Ecosystem Services 16 (2015) 136–145

Contents lists available at ScienceDirect

Ecosystem Services

journal homepage: www.elsevier.com/locate/ecoser

An on-site versus a household survey approach to modelling the demand for recreational angling: Do welfare estimates differ?☆

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ARTICLE INFO

Article history:
Received 12 May 2015
Received in revised form
18 September 2015
Accepted 23 October 2015
Available online 14 November 2015

JEL classification:
Q22
Q26

Keywords:
On-site and household sampling
Recreation demand
Hurdle count data models
Truncation
Endogenous stratification
Angling

ABSTRACT

This paper compares recreational fishing travel cost demand modelling results from an on-site angler intercept survey to results from a household survey where the respondents represent the same underlying population of interest. We employed a Poisson and negative binomial count data model with and without the econometric corrections for the on-site sampling issues of endogenous stratification and truncation as the onsite modelling approach and use Poisson and negative binomial count data hurdle specifications to control for excess zeros in the household modelling approach. We find that welfare estimates differ substantially across the two samples and argue that the underlying samples may represent two different types of anglers.

1. Introduction

Recreational pursuits represent an important category of cultural ecosystem service benefits obtained from human interaction with a wide variety of ecosystems. The travel cost method (TCM) has been an important tool in estimating the value of this particular cultural ecosystem service benefit. In this paper we develop travel cost models of recreation demand related to angling, using both an on-site and a household survey. Unusually, the on-site angler intercept survey and the household survey was carried out at the same time and asked the same trip frequency questions of respondents. Using the responses to these surveys we then compare a hurdle household recreation demand model to an on-site model that corrects for the three statistical issues of over-dispersion, truncation and endogenous stratification. While previous research has been carried out that compares zero-inflation household models to on-site models, this is the first direct comparison of a hurdle household recreation demand model to an on-site model in the recreation demand literature.

When modelling the demand for such an activity as angling count data travel cost modelling approaches have often previously been employed due to the discrete non-negative nature of the dependent variable; the number of fishing trips taken over a certain time period. In setting out to estimate a model of recreation demand the researcher must also decide whether the information to be used will be gathered from an on-site survey of users or from a general household survey. In the former case, care must be taken to account for the on-site sampling issues of endogenous stratification and truncation and in the latter the researcher needs to adjust for the likely specification issues surrounding the presence of excess zero responses for angling trips taken. Simply treating all zeros in the household sample as anglers, who took no trips in the period under investigation, will introduce a downward bias in the demand and welfare measures.

On the other hand, in the case of the on-site sample, demand is truncated at one since the anglers being interviewed are on-site so must have made, at least, that single trip in the period. In this case, welfare estimates will tend to have higher standard errors. The sampling issue of endogenous stratification (the probability of sampling individuals with higher trip frequencies) will also lead to an upward bias in demand estimation and welfare measures. Englin and Shonkwiler (1995) and Shaw (1988) have shown how the on-site issues of truncation and endogenous stratification can be adjusted for in recreation demand models. It is also possible to resolve the issue of excess zeros in household survey data by

☆The authors would like to acknowledge the financial support of Inland Fisheries Ireland.

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http://dx.doi.org/10.1016/j.ecoser.2015.10.013
2212-0416/

separating the recreation 'participation' decision from the trip 'consumption' decision using a two stage modelling approach such as a double hurdle or zero inflated count model (Anderson, 2009). In this paper we use both an on-site survey of Irish anglers and a household based survey to estimate our recreational fisheries demand functions. In doing so we examine if, after correcting for the sampling issues in each case both modelling approaches produce similar welfare estimates for the value of recreation angling amongst the Irish population.

Very few travel cost studies have attempted to directly compare recreational benefits derived from household and on-site surveys. Martínez-Espiñeira et al. (2008), Meisner and Wang (2006), Loomis (2003) and Shaw et al. (2003) being the exceptions. Only Meisner and Wang (2006) and Martínez-Espiñeira et al. (2008) compare a household recreation demand model to an on-site model that corrects for the three statistical issues of over-dispersion, truncation and endogenous stratification. In the case of Meisner and Wang (2006) they compare it to a zero-inflation model while Martínez-Espiñeira et al. (2008) compare to a standard negative binomial model. In this paper we use the same on-site modelling approach as Martínez-Espiñeira et al. (2008) but compare it to a hurdle household model. To the best of our knowledge this is the first such comparison in the recreation demand literature.

As Meisner and Wang (2006) point out, if it can be shown that welfare estimates derived from cost-effective on-site surveying techniques are similar to household survey results, then this may justify using on-site surveys in lieu of large and costly population-based surveys. In this paper we also raise the question as to whether it may be the case that even if one is as careful as possible with the econometric models applied using both sampling approaches, it still may be the case that the type of recreationist one gets from an on-site survey will be fundamentally different from the type one finds in a household survey.

In what follows we briefly review the approaches that have been taken in the literature previously to estimate the demand for recreational angling. In Section 3 we then present the on-site and house survey methodologies and review the count data modelling specifications applied to both data sets. Section 4 then presents the model results and welfare estimates, while Section 5 presents a discussion of results and offers some conclusions.

2. Estimating the value of recreational angling

The recreation value of angling has been extensively investigated in the literature (see for example Curtis, 2002; Shrestha et al., 2002; Bilgic and Florkowski, 2007). Indeed, Johnston et al. (2006) identified over 450 non-market valuation studies that deal with recreational fishing benefits and values. In an earlier study, Loomis et al. (1999) carried out a meta-analysis involving 109 CS estimates of recreational fishing demand in the United States. The most common form of modelling approach employed in these studies has been the revealed preference travel cost model (Loomis and Walsh, 1997; Curtis, 2002; Murdock, 2006).

Within this modelling framework the Poisson and the Negative Binomial count data model specifications have remained particularly popular due to the non-negative integer nature of the demand for pursuits such as recreational fishing (as measured by the frequency of trips) (Zhang et al., 2015). As shown in the next section whether this trip data is collected on-site or at the household level will have a bearing on the ultimate specification used. With on-site surveys, data issues such as truncation and endogenous stratification need to be controlled for as in Curtis (2002) model of salmon angling demand, while at the household level the fact that you are likely to see a high proportion of zero trips amongst any given sample need to be addressed. The latter issue has been dealt with previously in the recreational fishing demand modelling literature using zero inflation models (Loomis, 2003) or hurdle models (Bilgic and Florkowski, 2007).[1] More recently, Czajkowski et al. (2015) applied a Zero-Inflated Negative Binomial model to estimate the annual number of recreational trips to the Baltic Sea coast that allows the modelling of both the probability of non-participation and over-dispersion in distribution of the number of trips.

Travel cost random utility models have also been applied in a number of studies of recreational fishing (see for example Train, 1998; Morey et al., 2002; Johnstone and Markandya, 2006; Murdock, 2006; Mkwara and Marsh, 2011). In these cases, the demand for angling pursuits at alternative sites is modelled as a function of the attributes associated with each site such as potential catch rates, species on offer and distance to each site. Contingent behaviour travel cost models are another approach to valuing recreational fishing demand where the standard count data models have been expanded to include additional information about how users might change their behaviour if certain contingent conditions existed (Hynes and Greene, 2013).

In a typical recreation contingent behaviour model the respondents are first asked about the frequency of past trips. They are then presented with a hypothetical scenario with different site conditions and asked if they would change their intended number of visits. The revealed and stated trip responses are then analysed using panel count data modelling techniques. In a fisheries related application, Prayaga et al. (2010) used a panel data truncated negative binomial contingent behaviour model to estimate the change in the value of recreational fishing as conditions along the Capricorn Coast in Central Queensland, Australia were varied.

Although there have been a number of studies on recreational fishing in Ireland that have analysed angler numbers and expenditure patterns using surveys (e.g. Whelan and March, 1988; Marine Institute, 1997; Inland Fisheries Ireland, 2013), only two Irish studies have involved the estimation of demand functions for recreational fishing. One other involved estimating the non-market value of preserving the current quality of recreational angling. This is despite the fact that fishing is one of the most popular recreational activities in Ireland. In a comprehensive study by Inland Fisheries Ireland (2013) the contingent valuation method was employed to estimate the value to the general public and to anglers, respectively, of preserving Ireland's natural fish stocks and the current quality of recreational angling in Ireland. Based on their model results the aggregate non-market value of the angling resource to the Irish public (where there are 3,608,000 individuals above the age of 15) was estimated to be €57.6 million per annum. The equivalent figure for the 406,000 estimated active anglers using Irish waters on a yearly basis was €27 million per annum.

In an earlier Irish study, O'Neill and Davis (1991) estimated an angling demand function for coarse and game angling in Northern Ireland but only relied on an OLS modelling approach. The only other estimated recreational fisheries demand function in Ireland was by Curtis (2002). In that study Curtis estimated the demand and economic value of salmon angling in Co. Donegal, Ireland. Using a truncated negative binomial travel cost model that allowed for endogenous stratification and truncation he estimated consumer surplus per angler per day of IR£138. Angling quality, age and nationality of participants were the main factors found to affect angling demand.

We add to the above literature by developing two recreational angling demand models for the Irish population where the total

[1] For a more general discussion of hurdle count-data models in recreation demand analysis the interested reader should review Shonkwiler and Shaw (1996).