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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.

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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. 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.

Sainaghi (2012) review the literature on consumer expenditures in hospitality and tourism in general and remark on the low volume of research, not to mention research on angling tournaments. However, 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. These findings illustrate that an understanding among angling tournament organisers of the preferences of potential participants is likely to be beneficial to the success of the event. Bilgic et al. (2008) specifically investigate anglers' expenditure, estimating an expenditure share system for hunting and fishing activities in the United States. Their findings are consistent with observed preferences, including that men are more likely to engage in fishing than women, and similarly for urban versus rural residents, and retirees versus working age people. They also find that many socio-economic and demographic variables did not significantly influence spending on angling. The sole paper examining anglers' preferences for angling tournaments (Oh et al., 2007) focuses on fishery management interventions within tournaments, such as catch-and-release and bait restrictions. One of their important findings was that anglers' most preferred management option for angling tournaments in Texan salt waters included additional conservation-based measures.

The purpose of this paper is to consider whether socio-economic and demographic variables significantly influence expenditure patters of angling tournament participants. The research extends

both the literature on sports expenditure as well as the fisheries literature on angler preferences. This paper should underpin future research examining fishery management interventions at competitive angling events, similar to (Oh et al., 2007), but focusing on Irish tournaments where there is little research.

2 Materials and Methods

The analysis undertaken in the paper employs an existing survey dataset, which was collected to estimate travel cost models for angler tournaments during 2013 in Ireland (O'Reilly, 2014). The analysis aims to provide 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 expenditure dataset.

2.1 Data

The angler survey was conducted in 2013. 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 a research survey at a later date. All surveys were administered online. Further detail about the administration of the survey is available in O'Reilly (2014). The use of online surveys has fuelled a discussion about their quality and reliability for scientific use (Couper, 2000; Bethlehem, 2010). Arguments in their favour include their low cost and flexible questionnaire design. A serious drawback is that online surveys may not be representative of the population of interest because those with internet access may be a specific sub-population (Loosveldt and Sonck, 2008). The sample in the angler survey might not be subject to usual biases associated with online surveys, as some anglers were recruited in person. Nonetheless, not all invited anglers necessarily have internet access and more generally invited respondents were not drawn from a sampling frame and not every respondent has a known probability of being selected, being exposed to the invitation to participate in the survey, and accepting the invitation. Consequently the dataset must be treated as a convenience sample of competition anglers and cannot be taken as representative of the population of anglers participating in competitions in Ireland. This limits the usefulness of the analysis in terms of estimating the economic contribution of such events to regional economies and caution should be exercised in making policy recommendations. However, with a dearth of information on angling competitions in Ireland, the analysis provides some insight that was not previously available, which itself should assist in further research on angling competitions.

The 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.

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:					
Bed1	0.14	0.35	0	1	Hotel
Bed2	0.27	0.44	0	1	Guest-house, B&B
Bed3	0.24	0.43	0	1	Self catering/Rental
Bed4	0.05	0.22	0	1	Hostel/camping/caravan
Bed5	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

2.2 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 a single regression equation may be insufficient to fully reveal 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. Rather than a single expenditure function, 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 estimator rather than single equation OLS is that there can be an efficiency gain in simultaneous estimation by combining information on different equations. The expenditure equations can be represented by

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

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]

2.3 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. We propose using 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

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

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 $\sum_{j=1}^{C} \pi_j = 1$.

2.4 Explanatory variables

Irrespective of model estimated we use a number of explanatory 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.

[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.

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 may be similar across target species, it would be unreasonable to assume that total angling expenses are similar across target species specific. Therefore, we include dummy variables for target species (i.e. game, coarse, pike and sea) to allow for this variation in the model estimates. 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).

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.

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.

3 Results

The model estimates are presented in Tables 2 and 4. Table 2 presents the SUR model estimates, where the dependent variables are total tournament expenses in each of the three categories. 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.

3.1 SUR model estimates

Two variants of the SUR model estimates are reported in Table 2, with estimates from a single equation OLS also reported for comparison. In the first SUR model we include accommodation type and country of origin interactions as explanatory variables in the accommodation, food and drink equation, whereas in the second SUR model we instead include target species and country of origin interactions as explanatory variables. We first consider the travel expense equation, where the main parameters of statistical significance are country of origin, distance travelled and income. As expected, travel expense is increasing in travel distance, equivalent to €0.08 per mile, though this estimate is significant only at the 10% level. 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 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. Irrespective of the variant estimated, two other variables of significance are tournament length and whether the angler works fulltime. AFD expenditure increases by €40–68 per additional tournament day depending on model, and is €62–87 higher among anglers in full time employment. 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 €375–403 per day 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 the model 2 variant that includes target species and country of origin interaction variables, the reference category is all sea anglers (i.e. *Sea*). Two results are notable. First, game and course anglers from Ireland spend roughly €90–100 less per tournament on accommodation, food and drink than those attending sea angling competitions. Second, coarse anglers travelling from overseas spend substantially more, between €245–289 per tournament than Irish anglers in staying in hotel accommodation.

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 €1328.5 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 considerably more than coarse anglers from Ireland), averaging between €140–170 per trip. 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 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.

A single equation OLS expenditure equation is also reported in Table 2 for comparison. While the R^2 statistic is relatively high, the single equation approach does not reveal as much information. For instance, the OLS model does not attribute much explanatory power to accommodation type, which is implausible. The OLS results illustrate the potential miss-specification error associated with using a simple model to explain expenditures.

3.2 Mixture model estimates

For the mixture models the dependent variable was specified as expenditure per day. For comparative purposes the OLS results are also reported. 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.

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.

The OLS estimates for angling expenditure are also reported in Table 4 and they broadly match the coefficient estimates of the majority grouping in the mixture models. Relying an OLS model would not have unmasked the heterogeneity associated with angling-related expenditure at tournaments.

Table 2: Trip expenses regression models

Dependent variable:	*TripExp*	*TravelExp*	*FoodBedExp*	*AnglingExp*	*TravelExp*	*FoodBedExp*	*AnglingExp*
Estimator:	OLS	SUR (model 1)			SUR (model 2)		
Distance	0.0326	0.0817*			0.0759*		
	(0.24)	(1.91)			(1.77)		
GB	493.0**	187.7***			184.5***		
	(2.26)	(6.16)			(6.04)		
Else	3150.5***	607.9***			611.0***		
	(8.36)	(12.48)			(12.54)		
ln(*Income*)	4.443	25.99*			24.44*		
	(0.10)	(1.78)			(1.68)		
CompDays	85.49***		40.25***	29.37***		68.19***	28.15***
	(4.95)		(4.97)	(4.38)		(8.59)	(4.17)
Fulltime	111.8**		62.73***	51.61**		87.13***	51.83**
	(2.07)		(2.63)	(2.27)		(3.26)	(2.28)
Sea	**[REF]**			**[REF]**		**[REF]**	**[REF]**
Game : *Ire*	20.93			12.36		-91.93**	4.165
	(0.26)			(0.39)		(-2.28)	(0.12)
Game : *Else*	-690.9			1328.5***		66.51	1259.7***
	(-1.01)			(8.33)		(0.33)	(7.40)
Coarse : *Ire*	-38.47			2.365		-101.4***	0.739
	(-0.51)			(0.08)		(-2.81)	(0.02)
Coarse : *GB*	161.6			169.9***		245.6***	179.8***
	(1.38)			(5.29)		(6.28)	(5.35)
Coarse : *Else*	-2778.0***			139.8**		289.0***	163.0**
	(-5.31)			(2.18)		(3.84)	(2.49)
Pike : *Ire*	3.551			-12.68		-78.80	-17.82
	(0.04)			(-0.34)		(-1.62)	(-0.43)
Pike : *Else*	-2869.4***			109.2		225.8	65.58
	(-4.19)			(0.68)		(1.12)	(0.38)
Bed1 : *Ire*	**[REF]**		**[REF]**				
Bed1 : *GB*	186.1		390.9***				
	(0.82)		(5.69)				
Bed1 : *Else*	470.5		381.7***				
	(1.05)		(4.13)				
Bed2 : *Ire*	-45.68		2.618				
	(-0.51)		(0.07)				
Bed2 : *GB*	-50.67		403.3***				
	(-0.25)		(7.83)				
Bed2 : *Else*	352.3		375.9***				
	(0.88)		(4.40)				
Bed3 : *Ire*	225.6*		108.3**				
	(1.93)		(2.15)				
Bed3 : *GB*	-178.2		204.8***				
	(-0.92)		(4.55)				
Bed3 : *Else*	#		-49.66				
			(-0.41)				
Bed4 : *Ire*	-239.9**		-134.5**				
	(-2.00)		(-2.56)				
Bed5 : *Ire*	-283.2***		-143.2***				
	(-3.44)		(-4.03)				
Bed5 : *GB*	#		29.08				
			(0.33)				
OnSite	41.00	72.63***	17.83	15.99	75.11***	15.98	12.83
	(0.66)	(3.43)	(0.64)	(0.56)	(3.55)	(0.48)	(0.44)
Group	19.23	23.09	29.35	-3.979	21.46	14.38	-1.811
	(0.34)	(1.09)	(1.10)	(-0.16)	(1.02)	(0.50)	(-0.07)
Constant	185.1	-227.5	66.29	45.26	-209.1	7.406	50.25
	(0.42)	(-1.48)	(1.52)	(1.26)	(-1.36)	(0.17)	(1.36)
N	283	283	283	283	283	283	283
R^2	0.728	0.568	0.663	0.396	0.568	0.577	0.391

t statistics in parentheses, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

\# variable omitted because of collinearity

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: Regression results of angling expenses per day

Dependent variable:	*AnglingExp*/day	*AnglingExp*/day		*AnglingExp*/day		
Model	OLS	2 mixture distributions		3 mixture distributions		
Fulltime	17.56**	2.469	45.54	2.647	62.51**	28.14***
	(2.07)	(0.69)	(1.56)	(0.72)	(2.06)	(9.56)
Game	88.13***	53.32***	180.3***	54.26***	209.4***	123.4***
	(7.43)	(10.08)	(5.28)	(10.51)	(5.42)	(35.45)
Coarse	54.74***	56.47***	51.99	53.69***	50.56	100.6***
	(5.23)	(12.03)	(1.49)	(11.23)	(1.30)	(36.00)
Sea	50.07***	46.05***	156.6***	44.39***	150.1***	21.39***
	(4.36)	(9.44)	(3.62)	(8.70)	(3.26)	(7.03)
Pike	52.99***	46.65***	109.5**	46.33***	95.64	98.26***
	(3.44)	(7.37)	(2.10)	(7.26)	(1.58)	(21.22)
OnSite	3.932	-3.711	86.48***	-1.442	85.13***	-9.370***
	(0.42)	(-0.92)	(3.01)	(-0.35)	(2.70)	(-3.28)
Group	-1.327	-3.012	-22.15	-2.554	-31.64	23.50***
	(-0.15)	(-0.81)	(-0.81)	(-0.68)	(-0.96)	(8.68)
θ_1		1.503***			2.477***	
		(7.81)			(7.96)	
θ_2					0.737*	
					(2.05)	
$\ln(\sigma_1)$		3.118***			3.121***	
		(53.47)			(55.45)	
$\ln(\sigma_2)$		4.180***			4.135***	
		(35.77)			(30.10)	
$\ln(\sigma_3)$					1.239***	
					(6.00)	
π_1		0.82			0.79	
π_2		0.18			0.14	
π_3					0.07	
N	283	283			283	
LL	-1573.9	-1436.2			-1422.0	
AIC	3161.9	2906.3			2896.0	
BIC	3187.4	2968.3			2990.8	

t statistics in parentheses, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

4 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 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. In the analysis of total tournament expenditure, both on angling expenses, as well as accommodation, food and drink, coarse anglers from overseas spend substantially more 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 no substantive 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 negligible. Had the group size coefficient been positive and statistically significant there would have been a policy implication that tournament organisers target participation by groups of anglers if local economic impact was a tournament objective. The effect of group size on 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.

5 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 subgroups 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. 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.

In separate analysis the 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 and it is difficult to provide a rationale for why this is so. 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.

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