ESTIMATION OF RECREATIONAL BENEFITS OF LAKE MOKOAN, VICTORIA, AUSTRALIA USING THE TRAVEL COST METHOD

Gamini Herath and Julie Jackson

Senior Lecturers, Department of Business
Albury/Wodonga Campus
La Trobe University, Victoria, Australia

INTRODUCTION

A large number of commodities that are exchanged for money in the market place have a readily observed price. For these items, the interaction of supply and demand establishes their market price. However, many environmental amenities such as parks, lakes, wilderness areas, and wildlife are not exchanged in the market and hence they do not have a market price. Although the environmental goods are not bought and sold like many other commodities, they have a monetary value as long as people are willing to pay for them. In certain cases, such values are extremely important and economists have developed methods to obtain the values of such commodities.

The most notable of these methods are the Travel Cost Method (TCM) and (b) Contingent Valuation method (CVM) (Bennett and Carter, 1993). The aim of this study is to evaluate the recreational value of Lake Mokoan in Victoria in Australia, using the Travel Cost Method (Mitchell and Carson, 1989).

LAKE MOKOAN

Lake Mokoan was constructed in the late 1960s to harness flows in the Broken River and its tributaries. The main function of the Lake was to be for use in the Goulburn- Murray irrigation district (GMID). It is located about 10 km Northwest of Benalla. It is a shallow lake formed by building a low, 7.5 km long earthen wall across the natural overflow route of a system of wetlands. It receives water from the Broken River and Hollands Creek and also runoff from a catchment of about 30,000 ha.(Harrison. et. al.,1990; Herath, 1993). The water quality of the Lake has deteriorated sharply and in 1990/91 a major algal bloom caused the total closure of the Lake for all recreational activities. The Lake also suffered a major drought in 1982-83 and until 1987 it did not refill to capacity. This has resulted in the loss of aquatic vegetation and degradation of the shallower areas of the lake bed. Since refilling, turbidity has increased, underwater light climate is severely restricted and the macrovertebrate community of the Lake is relatively sparse. Lake Mokoan has been the centre of a number of investigations of water quality. None of these studies have estimated the recreational value of the Lake. This has constrained certain important decisions in planning.

TRAVEL COST METHOD

The TCM is one of the most commonly used techniques to estimate the recreational benefits of an amenity site. Originally proposed by Hoteling in the 1930s, this method was popularised by the work of Clawson and Knetch (Clawson and Knetch, 1966). This method was extensively used in the UK and the USA. It has been applied to water quality issues and wildlife sites. It is an indirect method of determining the benefits of an amenity resource. In this method, the value people place on a good environmental location is inferred from the time and cost they incur in travelling to it . The main assumption here is that the Travel Cost to visit a site represents its value and hence can be used as a proxy for the value of the visit. The method is obviously useful in situations where the visitors have to travel to reach the site rather than to sites which have mainly local users who do not travel. It is argued that the cost of travel that people pay enables a demand function for that attraction to be constructed in which the visitation rate is related to travel cost which is a proxy for an entry price (Bateman, 1993).

Since travel costs depend on part on the distance travelled, a basic assumption of the method is that the value of the enjoyment of a visit must be higher for those who travel further and thus incur greater travel costs. TCM measures the expectation of an enjoyment of a visit before the visit takes place, since the visitor has to commit himself to incur the costs at that point. This is quite in contrast to the CVM techniques which measures the enjoyment of the visit as it is experienced. It should be noted that the value of the Lake is not equal to the amount of travel costs; this information is simply used to derive the demand curve.

ESTIMATION OF TRAVEL COST

The data required for TCM are, total number of visitors to the Lake for a given period , the origin of the visitors, their travel costs to the site, other costs (eg. extra food cost), the time taken for travel, and the time spent at the recreation site. TCM starts by dividing the area surrounding the Lake into concentric circles, where the contours join points of equal travel distance. Visitors are then sampled from each of the zones of origin and for each zone a number of visitors is surveyed.

Two specific sets of data were obtained from the survey. Firstly, it was necessary to estimate the total number of visitors for a period, say an year. It is not feasible to count the visitor arrivals for a full year to obtain the estimate. Thus the visitors to the Lake over a full week which included weekdays and the weekend were counted. The average number of visitors (car load) was about 10 per day on weekdays and about 25 per day on weekends. Estimated visitors per week were thus 100 and this figure is used in the computations of visitation rate. The other data were collected by interviewing the visitors to the Lake. The survey was conducted at the site and was carried out over a period of about 2 weeks. The data collected relates to origin , travel cost , other costs, time spent in travelling and at the site and other socioeconomic variables such as family size , age, income level and occupation

Given the above information, a demand function for visits to the Lake can be estimated.Firstly, the visitation rates are computed for each city. A statistical regression is then fitted for each zone relating visitation rate to average travel cost and other socioeconomic variables such as income to derive a demand curve for visits to the site which measures the consumer surplus of visitors. This information is then used to estimate a demand curve for Lake use from each city as an increasing admission fee is imposed. At some price level there will be no visitors, and demand will be choked off. These curves from all cities can then be horizontally aggregated to obtain the aggregate demand curve for the Lake

Another way to derive the aggregate demand curve is to sum the number of visitors from all cities at each level of admission fee. This approach is used here although both methods give an identical result. Since the present admission fee to Lake Mokoan is zero, the whole area under the demand curve becomes a measurement of the consumer's surplus. The computation of the recreational value of Lake Mokoan is carried out as follows.

Using information on the percentage of sampled visitors from each of the 6 cities, total visitors per week, and the population in each city, the visit rate per 1,000 population in each city can be computed using equation 1 (Grandstaff and Dixon, 1986).

$$Visit/1000/yr = \frac{\frac{n}{N} \cdot V \cdot 52 \cdot 1000}{P} \tag{1}$$

Where:

V = visitors from city i.
n = sample size.
N = visitors per week.
P = total population

The visitation rates computed are given in Table 1. The average travel cost for each city was computed by summing the individual travel costs and then dividing it by the number of visitors from that city. The average travel costs for the different cities are given in Table 2.

TABLE 1:
Visitation Rates for 1,000 Population per Year for All Cities

City	Population	Sample size	Percent of sample	Visitation rate
Benalla	15000	15	0.44	152.9
Euroa	5000	4	0.12	122.3
Wangaratta	25000	8	0.24	48.9
Shepparton	35000	3	0.10	13.1
Albury/Wodonga	80000	4	0.12	7.6

TABLE 2:
Visitation Rates and Average Travel Cost

City	Travel Cost	Visitation rate
Benalla	4.6	152.9
Euroa	5.0	122.3
Wangaratta	5.5	48.9
Shepparton	9.0	13.1
Albury/Wodonga	9.4	7.6

A regression equation fitted between visitation rates against travel cost gave the following equation.

$$V = 237.66 - 25.1 \, TC \qquad\qquad (2)$$
$$(4.5) \qquad (-3.35)$$

Adjusted $R^2 = 0.70$

The total cost per visit from Table 2 for each city was substituted into equation (2) to obtain the visits per 1,000 population for each city at zero admission fee. When the fee became positive, say, $2.00 per visit per person, it was added to the total cost and again substituted into equation (2) to solve for the visitation rate per 1,000 people and the total visits from each zone at the new admission fee.

The number of visits from each zone at various entry fees are given in Table 3. The number of visits at various entry fees from one zone represents the demand function for Lake Mokoan from that zone. By summing up the total visits across all zones for a given entry fee, a point of the demand curve for recreation in Lake Mokoan can be found. We can now plot the demand curve using the total visits for different entry fees given in Table 3. This gives the demand curve for Lake Mokoan for recreation facilities. The user value of Lake Mokoan can be found by computing the area under the demand curve (See figure 1)

The travel cost method applies only to single end point of a trip. In valuing a single attraction, the same problem shows up if the attraction is visited as part of a linear tour. The second difficulty arises in defining what costs to include in travel costs. Evidently direct or variable costs of the carriage should be included but there in no unanimity regarding inclusion of the cost of time taken, or such indirect or fixed costs as the proportion of depreciation on a car used by family on a tourist trip in addition to everyday travel.

TABLE 3:
Visits at Various Admission Fees in One Year

Zone	Population	Tc	0	1	2	3	4
1	15(XX)	4.6	1833	1456.5	1080.1	703.5	327.0
2	5(XX)	5.0	560.0	435.3	309.8	188.3	58.8
3	25(XX)	5.5	2490.0	1846.2	1235.2	607.7	-
4	35(XX)	9.0	411.6	-	-	-	-
5	25(XX)	9.4	60.0	-	-	-	-
Total			5354	3730	2625.1	1499.5	385

Also the TCM assumes that visitors maximise utility by finding a known destination with a set of preferred benefits, always at the lowest cost. This is unlikely to be true, as market imperfections mean that visitors rarely have perfect information about all destinations and variety or change is in itself often a desirable change.

THE INDIVIDUAL TRAVEL COST METHOD (ITCM)

The data collected permits the estimation of recreational benefits using the ITCM. This method also permits the testing of the relevance of a number of other variables such as the socio economic variables and the attributes of the Lake being examined. Initially, a regression was run between the number of visits per year by the visitor and the travel cost. This regression is given in equation 3.

$$V = 10.7 - 0.898 \ TC \qquad (3)$$
$$(9.2) \qquad (-4.6)$$

$$R^2 = 0.41$$
$$\text{adjusted } R^2 = 0.38$$

As can be seen, the adjusted R^2 is only 0.38 indicating that travel cost explains only about 38% of the variation of the annual visits of a visitor. This can be easily understood because travel decisions are often influenced by income, age, family size, employment unemployment status etc. The influence of other variables will be examined in a later section of this paper. For the present, the ITCM equation estimated only for travel cost is used to compute the consumer surplus and this is compared with the estimates based upon the ZTCM.

Figure 1: Demand Curve for Lake Mokoan
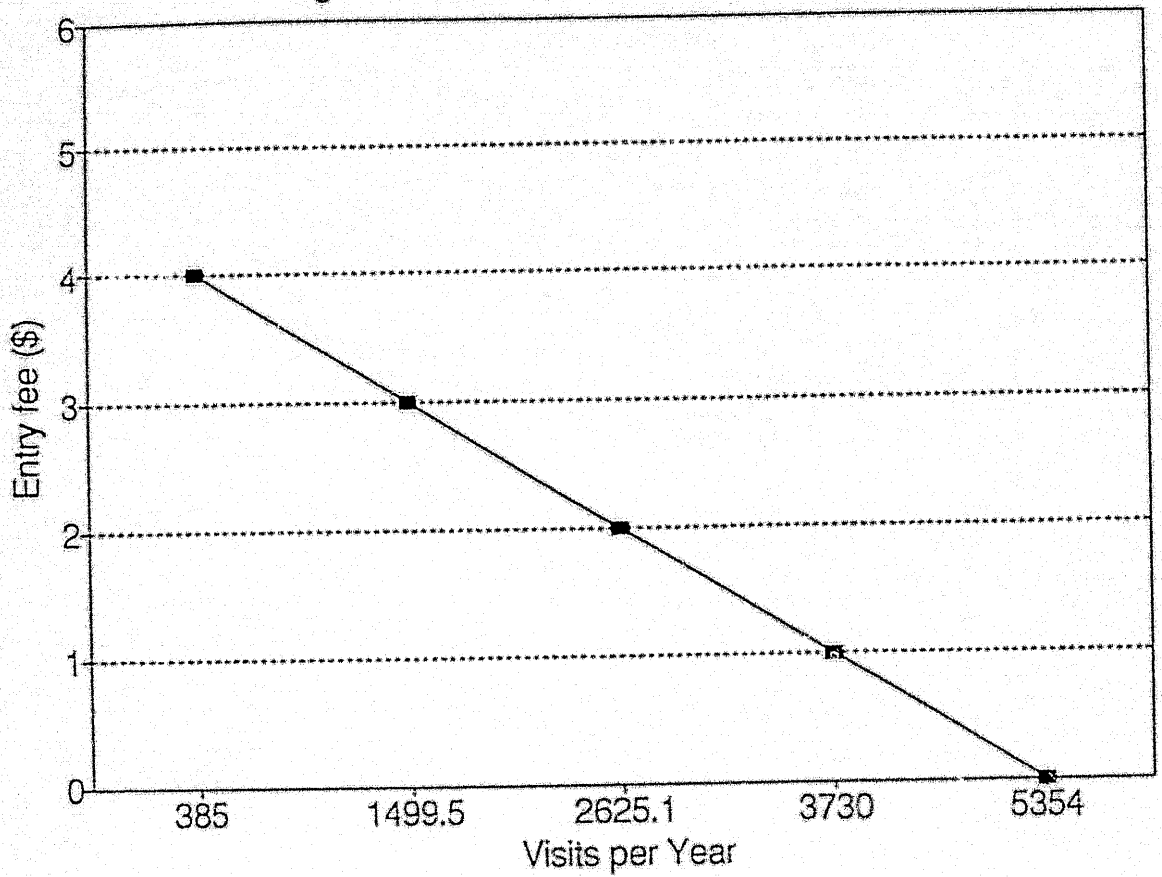
Several functional forms were considered. The double log model has simple non linearity and tends to describe spatial data well (Peterson and Stynes, 1986). In spite of this however, the semi-log form has found favour in many recreation demand analysis. This is in part due to the simplicity of the consumer surplus computations. The comsumer surplus can be simply estimated by using equation 4.

$$CS = 1 / (c. Cost) \qquad (4)$$

where CS is the consumer surplus and c is the coefficient of travel cost in the ITCM equation. The semi log model gave the following results:

$$V = 2.71 - 0.208 \ TC$$
$$(10.82) \qquad (-5.01)$$

$$R^2 = 0.43$$

$$ADJ \ R^2 = 0.42$$

Using the semi log model, the computed consumer surplus is $4.70 per person/year. The total consumer surplus can be computed by multiplying the individual consumer surplus by the total number of visitors. The total consumer surplus using the Individual Travel cost method is around $ 24440 which is nearly double the estimate obtained from the Zonal Travel Cost Method.

Multiple regression models were run with three additional variables. These are the income level, family size and employment status. These results are given in Table 4. Employment status did not show any significant relationship with frequency of travel and was dropped from the model. Income did not show any significance at traditional significance levels. However, it gave a fairly high coefficient compared to the employment status variable. This result reflects the difficulty in obtaining the actual income levels from respondents. Only the income range was obtained and their mid values were used in the estimating equation. Family size was significant at the 80% level of significance.

TABLE 4:
Multiple Regression Result

Model	Constant	Cost	Income	Family Size	R^2
1	9.36	- 0.825	0.000043	-	0.38
		(-4.04)	(1.05)		
2	7.37	- 0.734	0.000043	0.423	0.42
		(-3.58)	(1.17)	(1.71)	
3	8.88	0.816		0.408	0.41
		(-4.21)		(1.6)	

CONCLUSION

The use of the Zonal and Individual Travel Cost methods to estimate the recreational benefits of Lake Mokoan in Victoria, Australia has been demonstrated in this study. The Zonal method yielded a consumer surplus of about $12000 per year. The individual method yielded a consumer surplus of about $24900 which is nearly double the estimate obtained using the zonal method. The discrepancies have been reported in many studies. These values provide useful information for setting policy. An important policy question is whether Lake Mokoan should be further improved to cater for recreation and other purposes. Certainly the estimates obtained provide a rough guide as to what the results might be. These initial figures obtained could be refined further to obtain more accurate estimates. As the population pressure increases, we can expect that the Lake will become relatively more valuable and refined methods of analysis may be required.

REFERENCES

Bates, I. (1993), Valuation of the Environment Methods and Technique: Revealed Preference Methods, in Sustainable Environmental Economics and Management, eds. R.K. Turner, Belhaven Press; New York.

Bennett, J.W and M.Carter, (1993), Prospects for Contingent Valuation: Lessons from the South-East Forests, Australian Journal of Agricultural Economics, Vol 37, No.2, pp 79-93.

Grandstaff, S and John A. Dixon, (1986), Evaluation of Lampnee Public Park in Bangkok, Thailand, In Economic Valuation Techniques for the Environment, eds. John A. Dixon and M.M. Hufschimidt

Harrison, J (1990), Lake Mokoan and the Broken River: Factors Affecting Water Quality, Report No 105, Water, Materials and Environment Science Branch, Water Resources Board.

Herath, G (1993), The Algal Bloom Problem in Australia: A Resource Economics Perspective, Paper presented at the 37th annual conference of the Australian Agricultural Economics Society, 9-11 February, University of Sydney, Australia.

Mitchell, R.C and R.T.Carson, (1989), Using Surveys to Value Public Goods, : the Contingent Valuation Method, Resources for the Future, Washington.

Clawson, M and J.L. Knetch, (1966), Economics of outdoor Recreation, Johns Hopkins University Press, Baltimore.

Peterson, G.L and D.J. Stynes, (1986), Evaluating Goodness of Fit in Nonlinear Recreation Damand Model, Journal of Leisure Research, Vol 17, No. 2, pp.131-147.