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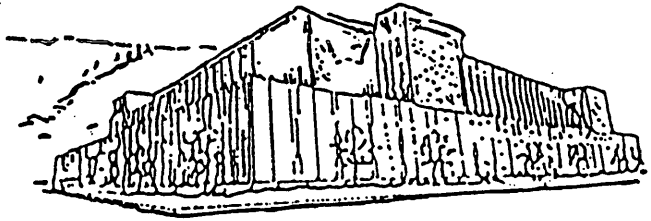
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**Developing an Aggregate Measure of Value for Nonmarket
Leisure Time through an Open-Ended Contingent Valuation
Method Survey**

by

Eric C. Schuck

B.A., Pacific Lutheran University, 1993

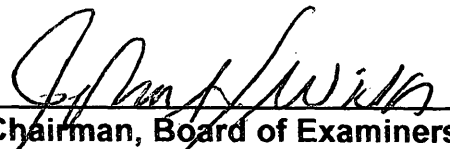
Presented in partial fulfillment of the requirements for the degree of

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1995

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All levity aside, the course of this project has seen the passage of two of the finest gentlemen I have ever known, my great uncle and my grandfather. My great uncle, the late LTC Henry K. Good, Jr. USAF (Ret) of Kalispell, passed on in February. Hank was a wonderful man, with a firm grasp of the value of a night spent with good whiskey and better conversation. His hospitality, as well as the splendid cooking of my Aunt Jeanne, revitalized my flagging spirits at the end of my first year of graduate work. I owe them a serious debt of gratitude which I can never hope to repay. My grandfather, the late LCDR James L. Wilkerson, USN (Ret) of Port Orchard, WA, slipped away in March, just as I was bringing the data analysis to a close. His death was a major loss for me. Throughout my life, I could always count on my Granddaddy's unwavering support for my work and unceasing confidence in my abilities. Finishing without him has been unspeakably difficult, but I have struggled on with the diligence and dedication to duty that he taught me. It is to the memory of these two men that I dedicate this work.

Schuck, Eric Christian, M.A., April 1995, Economics

Developing an Aggregate Measure of Value for Nonmarket Leisure Time Using an Open-Ended Contingent Valuation Method Survey (103 pp.)

Director: John H. Wicks 

An Open-Ended Contingent Valuation Survey (CVM) was employed to develop an annual aggregate value for nonmarket leisure time. The intent was to estimate the value of this time excluded in national income accounts. Two values were derived: one employed willingness to pay values and leisure quantities stated by survey respondents to estimate an annual per capita leisure value while the other utilized a technique first developed by Nordhaus and Tobin where an estimated wage rate is used as the opportunity cost of time. While the annual leisure value figures obtained through the two techniques differed significantly, the Nordhaus Tobin values were strongly dependent upon the choice of wage rate and the differences may be explained by that. Additionally, the results for both methods suggest that current national income accounts underestimate the value of an individual's time by two-thirds.

The values obtained through the CVM survey were also examined through regression analysis to determine if the values were prone to any survey introduced biases and if the values adhered to the expectations of rational utility maximization. Unlike other CVM surveys, the results do not indicate any significant survey introduced biases nor do they indicate irrational responses. As a whole, the results were supportive of the use of the CVM and the application of the obtained figures for national income accounts.

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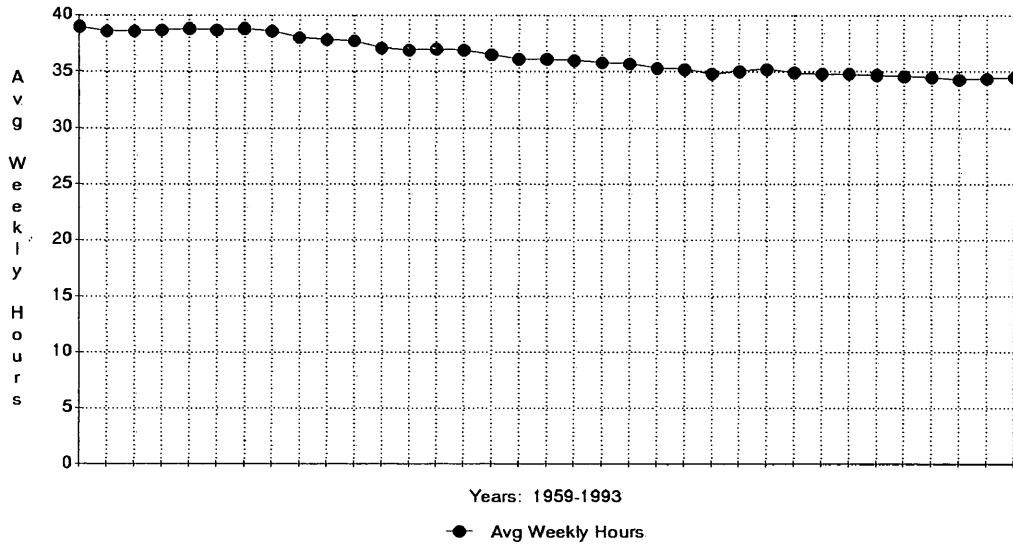
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1. Introduction

Figure 1-1 Average Weekly Hours of Work



Traditionally, gross domestic product serves as the measure of a nation's economic activity. Unfortunately, aside from imputed values for housing services rendered to homeowners and the value of food produced within farm households, GDP accounts for only that portion of a nation's activity which occurs in the marketplace, despite the fact that the time people spend in the market place represents only a small fraction of total human time. In his seminal work positing a theory of the allocation of human time, Gary Becker pointed out that the work week accounted for "less than a third of the total time available", (Becker, 1965, p.493) while more recent work by Eichenbaum, Hansen and Singleton (1988) found market labor time accounting for a share closer to one-sixth of human time. According to statistics kept by the U.S. Bureau of Labor Statistics, the average weekly hours for all private nonagricultural industries has declined from 39.0 hours in

1959 to 34.5 hours in 1993. As a share of time, hours spent working only account for about one-fifth of human time for those people who are actively employed, and as the graph at the beginning of the paper indicates, has been steadily declining over time. (Economic Report of the President, 1994) These figures only show the changes for those people who are actively employed. It says nothing of the value of time for those people who are not laboring in a form included in national income accounts, so the value of their time is doubly ignored. Given these exclusions, the words of Becker in 1965 still ring true: "the allocation and efficiency of non-working time may now be more important to economic welfare than that of working time". (Becker, 1965, p.493) Such a state implies that the vast majority of human time is spent outside of the marketplace engaging in leisure and producing goods within the home. All of this time, a finite and scarce commodity, is ignored in conventional national income accounting. Unvalued, however, should not be mistaken for valueless. As Gronau (1977) observes, increases in income tend to raise the share of time people spend in non-market time; such behavior is typical of a normal economic good and indicative of a positive value for this time. Consequently, justification exists for valuing this non-market time.

Additionally, gross domestic product measures the value of goods and services produced for the marketplace but fails to link their distribution, consumption and production to welfare. (Gramm, 1987) Current national income accounting does nothing to bridge this welfare gap. As noted in the 1992 Economic Report of the President, changes and growth in national income accounts can not be mistaken for changes in the standard of living. The standard of living is a measure of the welfare of the nation, and is

determined by the consumption and distribution of goods and services, not by their production alone. Changes in the consumption of leisure show changes in the standard of living, but given current national income accounting procedures, those changes are unobservable. This can lead to some confusion with regard to the well-being of the nation. To quote the Economic Report of the President, 1992:

In the last two decades, real GDP per person rose almost 40 percent, while leisure - that is, time spent outside the workplace - increased by seven percent (if it is measure by a decrease in the average hours worked per week). Did economic well -being rise by more than the 40-percent increase in output because working people also had more leisure time? Or did economic well being rise by less than 40-percent because some of the increase in output came from an increase in the number of two-earner families for whom "family leisure" time declined. (E.R.O.P., 1992)

All of this time spent outside of the workplace is used to engage in economic activity, such as leisure as mentioned above or producing goods and services for use inside the household. Unless the value of that excluded time is known, the type of question asked above will remain unanswered. Arriving at a measure of aggregate value for human time that both represents a welfare measure and includes non-market time would be a significant improvement over traditional national income accounting and would allow questions such as this to be answered.

Finally, current national income accounting reflects the needs of developed nations rather than less developed countries. Since GDP measures the value of economic activity within markets, nations which do not have highly developed economies will have lower GDPs. Countries with

higher GDPs appear relatively better off than those with lower GDPs, even though the largest portion of human time is spent outside the marketplace that weighs GDP per capita so heavily in favor of developed nations.

Establishing a value for this non-market time could conceivably offer a standard for comparing the standards of living of nations independent of the level of development and the marketplace.

Identifying a problem, however, provides only a target, not a solution. A solution is the purpose of this paper. It will attempt to establish a method for valuing at least some of the human time spent outside of the market place. It will estimate an aggregate measure of value for that non-market time. Before that, though, certain restrictions and assumptions about what constitutes non-market time must be made. For the purpose of this paper, non-market time will be divided into two distinct types: household production and leisure. Household production is that labor which occurs within the household for the purpose of creating goods and services for consumption within the household. Leisure is the residual time available to people after their market labor and household production obligations are met. These restrictions are in keeping with the trichotomous model of time allocation outlined by Wales and Woodland in 1977, and also supported by Gronau's 1977 results that indicate household production and leisure respond differently to changes in income. To facilitate analysis, only one of the two non-market uses of time will be addressed here. Consequently, the focus of this paper is ascertaining a value for leisure time in an aggregate form and closing the leisure gap in national income accounting.

2. Background Information

To date, very few measures of leisure value have been attempted, although much is available in the resource and recreation literature on specific leisure activities. The closest to a sweeping survey of leisure time is John Owen's 1969 book The Price of Leisure in which he estimates several leisure time and market recreation demand functions using the prices of leisure related goods and services and standard socioeconomic variables (income, education, wages, etc.). These demand functions are part of a larger system of leisure demand and labor supply functions aimed at finding the income and price elasticities for leisure and market recreation. Analyzing leisure primarily as an adjunct to the generalized consumption model developed by Becker, Owen included leisure time as part of income but otherwise did not value leisure. In keeping with this focus on the responsiveness of leisure to income and complementary prices, Owen's principal conclusion is that leisure time as a share of total time responds positively to both increases in income and declines in the price of leisure related goods and services, showing that leisure time is in fact a normal good and is a complement to certain categories of goods. Additionally, wage related income effects predominated over the substitution effects related to changes in the prices of leisure related goods. Thus the model outlined by Becker in 1965, where consumption of time also depends upon the input of consumption goods that complement time and where labor and leisure are merely extensions of the general consumption model, is an accurate depiction of reality. However, while knowing the nature

of leisure is important and Owen's calculation of leisure demand functions illuminating, the fact that no aggregate measure of value was produced from his regressions leaves a gap in the knowledge. Owen's broad study had found the nature of leisure, but nothing that would indicate the total value of leisure in either a welfare or national income accounting context.

Additionally, because of its use of complements as a proxy for the leisure activities themselves, any measure of value that was attained would be a subject to interpretive problems. For example, the consumer surplus would represent the area under the demand curve for leisure measured in quantity of time on one axis and the price of leisure related goods on the other. This is not the value of the leisure time itself, but rather the value of the time spent in leisure as it relates to the price of complementary goods. In no way does this value represent the actual value of the time spent in leisure. Additionally, Owen's values were derived nearly three decades ago and utilized information relating to primarily the first half of the century. The age of the data as well as the very likely possibility of structural differences between the economy as described by Owen's and that seen today would probably make extensions of Owen's data of questionable relevance at best. Achieving empirical results which are more modern and more closely related to leisure time itself rather than leisure complements would be preferable. Owen's study, while raising some interesting questions about the possibility of valuing the black hole of leisure time, does not probe as deeply as it might have.

Aside from Owen, the only attempts to study leisure have been related to finding the opportunity cost of time through the wage rate. The first, and best known, of such studies was the 1973 effort by Nordhaus and Tobin.

Their approach was quite simple; they multiplied the hours available for leisure after labor, sleep, nutritional, and hygienic needs were met times the average wage rate. The value they found was roughly equal to 120% of the regular income of middle income families, indicating that the exclusion of leisure time from national income accounts underestimates national wealth by a considerable amount. Another similar study was conducted by Wilfred Beckerman under the auspices of the Organization for Economic Cooperation and Development in 1978. This study differed in focus from Nordhaus and Tobin in that Beckerman compared differences between changes in GDP and changes in a Nordhaus-Tobin type leisure time value between the 1950s and 1970s in an effort to create an alternative, non-GDP measure of economic growth that incorporated leisure value.

While these two studies did attempt to arrive at some total value for leisure time, methodologically using the wage rate is not entirely appropriate. Assuming that the wage rate is the value of leisure time may lead to serious over- or underestimates of the value of that time since it assumes that the opportunity cost of leisure is constant and equal to the wage rate. To start, using a wage rate for people outside of the labor force means using a value for their time which may or may not apply to them. Institutions also limit the applicability of the wage rate as the opportunity cost of time. In the face of contract-mandated forty hour weeks it may not be possible to engage in additional labor at the margin so the wage rate a worker faces during the course of "regular" work may not be possible outside of the normal work week, leading to marginal labor that possesses either a value different from a person's typical wage rate or even possibly zero. There may also be such a

thing as Owens "productive consumption of leisure" where leisure is necessary to avoid output reducing fatigue that reduces productivity, so engaging in labor rather than leisure may in fact be counterproductive and therefore not worth a worker's normal wage rate. Finally, the fact that people do not choose to work at the margin indicates that they are in fact rejecting the wage rate as the value of their time. Choosing to do something else means that the value of their time is greater in leisure than it is for labor.(Walsh, pp.42-43) While a simple and convenient approach to valuing leisure time, this would also seem to be a methodological dead end.

Concurrent with Owens, Nordhaus and Tobin, economists working in the environmental and resource fields began to explore the feasibility of creating hypothetical markets to trade public and/or non-market goods. The possibility of estimating the values of a non-market good through direct questioning had first been proposed by Ciriacy-Wantrup in 1947, but Robert Davis in 1963 was the first to consider using markets "contingent" upon some hypothetical framework.(Mitchell and Carson, p.9, 1989) These first studies, such as Knetsch and Davis (1966), in what was to become known as contingent valuation dealt principally with estimating benefits of certain natural resource related recreation or, in the case of Randall, Ives, and Eastman (1974), valuing changes in environmental aesthetic quality.

However, while the impetus for the creation of the contingent valuation method came predominantly from the environmental economics field, that does not exclude it from use in other venues. Analysis of its properties will make it readily apparent that the contingent valuation method has uses well beyond that narrow specialty of economics. Additionally, it will be seen that

the contingent valuation method is a preferred method for dealing with the question of values for non-market goods and services.

Since contingent valuation methods (CVM) concentrate primarily on estimating the dollar value for a change in the stream of benefits from a non-market good, the values ascertained from a contingent valuation survey show the value of a change in welfare. To account for the difference in perception between a welfare gain and loss, contingent valuation method surveys may be constructed to capture the values placed on either type of change. This distinction between gains and losses in utility can be seen best through the difference between willingness to accept and willingness to pay for either a commodity decrease or increase. Willingness to accept (WTA) represents the willingness of the respondent to accept some cash compensation in return for accepting either a price increase or quantity decrease if the respondent already possesses the property rights to the good in question, or avoiding a price decrease or quantity increase if the person does not possess the property rights. Willingness to pay (WTP) is the amount of income a respondent is willing to sacrifice to avoid a price increase or quantity decrease when the individual does not have the property rights, or to acquire a price decrease or quantity increase under similar property right conditions. (Freeman, 1993, p.58) However, while WTP and WTA are more logically suited for non-ownership and ownership situations respectively, that does not exclude them from use in situations where the property rights are reversed. It is possible to construct the CVM, for example, to obtain a WTP value regarding a reduction in the quantity of a good to which the individual being questioned is in fact entitled. (Freeman, 1993, pp. 180-181; Mitchell and

Carson, 1989, pp. 37-41) Given that flexibility, the CVM may be employed to ascertain numerous types of values concerning non-market goods and services under many different scenarios. Such flexibility makes the CVM uniquely suited to addressing questions with potential policy implications, such as the valuing of leisure for national income accounting purposes.

The vehicles through which these values are acquired, however, is by no means a simple choice. Numerous alternatives exist. Common methods include bid cards, payment cards, dichotomous choice, and open-ended questions. Bid cards start by asking the respondent whether or not they would accept/pay a starting value, and if the response is negative, the individual being questioned is bid up or down to their exact payment value. Payment cards are similar, except that the respondent is asked to "x" next to the value in a list closest to his/her exact value. In dichotomous choice surveys, a respondent is given one of a range of values and asked to respond either yes or no. Values are then established by fitting the yes and no responses to a probability distribution. The final form, open-ended questions, is also the simplest. The respondent is asked to state his/her value for a good in question.(Freeman, 1993, pp. 170-173).

The principle question when establishing a value for a good using contingent valuation techniques is *which* method to use. There are no simple answers to this question. The solution depends upon the strengths and weaknesses of the format employed. Several problems are common to all CVM surveys: embedding, order influence, and strategic bias. Embedding is the tendency of respondents to give values for specific items that are virtually indistinguishable from the values for a broad category of items, such as

having values to preserve a specific lake that are virtually identical to values for preserving all of the lakes in a region. As the term suggests, the values for smaller issues are "embedded" in and masked by larger ones. The embedding of multiple issues artificially inflates values, primarily through "warm glow" effects where people improve their opinion of themselves by doing what they believe they "should" do rather than what they would do in valuing a good.(Diamond and Hausman, 1994) The problem of order is equally simple in that the order and manner in which questions are asked frequently affects the values received.(Diamond and Hausman, 1994) The final type of common difficulty is strategic bias, or the tendency of respondents to alter their true values in order to influence the final result of a survey.(Freeman, 1993, pp. 182-183) This is typically found in instances where the value of the good in question weighs heavily in the decision of policy surrounding a good. While much has been made of the potential for strategic bias, particularly with regard to environmental questions, very little evidence has been found to support the existence of this bias.(Forster, 1989) Well-defined, familiar goods are less prone to these problems than other types of goods.

The positive and negative attributes unique to each particular format are cataloged in detail by Mitchell and Carson (1989) as well as *The Report to the National Oceanographic and Atmospheric Administration* by Arrow et al.(1993), but the salient points will be reproduced here. Bid cards are subject to a problem known as bid point bias and as both Mitchell and Carson and Freeman note, this weakness is well-documented. Essentially, bid point bias is the tendency of willingness to pay and accept values to center on the values used in the bid card. CVM estimates can vary quite widely depending

upon the bid points utilized, a definite flaw since it implies that the construction of the survey instrument informs the decision of the respondent. Payment cards may also be subject to bid-range biases, and as in the case of bid cards, this flaw mitigates against their use. (Freeman, 1993, pp.182; Mitchell and Carson, 1989, pp. 240-246) Dichotomous choice models are well-supported in the literature as effective methods for estimating willingness to pay for non-market goods, but they require large sample sizes, work best for only one issue at a time, are extremely difficult to interpret mathematically, and need good initial estimates for bid offers prior to the survey to pin down the range of values. Additionally, dichotomous choice models frequently do not assume functional forms which are in keeping with economic theory, a definite drawback. (Loomis, 1988)

The simplest and most direct format, the open-ended question, benefits from simplicity and lowered risks of vehicle biases. Additionally, when determining values for a large number of goods simultaneously, the open-ended method reduces the survey instrument size considerably. Unfortunately, the open-ended approach has few similarities to actual market operations and is generally criticized as unreliable and unstable, weaknesses which Arrow et al. in their report to NOAA (1993) attributed to surveyor biases and hypothetical biases that led to a failure of the respondents to adhere to a budget constraint. Surveyor biases are found when the surveyor influences a respondent's reported value while hypothetical biases stem from the failure of respondents to offer responses which actually reflect what their behavior would be due to the hypothetical nature of the question. However, Wicks et al. (1994) found that the open-ended CVM provided estimates of willingness

to pay that were equally robust and not significantly different from other CVM methods for leisure activities. Their success is most likely attributable to their method of training of surveyors that specifically addressed the issue of budget constraints and the fact that their survey asked questions about very familiar and concrete leisure activities in which the participants had actually engaged, thereby avoiding the hypothetical bias issue. Consequently, it would appear that as long as the CVM surveyor is aware of the weaknesses of the method employed, the dichotomous choice format or open-ended question would be the preferred contingent valuation methods for valuing non-market goods such as leisure time.

After some initial growing pains, the broad family of techniques known collectively as contingent valuation methods, attained sufficient respect through the 1960s and 1970s to be accepted policy for several government agencies when estimating the benefits and costs of actions with non-market impacts. Used by agencies ranging from the Army Corps of Engineers to the Environmental Protection Agency, even featured in Executive Order 12291 under Reagan and continued under Executive Order 12866 under Clinton, CVM is an officially sanctioned method for agencies of the United States government to estimate values for non-market goods. (Mitchell and Carson, 1989, pp.13-14; Portney, 1994) This widespread acceptance provides justification for employing CVM to estimate an aggregate value for leisure activities in a national income accounting framework. CVM is a mature and capable tool, able to provide the economist with insight when there would otherwise be none.

While this may seem to be an appeal to the "some number is better than none" school of thought deplored by critics like Diamond and Hausman (1994), the application of CVM analysis to leisure may present fewer problems than the application of CVM to other goods. Employing the CVM under these circumstances means using a unique tool whose primary purpose is to value non-market goods to study a familiar but hitherto unvalued non-market good. The principle weaknesses of other non-market goods - the lack of familiarity and strategic influences - that lead to fragile values are not inherent in leisure. Leisure, unlike rain forests or elk hunting in congested forests, is a subject with which all people are well-acquainted given that it includes activities like sleeping and playing with pets, and which also does not possess particularly politically sensitive traits. As such, leisure should not be subject to either warm glow effects or strategy since it is not a politically sensitive issue, nor should it be prone to embedding since the activities can be very specifically defined. Consequently, leisure would seem to be an ideal application of CVM. Leisure is the type of activity for which the CVM is intended, and it plays to CVM's strengths rather than its weaknesses.

Once these techniques for establishing values for non-market environmental and resource goods were developed, their extension to other sorts of non-market goods took relatively little time. As Smith (1993) noted, changing goods from environmental goods to other kinds of goods does not change the methodology or the interpretation. It simply requires a different set of assumptions about the questions being asked. In fact, while studies addressing leisure as a whole are nonexistent in the CVM literature, studies addressing individual recreation and leisure activities are quite common and

actually marked the birth of the methodology. Starting with the aforementioned study by Knetsch and Davis in 1966, where hunters in Maine were surveyed about their willingness to pay for visits, the CVM has been a stock in trade of the recreation economist. Following their work, Hammack and Brown (1974) employed what they termed a "direct consumer surplus" approach, basically a CVM-type study, to ascertain total net benefits for waterfowl hunting trips using a willingness to accept payment card question in conjunction with a willingness to pay above estimated market costs of hunting payment card. Cocheba and Langford (1978) drew on this work to undertake a similar study valuing the total value for waterfowl hunting using a payment card mail survey derived from Hammack and Brown's willingness to pay above market costs question. The most notable differences between the Hammack and Brown study and the Cocheba and Langford survey was in survey sample procedures. Hammack and Brown surveyed only those people who purchased "duck stamps" in 1968, while Cocheba and Langford sampled households from the general population of Saskatchewan. The rationale for drawing the sample from the larger population was that it would be a more appropriate survey technique than acquiring just the values of the waterfowl hunters. This difference in survey techniques establishes a precedent which is useful in valuing leisure in that the survey did not restrict itself to only those people who actively engaged in the activity but to an entire population. While the values of those people surveyed who do not engage in an activity may be zero or undefined, they are at least being included to reduce problems arising from sample selection biases.

Other early CVM studies aimed at estimating benefits from recreation were more closely related to environmental amenities, but the fundamental concepts remained the same. Daubert and Young (1981) used a CVM to estimate the values of instream flows for the Cache la Poudre River in northern Colorado. These values were intended to provide points of comparison to market generated agricultural uses of the instream flows. As such, the CVM was being used to provide an answer to a question with implicit policy implications. Similar work was carried out by Walsh and Gilliam (1982) in estimating the benefits of lower congestion levels for the Indian Peaks Wilderness Area in Colorado given conditions of excess demand. While focusing primarily on the relationship between willingness to pay and the effects of congestion on WTP, this study did provide further insight into how recreation could be measured and valued in a non-market situation through the use of an open-ended WTP questionnaire.

The next step in the development of the CVM in valuing recreation and leisure- employing it to inform policy decisions - came shortly after the introduction of the technique. Using CVM in conjunction with travel cost models, economists working for the United States Forest Service Rocky Mountain Research Station utilized the contingent valuation method on numerous occasions throughout the 1980s: Valuing outdoor recreation activities such as steelhead fishing in Idaho (Donnelly, 1986), cold and warm water fishing in Idaho (Sorg-Swanson and Nelson, 1985), elk hunting in Idaho (Sorg and Nelson, 1986), deer hunting in Idaho (Donnelly and Nelson, 1986), waterfowl hunting in Idaho, (Sorg-Swanson and Nelson, 1987), upland game hunting in Idaho (Young, 1987) and big game hunting in Alaska (Swanson and

Donnelly, 1989), these economists used CVM as one of their primary tools in valuing non-market recreation for both the U.S. Forest Service and the states of Idaho and Alaska. In similar work for the state of Colorado in 1985, Walsh, Sanders and Loomis (1985) utilized an open-ended CVM to estimate the economic value of recreation on a group of wild and scenic rivers in Colorado. Altogether, CVM has been used on many occasions as a tool for ascertaining recreation and leisure values for goods not traded in the marketplace. The extension of CVM values from one leisure good to leisure time as a whole is simply a question of aggregation.

3. The Model

General Theoretic Model

Ascertaining an aggregate measure of value for leisure time is not as simple as measuring the value of market time. No receipts or tax records exist to indicate either the expenditures people make or the income they receive from their time outside of the work environment. Consequently, some other avenue must be pursued.

To start, the nature of leisure demand must be addressed and analyzed. As noted by Becker (1965) in his groundbreaking work on the allocation of time, traditional utility maximization deals only with a utility function depending upon the input of market goods and upon an income constraint based on money income. However, the actual consumption of those goods takes *time*. Converting market goods into utility generating consumption requires time, and without its introduction the general consumption model is only partially specified. According to Becker, the general consumption model is better represented by a model including a time vector. Rather than a model like

$$U=U(X_1, X_2, X_3....)$$

Becker suggests a model based on the household acting in an almost factory-like capacity converting time and market inputs into composite goods from which utility is derived. These commodities will be called Z_i and are produced through the production function

$$Z_i = f(X_i, t_i)$$

where t_i is the input of time necessary to consume market good X_i . The utility maximization problem then becomes a matter of maximizing

$$U = U(Z_1, Z_2, \dots)$$

which is implicitly constrained by the money costs of the market good and the universal allocation of time necessary to produce the composite good Z_i .

Since leisure is inherently a time-based activity, this model is more appropriate one to employ than traditional utility maximization models using only market goods. Therefore, when analyzing the consumption of leisure, two constraints exist - money and time. Money enters through two routes. The first is through expenditures on market goods and services which complement leisure and enable individuals to engage in leisure activities. The second is through the income either foregone or earned by substituting between labor and leisure at the margin. The second constraint - time - exists because leisure, by definition, represents the residual time left after labor and household production obligations are met. Consequently, the time available for leisure is finite and scarce. Choices must be made regarding the allocation and distribution of time between leisure and other activities, and those decisions depend upon the amount of time available to an individual.

Keeping these dual constraints and the composite nature of leisure in mind, the problem facing a utility maximizing individual with regard to leisure is

best represented by the following function, as outlined by Bockstael, Strand and Hanemann (1987):

Maximize U subject to the constraints on Z_r, Z_n

$$(1) \quad \mathcal{L} = U(Z_r, Z_n) + \lambda(M' - P_r X_r - P_n X_n) + \mu(T - t_m - t_r X_r - t_n X_n)$$

where:

U is a twice differentiable, quasi-concave utility function with Z_r and Z_n as vectors of leisure and market goods respectively

Z_r is a Becker-type leisure composite good created by the fixed coefficient production function of $Z_r = f(X_r, t_r)$ where

X_r is the market complement necessary to create the leisure good Z_r

t_r is both the time necessary to create the leisure good Z_r and the price, in time units, of consuming the leisure complement market good X_r

Z_n is a Becker-type market composite good created by the fixed coefficient production function of $Z_n = f(X_n, t_n)$ where

X_n is the market complement necessary to create the market based consumption good Z_n

t_n is the time necessary to create the market consumption good Z_n and the price, in time units, of consuming the market consumption complement market good X_n

λ is the lagrangian representing the income constraint where

M' is the sum of income earned in a fixed week job, M , and income from time spent in a moonlighting job, t_m , at the supplementary wage of w_m (or $M' = M + t_m w_m$)

P_n is the vector of market prices for market goods

P_r is the vector of market prices for leisure goods

μ is the lagrangian for the time constraint where:

T' is total time less time spent in a fixed work week job(t_f)
(or $T'=T-t_f$)

t_m is the time spent in a moonlighting job

Expanding function 1 out to include the implicit Becker production function leads to function 2:

$$(2) \quad \mathcal{L} = U(Z\{X_r, t_r\}; X_n) + \lambda(M' - P_r X_r - P_n X_n) + \mu(T' - t_m - t_r X_r - t_n X_n)$$

Maximizing (2) leads to the following first-order conditions:

$$1 \quad \{\delta U / \delta Z \delta Z / \delta X_r\} - \lambda P_r - \mu t_r = 0$$

$$2 \quad \{\delta U / \delta Z \delta Z / \delta X_n\} - \lambda P_n - \mu t_n = 0$$

$$3 \quad M' - P_r X_r - P_n X_n = 0$$

$$4 \quad T' - t_m - t_r X_r - t_n X_n = 0$$

At this point, several problems with the model appear. Ideally, to estimate the value of time spent in leisure, the model should be solved through for the marginal utility of time, μ . However, without a pre-specified utility function, no specific solution for either μ or a demand curve is possible. Also, from a national income accounting policy standpoint, solving through for a solution measured in time-utility space, as μ is, does not offer any insight. Secondly, in those cases where t_m is equal to zero, income and time are not substitutable, the two constraints will not collapse and the problem will not lead to a solution. (Bockstael, Strand and Hanemann, 1987) Two routes around this problem are possible. The first (and the simplest) is to avoid those cases entirely and to concentrate only on interior solutions rather than

corner solutions. The other option is to break down the goods vectors even further and to leave one of the newly created vectors out of each of the constraints. While that does allow corner solutions to be solved, it adds many more variables to the model and complicates matters considerably. Finally, the variable t_f in conjunction with t_m indicates the status of the individual in the labor market. If both of these variables are greater than zero, the person is working and at an interior solution in the labor/leisure market. If only t_m is greater than zero, then the individual is at an interior solution yet again and a closed-form solution is possible. The problems of when t_m is equal to zero have already been addressed. Yet more is at stake than the quantity associated with either of these two variables; determining whether or not these variables are endogenous or exogenous is of central importance since it will determine if a generalized labor supply function will also be necessary in the model. Assuming these to be determined externally to the leisure choice makes the model much more straightforward and readily estimable. Assuming them to be internal to the solution creates a model that is difficult if not impossible to estimate. Fortunately, some knowledge of the empirical data used to validate this general model provides insight into the endogeneity/exogeneity issue. Since the data gathered for leisure questionnaires are essentially point estimates in time, the labor decisions of the individual being surveyed are short-run decisions and labor is essentially fixed at the point in time at which the survey takes place. That short-run, fixed labor decision would indicate exogeneity for the variables representing time spent in the marketplace, and a dramatically easier question to be answered.

Assuming, however, that while the labor decision has been predetermined does not necessarily preclude the possibility of some marginal employment. In such circumstances where "moonlighting" is possible and where $t_m > 0$, it appears in both the income and time constraint. Solving $T' - t_m - t_r X_r - t_n X_n = 0$ through for t_m leads to $T' - t_r X_r - t_n X_n = t_m$. Since t_m also appears in the income constraint through M' , it can be substituted into that constraint and the two constraints collapse into one. The question then becomes simply maximizing (3)

$$(3) \quad \mathcal{L} = U(Z\{X_r, t_r\}; X_n) + \lambda(M + w_m(T' - t_r X_r - t_n X_n) - P_r X_r - P_n X_n)$$

and the associated first order conditions are

$$\begin{aligned} 1 \quad & \{(\delta U / \delta Z) (\delta Z / \delta X_r)\} - \lambda(w_m t_r + P_r) = 0 \\ 2 \quad & \delta U / \delta X_n - \lambda(w_m t_n + P_n) = 0 \\ 3 \quad & M + w_m(T' - t_r X_r - t_n X_n) - P_r X_r - P_n X_n = 0 \end{aligned}$$

Solving this system through for a generalized solution leads to a derived demand function for input X_r of the following form:

$$(4) \quad X_r = f(w_m t_r + P_r, w_m t_n + P_n, M + w_m T', X_n)$$

The interpretation of this demand function is simple; demand for leisure complementing market goods is a function of the price of the leisure complement market good in both its own market and opportunity cost of

foregone income, other goods market and opportunity costs of foregone income, and of the individual's income.

Since it is a trait of recreation activities and of leisure in general that those consuming it also produce it, the opportunity cost price, the quantity available to consume, and the quantity demanded represent the results of a transaction carried out by an economic actor with him/herself, as seen by the implicit production function for the leisure good Z_r , embedded in the Lagrangians. Given this, the Equation (4) contains both demand and supply side components. As long as all of these are exogenous, the Equation (4) is an appropriately specified reduced form equation for both leisure supply and demand.

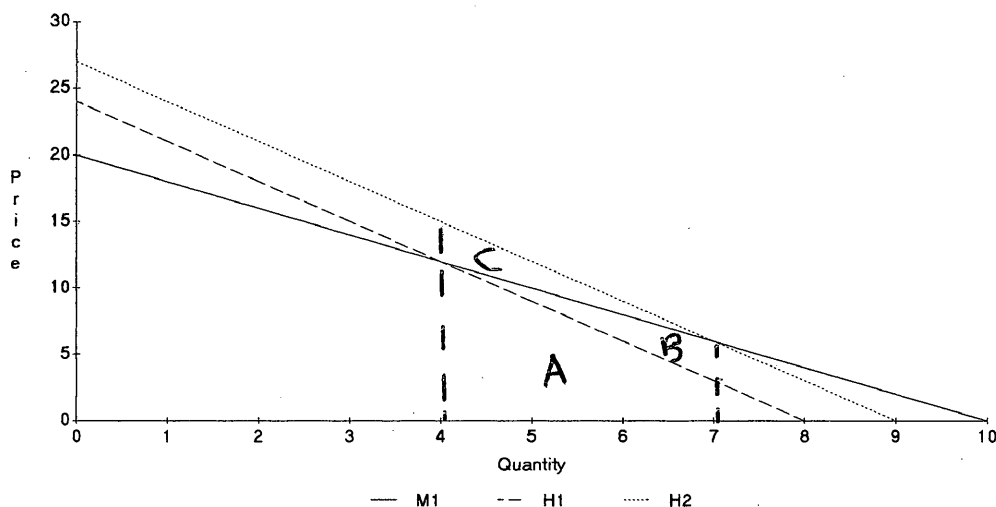
Yet while the demand for leisure goods is interesting, it will not address the problem of this paper: developing an aggregate measure of value for leisure. Essentially, the demand curve is simply mimicking much of the research already done by Owen (1969), where the demand for leisure time was a function of the price of leisure complementary market goods. Of more interest here is the term $w_m t_r$, which represents the opportunity cost of choosing to consume the goods necessary to produce leisure time, the dollar value for leisure time outside of the market costs. The opportunity cost is of central importance because it represents the marginal dollar value of leisure time that is excluded from national income accounts, while the market costs are already counted. Rearranging the previously derived demand curve for the opportunity cost leads to function (5):

$$(5) \quad w_m t_r = f(X_r, P_r, w_m t_n + P_n, M + w_m T')$$

At the margin, this opportunity cost should equal the value, in dollars, of an additional unit of leisure time. This marginal value would be akin to the marginal value of a market good, namely the price, used to develop national income accounts. Consequently, using a CVM survey to ascertain the value of the marginal unit of time spent in a leisure activity should give the opportunity cost value of that leisure time.

Unfortunately, up to this point the particular nature of the demand curve from which the marginal value function has been taken has not been specified. Depending upon whether or not utility or income is held constant, it may be either a Hicksian compensated or conventional Marshallian demand curve. Consequently, it can lead to a family of demand curves, representing both types and reflecting differing levels of utility or income, each of which has different marginal values. As the figure 3-1 indicates, moving between two different quantities can result in either motion along any one of the three demand curves, motion between the two Hicksian curves, or along the Marshallian curve. Any one of these curves can be found through a CVM survey, depending upon the nature of the question asked and the assumptions surrounding the model construction, so the nature of the research must inform the type of demand being analyzed.

Figure 3-1 Marshallian and Hicksian Demand Curves



A: Compensating Surplus
A+B: Consumer's Surplus
A+B+C: Equivalent Surplus

For the Marshallian curve **M1** (which holds income constant), movement along the curve results in a change in quantity and differing levels of utility.

Assuming that the price is equal to zero, integrating beneath this curve to the quantity line leads to the very familiar welfare measure, consumer surplus.

However, since movement along this curve incorporates multiple levels of utility, it does not provide an exact welfare measure for a specific utility level.

The other two curves, the Hicksian compensated demand curves, hold utility rather than income constant, so the integrals of these curves are associated with specific utility levels and are consequently exact welfare measures.

However, the two curves each have different welfare measures and the area underneath the curves represent offsets in income between different utility

levels. When integrated at a price of zero between two fixed quantities, 4 and 7, the lower of the two curves, H1, leads to the welfare measure known as compensating surplus while the integral of the upper curve, H2, leads to equivalent surplus. The compensating surplus is the form of Hicksian consumer surplus which measures the amount of money a consumer would have to lose in order to be equally well off consuming 4 as 7 when price equals zero. The equivalent surplus is the Hicksian consumer surplus measure which shows the change in income necessary to make a person as well off consuming 4 as 7. (Hicks, 1956, p.99) Compensating surplus is essentially a willingness to accept a loss in quantity while equivalent surplus represents a willingness to pay to avoid a loss in quantity. (Mitchell and Carson, 1989, p.26) The difference between the two measures indicate primarily differences between property rights conditions. Compensating measures imply that the old level of utility represents the allocation of property rights while the equivalent measures use the new level of utility as the base allocation of property rights.

The wording of a CVM questionnaire and the assumptions about the model can alter which form of consumer surplus is being found. In a situation where a reduction in quantity is being faced and willingness to pay is being asked, the equivalent surplus is the preferred measure of value since it represents the maximum willingness to pay to avoid a loss, while the compensating measure is preferred for willingness to accept figures since this represents the minimum "bribe" necessary to induce a person to accept a loss in quantity and utility. As a result, the nature of the question being asked can under some circumstances provide insight as to what type of marginal value

measure is being found. If the person is being questioned regarding a good or state to which he/she is not entitled, the amount willing to pay to arrive (or stay) at the new level of utility is equivalent variation. If the question relates to a good which the person does have a right to possess and the person is being asked about how much would be needed in compensation to accept its loss and remain at an original level of utility, then the value is compensating surplus.

As one of these measure the minimum bribe and the other the maximum payment, the two figure show the differences between "accept" and "pay" values. Theoretically, these two values should straddle the Marshallian measure, consumer surplus, as indicated by Figure 3-1.(Willig, 1976) In theory then, there is a clear relationship between the three different demand curves.

Empirical reality is not always so clean cut. These different types of demand curves mean that the marginal value function taken from the demand curve may relate to any one of these three consumer surpluses depending upon which demand curve is being observed. Since it is, as a practical matter, impossible to know with absolute certainty which demand curve is being observed when gaining the marginal values via the CVM survey, the insight gained from the type of question asked must inform the researcher as to the type of consumer surplus being found, whether it be conventional Marshallian consumer surplus, Hicksian compensating surplus, or Hicksian equivalence surplus. While the two Hicksian measures are preferable on theoretical grounds in that they represent specific levels of utility and are therefore unique money metrics of utility, consumer surplus provides a good

estimator of those two measures within certain bounds.(Willig, 1976) Under the assumptions of Willig, the relationship between the two Hicksian measures and the Marshallian measure should be quite close and should all fall within certain limits of each other.

Unfortunately, major discrepancies have been observed between willingness to pay and willingness to accept measures of equivalent and compensating surplus, well beyond the Willig bounds. This problem, known colloquially as the WTP-WTA controversy, is the failure of CVM values to meet the expectations of economic theory. The first major study to analyze this, Bishop and Heberlein (1979), found results that were over three times the difference predicted by the Willig bounds. This presents certain questions about the validity of CVM estimates as good general welfare estimates, particularly when the assertion is made that the CVM estimates are one of the two Hicksian measures of welfare. For the most part, WTP estimates have been shown to be more stable than WTA values. The principal difference is assumed to be from strong income effects, and since WTP values are constrained by income they are generally preferred to WTA values. However, Hanneman (1991) observed that major differences between willingness to pay and to accept could be accounted for through the existence of or lack of readily available substitutes. Leisure, which possesses numerous sub-categories and types of activities, possesses many different substitutes and should therefore not be subject to the fragility noted by Bishop and Heberlein. Indeed, Wicks et al. (1994) found that leisure was not prone to major pay/accept differences and was perceived as having many substitutes. Given this, the CVM value estimates for leisure are not prone to the problems of

other CVM studies and can be seen as an estimate of the value of leisure time.

Consequently, regardless of which demand curve is being observed, the marginal valuations obtained through the CVM is a definite measure of the marginal value of the time spent in leisure. Either a pay or accept value may be used to obtain the marginal value necessary for estimation of the marginal value function outlined earlier and for accounting values of leisure time in a national income context.

For the purpose of this study, this marginal valuation will be represented by maximum willingness to pay for an already consumed marginal unit of a leisure activity less the extra, market-related money costs. Since requiring payment for this marginal unit implies that the consumer is not entitled to the new utility level, the maximum willingness to pay to achieve the new utility level is a Hicksian equivalency measure. While changes in quantity are normally associated with surplus measures and changes in price with variation measures, the fact that a marginal change in the quantity of time spent in a leisure activity represents a change in the consumption basket of leisure, the value observed here is most likely an equivalent variation measure.

Although leisure goods have been shown in general to be less subject to major pay/accept differences, WTP is used primarily because of its greater general stability. Additionally, since willingness to pay is constrained by income and other factors limiting ability to pay, it is preferable to willingness to accept as a measure of value as it more closely reflects the market operations of the consumer.

4. Empirical Model, Methods, and Results ***General Regression Model***

To obtain the willingness to pay for leisure through a contingent valuation method, the ideal route to follow according to Arrow et al. (1993) and Smith (1993) is to employ personal interviews. The type of question used depends upon the nature of the good being examined. Typically, dichotomous choice estimates of willingness to pay are more stable (Kealy and Turner, 1993; Boyle and Bishop, 1988) than other methods for valuing non-market goods but the data requirements for that type of survey are immense. Several values need to be tried with sufficient numbers of yes/no responses at each value to ensure that the data can be effectively fitted to a probability function if willingness to pay estimates are to be made. Since leisure is inherently a composite good made up of numerous subactivities, acquiring values for each component activity and then aggregating would capture the most exact value for leisure time. Unfortunately, constructing dichotomous choice surveys for each leisure subactivity would require massive surveys and could make the survey administration prohibitively difficult.

Another method would be preferable. Since bid/payment cards possess well-documented bid and starting point biases, the only alternative is to follow an open-ended approach. As Kealy and Turner (1993) note, open-ended willingness to pay CVM values for market goods tend to be stable while values for environmental goods are not. The principal difference between these two goods is in the degree of familiarity people possess in trading them in a monetary context, and the instability of the environmental values can

most likely be attributed to a lack of familiarity. A study by Dickie, Fisher and Gerking (1987) comparing demand curves for strawberries derived from a CVM study and actual market generated curves found curves that were statistically indistinguishable and virtually identical willingness to pay estimates, providing support to the view that familiarity with the good in question leads to more robust and stable valuations. Since the labor/leisure choice implicitly trades leisure for labor derived income at the margin, it is safe to assume that leisure is a familiar good that possesses traits more common with a market good than an environmental good.

Not all research has been so supportive. A more recent study by Cummings et al. (1994) found significant differences between hypothetical and actual willingness to pay for several market goods in a laboratory setting based on respondents *ex ante* willingness to pay answers to a dichotomous choice survey. This would seem to call into question the assumption that familiar goods possess more stable values. While their findings are somewhat discouraging, it should be noted that using a survey focusing on *ex post* WTP values should be more reliable. Asking about values for an activity which the respondent has already consumed should not suffer from these hypothetical problems. At least implicitly, when a person chooses to engage in an activity, he/she assesses the value of that good. The person should then be capable of making a reasonable statement concerning the value of that good.

Empirical support for these assumptions come from a study by Wicks et al. (1994) which found that for several leisure goods no significant difference exists between values from open-ended and alternative CVM

techniques and that the values were fairly stable. Consequently, the open-ended method would seem to be both an attractive and effective way to acquire willingness to pay estimates, and it is the avenue followed here. An example of the survey may be found in Appendix A, *Survey Form*.

As noted earlier, leisure time is inherently a composite good, so CVM surveys constructed to capture willingness to pay values for each leisure component will provide more exact aggregate values. For the purpose of this paper, leisure has been divided into 22 different activities, as noted below:

<i>Activity</i>	<i>Unit</i>
<i>Sleeping</i>	<i>Hour</i>
<i>Napping</i>	<i>Quarter Hour</i>
<i>Personal Hygiene</i>	<i>Quarter Hour</i>
<i>Movies Plays and Concerts</i>	<i>Event</i>
<i>Parties and Bars</i>	<i>Outing</i>
<i>Socializing/Conversation</i>	<i>Quarter Hour</i>
<i>Eating at Home</i>	<i>Meal</i>
<i>Eating Outside Home</i>	<i>Meal</i>
<i>Attending Sporting Event</i>	<i>Event</i>
<i>Organized Competitive Sports</i>	<i>Event</i>
<i>Hunting/Fishing</i>	<i>Outing</i>
<i>Outdoor Activities</i>	<i>Hour</i>
<i>Exercise/Non organized Sports</i>	<i>Hour</i>
<i>Music/Radio Listening</i>	<i>Half Hour</i>
<i>TV/Video</i>	<i>Hour</i>
<i>Reading</i>	<i>Half Hour</i>
<i>Relaxing/Nothing</i>	<i>Quarter Hour</i>
<i>Volunteering</i>	<i>Hour</i>
<i>Playing with Pets</i>	<i>Quarter Hour</i>
<i>Hobbies/Crafts</i>	<i>Hour</i>
<i>Vehicular Travel</i>	<i>Hour</i>
<i>Religious/Spiritual</i>	<i>Event</i>

Each leisure activity was given a measurement unit, either a discrete amount of time or some easily recognized unit (such as a meal) for which the respondent provided a time length. The surveys were designed to ask respondents their willingness to pay for the marginal unit of the leisure activity in question, where in the absence of payment they would lose the unit. Focusing on the marginal unit is in keeping with neoclassical microeconomic demand theory where the price of a good displayed on a demand curve is the marginal willingness to pay for the good. Since losing the marginal unit means the consumer is deprived of the utility derived from consuming that unit, this willingness to pay represents a willingness to pay to avoid a loss in utility, so the appropriate Hicksian welfare measure is equivalent surplus (Zerbe and Dively, 1994, p.80) To ensure that the total value of leisure time was obtained for each respondent, all individuals were asked about each of the 22 leisure activities. Once the value of the marginal unit was obtained, questions were asked regarding the frequency with which respondents engaged in an activity and the average length of time spent while engaged in that activity, as well as any extra money costs associated with the activity.

In addition to the willingness to pay, quantity and cost questions, respondents were asked to provide certain socioeconomic data, such as marital status, number of individuals and of children in the household, employment status, level of educational attainment, age, gender, hours worked per week, total income and biweekly take-home pay. When the marginal willingness to pay, average lengths of time, frequencies (basically a variable indicating the seasonality of the activity), and socioeconomic data are combined, the marginal value curve can be estimated through regression

analysis. Starting with the general marginal value function outlined previously, the regression should be:

$$w_{m}t_r = f(X_r, P_r, w_{m}t_n + P_n, M + w_{m}T')$$

where $w_{m}t_r$ is the opportunity cost of leisure time and is equal to the marginal value of leisure time. It will be hereafter referred to simply as **WTP**, the net willingness to pay value for leisure activities obtained through the CVM survey.

There is a problem with this function. If the opportunity cost is exogenous with respect to X_r - a necessity for the demand equation to be identified - and the quantity X_r is endogenous with respect to the opportunity cost $w_{m}t_r$, then from an econometric standpoint this equation is improperly specified. To arrive at a properly specified model for econometric purposes, the quantity variable must be excluded. Another potential problem is that since the figures requested in the CVM survey were Gross WTP's, the Net WTP figures were calculated by subtracting market costs (prices or P_r here) from the reported Gross WTP's. Having prices on the right-hand side leads to an excessively high degree of correlation within the model and biases the R-squared upwards. As a result, using cost in the marginal value regression is a model misspecification and should not be done. Were it possible to analyze marginal values without the costs already embedded in the value, it would be appropriate to employ them in the regressions.

Some of these econometric problems, however, may be overcome. While the quantity of the leisure complementary good X_r is endogenous, the

supply of time necessary to produce the composite leisure good is determined exogenously by the short-run labor decision. As a result, the time supply needed to create the quantity Z_r can be introduced as an exogenous subcomponent of quantity that can proxy and compensate for the loss of the quantity variable, maintaining both the supply side restrictions in the model and the reduced form. This does mean that t_r appears on both sides of the regression, but as the left hand side t_r is the marginal unit of time and should be constrained to always equal one unit of time, and the right hand side t_r is the predetermined total time available to produce/consume leisure goods, in the short run the general variable t_r can be subdivided into the variables t_{rm} for the marginal time and t_{rt} for the total time constraint. The potentially troublesome own market price variable for the leisure complementary goods, P_r , should not present many problems since many of the leisure activities have zero market costs. Those which do have market costs can be identified through activity dummy variables, which should capture most of the effects of prices. Given this, the marginal value function becomes:

$$w_m t_{rm} = f(t_{rt}, w_m t_n + P_n, M + w_m T', \text{Activity Dummies})$$

or, when using WTP as the marginal value equal to the opportunity cost:

$$\text{WTP} = f(t_{rt}, w_m t_n + P_n, M + w_m T', \text{Activity Dummies})$$

Another potential problem is that the price and opportunity cost of other goods, represented by $w_m t_n + P_n$ in the general function, were not gathered in

the course of the CVM survey. However, these should exert primarily only a substitution effect and therefore only a shifting influence on the demand curve and the marginal value curve derived from it. Since the marginal values represent a short-run decision, there should be no changes in these prices and no associated shifts. Any income effects resulting from such changes should be captured by the income variables. Excluding them from the function should not exert any negative influence. After making those adjustments to the general function, it should look something like this:

$$\text{WTP} = f(t_{rt}, M + w_m T', \text{Activity Dummies})$$

From this general function, a regression may be developed. To proxy the occupations of the respondents which determine both some of the supply-side time constraints and income, the socioeconomic variables gender and education will be incorporated into the regression. To proxy other portions of the supply-side time constraint t_{rt} , annual frequency (intended primarily to capture seasonal variations), hours worked, and other socioeconomic data such as status in the labor market (retired, houseperson, student, etc.) are used to indicate the limits on the time available to produce/consume leisure. With two-week take-home pay used to indicate discretionary income and gross annual income to indicate all other income (and ideally to capture permanent income), the general marginal value function upon which a regression can be based becomes:

$$WTP_{ij} = f(\text{frequency}_{ij}, \text{2 week pay}_j, \text{income}_j, \text{socioeconomic data}_j, \text{activity}_i)$$

where i represents the leisure good under question and j represents a respondent. To allow an aggregate measure of value for leisure to be estimated using only one regression equation while still retaining the disaggregated values, the willingness to pay values must be calculated for each individual and each activity in turn. Distinguishing among activities requires incorporating a dummy variable representing each leisure activity, so the regression would take the specific form of

$$WTP_{ij} = \alpha + \beta \text{frequency}_{ij} + \beta_2 \text{2 week pay}_j + \delta \text{income}_j + \varepsilon \text{socioeconomic data}_j + \phi \text{activity}_i + U_{ij}$$

where the activity dummy accounts for each of the 22 activities. The error term U_{ij} is the error for each willingness to pay observation. However, since each respondent was asked for and provided willingness to pay values for as many as 22 leisure activities, and each one of those observations is reflected in the regression, it is not possible to assume independence between the U_{ij} . The presence of multiple responses precludes the use of that assumption. Given that it is entirely possible and actually quite likely that numerous WTP_{ij} 's come from one individual, the associated U_{ij} 's are related and their covariance is not equal to zero. Rather than a conventional independent error term, the errors are probably better represented by

$$U_{ij} = u_{ij} + v_j$$

where u_{ij} is the random "white noise" error term and v_j is an individual specific error term and reflects the individual respondent's systematic tastes and preferences as displayed across the multiple responses. Since this systematic correlation of the error terms clearly violates the assumption that the errors are independent, the classical normal linear regression model can not be used with confidence and the results achieved with that method are suspect. Dealing with this correlation caused by a "personality" effect displayed through multiple responses can be accomplished through a number of routes. The first is to follow the path used to allow all of the leisure activities to be incorporated into one regression, namely to use dummy variables for each individual included in the survey. This method is known as a fixed effects model. While this technique is feasible, it is not possible to estimate a fixed-effects model when there are multiple variables associated with the source of the multiple response bias. In the case of the leisure CVM survey, the source of the multiple response bias - each individual respondent - was also always associated with a specific interviewer and a specific neighborhood. If attempts are made to discern regional differences or interviewer biases, that relationship leads to an inestimable collinear regression. Fortunately, an alternative a regression technique is available that can cover this problem without the problems of the fixed effects model: the random effects model. (Hsiao, 1988, pp. 33-41) Essentially a weighted least squares regression, the random effects model estimates a value for the individual specific error and breaks out the effects caused by the inclusion of

multiple responses from each individual. This will remove the multiple response bias and allow the estimation of a regression that represents the best linear unbiased estimator.

With the decision made to use the random effects model, the general functional form of the regression becomes:

$$WTP_{ij} = \alpha + \beta \text{frequency}_{ij} + \beta_2 \text{week pay}_j + \delta \text{income}_j + \varepsilon \text{socioeconomic data}_j + \phi \text{activity}_i + u_{ij} + v_j$$

This represents the ultimate development of the general regression. All that remains is to gather the data and estimate the regression. From that data, the total willingness to pay values for leisure can be derived by applying the techniques of national income accounting and multiplying the marginal willingness to pay values by the quantities and the validity of the CVM technique examined by regressing the marginal value curve.

Survey Methodology

Gathering the data for this study began in the fall semester of 1993 and continued throughout the year, finally concluding in the middle of the spring semester in 1995. Data collection was the responsibility of the Economics 494 Empirical Research Seminar at the University of Montana, of which the author was a part-time facilitator. This class, offered every semester and containing a core cadre of veteran surveyors with several semesters of interview experience, proved a unique and valuable asset in conducting this study. By providing a readily available, experienced and essentially free pool of interviewers, the survey was able to be conducted on a fairly large sample through personal interviews. Additionally, the presence of experienced, veteran surveyors should both reduce the possibility of interviewer biases and ensure that income and time constraints are observed, thereby avoiding two of the most common complaints levied against CVM surveys.

The survey was conducted across the general metropolitan area of Missoula, Montana. For the purpose of sampling, the city was divided into 44 distinct neighborhoods with more common traits within the neighborhood than without. These neighborhoods were first created by the Census Bureau during the 1980 Census, and it was upon these neighborhoods and that census that the sample of approximately 400 was drawn. Midway through the sample, data from the 1990 Census became available, but unfortunately the Census Bureau did not subdivide Missoula into distinct neighborhoods for this census as for the previous one.

However, due to the generosity of Geoeconomics, Inc., a geographic mapping and database linking program became available, and through the use of this program the 1980 census neighborhoods were updated with 1990 census data by this author. Based on this new information, the total number of surveys and the relative weights of each neighborhood were modified to reflect the new data.

The surveys themselves were collected by assigning a survey team from Econ 494 to one of the 44 neighborhoods. These teams, typically 2-3 people led by an experienced surveyor, would randomly select a house as an initial starting point. Once that initial house had been approached and either the occupants surveyed, determined to be unoccupied, or the inhabitants declined the request for the survey, the team would move on to the next house using a random but predetermined interval. The team would continue through the neighborhood until the appropriate number of surveys for that neighborhood had been collected.

As stated above, the selection of houses to be surveyed followed some form of random walk linked to a previously, but randomly, chosen initial point. Common methods for selecting the initial point included rolling dice to select a house's position relative to an intersection, drawing numbers for the last digit of the house number, or, in one surveyor's case, using a random number table to select the last digit of the first house to be surveyed. The procedure for selecting the follow-on houses was similar; an interval would be chosen through some form of random number selection and the houses occupying positions relative to the initial point and following the interval would be approached for surveys. (For example, after rolling the dice to determine the

initial point, every *xth* house would be approached for a survey.) This method provided both an effectively weighted and randomly chosen sample.

To ensure that survey teams followed these random selection procedures, these policies were included in the verbal instructions given to the students of Econ 494 at the beginning of each semester by the seminar facilitators. In addition to this verbal training, they also received written guides explaining survey procedures (this instruction list is included in Appendix B *Steps to Avoid FUBARs*) and reference sheets defining the 22 leisure activities in brief, accessible terms (this definition list can be found in Appendix C *Definition List*). Both of these items were intended to accompany the surveyors in the field and to be used as reference materials in the event a survey respondent posed questions about the survey or one of the leisure activities.

The survey form itself was a refinement by the author of a survey form developed for an earlier, shorter leisure study (Wicks et al, 1994) that analyzed differences between willingness to pay and willingness to accept values acquired through various CVM formats. Given that history, the form represented a mature and well-developed instrument with extensive prior use. However, there is a common apprehension among economists that surveys in general and CVM surveys in particular tend to inform the values received (Hanneman, 1994). To fully ensure that the instrument did not introduce a bias, the form was reorganized in the middle of the 1994 fall term. This modification, carried out on roughly the last 114 of the surveys, allowed the inclusion of a form variable in the regression and meant that the influence of the form and the impact, if any, of the order of the questions could be tested

statistically. Essentially, this represented yet another validity check of the chosen CVM format. A final source of bias, the interviewer, was also accounted for in the construction of the model and included in the analysis. Interviewers with multiple surveys were catalogued and included in the regression as a dummy variable. While the training of the surveyors should have minimized the overall impact of those tasked with gathering the questionnaires on the responses gained, the inclusion of the surveyors as a dummy variable was a check of security and validity. A further test for surveyor bias was conducted outside of the regression analysis by comparing socioeconomic data between the whole of a neighborhood and those individuals included in the sample. By employing the Geographic Information Tracking Software (GITS) provided by Geoeconomics to provide census generated age and gender data, the socioeconomic makeup for each of the neighborhoods based on the information provided by the sample was compared to the expected composition of the neighborhoods as indicated by the 1990 census. Comparing the two figures for each neighborhood provided another way to test for surveyor introduced sampling bias. Descriptive statistics for the sample are located in *Appendix D Sample Descriptive Statistics*.

Initial Empirical Model Construction and Results

Once the data was collected and collated, the first step was to attempt the estimation of the reduced form marginal value curve previously outlined. The results of that regression are located in Table 4-1.

Table 4-1 Marginal Value Regression Results

Marginal Value Regression		<i>Napping</i>	D2	-0.35141
			Std Error	2.667
		<i>Personal Hygiene</i>	D3	0.64746
			Std Error	2.21
		<i>Movies, Plays, etc</i>	D4	-2.1953
			Std Error	2.615
		<i>Parties/Bars</i>	D5	-1.8441
			Std Error	2.651
		<i>Socializing</i>	D6	-1.8689
			Std Error	2.193
		<i>Eating at Home</i>	D7	-5.0119*
			Std Error	2.196
		<i>Eating Outside Home</i>	D8	-6.5482**
			Std Error	2.358
		<i>Attending Sporting Event</i>	D9	4.5541
			Std Error	2.737
		<i>Org. Comp. Sports</i>	D10	0.4654
			Std Error	3.587
		<i>Hunting/Fishing</i>	D11	16.481**
			Std Error	3.472
		<i>Outdoor Activities</i>	D12	-0.14651
			Std Error	2.49
		<i>Exercise</i>	D13	-0.92841
			Std Error	2.472
		<i>Music/Radio</i>	D14	-4.1012
			Std Error	2.283
		<i>TV/Videos</i>	D15	-4.3032
			Std Error	2.228
		<i>Reading</i>	D16	-3.0968
			Std Error	2.245
		<i>Relaxing/Nothing</i>	D17	-0.27255
			Std Error	2.371
		<i>Volunteering</i>	D18	1.4023
			Std Error	3.215
		<i>Playing with Pets</i>	D19	-1.15334
			Std Error	2.749
		<i>Hobbies/Crafts</i>	D20	-0.38025
			Std Error	2.873
		<i>Travel</i>	D21	-4.8753
			Std Error	2.518
		<i>Religious/Spiritual</i>	D22	4.883
			Std Error	2.828
2 Week Pay	-0.0002573			
Std Error	0.0003653			
Hours Worked	-0.0014361			
Std Error	0.001727			
Single	-0.18278			
Std Error	1.25			
Male	-1.3507			
Std Error	1.052			
Student	-2.061			
Std Error	1.696			
Retired	-7.6582**			
Std Error	2.204			
Houseworker	-2.6089			
Std Error	2.81			
Week	-2.6369*			
Std Error	1.135			
Month	-2.7263			
Std Error	1.545			
Year	-6.2097**			
Std Error	2.095			
# Kids	0.63926			
Std Error	0.8166			
Kids<5	0.64543			
Std Error	1.934			
Kids>12	-0.72096			
Std Error	1.88			
Gross Income	0.000023249			
Std Error	0.00003421			
# in Household	0.0014856			
Std Error	0.00981			
Education	-0.19816			
Std Error	0.2195			
Age	0.0011198			
Std Error	0.007492			
Constant	11.486*			
Std Error	4.467			

R-Squared 0.0173997

* Significant at 0.05 Error Level

**Significant at 0.01 Error Level

n=6593

The model employed was a Random Effects Model, chosen after the estimated correlation of uncorrected errors between leisure observations for specific individuals was 0.115799, a clear violation of the Classical Linear Regression Model assumption of uncorrelated errors. An alternative Classic OLS Model was also rejected after a model specification test between the OLS and Random Effects models generated a Lagrange Multiplier Chi-Squared test statistic of 21.11132 with 2 degrees of freedom and p-value of 0.000026, rejecting the OLS. A copy of the LIMDEP program used to estimate this regression can be found in Appendix E *LIMDEP Program*.

On the whole, the marginal value regression is not particularly enlightening. Only a few of the coefficients are significant and their economic implications are unclear. The only socioeconomic variable - the retirement dummy - does not have any particular economic meaning other than as a time constraint. The other significant variables - week, year, Leisure Activity 7 (Eating at Home), Leisure Activity 8 (Eating Outside the Home), and Leisure Activity 11 (Hunting/Fishing) - all represent either seasonality indicators or leisure activities which also do not have any particular economic meaning. Their primary importance is in indicating that leisure values are determined independently of the socioeconomic variables and leisure activities being investigated. The only other significant element of the regression, the constant, means that an intercept value does exist and that in the absence of all of the other factors there is a baseline value, but beyond that rather obvious point, not much else can be seen from this regression. All of these observations suggest that the variation in opportunity costs of leisure time

either originate from some other source than the variables used here or are possibly a constant.

For some time, a major point of contention about the CVM is that values ascertained through CVM studies do not adhere to economic theory and are frequently implausible. The low number of significant activity dummies in the initial regression results indicate that at the margin, most leisure activities have equivalent values. It would appear then, that at the margin people have pushed their leisure activities to the point where their values are equal. Such behavior is typical of rational utility maximization and conforms to the expectations of economic theory. It would appear, then, that in this study the problems encountered by other researchers do not appear to be an issue.

Additionally, for the most part, the activities which are significantly different all have reasonable explanations. The fact that both of the eating activities have significant negative coefficients is somewhat confusing and would suggest that people's values for eating are less than for other activities. Possible explanations of this could be overconsumption resulting in remorse or a dissatisfaction with the actual experience of the meal as compared to expectations. The fact that meals are not differentiated in terms of quality so that a hastily prepared meal is included in the same category as more elaborate meals may also lead to differing values.

The fact that hunting is among the significantly different activities is by no means surprising. Given the presence of strong constraints in the form of seasons, bag limits, and license fees, most hunters can not consume as much

hunting as they would like. The large positive coefficient on hunting supports that conclusion.

To confirm that the effects of the activity dummies are in fact insignificant, a partial F test was run on the coefficients representing that group of variables. With 21 and 6554 degrees of freedom and a null hypothesis that all of the leisure activity dummy variable coefficients were zero, the F-statistic for the leisure activity dummy variables as a group was 3.38216 and was significantly different from zero at the 0.05 error level. However, most of that is probably related to the three significant coefficients and probably represents those activities "pulling" the test-statistic into the significant range.

Since one of the primary objectives of this study is to obtain an aggregate measure of value for leisure for inclusion in national income accounts, it might seem appropriate to employ this regression to arrive at such a value by integrating beneath the regression line. This technique, while attractive and commonly used in the estimate of benefits from recreation, is not possible here. Given that a demand curve was not estimated and that quantity was excluded from the regression to avoid the potential simultaneity bias problems between the marginal willingness to pay values and the marginal quantities of leisure activities it is simply impossible to find a variable against which a meaningful integration can take place. Additionally, since annual values are of greater interest in a national income accounting context and the only way to arrive at an annual value with the available data is to transform it by using the reported frequencies and quantities, any regression between annual willingness to pay values and annual quantities would

definitely be subject to model misspecification errors. Consequently, while it would be interesting to explore the values obtained through such a method, it is not possible with the data available at this point in time.

The lack of any meaningful regression derived surplus values mean that some other avenue must be pursued if an aggregate value of leisure for use in national income accounts is to be derived. The simplest path to follow is to utilize the techniques of macroeconomic national income accounting and simply add up the annual values of all leisure activities. The values used may come from either one of two possible sources, the CVM values for each leisure activity gathered through surveys, or through imitating the techniques developed earlier by Nordhaus and Tobin using the wage rate as the opportunity cost and value of leisure time. Using the CVM data to arrive at a value will be called the simple CVM technique, while the use of the wage rate as the value of time will be called the Nordhaus-Tobin method after the study which first developed the methodology.

Of the two accounting methods to be employed here, both methods have positive and negative attributes relative to each other and to regression analysis. The benefit of the simple CVM approach is that it is mathematically easy to estimate, particularly for annual per capita values. It also benefits from the fact that it employs people's actual stated values for leisure as opposed to any assumed values. Unfortunately, unlike regression analysis, this method does not allow any tests to be run on the marginal values used for the estimation of total values. Correlations with income and other economic variables may not be examined without at least resorting to an ANOVA, so it is impossible to determine if leisure behaves in a manner consistent with

economic theory. It is also impossible to determine if the leisure values meet the rational utility maximizing condition of equal values at the margin. Finally, sample biases such as those introduced by surveyors can be examined only by comparing the socioeconomic attributes of the sample to the socioeconomic characteristics of the population from which it was drawn. The exact impact of those biases can not be measured. Other forms of biases, such as those introduced by the survey form itself, can not be examined within the context of this simple CVM accounting model.

The Nordhaus-Tobin model also benefits from simplicity in that it only involves multiplying a wage rate times the annual quantity of leisure hours. Since only one value for all hours of leisure is used, the calculations are even simpler for this method than for the simple CVM technique. Additionally, the survey requirements are lighter than the CVM technique in that only total time spent in leisure must be known, not the specific values for each individual leisure activity.

The primary weakness of this technique is in assuming that the wage rate is a representative value for all leisure time, particularly for those people not actively employed. While for household production it may be possible to find close market substitutes for which a wage rate is available to use as a value for the time spent in those activities, there are few such values for leisure time. In the face of institutional constraints like the forty-hour work week, additional work at the margin may only be possible at an "overtime" wage or at another occupation with a wage rate different from that of the primary employment wage. Since the marginal wage rate may be different from the average or typical wage rate, assuming that the wage is the value for

leisure time may be an untenable position. The existence of several alternative wage rates - the primary employment wage and the "overtime" or secondary employment wage - means that numerous total values could be estimated, each from potentially valid estimates of the wage rate. The Nordhaus-Tobin method is also subject to the weakness of the simple CVM method in addressing hypothesis tests about the attributes of leisure time as a good and in examining the data for potential biases. There is no way to determine if leisure time is positively or negatively correlated with any other variables, nor is it possible to determine if the rational utility maximization conditions of equal values at the margin are met. Finally, surveying biases can only be detected through comparing sample and population descriptive statistics. Measurement of those biases is impossible.

With the strengths and flaws in each approach strongly borne in mind, the actual calculations of aggregate values of leisure could begin. The first approach used will be the first introduced: the simple CVM accounting technique. Basically, an annual total value of leisure for each respondent was found by taking the rates of payment for each leisure activity for each individual respondent, as indicated by the marginal values reported in the CVM survey, and multiplying them by the annualized quantities of those leisure activities. The annualized quantities of leisure were found by multiplying the number of times a unit of leisure was performed per a specific time period (such as x hours per day) times a scalar that would annualize the quantity (eg., in a daily example the scalar would be 365).

The net annual willingness to pay values for each individual respondent were calculated. The general formulation for that figure is shown below:

Annual Aggregate Net WTP= (MARGINAL WTP-COSTS)*QTY*ANNUAL FREQUENCY

where:

Marginal WTP is the net willingness to pay for the marginal unit in question

Quantity is the number of units of the leisure activity performed at the margin

Annual Frequency is the frequency within a year that the leisure activity was engaged in, either daily, weekly, monthly or yearly, used to convert the marginal quantity into the annual quantity

In the actual formulas used for aggregate value calculation, the rate of payment for all activities was given by:

Marginal WTP/Last Unit Length

Calculating the annual quantity from the available data was somewhat more complicated. Since the leisure survey form included activities with both pre-specified and unspecified lengths of time for the marginal unit, the specific formulas used to calculate annual quantity were slightly different for each activity depending upon whether or not the last unit length of the leisure activity was already defined in the survey. The formulas used to convert the information gained through the survey into annual quantities are:

Pre-Specified Time Length: Last Unit Length*Number of Acts per Time Period*Annualizing Scalar

**Unspecified Time Length: Average Unit Length*Number of Acts per
Time Period*Annualizing Scalar**

where the annualizing scalar was either 365, 52, 12, or 1 depending upon the frequency with which the respondent participated in an activity. It was 365 if the activity was performed daily, 52 if weekly, etc.

The initial estimates of net aggregate willingness to pay for leisure were based on the full sample less those observations for which there was no response. Ignoring the non-responding individuals does run the risk of introducing a bias, known as non-response bias, but this should be of minimal importance since the people not providing a response did not engage in the activity in question within the last year. Ignoring these non-respondents seems the most practical route since a zero annual quantity of a leisure activity would ultimately lead to a zero annual value anyway. Excluding the non-respondents simplifies calculating the annual values and including them adds nothing.

It will be reiterated that the primary focus here will be on net values since they represent the value a respondent placed on leisure above and beyond the market cost of the activity. All that is left then is the opportunity cost of the marginal unit of a leisure activity. Observing changes in this figure over time could provide an index of the changes in a value measure for leisure relative to changes in market generated GDP. From these changes, observations concerning changes in the standard of living could be made by comparing changes in each value relative to each other. The problem introduced at the beginning of this paper, where changes in leisure time could not be understood in a welfare context, could at last be solved. Finally, since

the ultimate goal of this paper is to analyze the viability of employing a CVM to ascertain a value of leisure for national income accounts, using net willingness to pay allows the standards of national income accounting to be observed. Since the gross willingness to pay figures incorporate the market costs of leisure and those costs are already included in conventional national income accounts, using gross figures will result in a double accounting of those costs. Double accounting in leisure values would preclude their use in a national income accounting framework, and is therefore to be avoided.

Table 4-2 contains the results of the calculations for net annual per capita WTP. Also included as a point of comparison is the mean annual household income for the greater Missoula metropolitan area as reported in the 1990 census, inflated up to an estimate of that income for 1994 using the implicit price deflator for the intervening years. While most of the information for the CVM survey gathered applied to the individual being questioned, the household mean annual income figure was chosen for comparison because the census data did not include mean annual personal income. The only alternative census figures were either median incomes which are not comparable to the mean values obtained here or family mean annual income values. The family definition used by the census was quite narrow and did not cover most of the people included in the CVM survey, so using that income measure also did not seem appropriate. Additionally, the CVM survey also included a question regarding household annual income so the mean annual household income for Missoula provides a point of comparison for those figures and therefore a potential point of comparison between the census and

the CVM survey. All values are in nominal 1994 dollars since the survey was conducted throughout 1994.

Table 4-2 Annual Net WTP Per Capita Leisure Value

Census Mean Income Missoula	Annual Per Capita Leisure Value Net WTP from CVM
\$32,502	\$66,486.91*
Standard Error: \$4670.61	
Degrees of Freedom=399	
*Statistically Significantly Different from Zero at .01 Error Level	

Performing a standard t-test on the results show that the Annual Net WTP for leisure per person is statistically significantly different from zero at the .01 error level.

The value of leisure relative to the mean annual income shows that the value of leisure time is significantly greater than mean income. Such a finding supports Becker's view stated earlier that the value of non-market time may be of more importance to the study of economics than other forms of economic activity. It also supports the inclusion of a shadow account in national income accounts for leisure time. Without such an account, the value of national income is strongly understated since the value of leisure time consumed is implicitly assumed to be zero.

After the value estimates employing the simple CVM technique were made, the next step was to use the Nordhaus-Tobin method. Calculation of the Nordhaus-Tobin value simply involved multiplying the annual quantity of leisure hours already found by the simple CVM formulas times a wage rate.

The wage rate employed here is the average hourly non-agricultural wage rate for 1993 as reported in the 1994 Statistical Abstract of the United States inflated up by 2 percent and less 24.9 percent for taxes (Federal Income taxes, Montana State Income taxes, and the Montana State Old Fund Liability Tax). This overall tax rate was taken from the taxes calculated for the household mean annual income for Missoula using the Instructions for Form 1040 and the Montana Instruction Booklet for Individual Income Tax. After the adjustments for inflation and taxes were made, the wage rate was equal to \$8.30 per hour. Yet again, the annual quantity of leisure was taken from the CVM sample of 400 and included only those observations with a response.¹

Table 4-3 contains the mean per capita values for both the simple CVM approach and the Nordhaus-Tobin method. Included for comparison is the mean annual income for Missoula in 1994 as indicated by census data.

Table 4-3 Annual Nordhaus-Tobin Per Capita Leisure Value

Mean Income Missoula	Annual Per Capita Leisure Value Net WTP from CVM	Annual Per Capita Leisure Value Nordhaus Tobin Method
\$32,502	\$66,486.91*	\$55,983.50*
	Standard Error: \$4670.61	\$1380.78
Degrees of Freedom=399		
*Statistically Significantly Different from Zero at .01 Error Level		

Of principal note here is that while the Nordhaus-Tobin technique value and the Net WTP value are superficially similar, the Nordhaus-Tobin value is significantly smaller than the CVM value. This is somewhat encouraging from

a theoretical standpoint in that as Walsh (1986, pp.42-43) noted the fact that people are engaging in leisure rather than work would indicate that they place a higher value on leisure than labor. These results would seem to support that view. Since the hours used to achieve the total values and the sample size for both figures is the same, the any differences in the two values must be attributed to a difference between the marginal values reported in the CVM and the wage rate.

This comparison of leisure values using separate techniques raises the question of the practicality of the use of the CVM. While the fact that the two measures of total leisure time are statistically different is somewhat confusing, it is important to realize that the comparison could not have been made without the CVM data. Additionally, the volume of data available through the use of the CVM enables the researcher to undertake a more complete analysis of the question of leisure. Finally, the Nordhaus-Tobin value is strongly dependent upon the choice of the wage rate. Using another estimate of the wage rate may not lead to similar results, and that is a potential weak point for this technique. As an example, had the available non-agricultural wage rate for 1993 been inflated up by the average annual change in wages between 1989-1993 rather than an estimate of the rate of inflation between 1993 and 1994, the wage rate used would have jumped from \$8.30 per hour to \$8.38. Such a minor difference can have noticeable results: the annual Nordhaus-Tobin per capita leisure value goes from \$55,983.50 to \$56,505.09 using the alternative wage rate. Not removing taxes also changes the value. When taxes are not subtracted from the wage rate used here, the annual per capita Nordhaus-Tobin value rises to \$74,509.31, a figure whose p value from

a t-test in comparison to the per capita net annual willingness to pay is .04. Since all of these wage rates are defensible, determining which one is the actual value can be a major stumbling point for the use of this technique.

Regardless of the approach, however, one result is clear. The annual value of leisure as indicated by the accounting values is somewhere on the order of twice the size of mean annual income in Missoula. The implication of such a difference is staggering in a national income accounting context. By not including the value of consumed leisure time, personal income accounts may be understated by as much as two-thirds if the results for Missoula are representative. Additionally, it would indicate that the marginal value of leisure time, its opportunity cost, is not equal to the wage rate and that there are quantifiable imperfections within the labor market. That, however, is a study best left to another time and place.

Admittedly, these aggregate values for leisure are rather *ad hoc*. As noted by Loomis (1987), there is no clear consensus as to how aggregate benefit measures from CVM surveys can be made. That is one of the principal reasons multiple approaches were used. However, the difference between the simple CVM and Nordhaus-Tobin annual per capita values would suggest that people do have a fairly consistent idea of what the value of their leisure time is and it is more than the wage rate. It would also indicate that this value is a very sizable sum, particularly in comparison to mean annual income. Judging from these figures, failure to include leisure in national income accounts understates the value of people's actual consumption in the United States by about two-thirds. All of this leisure produced for consumption within the household is a very important element in the total

economic well-being of the nation given the extremely high value place upon it by those consuming it.

Tests for Biases, Rationality, and Regression Analysis

So far, no attempt has been made to determine if the sample used as the basis for either the CVM or the Nordhaus-Tobin values is representative of Missoula. Given the concerns expressed by many CVM researchers about various biases and inconsistencies with economic theory seen in other studies, examining the survey for these influences is of paramount importance. Determining the validity of the tool used not only supports the obtained values, but adds credence to the use of the CVM in non-market valuation in general.

To start analyzing the data for survey biases, a quick and simple way is to compare the socioeconomic data for the neighborhoods gathered through the surveys with the census data for those neighborhoods. While this comparison ideally would have covered all of the neighborhoods and been made using the computerized Geographic Information Tracking System program, the data available from the Census Bureau did not have the same geographic identification codes as the data employed in the Geographic Information Tracking System. As a result, the data in the census tabulation blocks could not be used in the GITS program and had to be sorted into neighborhoods by hand. A very laborious and time consuming process, hand-sorting limited the comparison of neighborhood traits according to the survey sample and the census to a spot check on only approximately five percent of the neighborhoods. Additionally, the degree of precision available by hand-sorting was not the same as that possible employing a computer. Finally, since all of the census data was collected nearly five years ago, the age of the

statistics should be kept strongly in mind. While the tests between the survey sample and the census are the best possible under the circumstances, the results should be interpreted with their potential weaknesses in mind.

Of all the statistics gathered in the census, the only socioeconomic data from the census disaggregated to a level suitable for comparison to the survey data were the proportions of gender and children in each census tabulation block. The percentage of males to females by neighborhood for both the census and the survey were compared and tested using a chi-squared test. The null hypothesis used was that the proportion of men to women in the survey was equal to the proportion in the census data. Failure to reject the null hypothesis would indicate that the proportions between the survey sample and the census are statistically indistinguishable and the sample a good representation of Missoula. The chi-squared test statistics and their associated p values are included in Table 4-4.

Table 4-4 Sample vs. Census Gender Proportion Test

	Chi Square Statistic	P Value
<i>Neighborhood 4</i>	.734	.39
<i>Neighborhood 23</i>	.215	.64
<i>Neighborhood 44</i>	2.576	.11
Degree of Freedom= 1		

These results are encouraging in that they do not indicate any significant differences between the sample and census neighborhood traits, although the aforementioned caveat should not be forgotten.

The proportion of the neighborhood population between the ages of five and eighteen as indicated by both the census and the sample was also examined. The null hypothesis used was that the proportion of the neighborhood population between the ages of five and eighteen is the same between the survey and the census. Based on the results in the Table 4-5, there does not appear to be a significant difference between the demographic makeup of the neighborhoods tested as shown by the survey sample and the census. Yet again, however, the interpretation of the results should bear in mind that the degree of precision in determining the neighborhood traits according to the census data was not as precise as those traits determined by using the GITS program.

Table 4-5 Sample vs. Census Proportion of Children Test

	Chi Square Statistic	P Value
<i>Neighborhood 4</i>	1.49	.22
<i>Neighborhood 23</i>	.565	.45
<i>Neighborhood 44</i>	2.576	.14
Degree of Freedom= 1		

A final test of the attributes of the sample versus the whole of Missoula was carried out by means of a simple t-test between the mean annual income of survey respondents against the mean annual income of the population of Missoula as indicated by the census. A comparison of the income data for all of the sample rather than a neighborhood by neighborhood comparison was carried out because of the lack of disaggregated income data. The results are located in Table 4-6

Table 4-6 Sample vs. Census Income Test

Mean Annual Income Missoula	Mean Annual Income Survey
\$32,502	\$30,259.62*
Standard Error:	\$898.23
Degrees of Freedom=399	
*Statistically Significantly Different from Each Other at .01 Error Level	

These results seem to indicate that the mean annual income of the sample is different from the mean annual income of Missoula. It should be recalled, however, that the census-based figure is an extrapolation of a five-year old statistic which is strongly dependent upon the estimates of inflation between the time the data was gathered and the time the survey was conducted. The extrapolated income value may not be particularly accurate, but it is unfortunately the only figure currently available.

While the chi-squared tests between the sample and census demographic attributes do not suggest any sampling biases and therefore

support the CVM, an alternative approach to analyzing the CVM survey for both biases and adherence to the expectations of economic theory is to employ regression analysis as a diagnostic. Unlike the two accounting techniques, a regression can positively ascertain the impact of any surveyor or survey introduced biases and whether or not those biases are statistically significant. Tests on the survey methodology can be run and the usefulness of employing the 1980 census neighborhoods examined. Regression can also determine whether or not the marginal values of leisure behave in a manner consistent with the expectations of neoclassical microeconomic theory by testing for differences between values for different leisure activities.

In order to do that, the regression model must first be specified generally. As noted earlier, to avoid potential simultaneity and multiple response biases, the model must be a reduced form equation employing only exogenous variables and it must employ the random effects model. Drawing on the original marginal value curve discussed previously and after the inclusion of the bias and validity checking variables, the regression analysis of the data began with the general model of:

$$WTP_{ij} = \alpha + \beta \text{frequency}_{ij} + \gamma \text{socioeconomic data}_j + \delta \text{income}_j + \varepsilon \text{activity}_i + \phi \text{form} + \eta \text{interviewer} + u_{ij} + v_j$$

From this opening regression, the impact of the various factors on Net WTP could be assessed and a total value calculated. Yet again, Net WTP was chosen since it represents the residual value above and beyond cost placed

upon a leisure activity by a respondent and is the figure primarily used throughout this paper for analysis.

Several alternative models, including both a Classic OLS and a Random Effects Model, were tried, and the best fitting model is reported here. This model is a Random Effects Model, chosen after several alternatives proved either inappropriate or inestimable. A Classic OLS was not appropriate since the Random Effects Model indicated that there was a small, positive correlation between the residual errors equal to 0.021395. The classic normal linear regression model assumes that the residual errors are completely independent, so this correlation is a violation of the assumptions of the Classic OLS model. A Fixed Effects Model proved, as expected, to be largely inestimable due to multicollinearity. Additionally, a Lagrange Multiplier Test against an OLS Model supported the choice of a Random Effects Model. With a chi-squared test statistic of 25.32 and 1 degree of freedom, the p value is 0.0, indicating that the OLS Model should be rejected in favor of the Random Effects Model. Clearly, the Random Effects Model is the appropriate model.

After stepping down from a model incorporating all possible frequency, socioeconomic, interviewer dummy, form dummy, and activity variables, the model with the best fit (albeit not a particularly good fit with an R-squared of only 0.016429) incorporated only the following variables: the dummy variable for retirement; the month, week, and year frequency dummy variables; the interviewer dummy variables for groups 1, 4, and 6; and the activity dummies for activities 7, 8, 11, 21, and 22. These leisure activities are Eating at Home, Eating Outside the Home, Hunting/Fishing, Vehicular Travel, and

Religious/Spiritual Activities respectively (the same activities were significant in the marginal value regression). The other socioeconomic variables - hours worked, employment status, weekly 2-week "take-home" pay, gross annual income, age, gender, education, number of people in the household, number of children and ages of children - all proved insignificant and were excluded from the regression. The results for the included variables of the general regression model are found in Table 4-7.

Table 4-7 Random Effects Model Regression Results

Net WTP	
Marginal Value	
Retd	-5.5711***
<i>Std Error</i>	1.363
Week	-2.9666***
<i>Std Error</i>	0.9967
Month	-3.0777**
<i>Std Error</i>	1.276
Year	-6.3538***
<i>Std Error</i>	1.902
IV1	-2.9256**
<i>Std Error</i>	1.401
IV4	4.5217*
<i>Std Error</i>	2.665
IV6	5.1754***
<i>Std Error</i>	1.615
L7	-5.4247***
<i>Std Error</i>	1.809
L8	-4.935***
<i>Std Error</i>	1.74
L11	16.791***
<i>Std Error</i>	3.023
L21	-3.3448*
<i>Std Error</i>	1.928
L22	8.8011***
<i>Std Error</i>	2.513
Constant	7.2044***
<i>Std Error</i>	0.7619

R-Squared: 0.01643

*Significant at 0.10 Error Level

**Significant at 0.05 Error Level

***Significant at 0.01 Error Level

REM vs. OLS Lagrange Multiplier Test

(1 d. of f.): 25.32211***

n=6593

The results obtained here are virtually identical to those found with the marginal value regression alone. The fact that almost all of the socioeconomic variables contributed little to the understanding of leisure should not be taken as an indictment of the CVM. The use of these variables to explain marginal values is essentially an attempt to quantify and model people's preferences and productive means, and either that may not be possible or it may not be important. As far as the interpretation of those variables which were significantly different from zero, theory does not really predict how these variables should relate to the marginal values so there are several possible explanations.

Retirement appears to exert a strong negative influence on reported marginal values. The age of most retirees may limit their ability to engage in leisure, so the negative coefficient for retirees may reflect a frustrated ability to enjoy the leisure which they can consume. Alternately, it could be that their tastes and preferences are a product of a different generation and the retirement variable is capturing the effects of that difference.

The frequency variables are essentially seasonality measures, and the lower incidences of consumption for activities with longer intervals between acts may reflect a lower demand leading to a lower value. The negative coefficients on the frequency variables, while of unclear economic interpretation, may suggest that conclusion.

All of the other variables incorporated in the regression are specifically related to testing the validity of the CVM instrument and the adherence of reported values to economic theory.

The results obtained from the regression as far as the form and interviewer variables are for the most part encouraging. The form variable was not significant and was excluded from the final model. Since other CVM surveys have found biases introduced by the ordering of questions on the survey form, the lack of significance for this variable indicates that the survey form did not inform the reported values. This adds support to the use of the CVM and the open-ended format in particular.

Of slightly greater concern is the presence of interviewer dummies in the final model. Their presence would seem to indicate that interviewers in some way informed the values reported. To test the influence of interviewers, thirty-four distinct interviewer groups were identified and assigned dummy variables. Quite a few of these groups were simply different combinations of each other, so the dummies for those groups were compressed into single dummies and as a result of that compression, only 21 interviewer dummy variables actually entered into the regression. Of these 21 interviewer groups, 18 proved insignificant and were dropped from the regression. The three significant groups were retained. Of these three groups, IV4 is significant only at the 0.10 error level and is of minimal concern. The other two groups, IV1 and IV6, are significant at the 0.05 and 0.01 error levels respectively and have more serious implications. However, it should be noted that at the 0.05 error level it is reasonable to expect that one of the 21 groups may appear significant. Two of the 21 groups appearing to be significant at this level is only one over the expectations of probability and provides no solid evidence of an interviewer introduced bias.

To further test the influence of the interviewers, a partial F test was run assessing the impact of the dummy variables as a group. With 3 and 6580 degrees of freedom and a null hypothesis that all of the coefficients were equal to zero, the F-statistic was 6.5536 and significantly different from zero at the 0.05 error level. Since two groups of interviewers were significant at this level within the regression, the results of this test are by no means unexpected and not particularly worrisome. In this particular study, surveyor biases do not appear to be a major point of concern.²

To return to the issue of adherence to economic theory and the failure of CVM studies to arrive at plausible values noted earlier, it should be noted that yet again, the marginal values are for the most part equal. Those activities which were significantly different in the earlier marginal value regression were significantly different here, as well as two other activities, Leisure Activities 21 and 22. As with the other activities previously discussed, these also have reasonable explanations.

The negative coefficient on vehicular travel for recreation may be an indication of overconsumption and dissatisfaction with a trip. As in the case of eating, the expectations of the trip may have been more attractive than the actual experience, hence the lower value.

The last of the activities possessing a significantly different marginal value is religious/spiritual activity. Next to hunting, this category of activities has the largest positive coefficient, indicating that the values for religious activities are greater than most other forms of leisure. Given that religion may draw on a different set of values than those typically used in making economic decisions, the difference is by no means unexpected.

As noted with the marginal value regression, it would appear that at the margin people have pushed their leisure activities to the point where their values are equal. Such behavior is typical of rational utility maximization and conforms to the expectations of economic theory. Yet again, in this study the implausibility and irrationality problems encountered by other researchers do not appear to be an issue.

Since the initial regression results and the annual per capita values for leisure found above using the simple CVM accounting method and the Nordhaus-Tobin method as well as both the marginal value and bias-checking random effects regression superficially conform to the expectations of rational utility maximization, a more specific check of the data should be undertaken to determine if this behavior is consistent throughout the results of the CVM survey. Checking the plausibility of the acquired values for leisure by comparing the marginal values of different leisure activities and determining whether or not they adhere to the assumptions of neoclassical economics with regard to utility maximization provides another validity check of the survey methodology. Specifically, in accordance with neoclassical theory, the marginal values should be equal. If the values are not equal, people place a higher value on one activity than another and they would be better served doing more of the higher value activity than of the lesser. Meeting this criteria would indicate not only that people are behaving rationally and are maximizing their utility but also that the CVM is able to acquire the appropriate values. Receiving a value through the survey which does not appear rational or which does not match the *a priori* assumptions of theory typically raises more questions about the validity of the survey instrument itself than of the theory.

Inequality without some plausible alternative explanation such as excessive constraints can be taken as a failure to adhere to the appropriate utility maximizing conditions or as the failure of the CVM to capture the appropriate value.

Comparing marginal values involved techniques similar to those used to estimate the marginal value equation. Basically, a Random Effects Model regression was run employing only the marginal net willingness to pay responses and the dummy variables representing activity. The Random Effects Model was chosen after a Classic OLS and a Fixed Effects Model were rejected. The Classic OLS was rejected due to a positive correlation between the uncorrected stochastic errors while the Fixed Effects Model was discarded when a Lagrange Multiplier chi-squared test statistic of 33.65 with 1 degree of freedom and p-value of 0.0 indicated that the Fixed Effects Model was inappropriate. By using only the marginal values and the activity dummies, the constant would capture the mean marginal willingness to pay of the base case (sleep was used as the base case because response rates for it were 100%) and all of the other excluded factors with the various activity dummies showing the variation between values accounted for by the activities. A dummy whose coefficient was significant would indicate that the marginal values for that activity were significantly different from the base case of sleep. While such a regression may seem superficially to be a specification error, it is actually more along the lines of an ANOVA, except that this technique allows the exact determination of between groups effects. Additionally, the null hypothesis for this model is that all variation within willingness to pay is a function of the activity and that marginal values are in

fact a constant. Given the poor results from the other regressions, that is not an unreasonable hypothesis.

After carrying out the regression net willingness to pay, the results in Table 4-8 were achieved:

Table 4-8 Net WTP Marginal Value and Activity Regression

		Net Marginal WTP
<i>Napping</i>	D2	-2.4382
	Std Error	2.659
<i>Personal Hygiene</i>	D3	0.4763
	Std Error	2.311
<i>Movies, Plays, etc</i>	D4	-4.9695*
	Std Error	2.398
<i>Parties/Bars</i>	D5	-4.9043
	Std Error	2.521
<i>Socializing</i>	D6	-2.2399
	Std Error	2.317
<i>Eating at Home</i>	D7	-5.0326*
	Std Error	2.313
<i>Eating Outside Home</i>	D8	-8.333**
	Std Error	2.323
<i>Attending Sporting Event</i>	D9	-6.9574*
	Std Error	2.56
<i>Org. Comp. Sports</i>	D10	-1.1795
	Std Error	3.628
<i>Hunting/Fishing</i>	D11	11.048**
	Std Error	2.948
<i>Outdoor Activities</i>	D12	-1.7938
	Std Error	2.397
<i>Exercise</i>	D13	-2.1794
	Std Error	2.468
<i>Music/Radio</i>	D14	-3.7549
	Std Error	2.381
<i>TV/Videos</i>	D15	-4.4022
	Std Error	2.325
<i>Reading</i>	D16	-3.7326
	Std Error	2.339
<i>Relaxing/Nothing</i>	D17	-1.3806
	Std Error	2.455
<i>Volunteering</i>	D18	-1.9918
	Std Error	3.156
<i>Playing with Pets</i>	D19	-0.88675
	Std Error	2.852
<i>Hobbies/Crafts</i>	D20	-2.8172
	Std Error	2.857
<i>Travel</i>	D21	-6.9723**
	Std Error	2.475
<i>Religious/Spiritual</i>	D22	2.3241
	Std Error	2.783
	Constant	7.5678**
	Std Error	1.653

R-Squared: 0.01084

*Significant at .05 Level

**Significant at .01 Level

n=6593

Given the results in Table 4-8, it would appear that for the most part, people are in fact behaving rationally and that their marginal values are equal.

The significant coefficients, D4, D7, D8, D9, D11, and D21, are the dummy variables for "Movies, Plays and Concerts", "Eating at Home", "Eating Outside the Home", "Attending Sporting Event", "Hunting/Fishing" and "Recreational Travel". The coefficients on all but the very heavily constrained "Hunting/Fishing" are negative, suggesting that the marginal values for these activities are significantly lower than for other activities. All of the negatively signed coefficients are for activities which have market money costs that may account for the majority of consumers' values for these activities. Also, to a certain extent, all of these activities depend upon expectations prior to their consumption. These negative values may indicate that the experience of the activity once it was actually consumed did not meet the *a priori* expectations of the consumer and the consumer was disappointed. Examples may be such things as watching a movie that did not match its billings or attending a sporting event which was not as exciting as hoped. A failure to maximize utility due to a misinformed choice is not all that worrisome empirically since it is always a distinct possibility in a world without perfect information.

Additionally, most of these activities are social activities, and the negative values may be caused by some failure to maximize utility due to a joint utility function. All in all, most of these apparent failures to maximize utility and to equilibrate values at the margin have plausible explanations. Since the empirical world is a messy and frequently misinformed place, none of these differences are particularly worrisome. For the most part, it would appear that people are behaving rationally. The fact that people were able to respond rationally with meaningful values would support not just the CVM itself, but the open-ended question format as well.

The final test involving regression analysis is a test of sampling procedure similar to the test of equivalent marginal values. The Net Marginal WTPs were regressed on the neighborhood dummy variables. In theory, the effects of all of the excluded variables should be captured in the constant and error terms while the dummy variables should capture the effects of the different neighborhoods.

Since the neighborhoods were created by the census based on greater socioeconomic differences between the neighborhoods than within them, significant differences between the reported marginal values attributable to the different neighborhoods would support the use of a geographically weighted sample and suggest that major generalizations from the data should keep the regional differences strongly in mind. Insignificant contributions would indicate that as far as the marginal values of leisure are concerned, there are no appreciable differences between neighborhoods and broad generalizations can be made without too many reservations. The results of these tests are contained in Table 4-9.

Table 4-9 Net WTP Marginal Value and Neighborhood Regression

Net Marginal WTP			
N2	1.9405	N24	5.3945
Std Err	4.918	Std Err	4.124
N3	-0.55573	N25	-1.7662
Std Err	3.336	Std Err	3.933
N4	-2.2314	N26	0.32835
Std Err	4.048	Std Err	4.231
N5	-1.0335	N27	4.1009
Std Err	3.696	Std Err	4.522
N6	-1.0394	N28	-1.5093
Std Err	3.691	Std Err	3.767
N7	-0.002185	N29	0.27673
Std Err	3.61	Std Err	4.959
N8	-1.575	N30	-0.61731
Std Err	4.664	Std Err	4.124
N9	0.5257	N31	-0.065038
Std Err	3.547	Std Err	4.708
N10	5.5536	N32	4.976
Std Err	3.453	Std Err	5.094
N11	-1.3139	N33	0.32756
Std Err	3.904	Std Err	4.134
N12	-0.24282	N34	-3.0305
Std Err	3.454	Std Err	4.312
N13	-2.6964	N35	-2.7632
Std Err	4.6	Std Err	4.24
N14	0.71409	N36	-1.9073
Std Err	3.634	Std Err	4.359
N15	3.4462	N37	1.1182
Std Err	3.941	Std Err	5.403
N16	-0.26169	N38	-9.5711**
Std Err	4.812	Std Err	4.21
N17	-0.84133	N39	2.7544
Std Err	3.822	Std Err	4.654
N18	2.2143	N40	-0.927
Std Err	4.729	Std Err	3.916
N19	1.1015	N41	0.58682
Std Err	3.845	Std Err	3.905
N20	0.93933	N42	-1.2523
Std Err	4.605	Std Err	4.841
N21	1.5491	N43	-3.1318
Std Err	3.738	Std Err	6.653
N22	2.6556	N44	0.97675
Std Err	4.181	Std Err	4.701
N23	-2.0336	Constant	4.6245*
Std Err	5.977	Std Err	2.412

R-Squared: 0.00566256

* Significant at 0.10 Error Level

** Significant at 0.05 Error Level

*** Significant at 0.01 Error Level

The results for Net WTP are for the most part encouraging. The model chosen was a Random Effects Model after model specification tests rejected alternative models. The constant was marginally significant at the 0.10 error level, and only one of the neighborhood coefficients was significant. That neighborhood, N38, was significant at the 0.05 error level. At that error level it is reasonable to expect 2 of the 44 neighborhoods to appear significant, so one significant neighborhood is less than expected. It would seem, then, that while census data indicates differences between the neighborhoods, the marginal values of leisure would not. Regional differences do not exert a significant effect on reported marginal values and extrapolation of values for all of Missoula from the per capita values derived here would not seem to involve excessive or indefensible assumptions about the general nature of values across the Missoula metropolitan area.

On the whole, after all of the tests for biases and rationality were conducted only minor sample and surveyor biases were found and no form influences found. Additionally, the responses appeared to conform to the expectations of economic theory and do not appear to be irrational. The overall success of the survey supports not only the choice of employing the CVM but the decision to use the open-ended question format as well.

5. Conclusions

In 1993, the last year for which data was available, per capita Gross Domestic Product was equal to \$24,683.13.(E.R.O.P., 1994) When compared to the per capita annual Net WTP value of \$66,486.91 from the survey used here, the value of consumed leisure is over two times the size of the annual value of market production of goods and services per person. Extrapolating the per capita annual Net WTP value to a national figure leads to a sum equal to \$17 trillion - an absolutely mind-boggling figure that dwarfs other measures of national income. Failing to incorporate leisure in national income accounts understates the value of the nation's time by almost two-thirds.

In the past, this unaccounted-for time could not be measured or valued. The rise of the CVM has provided a way to assess the value of this time. While the CVM has proven to be a contentious instrument in other fields of economics and subject to numerous types of biases, this study found no such difficulties, a finding of significant import to the growing body of literature surrounding the CVM. The order of the questions in the form, the surveyors involved - none showed conclusive evidence of any of the biases found by other researchers. Additionally, the values reported conformed to the expectations of economic theory and do not appear to be implausible or unrealistic, which would support the use of an open-ended question CVM survey. For leisure at least, the results from this study would seem to allay many of the problems found in other CVM related studies. In light of the relative success of this survey, there would seem to be no barriers to the

inclusion of CVM-derived leisure values in national income accounts, nor should exploration of the uses of the CVM cease.

The use of CVM-based leisure values need not stop at simply filling in gaps in current national income accounts. By indexing the changes over time of the per capita net annual WTP and comparing those changes to changes in other measures of national wealth and personal income, it may be possible to finally answer questions of the type posed in the introduction. Changes in the standard of living as they relate to both income and leisure time could finally be quantified and evaluated by comparing the relative changes in both figures and drawing conclusions based on long-run observations of their comparative values. That type of analysis, however, would have to be conducted over a much longer term than the data available through this pilot study alone allows. The fact that this study was possible, though, does indicate that such a study is feasible and does provide a general direction for further analysis.

Additionally, the fact that wages do not appear to provide a good estimate of the marginal value of leisure time would indicate that people are unable to maximize and equilibrate these activities. The difference between the CVM accounting figures and the Nordhaus-Tobin values provide an annual, per-capita value for the imperfection of labor markets. That value could be of long-run importance to labor economics in both measuring changes in the relative competitiveness of the labor market and in indicating whether work weeks need to be increased or decreased.

CVM-derived leisure values may also prove useful to other branches of economics as well. Currently, in death or injury cases, forensic economists estimate the value of lost leisure time by using lost wages as the value of the

lost time and discounting those values over time. In light of the findings here where the values gained by using the Nordhaus-Tobin wage method offered values significantly lower than overall Net WTP values, that practice appears to underestimate the value of time. Forensic economists may find that using the values for individual leisure activities acquired by CVM studies provides them with better estimates of the value of time lost through injuries and accidents. Yet again, while this study points the way for potential uses of leisure value data gathered through CVM studies, further research is needed to confirm this possible use of the data.

Microeconomists may also find use for data such as this as well. Extending beyond the rather simple tests of rationality employed in this study, microeconomists could examine non-market activities for rational behavior consistent with the predictions of theory. Microeconomic theory could be applied to more than just market behavior, and universal theories encompassing both market and nonmarket time developed.

All in all, this study holds great promise for the future. Valuing leisure through a CVM instrument does not seem prone to any of the problems found in other studies employing this methodology. The success here supports the further application of this unique and valuable tool to other leisure related questions.

Endnotes

¹ Using a wage rate more closely tied to Missoula would have been preferable, but unfortunately such a figure was simply not available. A wage rate created from sample data was considered, but only 69% of the respondents reported any weekly work hours or biweekly "take home" pay from which wages could be constructed. In light of that, the national non-agricultural wage seemed to be the best available statistic.

² Given that individual interviewers were frequently associated with specific neighborhoods, the possibility existed that the interviewer dummy was actually capturing neighborhood effects. Alternative regression models designed to test for that possibility did not show significant neighborhood effects and it must be assumed that the interviewers themselves are the source of the variation.

SocioEconomic Variables

**THIS INFORMATION IS STRICTLY CONFIDENTIAL
AND WILL ONLY BE USED FOR RESEARCH**

Household Information

Number of children living at home _____ Ages _____

Marital Status

Married _____ Single _____ Cohabiting _____

Household gross yearly income \$ _____ # of people in household _____
(include transfer payments, such as social security, unemployment, etc.)

Individual Information

Market Employment:

Employed _____ Retired _____ Unemployed (and Looking) _____

Non-Market Employment (eg. Housewife) _____ Student _____

Years of Formal Education _____

(Include years through high school, eg. a high school graduate has 12 years)

Age _____

Gender

Male _____ Female _____

Hours worked per week _____ (Market employment only)

Individual two week take home pay (net) _____

Thank You for your cooperation!

Name:

Phone:

Address:

Appendix B: Steps to Avoid FUBARs*

THE INTRODUCTION

it is important to remember that the introduction will set the pace of the interview. Keys to gaining access to an interview are as follows:

- Identify yourself by name and that you are a student at the University of Montana.
- Explain that you are a student in an upper level economics seminar class in which you are conducting interviews to find out how people utilize their leisure time.
- Explain to the prospective interviewee that this interview will take a few minutes.

** It is important that you explain that the interview is done in COMPLETE CONFIDENTIALITY. This is important to mention, because it allows the interviewee to be more at ease with the questions and the subsequent responses you obtain.

ACTIVITY DEFINITIONS

- Refer to the list of Activities and Definitions and the Instruction Sheet for the definitions of the activities that you are questioning the interviewee about.
- RELIGIOUS/SPIRITUAL ACTIVITIES are to be defined as the last event the interviewee participated in. This event can include anything the interviewee did that they consider to be part of this broad activity. Activities may include church, prayers, spiritual contemplation, confession, grace, Bible study, etc. When asking about this activity let the interviewee define the activity for themselves whenever possible. Only give examples when necessary, because they could easily bias the response. Make sure the Frequency and Period are recorded accurately for the last unit of the specific religious activity referred to, not all activities the individual may be involved in.

NOTES CONCERNING THE ACTIVITIES LIST AND THE PROPER PROCEDURE IN RECORDING DATA ON THE LEISURE STUDY FORM

** ALL BLANKS MUST BE ACCOUNTED FOR!!!!

** If something is Non-Applicable record the space provided with N/A. Non-Applicable means that the interviewee has not participated in the activity at any time within the last year.

** Circumstances have arisen questioning what should be entered when confronted with a person who receives Social Security or any other form of income where the person is NOT gainfully employed. If the person is receiving income outside of a paycheck it is NOT TO BE INCLUDED IN AN INDIVIDUAL'S TWO WEEK TAKE HOME PAY! If they don't work then they cannot be bringing home any take home pay! This would constitute the

recording of an N/A under the Individual Two Week Take Home Pay. However this type of income should be included in the Interviewee's Household Gross Annual Income.

**** An Answer should be recorded as 0 (Zero) if the following circumstances apply:**

- The interviewee has participated in the activity at least once in the last year and received no personal satisfaction from the experience. (i.e., it was worth nothing to them at all.)
- If there was no extra monetary cost to perform the particular activity in question.
- If there are no children living at home, you should record 0 (Zero). Any space that follows, i.e. ages of children, should be recorded with N/A.

**** Many questions have arisen surrounding the recording of interviewee's years of FORMAL EDUCATION.**

- Formal education begins with first grade.
- A High School education is to be recorded as 12 years of formal education. If the interviewee has not completed 12 grades of school subtract the years missing from 12.
- Any subsequent years of education should, whenever possible, be added to high school education in terms of degrees:
 - Vocational and Technical Degrees = 2 years
 - Associate's Degrees or Community College Degrees = 2 years
 - Culinary School = 3 years
 - Normal Bachelor's Degrees = 4 years
 - Specialized Bachelor's Degrees, such as Pharmacy, Accounting, Engineering, Sciences, Architectural, etc., should be given 5 year program status. Double majors would also be given credit for a 5 year Bachelor's Degree.
 - Master's Degrees are not as readily defined, but should be considered to vary from 2-5 year programs. A normal Liberal Arts program should take 2 years while an M.S. in Chemical Engineering may take as long as 5.
- ** If confronted with a person who has more than 17 years of education, ask what the last degree achieved was.**
 - Law degrees will be credited with 3 years. Total education = 19 years.
- People with a Ph.D. should be able to figure out how many years of education they have without too much difficulty.
- People with a full year's work invested in a degree but have not yet received the degree should have these years added to their total years of education, including the last completed degree.

SOCIOECONOMIC VARIABLES

- The interviewees must be told of the ABSOLUTE CONFIDENTIALITY of these questions.
- ** Household Gross Annual Income must be obtained for the interview to be valid.
- ** Take Home Pay **MUST BE** current market employment. No paycheck, no take home pay!
- ** Without the interviewee's name or address, especially in the circumstances where questions arise, the interview will be useless because remedial efforts can not be made. Make sure to write this information on the interview form!

INSTRUCTIONS FOR ENTERING DATA ON THE LEISURE STUDY FORM

- You must be sure that you have entered the Neighborhood in the appropriate space. Without the neighborhood number the interview will be invalid.
- The Unit will be defined by the Event or Time. In the case of recording time make sure the last unit length coincides with the appropriate defined unit. If the Unit is defined in terms of being an event, outing, or meal, you must be sure to record the Unit Length under Last Unit Length. This value must be obtained from the Interviewee.
- Amount Willing to Pay is the definitive question we are trying to have answered; keep this in mind. It is important to remember that the interviewee answer must be obtained without any interviewer bias or influence. The interviewee must gain an understanding of the value that we are trying to obtain. In understanding this value, it is important to explain that these values are to derived WITHIN THEIR ECONOMIC MEANS! ALL ANSWERS for the Amount Willing to Pay must be derived from the last time the interviewee spent on the particular leisure activity. All answers must be accounted for. Non-applicable (N.A) and 0 (Zero) values are explained above.
- Extra Money Cost of Unit is defined as any extra monetary cost incurred while participating in the last unit of the activity in question. The interviewer must only take the cost of the last unit, not the average unit. It is also important to record any extra cost only for the last unit length, instead of the entire activity cost. An example of this entry can often be seen in T.V./Video Watching. If the interviewee has last seen a two hour movie which he/she has tented for \$3, the extra cost of unit would not be recorded as \$3, bur rather \$0 (not \$1.50) because the last unit length is 1 hour; remember we are looking for marginal cost, not average cost. If there is not Extra Money Cost for the Unit, it must be recorded as 0 (Zero) not N/A.
- Period for each activity should be defined in terms of participation on a daily, weekly, monthly or yearly basis. The frequency column is to be recorded with a number that is corresponds with the average number of times that the activity is done in an average period. The only time that these columns

should be entered as N/A is when the activity has not been participated in for the last year.

WHEN YOU HAVE FINISHED THE INTERVIEW, REVIEW THE FORM TO FILL IN ANY MISSED ANSWER SPACES AND CHECK FOR FUBARs. THIS WILL HELP TO ENSURE THE INTERVIEW FORM IS CORRECT AND UNNECESSARY PROBLEMS DO NOT ARISE.

* These instructions were produced collaboratively by the members of the Economics 494 seminar as a way to codify the lessons learned in the course of actually surveying people. The instructions change periodically as seminar members enter and exit the course and as research projects change. Incidentally, FUBAR, is interviewer slang for "fouled up beyond all recognition".

Appendix C: Definition List

1. Sleeping

UNITS: Last hour spent sleeping.

DEFINITION: period of slumber (excludes napping).

2. Napping

UNITS: Last 15 minutes spent napping.

DEFINITION: Time spent asleep outside normal sleeping period.

3. Personal Hygiene

UNITS: Last 15 minutes spent maintaining personal hygiene.

DEFINITION: Including all aspects of personal grooming (e.g. showering, shaving, brushing teeth, etc.) and going to the bathroom.

4. Movies, Plays, Concerts, etc.

UNITS: Last event attended.

DEFINITION: Includes all non-sporting performances attended in person (NOT VCR or cable TV viewing).

5. Parties and Bars

UNITS: Last outing.

DEFINITION: This category includes socializing at parties and/or taverns, night clubs, and bars.

6. Socializing/Conversation

UNIT: Last 15 minutes spent socializing.

DEFINITION: This category is to include telephone conversations and all other means of socializing not done in conjunction with any of the other activities or as the secondary objective of the event.

7. Eating Home Prepared Meals

UNITS: Last meal consumed

DEFINITION: Consuming a meal prepared at home; includes picnics and sack lunches.

8. Eating Meals Not Prepared at Home

UNIT: Last meal consumed.

DEFINITION: This category includes the consumption of all meals not prepared in one's home (e.g., eating out, eating delivered food, eating at friends an parents, etc.)

9. Attending Sporting Events

UNITS: Last event attended

DEFINITION: This involves only attending (in person) an "official" sporting event. Not to included practices and scrimmages.

10. Organized Competitive Sports

UNITS; Last event competed in.

DEFINITION: Category is to include all organized (scheduled, officiated and recorded) sporting events in which interviewee competed (e.g., intramurals, golf tourneys, league bowling, etc.)

11. Hunting/Fishing

UNITS: Last outing.

DEFINITION: This category includes all time actually engaged in either hunting for game or fishing.

12. Outdoor Activities

UNITS: Last hour spent.

DEFINITION: Time spent in the outdoors for the primary purpose of enjoying the out-of-doors (not to included exercising). This category includes hiking, boating, bird watching, snowmobiling, etc.

13. Exercise and Non-organized Sports

UNITS: Last hour spent exercising, etc.

DEFINITION: This activity should include but is not limited to : club athletics (aerobics, weight training, racquetball, etc.), swimming, jogging undertaken for the primary purpose of exercise, and other similar activities.

14. Music/Radio

UNITS: Last half hour spent listening to or playing music.

DEFINITION: Listening to music or playing a musical instrument (to include singing). Listening to sports and news programs would be included here.

Key: Must be primary activity.

15. TV/Video Watching

UNITS: Last hour spent viewing

DEFINITION: Time spent viewing TV to include video rentals and home recordings.

16. Reading

UNITS: Last half hour spent reading

DEFINITION: Any form of reading done for pleasure i.e. periodicals, circulars, novels and picture books (not to include reading done for work or school).

17. Relaxing

UNITS: Last 15 minutes spent relaxing

DEFINITION: This activity only includes time awake spent doing absolutely nothing (e.g. sunbathing and watching grass grow). This means TV watching, napping and music listening are not to be included in this category.

18. Volunteering

UNITS: Last hour spent doing volunteer work

DEFINITION: This activity includes work done for the church, community, or family and friends. Be careful not to include household production in this category.

19. Playing with Pet

UNITS: Last 15 minutes spent playing with pet

DEFINITION: Total time spent playing with pet (not to include the actual maintenance of the pet).

20. Hobbies and Crafts

UNITS: Last hour spent

DEFINITION: This is a very broad category. Could include knitting, model building, ceramics, flower gardening, etc.

21. Vehicular Travel

UNITS: Last hour spent

DEFINITION: Time spent while travelling in any vehicle (car, bus, train, etc.) not related to work activity.

22. Religious/Spiritual Activity

UNIT: Last religious or spiritual event.

DEFINITION: This could include church, prayers, spiritual contemplation, confession, grace, Bible study, etc.

Appendix D: Sample Descriptive Statistics

Descriptive Statistics

Variable	Mean	Std. Dev.	Skew.	Kurt.	Minimum	Maximum	Cases
WTP	9.8371	43.781	37.618	*****	0.0000	2500.	6661
EMC	5.0214	55.002	60.362	*****	-2.000	4000.	6594
ACTS	3.1678	4.3732	8.575	*****	0.0000	100.0	6592
AVG	2.1146	3.8584	14.780	*****	0.0000	96.00	2193
KIDS	0.67182	1.0514	1.770	6.491	0.0000	6.000	6661
K5	0.14818	0.35530	1.980	4.922	0.0000	1.000	6661
K12	0.17400	0.37914	1.720	3.957	0.0000	1.000	6661
MAR	1.6026	0.62181	0.525	2.368	1.000	3.000	6661
GROSS	30809.	18213.	1.119	4.669	2500.	0.1050E+06	6661
PEOP	2.5901	1.2491	0.951	4.279	1.000	8.000	6643
EMP	2.0080	1.5322	1.180	2.682	1.000	5.000	6661
EDU	14.797	2.6572	1.136	10.545	5.000	34.00	6661
AGE	37.983	16.601	1.032	3.371	4.000	89.00	6625
GEND	.4735	0.49934	0.106	1.011	1.000	2.000	6625
HRSWRK	36.896	12.220	-0.747	4.844	-0.9990	80.00	4871
WK2	945.97	1629.8	7.610	68.534	-0.9990	0.1800E+05	4813
NID	1960.7	1262.0	0.291	1.862	101.0	4408.	6661
LID	10.826	6.2860	0.104	1.804	1.000	22.00	6661
IVID	12.245	9.1462	0.816	2.702	1.000	34.00	6661

Appendix E: LIMDEP Program

```

read; nobs=6661; nvar=23; names=wtp, lul, emc, acts, avg, kids, k5,
k12, mar, gross, peop, emp, edu, age, gend, hrswrk, wk2, nid, annu, lid,
ivid, formid, nhood;
file=c:\schuck\thes66l.dat$
recode; hrswrk, wk2; -0.999=-999$
dstat; rhs=wtp, emc, acts, avg, kids, k5, k12, mar, gross, peop, emp,
edu, age, gend, hrswrk, wk2, nid, lid, ivid$
reject; emc<0$
reject; nid<0$
create; nwtp=(wtp-emc)$
?delete; nid$
delete; lul$
delete; avg$
?delete; wtp$
?delete; emc$
delete; acts$
?delete; formid$
?delete; gross$
?delete; hrswrk$
?delete; annu$
?delete; wk2$
?new dummies are sing, work, retd, house, stdt, male, week, month, year
create; if (mar=2) sing=1 ; (else) sing=0$
create; if (emp=1) work=1; (else) work=0$
create; if (emp=2) retd=1; (else) retd=0$
create; if (emp=4) house=1; (else) house=0$
create; if (emp=5) stdt=1; (else) stdt=0$
create; if (gend=1) male=1; (else) male=0$
create; if (annu=52) week=1; (else) week=0$
create; if (annu=12) month=1; (else) month=0$
create; if (annu=1) year=1; (else) year=0$
delete; emp$
delete; mar$
delete; gend$
delete; annu$
?delete; peop$
?delete; kids$
?delete; k5$
?delete; k12$
?delete; work$
?delete; retd$

```

```

?delete; house$
?delete; stdt$
?delete; sing$
?delete; male$
create; if (lid=2) l2=1; (else) l2=0$
create; if (lid=3) l3=1; (else) l3=0$
create; if (lid=4) l4=1; (else) l4=0$
create; if (lid=5) l5=1; (else) l5=0$
create; if (lid=6) l6=1; (else) l6=0$
create; if (lid=7) l7=1; (else) l7=0$
create; if (lid=8) l8=1; (else) l8=0$
create; if (lid=9) l9=1; (else) l9=0$
create; if (lid=10) l10=1; (else) l10=0$
create; if (lid=11) l11=1; (else) l11=0$
create; if (lid=12) l12=1; (else) l12=0$
create; if (lid=13) l13=1; (else) l13=0$
create; if (lid=14) l14=1; (else) l14=0$
create; if (lid=15) l15=1; (else) l15=0$
create; if (lid=16) l16=1; (else) l16=0$
create; if (lid=17) l17=1; (else) l17=0$
create; if (lid=18) l18=1; (else) l18=0$
create; if (lid=19) l19=1; (else) l19=0$
create; if (lid=20) l20=1; (else) l20=0$
create; if (lid=21) l21=1; (else) l21=0$
create; if (lid=22) l22=1; (else) l22=0$
create; group=ndx(nid,0); time=ndx(nid,1)$
dstat; rhs=nid, group$
delete; nid$
delete; lid$
regress; lhs=nwtp; rhs= wk2, hrswrk, sing, male, stdt, retd, house,
week, month, year, kids, k5, k12, gross, peop, edu, age; panel;
random; str=group; period=time; output=2; keep=sumsqdev; list$
reject; l7=1+l8=1+l11=1$
regress; lhs=nwtp; rhs= wk2, hrswrk, sing, male, stdt, retd, house,
week, month, year, kids, k5, k12, gross, peop, edu, age; panel;
random; str=group; period=time; output=2; keep=sumsqdev; list$
dstat; rhs=nwtp$
stop$
stop$
create; if (formid=2) fid2=1; (else) fid2=0$
create; if (ivid=1+ivid=2) iv1=1; (else) iv1=0$
?create; if (ivid=2) iv2=1; (else) iv2=0$
create; if (ivid=3+ivid=18+ivid=19+ivid=29+ivid=31) iv3=1; (else) iv3=0$
create; if (ivid=4) iv4=1; (else) iv4=0$

```

```
create; if (ivid=5) iv5=1; (else) iv5=0$
create; if (ivid=6+ivid=13+ivid=14) iv6=1; (else) iv6=0$
create; if (ivid=7) iv7=1; (else) iv7=0$
create; if (ivid=8) iv8=1; (else) iv8=0$
create; if (ivid=10) iv10=1; (else) iv10=0$
create; if (ivid=11+ivid=20+ivid=28) iv11=1; (else) iv11=0$
create; if (ivid=12+ivid=22+ivid=23) iv12=1; (else) iv12=0$
?create; if (ivid=13) iv13=1; (else) iv13=0$
?create; if (ivid=14) iv14=1; (else) iv14=0$
create; if (ivid=15) iv15=1; (else) iv15=0$
create; if (ivid=16) iv16=1; (else) iv16=0$
create; if (ivid=17) iv17=1; (else) iv17=0$
?create; if (ivid=18) iv18=1; (else) iv18=0$
?create; if (ivid=19) iv19=1; (else) iv19=0$
?create; if (ivid=20) iv20=1; (else) iv20=0$
create; if (ivid=21) iv21=1; (else) iv21=0$
?create; if (ivid=22) iv22=1; (else) iv22=0$
?create; if (ivid=23) iv23=1; (else) iv23=0$
create; if (ivid=24) iv24=1; (else) iv24=0$
create; if (ivid=25) iv25=1; (else) iv25=0$
create; if (ivid=26) iv26=1; (else) iv26=0$
create; if (ivid=27) iv27=1; (else) iv27=0$
create; if (ivid=28) iv28=1; (else) iv28=0$
?create; if (ivid=29) iv29=1; (else) iv29=0$
create; if (ivid=30) iv30=1; (else) iv30=0$
?create; if (ivid=31) iv31=1; (else) iv31=0$
create; if (ivid=32) iv32=1; (else) iv32=0$
delete; ivid$
create; if (nhood=2) n2=1; (else) n2=0$
create; if (nhood=3) n3=1; (else) n3=0$
create; if (nhood=4) n4=1; (else) n4=0$
create; if (nhood=5) n5=1; (else) n5=0$
create; if (nhood=6) n6=1; (else) n6=0$
create; if (nhood=7) n7=1; (else) n7=0$
create; if (nhood=8) n8=1; (else) n8=0$
create; if (nhood=9) n9=1; (else) n9=0$
create; if (nhood=10) n10=1; (else) n10=0$
create; if (nhood=11) n11=1; (else) n11=0$
create; if (nhood=12) n12=1; (else) n12=0$
create; if (nhood=13) n13=1; (else) n13=0$
create; if (nhood=14) n14=1; (else) n14=0$
create; if (nhood=15) n15=1; (else) n15=0$
create; if (nhood=16) n16=1; (else) n16=0$
create; if (nhood=17) n17=1; (else) n17=0$
```



```

create; if (nhood=18) n18=1; (else) n18=0$
create; if (nhood=19) n19=1; (else) n19=0$
create; if (nhood=20) n20=1; (else) n20=0$
create; if (nhood=21) n21=1; (else) n21=0$
create; if (nhood=22) n22=1; (else) n22=0$
create; if (nhood=23) n23=1; (else) n23=0$
create; if (nhood=24) n24=1; (else) n24=0$
create; if (nhood=25) n25=1; (else) n25=0$
create; if (nhood=26) n26=1; (else) n26=0$
create; if (nhood=27) n27=1; (else) n27=0$
create; if (nhood=28) n28=1; (else) n28=0$
create; if (nhood=29) n29=1; (else) n29=0$
create; if (nhood=30) n30=1; (else) n30=0$
create; if (nhood=31) n31=1; (else) n31=0$
create; if (nhood=32) n32=1; (else) n32=0$
create; if (nhood=33) n33=1; (else) n33=0$
create; if (nhood=34) n34=1; (else) n34=0$
create; if (nhood=35) n35=1; (else) n35=0$
create; if (nhood=36) n36=1; (else) n36=0$
create; if (nhood=37) n37=1; (else) n37=0$
create; if (nhood=38) n38=1; (else) n38=0$
create; if (nhood=39) n39=1; (else) n39=0$
create; if (nhood=40) n40=1; (else) n40=0$
create; if (nhood=41) n41=1; (else) n41=0$
create; if (nhood=42) n42=1; (else) n42=0$
create; if (nhood=43) n43=1; (else) n43=0$
create; if (nhood=44) n44=1; (else) n44=0$
create; if (nhood=1+nhood=3+nhood=9+nhood=13
+nhood=20+nhood=21+nhood=22+nhood=34
+nhood=42+nhood=44) sk1=1; (else) sk1=0$
create; if (nhood=5+nhood=10+nhood=12+nhood=15
+nhood=16) sk6=1; (else) sk6=0$
delete; nhoo$
create; group=ndx(nid,0); time=ndx(nid,1)$
dstat; rhs=nid, group$
delete; nid$
delete; lid$
?regress; lhs=wtp; rhs=l* $
?regress; lhs=wtp; rhs=n2, n3, n4, n5, n6, n7, n8, n9, n10, n11, n12, n13, n14,
?n15, n16, n17, n18, n19, n20, n21, n22, n23, n24, n25, n26, n27, n28,
n29,n30,
?n31, n32, n33, n34, n35, n36, n37, n38, n39, n40, n41, n42, n43, n44;
?panel; random; str=group; period=time; output=2$ $
?regress; lhs=wtp; rhs=n2, n3, n4, n5, n6, n7, n8, n9, n10, n11, n12, n13, n14,

```

```

?n15, n16, n17, n18, n19, n20, n21, n22, n23, n24, n25, n26, n27, n28, n29,
?n30, n31, n32, n33, n34, n35, n36, n37, n38, n39, n40, n41, n42, n43, n44$
?regress; lhs=nwtp; rhs=l* $
?regress; lhs=nwtp; rhs=n2, n3, n4, n5, n6, n7, n8, n9, n10, n11, n12, n13,
n14,
?n15, n16, n17, n18, n19, n20, n21, n22, n23, n24, n25, n26, n27, n28, n29,
?n30, n31, n32, n33, n34, n35, n36, n37, n38, n39, n40, n41, n42, n43, n44;
?panel; random; str=group; period=time; output=2$
?regress; lhs=wtp; rhs=n2, n3, n4, n5, n6, n7, n8, n9, n10, n11, n12, n13, n14,
?n15, n16, n17, n18, n19, n20, n21, n22, n23, n24, n25, n26, n27, n28, n29,
?n30, n31, n32, n33, n34, n35, n36, n37, n38, n39, n40, n41, n42, n43, n44 $
regress; lhs=nwtp; rhs=emc, wk2, hrswrk, sing, male, stdt, retd, house,
week, month, year, kids, k5, k12, gross, peop, edu, age, iv*, l*, fid2; panel;
random; str=group; period=time; output=2$
regress; lhs=nwtp; rhs= hrswrk, sing, male, wk2, stdt, house, retd,
week, month, year, gross, peop, edu, age, kids, k5, k12, iv1, iv3, iv4, iv6,
iv11, iv12, iv21, iv27, l2, l7, l8, l11, l12, l16, l21, l22,
fid2; panel; random; str=group; period=time; output=2$
regress; lhs=nwtp; rhs= retd,
week, month, year, iv1, iv3, iv4, iv6,
iv11, l7, l8, l11, l21, l22;
panel; random; str=group; period=time; output=2$
regress; lhs=nwtp; rhs= retd,
week, month, year, iv1, iv3, iv4, iv6,
l7, l8, l11, l21, l22;
panel; random; str=group; period=time; output=2$
regress; lhs=nwtp; rhs= retd,
week, month, year, iv1, iv4, iv6,
l7, l8, l11, l21, l22;
panel; random; str=group; period=time; output=2$
regress; lhs=nwtp; rhs= retd,
week, month, year, sk1, sk6,
l7, l8, l11, l21, l22;
panel; random; str=group; period=time; output=2$
?regress; lhs=nwtp; rhs=emc, week, month, year, gross, age, iv*, l*, fid2;
panel;
?random; str=group; period=time; output=2$
?dstat; rhs=iv*, l*; output=3$
?regress; lhs=nwtp; rhs= iv*; panel;
? random; str=group; period=time; output=2$
stop$

```

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