Using Contingent Behavior and Contingent Pricing Analysis to Improve the Valuation of Travel Cost Components

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Proposed Running Head: Value of Time and Transport Costs

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ABSTRACT

This paper uses contingent behavior and contingent pricing analyses to explore the proper valuation of time and transport costs within the context of recreation demand. The contingent behavior analysis poses hypothetical increases in access fees, travel time, and travel distance and considers recreation demand responses. As a useful complement, the contingent pricing analysis poses hypothetical decreases in recreation demand and then asks respondents to state the associated increases in travel costs in terms of the same three components. In particular, the contingent pricing analysis poses decreases that eliminate current demand levels (e.g., generate zero demand) and respondents state demand-choking cost increases. By comparing time-related responses and distance-related responses to fee-related responses, the two analyses estimate the proper valuation factors for time and transport components.

Keywords: Recreation, Travel Cost, Contingent Behavior, Contingent Pricing

JEL Classification Numbers: Q26, D12

1. Introduction

The proper valuation of time and transport costs is important for estimating the demand for several economic goods. Examples include automobile use (McFadden, 1974; Calfee and Winston, 1998), money (Mulligan, 1997), labor (Gronau, 1973; Grossbard et al., 1988), medical care (Cauley, 1987), energy (Deacon and Sonstelie, 1985), residential homes (Hochman and Ofek, 1977), air travel (De Vany, 1974), and household production goods (Becker, 1965). In the field of environmental economics, estimating the demand for recreational goods has a long history of research (Clawson, 1959; Bockstael, 1995). The main analytical framework is the travel cost model, in which travel costs (Apurchase price@) include access costs (e.g., entrance fee), transport costs (e.g., vehicle depreciation), and time costs (i.e., opportunity costs). In empirical analysis, time and transport costs generally represent a substantial portion of travel costs. Historically, economic analysis employed the travel cost model to examine actual recreational demand to measure revealed preferences over recreational goods. Recently, economic analysis has begun to employ an associated analytical method, contingent behavior analysis, to investigate intended demand under various circumstances (e.g., increase in entrance fee) to measure stated preferences over recreational goods. Unlike any previous economic analysis, this paper employs a highly similar type of analysis C contingent pricing, which investigates the implicit pricing for various demand levels. In particular, this paper forces respondents to consider the pricing associated with zero demand. This paper uses both contingent-based analyses to examine time and transport costs within the context of recreation demand.

Although valuation of time is critical to the analysis of recreation demand (Chavas et al., 1989), most analyses address it in an ad hoc fashion, such as exploring multiple adjustment factors and selecting the factor that generates the best goodness of fit (e.g., Layman et al., 1996). Few previous analyses address the monetary valuation of time (Bockstael et al., 1987; Smith et al., 1983; McConnell and Strand, 1981; Casey et al., 1995; Larson, 1993; Englin and Shonkwiler, 1995b; Feather and Shaw, 1999; Feather and Shaw, 2000). No previous travel cost study examines the valuation of transport-related costs. In general, it is difficult to address separately the individual components of travel costs C access fees, time costs, and transport costs C for two reasons. First, access fees do not vary across individuals and do not vary much across sites. Second, time and transport costs are highly collinear. Fortunately, contingent behavior analysis and contingent pricing analysis employed in this paper overcome both of these impediments by generating variation in access fees and orthogonal data with respect to travel time costs. Contingent behavior analysis forces current recreators to consider an increased entrance fee and travel time.[1] Contingent pricing analysis forces current recreators to state the necessary increase in entrance fee and travel time to choke off demand. By estimating the responses to hypothetical changes in access fees and travel time and estimating the demand-choking access fees and travel time, this paper explores the implicit trade-offs between money and time and provides better valuation of time costs. In a similar fashion, this paper examines the combination of time and transport costs by forcing recreators to consider increased travel distance and to state the necessary increase in travel distance to choke off demand. Lastly, this paper isolates the effect of increased transport costs and the demand-choking transport

[1] Most previous contingent behavior studies consider only changes in the access fee (Cameron, 1992; Herriges et al., 1999; Loomis and Gonzalez-Caban, 1997; Englin and Cameron, 1996). Surprisingly, no previous study considers an increase in travel time or distance. [Adamowicz et al. (1994) consider variation in travel distance within a multiple-site random utility framework.]

costs associated with increased travel distance. Then analysis explores the implicit trade-offs between money and transportation.

The rest of the paper is structured as follows. The following section theoretically frames the analysis of recreation demand. Section 3 depicts the empirical application to Clinton Lake in Kansas. Section 4 examines the implicit valuation of time and transport costs using contingent behavior and pricing analyses. Section 5 summarizes.

2. Theoretical Framework of Preferences and Behavior

2.1. Model for Revealed Preference Data

To motivate the need for contingent behavior and pricing analyses, I first describe a basic demand model that describes revealed preference (RP) data on recreation demand (Herriges et al., 1999). This model assumes that individual *I* allocates his/her income y_i between a composite commodity z_i^{RP} and a recreation good q_i^{RP}. This allocation depends on the price of the recreation good, denoted p_i^{RP} and titled Atravel costs@, and other factors, denoted x_i. The ordinary Marshallian demand function associated with the recreation good is the following:

$$q_i^{RP} = f^{RP} (p_i^{RP}, y_i, x_i; \beta^{RP}) + \varepsilon_i^{RP} , \quad (1)$$

where β^{RP} is the vector of unknown parameters and ε_i^{RP} is the additive stochastic term.

In theory and practice, the price of the recreation good, p_i^{RP}, generally consists of three components: (1) transport costs, t_i^{RP}, (2) time (or opportunity) costs, o_i^{RP}, and (3) access fees, a_i^{RP}, so that $p_i^{RP} = t_i^{RP} + o_i^{RP} + a_i^{RP}$. In theory, this decomposition permits the proper monetary valuation of transport costs (associated with travel distance) and time costs. [See Bockstael et al. (1987) and Smith et al. (1983) for models on the monetary valuation of time costs.] One can regress recreational demand against the decomposed travel costs, i.e., estimate the following equation:

$$f(q_i^{RP}) = \alpha^{RP} + \beta_t^{RP} t_i^{RP} + \beta_o^{RP} o_i^{RP} + \beta_a^{RP} a_i^{RP} + \beta_y^{RP} y_i + \beta_x^{RP} x_i \,, \qquad (2)$$

where the separate coefficients related to t_i^{RP}, o_i^{RP}, and a_i^{RP}, are denoted respectively β_t^{RP}, β_o^{RP}, and β_a^{RP}. If transport costs and time costs are <u>properly</u> measured in monetary terms, then the ratios $\beta_t^{RP}/\beta_a^{RP}$ and $\beta_o^{RP}/\beta_a^{RP}$ should both equal 1 (i.e., $\beta_t^{RP} = \beta_o^{RP} = \beta_a^{RP}$). If not true, these ratios represent the proper factor for adjusting the monetary valuation of transport and time costs, respectively, given the effect of access costs on demand as the proper benchmark.

In practice, decomposition of travel costs generally does not permit empirical analysis to calculate these adjustment factors with any confidence, if at all. First and foremost, access fees generally do not vary across individuals for a single site at a given time and generally vary little across multiple sites or time. Therefore, it is quite difficult to estimate β_a^{RP}. Second, travel distance and time are highly correlated (Bockstael et al., 1987; Bockstael, 1995). Therefore, multicollinearity undermines accurate estimation of the individual coefficients associated with transport and time costs, β_t^{RP} and β_o^{RP}, since it generates coefficients with wrong signs and/or implausible magnitudes (Greene, 1997). This concern notwithstanding McConnell and Strand (1981) exploit the monetary nature of transport costs and use the ratio of $\beta_o^{RP}/\beta_t^{RP}$ to estimate the ratio between the value of time and the wage rate. Their approach accepts the notion that individuals view transport costs at full value and disregards the concern of accurate estimation in the presence of multicollinearity.

Smith et al. (1983) also attempt to estimate separate effects for transport and time costs. They test whether time costs seem to be based on either full wage rates or one-third the wage rate as predicted by Cesario (1976). As expected, multicollinearity between these two types of costs generates contradictory signs for one of the effects in 12 of the 22 cases and implausibly large ratios between time value and wage rate for the majority of the remaining cases. These results undermine the validity of the McConnell and Strand (1981) approach.

2.2. Benefit of Contingent Behavior and Contingent Pricing Analyses

Fortunately, contingent behavior (CB) and contingent pricing (CP) analyses avoid these pitfalls. Consider contingent behavior. First, it can generate variation in access fees by asking respondents the following question: AHow many fewer recreational trips would you take if the access fee increases by \$ A?@ Second, contingent behavior analysis can generate data that contains orthogonal data on time and transport costs, respectively, by asking the following questions: AHow many fewer recreational trips would you take if your one-way travel time increased by B minutes?@ and AHow many fewer recreational trips would you take if the one-way distance from your home increased by C miles, yet your travel time remained the same?@ The former question poses an increase only in time costs, while the latter poses an increase only in transport costs. Unfortunately, the second question proves too difficult to implement within a survey format. Instead, the chosen survey question combines the effects of transport and time costs by asking the following question: AHow many fewer recreational trips would you take if your one-way distance from home increased by D miles?@ Although less analytically appealing then the initial question, it is much more realistic. Moreover, it is completely consistent with the common empirical approach of treating transport and time costs as a composite by measuring only travel distance and inferring travel time based on some fixed driving speed. With an additional step, the econometric analysis in Section 4.3.2 isolates the effect of transport costs on recreational demand by subtracting the Apure@ effect of time costs. The contingent behavior analysis also asks respondents to state their intended demand under actual / normal circumstances.

Contingent pricing analysis serves as the natural complement to contingent behavior analysis.

While CB analysis examines behavioral responses to various travel costs (Aprice@) contingencies, CP analysis examines the pricing responses to various behavioral contingencies, specifically, zero demand. In other words, contingent pricing asks for the price conditions under which demand is zero. Implicitly, the survey asks respondents to state the travel cost increase needed to choke off demand. Given their initial costs, these responses identify each respondent=s Achoke price@. In this sense, contingent pricing is similar to asking respondents for their maximum willingness-to-pay to recreate at some minimal level. Each CB question has its CP counterpart:

Access Fee: How much would the access fee need to increase before you would stop visiting?

Travel Time: How much would the travel time need to increase before you would stop visiting?

Travel Distance: How much would the travel distance need to increase before you would stop visiting?[2]

2.3. Model for Contingent Behavior and Contingent Pricing Data

2.3.1. Contingent Behavior Data

Similar to revealed preference data, the stated responses to the four contingent behavior questions and the three contingent pricing questions (all forms of stated preference data) stem from

[2] Even though both the CB analysis and the CP analysis are able to measure the trade-offs between travel cost components, the former analysis asks respondents to perform a presumably more familiar calculation of deciding visitation levels, while the latter analysis asks respondents to perform a presumably less familiar calculation of identifying their maximum willingness-to-pay.

an underlying set of preferences or its associated demand equation. First, I construct a model for exploring the contingent behavior data, later I fit the contingent pricing data into this model. The demand model describing the contingent behavior (CB) data assumes that individual *I* allocates his/her income y_i between a composite commodity z_i^{CB} and a recreation good q_i^{CB}. This allocation depends on the price of the recreation good, $p_i^{CB} = t_i^{CB} + o_i^{CB} + a_i^{CB}$, and other factors, x_i. The ordinary Marshallian demand function associated with the recreation good is the following:

$$q_i^{CB} = f^{CB}(p_i^{CB}, y_i, x_i; \beta^{CB}) + \varepsilon_i^{CB}, \qquad (3)$$

where β^{CB} is the vector of unknown parameters and ε_i^{CB} is the additive stochastic term, which is assumed to follow a normal distribution: $\varepsilon_i^{CB} \sim N(0,\sigma_{CB}^2)$. For generality and testing purposes, each survey question is constructed as stemming from a separate demand equation; i.e, preferences are allowed to vary across the respondents= consideration of various travel cost components. The CB equations regarding increased access fees, increased time costs, and increased composite transport and time costs (Ad@ stands for Adistance@) are shown below:

Increased Access Fees: $$q_i^{CBa} = f^{CBa}(p_i^{CBa}, y_i, x_i; \beta^{CBa}) + \varepsilon_i^{CBa}, \qquad (4a)$$

Increased Time Costs: $$q_i^{CBo} = f^{CBo}(p_i^{CBo}, y_i, x_i; \beta^{CBo}) + \varepsilon_i^{CBo}, \qquad (4b)$$

Increased Transport and Time Costs: $$q_i^{CBd} = f^{CBd}(p_i^{CBd}, y_i, x_i; \beta^{CBd}) + \varepsilon_i^{CBd}, \qquad (4c)$$

Note that three equations is warranted if either the equation coefficients or the variance associated with the error terms (σ_{CB}^2) varies across the three equations. (While econometric analysis could easily accommodate the possibility of contingent-specific coefficients within a single equation, accommodation of contingent-specific heteroskedasticity would most likely prove difficult.)

Intended demand under actual / normal circumstances represents levels of demand. Analysis of these contingent behavior data faces the same pitfall as analysis of revealed preference data. Therefore, analysis focuses on the other CB data. Yet all of the demand data are useful. The contingent behavior data on demand levels under actual circumstances (which represent ex ante demand level data) is used for addressing censoring issues in the CB analysis, as noted in Section 3.2, and for posing demand reductions in the CP analysis, as noted in Section 2.3.2. The revealed preference data on demand levels (which represent ex post demand level data) is used to weight observations correctly, as noted in Section 3.2.

Responses to the three contingent behavior questions noted above (i.e., Ahow many *fewer* trips ...?@) represent changes in demand. Therefore, the empirical analysis estimates these changes: Δq_i^{CBa}, Δq_i^{CBo}, and Δq_i^{CBd}, where Δ denotes a change in demand. The chosen question format purposively focuses on the link between changes in Aprice@ and changes in demand; the chosen analytical approach is completely consistent with this question format.

For the empirical analysis, I specify the functional form of demand for the CB data in both linear and semilog form to demonstrate robustness:

Linear:

$q_i^{CBk} = \alpha^{CBk} + \beta_t^{CBk} t_i^{CBk} + \beta_o^{CBk} o_i^{CBk} + \beta_a^{CBk} a_i^{CBk} + \beta_y^{CBk} y_i + \beta_x^{CBk} x_i + \varepsilon_i^{CBk}$, where $k \varepsilon \{n,a,o,d\}$.(5)

Semilog:

$\ln q_i^{CBk} = \alpha^{CBk} + \beta_t^{CBk} t_i^{CBk} + \beta_o^{CBk} o_i^{CBk} + \beta_a^{CBk} a_i^{CBk} + \beta_y^{CBk} y_i + \beta_x^{CBk} x_i + \varepsilon_i^{CBk}$, where $k \varepsilon \{n,a,o,d\}$.(6)

In the linear case, absolute changes in stated demand, Δq_i^{CBk}, relate to absolute changes in one or two of the price components C Δt_i^{CBk}, Δo_i^{CBk}, and Δa_i^{CBk} C in the following way:

$$\Delta q_i^{CBk} = \beta_t^{CBk}\Delta t_i^{CBk} + \beta_o^{CBk}\Delta o_i^{CBk} + \beta_a^{CBk}\Delta a_i^{CBk} + \sigma_i^{CBk}\text{, where } k\ \varepsilon\ \{a,o,d\}. \quad (7)$$

In the semilog case, relative changes in stated demand, $\Delta q_i^{CBk} / q_i^{CBk}$, relate to absolute changes in price in the following way:

$$\Delta q_i^{CBk} / q_i^{CBk} = \beta_t^{CBk}\Delta t_i^{CBk} + \beta_o^{CBk}\Delta o_i^{CBk} + \beta_a^{CBk}\Delta a_i^{CBk} + \sigma_i^{CBk}\text{, where } k\ \varepsilon\ \{a,o,d\}, \quad (8)$$

which follows from taking a total derivative of equation (6). Note that the analysis identifies β_a^{CBk}, effect of a_i, only in the CB dataset on increased access fees. Regression analysis estimates the three equations on demand change for each specification:

Linear:

$$\Delta q_i^{CBa} = \beta_t^{CBa}\Delta t_i^{CBa} + \beta_o^{CBa}\Delta o_i^{CBa} + \beta_a^{CBa}\Delta a_i^{CBa} + \mu_i^{CBa}, \quad (9a)$$

$$\Delta q_i^{CBo} = \beta_t^{CBo}\Delta t_i^{CBo} + \beta_o^{CBo}\Delta o_i^{CBo} + \beta_a^{CBo}\Delta a_i^{CBo} + \mu_i^{CBo}, \quad (9b)$$

$$\Delta q_i^{CBd} = \beta_t^{CBd}\Delta t_i^{CBd} + \beta_o^{CBd}\Delta o_i^{CBd} + \beta_a^{CBd}\Delta a_i^{CBd} + \mu_i^{CBd}. \quad (9c)$$

Semilog:

$$\Delta q_i^{CBa} / q_i^{CBa} = \beta_t^{CBa}\Delta t_i^{CBa} + \beta_o^{CBa}\Delta o_i^{CBa} + \beta_a^{CBa}\Delta a_i^{CBa} + \mu_i^{CBa}, \quad (10a)$$

$$\Delta q_i^{CBo} / q_i^{CBo} = \beta_t^{CBo}\Delta t_i^{CBo} + \beta_o^{CBo}\Delta o_i^{CBo} + \beta_a^{CBo}\Delta a_i^{CBo} + \mu_i^{CBo}, \quad (10b)$$

$$\Delta q_i^{CBd} / q_i^{CBd} = \beta_t^{CBd}\Delta t_i^{CBd} + \beta_o^{CBd}\Delta o_i^{CBd} + \beta_a^{CBd}\Delta a_i^{CBd} + \mu_i^{CBd}. \quad (10c)$$

Section 4 uses the regression results to examine the implicit trade-offs between money and time, between money and transport, and between money and distance-related factors (i.e., combination of time and transport).

2.3.2. Contingent Pricing Data

As with the CB analysis, the three CP questions concerning separate travel cost components permit analysis of the trade-offs between money and other travel cost components. Rather than developing another model to capture the CP data, I instead fit the CP data into the model developed for the CB data. Therefore, I am implicitly assuming that the CB and CP data stem from the same preference structure for each travel cost component. Denote the CP responses regarding demand-choking increases in access fee, travel time, and travel distance as Δa_i^{CPa}, Δo_i^{CPo}, and $\Delta o_i^{Cbd} + \Delta t_i^{CBd}$, respectively. For each CP question, the hypothetical change in demand is equal to the negative of the intended level under actual / normal circumstances: $- q_i^{CBn}$. Given this fact and the intrinsically linear construction of total travel costs ($p_i^{CB} = t_i^{CB} + o_i^{CB} + a_i^{CB}$), the analysis of trade-offs between individual cost components simplifies to a comparison of CP responses. If time and transport costs are measured properly relative to access fees, then all CP responses are equal. If not equal, the ratios of CP responses indicate the appropriate adjustments to time and transport valuation. Section 4 provides the complete analysis.

3. Application to Clinton Lake in Kansas

3.1. Data Collection

To examine the proper measurement of time and transport costs, this study surveyed actual and hypothetical recreation at Clinton Lake, a reservoir located near Lawrence, KS. The survey instrument was developed according to the responses of two focus groups C one representing water recreators and one representing fishermen C and a pretest of 10 respondents.[3] The survey was implemented on site at the Bloomington Park section of the Clinton Lake project managed by the U.S. Army Corp of Engineers. Recreation users were sampled at two locations: beach and boat dock. The survey was performed on weekdays and weekends during the months of July, August, and September in 1998. The interviewer contacted all adults who had not been previously interviewed

[3] A copy of the survey instrument is available from the author upon request.

at the research site. Unlike some previous studies, this study did not limit contact to only one person from each recreation group (Loomis and Gonzalez-Caban, 1997) since each recreator has his or her own time costs. In total, 310 surveys were completed.

The economic section of the survey instrument elicited information on the respondents= use of Clinton Lake: ex post visitation (previous 12 months) and travel costs (one-way travel distance and time). The economic section also elicited information on respondents= contingent behavior and contingent pricing by posing these questions:

(1) How many times do you intend to visit the lake <u>in the next 12 months</u>?

(2a) Suppose that, for each visit to Clinton Lake, you and other visitors were charged an additional fee of $ 3.00, and the collected fees were pooled with general federal revenues. How many <u>fewer</u> times <u>in the next 12 months</u> would you visit?

(2b) How much would this additional fee need to be in order for you to stop visiting the lake altogether?

(3a) If you moved 20 miles farther away from Clinton Lake, yet remained the same distance from other recreational sites, how many <u>fewer</u> times <u>in the next 12 months</u> would you visit Clinton Lake?

(3b) How much farther away (in miles) would you need to be in order for you to stop visiting the lake altogether?

(4a) If there was no change in your current residence but your travel time to the lake increased by 30 minutes (due to construction, for example), how many <u>fewer</u> times would you visit the lake <u>in the next 12 months</u>?

(4b) How much longer (in minutes) would your travel time need to be in order for you to stop visiting the lake altogether?

These questions force the respondent to re-examine its intended visitation rather than reconsider in hindsight its previously chosen visitation. Consequently, the responses are linked to the reported ex ante visitation. This approach seems more appropriate for a contingent framework.

The demographic section of the survey instrument gathers information on the following components: employment status, capacity to work at a paid job on the day of visit, and hourly wage or annual salary.[4]

From these reported data, I generate additional variables. I calculate respondents= travel costs associated with recreating at Clinton Lake using wage/salary data and one-way travel distance and time. Transport costs equal the product of two-way travel distance and 31.5 4 per mile, the IRS official rate of auto travel reimbursement for 1998. This paper later identifies the factor need to adjust this rate so that transport costs more accurately reflect individuals= valuation of transportation. Time costs equal the product of two-way travel time and the mid-point of the respondent=s identified wage bracket or salary bracket (except the top bracket, where the bottom point is used) after dividing salary by 2,000 hours per year. Thus, unemployed workers face no time costs and employed workers without capacity to work on the day of visit face time costs based on their full wage/salary. This paper later estimates the factors needed to adjust both of these restrictions so that time costs more accurately reflect individuals= valuation of time. Access fees equal $ 1 per person. Full

[4] The demographic section of the survey also gathers information on gender, age, marital status, existence of children, and zip code. The economic section of the survey also gathers details on duration of visit (day versus overnight), fishing activity (yes or no), catch rate of anglers, entrance into the lake water (yes or no), and the perception of water quality (scale of 1 to 5 from very low to very high). However, given the linear and semilog specifications and the focus on changes in demand and demand-choking travel cost increases, there is no need to consider non-price and non-quantity variables.

documentation on the database is available upon request from the author.[5]

3.2. Data Description

[5] For four observations, I estimate responses to questions regarding wage/salary based on age and gender. For two observations, I estimate one-way travel based on the zip code.

Prior to analysis of the collected and derived data, two adjustments are necessary. Intended changes in visitation are top censored at the level of intended demand under actual circumstances.[6] Estimation of these CB equations addresses the censoring issue by applying a Tobit model (Greene, 1997).[7] As an additional complication, the on-site survey design most likely oversamples individuals who visit more often, which leads to endogenous stratification (Loomis and Gonzalez-Caban, 1997). To accommodate this stratification, I weight each response by the reciprocal of ex post visitation frequency. Note that the contingent behavior and contingent pricing questions apply only to current visitors. Therefore, on-site sampling seems quite appropriate even though it generates a non-random sample of visitors.

After adjusting for the stratification, Table 1 displays the mean responses to the survey instrument. Of the 310 surveys completed, 256 of them provided complete information for all CB and CP questions. For consistency, this paper restricts its analysis to only these 256 observations with complete response data. The average recreator visited Clinton Lake 2.5 times in the previous 12-month period, intends to visit 3.8 times in the subsequent 12-month period, and faces \$ 17 time costs and \$ 20 transport costs per trip. In response to a \$ 3 increase in the access fee, the average

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[6] One could argue that intended changes in visitation are also bottom censored at zero since the survey did not permit increased visitation in response to increased travel costs. Since such responses would be economically irrational, the analysis ignores this possible censoring.

[7] I choose not to employ a count data model, such as Poisson, because nearly 10 % of the respondents visit Clinton Lake at least 20 times in a 12-month period and count data models poorly explain large integers (Englin and Shonkwiler, 1995a).

recreator takes 1.3 fewer trips, reducing its visitation by 33 %. The average recreator requires an increased fee of $ 5.92 to stop visiting. In response to a 20-mile increase in the one-way travel distance, the average recreator faces increased costs of $ 12 and takes 1.8 fewer trips, reducing its visitation by 45 %. The average recreator requires an increased one-way travel distance of 48 miles to stop visiting, i.e, increased distance-related costs of $ 58.63 that divide into $ 30.29 of transport costs and $ 28.34 of time costs. In response to a 30-minute increase in the one-way travel time, the average recreator faces increased time costs of $ 11 and transport costs of $ 13 and takes 1.7 fewer trips, reducing its visitation by 44 %. The average recreator requires an increased one-way travel time of 51 minutes to stop visiting, i.e., increased time costs of $ 21.65.

4. Regression Analysis and Adjustments to Travel Cost Valuation

4.1. Adjusting Time Costs

4.1.1. The Value of Time for Different Groups of Respondents

The survey instrument distinguishes people with and without employment and of those employed, people with and without the capacity to work on the day of their visit. Based on this information, I identify three categories of respondents:

(1) non-employed (including retired),

(2) employed without the capacity to work on day of visit C fixed work schedule,

(3) employed with the capacity to work on day of visit C flexible work schedule.

Based on previous research, economists anticipate that the value of time varies across these three categories of respondents because of differences in their time constraints and discretion to work during recreational time (Smith et al., 1983; Bockstael et al., 1987). Group (1) is not able to work during recreational time because it has chosen a corner solution regarding work allocation. Group

(2) is unable to work because it has chosen to work at a job that requires a fixed-work-week. Group (3) has the discretion to work during recreational time. While Smith et al. (1983) show that the opportunity cost of time is best treated as a nonlinear function of wage rates for all workers, Bockstael et al. (1987) show that no relationship exists between the wage rate and the opportunity cost of time for workers without the flexibility to trade time for work. Moreover, Bockstael et al. (1987) show that the wage rate serves as neither an upper nor lower bound on the opportunity cost of time for workers with a fixed work schedule. Consistent with these previous studies, this analysis examines the effects of travel costs, especially time costs, for each category separately, while recognizing that the wage rate may not be an appropriate reference for workers lacking the capacity to trade recreational time for work.

4.1.2. Contingent Behavior Analysis

Unlike analysis of revealed preference data, estimation of stated changes in demand (CB data) generates regression results that identify the effect of each travel cost component. First, estimation of demand changes prompted by increased access costs clearly identifies the coefficient on access costs: each coefficient is highly significant at the 1 % level and correctly signed. Second, estimation of demand changes prompted by increased travel time clearly identifies the coefficient on time costs: each coefficient is correctly signed and highly significant at the 1 % level. It proves useful to distinguish between types of workers since the effect of time costs significantly varies across types. Third, estimation of demand changes prompted by increased travel distance clearly identifies the coefficient on transport costs: each coefficient is statistically significant and correctly signed. (For this equation, the analysis initially decomposes increased travel costs into transport costs and time costs. Section 4.2 combines these costs. Section 4.3 isolates transport costs.

To improve the monetary valuation of time costs, this study first uses the CB data on demand changes to estimate the ratio of time costs to access fees ($\beta_o^{CBo}/\beta_a^{CBa}$). This ratio differs significantly from one for both employed worker types.[8] Therefore, time is inconsistently valued relative to access fees in the SP data on demand changes. The ratio of $\beta_o^{CBo}/\beta_a^{CBa}$ indicates the factor needed to adjust time costs so that time cost and access fees generate the same effect on demand. Consider first groups (2) and (3) C employed workers with fixed and flexible schedules. As shown in Table 2, employed workers on a fixed schedule value their time at approximately 21 % of their wage/salary rate, while employed workers on a flexible schedule value their time at 10 % of their wage/salary rate. These results are consistent with the theory described by Bockstael et al. (1987) and their empirical results in which workers on a fixed schedule valued the trade-off between money and time at more than three-fold the rate of workers on a flexible schedule.

Next, consider the valuation of time costs for the non-employed respondents. Since their opportunity costs are initially set at zero, I cannot generate an adjustment ratio for them. Nevertheless, I can calculate an implicit value of time. Responses by the non-employed to the CB question regarding increased travel time strongly reject the notion that their time is worthless. The mean responses of absolute and relative change in visitation (- 0.019 trips and - 47.0 %) are highly significant at the 1 % level (t-test statistics equal 3.74 and 7.48, respectively). Each mean response decomposes into increased time costs times the parameter translating opportunity costs into demand reduction, denoted γ. The first component decomposes further into the change in travel time (60 minutes) and the parameter translating time into costs, denoted θ. As estimated, β_o^{CBo} captures the ratio between the mean response and the increased travel time. Therefore, $\theta = \beta_o^{CBo}/\gamma$. β_a^{CBa}

[8] For the linear specification, Wald test statistics are 17.33 and 6.86, respectively for fixed- and flexible-schedule workers; for the semilog specification, the Wald test statistics are 30.93 and 37.86.

represents the parameter translating increased access costs ($ 3) into demand reduction. Letting β_a^{CBa} substitute for γ, since both translate increased travel costs into demand reduction, θ equals $\beta_o^{CBo}/\beta_a^{CBa}$. The two specifications generate very similar results, as shown in Table 2. Estimates are 0.0679 and 0.0728 C roughly 7 4 per minute or $4.20 per hour. These estimates seem very reasonable.

4.1.3. Contingent Pricing Analysis

As a natural complement to the contingent behavior analysis, contingent pricing analysis also improves the monetary valuation of time costs. For all three CP equations, the absolute and relative changes in demand are constant for all three CP questions / equations; i.e., absolute changes equal the stated level of demand under actual circumstances and relative changes equal - 100 %). Moreover, travel cost components linearly sum to total travel costs. Given these realities, if time is properly valued for employed respondents, the demand-choking cost increases associated with access fees (Δa_i^{CPa}) and with time (Δo_i^{CPo}) must equal: $\Delta a_i^{CPa} = \Delta o_i^{CPo}$. (Note that Δo_i^{CPo} uses wage/salary information as the proxy for time costs.) Put differently, the ratio of access fees to time costs ($\Delta a_i^{CPa} / \Delta o_i^{CPo}$) must equal one. This ratio differs significantly from one for both employed worker types.[9] Therefore, as with the CB analysis, time is inconsistently valued relative to access fees. The ratio indicates the factor needed to adjust time costs to that time costs and access fees generate the same effect on demand, i.e., choke off demand. As shown in Table 2, workers on a fixed schedule value their time at 24 % of their wage/salary rate, while workers on a flexible schedule value their time at 20 % of their wage/salary rate. These estimates are quite similar to CB estimates of 22 % and 10 %, respectively.

[9] The t-test statistics are 9.820 and 10.436, respectively, for fixed- and flexible-schedule workers.

Now consider the valuation of time costs for the non-employed respondents. As with CB analysis, I cannot generate an adjustment ratio for them since their opportunity costs are initially set at zero. Instead, I calculate an implicit value of time. Responses by the non-employed recreators to the CP question regarding demand-choking travel time strongly reject the notion that their time is worthless. The mean response of 88.85 minutes (two-way travel time) is highly significant at the 1 % level (t-test statistic equals 15.082). The ratio of demand-choking access fees to demand-choking travel <u>time</u> (measured in minutes) identifies the implicit value of time per minute. As shown in Table 2, this estimated value is 0.103 C roughly 10 4 per minute or $ 6 per hour. This ratio differs significantly from 0 (t-test statistic equals 6.729). This estimated value of time is quite comparable to the CB estimate of 7 4 per minute.

4.2. Adjusting Distance-Related Costs (Time and Transport Costs)

4.2.1. Discerning Time and Travel Costs from a Distance Increase

Next, the analysis examines distance-related costs, which involve both time costs and transport costs. As posed within the survey, the CB question and associated CP question on greater travel distance prompts an increase in both time and transport costs. Section 4.3 attempts to isolate the effect of transport costs and improve the monetary valuation of transport costs. Nevertheless, analysis of composite time/transport costs is beneficial since much travel cost analysis combines these two cost components when evaluating recreational demand.

For both the CB and CP analyses, the increased distance easily translates into higher transport costs using the IRS rate of 31.5 4 per mile. To translate the increased distance into higher time costs demands a conversion from distance into time using some measure of speed. Since respondents will presumably travel these <u>extra</u> miles on roadways with speeds faster than their currently used roads, it would seem inappropriate to use the respondents= average speed. Rather than using the speed affected by local streets, I employ speeds from interstate and state highways and county roads. For the relevant region of Kansas, the maximum speed on interstate highways is 70 MPH, 65 to 70 MPH on state highways, and 60 MPH on county roads.[10] As a median value, I employ a conversion speed of 65 MPH. To accommodate visitors that currently travel at even greater speeds, I permit the conversion speed to exceed 65 MPH based on the respondent=s average speed.[11] After converting the increased distance into time, I translate time into money using the respondent=s wage/salary information as before.

4.2.2. Regression Analysis of Contingent Behavior Data

To examine the effects of distance-related costs on intended demand using the CB data, the analysis must combine time costs and transport costs and employ a single regression coefficient on this composite term. Accordingly, it restricts the coefficients on time costs and transport costs to equal each other: $\beta_t^{CBd} = \beta_o^{CBd} = \beta_d^{CBd}$, where β_d^{CBd} represents the composite coefficient. The ratio of coefficients for composite time/transport costs and access fees ($\beta_d^{CBd} / \beta_a^{CBa}$) identifies the relative effect on demand. This ratio differs significantly from one for each worker type in both specifications. Therefore, composite time/transport costs are inconsistently valued relative to access fees in the CB data. The ratio of $\beta_d^{CBd} / \beta_a^{CBa}$ indicates the factor needed to adjust composite time/transport costs so that distance-related costs and access fees generate the same effect on demand. As shown in Table 3.a, non-employed respondents value distance-related costs at 37 % of

[10] Although high for other states, these speeds are common for the well-developed yet little trafficked roadways of Kansas.

[11] Put differently, the conversion speed equals the respondent=s average speed but takes a lower bound of 65 MPH.

the benchmark valuation, employed workers on a fixed schedule at 14 %, and flexible-schedule workers at 10 %. The adjustment factor for non-employed respondents is substantially higher than the factor for employed respondents because the benchmark valuation of non-employed time is zero. To accommodate the presumably positive valuation of time, composite time/transport costs must be more greatly valued.

4.2.3. Analysis of Contingent Pricing Data

Similar to the CB analysis, the CP analysis examines the valuation of distance-related costs relative to access fees. The same logic described for the valuation of time costs in Section 4.1.3 applies to the valuation of distance-related costs. The absolute and relative changes in demand are equal for the two relevant CP equations concerning increased access fees and increased distance-related costs. When time and transport costs are properly valued, the demand-choking access fee increase (Δa_i^{CPa}) must equal the demand-choking distance-related cost increase ($\Delta o_i^{CPd} + \Delta t_i^{CPd}$); i.e., $\Delta a_i^{CPa} = \Delta o_i^{CPd} + \Delta t_i^{CPd}$. Put differently, the ratio of $\Delta a_i^{CPa} / (\Delta o_i^{CPd} + \Delta t_i^{CPd})$ must equal one. This ratio differs significantly from one at the 1 % level for all worker types.[12] Therefore, as with the CB analysis, time and transport costs as a composite are inconsistently valued relative to access fees. The ratio indicates the factor needed for adjustment. As shown in Table 3.b, non-employed respondents value distance-related costs at 31 % of the benchmark valuation, workers on a fixed schedule at 16 %, and flexible-schedule workers at 15 %. These estimates are very comparable to the CB estimates of 37 %, 14 %, and 10 %, respectively.

4.3. Better Valuation of Transport Costs

4.3.1. Isolate Transport Costs

[12] The t-test statistics are 2.983, 6.230, and 7.885, respectively for non-employed, fixed-schedule, and flexible-schedule workers.

Finally, the analysis attempts to isolate the effect of transport costs and improve the monetary valuation of transport costs. Unfortunately, the contingent behavior analysis does not generate orthogonal data on transport costs. As stated in Section 4.2, the contingent behavior question and associated contingent pricing question on greater travel distance increases both transport costs and time costs. However, the CB analysis and CP analysis can isolate the effect of transport costs and the demand-choking increase in transport costs.

4.3.2. Regression Analysis of Contingent Behavior Data

The CB analysis uses the improved valuation of time costs to isolate the effect of transport costs by subtracting the effect of increased time costs from the demand response prompted by increased travel distance. In particular, the CB analysis captures the pure effect of time costs based on the orthogonal data generated by increasing only travel time. (Equivalently, the econometric analysis constrains the effect of time costs in the CB distance equation to equal the effect of time costs in the CB time equation.) The isolated effect, β_{ti}^{CBd}, for each specification is shown in Table 4. Since the value of transport costs should not depend on employment status, Table 4 reports the effect for all respondents as a whole.

As with time costs, to adjust the monetary valuation of transport costs, this study uses the ratio of transport costs to access fees ($\beta_{ti}^{CBd}/\beta_{a}^{CBa}$). The ratio of $\beta_{ti}^{CBd}/\beta_{a}^{CBa}$ indicates the factor needed to adjust transport costs so that transport cost and access fees generate the same effect on demand. As shown in Table 4, respondents value their transport costs at 18 % of the IRS rate of 31.5 4 per mile or 6 4 per mile. Based on these results, the IRS rate greatly exaggerates the valuation of transport costs.

4.3.3. Analysis of Contingent Pricing Data

Similar to the CB analysis, the CP analysis isolates transport costs from the composite distance-related costs. First, it identifies the increased time implied by the demand-choking increase in distance using the same conversion speed noted in Section 4.2.1. Second, it calculates the value associated with the implied time increase using individually implied values of time. For non-employed respondents, the value of time (per minute) is taken directly from the ratio of demand-choking access fee and demand-choking travel time (in minutes), as noted in Section 4.1.3. For employed respondents, the implied time cost adjustment factor is taken directly from the ratio Δa_i^{CPa} / Δo_i^{CPo}. Time costs for non-employed respondents are the product of time and value per minute, while time costs for employed respondents are the product of initially-valued time costs and the adjustment factor. Third, the CP analysis calculates increased transport costs using the IRS rate of 31.5 4 per mile; these costs are denoted as Δt_i^{CPd}. Fourth, the analysis sets the demand-choking access fee increase equal to the demand-choking distance-related cost increase: $\Delta a_i^{CPa} = \Delta o_i^{CPd} + \Delta t_i^{CPdi}$, where Δt_i^{CPdi} represents the Aisolated@ transport costs. Fifth, it isolates the transport costs: $\Delta t_i^{CPdi} = \Delta a_i^{CPa} - \Delta o_i^{CPd}$. Finally, it relates these Aisolated@ transport costs to those costs implied by the IRS rate: $\Delta t_i^{CPdi} / \Delta t_i^{CPd}$. This ratio identifies the proper adjustment so that transport costs are valued consistently with access fees. As shown in Table 4.b, this ratio differs significantly from one at the 1 % level (t-test statistic equals 15.63). Moreover, the proper adjustment is 7 % of the IRS rate of 31.5 4 per mile or 2.2 4 per mile. This estimate is comparable to the CB adjustment estimate of 19 % and 6 4 per mile. Again, the IRS rate seems to exaggerate greatly the valuation of transport costs.

6. Summary

In sum, this paper improves the valuation of time costs, transport costs, and combined time/transport costs in the context of recreation demand. To achieve this improvement, this paper uses contingent behavior analysis to consider hypothetical increases in access fees, travel time, and travel distance and uses contingent pricing analysis to consider stated demand-choking increases in the same travel cost parameters. Unlike travel cost analysis of revealed preference data, both types of analysis generate orthogonal data on access fees, travel time, and transport costs. By relating responses regarding travel time to responses regarding access fees, the two analyses identify the implied value of time. By relating responses regarding travel distance to responses regarding access fees, the two analyses identify the implied value of distance-related costs as a composite. By isolating transport costs from these composite distance-related costs, the two analyses identify the implied value of transportation.

The two types of analysis approach the valuation from completely different yet complementary perspectives. The CB analysis examines behavioral responses to price contingencies, while the CP analysis examines pricing responses to demand contingencies. Nevertheless, they generate highly comparable estimates of travel cost valuation.

Table 1

Statistical Summary

Variable	Description of Values	Mean	Standard Deviation
Ex post Visitation		2.508	2.121
Ex ante Visitation		3.776	2.768
Time Costs ($)		17.095	22.126
Transport Costs ($)		19.734	10.945
Reduced Visitation - Access Fee (Trips)		1.310	1.683
Reduced Visitation - Access Fee (%)		33.353	26.013
Reduced Visitation - Travel Time (Trips)		1.657	1.627
Reduced Visitation - Travel Time (%)		43.513	26.793
Reduced Visitation - Travel Distance (Trips)		1.818	1.901
Reduced Visitation - Travel Distance (%)		45.345	27.096
Increased Time Costs - Travel Time		12.499	8.795
Increased Time Costs - Travel Distance		11.034	13.352
Increased Transport Costs - Travel Distance		12.600	N/A
Demand-Choking Access Fee ($)		5.915	4.260
Demand-Choking Time (two-way minutes)		103.052	86.575
Demand-Choking Time Costs (two-way $)		21.652	26.772
Demand-Choking Distance (two-way miles)		96.161	85.362
Demand-Choking Distance-related Costs ($)		58.634	60.930
Demand-Choking Distance-related Time Costs ($)		28.344	47.308
Demand-Choking Distance-related Transport Costs ($)		30.291	26.889
Perceived Water Quality	1=very low 5=very high	3.104	0.437
Entrance into Lake Water	1=yes, 0=no	0.919	0.182
Fish Activity	1=yes, 0=no	0.285	0.285
Catch Rate (for fisherpeople, N=93)		5.933	4.786
Duration of Use	1=Overnight 0=Day	0.223	0.263
Age	1=18-19 2=20-29, etc.	2.576	0.791
Marital Status	1=yes, 0=no	0.426	0.313

Existence of Children	1=yes,0=no	0.384	0.308
Gender	0=M,1=F	0.548	0.315
Annual Income ($)		24,306	17,756

Table 2

Adjustment of Time Costs

2.a. Based on Tobit Regression of Contingent Behavior Data

Respondent Category According to Work Schedule	No. of Observations	Coefficient on Travel Costs		Coefficient Ratio
		CB Travel Time	CB Access Fee	
Linear Specification				
Non-employed [a]	63	- 0.0421	- 0.6206	0.0679
Fixed Schedule	109	- 0.1428	- 0.6708	0.2129
Flexible Schedule	84	- 0.0692	- 0.6952	0.0995
Semilog Specification				
Non-employed [a]	63	- 0.0105	- 0.1448	0.0728
Fixed Schedule	109	- 0.0279	- 0.1240	0.2250
Flexible Schedule	84	- 0.0154	- 0.1520	0.1015

2.b. Based on Mean Responses of Contingent Pricing Data

Respondent Category According to Work Schedule	No. of Observations	Demand-Choking Costs ($)		Ratio
		CP Travel Time	CP Access Fee	
Non-employed [b]	63	88.845	5.769	0.103
Fixed Schedule	109	26.851	6.274	0.235
Flexible Schedule	84	35.158	5.617	0.203

[a] To generate coefficient on increased travel costs for the CB data involving travel time, regress the change in visitation on the change in travel time (60 minutes) rather than the change in travel costs.

[b] Travel time is measured in minutes. The ratio of demand-choking responses represents the implied monetary value of time per minute (in dollars).

Table 3

Adjustment of Distance-Related Costs: Composite Time and Transport Costs

3.a. Based on Tobit Regression of Contingent Behavior Data

Respondent Category According to Work Schedule	No. of Observations	Coefficient on Travel Costs		Coefficient Ratio
		CB Distance	CB Access Fee	
Linear Specification				
Non-employed	63	- 0.0422	- 0.1151	0.3663
Fixed Schedule	109	- 0.0148	- 0.1029	0.1436
Flexible Schedule	84	- 0.0109	- 0.1170	0.0931
Semilog Specification				
Non-employed	63	- 0.0105	- 0.0269	0.3903
Fixed Schedule	109	- 0.0029	- 0.0190	0.1526
Flexible Schedule	84	- 0.0024	- 0.0256	0.0938

3.b. Based on Mean Responses of Contingent Pricing Data

Respondent Category According to Work Schedule	No. of Observations	Demand-Choking Costs ($)		Ratio
		CP Distance	CP Access Fee	
Non-employed	63	33.235	5.769	0.310
Fixed Schedule	109	61.050	6.274	0.156
Flexible Schedule	84	78.902	5.617	0.154

Table 4

Adjustment of Transport Costs

4.a. Based on Tobit Regression of Contingent Behavior Data

No. of Obs.	Coefficient on Travel Costs		Coefficient Ratio	Adjusted Cost (4/mi)
	CB Transport [a]	CB Access Fee		
Linear Specification				
256	- 0.1252	- 0.6665	0.1879	5.92
Semilog Specification				
256	- 0.0257	- 0.1383	0.1859	5.86

4.b. Based on Mean Responses of Contingent Pricing Data

No. of Obs.	Demand-Choking Transport Costs ($)		Ratio	Adjusted Cost (4/mi)
	CP Isolated [b]	CP Benchmark [c]		
256	2.108	30.291	0.0696	2.20

[a] To isolate the effect of transport costs on changes in visitation, reduce the change in visitation due to increased travel distance by the product of increased time costs (or increased time for non-employed respondents) and the coefficient relating time costs (or time for non-employed respondents) to the change in visitation prompted by increased travel time.

[b] To isolate the demand-choking transport cost increase, subtract the implied demand-choking time cost increase from the demand-choking access fee increase.

[c] Benchmark valuation of transport costs based on IRS rate of 31.5 4 per mile.

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