"Recreational use values for Victoria's Parks"

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Abstract

Generalised travel-cost models were specified for the repeatable measurement of the economic value of recreation in Parks. Valuations of recreational use have been undertaken for approximately 30 metropolitan parks in Melbourne and 35 National Parks and other sites in rural Victoria.

Zonal models were used and the distance ranges for each zone were set as variable parameters in a spreadsheet model. The distance from each postcode in Australia to the park was calculated using the longitude and latitude for the particular park, and for the centroid of each postcode. This specification enabled us to observe that the choice of distance ranges for each zone can have a substantial impact on the goodness of fit and on the implied level of consumer surplus per visit.

The study has not been finalised and consequently few results are presented here. Nevertheless, the process of developing a generalised model and the preliminary results have caused the authors to be concerned about three aspects of travel-cost modelling, namely:

1. the allocation of consumer surplus between multiple destinations for those visitors who visited more than one destination during the trip that included the Park in question;

2. the choice of distance ranges for each postcode zone; and

3. the choice of functional form.

Different approaches to each of these matters changes substantially the results obtained from the travel-cost modelling. The second aspect (distance ranges) appears not to have been addressed previously in the literature, and our approach to the first aspect (multiple destinations) may offer a new approach.

Comments would be appreciated, particularly since this Study is yet to be completed. Readers are encouraged to email us: Economists@readsturgess.com.au

Keywords

travel-cost models, definition of postcode zones, functional forms, multiple destinations, benefit transfer.

INTRODUCTION

Read Sturgess and Associates is presently engaged by the Department of Natural Resources and Environment, Victoria to assess the recreational values of 180 Parks in Victoria. As far as we can discover a project of this size has not been tackled before. For the task to be manageable within the required timeframe, a generalised model which could be readily applied to all Parks was needed, rather than constructing a specific, detailed model for each Park.

Furthermore, a large data base derived from surveys of visitors was available for about one-third of the Parks. Although these surveys were not specifically designed for to provide data for economic valuation, the information contained in the data base could be adapted for that purpose. The generalised model will enable the determination of recreational values at other Parks as suitable data becomes available. A zonal travel cost model offered the greatest opportunity for an appropriate, generalised model capable of making effective use of the considerable amount of available data.

Attempts will be made at a later stage to extrapolate the values for a sample of approximately 35 Non-Metropolitan Parks to the remaining 115 Parks.

The consultancy has attempted to quantify only the valuation of recreational use; however, as part of the consultancy, the applicability of methodologies for assessing non-use values is being considered.

The study has not been finalised and consequently few results are presented in this paper. Nevertheless, our efforts to develop a generalised approach to travel cost modelling has caused us to be concerned about three aspects of the travel-cost modelling, namely:

1. the allocation of consumer surplus between multiple destinations for those visitors who visited more than one destination during the trip that included the Park in question;

2. the choice of distance ranges for each postcode zone; and

3. the choice of functional form.

An overview of the travel-cost model is presented before discussing these matters.

OVERVIEW OF TRAVEL-COST MODEL

Parks Victoria has undertaken surveys of visitors to about one-third of the Parks which are relevant to this Study. The Parks with data include:

30 Metropolitan (Melbourne) Parks;

23 Non-metropolitan Parks (mainly National Parks);

4 Gardens; and

8 Piers and jetties.

The sample size (i.e. number of interviews) varies between Parks. Generally the sample size is 300 or greater for Non-metropolitan Parks. The sample size is around 100 for most Metropolitan Parks. While the sample sizes are relatively small for many Parks, many respondents stated that they visited that Park a number of times each year, and that they were part of a group of visitors. The mean number of visits per year per group was 3.5 for Non-metropolitan Parks and 17.9 for Metropolitan Parks. The mean group size was 5.9 for Non-metropolitan Parks and 3.0 for Metropolitan Parks. Consequently the implied number of group visits per year, or number of visitors per year, is much greater than the number of interviews.

The data used from each interview included the following:

- postcode of the point of origin for each visitor (this enables the estimation of distance travelled)

- frequency of visits for each visitor
- group size
- length of stay
- type of trip (3 categories - day trip away from home, trip which is part of a holiday, overnight stay in the Park)
- type of accommodation for overnight visitors
- activities undertaken in the Parks

In the case of surveys for National Parks, there are also data describing how many other National Parks were visited by each respondent.

The survey data do not provide estimates of travel expenditure. Consequently the travel-cost models (TCM) have to use imputed estimates of travel costs, based on travel distance and standard rates. The many assumptions made in deriving these rates are not discussed here as they do not affect the central themes of the paper.

Zonal models were used and the distance ranges for each zone were set as variable parameters in a spreadsheet model. The distance from each postcode in Australia to the Park was calculated using the longitude and latitude for the particular park, and for the centroid of each postcode. Regression analyses were used to fit a relationship between the frequency of visitors from each zone and the mean travel costs for the visitors from each zone. Demand curves were then derived by re-estimating the number of visitors from each zone over a range of hypothetical entrance fees. The total consumer surplus was estimated as the area under that demand curve, and mean values of consumer surplus per visitor day were calculated.

TREATMENT OF MULTIPLE DESTINATIONS

Recreation trips will often involve multiple destinations, and so the travel cost of the whole trip is the joint cost of travel to all the destinations. In considering the full range of Parks in Victoria, there are many instances where a visit to a particular Park represents only part of the outing for some visitor groups. Apportioning all the consumer surplus indicated by the TCM to the Park in question would result in an overestimation of the site's recreational use value.

This raises the difficult question about how to allocate the consumer surplus of the total outing, as revealed by a straightforward TCM, between the visit to the Park in question and those other activities undertaken during the same as outing. In theory, it would be appropriate to estimate the consumer surplus based on total travel costs for each trip and to then apportion that estimate of consumer surplus according to the relative size of recreational value at the Park in question and the total recreational value for the entire trip.

Unfortunately, we do not have the necessary data to use this approach. The survey data provides only limited information as to whether the visits represented the sole destination for each visitor's trip, and no information as to the duration or importance of the visit to the park relative to other destinations. We believe that this is an important omission.

We note that other studies have instead apportioned the travel costs. Some have allocated the costs of travel according to the time spent on the various purposes of the trip (see for example, Knapman and Stanley (1991)). Others have apportioned costs with reference to the visitor's perception of the importance of the visit to the site relative to the other activities undertaken in the course of the trip (see for example, Bennett (1995) and Gillespie (1997)).

We reject the apportionment of consumer surplus in proportion to travel costs since the consumer surplus estimated using TCMs **is by no means directly proportional to the travel costs of visitors**. For example, the travel-cost model indicates that the mean level of consumer surplus across the sample of Parks is reduced only by 28 per cent when travel costs were reduced by 40 per cent. That is, the apportionment of travel costs, as a proxy for the apportionment of consumer surplus, leads to an over-

estimate of the consumer surplus that is attributable to Parks in question.

Officers of Parks Victoria believe that many trips to both Non-metropolitan Parks and Metropolitan Parks would include multiple destinations. For example, it is believed that many visitors to St Kilda Pier would also visit nearby markets, beaches or restaurants. Similarly it is believed that some visitors to the Port Campbell National Park would also visit the Otways National Park and/or Grampians National Park. Therefore, estimates of consumer surplus based on total trip costs would provide an estimate of the total consumer surplus attributable to all the destinations visited during the trips made by visitors interviewed for the Parks Victoria surveys. Consequently, in its forthcoming survey of visitors to be undertaken in March 1999, Parks Victoria has decided to seek directly information about the extent of multiple destinations and their relative importance. The results from these surveys will be used to refine the preliminary estimates formed in the current study.

The presently-available data indicate <u>for day trips only</u> whether visits represented part of a multiple-destination trip or visits where the Park in question was the sole destination. These data reveal that there is a strong tendency for the incidence of multiple destination trips to increase in proportion to distance travelled. That is, a higher proportion of visitors from the most distant zones indicated that their day trip was only one of the destinations visited during their day trip away from home.

We believe that the treatment of multiple destinations can have a marked impact on estimates of recreational values and believe that this is a major factor in increasing the confidence ranges that should be placed around estimates derived using TCM.

DETERMINATION OF ZONES

Distance ranges for each zone, are set as parameters in the spreadsheet model, which then calculates the distance from each postcode in Australia to the Park, based on the longitude and latitude for the particular park, and for the centroid of each postcode. This specification has enabled us easily to vary the distance ranges used for each park. Researchers seem not to have previously considered the importance of this variable. We have found that the choice of distance ranges for each zone can have a substantial impact on the goodness of fit, the prediction of visitor numbers at zero fee and on the implied level of consumer surplus per visit.

For example, in the case of one National Park, situated about 150 km from Melbourne, using a log-log model, the estimated consumer surplus per visitor day is $5 when ten zones placed 100 km apart are used, and $10 when ten zones placed 50 km apart are used. In large part the difference arises in response to the following matters:

1. The number of zones that include the population centre for which visitor frequency is the greatest (Melbourne in this case). In the case of the 100 km radii, all visitors from Melbourne are specified as falling in one zone whereas in the case of the 50 km radii, visitors from Melbourne are specified as coming from two zones.

2. The fact that local residents visit the Park but population density in the immediate vicinity of the Park is relatively low. Local residents visit the Park at a very low travel cost and, with Zone 1 being defined as zero to 50 km, those visitors represent a very high frequency of visitors per head of population. They represent a much lower frequency when Zone 1 is defined as zero to 100 km.

For most Parks there seem to be features of the visitation pattern that mean the ‘outlying points’ on the plot of travel cost versus visitor frequency will shift dramatically in response to changes in the choice of distance ranges for each zone. Such changes to the position of one or two extreme points can affect substantially the shape of the estimated curve used to represent the relationship between visitor frequency and travel cost. Given that it is the shape of that curve that determines

the shape of the derived demand curve, this can greatly affect the estimated consumer surplus.

We have, therefore, determined a set of distance intervals which produce high R^2 values and satisfactory predictions of the number of visitors for most parks (see Table 1). Nevertheless, we are concerned that the choice of distance ranges for each zone can have such a marked impact on the estimates of recreational values and believe that this is a major factor in reducing the precision of estimates derived using TCM.

FUNCTIONAL FORM

We tested zonal models using, linear, log-log, log-linear and reciprocal forms. Linear models failed to produce a satisfactory explanation of total visitation, typically producing R^2 values of 10 to 30 per cent. Both the log-log models and reciprocal models produced R^2 values typically in the range 70 to 98 per cent; however, the log-log models predicted the actual number of visitors much more closely than the reciprocal models.

The log-log form of the TCM has been derived for each Park by transforming data describing the visitor frequency (V, which represents the number of visitors per '000 head of population) and mean travel costs (TC) for each zone into natural logs, and performing a linear regression using ordinary least squares regression techniques. This form is expressed as:

$$\text{Log}(V) = a + b^* \text{Log}(TC) \qquad (1)$$

Recalling that the TCM is then used to predict the total number of visitors for each zone (Q), at a range of simulated entrance fees, an alternative approach has also been used to identify a fitted relationship that predicts Q directly. Mr D. Zanon, a senior analyst and modeller employed by Parks Victoria, has pointed out that Eqn. (1) can be reduced further by breaking V down into its component parts; namely, that V (visitor frequency) is derived by dividing the total number of visitors from a particular zone (Q) by the population of that zone (P). This allows us to reduce further Eqn (1) to:

$$V = C / TC^d \quad \text{where } C = e^b \text{ and } d = -a \qquad (2)$$

and so,

$$Q = C * P / TC^d \qquad (3)$$

Mr. Zanon has used the SPSS package to perform an iterative technique for computing a non-linear regression model that fits this functional form, referred to herein as the 'multi-variate model'.

Both models provide similar estimates for the mean recreational values across the sample of Parks (see Table 2). However, each model provides a different fit for particular Parks, as measured by R^2 and the closeness with which it predicts the actual number of visitors for the sample (at zero fee). We have adopted an approach suggested by the Steering Committee for the project, namely, to adopt either the log-log model or the multi-variate model for each Park, depending on which one provides the best fit for that Park.

We share the concerns of others (see for example, Chotikapanich and Griffiths 1998) that the choice of functional form can have a marked impact on the estimates of recreational values. We believe that this is another major factor in reducing the precision of estimates derived using TCM.

DISCUSSION

We conclude that TCM remains the best tool for estimating the economic value of recreation - particularly in the context of a large set of Parks. However, the three issues which the development of a generalised model has highlighted suggest that wider confidence ranges than previously believed may be needed around estimates of value derived from TCMs.

Even so, our preliminary results conform broadly with our expectations. In particular, the estimated values for recreation at Metropolitan Parks are much lower than for Non-metropolitan Parks. This almost certainly reflects the relatively high concentration of Parks in Melbourne.

The high concentration of Parks in the Metropolitan area means that potential visitors are faced with many close substitutes and, as predicted from basic economic theory, the willingness to pay for a good or service is smaller if more substitutes are available. By contrast, Non-metropolitan Parks have less close substitutes, and this 'relative uniqueness' or 'scarcity' leads to a greater willingness to pay for recreation at those Parks.

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Table 1 Distance zones adopted

Zone definition	Parks outside metropolitan area	Parks in metropolitan area
	km	km
Zone1	0-50	0-5
Zone2	50-100	5-9
Zone3	100-150	9-13
Zone4	150-200	13-17
Zone5	200-250	17-21
Zone6	250-300	21-25
Zone7	300-800	25-50
Zone8	800-1300	50-100
Zone9	1300-1800	100-250
Zone10	> 1800	>250

Table 2 Preliminary results

	Log-Log Model	Multi-variate model
Mean recreational value for Non-metropolitan Parks	$11.75 per visitor day	$10.86 per visitor day
Mean recreational value for Metropolitan Parks	$2.91 per visitor day	$2.86 per visitor day