Recreation Demand Model Construction Through the Use of Regression Analysis With Optimal Scaling

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Abstract

The creation of a demand model for a natural resource without a market price and the determination of the most significant factors affecting it constitute the basic goal of every integrated management plan and evaluation of the said resource. The present study aims to construct such a demand model for forest recreation at the ski center in the region of Pilio. One of the most specific goals of the present study is to reveal all those factors (quantitative and qualitative) that influence demand at the Pilio ski center, as well as to specify the degree and type of relation that exists between them and the above-mentioned demand. Special emphasis was placed on the determination of the qualitative factors that influence demand in this mountainous region. The method applied for the construction of a demand model for the Pilio ski center has been Regression Analysis with Optimal Scaling, also known as Categorical Regression.

Résumé

La mise au point d'un modèle de demande pour une ressource naturelle sans prix de marché et la définition des facteurs qui la déterminent représentent le but principal de chaque projet de gestion intégrée et d'évaluation de cette ressource naturelle. L'objectif de ce travail est de construire un modèle de demande de recréation dans le centre de ski de la région de _ilio. Les facteurs (qualitatifs et quantitatifs) qui déterminent la demande de recréation dans le centre de ski de _ilio sont mis en évidence et on évalue, parallèlement, le degré et le type de relation entre ces facteurs et la demande. Tout particulièrement, l' accent est mis sur la détermination des facteurs qualitatifs qui influencent la demande de recréation dans cette région de montagne. La méthode retenue pour la construction du modèle de demande dans le centre de ski de Pilio est l'analyse de régression avec échelle optimale, aussi connue comme régression catégorique.

1. Introduction

Environmental resources are frequently focused on recreation trips. The significance of the environment, as recreational area, has increased over the last decades. Environmental economists have been interested in modeling demand for recreation trips. According to the Metropolitan Area Planning Council (2002), demand analyses for recreation serve to indicate what people do, how people feel and what people want in recreation. Recreation demand models are used to forecast demand for recreation activities as well as to determine the value that recreators place on the various factors that affect the choices (Train, 1997). Jacsman (1994) pointed out that land-use planners define the term recreational demand as the numbers of humans that are or would like to be involved in outdoor recreation. Clawson and Knetsch were the first to define recreation demand as a function of travel cost, which they consider a substitute of its price. Travel cost recreation demand models stem from Hotelling's simple, but penetrating, insight (Phaneuf and Smith, 2004). Hotelling's travel cost method has been applied to demand estimation for forest use, water quality (Sutherland, 1982), hiking and biking (Hesseln et al., 2002), fishing (Morey et al., 2002), and snorkeling (Park et al, 2002).

Since the 1970s, significant progress has been made and many categorical variables have been included in the demand function. Several different approaches and methods exist in order to quantify the demand of recreation. Forest recreational demand presents two particular characteristics (Gregory, 1972): a) It is consumed where it is produced and thus, all factors related to the recreational area have to be taken into account. b) It consists of a group of specialized distinct activities.

As a result, demand for recreation is considered a multidimensional unit with the following variables: the socio-economic characteristics of its users, the recreational area attractiveness and quality, the availability of substitute and alternative recreation opportunities in the area, travel time, congestion in the recreation area, site characteristics and users' preferences (Walsh, 1986; Jacsman, 1994; Chakraborty et al., 2000; Bowden, 2003).

This paper studies the demand for winter recreation activities in Greece and should determine the origin of demand for these activities. The main approach used is the regression analysis with optimal scaling known as categorical regression, based on revealed preference data from a sample of skiers. Categorical regression, also called CATREG in SPSS, is a regression family variant which can be used when there is a combination of nominal, ordinal, and interval-level independent variables (PA765F01, 2005). In the second stage we will compare models that have been contracted with optimal scaling regression with traditional recreation models.

Secondly, the lack of many previous recreation demands

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studies in our country makes this attempt very interesting. It is very important to determine the factors that influence the demand for winter recreation activities in a country where the demand for winter recreation has recently increased.

This study is a part of a whole study on winter recreation demand in Greece whose main object is their economic valuation.

2. Background Concepts

According to Cordell and Bergstram (1989), outdoor recreation demand analysis is further complicated because first it is difficult to exactly define what is demanded and to measure recreation demand and second, even if this problem is resolved, defining theoretically appropriate demand curve tends to be very problematic. Several different methodologies for determining recreation demand have been developed over the years.

For the majority of studies, demand function for recreation at a given site or sites is a relationship between the number of trips taken by an individual (or household) in a given period of time and trip price (travel cost), site characteristics and personal preferences or characteristics (Cordell and Bergestrom, 1989; Chakraborty, et al., 2000). In case that people (or households) spend one or more nights at the recreational site, demand for travel to the site, measured in number of days on-site, is modeled as a function of the daily on-site costs incurred by the household (Day, 1998).

Recreation demand functions are generally of two types, aggregate or individual (Cordell and Bergestrom, 1989). Ordinary demand functions for access to recreation sites that have no entry fee are commonly estimated using travel cost methods (Loomis & Walsh, 1997). The theoretical basis for travel cost derives from the basic notion of economic utility maximization subject to budget and time constraints (Betz et al., 2003). The demand for a site can be modeled as a market or aggregate demand using the zonal travel cost approach (Loomis & Walsh, 1997). Zonal models are particularly useful in situations where data on the individuals are limited (Boxall et al., 1996).

Modern multiple-site travel cost methods allow the spatial patterns of recreation demand to be linked to quality characteristics of recreation sites. This linkage can be used to estimate values of changes in site characteristics. The most common multiple-site travel cost model is the random utility model (Lupi et al, 1998). Hanemann was the first who described the random utility model as a theoretically consistent method for resolving the mixed discrete/continuous choice problem he used to describe recreation demand (Phaneuf and Smith, 2004); he was popularized in the recreation demand literature by Bockstael (Lupi et al., 1998). The random utility model is used for multiple sites, it allows for the provision that some sites may have no consumption, and can interpret how people make their choices of recreation participation in a particular site taking into account site characteristics.

Many other techniques have been used to describe recreation demand like logit analysis and meta analyses techniques. Recreational demand models have usually been specified as logit or nested logit models which have several advantages, including simplicity of estimation (Train, 1997). Meta analyses of recreation involve estimating a statistical model of recreation value based on information derived from previous modeling efforts (Platt and Ekstrand, 2001).

As mentioned above, explanatory variables of recreation demand are several socio-economic characteristics of consumers. Loomis & Walsh (1997) list a number of candidate socio-economic variables that may be included in travel cost demand models, including age, education, race, gender, occupation and others.

It is important to note that insignificant income coefficients are not uncommon in recreation demand studies; many recreation demand studies do not find income to be statistically significant (Siderelis and Moore, 1995; Fix and Loomis, 1998). Normally consumers are more willing and availed to spend money when they are paid with a good salary (Hanley et al., 2000). The insignificant relation of income variable has been observed for many kinds of recreation activities, including skiing (Walsh, 1986).

Many socio-economic variables that have been included in travel cost demand models are age, education, race, gender, occupation and others (Loomis and Walsh, 1997; Betz, et al 2003).

Regarding the age variable, Fix and Loomis (1998) included it as the only socio-economic demand shifter; other researchers like Siderelis and Moore (1995) use a variable reflecting the age composition of each group of visitors. Both studies found mixed results with age variables. Age influences the participant's recreation selection, particularly when recreation activities require significant physical strength and/or dexterity (Department of the Army Technical Manual, 1986). Englin and Moeltner (2003) found that demand for ski activities is higher for younger students.

Education is positively related to participation in many recreation activities (Betz, 2003). More educated people generally participate in physically strenuous activities like skiing (Walsh, 1986).

Gender is another variable that influences the decision for winter activities; men are more willing to take part in them (Walsh, 1986; Englin and Moeltner, 2003). For most activities, males often have higher participation rates than females and participation rates decline with age, increase with income (up to a certain level) and education, and increase with average household size (New Hampshire Office of State Planning, 2003). There are studies that find gender insignificant in wildlife viewing behavior (Bowker, 2001).

The tourist product is a set of elements such as attractions, services, and infrastructures (Formica, 2000). Lew

(1989) defines attractions as things to see, activities to do, and experiences to be remembered (Formica, 2000). Lim (1995) has reviewed 110 studies, of which only 60 include qualitative variables in the model specification. The amount of studies, which include destination attractiveness as a variable or the aspects of destination attractiveness, is not specified. Lim concludes that the majority of studies focus on economic factors in estimating demand. Morley (1992) shows that for different destinations different levels of utility will be attainable depending on the attributes of the destinations. Morley (1992) criticizes the majority of tourism demand analyses on the grounds that they lack a theoretical basis and do not consider utility in the decision making process; he notes that climate and landscape attributes should be included in the characteristics set.

Hu and Ritchie (1993) review several tourist studies from the 1970's and find that "natural beauty and climate" are of universal importance in defining destinations attractiveness. In Lohmann and Kaim (1999), the importance of certain destination characteristics is assessed, landscape is found to be the most important factor even before price considerations.

3. Method

As mentioned above, for the construction of a demand model for Pilio Ski center, the Regression analysis with optimal scaling is used. CATREG is especially suitable to model nonlinear relationships between a set of predictor variables and one outcome variable (SPSS, 2005). Regression with optimal scaling quantifies categorical predictor variables so that they have very strong relationships with a nominal, ordinal, or numerical outcome variable (SPSS, 2005).

Categorical regression offers a combination of such a regression model and optimal scaling. CATREG uses optimal scaling, which quantifies categorical variables considered as numerical variables, including applying nonlinear transformations to find the best-fitting model (ISS, 2004; PA765F01, 2005). As in linear regression, the estimated coefficients reflect how changes in the predictors affect changes in the response, after the quantification for the different categories is available (PA765F01, 2005).

The regression with optimal scaling procedure considers categorical variables to be quantified with numerical values, resulting in a linear equation with transformed variables (www.rz.uni-hohenheim.de, 2005; SPSS, 2004). The resulting regression equation can be used to predict the outcome variable for any combination of the three independent variables.

Categorical regression is considered an extension of the principles of classic linear regression and logarithmic analysis; it uses a scaling method to give values to every category of variables in such a way that they are optimal as far as regression is considered and reflect the characteristics of the initial variables (Siardos, 2000).

The categorical regression approach extends the standard approach by simultaneously scaling nominal, ordinal and numerical variables and offers more flexibility (Siardos, 2000).

The existence of a great number of quality variables regarding recreation at the Pilio ski centre demand model and the conclusion that the relation between them is not linear, made us opt for regression with optimal scaling as opposed to other statistical means of analysis.

4. Model structure

The target population from which the sample was chosen consisted of visitors who participated in winter recreation activities (e.g. skiing) at the Pilio ski centre. The present research was carried out when the ski center was in operation during the whole winter period 2002-2003.

Ski Center of Mount Pelion was one of the first ski centers to operate in Greece. It is one of the best international standard ski centers, at the altitude of 1500m. It is located between Athens and Thessaloniki, the two largest cities in Greece and 27 km from Volos, one of the greatest civil centers in the country, in a very beautiful landscape with a view to the sea. It offers five downhill runs, one for strength and two chair-lifts. As well as skiing, other winter activities can take place here including snowboarding and mountain artillery ski. There is also a school for youngsters and beginners. The center also provides shelter and has approximately 80 beds available, as well as a selection of facilities such as parking and a café.

The systematic sampling was the chosen method (Aaker et al., 1995). Before the final sampling was completed, presampling was carried out. Pre-sampling data was used to calculate the size of the final sample which took into account both quantities and variables in a ratio form (quality factors).

The sampling application on the population produced sample n=350; the survey method used is the personal interview.

Recreation at the ski center of Pilio was viewed as a multi-dimensional unit of socioeconomic variables. We decided to include in the demand function variables that are related to landscape, the ski center and consumers. More specifically:

$Q = f(C,S,I,E,SU,V,A,EC,O,VIS,L)$

Where: Q = annual trips demanded for recreation activities in Pilio Ski center

C = cost of the trips

I = visitors' monthly income

A = users' age

E = visitors' level of education

L = users' judgement for the quality of landscape

INFR = users' judgement for the quality of infrastructure

ACT = users' judgement for the quality of recreation activities the area offers

S = users' sex

V = vacation time period
ECL = participation in environmental protection organizations.
Nevertheless, the conclusions from previous studies for income variable were included only for theoretical reasons. We also decided to include variables related to the region's attractiveness.

Three of the ten independent variables of our model, "existence of substitute areas", "sex" and "participation in environmental protection organizations" are nominal. Seven variables, i.e." cost", "income", "education", "vacation time period", "age", "judgement for landscape", "judgement for infrastructure" and "judgement for activities" are ordinal.

The variables were codified as follows:
- C: 1 = 1-50€, 2=50-100€, 3=100-150€, 4=150-200€, 5=250-300€, 6=300-350€ and 7= > 350€
- I: 1 = 0-900€, 2= 900-1800€, 3=1800-2700 and 3= >2700€
- S : 1= man and 2 = woman
- A: 1 = <25 years old, 2= 25-35, 3=35-45, 4= 45-55 and 5>55
- E: 1 = Primary and secondary school graduates, 2 = University/college graduates and 3 = Postgraduate degree and PhD holders
- V: 1= 1-15 days, 2= 15-30 days and 3= > 30 days
- EC: Yes = 1 and No = 2
- L: 1 = Extremely, 2 = Very much, 3 = Moderately, 4 = Not very much, 5 = Not at all
- INFR : 1 = Extremely, 2 = Very much, 3 = Moderately, 4 = Not very much, 5 = Not at all
- ACT: 1 = Extremely, 2 = Very much, 3 = Moderately, 4 = Not very much, 5 = Not at all.

It should be mentioned that in order to determine the "cost" variable, visitors were asked to answer a question about the total cost of their visit to the ski center.

5. Results

It should be mentioned that in order to determine the "cost" variable, visitors were asked to answer a question about the total cost of their visit to the ski center.

The independent variable is numerical and varies from one to twenty-three trips.

The intercorrelations between the independent variables, both for the initial, non-transformed and the transformed variables, are given in tables 1 and 2.

Table 1. *Categorical Regression ANOVA table*

	Sum of Squares	df	Mean Square	F	Level of Significance
Regression	125,65	12,00	10,47	16,05	0,00
Residual	211,35	324,00	0,65		
Total	337,00	336,00			

From these tables we can see that the values of the simple correlation coefficients are low (almost zero). Thus, we may ascertain that there is no multiple co-linearity between the variables.

After thirteen (13) applications, the categorical regression gave the value of the multiple determination coefficient R^2=0,381 which shows that 38.1% of the recreation demand variation is explained by the transformed values of the independent variables included in the regression equation.

Moreover, the variation analysis (ANOVA) (table 1) produced the value F=4.64, that corresponds to the zero-level of significance, which means that the categorical regression model adapted well to the transformed data.

Table 2 shows the standard regression coefficients of independent variables and the corresponding F values. The F value for each independent variable is related to the existence of the other model variables and states the degree to which, if the variable is removed from the model while all the others remain, this decreases the model forecasting ability. Thus, if we remove the variables "cost" and "activities" from the model, the latter becomes too weak to forecast recreation demand at the ski center. On the contrary, if we remove the variable "ecologist" from the model, the latter becomes less weak, since this variable presents the lowest F value.

Out of the standard regression coefficients, the highest is the one corresponding to the negative values of recreation

Table 2. *Coefficients of categorical regression*

	Standardized Coefficients			Correlations				Tolerance	
	Beta	Standard Error	F	Zero-Order	Partial	Part	Importance	After Transformation	Before Transformation
L	0.08	0.057	1.992	0.03	0.085	0.079	0.018	0.965	0.944
Y	-0.109	0.058	3.500	-0.13	-0.113	-0.105	0.098	0.920	0.831
AC	-0.173	0.058	8.766	-0.22	-0.176	-0.166	0.266	0.917	0.831
C	-0.233	0.059	15.77	-0.26	-0.234	-0.222	0.420	0.907	0.858
SX	0.093	0.057	2.648	0.08	0.098	0.091	0.048	0.962	0.890
ED	0.117	0.058	4.088	0.09	0.121	0.113	0.076	0.937	0.903
I	0.031	0.059	0.276	-0.01	0.032	0.029	-0.001	0.900	0.660
VC	0.039	0.060	0.420	0.06	0.039	0.036	0.016	0.872	0.862
EC	-0.016	0.058	0.080	-0.04	-0.017	-0.016	0.005	0.932	0.925
AG	-0.093	0.057	2.661	-0.08	-0.098	-0.091	0.054	0.971	0.866

"cost" variable (-0.233) followed by the "activities" (-0.173) and "infrastructure" (-0.109).

The coefficient "ecologist" is the lowest (-0.016). The coefficient β =-0.233 of "cost" can be explained as follows: an increase by one standard deviation unit of the trip cost, decreases the forecasted demand for recreation (in number of trips per year) at the ski center by 0.233 standard deviation units. The remaining regression coefficients have a relative, although smaller, effect.

The regression coefficients do not suffice in precisely describing the impact of each independent variable on a dependent one. Thus, the use of all the additional statistical measures and graphs of independent variable transformation is considered essential in order to better explain the model in question.

The simple, partial and part correlation coefficients for each variable of the regression are presented in table 2.

Of the zero-order correlation coefficients, the highest (in absolute values) appear to be those of "cost" (r = -0.26) and "activities" (r = -0.22). This is an indication of the bilateral relation (negative) that associates each variable with the dependent variable of our model, when the remaining variables are not taken into account.

After removing the linear correlation of the remaining variables (from the dependent variable in question as well as the independent variable), the partial correlation coefficients present a very high value for the "cost" variable (-0.234), followed by the variables "activities", "education" and "infrastructure". The lowest value is present at the "ecologist" variable (-0.017). The value -0.234 of the partial correlation coefficient of "cost" explains 5.476% (-0.2342) of the dependent variable values variance, when the impact of the other variables is removed. The remaining values function in a similar way in relation to the dependent variable of our model.

About the part correlation coefficients, the highest values appear for the "cost" variable (-0.222), followed by "activities" (-0.166) and "infrastructure" (-0.105). The remaining variables have significantly lower coefficients. The square of the part correlation coefficient reflects the ratio of the distance-related dependent variable variance in relation to the total, when the effect of all the other variables is removed. When this is done, the remaining amount accounts for 4.928% (0.2222) of the variance of recreation demand values at the Pilio ski center.

Of great assistance in explaining how the independent variables contribute to the dependent variable are Pratt's measures of importance (table 2) (Siardos, 2000).

Table 2 reports the relative importance of independent variables for the "cost" variable, followed by the "activities". These two variables cumulatively account for 68.6% of the total importance of the independent variables.

As we have already mentioned, multiple co-linearity does not exist (due to the low values of the correlation coefficients). This is also confirmed by the independent variables' rarefied values of tolerance that reflect the contribution of the variance of each independent variable, not explained by the rest.

If we look at the graphs of independent and dependent variable transformation, we come to the same conclusions.

6. Conclusions

According to the results of our research, winter recreation activities demand, which are offered by a ski center like Pilio, depends mainly on the cost of recreational trips that are made to a ski center in one year by each visitor. As we may expect, their relation is negative, the individuals who afford higher costs spend a fewer days in the region annually. More specifically, when there is an increase in the recreation cost, this decreases recreation demand and vice versa. In this case, an increase in the cost by one standard deviation results in a deduction in recreation demand by 0.233 standard deviations. 4.9284 of the variance of demand values are explained by cost, if all the other factors are ignored.

The second variable that influences recreation demand of Pilio ski center is the users' judgement for the quality of recreation activities the area offers. As expected, the relation between these two variables is negative (as codified). People who do not appreciate the offered activities, are not willing to spend their vacations in Pilio ski center.

Cost and quality of activities are the two major factors that determine recreation demand at the Pilio ski center. If they are excluded from the demand model, the model's forecasting ability decreases dramatically.

Infrastructure and education are two other variables that influence recreation demand for Pilio ski center but not in the same way. Infrastructure has negative relationship (as codified in this variable) with recreation demand; on the other hand education has a positive relation. Education level has a positive relation (as codified in this variable), with recreation demand at the Pilio ski centre, as people with a higher level of education spend more days at the ski centre (an increase in the education variable value by one standard deviation decreases the forecasted number of recreation days by 0.117 standard deviations). Both results agree with previous studies, as we have demonstrated above.

Income has a positive relation with recreation demand but as it results from the value of Zero-Order coefficient and the value of importance, the income variable is not very important for the demand of Pilio ski center.

Two other variables that have approximately the same influence on recreation demand for winter activities are the quality of landscape and the available vacation time. Both have a positive relation (as this codified variable), but they do not contribute to explaining the consumption of recreation trips. In this case, the possessive relation between quality of landscape and consumption means that a decrease in the quality of landscape by one standard deviation results in the number of recreation trips, an increase by 0.08 standard deviations. This is quite peculiar, and can be explained by the answers to this question, following which the majority of participants consider that the quality of the landscape is high.

Finally age and sex have approximately the same effect on recreation demand at the Pilio ski center. Age is one of the most important socioeconomic variables; from the results of our research young people are more apt to participate in skiing recreation activities than older people. On the other hand, men are more interested in participating in winter recreation activities than women. The importance of both variables for our model is not high; only 0.64% of the variance of demand values is explained by each variable, if all the other factors are ignored.

The "ecologist" variable also has a positive influence on the recreation demand at the Pilio ski center, but to a lower extent. Its exclusion from the demand model has almost no effect on the model's forecasting ability.

According to the results of this study, socio-economic variables do not place an important role to the determination of demand for ski activities (the most important among them are education level and age). The most crucial factor is the travel cost. What must be mentioned is the significance of variables that are related to the site quality (landscape, recreation activities, and infrastructure). The most important factors that influence the demand for ski activities are cumulative. Therefore, they must be included in every effort to predict or calculate them. On the other side, managers of areas that offer ski activities must take into account the importance of site characteristics in every attempt to increase their demand.

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