on the difference between the two measures in the field of wildlife, especially birdwatching in the Cave Creek recreation area. The best way to generate primary data for this study is to carry out a field survey.

Method of Collecting Data

Survey Technique

A contingent valuation survey technique, is used to collect primary data for this study. This approach involves setting up a hypothetical environment and elicits responses from the respondents. The hypothetical money and consumption opportunities are used in place of real ones.

This approach can be administered by mail, phone or personal interview. When the survey is administered by mail, the questionnaire is sent to the designated respondent with an accompanying cover letter. The respondent completes the questionnaire at his or her leisure and mails the response back to the research organization. The telephone interview means conversation over the phone. A personal interview involves face-to-face conversation between the interviewer and the respondent. The interviewer asks the questions and records the answers during the interview or immediately upon its termination.

When survey technique is involved, researchers have to design questions such that answers reflect the true behavior and preference of the respondents regarding the specific research. It is not easy for

researchers to design and ask questions in order to avoid biased answers. The hypothetical situation may cause the respondents to react inconsistently in the real world situation.

This approach has some weaknesses which could be caused by various sources of bias, such as,

1. hypothetical bias,
2. strategic bias,
3. vehicle bias,
4. starting point bias, and
5. information bias.

Hypothetical Bias

The hypothetical bias is one problem source in contingent valuation. The "cost" of being wrong in a hypothetical situation is relatively insignificant because all payments and consumption opportunities are not real. Normally, respondents may not have an incentive to reveal their exact preferences and budgetary commitment in a hypothetical situation. Thus, the valuation may incorrectly predict how the respondents would behave because of insufficient experience and lack of knowledge to know how they would react in a real market situation.

Strategic Bias

Strategic bias is one of the main problem in a contingent valuation. It is the situation whereby the respondents intentionally

mislead the researcher because they believe that there are some benefits in doing so. For instance, the respondents might express lower value than they actually would in the real market if they believed that the result of the study will affect user costs. The reverse is possible if they believed that large contingent values would increase the inflows of funding.

Vehicle Bias

Vehicle bias occurs when the respondents are sensitive to the method of payment used in the research. If the contingent valuation technique derived taxes as a scheme of payment, most respondents might dislike it. They will express relatively low values to the existing level of taxes rather than reveal their true values of the facilities.

Starting Point Bias

Starting point bias is the potential problem of the bidding game approach of eliciting contingent value. Bidding game involves asking respondents whether or not they will pay a given amount of money as the starting bid. A positive response would lead to interviewer to inquire about successively higher amounts while a negative response would lead the interviewer to inquire otherwise until the maximum willingness-to-pay is elicited. The starting point bias would have occurred if the starting bid affected the final bids.

Information Bias

Information bias exists when information provided as part of the contingent valuation affects the contingent values. Rightly, the values of the resources quoted by other repondents should not affect the true values of the willingness-to-pay of any given individual because each individual has his/her own preference and value of judgement.

Bishop, Heberlein, Welsh and Baumgartner (1984) indicated that substantial empirical research had been conducted to learn the extent to which potential biases actually distort the results of contingent valuation. But no concrete results have been obtained. Though the contingent valuation is not 100% accurate, at least it is close enough to the true value at the relevant range so that it is useful in the research.

According to Bishop, et al. (1984) most of the experimental literature on public goods does not successfully pin-point the large distortion caused by strategic behavior. Furthermore, several contingent valuation studies had used "methodological cross-check" (Bishop, et al. 1984, p. 6) in comparing the results obtained from the survey technique. These comparisons indicated that there is no significant difference at least up to the relevant range.

The survey technique is proposed for this study because it is less complicated than the simulated market technique. It has an edge over other technique in terms of monetary cost and time. Furthermore, "Most economists would agree that contingent values are accurate to the

extent that they approximate values that would be generated if a well-functioning competitive market could be established" (Bishop, et al. 1984 p. 2).

Design of Data-Collection Forms or Questionnaires

Figure 7. Forms of Questionnaires

	Structured	Unstructured
Undisguised	d	a
Disguised	c	b

The figure above suggests that a questionnaire is either disguised or undisguised, and structured or unstructured. It should be specified that these characteristics are matters of degree of standardization.

A highly structured questionnaire is one in which the questions only allow completely predetermined responses on the subjects. On the other hand, a highly unstructured questionnaire is one in which the questions are loosely predetermined. They allowed respondents to answer in their own words. A questionnaire in which the questions are fixed, but answers are open in form, would represent an intermediate degree of structure. The classification of Figure 7 is based on the degree of structure imposed on the responses rather than the questions.

An undisguised questionnaire is the one in which the purpose of the study is revealed in the questions asked. On the other hand, a

disguised questionnaire is one in which the purpose of the study is not revealed.

a. Unstructured-Undisguised Questionnaires

Unstructured-undisguised questionnaires reveal clearly the purpose of the study to the respondents. The responses to questions are open ended. The interviewer asks exactly the same questions to all respondents. He allows respondents to express their answers freely as they see fit. However, the interviewer is allowed to deviate from the standard questions in order to probe for elaboration after the first response. Also, the respondent would clarify his or her answers. The whole process is repeated until the interviewer gets the satisfactory answers.

The sequence and framing of the questions will vary from one interview to another. The specific content or depth of each interview may vary and would distort the results of the research. However, this category of questionnaire allows more flexibility for both respondents and interviewers. An experienced interviewer would be able to probe for more detailed responses which would be useful for the research.

b. Unstructured-Disguised Questionnaires

This category of questionnaires is also known as the motivated research approach. That is, the questionnaire is developed in response to the research problem. It requires techniques that are independent of

respondents' self-insight and willingness to reveal themselves. This type of questionnaire is useful to tackle the problem of the respondents' reluctance to reveal their true feelings. This approach disguises the subject by using a disguised stimulus, and the questionnaire format is very unstructured.

This projective method assumes that an individual's reaction to the unstructured stimulus indicates his perception of the phenomenon. The storytelling concept is usually suitable to this type of questionnaire.

These questionnaires have the advantages of not disclosing the true purpose of the study and reducing the incidence of respondents' reluctance to react to the questions. In most instances, the questions asked stimulate the responses. But individuals' perceptive powers vary across the population. An unstructured stimulus which works for certain individuals might not be effective for others. Different interpreters often arrive at different conclusions about the same response. This creates more problems in editing, coding and tabulating data.

c. Structured-Disguised Questionnaires

Structured-disguised questionnaires are not commonly used in economic research. These questionnaires attempt to secure the advantage of disguise by hiding the motive and purposes of the study. They also have advantages in coding and tabulating data because of their structure. These questionnaires prove to be useful in situations when direct questions to respondents would produce biased answers.

The advantage of this category of questionnaire is that responses can be easily coded and tabulated. The results obtained with structured-disguised questionnaires can be quite comparable to those obtained with the unstructured-disguised questionnaires to a certain extent.

d. Structured-Undisguised Questionnaires

This type of questionnaire is popular in economic research. The questions are asked with exactly the same wording and the same sequence to all respondents. This is to ensure that all the respondents are answering the same questions. In a typical structured-undisguised questionnaire, the respondents and the questions asked are standardized. This is done by using fixed-alternative questions in which the answers of the subject are limited to the alternatives provided.

The advantage of structured-undisguised questionnaires over the other categories is that they are simple to administer. The data obtained are easy to tabulate and analyze. In addition, respondents experience fewer problems and difficulties answering the questions.

This type of questionnaire does not work well under certain circumstances. For instance, the fixed alternative questions may have certain discounts on the validity because the predetermined answers may not reflect the state of affairs. The provision of fixed alternative may force a respondent who does not have an option, to respond to a question anyway. Another situation might occur where the respondent has

an opinion, but none of the categorized responses accommodates his exact attitude. However, these weaknesses could be avoided by carefully designing fixed alternative responses so that they would contain the expressions of the majority.

The Questionnaires

Three sets of questionnaires as shown in Appendixes A, B and C were designed and pretested on a selected group of listed birders. The questionnaires are designed to assess preferences for three hypothetical birdwatching experiences in the Cave Creek recreation area. The questionnaires present alternatives recreation quality conditions and various hypothetical admission policies.

The site proposed for future research is the Cave Creek recreation area in the Chiricahua Mountains. This area was selected for its unique wildlife characteristics, particularly with respect to birdwatching. It is part of the Douglas Ranger District, Coronado National Forest. Cave Creek is located about 150 miles south of Tucson in Cochise County, Arizona. The Cave Creek location encompasses five district ecological zone. This recreation area contains beautiful canyon walls and mysterious caves. Its altitude is above 5000 feet.

All three sets of questionnaires are of an intermediate degree of structure. They are highly undisguised. These questions are arranged and asked at a fixed sequence and in the open form except the second question in Questionnaire #1. Questionnaire #1 has six

questions, Questionnaire #2 and #3 each has four questions. Each questionnaire has a brief description of a species of bird which is assumed to show up in the Cave Creek recreation area. The odds of sighting each species of bird is furnished as additional information for the birders.

Questionnaire #1 (See Appendices A on pages 91 and 92)

The first question is in the open form. It requires the respondent to report his approximate life-list total for North American birds. The answer of each birder reflects his level of birding experience and competency. It is assumed that the higher the life-list, the more realistic would be the value of birds he reports. In most cases, the possibilities are great that the individual would be more interested in searching for rare bird species instead of common ones.

The second question is a closed form question with two predetermined alternative responses of either yes or no. If the response is yes, the individual already has the bird listed and may have less incentive to reveal his exact value of the bird. Thus, the subsequent questions might be affected significantly. If the individual has not seen the bird, he is more likely to reveal the exact value of the bird because there is an incentive to do so.

The third question is in the open form. The respondent is informed of the odds of sighting the bird. He is requested to report the maximum willingness-to-pay that the payment will not be refunded

whether or not he sights the bird. The reponse represents the option price, which is illustrated graphically by point c on the willingness-to-pay locus in Figure 8.

The fourth question is in the same form as question two. Given the odds of sighting the bird, the respondent is asked to report his maximum willingness-to-pay if the payment will be refunded fully in the event that the bird is not sighted. The answer reflects the exact value of the consumer's surplus. Point a on the willingness-to-pay locus in Figure 8 is the graphical representation of consumer's surplus.

For the fifth question, the same information was furnished as for previous questions. The answer reflects point b on the willingness-to-pay locus in Figure 8. The value reported by the birder should be the intermediate of those values reported for questions 3 and 4 because 50% of the payment will be refunded in the event of no sighting.

The sixth or the last question in this questionnaire is an open form question. The respondent is provided with the same amount of information as for the previous three questions. The only difference is that the respondent is asked to report his maximum willingness-to-pay on the condition that his payment will be refunded in full if he has a sighting of the bird. Point d in Figure 8 is a graphical representation of this value.

Questionnaires #2 and #3 (See Appendices B and C on pages 93, 94, 95 and 96)

Questions number 1 in both of these questionnaires are in the open form. The birders are requested to report their maximum willingness-to-pay given their odds of sighting and the non-refund policy. These questions are symmetrical to question 1 of Questionnaire #1. The response to each of these questions is the option price as indicated by point c in Figure 8.

Questions number 2 correspond to the third question in Questionnaire #1. All these questions have the same forms and structures. Each of the answers to these questions represent the consumer's surplus because payment is collected only if there is sighting of the bird. Graphically this value is indicated by point a on the willingness-to-pay locus in Figure 8.

Questions number 3 in both questionnaires specified the half refund policy in the event of no sighting. The answers for each of these questions should be indicated by point b on the willingness-to-pay locus in Figure 8.

Both questions number 4 are the same as the last question in Questionnaire #1. The respondents are requested to report their maximum willingness-to-pay under this full refund scheme when they have sightings of the birds. Each of the responses can be expressed graphically by point d in the willingness-to-pay locus in Figure 8.

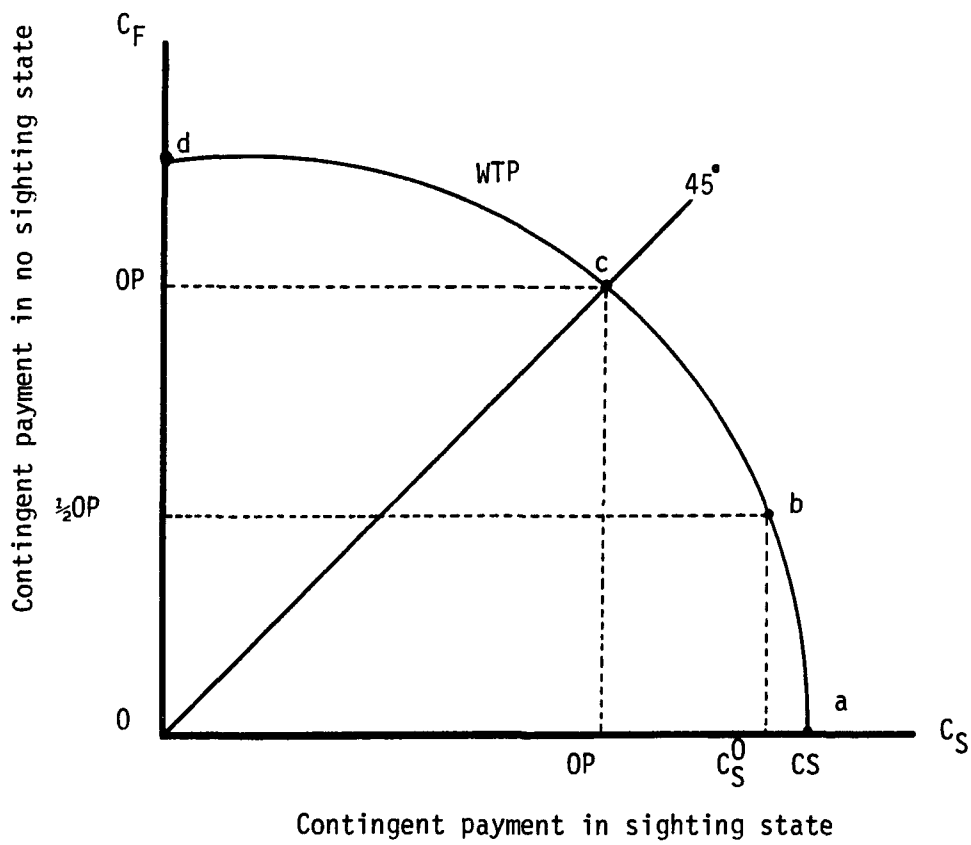

Figure 8. The Willingness-to-Pay Locus

CHAPTER 5

RESULTS OF PRETESTS AND REVISION OF QUESTIONNAIRES

The designed questionnaires were pretested on five listed birders on November 14, 1985. The survey was conducted in the form of a group discussion. The respondents were briefed on the purpose of the pretest and they were requested to report their responses in the questionnaires distributed to them. Later they were asked to comment on the questionnaires.

Results of the First Pretest

The results of the first pretest by using Questionnaires #1, #2 and #3 are summarized in Tables 1, 2, 3 and 4.

Table 1. Approximate Life List Total for North American Birds (First Pretest)

Respondents	Approximate Life List Total for North American Birds (Species)
1	605
2	525
3	478
4	389
5	368
Mean	473
Standard Deviation	98
Range	237

Table 2. Contingent Payments Under Various Admission Policies in Valuing the Flame-colored Tanager in the Cave Creek Area (Questionnaire #1)

Respondents	Question 3		Question 4		Question 5		Question 6	
	C_F	C_S	C_F	C_S	C_F	C_S	C_F	C_S
1	20	20	0	50	20	40	50	0
2	4	4	0	10	2.5	5	2	0
3*	5	5	0	7	3	6	7	0
4	7	7	0	7	3.5	7	12	0
5	10	10	0	10	5	10	20	0
Total	46	46	0	84	34	68	91	0

Table 3. Contingent Payments Under Various Admission Policies in Valuing the Thick-billed Parrot in the Cave Creek Area (Questionnaire #2)

Respondents	Question 1		Question 2		Question 3		Question 4	
	C_F	C_S	C_F	C_S	C_F	C_S	C_F	C_S
1	20	20	0	50	20	40	50	0
2	2	2	0	4	1	2	2	0
3*	5	5	0	7	3	6	7	0
4	10	10	0	15	5	10	10	0
5	5	5	0	5	2.5	5	5	0
Total	42	42	0	81	31.5	63	74	0

C_F: Contingent Payments ($) in no sighting state.
C_S: Contingent Payments ($) in sighting state.
* Contingent Payments reported are consistent with the theoretical framework of the willingness-to-pay locus.

Table 4. Contingent Payments Under Various Admission Policies in Valuing the Gray Silky-flycatcher in the Cave Creek Area (Questionnaire #3)

Respondents	Question 1		Question 2		Question 3		Question 4	
	C_F	C_S	C_F	C_S	C_F	C_S	C_F	C_S
1	20	20	0	40	25	50	50	0
2	2	2	0	4	1	2	1	0
3*	5	5	0	7	3	6	7	0
4	3	3	0	3	1.5	3	3	0
5	5	5	0	10	5	10	10	0
Total	35	35	0	64	35.5	71	71	0

C_F: Contingent Payments ($) in no sighting state.
C_F: Contingent Payments ($) in sighting state.
* : Contingent Payments reported are consistent with the theoretical framework of the willingness-to-pay locus.

Table 5. Responses to Questionnaire #1

Respondents \ Questions	3	4	5	6
1	C	C	x	x
2	C	C	x	x
3	C	C	C	C
4	C	x	x	x
5	C	x	x	x

C : Response which is consistent with the willingness-to-pay locus.
x : Response which is inconsistent with the willingness-to-pay locus.

Table 6. Responses to Questionnaire #2

Questions / Respondents	1	2	3	4
1	C	C	x	x
2	C	C	x	x
3	C	C	C	C
4	C	C	x	x
5	C	x	x	x

Table 7. Responses to Questionnaires #3

Questions / Respondents	1	2	3	4
1	C	C	x	x
2	C	C	x	x
3	C	C	C	C
4	C	x	x	x
5	C	C	x	x

C : Response which is consistent with the willingness-to-pay locus.
x : Response which is inconsistent with the willingess-to-pay locus.

The information in Table 1 shows the various levels of experience of the five birders. There is a big gap between the level of experience because the life-list range is very wide. The difference between the highest and the lowest approximate life-list total of North American birds is 237 species. The standard deviation is 98 species. However, they are considered to be the top-ranked birders in the Tucson area because of their North American life-list.

Tables 2, 3 and 4 are designed to tabulate the contingent payments of the five respondents on various admission policies. The contingent payment reported by 4 out of 5 respondents are not consistent with the theoretical concept of the willingness-to-pay locus. Theoretically, the value of maximum willingness-to-pay reported for the non-refund policy should be the minimum because the respondent involved is taking his chance to enter the Cave Creek recreation area. On the other hand, the payment for full refund, when no sighting state materialized, should be the maximum. This payment guarantees complete satisfaction. Rightly, the payment value for the half refund policy should be between the maximum and minimum payments. The values reported for the last questions of each questionnaire should exceed the values reported for the option price. If the value reported by an individual equals the value of the option price, the individual is indifferent to the various admission policies.

Tables 5, 6 and 7 indicate the response of the birders to each set of questionnaires. In general, these birders did not have much

difficulty in responding to questions related to option price and consumer's surplus (Question 3 and 4 of Questionnaire #1, and questions 1 and 2 of Questionnaires #2 and #3). In particular, 4 out of 5 of the birders interviewed in the morning session had problems responding to the last two questions. Some of them felt offended by the last question because the payment will be refunded in full in the sighting state. This refund policy is too hypothetical. Surprisingly, even the questions on the half refund policy did not work well because they appeared to be slightly unusual.

Weaknesses of the Questionnaires

The reasons for the poor performance of these questionnaires could be divided into three main categories, i.e. information, vehicle and hypothetical biases.

The information provided as part of the questionnaires, especially the probabilities of sighting the birds, were not fully accepted by most respondents. The probabilities provided may not represent the realistic probabilities to the birders. The birds used in the three hypothetical birdwatching experiences may not necessarily reflect the birds which birders would most prefer to see in the Cave Creek recreation area.

Admission payment is used here as a device to measure the maximum willingness-to-pay. The different type of admission policies might not be accepted by these birders. Thus, they may respond differently.

As a matter of fact, these questionnaires may be too hypothetical in nature. The birds described have not been seen in the U.S. for 30 to 40 years. Competent birders know fairly well that it is next to impossible to see these birds in the Cave Creek recreation area. The last questions of each set of questionnaires posed a very serious problem for the respondents because they cannot accept this unusual refund policy. Some of them commented that this refund policy violates their personal philosophical concept of birdwatching as a hobby.

Generally, the respondents find it difficult to differentiate the various refund policies, specifically the half refund policy and the unusual full refund policy, which are obviously very hypothetical.

First Revised Questionnaires

The original set of questionnaires were revised immediately after the first pretest session. The whole set of questionnaires have undergone major revisions in order to avoid the weaknesses which were pointed out in the first pretest. The first revised questionnaires are shown in Appendixes D, E and F.

These revised questionnaires do not present any information about the probabilities of sighting the birds or the species of the birds that can be seen in the Cave Creek recreation area. It is hoped that the information bias could be avoided by doing so. This approach would provide more flexibility for the birders to reveal the birds they prefer to see most in the Cave Creek area. They are also requested to fix their own probabilities of sighting the birds. However, the whole structure of the questionnaires does not change; all are in the open form and are still highly undisguised.

Questionnaire #1 (See Appendix D on pages 97 and 98)

There are seven questions in this questionnaire. The first question is the same as the first question of the original pretested questionnaire. The response of each birder reflects the competency of the individual birder.

The second question is a simple question which requests the respondent to name the bird he would like to see most in the Cave Creek recreation area. This question is relevant for the individual to answer the subsequent questions regarding the value of maximum willingness-to-pay under various hypothetical admission policies.

The third question is a question which requires the respondent to report his calculated odds of sighting the specified birds in Cave Creek recreation area for a given time period.

The fourth question is simplified such that only the refund policy is mentioned. The response to the question is the exact value of

option price because it does not matter whether the individual has seen the bird or not; he will not receive any refund. Point c in Figure 8 is the graphic illustration of the option price.

The fifth question is framed in such a way that the answer of each respondent reflects the consumer's surplus, graphically shown by point a in Figure 8. The response indicates consumer's surplus because it is a state-dependent payment, when payment is not refunded in sighting of the bird.

The sixth question involves the 50% refund policy if no sighting state occurs. The answer reflects the value of the half option price which can be shown by point b in Figure 8.

The seventh question, the last question, presents the unusual refund policy of refunding the payment in full if the birder sees the bird. Point d in Figure 8 is the graphic illustration of the value.

Questionnaires #2 and #3 (See Appendices E and F on pages 99, 100, 101, and 102)

The first questions in both questionnaires are plain and simple. The respondents are required to report the second and third species of birds which they would like to see most in the Cave Creek.

The second question require the respondent to reveal their probabilities of sighting the second and third species of birds which they have reported in the previous questions.

The third questions are symmetrical to the fourth question of Questionnaire #1. These questions are designed to locate the point on

the willingness-to-pay locus, such as point c, which is the option price. This response represents the option price because it is the maximum independent state of payment.

The fourth questions are comparable to the fifth question of Questionnaire #1. The response to these questions lead to the exact value of consumer's surplus because payment is dependent, full refund in the event of no sighting of the birds. Point a on the willingness-to-pay locus in Figure 8 described the consumer's surplus graphically.

The fifth questions administer the 50% refund policy in the event that the birders could not see the birds. The response to the questions is the half option price which is shown by point b in Figure 8.

The sixth questions introduce the refund policy which will refund the payment in full, in the event that the birders did actually see the bird. The responses to these questions is point d on the willingness-to-pay locus in Figure 8.

Results of the Second Pretest

The second pretest of the first revised questionnaires was held at 1:00 p.m. on the same day as the first pretest. Five different listed birders were invited to participate in the same pattern of interview. The interview results based on the first revised questionnaires are reported in Tables 8, 9, 10 and 11.

Table 8. Approximate Life-List Total for North American Birds (Second Pretest)

Respondents	Approximate Life-List Total for North American Birds (Species)
1	480
2	540
3	550
4	590
5	630
Mean	558
Standard Deviation	56
Range	150

Table 9. Contingent Payments Under Various Admission Policies in Valuing Various Species of Birds in the Cave Creek Recreation Area (Questionnaire #1)

Respondents	Names of various species of birds	Probability of sighting %	Question 4 ($)		Question 5 ($)		Question 6 ($)		Question 7 ($)	
			C_F	C_S	C_F	C_S	C_F	C_S	C_F	C_S
1	Flame-colored colored Tanager	70	10	10	0	20	5	10	0	0
2	Eared Trogan	80	15	15	0	20	10	20	0	0
3	Eared Trogan	75	15	15	0	25	12.5	25	15	0
4	Thick-billed Parrot	75	50	50	0	100	25	50	50	0
5	Thick-billed Parrot	25	200	200	0	200	100	200	200	0

C_F: Contingent payments ($) in no sighting state.
C_S: Contingent payments ($) in sighting state.

Table 10. Contingent Payments Under Various Admission Policies in Valuing Various Species of Birds in the Cave Creek Recreation Area (Questionnaire #2)

Respondents	Names of various Species of Birds	Probability of sighting %	Question 3 ($)		Question 4 ($)		Question 5 ($)		Question 6 ($)	
			C_F	C_S	C_F	C_S	C_F	C_S	C_F	C_S
1	Tufted Fly-catcher	60	10	10	0	20	7.5	15	0	0
2	Aztec Thrush	60	10	10	0	25	10	20	20	0
3	Crescent chested Warbler	50	10	10	0	25	10	20	10	0
4	Slate-throated Redstart	90	40	40	0	75	20	40	40	0
5	White-stripe Wood-creeper	75	200	200	0	200	100	200	200	0

C_F: Contingent payments ($) in no sighting state.
C_S: Contingent payments ($) in sighting state.

Table 11. Contingent Payments Under Various Admission Policies in Valuing Various Species of Birds in the Cave Creek Area (Questionnaire #3)

Respondents	Names of various Species of Birds	Probability of sighting %	Question 3 ($)		Question 4 ($)		Question 5 ($)		Question 6 ($)	
			C_F	C_S	C_F	C_S	C_F	C_S	C_F	C_S
1	Eared Trogan	50	10	10	0	25	7.5	25	0	0
2	Rufous-capped Warbler	70	10	10	0	25	10	20	20	0
3	Aztec Thrush	20	5	5	0	25	7.5	15	5	0
4	White-striped Wood-creeper	80	40	40	0	75	20	40	40	0
5	Slate-throated Redstart	25	100	100	0	100	50	100	100	0

C_F: Contingent payments ($) in no sighting state.
C_S: Contingent payments ($) in sighting state.

Table 12. Responses to Questionnaire #1

Questions / Respondents	4	5	6	7
1	C	C	x	x
2	C	C	x	C
3	C	C	x	x
4	C	C	x	x
5	C	x	x	x

Table 13. Responses to Questionnaire #2

Questions / Respondents	3	4	5	6
1	C	C	C	x
2	C	C	x	C
3	C	C	x	x
4	C	C	x	x
5	C	x	x	x

Table 14. Responses to Questionnaire #3

Questions / Respondents	3	4	5	6
1	C	C	x	x
2	C	C	x	x
3	C	C	x	x
4	C	C	x	x
5	C	x	x	x

C: Responses which is consistent with the willingness-to-pay locus.
x: Response which is inconsistent with the willingness-to-pay locus.

Table 8 presents the various levels of experience among the five different listed birders who had participated in the pretest of the revised questionnaires. The range of their experience is 150 species, less than that in the morning session which listed 237 species. In fact, the standard deviation is 56 species. Thus, this group has less variability in terms of experience as compared to the first group of birders.

The contingent payments of these five birders in response to vaious refund policies are recorded in Tables 9, 10 and 11. The overall responses of the five birders are still not consistent with the theoretical implications of the willingness-to-pay locus. Generally, most of them showed certain levels of consistency for questions regarding the option price (point c of Figure 8) and the consumer's surplus (point a of Figue 8). The answers for the last two questions (point b and d in Figure 8) are out of the relevant range such that the individual's willingness-to-pay locus is not consistent with the theoretical form of willingness-to-pay locus.

Tables 12, 13 and 14 pictured clearly how each respondent performed in response to each question in the various questionnaires. With the question revised to accomodate more flexibility and the preferences of the birders in terms of the species of birds and their own calculated probabilities, they had no difficulty responding to the questions, except the last two questions.

Some of the birders commented that the questions are confusing to them because various admission policies are asked side by side. They failed to distinguish the differences between various policies. Some of them treated all the different refund policies as identical because they said the situations made no difference to them. As long as the bird showed up in the Cave Creek area, they are sure to see the bird.

The respondents in this session did not comment on the format and structure of the questionnaires. They suggested that the first questionnaire should allow them to list the three different species of birds they would most like to see in order to facilitate the answering process in the subsequent questionnaires.

The Second Revised Questionnaires

The results of the second pretest indicated that there was some improvement in the questionnaires. Most of the five birders managed to answer the questions up to the level we have projected. However, there are still problems with the last two questions.

The revised questionnaires are aimed to distinguish clearly the different admission policies with some key words inserted at the beginning of each question. The key words are intended to impress upon the respondent that four different admission policies are presented. In order to facilitate the process of answering the questionnaires, question 2 has been changed slightly to ask respondents to report the three species of birds they would most like to see in Cave Creek

recreation area. The second revised questionnaires are shown in Appendixes G, H and I.

Questionnaire #1 (See Appendix G on pages 103 and 104).

The first question remains unchanged. The second question is modified such that the respondent is requestd to report the three different species of bird instead of one. It is hoped that this change will facilitate the respondent's answering process. The third question was improved to make it look more realistic so as to induce the respondent to report an exact probability of sighting the bird.

Questions 4, 5, 6 and 7 did not have any alterations in terms of structure and form except key words are inserted. For instance, "NO REFUND POLICY:" is inserted on top of question 4 in order to alert the respondent that the payment will not be refunded. Thus, at first glance, the respondent would have a clear understanding that questions 4, 5, 6 and 7 are different. The inclusion of key words would facilitate the decision making process of the respondents which will help them to differentiate clearly the different policies presented.

Questionnaires #2 and #3 (See Appendices H and I on pages 106 107, 108, and 109).

The first questions of both questionnaires required the respondent to rewrite the name of the birds which he had reported in the Questionnaire #1. The second questions are symmetrical to the third questions of Questionnaire #1. Questions 3, 4, 5 and 6 are symmetrical to questions 4, 5, 6 and 7 of Questionnaire #1, described earlier.

Results of the Third Pretest

The third interview was the pretest of the second revised questionnaires. It was held on November 20, 1985 in Dr. Stephen Russell's office. Only three participants were involved. The results of this pretest are recorded in Tables 15, 16, 17 and 18.

Table 15. Approximate Life-List Total for North American Birds (Third Pretest)

Respondents	Approximate Life-List Total for North American Birds (Species)
1	600
2	550
3	500
Mean	550
Standard Deviation	50
Range	100

Table 16. Contingent Payments Under Various Admission Policies in Valuing Various Species of Birds in the Cave Creek Area (Questionnaire #1)

Respondents	Names of various species of birds	Probability of sighting %	Question 4 ($)		Question 5 ($)		Question 6 ($)		Question 7 ($)	
			C_F	C_S	C_F	C_S	C_F	C_S	C_F	C_S
1	Thick-billed Parrot	30	25	25	0	40	15	30	25	0
2	Gray Silky-flycatcher	60	10	10	0	25	10	20	10	0
3	Social Flycatcher	50	2	2	0	3	1.25	2.5	2	0

C_F: Contingent payments ($) in no sighting state.
C_S: Contingent payemtns ($) in the no sighting state.

Table 17. Contingent Payments Under Various Admission Policies in Valuing Various Species of Birds in the Cave Creek Area (Questionnaire #2)

Respondents	Names of various species of birds	Probability of sighting the bird (%)	Question 3 ($)		Question 4 ($)		Question 5 ($)		Question 6 ($)	
			C_F	C_S	C_F	C_S	C_F	C_S	C_F	C_S
1	White-striped Woodcreeper	75	40	40	0	50	20	40	30	0
2	Thick-billed Parrot	20	5	5	0	15	5	10	10	0
3	Fan-tailed Warbler	25	2	2	0	3	1.25	2.5	2	0

C_F: Contingent payments ($) in no sighting state.
C_S: Contingent payments ($) in the sighting state.

Table 18: Contingent Payments Under Various Admission Policies in Valuing Various Species of Birds in the Cave Creek Area (Questionnaire #3)

Respondents	Name of various species of birds	Probability of sighting the bird (%)	Question 3 ($)		Question 4 ($)		Question 5 ($)		Question 6 ($)	
			C_F	C_S	C_F	C_S	C_F	C_S	C_F	C_S
1	Russet-crowned Motmot	10	10	10	0	40	10	20	10	0
2	Military MaCaw	60	10	10	0	25	10	20	10	0
3	Rufous-capped Warbler	33	2	2	0	3	1.25	2.5	2	0

C_F: Contingent payments ($) in no sighting state.
C_S: Contingent payments ($) in the sighting state.

Table 19. Responses to Questionnaire #1

Questions / Respondents	4	5	6	7
1	C	C	C	x
2	C	C	C	x
3	C	C	C	x

Table 20. Responses to Questionnaire #2

Questions / Respondents	3	4	5	6
1	C	C	x	x
2	C	C	C	x
3	C	C	C	x

Table 21. Responses to Questionnaire #3

Questions / Respondents	3	4	5	6
1	C	C	C	x
2	C	C	C	x
3	C	C	C	x

C: Response which is consistent with the willingness-to-pay locus.
x: Response which is inconsistent with the willingness-to-pay locus.

The data in Table 15 show that the mean life-list total for these three birders is 550 species. The range is 100 species and the standard deviation for this sample size is 50 species. However, the birder who has a life-list total of 500 species for North American birds is considered to be an experience birder.

Tables 16, 17 and 18 summarized the contingent payments of these three birders in response to various admission policies. Their contingent payments reported are quite consistent to the theoretical aspect of the willingness-to-pay locus, except in the responses to the last questions. These three birders did not have a problem in differentiating the various admission policies with the help of the key words. The only trouble with the questionnaires is the acceptance of the last question which is very unusual and hypothetical. In fact all respondents could not accept this last question because it was too hypothetical and unusual to society.

Tables 19, 20 and 21 indicates that these three birders answered the questions regarding no refund, full refund and half refund policies very well. However, they still have problems in accepting the last questions which deal with the unusual refund policies. As a whole this pretest results are quite satisfactory and encouraging.

CHAPTER 6

SUMMARY, CONCLUSION AND IMPLICATIONS FOR FUTURE RESEARCH

Summary

Primary data are the only source of information suitable for the defined study and have to be generated by field survey. However, the field survey cannot be held without an appropriate set of questionnaires. Thus, questionnaires have to be designed and pretested before employed in the field survey.

The original sets of questionnaires were designed in consultation with field survey experts and knowledgeable wildlife experts, especially those involved greatly in birdwatching. Respondents could hardly answer two-thirds of the questions in the first set of questionnaires and half of the questions in the other two sets of questionnaires. The first pretested results were not consistent with the theoretical concept of the willingness-to-pay locus as a whole. Reasons for the inconsistency and poor perception of respondents can be categorized into three main sources, mainly the information, vehicle and hypothetical biases.

The second set of questionnaires were designed to avoid weaknesses of the original sets of questionnaires. These revised

questionnaires have the same structure and form as the orginal questionnaires. The revised questionnaires were framed such that description of birds and probabilities of sighting them were omitted. Instead, the respondents were required to report the birds they would most like to see and the probabilities of sighting them in the Cave Creek recreation area. The results of the second pretest was encouraging. The five respondents managed to answer the questionnaires better than the first pretest session. They still found it difficult to accept the various admission policies presented in the questionnaires. However, the results of this pretest indicated that there was some progress. The last four questions of these questionnaires needed some sort of emphasis in order to stress the differences of various admission policies.

The third set of questionnaires (second revised) adopted the basis of the second one with only minor alterations and the inclusion of key words at the beginning of each of the last four questions. The pretest results were very encouraging. These results were consistent with the theoretical aspect of the willingness-to-pay locus if the answers for the last questions were omitted. These results indicated that there are still problems with the last questions, particularly the questions of the unusual refund policy.

Conclusion

The original set of questionnaires went through various processes of alteration, refinement and pretest. The final products are the second revised questionnaires as shown in Appendixes G, H and I. The "final" set of questionnaires were pretested and the results were very satisfactory. But the pretest result may not be significant because only three birders participated in the pretest. In order to have a good representation of the data, at least another pretest should be held with a much bigger sample. These questionnaires still required some touch up in order to be a good instrument to generate useful and accurate data from the field survey.

Certain questions in the second revised questionnaires need some refinement, especially the sixth and the last questions in Questionnaire #1, the fifth and last questions in Questionnaires #2 and #3. However, the third question in Questionnaire #1 and second questions in Questionnaires #2 and #3 are symmetrical. These three questions which required the respondents to report their calculated odds of sighting the birds would appear to be more realistic if the questions could be improved and rephrased.

On the other hand, all the last questions are symmetrical for all the three sets of questionnaires. These last questions are difficult because they were not accepted by the birders in the pretest.

The respondents' unacceptance of these questions branched from the unusual refund policy which has not been experienced by the birders and society as a whole.

Finally, it should be reminded that all these questionnaires are based on hypothetical situations; no real or actual transaction and consumption opportunity occur, the birds also are assumed to show up in Cave Creek recreation area. Most likely these birds will not show up. Theoretically, the willingness-to-pay locus depicts the rational behavior of an individual in the real world situation. But the pretests equate the hypothetical situation. Thus, it is difficult to predict the behavior of the individual in such a hypothetical situation.

Implications For Future Research

Hypothetical birdwatching experience is used to elicit responses of birders to generate primary data. The costs of being wrong in this hypothetical situation are insignificant because no actual transaction takes place. Respondents may not take this type of survey seriously because there is no incentive to do so. Furthermore, respondents may mispredict their behavior even though they tried hard to evaluate their preference and probabilities in the hypothetical situations. So in this particular study, hypothetical bias should be one of the major problems to be considered seriously in collecting primary data by the survey technique. In order to design the questionnaires and gather accurate

data, the degree of hypothetical situation should be reduced to minimum. This may be difficult, but not impossible.

The results of all these pretests indicated that the last questions are the most difficult questions for the respondents. They are difficult not because of the structure and form, but the concept. This concept is odd to all the repondents because no such unusual refund policy exists in the society. These questions will be useful to complete the willingness-to-pay locus if they could be reframed such that the concept of the unusual refund policy does not change, yet the respondents would accept it.

Point e on the willingness-to-pay locus in Figure 9 is a very important point for it completes the locus more precisely and accurately. It would be very helpful for the study if a question could be designed to locate this point on the willingness-to-pay locus.

Finally, these questionnaires would be a very effective tool in field survey to gather primary data if the degree of hypothetical and vehicle biases could be reduced to the minimum.

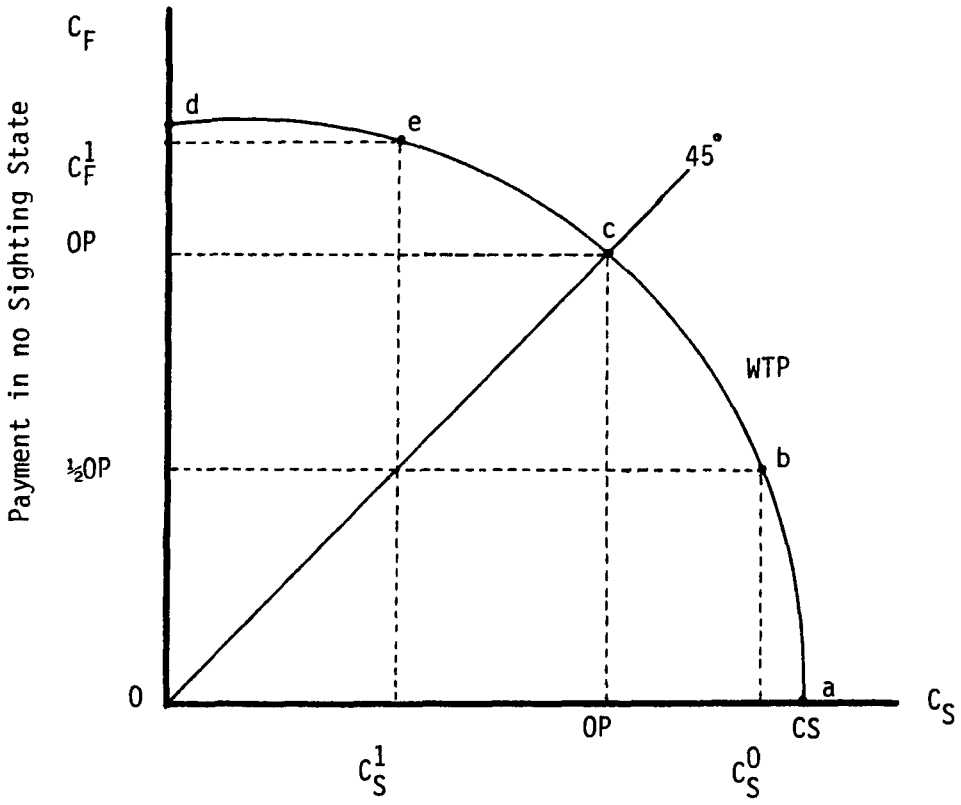

Figure 9. Willingness-to-Pay Locus (with point e included)

APPENDIX A

Questionnaire #1

1. What is your approximate life list total for North American (U.S. and Canada) birds?

_____

The Flame-colored Tanager (Piranga bidentata) is also known as the Stripe-backed Tanager. It is a rare species in the United States; usually it can only be seen in Mexico. It showed up in the South Fork of Cave Creek in the past summer and was last seen yesterday. It has been seen by 4 of every 5 birders who searched for it.

2. Have you seen the Flame-colored Tanager in the U.S.?
Please check (x)

☐ yes

☐ no

3. Assume that you have never seen the Flame-colored Tanager. With an 80% chance of sighting this rare bird, what is the maximum amount you would be willing to pay to gain access to Cave Creek recreation area if your payment is non-refundable?

$_____

4. Suppose your payment is refundable in full in the event that you do not have a sighting of the Flame-colored Tanager. With an 80% chance of sighting the bird, what is the maximum amount you would be willing to pay to gain access to the Cave Creek recreation area under this full-refund policy?

$_____

5. Now, suppose that the admission payment is only partially refundable in the event that you do not have a sighting of the Flame-colored Tanager. Specifically, half of the amount you pay will be refunded. Remember, the chances are 4 out of 5 that you will sight the bird. What is the maximum amount you would be

willing to pay under such a 50% refund policy to gain access to the Cave Creek recreation area?

$_____

6. As a special promotion to encourage birdwatching at Cave Creek recreation area, the U.S. Forest Service is considering an admission policy of refunding your payment in full if you have a sighting of the Flame-colored Tanager. With an 80% chance of success, what is the maximum amount you would be willing to pay to gain entrance to the Cave Creek recreation area under this refund policy?

$_____

APPENDIX B

Questionnaire #2

The Thick-billed Parrot (Rhynchopsitta pachyrhyncha) is a very rare species of parrot which has not been seen in the United States for 40 to 50 years. It can be seen in Mexico. This bird is 15 to 16 inches in overall size. It is a heavily built green parrot with a long pointed tail, thick black bill and yellow underwing stripe. It has been seen by 2 of the last 5 birders who looked for it in the Cave Creek area.

1. Assume that you have never seen the Thick-billed Parrot. Keeping in mind that it has been sighted by 2 of the last 5 birders who looked for it in the Cave Creek, what is the maximum amount you would be willing to pay to gain access to the Cave Creek recreation area? Remember that the payment you make is non-refundable.

   $_____

2. Suppose your payment is refundable in full in the event that you do not have a sighting of the Thick-billed Parrot. You have a 40% chance of success. What is the maximum amount you would be willing to pay to gain access to the Cave Creek recreation area under this full-refund policy?

   $_____

3. Now, suppose that the admission payment is only partially refundable in the event that you do not have a sighting of the Thick-billed Parrot. Specifically, half the amount you pay will be refunded. Keeping in mind that it has been seen by 2 of the last 5 birders who looked for it in Cave Creek, what is the maximum amount you would be willing to pay under such a 50% refund policy to gain access to the Cave Creek recreation area?

   $_____

4. As a special promotion to encourage birdwatching at Cave Creek recreation area, the U.S. Forest Service is considering an admission policy of refunding your payment in full if you have a sighting of the Thick-billed Parrot. With a 40% chance of a

sighting, what is the maximum amount you would be willing to pay to gain entrance to the Cave Creek recreation area under this refund policy?

$_____

APPENDIX C

Questionnaire #3

The Gray Silky-flycatcher (Ptiligonys sinereus) is a species which has never been recorded in the United States. It can be seen in Mexico. The male flycatcher is gray in color and crested. It has a long black and white tail with yellow crissum. The female looks like the male, except it is brown in color. It has been seen by 2 of the last 5 birders who looked for it in Cave Creek.

1. Assume that you have never seen the Gray Silky-flycatcher. Keeping in mind that you have a 40% chance of seeing this flycatcher, what is the maximum amount you would be willing to pay to gain access to the Cave Creek recreation area? Remember, the payment you make is non-refundable.

   $_____

2. Suppose your payment is refundable in full in the event that you do not have a sighting of the Gray Silky-flycatcher. With a 2 out of 5 chance of success, what is the maximum amount you would be willing to pay to gain access to the Cave Creek recreation area under this full-refund policy?

   $_____

3. Now, suppose that the admission payment is only partially refundable in the event that you do not have a sighting of the Gray Silky-flycatcher. Specifically, half the amount you pay will be refunded. Again, you have a 40% chance of sighting. What is the maximum amount you would be willing to pay under such a 50% refund policy to gain access to the Cave Creek recreation area?

   $_____

4. As a special promotion to encourage birdwatching at Cave Creek recreation area, the U.S. Forest Service is considering an admission policy of refunding you payment in full if you have a sighting of the Gray Silky-flycatcher. There is still a 40% chance

you will sight the bird in Cave Creek. What is the maximum amount you would be willing to pay to gain entrance to the Cave Creek recreation area?

$_____

APPENDIX D

Questionnaire #1 (First Revised)

1. What is your approximate life list total for North American (U.S. and Canada) birds?

   _____

2. Name the bird that you would most like to see in the Cave Creek recreation area.

   _____

3. Assume the bird is in the Cave Creek recreation area today. What would you estimate to be your chances of sighting this bird, given that you can spend no more than a full day looking for it?

   _____

4. Given your chance (the chance you estimated above) of sighting this bird, what is the maximum amount you would be willing to pay to gain access to the Cave Creek recreation area if your payment is non-refundable?

   $_____

5. Suppose your payment is refundable in full in the event that you do not have a sighting of this bird. Given your chance of sighting this bird, what is the maximum amount you would be willing to pay to gain access to the Cave Creek recreation area under this full-refund policy?

   $_____

6. Now, suppose that the admission payment is only partially refundable in the event that you do not have a sighting of this bird. Specifically, half of the amount you pay will be refunded. Given you probability of sighting this bird, what is the maximum amount you would be willing to pay under such a 50% refund policy to gain access to the Cave Creek recreation area?

   $_____

7. Assume that the U.S. Forest Service is considering an admission policy of refunding your payment in full if you do have a sighting of this bird. Given your chance of success, what is the maximum amount you would be willing to pay to gain entrance to the Cave Creek recreation area under this refund policy?

   $_____

APPENDIX E

Questionnaire #2 (First Revised)

1. Name the second bird that you would most like to see in the Cave Creek recreation area.

   _____

2. Assume the bird is in the Cave Creek recreation area today. What would you estimate to be you chances of sighting this bird, given that you can spend no more than a full day looking for it?

   _____

3. Given your chance (the chance you estimated above) of sighting this bird, what is the maximum amount you would be willing to pay to gain access to the Cave Creek recreation area if your payment is non-refundable?

   $_____

4. Suppose your payment is refundable in full in the event that you do not have a sighting of this bird. Given you chance of sighting this bird, what is the maximum amount you would be willing to pay to gain access to the Cave Creek recreation area under this full-refund policy?

   $_____

5. Now, suppose that the admission payment is only partially refundable in the event that you do not have a sighting of this bird. Specifically, half of the amount you pay will be refunded. Given your probability of sighting this bird, what is the maximum amount you would be willing to pay under such a 50% refund policy to gain access to the Cave Creek recreation area?

   $_____

6. Assume that the U.S. Forest Service is considering an admission policy of refunding your payment in full if you do have a sighting of this bird. Given your chance of success, what is the maximum

amount you would be willing to pay to gain entrance to the Cave Creek recreation area under this refund policy?

$_____

APPENDIX F

Questionnaire #3 (First Revised)

1. Name the third bird that you would most like to see in the Cave Creek recreation area.

   _____

2. Assume that the bird is in the Cave Creek recreation area today. What would you estimate to be your chances of sighting this bird, given that you can spend no more than a full day looking for it?

   _____

3. Given your chance (the chance you estimated above) of sighting this bird, what is the maximum amount you would be willing to pay to gain access to the Cave Creek recreation area if your payment is non-refundable?

   $_____

4. Suppose your payment is refundable in full in the event that you do not have a sighting of this bird. Given your chance of sighting this bird, what is the maximum amount you would be willing to pay to gain access to the Cave Creek recreation area under this full-refund policy?

   $_____

5. Now, suppose that the admission payment is only partially refundable in the event that you do not have a sighting of this bird. Specifically, half of the amount you pay will be refunded. Given you probabilities of sighting this bird, what is the maximum amount you would be willing to pay under such a 50% refund policy to gain access to the Cave Creek recreation area?

   $_____

6. Assume that the U.S. Forest Service is considering an admission policy of refunding your payment in full if you do have a sighting

of this bird. Given you chance of success, what is the maximum amount you would be willing to pay to gain entrance to the Cave Creek recreation area under this refund policy?

$_____

APPENDIX G

Questionnaire #1 (Second Revised)

1. What is your approximate life list total for North American (U.S. and Canada) birds?

   _____

2. Name 3 species of birds that you would most like to see in the Cave Creek recreation area, according to the importance you rank them

   First_____(Applicable to Questionnaire #1)

   Second_____(Applicable to Questionnaire #2)

   Third_____(Applicable to Questionnaire #3)

3. Assume your first bird was sighted in the Cave Creek recreation area yesterday. What would you estimate to be your chances of sighting this bird today, given that you can spend no more than a full day looking for it?

   _____%

   NO-REFUND POLICY:

4. Given your chance (the chance you estimated above) of sighting this bird, what is the maximum amount you would be willing to pay to gain access to the Cave Creek recreation area if your payment is non-refundable?

   $_____

   FULL-REFUND POLICY; Satisfaction Guaranteed.

5. Suppose your payment is refundable in full in the event that you do not have a sighting of this bird. Given you chance of sighting this bird, what is the maximum you would be willing to pay to gain access to the Cave Creek recreation area under this full-refund policy?

   $_____

HALF-REFUND POLICY: Satisfaction Partially Guaranteed.

6. Now suppose that the admission payment is only partially refundable in the event that you do not have a sighting of this bird. Specifically, half of the amount you pay will be refunded. Given your probability of sighting this bird, what is the maximum amount you would be willing to pay under such a 50% refund policy to gain access to the Cave Creek recreation area?

$_____

AN UNUSUAL REFUND POLICY:

7. Assume that the U.S. Forest Service is considering an admission policy of refunding your payment in full if yo do have a sighting of this bird. Given your chance of success, what is the maximum amount you would be willing to pay under a 50% refund policy to gain access to the Cave Creek recreation area?

$_____

APPENDIX H

Questionnaire #2 (Second Revised)

1. Name the second species of bird that you would like to see in the Cave Creek recreation area.

   _____

2. Assume this bird was sighted in the Cave Creek recreation area yesterday. What would you estimate to be your chances of sighting this bird today, given that you can spend no more than a full day looking for it?

   _____%

NO-REFUND POLICY:

3. Given your chance (the chance you estimated above) of sighting this bird, what is the maximum amount you would be willing to pay to gain access to the Cave Creek recreation area if your payment is non-refundable?

   $_____

FULL-REFUND POLICY: Satisfaction Guaranteed.

4. Suppose your payment is refundable in full in the event that you do not have sighting of this bird. Given your chance of sighting this bird, what is the maximum amount you would be willing to pay to gain access to the Cave Creek recreation area under this full-refund policy?

   $_____

HALF-REFUND POLICY: Satisfaction Partially Guaranteed.

5. Now suppose that the admission payment is only partially refundable in the event that you do not have a sighting of this bird. Specifically, half of the amount you pay will be refunded. Given your probability of sighting this bird, what is the maximum amount you would be willing to pay under such 50% refund policy to gain access to the Cave Creek recreation area?

   $_____

AN UNUSUAL REFUND POLICY

6. Assume that the U.S. Forest Service is considering an admission policy of refunding your payment in full if you do have a sighting of this bird. Given your chance of success, what is the maximum amount you would be willing to pay to gain entrance to the Cave Creek recreation area under this refund policy?

$_____

APPENDIX I

Questionnaire #3 (Second Revised)

1. Name the third species of bird that you would most like to see in the Cave Creek recreation area.

   _____

2. Assume this bird was sighted in the Cave Creek recreation area yesterday. What would you estimate to be your chances of sighting this bird today, given that you can spend no more than a full day looking for it?

   _____%

NO-REFUND POLICY:

3. Given your chance (the chance you estimated above) of sighting this bird, what is the maximum amount you would be willing to pay to gain access to the Cave Creek recreation area if your payment is non-refundable?

   $_____

FULL-REFUND POLICY: Satisfaction Guaranteed.

4. Suppose your payment is refundable in full in the event that you do not have a sighting of this bird. Given your chance of sighting this bird, what is the maximum amount you would be willing to pay to gain access to the Cave Creek recreation area under this full-refund policy?

   $_____

HALF-REFUND POLICY: Satisfaction Partially Guaranteed.

5. Now suppose that the admission payment is only partially refundable in the event that you do not have a sighting of this bird. Specifically, half of the amount you pay will be refunded. Given your probability of sighting this bird, what is the maximum amount you would be willing to pay under such a 50% refund policy to gain access to the Cave Creek recreation area?

   $_____

AN UNUSUAL REFUND POLICY

6. Assume that the U.S. Forest Service is considering an admission policy of refunding your payment in full if you do have a sighting of this bird. Given your chance of success, what is the maximum amount you would be willing to pay to gain entrance to the Cave Creek recreation area under this refund policy?

$_____

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