Recreational angling tournaments: participants' expenditures

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Abstract

Fishing tournaments are a common feature in recreational angling across a wide range of target species both in fresh and salt waters. Tournaments are organised for a number of purposes, including as commercial enterprises; as fund-raising initiatives for angling clubs; for economic development purposes (e.g. tourism); as well as improve participants' skill levels. Most tournaments are confined to geographically small areas and usually occur over a small number of days, which can mean a pulse of economically significant activity in the local area. This paper analyses the nature of expenditure associated with angling tournaments, including travel, food and accommodation, and angling-related expenditures as a function of socio-economic and angler characteristics. Analysis based on 106 tournaments across Ireland during 2013 finds a clear 80/20 segmentation between 'high' and 'low' spend anglers and that the segmentation occurs across all fish target species considered. The analysis also finds that British coarse anglers participating at Irish angling tournaments spend considerably more than other anglers irrespective of target species or angler country of origin.

Keywords: expenditure; competitive angling; angler preferences; recreational fishing;

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1 Introduction

Tournaments are a common feature of recreational angling. In North America alone there are an estimated 25-31,000 competitive fishing events annually (Schramm Jr et al., 1991; Kerr and Kamke, 2003) and as many as one-in-five anglers participate in fishing tournaments (Petchenik, 2009). In the UK up to a quarter of angling club members cited competitive angling as an important reason for joining an angling club (Brown et al., 2012), while in Ireland there were in excess of 280 competitive angling events during 2013 (O'Reilly, 2014). Angling tournaments serve a number of purposes. From an angling perspective, like all competitive sports, they help improve participants' skill levels. Angling clubs organise competitions as a fund raising initiative, though in many instances entry fees are returned to participants as prizes. Fishing competitions can also be used as a mechanism for social cohesion or community development and particularly to enhance off-season tourism (Brown et al., 2012). Fishing tournaments are also organised as commercial enterprises, especially in the United States, where there is also a professional angling league tour.

Many studies have considered the economic impacts of recreational angling (e.g. Agnarsson et al. (2008); Lawrence (2005); Lew and Larson (2012); Raguragavan et al. (2013); Hutt et al. (2013); Yamazaki et al. (2013); Melstrom et al. (2015)). Studies estimating national level expenditures include Toivonen et al. (2004), which reports angler expenditures in five Scandinavian countries, including Iceland, ranging from US$ 23–281 million per annum. Per annum angler expenditures in Ireland total €555 million (TDI, 2013), £112 million in Scotland (Radford et al., 2004) and at least £2.4 billion in England and Wales (Radford et al., 2007; Armstrong et al., 2013). Little is known specifically about angling tournaments and their contribution to total angling expenditure, though McKean et al. (2014) report a $244 difference in per angler per trip expenditures between tournament and 'regular' sportfishing trips. Angling tournaments entail relatively short periods of intense activity, usually within a small geographic area, and consequently their economic impact can be quite significant in the local economy. A comprehensive understanding of tournament participants and their expenditures would be practical information for fishery managers or angling clubs seeking to raise funds or for communities attempting to boost local economic activity or to develop facilities.

Tourism is often advocated as a means for economic development, especially as an instrument to generate revenue in host regions and communities. There is a considerable research about the general value of tourism at the macro level (e.g. Narayan (2003); Song and Li (2008); Blake (2008)) using variables such as real per capita income, exchange rates, relative prices and transport costs to forecast tourism demand. There is also a growing literature examining visitor expenditure at the micro level (*inter alia* Lima et al. (2012); Suh and

McAvoy (2005); Petrick (2005); Jang et al. (2004); Downward and Lumsdon (2003)) but there is a gap in the literature regarding angling tournaments as sports tourism. This paper attempts to fill that gap and contribute to the sports tourism literature by examining the determinants of expenditure at angling tournaments. The analysis considers three distinct expense categories (i.e. travel; accommodation, food and drink; and angling-related expenses) showing how expenditure varies by socio-demographic characteristics, as well as by angler country of origin, target species and accommodation type. Focusing on angling-related expenses we consider the segmentation of expenditure, finding distinct categories of 'high' and 'low' spend anglers and that this division occurs across all fish target categories considered. An important objective of micro level research is improving market knowledge based on visitors' expenditure levels, which contributes to developing marketing and planning strategies aimed at improving economic growth in local areas.

2 Literature Review

As mentioned in the introduction, there has been relatively little research on expenditure patterns generated by angling tournaments. There have however been numerous reports on actual expenditure by anglers across many countries. The most recent example in the Irish case was a national level study of anglers that broke down expenditure patterns by angling type (TDI, 2013). It is also widely recognized that there can be significant expenditure heterogeneity across different tourism segments (Brida et al., 2013; Downward and Lumsdon, 2000) and this has been shown to hold for other sports events and angler tourism also (Toivonen et al., 2004; Downward et al., 2009; TDI, 2013). There is also a view that greater analytical effort should be employed on segmentation of the market, specifically visitor expenditures, which would in turn facilitate more effective marketing (Lima et al., 2012; Craggs and Schofield, 2009; Fredman, 2008).

There have been many studies on the economic impacts of general angling tourism and the estimation of travel cost demand models for angling using angler related trip expenditure as a key explanatory factor for trip frequency but very few examine the relationship between angling trip expenditures and angler characteristics; i.e. the determinants of expenditure (Schorr et al., 1995). One recent exception to this has been Melstrom (2017) who estimates an exponential model of sport fishing tourist expenditures estimated by a quasi-maximum likelihood (QML) technique. In doing so the paper examines the role of socio-economic demographic characteristics and species preferences on angling trip expenditure.

While little research has been carried out on the contribution of angling tournaments to total angling expenditure a lot of research has been carried out on more general tourism events and their impacts on tourism expenditure. The literature on the economic benefits of visitors to specific events at destinations is extensive (Getz, 1991; Tyrrell and Johnston, 2001; Crompton et al., 2001; Hodur and Leistritz, 2006). Indeed Bond (2008) provides a comprehensive review of the various methods and models currently in use in estimating the economic impact of event visitors. Getz (2008) see events and festivals as an important motivator in tourism and as an effective method to enhance the image of a destination.

A number of papers have examined the determinants of tourist expenditure, including addressing methodological issues. For instance, Brida and Scuderi (2013) reviews econometric methods, while Marcussen (2011) provide an extensive review of the types of explanatory variables used in empirical analyses. On the methodological side Brida and Scuderi (2013) note that econometric applications have been relatively static in their approach. Both Thrane (2014) and Thrane (2015) provide a critical review of estimation methods and among the issues they highlight is that the standard estimation approach, which treats length of visit as exogenous rather than endogenous, in trip expenditure models leads to bias. Across an extensive literature Marcussen (2011) identify eighteen significant determinants of tourist expenditures. These include trip related characteristics (e.g. length of stay, type of accommodation, travel party size, etc.), and socio-demographic variables (e.g. age, gender, income, etc.). Thrane (2014) considers these to be "very relevant predictors of tourism expenditure" and except in exceptional circumstances tourism expenditure regression models should incorporate most of these independent variables. In addition, a number of authors suggest that psychographic variables should also be incorporated into the analysis of tourism expenditure (Brida and Scuderi, 2013; Veisten et al., 2014; Wang and Davidson, 2010).

In a review of the tourism literature, Moscardo (2007) concluded that research on tourism festivals and events is dominated by four main topics; economic impacts, audience analysis, the management of events and event impacts as perceived by residents. Quinn (2009) notes the substantial research attention focused on measuring and evaluating the economic impacts of events on the host economies, a development that the authors believe is at least partially inspired by "the realities of city and regional government needs for justifying investment in festival and event development strategies". The same author also highlights an ongoing debate concerning both the robustness of the methodologies and approaches used to determine economic impacts of event tourism products and the accuracy of economic gains attributed to events.

Whether both direct and indirect expenditure contributions of event tourism is something that should be examined is one issue that has seen particularly regular discussion. Tyrrell and Johnston (2001) assert that only direct expenditure attributable to an event should be considered in estimating the economic impact of an event while elsewhere studies such as Wood et al. (2006) argue that a focus on direct expenditure benefits produces only a first order understanding of the impacts and that a focus of the indirect impacts are also important. Even though an extensive literature now exists on event tourism, Kostopoulou et al. (2013) point out that more research is needed on the variety of social, cultural and economic effects of events and festivals, although they do acknowledge that some research work mainly focussed on 'mega' and other hallmark events has been carried out in this regard.

A number of studies have examined expenditures on sports, including in Ireland (Eakins, 2016), Spain (Lera-López et al., 2011; Lera-López and Rapún-Gárate, 2005) and the United States (Dardis et al., 1994). Among the findings are that spending is higher among men, the more highly educated, and those with higher incomes. Expenditure levels vary depending on household composition, especially with the presence of children, and the type of sporting activity. Both Eakins (2016) and Scheerder et al. (2011) find evidence that expenditure is segmented between sporting activities, while Dixon et al. (2012) and Saayman and Saayman (2012) additionally find that within sporting events there is expenditure segmentation between low, medium, and high spenders. In a study of three outdoor sporting events Saayman and Saayman (2012) find that each event has its own unique set of determinants of spending and that knowledge of the determinants of spending in one type of event is not necessarily transferable to other events. Within angling it is known that species preference is an important factor in determining fishing trip frequency and site selection (Melstrom and Lupi, 2013; Melstrom, 2017). In additional to such delineation, Melstrom (2017) points out that knowledge about which segments anglers belong, particularly with respect to spending, can be useful for the management and marketing decisions related to fishing areas. This we believe is also the case for angling tournament events and this is an issue examined for the first time in this paper.

We therefore add to the above literature by examining for the first time the expenditure patterns of anglers that are specifically visiting angling tournaments. We also examine the segmentation of expenditure by the type of anglers attending the tournaments and rather than use the standard linear or logged expenditure Models based on ordinary least squares (OLS) or Tobit models based on maximum likelihood methods we introduce the use of mixture models to facilitate the modelling of heterogeneous expenditure patterns by sub-groups within the tournament angler population.

3 Materials and Methods

The analysis undertaken in the paper employs angler survey data, collected in Ireland in 2013. The survey of anglers attending Irish angling events was carried out over an eight month period designed to coincide with the busiest period in Ireland in terms of angling events (March-October). The survey was designed to gauge anglers attitudes, opinions and motivations as a means of assessing the main driving factors behind angler participation in competitive angling events in Ireland. The survey instrument also provided information that facilitates better insight into the drivers of various categories of expenditures incurred by anglers attending fishing competitions. The methodological approach uses numerical analyses to evaluate angler expenditures at tournaments. We estimate expenditure equations, also termed Engel curves, which have long been used to examine household expenditure (Prais and Houthakker, 1955). Before discussing the motivation for the numerical analyses undertaken we start by describing the survey methodology and expenditure dataset.

3.1 Survey Instrument and Data

A two-tiered approach was designed to target anglers mainly participating in local club matches and also those travelling more widely to participate in larger angling tournaments. To target the former group several larger angling clubs and federations advertised the research study on their web and social media sites inviting members to partake. Anglers that participate in larger angling tournaments were contacted directly on-site during a number of tournaments and requested to participate in the survey at a later date. All surveys were administered online. Where event organisers were willing to cooperate with the survey, an Inland Fisheries Ireland (IFI) representative attended the event to discuss the survey with the attending anglers. Events were chosen based on logistical and temporal restrictions relating to the availability of research coordinators and to get geographical spread.

While attending the festival the IFI representative would approach participating anglers, usually at the daily draws or in the evening after the days angling had taken place and the nature of the study was discussed with them. The vast majority of anglers expressed their willingness to participate in the project and provided contact details to the researcher. The anglers were given the option of being contacted by email, telephone or by traditional mailing methods. Interestingly, approximately 90% of the anglers who were met on-site chose to be contacted through email and provided the relevant details to achieve this. Each angler was then contacted within a specified time frame and asked to complete the survey.

Anglers were not surveyed while participating in the event because a) anglers would not have been able to give accurate details on expenditures until after they had participated in an event, b) anglers who fish in matches are often very competitive and do not take kindly to distraction that could have negative effects on their performance and c) anglers who are focussed on catching fish might not be able to give due consideration to the questions being asked of them.

The second approach taken was to contact the secretaries and chairpersons of several of the larger Irish angling clubs and federations. With their permission and assistance a web-link was placed in a prominent position on the club or federations websites and/or on their social media websites (Facebook/Twitter). A paragraph explaining the purpose of the survey was also included to promote the survey amongst site users. Anglers who wanted to participate in the study would click on the web-link and be brought to the survey.

This two-tiered approach was designed to target both the anglers who mainly participate in local club matches (via federation/club websites) and those who travel more widely to participate in the larger festivals. There are, however, clear limitations to this email and internet based approach. People have to choose to click on the link to the survey and in this sense they 'select themselves'. Some people will criticise this as 'not representative' as the results and findings that are recorded are of competition anglers who took the survey, not necessarily a representative sample of competition anglers as a whole and that shortcoming is acknowledged. In total, 85% of the completed surveys were done via angling websites and email contact. A further 10% were returned via traditional mail methods and 5% were completed through telephone interview.

While the use of on-line methods to conduct surveys has been called into question in the past due to the likelihood of potential sampling bias (Fleming and Bowden, 2009) no single method of survey administration has been proven superior to any other (Champ, 2003). Also internet surveys do have several advantages over traditional survey methods, not least the low costs incurred and also the speed and accuracy of data collection (Fleming and Bowden, 2009). Data can also be collected continuously regardless of date or time and also without geographical limitation (Madge, 2006). The on-line survey questionnaire can also be tailored to suit the individual respondents' answers therefore guiding the respondent to the next relevant question for their specific needs. While acknowledging that a cautious view should be taken of the representativeness of our sample to the population of competition anglers we still believe the survey approach undertaken was the correct one given the difficultly with carrying out a full survey on-site of competitors or of locating them in randomised household surveys.

The present survey collected a range of information, including travel routes of international visitors, accommodation details, trip length, trip expenditures under a number of categories, as well as opinions on a range of fishery management issues. The analysis here focuses on the expenditure data, using a number of socio-economic and demographic variables to understand anglers' preferences. The survey elicited 315 responses across 109 angling events. We confine the analysis to 283 observations (across 106 events) where the sole purpose of the trip was angling and where the recorded expenditures relate to the responding angler (i.e. observations where the respondent paid for other's expenses are excluded). Table 1 reports descriptive statistics of the variables included in the models.

Of the 283 observations used in the analysis respondents 67% were resident in the Republic of Ireland or Northern Ireland; 29% were resident in Great Britain and 4% were from other overseas areas. These figures were broadly comparable to the profile of anglers in Ireland provided by Tourism Development Ireland's (TDI) Socio-Economic Study of Recreational Angling in Ireland (TDI, 2013). The TDI report estimates that 406,000 anglers participated in recreational angling in 2013 where 68% of anglers were resident in the Republic of Ireland or Northern Ireland, 22% from Britain and 10% from other overseas markets. Not unexpectedly, 99% of anglers surveyed were male. Also, 54% of all anglers surveyed were 50 years of age or older. The average age for anglers from Ireland was 42 while that of overseas anglers was older at 53 years of age.

3.2 Seemingly unrelated regressions (SUR)

An obvious starting point to explain trip expenditure as a function of angler characteristics is to estimate an ordinary least squares (OLS) regression. However, total trip expenditure comprises distinct categories of costs and multiple expenditure equations may be more appropriate than a single regression equation to best explain the drivers associated with different cost categories. In the case of angling trips at least three distinct categories of expenditure can be easily envisaged: travel expenses; accommodation, food and drink (AFD) expenses; and angling-related expenses. We estimate three equations to explain the components of total trip expenditure. It is conceivable that the factors explaining the different types of expenditure may differ across equations and the scale of their effect between expenditure types may vary. For instance, the level of angling expenditure may differ by type of angling, as it may be more expensive to engage in one type of angling compared to another. However, it is inconceivable that the type of angling is likely to have any effect on the level of travel expense and similarly accommodation type is unlikely to affect either travel or angling expenses. The three expenditure equations could be estimated separately but it is likely that the error terms across equations are correlated, as some factor unknown to the analyst has an effect on all types of expenditure. To estimate such a system of equations we use the seemingly unrelated regression (SUR) estimator (Zellner, 1962), which assumes a joint distribution for the error terms from the individual equations. The motivation for using the SUR rather than an OLS estimator is that there can be an efficiency gain in simultaneous estimation by combining information on different equations. The expenditure equations can be represented by

$$y_i = x_i\beta_i + \epsilon_i \qquad i = 1 \ldots M \tag{1}$$

With N respondent observations y_i is a $N \times 1$ vector, x_i is a $N \times k_i$ matrix of explanatory variables, β_i is a $k_i \times 1$ vector, and ϵ_i is a $N \times 1$ vector of errors. In our case $M = 3$ and the dimension of k_i varies between equations (i.e. the number of explanatory variables differs across equations). Stacking the equations the system can be expressed as

$$y = x\beta + \epsilon \tag{2}$$

where y is a $(NM \times 1)$ vector, x is a $(NM \times k^*)$ matrix, β is $(k^* \times 1)$, ϵ is $(NM \times 1)$ and $k^* = \sum_i k_i$. The assumptions on the error term are that $\mathbf{E}[\epsilon_i] = 0$ and $\mathbf{E}[\epsilon_i \epsilon_j'] = \sigma_{ij} I$. The latter assumption allows errors in different equations corresponding to the same respondent angler to be correlated and it is this assumption that makes the SUR estimator more efficient than OLS estimates equation by equation.[1]

3.3 Mixture models

Our implicit assumption to this point was that tournament anglers are generally a homogeneous group. There may be equally good reason why this is not the case. Anglers differ by country of origin, income, social class, as well as other unobserved characteristics. Differences in these traits may manifest themselves as differences in preferences as anglers and specifically in the type and magnitude of expenditures incurred during angling trips. For example, one sub-group of anglers may prioritise expenditure on angling equipment and services, whereas other anglers may prioritise the social aspects of angling tournaments and spend more on accommodation, food and drink. *Ex ante*, we usually cannot identify such categories of anglers. As an alternative to the SUR model we also propose estimating a mixture (or latent class) model to reveal unrecognised or undefined sub-groups within the sample of tournament anglers. The basic principle behind the model is that the observed distribution of angler expenditures at a tournament is really a mixture of distributions of expenditures of multiple unknown sub-groups.

We follow the nomenclature from Deb and Trivedi (2002) to define the mixture model.[2] A random variable y is postulated as a draw from a population which is an additive mixture of C distinct sub-populations in proportions $\pi_1 \ldots \pi_C$, where $\sum_{j=1}^{C} \pi_j = 1$ and $\pi_j \geq 0$. The density function for that C-component finite mixture is

$$f(y|x; \beta_j; \pi_j) = \sum_{j=1}^{C} \pi_j f_j(y|x; \beta_j) \tag{3}$$

[1] See Judge et al. (1988) for more detailed exposition of the SUR model (p. 444).

[2] See McLachlan and Peel (2000) for a detailed discussion of mixture models.

And its log-likelihood function is given by

$$\max_{\pi,\,\beta} lnL = \sum_{i=1}^{N} \left(\sum_{j=1}^{C} \pi_j f_j(y|x;\beta_j) \right) \tag{4}$$

During estimation π_j is specified as $\pi_j = exp(\theta_j)/(\sum_{s=1}^{C-1} exp(\theta_s) + 1)$ to ensure that the estimated mixing probabilities π_j satisfy the basic properties of a probability: $0 \leq \pi_j < 1$ and $\sum_{j=1}^{C} \pi_j = 1$.

3.4 Explanatory variables

Irrespective of model estimated we use similar variables to explain anglers' expenditure. Among those we include is income on the supposition that anglers with high incomes have the means to spend more, though empirically this is not always found to be the case (e.g. Tavares et al. (2016)). We also include a dummy variable indicating whether the angler was in full-time employment. A significant estimate on the parameter for this variable would suggest that it is the stage in life (i.e. working versus retired or student) that may be as relevant in explaining expenditure levels as items such as income. Following Weagley and Huh (2004), who find that retirement leads to increasing levels of leisure expenditures, a negative coefficient might be anticipated on this variable.

Two-thirds of the angler sample are resident on the island of Ireland and the majority of the balance are from Great Britain. Given the substantial variation in travel distances we expect differences in expenditures across anglers by country of origin, especially in travel costs, but there may also be differences in the other categories of expenditure.

While some angling expenses will be similar across target species, they need not equal so we include dummy variables for target species (i.e. game, coarse, pike and sea) to allow for this variation in the model estimates (Melstrom and Lupi, 2013). We have no *a priori* expectation on the relative magnitude of these coefficients, though there is evidence that spending among non-tournament game anglers in Ireland is higher than coarse anglers (Curtis and Stanley, 2016). The target species categories are defined as follows. Game species refer to salmonids, primarily Atlantic salmon (*Salmo salar*), brown trout (*Salmo trutta*) and sea trout (*Salmo trutta*). Coarse fish are freshwater fish that are not salmonids, including for example, bream (*Abramis brama*), tench (*Tinca tinca*), and roach (*Rutilus rutilus*). Pike refers to *Esox lucius* and sea fish are all salt water species, including for example, pollack (*Pollachius pollachius*), turbot (*Scophthalmus maximus*), and bass (*Dicentrarchus labrax*).

Two factors that are likely to be very important in distinguishing between expenditure levels are the accommodation type and the duration of the angling tournament. Staying in a hotel for a 7-day tournament is likely to cost more than camp-site accommodation for a 1-day tournament. In the first set of models estimated we include the number of days in the competition as an explanatory variable, whereas in the second set of models we define the dependent variable as expenditure per competition day. We control for five accommodation types, as described in Table 1, and include them in the regression models as interaction variables with anglers' country of origin. The interaction terms will enable us to determine whether expenditure on different accommodation types substantially differs by angler country of origin. Thrane (2014) argue that length of stay is an endogenous explanatory variable and should be instrumented during estimation. With the length of angling tournaments decided by event organisers it is reasonable in this instance to incorporate length of stay as an exogenous explanatory variable.

Previous research suggests that group size has an important effect on daily expenditures but there is no definite pattern. Wynen (2013) find that there is a higher propensity to spend as tourist group size increases up to a certain point, after which the opposite is the case. On the other hand García-Sánchez et al. (2013) find that expenditure is higher among tourists travelling alone or in small groups and suggest that there are scale economies in the group size. We include a dummy variable indicating whether the angler participated in the tournament as part of a group to investigate whether there is a group effect on expenditure.

Age is frequently included as an explanatory variable to allow for variation in preferences. In analyses of tourist expenditure a range of effects were found, including evidence of an inverted U-shape relationship (García-Sánchez et al., 2013) and that younger compared to older tourists were higher spenders (Cini and Saayman, 2014). In the case of sports expenditure neither Eakins (2016) in the case of Ireland nor Lera-López et al. (2011) find a significant effect of age on expenditure. When included in the models estimated here age is also found not to have a significant effect on expenditure.

The dataset was collected by on-line survey with 46% of the sample recruited during a number of prestigious competition events. The angling tournaments where on-site recruitment occurred were not selected randomly nor were the anglers selected randomly. We include a dummy variable, *OnSite*, to investigate whether any selection biases may exist within the data.

4 Results

4.1 SUR model estimates

The dependent variables in the SUR model equations are total expenditure in each of the three categories: travel; accommodation, food and drink; and angling-related activities. The SUR model was estimated by Stata™ using the `sureg` command. A Breusch-Pagan test of independence of equations ($\chi^2_{(3)} = 111.7, p < 0.0001$) rejects the null hypothesis (Breusch and Pagan, 1980). Not unexpectedly with a dataset with a a wide mix of survey respondents, for example, in terms of income or country of origin, heteroscedasticity in the errors was a problem. Using the estimated residuals from each of the three expenditure equations a Breusch and Pagan (1979) and Cook and Weisberg (1982) test for heteroscedasticity rejects a null hypothesis of homoscedastic errors ($\chi^2_{(1)} = 163.1, = 153.5, = 228.9; p < 0.0001$). Our estimation strategy was then to use the structural equation model (`sem`) framework within Stata™, which facilitates the use of a Huber/White/sandwich estimator for the calculation of the variance-covariance matrix and is robust to heteroscedasticity of the errors. A maximum likelihood estimator was used to estimate the SUR model. The SUR model estimates are presented in Table 2, where two variants of the model are reported.

In the first variant (SUR model 1) we include accommodation type and country of origin interactions as explanatory variables in the accommodation, food and drink equation, whereas in the second variant (SUR model 2) we instead include target species and country of origin interactions as explanatory variables. In terms of most preferred model, both provide insight into anglers' expenditure. SUR model 2 has a higher log-likelihood but when comparing AIC statistics, both models are almost equally probable in minimising information loss. However, the equation level coefficient of determination for AFD equation is slightly higher for SUR model 1 at 0.65 compared to 0.57 for model 2.

We first consider the travel expense equation, where the main parameters of statistical significance are country of origin, income, and the variables *Group* and *OnSite*. Travel expense is increasing in travel distance, equivalent to €0.08 per mile, though this estimate is not statistically significant. The large values associated with the variables *GB* (€187 in model 1) and *Else* (€607) possibly reflect the additional air and ferry fares associated with international visitors. There is a statistically significant income effect associated with travel expense. The significant estimate on the *OnSite* variable indicates higher travel costs among anglers recruited on-site at several larger tournament venues. The insignificance of this variable in the other two SUR equations suggests that a selection bias is not a particular concern for the more policy relevant categories of expenditures that occur on site at tournament venues. The significance of the *Group* variable was unexpected, as it indicates no economies in group travel.

The primary difference between the two model variants of the estimated SUR model occur in the accommodation, food and drink (AFD) equation. SUR model 1 largely shows how AFD expenditure varies by anglers' accommodation type and country of origin, whereas model 2 focuses on anglers' target species and country of origin. In both models two other variables of significance are tournament length and whether the angler works fulltime. AFD expenditure increases by €39–66 per additional tournament day depending on model, and is €63–87 higher among anglers in full time employment. The *Group* variable is also statistically significant in model 1 indicating that individual anglers spend more on accommodation, food and drink when participating as part of a group but is not significant in model 2. When examining the accommodation and country of origin interaction variables in the model 1 variant the reference category is Irish anglers staying in hotel accommodation (i.e. $Bed1 : Ire$). The negative coefficients on variables $Bed4 : Ire$ and $Bed5 : Ire$ indicate that AFD costs for anglers that either stay with friends or in camp-grounds/hostels are, as anticipated, lower than expenditure in the reference category. The highest expenditures are associated with non-Irish anglers staying in guest-house and B&B accommodation, as well as British anglers staying in hotel accommodation, spending between €398–410 per tournament more than the reference category of Irish anglers. While some of the difference may reflect higher priced accommodation, the dependent variable includes expenditure on food and drink and therefore the large difference with respect to the Irish anglers in the reference category may be a reflection that international anglers spend substantially more socialising at angling tournaments. When examining SUR model 2 variant that includes target species and country of origin interaction variables, the reference category is all sea anglers (i.e. *Sea*). Three results are notable. First, game, pike and course anglers from Ireland spend between €79–97 less per tournament on accommodation, food and drink than those attending sea angling competitions. Second, coarse anglers travelling from overseas spend substantially more, between €251–311 per tournament than those anglers participating in seafishing competitions. And finally, there is a difference of €300–400 in total spend on accommodation, food and drink by Irish compared to visiting anglers, particularly during coarse and pike angling tournaments.

The third equation examines angling-related expenditure at tournaments. Similar to AFD expenditure equation, expenditure is higher among anglers working fulltime and also increasing in the length of angling tournament. The interaction terms between country of origin and target species enables us to see if there are distinct categories of angling expenditure. The reference category in this instance are all sea tournament anglers. The estimated €1317.2 coefficient on the $Game : Else$ interaction term (in model 1) is most striking but is largely driven by one observation and therefore can be discounted. Table 3 reports the number of observations associated with each interaction variable. The most notable result is that international coarse anglers spend considerably more than sea anglers (as well as considerably more than coarse anglers from Ireland), averaging between €151–173 per trip (€186–190 in model 2). There is no statistical difference in angling related expenditure among other target species/country of origin categories compared to sea anglers. Previous research on expenditure among anglers in Ireland has indicated that game anglers spend substantially more than coarse anglers (Curtis and Stanley, 2016) but this result combined with the similar finding from the AFD equation suggests that coarse tournament anglers travelling from abroad, particularly Great Britain, are the highest spenders by a considerable margin. Much of the angling expenses that arise within a tournament, as well as AFD expenses, will occur within the geographic locality of the tournament and it is reasonable to conclude that coarse angling tournaments with a high proportion of international participants are likely to have the greatest economic impact on the local economy on a per angler basis.

4.2 Mixture model estimates

The dependent variable in the mixture models is expenditure per day, and the estimation focused on angling, accommodation, food and drink expenditures. A mixture model for travel expenses was not estimated as there is unlikely to be policy interest in understanding variations on travel expenses, especially as the majority of travel expense occurs at locations distant from angling tournament site. The estimation of a mixture model for AFD expenditures was problematic. In the instances where estimation was feasible a practical interpretation of the results was difficult. Our consequent conclusion is that AFD expenditures are not best explained by means of a mixture model and we do not report estimation results. For the angling-related expenditure mixture models we assumed normal distributions and present results for 2 and 3 mixture distributions. The model with the lowest Akaike Information Criterion (AIC) or Bayesian information criterion (BIC) is usually preferred. Based on AIC either model is equally probable, whereas a 2-mixture model has stronger support based on BIC in the case of angling expenditures. Estimates of models with 4 component mixtures did not converge. Upon convergence, robust standard errors of the parameter estimates were computed using the Huber/White/sandwich estimator.

Results for angling expenditure are reported in Table 4, where the estimated mixing probabilities are 0.82 and 0.18 for the 2-mixture model compared to 0.79, 0.14 and 0.07 in the 3-mixture model. Irrespective of model the larger grouping represents approximately 80% of respondent anglers and their respective coefficient estimates are broadly similar between the two models, i.e. coefficients on $Game$ and $Coarse$ are between €53–56 and those on Sea and $Pike$ are slightly less, between €44–46. The balancing 20% is split between one or two further groups depending on whether the 2- or 3- mixture model is preferred. What is most noteworthy in these models is the difference in the magnitude of coefficients on target species between groups. In the 2-mixture model the larger grouping (i.e. 82% of sample) spend €53 per trip on game angling expenses compared to €180 by the second group. In the 3-mixture model the second and third groups spend €209 and €123. Depending on the selected model (i.e. 2 or 3 mixtures) the majority of game anglers (i.e. 80% approx) could be termed as 'low' spenders, whereas there is a second or possibly third category of game anglers that spend substantially higher amounts on angling expenses. Across the other target species there are similar differences in expenditure. For sea angling the range of expenditure varies between €46 and €156, with a smaller range for pike angling, between €46 and €109. The coefficient for coarse angling was not significant in the 2-mixture model, though the 3-mixture model suggests that there is also a small proportion of anglers that spend substantially higher than the average on tournament angling expenses.

In the SUR models the estimated coefficient on the *OnSite* variable in the angling expenses equation was not statistically significant, suggesting that angler recruitment on-site at a small number of prestige tournaments did not introduce bias. The same *OnSite* variable in the mixture models is significant for the minority high expenditure anglers, which suggests that the high-expenditure anglers may be more prevalent among the anglers that were recruited during a small number more prestigious angling tournaments to participate in the online survey.

5 Discussion

The dataset analysed relates to 106 angling tournaments held during 2013 including small club events, as well as prestigious tournaments attracting international participants. Prior to discussing the results further it is important to reiterate that the dataset has a relatively small sample size with just 283 anglers and additionally that it is not necessarily representative of all anglers engaged in competitive angling within Ireland. Nonetheless, the data does provide useful insight into expenditure patterns at angling tournaments.

In non-angling sports events there is evidence of segmentation between low, medium, and high spenders (Dixon et al., 2012; Saayman and Saayman, 2012). We find evidence, at least in angling-related expenses, that expenditure is segmented across two or possibly three groupings. In Irish angling tournaments the majority of anglers (approx 80%) fall in the 'low' spender category but a sizeable minority spends substantially higher amounts. Profiling the high spend group is not feasible within the mixture model framework but an awareness that there is distinct expenditure segmentation is potentially of practical interest to angling tournament organisers, for example, in planning sufficient resources and facilities for event participants or trying to maximise the local economic benefit of tournaments. While the segmentation result is specific to this data on Irish angling tournaments, there is no obvious reason why this will not be applicable in other countries, especially since about one-third of anglers in the dataset are resident outside the island of Ireland.

A second noteworthy result is the high level of expenditure by coarse anglers visiting Ireland. Their expenditure, both on angling expenses, as well as accommodation, food and drink, is substantially higher than other angler categories. Previous research on recreational angling expenditure in Ireland found that coarse anglers were among the lowest spenders (TDI, 2013, p.18). The two studies are not directly comparable in that we are specifically referring to coarse anglers from overseas rather than all coarse anglers, and expenditure at tournaments rather than all expenditure. The high expenditure among visiting coarse anglers may be partially explained by the fact that coarse anglers from overseas tend to participate in tournaments of longer duration (average, 5 days) compared to Irish anglers (average, 2.5 days), however, the reference category for the analysis (i.e. sea anglers) also participate in tournaments of longer duration (average, 4 days).

We find only limited evidence that angler group size has an important effect on daily expenditures. Previous research has differed on the nature of the impact of group size on expenditure (Wynen, 2013; García-Sánchez et al., 2013) but the analysis in this instance finds the impact is relatively small. The SUR model results suggest that groups spend more on a per person basis on accommodation, food and drink, whereas the mixture model suggests that a minority of tournament anglers (circa 14-18%) have higher angling related expenses. The effect of groups' tournament participation is not considered in this research and it is feasible that tournament participation is higher among groups. In that instance tournament organisers should specifically target groups of anglers to boost the number of entrants.

Only in the travel expenses equation of the SUR model was there any evidence of an income effect on expenditure. We found no evidence that expenditure on either angling expenses or AFD is greater for anglers with higher incomes compared to others, which is similar to findings elsewhere for fishing (Bilgic et al., 2008) and tourism (Tavares et al., 2016) expenditure. The implication is that if local economic impact is an objective for tournament organisers there is no evidence that targeting high-income anglers will be beneficial.

There are a number of practical implications from this research, for example, for angling tournament organisers. First, the analysis shows an important segmentation in expenditure levels for angling related items, a segmentation that occurs across all tournament types, including club competitions. Angling related expenses include boat hire, ghillie (guide) services, and fishing tackle among other items and are retail services that event organisers could provide. The model estimates suggest that 1 in 5 anglers is a ‘high’ spender on angling related items, consequently tournament organisers could directly benefit through the provision of retail opportunities at tournaments. The analysis also suggests that not all anglers are equal in terms of expenditures at tournament events, with British course anglers at Irish tournaments identified as the highest spenders. If the primary objective of an angling tournament is for its economic potential or tourism boost to the local area then a tailored marketing strategy would be important. On a per angler basis, coarse and pike angling tournaments are more lucrative to local accommodation and food hostelries compared to other target species, and especially so if the participants are travelling from overseas.

6 Conclusions

This paper estimates expenditure equations for recreational angling tournaments as a function of socio-demographic variables. Two methodological approaches are utilised, the first follows an expenditures system approach estimating expenditure equations for three categories of expenditure associated with angling tournaments using the Seemingly Unrelated Regression (SUR) estimator. The second method uses a mixture (or latent class) model to reveal unrecognised or undefined sub-groups within the sample of tournament anglers. In the case of the mixture model the estimated results focus on angling-related expenditures only, whereas the SUR results additionally consider travel, as well as, accommodation, food and drink (AFD) expenses.

One conclusion from the analysis is that among tournament anglers there is an 80/20 split between ‘low’ and ‘high’ spend anglers for angling expenditures. The minority ‘high’ spend anglers spend up to 4 times as much as the more common regular angler. One might expect that angling expenditure is higher at more prestigious tournament events, which we find also, but the ‘high’ spend 20% minority occurs across all tournament types.

A striking result is that tournament coarse anglers visiting Ireland, predominantly from Great Britain, spend substantially more than other anglers irrespective of target species or angler country of origin. This result was unexpected as coarse anglers in general (i.e. not specifically participating in angling tournaments) were found to be among the lowest spenders (TDI, 2013, p.18). However, anecdotal evidence from fishery managers suggests that British coarse anglers visiting Ireland competing in angling tournaments do so as part of their annual vacation or that the trip is often the high-point of their angling season. Further data and research is necessary to determine whether the result is unique to the current dataset or more widely applicable.

The analysis also considered expenditure on accommodation, food and drink (AFD) as a single category of expenditure, investigating whether total AFD expenditure differed by accommodation type or angler country of origin. Among international visiting anglers there was no practical difference in total AFD expense among those that stayed in hotel, guest-house or B&B accommodation, with visitors staying in self-catering accommodation spending somewhat less, which is as one would expect. Irish tournament anglers spend considerably less than international visiting anglers, as it is feasible for them to return home on the same day in many instances.

The current paper considers expenditure by tournament anglers at over 100 sea, coarse, pike and game angling tournaments during 2013, principally attributing expenditure by angler socio-demographics. The dataset contained limited information about the tournament venues and further research is necessary to evaluate how expenditures differ depending on tournament-specific characteristics (e.g. facilities, fish stocks, associated social events, etc.) and also whether there are seasonal variations.

The use of mixture (or latent class) models adds a new dimension to the analysis of tourism and sports expenditures. The estimated model clearly demonstrates the heterogeneity of preferences, in our case in respect of angling related expenses. Accordingly analytical models must be cognisant of underlying preferences. Estimators frequently used to investigate visitor expenditures, e.g. OLS, assume homogeneity of preferences and therefore are unable to reveal the distinct categories of 'high' and 'low' spend anglers that we find in our data. The segmentation of visitor expenditure is not new within the tourism literature but the use of mixture models potentially offers new insights to decision-makers seeking to develop marketing and planning strategies for their tourism attraction, including sports events.

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Table 1: Descriptive statistics of variables used in empirical models

Variable	Mean	Standard Deviation	Minimum	Maximum	Description
TripExp	733.59	663.85	30	4,515	Total trip expenditure, €
TravelExp	191.22	223.06	0	2,050	Trip travel expenses, €
FoodBedExp	318.15	315.88	0	2,135	Food & accommodation expenses, €
AnglingExp	224.22	232.88	0	1,880	Angling related expenses, €
CompDays	3.36	1.97	1	7	No. days in angling tournament
OnSite	0.46	0.50	0	1	Dummy=1 if respondent recruited on-site
Tournament type:					
Game	0.18	0.38	0	1	Game species tournament
Coarse	0.37	0.48	0	1	Coarse species tournament
Pike	0.10	0.30	0	1	Pike tournament
Sea	0.36	0.48	0	1	Sea angling tournament
Angler's home:					
Ire	0.67	0.47	0	1	Ireland, incl. Northern Ireland
GB	0.29	0.46	0	1	Great Britain
Else	0.04	0.19	0	1	Elsewhere
Accommodation type:					
*Bed*1	0.14	0.35	0	1	Hotel
*Bed*2	0.27	0.44	0	1	Guest-house, B&B
*Bed*3	0.24	0.43	0	1	Self catering/Rental
*Bed*4	0.05	0.22	0	1	Hostel/camping/caravan
*Bed*5	0.30	0.46	0	1	Stayed with friends or returned home
Distance	285.52	276.71	5	1,250	Road distance travelled (miles)
Income	46,902	29,895	12,000	175,000	Annual pre-tax household income, €
Fulltime	0.72	0.45	0	1	Working full-time=1, 0 otherwise
Group	0.37	0.48	0	1	Dummy=1 if respondent attended as part of a group

Table 2: Trip expenses – SUR regression models

	SUR model 1						SUR model 2					
	TravelExp		FoodBedExp		AnglingExp		TravelExp		FoodBedExp		AnglingExp	
Constant	-228.1*	(138.0)	66.75	(40.58)	47.33	(31.32)	-199.2	(135.8)	9.695	(0.24)	53.05*	(31.67)
Distance	0.0819	(0.05)					0.0757	(0.05)				
GB	186.8***	(26.67)					182.2***	(27.80)				
Else	607.3***	(139.5)					613.4***	(144.0)				
$\ln(Income)$	26.06**	(13.13)					23.54*	(12.93)				
CompDays			38.83***	(10.13)	28.08***	(6.918)			66.56***	(9.607)	26.16***	(6.838)
Fulltime			63.01***	(21.57)	51.42***	(18.03)			86.72***	(25.59)	51.32***	(18.14)
OnSite	72.95***	(20.52)	21.08	(22.38)	18.35	(29.30)	76.03***	(20.54)	18.57	(29.63)	16.00	(29.44)
Group	22.82*	(11.88)	30.15*	(16.21)	-3.948	(18.74)	20.78*	(11.83)	15.01	(24.13)	-1.046	(18.63)
Sea					**[REF]**				**[REF]**		**[REF]**	
$Game : Ire$					13.09	(27.92)			-91.84***	(29.67)	4.292	(27.61)
$Game : Else$					1317.2***	(65.29)			28.88	(97.86)	1213.8***	(78.11)
$Coarse : Ire$					4.450	(22.27)			-97.36***	(28.71)	5.663	(23.97)
$Coarse : GB$					173.0***	(41.69)			250.6***	(53.93)	185.9***	(47.02)
$Coarse : Else$					150.5*	(79.87)			310.9***	(103.0)	189.9**	(92.76)
$Pike : Ire$					-12.19	(28.74)			-78.91***	(28.98)	-17.94	(31.01)
$Pike : Else$					114.7	(71.86)			235.2***	(65.27)	77.15	(83.37)
$Bed1 : Ire$			**[REF]**									
$Bed1 : GB$			394.1***	(78.15)								
$Bed1 : Else$			385.4***	(95.23)								
$Bed2 : Ire$			3.952	(31.29)								
$Bed2 : GB$			409.5***	(69.36)								
$Bed2 : Else$			398.3***	(101.8)								
$Bed3 : Ire$			103.2**	(49.54)								
$Bed3 : GB$			207.7***	(44.08)								
$Bed3 : Else$			-89.71	(109.0)								
$Bed4 : Ire$			-131.2***	(27.64)								
$Bed5 : Ire$			-139.3***	(25.45)								
$Bed5 : GB$			20.30	(152.8)								
R^2	0.56		0.65		0.37		0.56		0.57		0.36	
Log Likelihood			-8011.9						-7637.9			
AIC			16101.8						15341.8			
BIC			16243.9						15462.1			
No. of observations			283						283			

Standard errors of coefficient estimates are in parentheses, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 3: Number of respondents by accommodation type, target species and country of origin

		Ireland	Great Britain	Elsewhere	All
	Variable name	*Ire*	*GB*	*Else*	
Hotel	*Bed*1	29	8	4	41
Guest-house, B&B	*Bed*2	44	26	5	75
Self catering/Rental	*Bed*3	20	45	2	67
Hostel/camping/caravan	*Bed*4	15	0	0	15
Stayed with friends or returned home	*Bed*5	81	4	0	85
Total		189	83	11	283
Game	*Game*	49	0	1	50
Coarse	*Coarse*	51	45	8	104
Pike	*Pike*	27	0	1	28
Sea		62	38	1	101
Total		189	83	11	283

Table 4: Angling expenses per day – Mixture model estimates

Dependent variable:	*AnglingExp*/day		*AnglingExp*/day		
Model	2 mixture distributions		3 mixture distributions		
Fulltime	2.469	45.54	2.647	62.51**	28.14***
	(3.502)	(29.12)	(3.543)	(25.91)	(2.363)
Game	53.32***	180.3***	54.26***	209.4***	123.4***
	(6.214)	(32.84)	(5.787)	(36.94)	(3.470)
Coarse	56.47***	51.99**	53.69***	50.56*	100.6***
	(5.256)	(25.91)	(4.999)	(27.51)	(2.116)
Sea	46.05***	156.6***	44.39***	150.1***	21.39***
	(5.107)	(45.40)	(5.208)	(43.22)	(2.343)
Pike	46.65***	109.5***	46.33***	95.64**	98.26***
	(5.696)	(38.75)	(5.720)	(42.56)	(5.250)
OnSite	-3.711	-22.15	-1.442	-31.64	23.50***
	(4.178)	(28.47)	(4.189)	(35.63)	(2.880)
Group	-3.012	86.48***	-2.554	85.13**	-9.370***
	(4.021)	(29.88)	(4.076)	(33.14)	(2.261)
θ_1	1.503***		2.477***		
	(0.200)		(0.311)		
θ_2			0.737**		
			(0.361)		
$\ln(\sigma_1)$	3.118***		3.121***		
	(0.0657)		(0.0618)		
$\ln(\sigma_2)$	4.180***		4.135***		
	(0.0957)		(0.136)		
$\ln(\sigma_3)$			1.239***		
			(0.175)		
π_j	0.82	0.18	0.79	0.14	0.07
No. of observations	283		283		
Log likelihood	-1436.2		-1422.0		
AIC	2906.3		2896.0		
BIC	2968.3		2990.8		

Standard errors of coefficient estimates are in parentheses, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

The mixing probabilities $\pi_j = exp(\theta_j)/(\sum_{s=1}^{C-1} exp(\theta_s) + 1)$, as noted in discussion to equation (4)

Normal distributions were assumed, with σ_j therefore being the standard deviation of the j^{th} mixture