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TWO PHASE ANALYSIS OF SKI SCHOOLS CUSTOMER SATISFACTION: MULTIVARIATE RANKING AND CUB MODELS

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1. INTRODUCTION

In the sport tourism field, customer satisfaction and service dimensions are crucial points in order to deliver a high quality service and to be competitive. Evaluations of such dimensions with appropriate statistical tools is therefore of fundamental importance.

Sport tourism has been defined as 'travel for non-commercial reasons, to participate or observe sporting activities away from the home range' (Hall, 1992). Weed and Bull (2004) suggest five types of sport tourism: tourism with sport content, sport participation tourism, sport training, sport events and luxury sport tourism. In Weed (2009) it is reported a meta-review of 18 different references (four journal articles, eight book chapters, three reports, etc.) from 1990 to 2008, aimed to trace different research paths undertaken in the sports tourism field. Weed (2006, 2009) describes the 'event sports tourism' as the main researched area followed by 'active sport tourism', particularly golf and ski tourism. Golf and ski tourism have been classified as 'active sport tourism' or 'sports participation tourism' by several authors (Gibson, 2002; Weed and Bull, 2004). The following studies have dealt with the behaviours of sport tourists: Petrick and Backman's researches on the satisfaction and value perceived by golf tourist (2002a, 2002b, 2002c); the research of Williams and Fridgeon (2000) on the barriers that keep many potential skiers off the slopes and trails. As stated by Chaplin (2001), sports tourism field is 'multi-faceted' with authors performing sport tourism researches from different disciplinary perspectives. Weed (2009) outlined the importance of the contribution of different disciplines to the sport tourism research, highlighting also the scarcity of studies related to customer satisfaction particularly in winter sports. In a study on how addressing the participation constraint in potential skiers, Williams and Fridgeon (2000) stated that 'so much of the breaking down of the barriers to skiing evolve around treating new skiers in friendly and hospitable ways'. To accomplish this aspect seems important not only a customer service marketing that makes skiers feel comfortable, but also it seems important to evaluate and monitor customer satisfaction and service quality.

Within the sport tourism industry, quality of provided services is a relevant issue in order to be competitive (Kouthouris and Alexandris, 2005; Shonk and Chelladurai, 2008). Some studies on customers' perception of service quality have been conducted in health and fitness centers (Alexandris *et al.* 2004), golf courses (Crilley *et al.* 2002), recreational and leisure facilities (Ko and Pastore, 2004) and during sport events (Greenwell *et al.* 2002a, 2002b; Kelley and Turley, 2001; McDonald *et al.*1995; Wakefield *et al.* 1996).

Customer satisfaction can determine the success of a sport organization (Ko and Pastore, 2004). Matzler *et al.* (2008) in a study on customer satisfaction in Alpine areas claimed that winter tourism is crucial for eastern Alpine region's economy, in particular Alpine skiing activities (Dolnicar and Leisch, 2003; Franch *et al.* 2003, Matzler *et al.* 2004; Matzler and Siller, 2003; Weiermair and Fuchs, 1999; Williams and Fidgeon, 2000). Matzler *et al.* (2008) also reported that 'more and more winters with few snow and the rapid growth of long-distance travel increase competition between Alpine ski areas' (Pechlaner and Tschurtschenthaler, 2003). In this competitive market environment, a careful analysis of tourist motivations, customer satisfaction and loyalty can make the difference (Yoon and Uysal, 2005).

Requirements for high quality service are also specified by ISO 9001 document (2008). The European regulation ISO 9001 states that an organization needs to show its ability to regularly provide a product which satisfies customers' requirements and wishes to increase customers' satisfaction, the former related to monitoring of quality, the latter to improvement of quality. In this context it is advised to perform statistical survey and to apply methods and statistical techniques, in order to monitor, analyze and improve the service and customer satisfaction.

The aim of this paper is to present a statistical approach based on a two phase analysis, to evaluate customers' opinion scores on several quality aspects of services or products.

Several multi-criteria approaches to derive overall customer satisfaction have been introduced in the literature. Successful examples are related to MUlti-criteria Satisfaction Analysis (MUSA) (Ipsilandis *et al.* 2008; Grigoroudis and Siskos, 2002; Siskos *et al.* 1998). Recently a multi-phase analysis was applied to measure customer satisfaction of mobile services by a two-stage analysis: at first the authors analyze customer's opinion in order to obtain customer satisfaction criteria and then they performed an analysis to rank service aspects (Kang and Park, 2014).

In the present work we propose a two phase analysis with the first step aimed at ranking a sample of ski schools. A ranking methodology (Bonnini et al. 2006; Corain and Salmaso, 2007) based on the NonParametric Combination of dependent permutation tests (NPC, Pesarin and Salmaso, 2010), establishes a ranking of the best ski schools by elaborating raw data from customers' evaluations of several ski service aspects. The second step is aimed to analyze in detail the schools ranking by CUB models (Piccolo, 2003a, 2006; D'Elia & Piccolo, 2005), in order to identify specific components (feeling and uncertainty) in the customer evaluation process.

The methodological section presents the methods and models applied to customers' opinions, then the case study is introduced describing the main results of the two-phase analysis.

2. MATERIALS AND METHODS

2.1. A two phase approach to customer satisfaction surveys

We introduce a two-phase approach for customer satisfaction surveys essentially based on two steps of analysis: in the first step a classification of statistical units is performed using the NPC-Global ranking methodology and in the second step CUB models are applied to detect important variables inducing different satisfaction evaluations and consequently different rankings. CUB models are very helpful in identifying specific components of the decision process like the feeling and the uncertainty of the respondent. These two components are specifically modelled in CUB models as it will be shown in the next paragraphs.

2.2. The NPC ranking method

NPC-Global ranking (Bonnini et al., 2006; Corain and Salmaso, 2007), based on the NonParametric Combination methodology (Pesarin and Salmaso, 2010), considers the problem of finding a global ranking of C populations with respect p variables, as formally represented in a testing-like framework where the hypotheses of interest are related to the stochastic inferiority or superiority when comparing C populations. The method considers first nonparametric tests for pairwise comparisons of 'Cx(C-1)/2' populations of interest for each variable, and then a combination of directional p-values (through an NPC score) in which all variables are simultaneously considered. On the basis of the NPC score a global ranking of the C populations is derived (see Arboretti et al. (2014) for more methodological and computational details).

2.3. CUB models

CUB models (Piccolo, 2003a, 2006; Iannario and Piccolo, 2009; Iannario and Piccolo, 2014;) are based on a class of discrete probability distributions originally called MUB (Mixture of a Uniform and a shifted Binomial distributions). This class of models are useful for analyzing preference data, when respondents are requested to arrange a list of m items in order of preferences (ranking), or to express judgments using a given *m*-point ordinal scale (rating), with $m > 3$.

In this preference evaluation framework, without loss of generality let *1* represent the worst evaluation and m the best. The model is the following:

$$\Pr(R = r) = \pi \left[\binom{m-1}{r-1} (1-\xi)^{r-1} \xi^{m-r} \right] + (1-\pi) \left[\frac{1}{m} \right], \tag{1}$$

where R is a random variable that describes the composite nature of the evaluation process and r is a realization of R, with R varying from 1 to m, $\xi \in [0,1]$, $\pi \in (0,1]$ and $m > 3$.

The random variable *R* is supposed to summarize two latent variables, the '*feeling*' and the '*uncertainty*' of the respondent, by means of a *shifted binomial* distribution and a *discrete uniform* distribution respectively. The rationale of the model is that the expressed preference is the result both of feeling and uncertainty components, which are different random variables to be combined in a mixture (D'Elia and Piccolo, 2005). About the feeling component, a shifted binomial random variable is an adequate probability model for representing the discrete version of a latent judgment process (the probability $1-\xi$ can be considered a measure of the feeling toward the object). About uncertainty component, a discrete uniform random variable is a suitable structure for describing the inherent uncertainty of a discrete choice process ($(1-\pi)/m$ can be considered an index of uncertainty).

The introduction of subjects' or objects' covariates usually improves model fitting and it is a useful tool in order to detect subgroups of people that behave differently (Corduas et al., 2009). A general formulation for CUB (p,q) model is as follows:

$$\Pr(Y_i = y_i) = \pi_i \left[\binom{m-1}{y_i - 1} (1-\xi_i)^{y_i - 1} \xi_i^{m-y_i} \right] + (1-\pi_i) \left[\frac{1}{m} \right] \quad (2)$$

$$\pi_i = \frac{1}{1+e^{-\beta_0 - \beta_1 x_{i1} - \ldots - \beta_p x_{ip}}} = \frac{1}{1+e^{-\beta_0 - x_i \beta}}, \quad (3)$$

$$\xi_i = \frac{1}{1+e^{-\gamma_0 - \gamma_1 w_{i1} - \ldots - \gamma_q w_{iq}}} = \frac{1}{1+e^{-\gamma_0 - w_i \gamma}}, \quad (4)$$

where x_i and w_i are subjects' and/or objects' covariates explaining for π_i and ξ_i respectively.

In some cases a specific value, let's say *c*, can be over-selected in order to avoid a more demanding situation: this *c*-value is known as a shelter choice (Iannario, 2012). An extended CUB model is then designed to deal with shelter effects. Formally we have:

$$\Pr(R = r) = \pi_1 \left[\binom{m-1}{r-1} (1-\xi)^{r-1} \xi^{m-r} \right] + \pi_2 \left[\frac{1}{m} \right] + (1 - \pi_1 + \pi_2) D_r^{(c)}, \quad (5)$$

where $\theta = (\pi_1, \pi_2, \xi)$ is the parameter vector and $D_r^{(c)}$ is a degenerate random variable with $D_r^{(c)} = 1$, if $r = c$ or $D_r^{(c)} = 0$, if $r \neq c$. The quantity $\delta = 1 - \pi_1 - \pi_2$ characterizes the relative contribution of the shelter effect at $R = c$.

MaximumLikelihood-estimate procedures are used for deriving parameters in CUB models (D'Elia, 2003; Piccolo, 2003b).

A measure of model fitting is proposed and called normalized dissimilarity index: $Diss = 0.5 \sum_{r=1}^{m} \left| f_r - p_r(\theta) \right|$. It measures the distance between the estimated probabilities and the observed probabilities (Corduas et al. 2009).

For the latest advances on CUB models see Iannario (2014).

2.4. *The case study*

In the winter season of 2011 a large survey has been conducted in 38 ski schools of Alto Adige (an area of Italian Alps), in which customers and parents of young children under the age of 13, who participated in a ski course, were asked to answer a questionnaire to express their level of satisfaction about some aspects of the experience.

This study was innovative at a national level: it was the first systematic study performed on different schools, with quantitative evaluation, using a questionnaire specifically designed to measure satisfaction and quality perceived by customers.

The first part of the questionnaire was about demographics and general information. The second part asked for opinions about three aspects of the service, each with specific quality

dimensions:

1. booking service, with the following quality dimensions: adequate opening times; clarity and completeness of informative brochures and website information; staff clarity and completeness of information provided; staff courtesy;
2. course organization: homogeneity of groups after selection (for collective courses);
3. ski lessons: teaching (progress in skiing skills, courtesy of instructors); safety (adequate slopes and lifts, subjective perception of safety); general satisfaction (enjoyment & fun, increased passion for skiing, kids' comfort, ...).

Each dimension was investigated with specific questions reporting the score on a scale 0-10 (0: not satisfied, 10: fully satisfied).

The aim of the present work was to obtain a ranking of five selected schools (chosen from the sample of 38 ski schools for marketing reason) from the 'best' to the 'worst' on the basis of the responses of satisfaction about different aspects of the course. Schools were codified as A, B, C, D, E for illustrative purposes.The aspects of satisfaction considered, were related to:

1. Improvement: progress in skiing skills;
2. Courtesy: courtesy and helpfulness of the instructor;
3. Fun: fun during the course.

3. RESULTS

3.1. First phase: application of the NPC-Global ranking

The methodology NPC-Global ranking was applied to these data and the summary of the analysis is shown in Table 1, 2, and 3. Table 1 contains the combined *p*-values (after multiplicity adjustment) of the pairwise comparisons among the five schools. Those p-values are calculated according to the procedure shown in Arboretti *et al*. (2014).

The value of the NPC scores which determine the preliminary ranking are reported in Table 2. We considered an α-level equal to 0.05. The global ranking of the schools reported in Table 3, was obtained from significant comparisons in Table 1.

TABLE 1
Combined p-values (after multiplicity adjustement) of the pairwise comparisons

School	A	B	C	D	E
A	-	0.278	0.053	0.011	0.0099
B	-	-	0.189	0.095	0.0059
C	-	-	-	0.167	0.0059
D	-	-	-	-	0.2557
E	-	-	-	-	-

TABLE 2
NPC scores of the five schools

A	B	C	D	E
8.78	5.41	4.22	0.905	0.331

After this multivariate analysis (based on the three aspects of interest i.e. Improvement, Courtesy and Fun) also a univariate analysis was conducted in order to outline differences between the ranking obtained by means of NPC-Global ranking when multi items were considered, and the ranking resulted from the consideration of a single item (in particular we considered the responses about 'overall satisfaction' question).

The ranking of the five schools obtained from the univariate analysis is reported in Table 4. What we can see in this case is that, even if the ranking is substantially maintained (at least for the 'first' and for the 'last' position) with respect to previous overall multivariate analysis, the first three positions are not well discriminated. Thus considering only the variable 'overall satisfaction' we conclude that A, B, C have the same degree of preference.

TABLE 3
NPC-Global ranking based on the three variables: Improvement, Courtesy and Fun

Schools	Ranking
A	1°
B	2°
C	2°
D	4°
E	4°

TABLE 4
Ranking based on univariate analysis

Schools	Ranking
A	1°
B	1°
C	1°
D	4°
E	4°

3.2. Second phase: application of the CUB models

After the NPC-Global ranking, CUB models were applied considering the three aspects: Improvement, Courtesy and Fun evaluated in the five selected schools.

Hence the CUB model without and with shelter choice were applied in order to obtain estimates for parameters π and ξ. The results for the CUB model are shown in Table 5, where π and ξ estimates are listed. Parameter $1-\pi$ is considered a measure of uncertainty because it is directly related to the uncertainty component and inversely related with respect to the feeling of the model. Parameter ξ is a measure of feeling whose interpretation changes with respect to the positive or negative direction of the measurement scale when going from 1 to m. In the case study presented, 0 means completely dissatisfied so the lesser is ξ the greater is feeling.

All π and ξ estimates (Table 5) were significant and we report also the dissimilarity index according to Corduas *et al.* (2009). The index varies from 0 to 1 with 0 meaning a perfect fitting. From Table 6 we reported also estimates for a CUB model with shelter choice (c = 10) when the shelter effect was significant. When a shelter effect was present, the Dissimilarity index approaches

zero and the feeling parameter increased.

TABLE 5
CUB models without and with shelter effect in the first and second line respectively

School	Variable	π	ξ	δ	Diss. index	LRT
A	Improvement	0.983	0.066		0.189	
		n.s.	n.s.	n.s.		n.s.
	Courtesy	1	0.038		0.141	
		n.s.	n.s.	n.s.		n.s.
	Fun	0.984	0.047		0.152	
		n.s.	n.s.	n.s.		n.s.
B	Improvement	0.975	0.103		0.126	
		n.s.	n.s.	n.s.		n.s.
	Courtesy	1	0.043		0.011	
		n.s.	n.s.	n.s.		n.s.
	Fun	1	0.063		0.043	
		n.s.	n.s.	n.s.		n.s.
C	Improvement	0.999	0.111		0.187	
		1	0.155	0.282	0.074	21.896**
	Courtesy	0.989	0.051		0.086	
		n.s.	n.s.	n.s.		n.s.
	Fun	0.984	0.079		0.144	
		0.985	0.121	0.328	0.036	14.920**
D	Improvement	0.929	0.108		0.246	
		0.949	0.190	0.367	0.057	152.815**
	Courtesy	0.854	0.038		0.127	
		n.s.	n.s.	n.s.		n.s.
	Fun	0.942	0.056		0.165	
		n.s.	n.s.	n.s.		n.s.
E	Improvement	0.988	0.164		0.156	
		0.989	0.197	0.161	0.052	20.426**
	Courtesy	1	0.096		0.148	
		1	0.133	0.271	0.044	17.916**
	Fun	0.954	0.073		0.038	
		n.s.	n.s.	n.s.		n.s.

Note. For each variable, the first line is considering CUB model without shelter effect, the second line is considering CUB model with shelter effect. π in the second line of each variable is justified by the following one-to-one relationship: $\begin{cases}\pi_1=(1-\delta)\pi \\ \pi_2=(1-\delta)(1-\pi)\end{cases} \Leftrightarrow \begin{cases}\pi=\frac{\pi_1}{\pi_1+\pi_2} \\ \delta=1-\pi_1-\pi_2\end{cases}$; **p < .001; n.s. = not significant.

When parameter π is equal to 1, the CUB model collapses into a shifted Binomial distribution, whereas for a CUB model with shelter choice when π is equal to 1, we have π_2 equal to 0 and π_1 equal to $1-\delta$, so that we are considering a mixture of a shifted Binomial distribution and a degenerate probability with mass at $R=c$ (see paragraph on CUB model description). However about shelter choices caution would be put on extreme scores (c = 10) because it is not so easy to differentiate between lazy respondents and truly happy respondents (Iannario, 2012).

The uncertainty component π is very close to 1 for all variables (Table 5) indicating that customers have a clear perception of what grade better describes their feeling. About the feeling component ξ, it seems that 'Improvement' is the critical variable in order to obtain a ranking in NPC-Global ranking. In fact school A has the highest feeling parameter estimate, D and E schools have the worst ξ estimates with finally B and C schools in the middle.

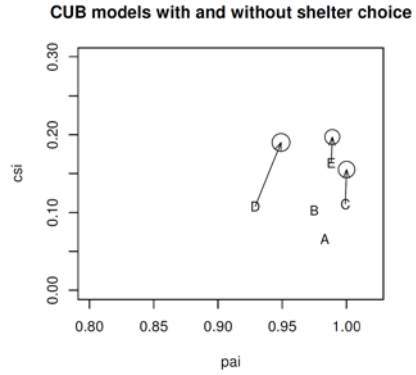
In order to visualize the results of CUB model considering variable 'Improvement', it is useful to place the 5 schools into a plot (Figure 1). While the 5 schools are very close to 1 with respect to parameter π, they are well discriminated along the parameter ξ.

Parameter δ in Table 5 measures the extent of shelter effect, in this way we can visualize in Figure 1 parameters π and ξ into space in order to show the displacement caused by shelter effect.

Except for schools A and B, a shelter effect seems to be present and the Diss. indexes clearly show a better model fitting. The highest score 10 chosen to evaluate schools C, D and E seems to be a shelter choice, probably in order to avoid a more elaborated satisfaction answer.

FIGURE 1

Shifting of π and ξ parameters caused by shelter effect considering variable 'Improvement'. The size of circles is proportional to shelter effect degree



In order to improve the model fitting and detect subgroups of subjects that behaved differently in experiencing the service, we introduced some covariates for the parameter ξ such as age, gender, nationality and first presence at the ski school, performing a CUB (0,4) model.

Significant covariates were sex and age for improvement in school A, age, nationality and first presence for improvement in school C (Table 6). Figure 2 shows the probability distribution for variable 'Improvement' and subgroups 'age $<=$ 9' and 'age $>$9' with respect to the school A.There were no significant covariates for school B. School D had significant covariates for all aspects of the service: first presence for improvement, nationality for courtesy and finally both sex and first presence for fun. For school E, nationality showed different feeling considering the three aspects of the service.

Variables for School A and 'Fun' for school D do not have very good fitting, thus indicating a peculiar behavior which might be explained by other covariates not considered here.

FIGURE 2
Probability distributions for children with age less or equal to 9 (circles) and for children with age greater than 9 (dots) in school A

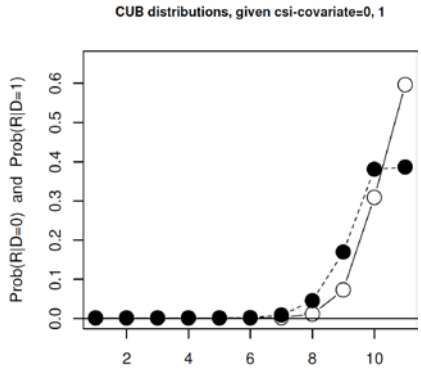


TABLE 6
ξ and π parameters for subgroups of subjects that behave differently in terms of feeling toward the ski school services

Schools	Var			Sex	Age	Nationality	First presence
		π	γ_0	γ_1	γ_2	γ_3	γ_4
A	I	0.984	-2.612	-0.556**	0.616**	n.s.*	n.s.
	C	1	-3.447	n.s.	n.s.	n.s.	n.s.
	F	0.986	-3.084	n.s.	n.s.	n.s.	n.s.
B	I	0.976	-2.350	n.s.	n.s.	n.s.	n.s.
	C	1	-3.689	n.s.	n.s.	n.s.	n.s.
	F	1	-2.986	n.s.	n.s.	n.s.	n.s.
C	I	0.970	-1.967	n.s.	0.382**	-0.357**	-0.547**
	C	0.986	-2.753	n.s.	n.s.	n.s.	n.s.
	F	0.987	-2.332	n.s.	n.s.	n.s.	n.s.
D	I	0.884	-2.101	n.s.	n.s.	n.s.	-3.572**
	C	0.874	-2.840	n.s.	n.s.	-0.873**	n.s.
	F	0.970	-2.392	-0.724**	n.s.	n.s.	-0.939**
E	I	0.988	-1.298	n.s.	n.s.	-0.370**	n.s.
	C	1	-1.741	n.s.	n.s.	-0.662***	n.s.
	F	0.961	-2.108	n.s.	n.s.	-0.469**	n.s.

Note. *not significant; ** $p < .05$; *** $p < .01$; I=Improvement; C=Courtesy; F=Fun.

4. DISCUSSION AND CONCLUSION

This work applies a two-phase approach based on NPC-Global ranking and CUB models to detect a global ranking of a sample of ski schools with respect to a set of partial indicators of service quality dimensions and to analyze in detail the influence of customers' characteristics and evaluation process's components.

In line with the NPC-Global ranking results which outlined customers of school A giving the higher scores to the provided service, CUB models showed for this school a very positive feeling about the evaluated service.

Furthermore, the introduction of covariates gave some tips on how to improve the service.

Customers in school E gave worse scores with respect to the other schools. From Table 6 it seems that foreign customers were less satisfied than Italians with respect to the three aspects of the service under evaluation. Foreign customers' perception of improvement, courtesy and fun at the ski school E was not so high as the Italian's one.

A shelter choice seems to be present at a value equal to 10. The effect brings to a lower feeling especially for school D that has the higher shelter effect. Despite such effects, the ranking doesn't change with CUB models helping to define how costumers evaluate school services and to give a customer satisfaction index.

NPC-Global ranking may be a useful tool when the aim is to outline an overall evaluation of a service starting from score on several aspects. The methodology is able to combine the satisfaction scores of several quality dimensions under evaluation in order to provide a global result reflecting the multivariate customer perception. 'The single-item scale cannot provide information on components and cannot separately assess various dimensions, and thus may not entirely capture the complexity of Customer Satisfaction' (Yi, 1990). Once the classification is given, CUB model can help to better understand the psychological aspects of the decision process and in analyzing respondents' behavior in terms of different degree of feeling/uncertainty.

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SUMMARY

Two Phase Analysis of Ski Schools Customer Satisfaction: Multivariate Ranking and Cub Models

Monitoring tourists' opinions is an important issue also for companies providing sport services. The aim of this paper was to apply CUB models and nonparametric permutation methods to a large customer satisfaction survey performed in 2011 in the ski schools of Alto Adige (Italy). The two-phase data processing was mainly aimed to: establish a global ranking of a sample of five ski schools, on the basis of satisfaction scores for several specific service aspects; to estimate specific components of the respondents' evaluation process (feeling and uncertainty) and to detect if customers' characteristics affected these two components. With the application of NPC-Global ranking we obtained a ranking of the evaluated ski schools simultaneously considering satisfaction scores of several service's aspects. CUB models showed which aspects and subgroups were less satisfied giving tips on how to improve services and customer satisfaction.

Keywords: customer satisfaction survey, permutation tests, rankings, CUB models, NPC test