Teaching Environmental Valuation Methods Through Real-World Applications: A Travel Cost Method Field Study

Lint Barrage[1]
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Abstract: Adding to a wealth of literature developing classroom experiments to enhance students' understanding of natural resource economics, this article describes a simple protocol for a *field application* of an environmental valuation method to a real-world setting. In particular, a simple implementation of the Travel Cost Method is described that enabled an undergraduate class to provide a basic estimate of visitor valuations of a state park. The article provides the survey, data collection, and data processing protocols, and guidelines for implementation.

Keywords: Environmental Valuation, Travel Cost Method, Active learning, Economic Education, Environmental Economics Applications

JEL Codes: A2, Q26, Q50; H41

[1] Assistant Professor, Brown University, Department of Economics and Institute at Brown for Environment and Society (IBES). Contact Email: lint_barrage@brown.edu. Phone: 203-506-9767. Mailing address: Department of Economics, 64 Waterman Street, Providence, RI 02912. I thank Terri Bisson, Dylan Hogan, and Sagar Wadhwa.

1. INTRODUCTION

In an effort to enhance students' understanding and interest in economic theories, the literature has developed a wealth of classroom experiments that make students participants in the markets they study,[2] including in natural resource and environmental economics (e.g., Giraud and Herrmann, 2002; Murphy and Cardenas, 2004; Dissanayake and Jacobson, 2016, etc.). These experiments have proven effective at teaching key theories, such as the tragedy of the commons (Frank, 1997).

This article describes a simple protocol that takes students *outside the classroom* to apply an environmental valuation method in the field. Specifically, the protocols describe a class research project to estimate the value of a local park or recreational site based on the Travel Cost Method (TCM). The basic premise of the TCM is that households *reveal* a lower bound on their willingness to pay to experience public parks through the costs they incur in order to visit them.[3] By linking visitation rates to travel costs, one can construct a *demand curve* for a park and infer its net benefits (consumer surplus). The TCM has many instructive advantages. On the one hand, it does not require econometrics knowledge in all but one step of the project. On the other hand, the TCM estimates the value of sites based on visitors' revealed preferences, and thus escapes the controversies associated with stated preference valuation methods. Finally, the TCM can be used to value local public goods in the students' communities, thus providing a tangible connection and potential for policy interest. Public funding for, e.g., state parks has steadily declined since the 1990s (Walls, 2013), and it can be difficult for park management agencies to demonstrate the value of park space. While the protocols described in this note are greatly simplified for educational purposes, they do generate a basic economic assessment rooted in the literature. Consequently, the

[2] For general discussions, see also, e.g., Holt (1999), Durham, McKinnon, and Schulman (2007), Dickie (2006).
[3] Ward and Beal (2000) provide a detailed review of the TCM and its implementation.

project results may be of interest to local and state site managers. Anecdotally, our students reported greater motivation due to potential policy-relevance.

The remainder of this note proceeds as follows. Section 2 describes the different project work tasks, their allocation to students, and the survey. Section 3 presents the data analysis and results. Section 4 concludes. Appendix A provides the survey instruments, and Appendix B describes the respondent recruitment procedure and script.

2. PROJECT OVERVIEW

The project was completed by an undergraduate "Environmental Economics and Policy" class consisting of 26 students. The only prerequisite for the course was Introductory Microeconomics. The instructor consulted with the state's Department of Environmental Management both to obtain permission to conduct the surveys, and for advice on a suitable site for the project.[4]

Students were each required to provide a 3 hours of work for the project, and were given the choice to serve as surveyor in the field, or to join the "Data Entry and Analysis" Team. Importantly, this choice ensured that the project would not place an undue burden on students with scheduling restrictions, nor on students who would not feel comfortable conducting surveys. Students performing data entry were required to attend a TA section that trained them and provided an opportunity for supervised data entry. For example, students were trained to convert heterogeneous responses to the question of how often visitors go to the park ("1-2 times per week" versus "every other week") into uniformly coded answers. Afterwards, they were able to conduct the reminder of their data entry work remotely. Survey data were entered into an Excel spreadsheet based on a template provided by the instructor.

[4] Upon consultation with the IRB, it was decided that formal review was not required as the goals of the survey were purely educational (and for an outside agency). Also, no personal identifying information was collected.

Students on the Survey Team were given a choice of time slots when the instructor would take them to the park to conduct surveys (with her supervision). A total of 15 students conducted surveys in the park during four 2-hour sessions, and were able to collect data from 164 park visitors in total. Appendix B describes the recruitment procedures and scripts.

The survey is designed to provide necessary information for both a "zonal" or "individual" application of the TCM (see Ward and Beal, 2000). The zonal TCM models park visitation rates at the level of zones surrounding a park (e.g., counties, census blocks, etc.). That is, the fraction of residents in a given zone that visit the park is modeled as a function of travel cost (and other covariates, such as demographics). In contrast, the individual TCM focuses on *individuals'* park visitation rates – their number of visits per year - as the dependent variable, and studies how this park demand is affected by travel cost (controlling for other individual covariates). The estimated price elasticity can then be used to construct a demand curve for the park, as described in Section 3. The survey took only 2-5 minutes to complete with most visitors. [5]

2. DATA PROCESSING AND ANALYSIS

After the survey data were entered and compiled, remaining students on the Data Team were given background research and data processing tasks: (1) To look up driving distances from each visitor's zip code to the park; (2) To look up U.S. Department of Transportation estimates of car ownership and operational costs per mile to calculate driving costs for each respondent; (3) To calculate hourly wage-rate equivalents for each respondent based on their demographic questionnaire answers, and to calculate visitors' opportunity cost of time based on their self-

[5] The survey also asks a few questions that may be of interest to park management agencies but are not essential for the TCM analysis (e.g., food expenditures) and can be omitted from the analysis.

reported travel times.[6] With this information, the TCM could be applied.

As econometrics was not a course pre-requisite in our setting, the instructor completed the econometric analysis for the coefficient on travel cost. However, in other settings, the completion of the TCM could be turned into a homework assignment, as could the creation and analysis of descriptive statistics and figures (e.g., plotting visitation rates against travel costs).

The following OLS specification was run to estimate the price response of demand:

$$(\#Trips/yr)_i = \beta_0 + \beta_1 TravelCost_i + \beta_2 Age_i + \delta_3 Male_i + \beta_4 \#AdultsinParty_i + \beta_5 \#KidsinParty_i + \beta_6 \#DogsinParty_i + \beta_7 Income_i + \delta_8 Caucasian_i + \beta_9 Schooling_i + \delta_{10} Employed_i + \delta_{11} NoAlt.Destination_i + \varepsilon_i$$

where *TravelCost*$_i$ consists of driving plus time costs for visitor i,[7] *#AdultsinParty* is the number of adults in the party of the respondent visiting the park during the survey (and *#KidsinParty* and *#DogsinParty* are analogously defined), *Income* is the lower bound on respondents' reported income bracket, *Schooling* is an index for the respondent's highest level of schooling completed, and *Employed* is a dummy for respondents being "Employed for wages" or "Self-Employed." Finally, *NoAlt.Destination* is a dummy for visitors reporting that they would "stay home" or "do nothing" if the park had been closed on the day of the survey, indicating that they cannot think of an alternative destination.[8]

Table 1 presents the regression results. Every $1 increase in the cost of traveling to the park is estimated to decrease the average respondent's annual number of park visits by -0.5.

[Insert Table 1 about here]

[6] For an application of the zonal TCM, one would also need to ask students to (i) collect data on zones' populations, demographics, and centroid driving distances to the park, (ii) match each respondent's location to their respective zone, and (iii) to calculate visitation rates and zonal travel costs.

[7] In line with the literature, we also consider a specification where the opportunity cost of time is 33% of the wage.

[8] Note that this variable had to be coded manually based on a reading of survey responses.

Next, we evaluate the regression equation at the sample means for all variables (except trip cost) in order to calculate the *average visitor's demand for trips as a function of price*. In our sample, this turns out to be:

$$\#Trips = 86 - (0.503)TripCost(\$)$$

The associated *inverse demand curve* can then be calculated as:

$$TripValue(\$) = 168 - (1.99)\#Trips$$

Finally, in order to calculate the consumer surplus that the park provides to the average visitor, we calculate the area under the inverse demand curve (net of travel cost), as illustrated in Figure 1.

[Insert Figure 1 about here]

Overall, our survey results suggest that visitors enjoy a substantial surplus from the park we studied. While the analysis makes a host of implicit of simplifying assumptions, it arguably provides a clear illustration and application of the underlying economic ideas, such as revealed preferences, demand and inverse demand, environmental valuation, and consumer surplus.

4. CONCLUSION

This note presents a simple protocol that enabled undergraduate students to engage in a real-world field application of the Travel Cost Method to estimate visitors' consumer surplus from a state park near the university. In contrast to other revealed preference environmental valuation methods – such as the hedonic method – knowledge of econometrics is not required in all but one step of the project. Students were overwhelmingly positive in their evaluation of this exercise, both as a class research project and field application of the tools taught in the classroom. As not all the tools and concepts that we teach our students can be applied through in-classroom experiments, we hope that this note will be useful in facilitating field applications for other instructors.

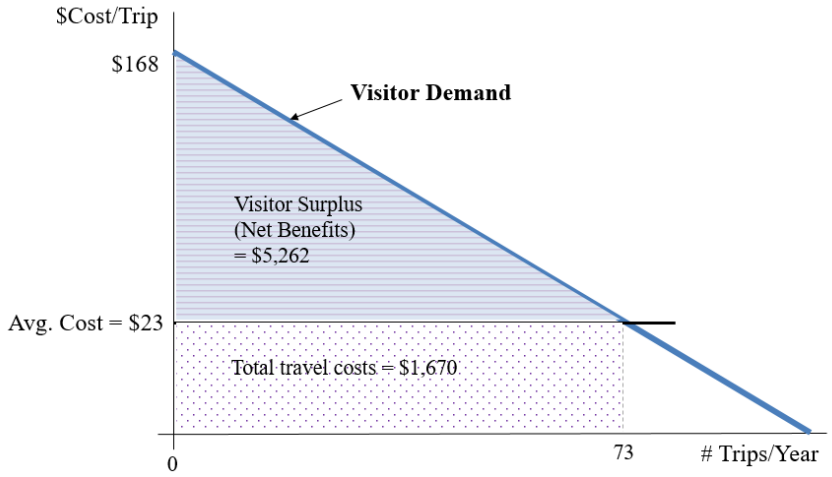
FIGURES AND TABLES

Table 1: Regression Results

Variable	#Visits/Yr
Total Trip Costs ($)	-0.503**
	(0.248)
Age	1.441**
	(0.652)
Male (=1)	-62.897***
	(17.557)
#Adults in Party	-12.054
	(7.383)
#Kids in Party	-35.716**
	(14.587)
#Dogs in Party	-31.688**
	(14.646)
Income ($10k)	0.323*
	(0.163)
Caucasian (=1)	2.546
	(25.430)
Schooling Level	-7.216
	(4.600)
Employed (=1)	-33.767
	(22.262)
No Alt. Destination (=1)	72.498***
	(27.047)
Constant	138.387**
	(58.785)
Observations	110
Adjusted R-squared	0.281

Standard errors in parentheses.
*** p<0.01, ** p<0.05, * p<0.1

Figure 1: TCM Consumer Surplus Calculation



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APPENDIX A: SURVEY INSTRUMENTS

_____ State Park Visitor Survey

Surveyor:

Thank you for your time and participation in this survey. We would like to ask you ask you a few questions about your visit to _____ State Park today.

1) From where did you travel to the park today?

City:_____ State:_____ Zip Code:_____

2) Is that where you currently live? [] Yes [] No

[If No] Where do you live?

City:_____ State:_____ Zip Code:_____

3) Approximately how long did it take you to get here today?

_____ minutes

4) Did you travel here today just to visit the park, or are you visiting other destinations as well?
[] Single-purpose trip [] Multi-Destination trip

[If Multi-Destination]: What are the *primary* destination and purpose of your trip?

_____

5) We now would like to ask you about all your *expenditures* associated with this trip.

For **Transportation**:

[If respondent from <=30 minutes away]: Did you have any transportation expenditures besides gas, such as toll roads, parking fees, etc.? [] No [] Yes:_____

[If respondent from > 30 minutes away]: Approximately how much did you spend in total on:
$ _____ Gas, oil, other fuels (auto, RV, boat, etc.)
$ _____ Fees for toll roads, parking, etc.
$ _____ Other transport expenses such as auto repairs, airfares, bus, taxi, car rental, etc.

Did you spend any money on **Food and Beverages**, such as:
$ _____ Groceries $ _____ Restaurants, bars, etc.
Did you incur any **Lodging** expenditures on this trip? [] No [] Yes

[If Yes]: Approximately how much did you spend in total on:
$_____ Hotels, motels, B&Bs, etc.
$ _____ Campground fees

Did you incur any **Other Expenses** associated with this trip, such as fishing bait, sporting goods?
[] No [] Yes:_____ ([] Own equipment but not for this trip specifically)

[If >1 person]: Do these amounts represent how much you spent as an individual, or as a group?
[] Individual [] Group Comments:_____

6) What kinds of activities will you do during your visit to _____ Park today?
(E.g.: walking, hiking, dog walking, picnicking, boating, biking, riding, fishing, etc.)

_____

_____

7) How long do you plan to stay at the park? _____

8) Have you previously visited _____ Park? [] Yes [] No

[If Yes]:

8.1) approximately how many times have you visited _____ during the past 6 months?

_____ times

9) We are interested in where else you might have gone if you had not come here today. If _____ had been closed today, is there another park or site you would have most likely visited instead? Or would you have done another activity?

_____

_____

Thank you very much for answering our questions! We are almost done. We would really appreciate if you could fill out an anonymous demographic questionnaire.

[Hand over questionnaire]

Anonymous Questionnaire

Respondent Gender: [] Male [] Female

1) How many people are in your party visiting the park today, yourself included?

Adults:	[] 1	[] 2	[] 3	[] 4	[] 5+
Children:	[] 1	[] 2	[] 3	[] 4	[] 5+
Dogs:	[] 1	[] 2	[] 3	[] 4	[] 5+
Horses:	[] 1	[] 2			

2) What is your age? _____

3) What is your current employment status?

[] Employed for wages [] Self-employed [] Not employed and looking for work
[] A student [] Retired [] A homemaker [] Other

4) What is your total annual household income?

[] Less than $15,000 [] $15,000-$29,999 [] $30,000-$44,999 [] $45,000-$59,999
[] $60,000-$74,999 [] $75,000-$99,999 [] $100,000-$149,999 [] $150,000-$199,999
[] >$200,000

5) What is your ethnicity (or race)?

[] Caucasian/White [] Hispanic/Latino [] African American [] Asian/Pacific Islander
[] Native American/American Indian [] Other

16) Lastly, what is the highest degree or level of schooling you have completed?

[] 8th Grade or Less [] Some High School [] High School Graduate or equivalent (GED)
[] Some College [] Trade/Technical/Vocational Training [] Associate Degree
[] Bachelor's Degree [] Some Graduate School [] Graduate Degree

Thank you very much for your time and participation!

APPENDIX B: RECRUITMENT PROCEDURES

Our survey team set up in the parking lot of the park. Each surveyors wore neon yellow reflective vests, name tags, and a "____ University Survey Team" sign. We also set up a large cardboard sign with the university logo, the name of the park, and the text "Park Visitor Survey – Please help us understand demand for public parks! Only a few minutes // Anonymous survey."

Students walked around the parking lot and approached all visitors. For safety reasons, students were strictly prohibited from ever leaving the sight of the instructor (who was present at all times), and from getting into any vehicle. The students were asked to approach all visitors and ask if any *one* person in each party would participate in the survey with the following approximate script:

> "Excuse me / Good morning / Good afternoon,
>
> My name is ____ and I am a student at _____ University. We are conducting surveys of ____ Park visitors today about their visits and travel to the park.
>
> The goal of the survey is to learn about the public's demand for park space in _____.
>
> The survey is a class research project, and our professor will also share the results with the state's Department of Environmental Management.
>
> The survey is fully anonymous and takes only a few minutes to complete. Would [anyone of] you be willing to help us out and take the survey?"

We conducted surveys only with one member of each party, and only with adult visitors aged 18 years or older. Note that we did not provide any payment to respondents for their time. However, visitors were generally happy to talk to the students and express their thoughts about the park.