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NON-MARKET VALUE OF SUMMER OUTDOOR RECREATION IN VAL BEDRETTO, SWITZERLAND

TESINA

QUE PARA OBTENER EL TÍTULO DE

LICENCIADO EN ECONOMÍA

PRESENTA

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Con respeto, admiración, cariño y agradecimiento.
A ustedes, mamá y papá.

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Al CIDE como institución, los profesores, profesoras y demás personas que lo conforman.

Abstract

Most of the research done to date on Alpine area focuses on winter activities due to its worldwide popularity. However, the Alps offer a wide variety of outdoor activities during the summer/autumn that are enjoyed by the Swiss and non-Swiss alike. This thesis estimates the consumer surplus for the summer/autumn season obtained by climbing, cycling, mountaineering and walking in Val Bedretto (Swiss Alps), based on the Travel Cost Method. The data is analyzed by latent class panel on-site models. This analysis achieves to identify two types groups of visitors, frequents and occasional; where frequent ones obtain a consumer surplus of 458.6$ per season while the occasional (90% of the visitors) get a consumer surplus statistically equal to zero.

Keywords: Summer outdoor recreation, Travel Cost Method, Latent Class, Alpine area, Switzerland

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Chapter 1

Introduction

Switzerland is a country that offers a great list of options to its visitants and its local to spend leisure time outdoors.The Alpine Region of Switzerland is known worldwide for its great opportunities to do recreation activities in summer such as in winter. In summer, the principal activities are hiking, biking, and mountaineering; each of this activities are focus on different groups due to its complexity and preferences. In addition, it is important to remark that the Alpine zone have a big influence into many communities around this areas since their economies depend mostly on the alps tourism all over the year.

In relation with the outdoor activities, hiking, mountaineering and biking are some examples of activities where people do not have to give a monetary compensation for the entrance since this areas are totally free to the public; in the same line, neither the government or any private institution monitors have a control of the alpine area. The only information that is available despite surveys, is from a local hut name Cappana Piansecco.[1] The purpose of this papers is to estimate the economic value of all the off-site activities in summer on the area of Bedretto - a valley located in the south of Switzerland, adjoining Italy- The contribution of this paper comes from the econometric section, since the previous studies do not contemplate endogenous stratification data and the use of latent class model to achieve a more reliable result. Latent class models usually are useful in cases where the analyst suspects presence of unobserved

[1] A small hut that have less than twenty rooms and usually is used for only one-night accommodation.

preference heterogeneity. The present analysis is divided into four section. The firs section shows the existence literature of non-market recreational values in alpine sites, emphasizing in the studies in summer; the second section describes the methodology of the thesis, since the travel cost method, count models specifications, on-site sampling, and latent class models; the third section gives a description of the Bedretto Vallety and the Piansecco Alpine zone; while the last section analyze the results obtained from the models.

Chapter 2

Literature Review

2.1 Non-market Recreational Values of Alpine sites

Most of the projects have been approached on winter season due to the popularity of the season sports, specially ski. Even though, latest studies have discovered an important market in summer outdoor activities practiced off-site resorts (i.e. hiking, climbing, biking, and mountaineering), activities where people is not forced to a payment in order to carry out these off-site activities.

where users do not pay any fee to practice these off-site activities.

Nevertheless, this section will describe studies focus on estimating recreational values of alpine sites through non-market valuation methods –All the quantity results were converted to dollars, adjusted by inflation and standardized in prices of 2019 due to the economic shock of 2020 (Inflation, consumer prices (annual %), n.d.)–. We have identified 16 studies that have done an estimation of the value of recreational activities in the alpine region. Table 2.1 describe the studies for location of study, date, sample size, economic method, recreational activity of interest, model use and the results reached. From this table, four of the studies use the method of hedonic prices, two of them use contingent valuation, three studies use discrete choice experiments, two papers use benefit transfer and lastly, four of them use purely travel cost method.

Economist interest had focused on a certain non-market areas, one of them is the environmental services (ES) that the alpine sites provide to human society.Ragemey, Walz and Peter reviews ES valuation into the Davo´s resorts area, belonging to the Swiss Alps (Gret-Regamey,Walz, and Bebi, 2008). One of the objectives of this study was to find out how much literature was at the moment of this area. The authors report that only 11 studies where found about non-market valuation of ES in the Alps. From this studies, three of them where from recreational activities and just one of the use travel cost method (Glück and Kuen, 1977).

Years later, some other investigations arise combining the Travel Cost Method (TCM) and other economic tools. The next group of investigations cited use hedonic price method to value mostly the ski activity around the European Alps.

Falk analyze the ski activity on 85 ski resorts and 1,524 lifts and cable cars in Austria Alps zone. The author apply an hedonic price model to estimate the skiers´ marginal willingness to pay for a lift ticket. The methodological process was to estimate a hedonic price function using OLS and robust regression on factors that influence the quality of ski resorts as independent variables and the ticket price as dependent. The results indicate that the price dispersion is explained between 60% and 70% by the quality attributes (adjusted R^2); also, longer ski runs, greater lift capacity and modern high speed chairlifts charge higher lift ticket prices; and up to 3.58$ of difference (41.85$ to 45.44$) between observed and predicted prices for one-day ticket; and up to 15.54$ of difference (204.49$ to 220.03$) between observed and predicted prices for six-day ski pass (Falk, 2008).

In 2009, Borsky and Rascky estimates the individual WTP to risk-taking activities in Austria Alps. They use 69 Austrian Ski resorts and 3,637 reported ski accidents. The authors apply the hedonic method using the ski accidents as a proxy indicator for risk-taking behaviour.[2] Borsky and Rashky found that if the mean price of a day pass is at 35.62$, the individual economic value of risk-taking activities is from 4.07$ (11.44% of the day pass) to 8.9569$ (25.16% of the day pass); this value can be interpreted as the individual WTP on a hypothetical increase in the possibility to undertake risk-taking activities (Borsky and Raschky, 2009).

[2] Asuming that Alpine skiing is a risk-taking behaviour than can caused accidents.

The aim of Pawloski and Pawlowski investigation is to provide information to cable car companies about how to adapt ski-lift ticket fees according to the ski-area specific supply characteristics in the European Alps (Austria, France, Germany, Italy, and Switzerland) (Pawlowskiand Pawlowski, 2010). The technique used is use hedonic prices (by OLS modeling) to derive the monetary value of single-services attributes in winter sports and analyze the differences (in monetary values) between the European countries studied. In the results, another approach was to project the ELT of two popular ski resorts in Europe (Zermatt and Zugspitzplatt).[3] Where the author projected the empirical lift ticket price [ELT] in an overall average of around 25.11$ per day. In addition, Tim Pawlowski made a similar study with the same data with the difference of a robust estimator of the variance and inference is drawn by bootstrapping (Pawlowski, 2011).

Alessandrini also use a hedonic framework to estimate the ticket prices of 19 ski resorts located in the Emilian Apennines and Altipiani Trentini (Alessandrini, 2012). The data used was lift facilities and slopes as well as climatic data and characteristics of the ski resorts on 2008-2011 winter season. It was used hedonic linear and logarithm regression models for the ticket prices (using the ticket price of weekday and weekends separately).This study finds out resort characteristics are positively valued by skiers, having a direct effect on ticket prices.[4] Where the WTP for the length of winter season tends to be higher than the rest of characteristics. Where in weekends, the high overpriced ski lift tickets is of 3.25$ (36.42$ to 33.18$) and the most overpriced is from -1.97$ (32.37$ to 34.3$). On weekdays, the most overpriced is of 5.03$ (29.34$ to 24.28$) and the most overpriced is from -1.01 (13.15$ to 14.16$). Furthermore, this results were particularly important to find out ski resorts that were overpriced.[5]

Up to here I have been describing those projects that use hedonic price; in order to use hedonic prices, indeed you need a market so it is no surprising that all of these previous studies have focus on estimations that can be thought as revealing information of activities that are carried out in-site the resorts. For those activities that are carried outside the resorts, travel

[3] The arithmetical mean of four lift ticket prices (adults peak and low season, children peak and low season).
[4] Length of the ski slopes, vertical drop, capacity of the lifts and length of the season.
[5] Cerreto Laghi, Corno alle Scale, Prato Spilla, Lavarone, and Abetone.

cost is the method that have been used for this estimations. In this way, other method used in non-market valuation is contingent valuation method where trough the years, some authors have done works estimating the recreational value of the Alpine Areas with CVM.

In the paper of Gios et al, the authors explore the measurement of the benefits provides by the tourist development of an particular area in Italian Alps; particularly, the area of Campogroso, situated in the northern of Italy (Gios, Goio, Notaro, and Raffaelli, 2006). They used contingent valuation to estimate the value attributed by the individual to the natural area on the basis of their WTP for an increase in well-being. From the survey they found the average WTP for an entry ticket the area of Campogrosso was valued at 4.26$; the average willingness to pay a single bid in order to contribute to funding the costs of reviving the area was calculated to be 8.52$; and the WTP a single bid for the protection of the area was measure at 10.5$. As a result, the total economic value of the Campogrosso area was calculated by aggregating the pessimistic and optimistic valuations of the use, option and non-use value. The estimation varies from almost 25,000,000$ (optimistic scenario at an interest rate of 1%), up to 8,000,000$ (pessimistic scenario with a 3% rate).

On the same line, the objective of Notaro and Paletto was to evaluate the importance of Alps communities in increasing the value of environmental services. The study was developed in the municipality of Premana in the Italian Alps, surveying 319 randomly selected residents.[6] The alpine and forest environmental services was estimated using Contingent Valuation Method, with the WTP or donate working hours information. The results shows a mean WTP of about 110.2$ in money (69.9% of the sample) and 1050.5$ in labour hours (12.4% of the sample); while 10.7% of the people where zero WTP. This numbers demonstrate that local traditions and social capital play a key role in the multi functional management of alpine pastures (Notaro andPaletto, 2011).

Within the non-market area, Scarpa and Thiene have published a set of studies, using Discrete Choice Method, documenting the economic value of certain recreational activities on the

[6] This number only represented the 14% of the total population of Premana.

Alpine area, some of the activities reported were rock climbing and hiking. In 2005, Scarpa and Thiene focus on sports as rock climbing during summer and estimate its demand using a sample of members of the Italian Alpine Club (Scarpa and Thiene, 2005). The study found four different groups of visitors employing a discrete choice method with latent class specification. The found an entrance fee of 4.76$ fits to the econometric specification.

Later by 2007, Scarpa and coauthors studied destination choices of a diverse population of tourists to alpine destination in the North-East of Italy (Scarpa, Thiene, and Train, 2007). Using a data set of 858 surveyed, the authors estimate WTP distributions for key site attributes. Although the main objective of the paper is methodological, it provide some interest implications. About 83% of hikers dislike sites with high tacking difficulty; also, 5% of the visitor prefer sites without shelters; for last, most visitors were found to be WTP more at visiting Dolomites than Prealps.

Later, Scarpa and Thiene studied the problem of the increasing demand for hiking which is connected with congestion problems. They modelled the probability of choice of destination by visitors on 18 Alps hiking area in Veneto, Italy. The main result was from the increase of alpine shelters in all sites, which gave an average consumer surplus (CS) in the sample of 8.57$ per visitor; also the prediction support more the hypothesis of election according to "geographical proximity and difficulty hikes" rather than "wilderness of the sites" (Thiene and Scarpa, 2008).

Additionally, some others works have been developed in the Alps but no in the area of recreational activities. The following two studies developed a discrete choice experiments method; Mattea, Franceschinis, Scarpa, and Thiene (2016) investigate the social demand for landslide protection projects due to the climate changes; while Mattea, Franceschinis, Scarpa, and Thiene (2017) value the cultural ES changes to a landscape in Visp, an inner-Alpine region in Switzerland.

Similarly, some other approach Benefit Transfer method; Grilli, Meo, and Paletto (2015) estimates the economic value of bundle of forest ecosystem services in the Italian alps and perceived recreation in forest is an important ES with a value of 60.97$/ha/year for outdoor activities and 5.62$/ha/year for game activities. For last, Paletto et al. (2015) analyze an area in the Austian Alps due to the high importance of forest and grassland. The authors use Benefit Transfer Method to estimate the value of the ES. The results show that the mean recreational value obtained is for 10.91$ per visit per person in mountain forest areas.

For now, this work have describe most of the tools and methods used in the studies around non-market valuation in the Alps. Nevertheless, just a few group of authors have used travel cost in the Alps as a methodology to value the off-site resorts recreational activities. Chronologically, Stoeckl and Mules estimates the value of the recreational activities in seven regions of the Australian Alps using TCM. The results they obtained using OLS were an average consumer surplus between 412$ and 1241$ per visitor per year for the season of 2001-2002 (Stoeckl and Mules, 2006).

Then, in 2007 Scarpa et al apply a latent class count model identifying two classes of people visiting the area, with their respective consumer surplus of 2.83$ and 6.56$ applying Poisson and negative binomial model for the econometric section; while the proportions of this groups where from 33% and 67% respectively. This study was adapted in the Italian Eastern Alps using data from 1999 (Riccardo Scarpa and Tempesta, 2007).

Then, some projects more were developed the Switzerland Alps in the last years. First, Kossler (2014) recollected the data from surveys in different locations from Bedretto in 2014 and estimates the consumer surplus using TCM and linear regressions for the econometric. Later, Filippini and Martinez-Cruz apply a TCM plus a Contingent Behaviour Method to estimate the consumer surplus of the winter sports and the welfare changes due to the designing and creation of an alpine center for the purpose of being an emergency and help center in order to avoid accidents.

Since the authors also use latent class models in their results they find three classes (avid, frequent and occasional) where the average consumer surplus were between 11.73$ for occasional and 450$ for avid visitors, finding that under a contingent scenario of a construction of an alpine center, the increase of the consumer surplus will be of 27$ (Filippini, Greene, and

Martinez-Cruz, 2017).

Lastly, Russi (2017) apply a TC analysis for the summer activities in the Piansecco Alpine are (in Val Bedretto) including a similar contingent scenarios of Filippini et al. (2017) for the renovation of the Capanna Piansecco. Russi estimated the consumer surplus by a linear regression without latent class model and count models, obtaining a consumer surplus of 218$. In contrast with the analysis of this thesis, the results should be different since latent class model would give different classes of visitors and the analysis in economic or public policies can be made for each class (frequent or occasional visitors). Finally, in the line of studies made on the Swiss Alps, this thesis contribute knowledge into the non-market value area, specially into the outdoor recreational activities on the alpine zone.

Table 2.1: Non-Market Literature Review

Author(s)	Location	Date	Sample Size	Technique	Recreational Activity	Model	Results (in dollars/ adjusted for inflation for 2019 prices)
Martin Falk	Austria Alps	2005-2006	85 ski resorts	Hedonic Prices	Ski- Inside Resort	Ordinary Least Square / robust regression	Up to 3.58$ of difference between observed and predicted prices for one-day ticket; and up to 15.54$ of difference between observed and predicted prices for six-day ski pass
Borsky and Raschkey	Austria Alps	2005-2006	69 Ski Resorts / 3637 accidents	Hedonic Prices	Ski- Inside Resort/ risk-taking	Log-Log Ordinary Least Square	If the mean price of a day pass is at 35.62$, the individual economic value of risk-taking activities is from 4.07$ (11.44% of the day pass) to 8.9569$ (25.16% of the day pass)
Pawlowski and Pawlowski	Europe Alps	2006-2007	260 ski areas	Hedonic Prices	Ski- Inside Resort	Ordinary Least Square model	The empirical lift ticket price [ELT] has an overall average of around 25.11$ per day
Sergio Alessandri	Italian Alps	2010-2011	19 ski resorts	Hedonic Prices	Ski- Inside a Resort	Log-Log Ordinary Least Square	In weekends, the high overpriced ski lift tickets is of 3.25$ (36.42$ to 33.18$) and the most overpriced is from -1.97$(32.37$ to 34.3$). On weekdays, the most overpriced is of 5.03$ (29.34$ to 24.28$) and the most overpriced is from -1.01 (13.15$ to 14.16$)

Source: Own elaboration

Table 2.1: Non-Market Literature Review

Author(s)	Location	Date	Sample Size	Technique	Recreational Activity	Model	Results (in dollars/ adjusted for inflation for 2019 prices)
Gios, Goio, Notaro and Rafaelli	Italian Alps	1998	113 visitors	Contingent Valuation	landscape and recreational activities	Willing to Pay	The average WTP for an entry ticket the area of Campogrosso was valued at 4.26$. Average willingness to pay a single bid in order to contribute to funding the costs of reviving the area was calculated to be 8.52$. And the WTP a single bid for the protection of the area was measure at 10.5$.
Notaro and Paletto	Italian Alps	2003	319 residents	Contingent Valuation	Environmental Services	WTP/ OLS-validation	A mean WTP of about 110.2$ in money (69.9% of the sample) and 1050.5$ in labour hours (12.4% of the sample). While 10.7% of the people where zero WTP.
Scarpa and Thiene	Italian Alps	1999	528 members	Discrete Choice Experiments	Rock Climbers/ Alpine Club	Latent Class Logit Model	The author propose a fee entrance of 4.76$ which fit best for the rock climbers.
Scarpa, Thiene and Train	Italy Alps	2005	858 members	Discrete Choice Experiments	Mountain Visits/ Italian Alpine Club	Panel Mixed Logit	Most of the individuals prefers shelters, unless a 5% of the population, that prefere sites without them.
Scarpa and Thiene	Italian Alps	2008	904 excursionist	Discrete Choice Experiment	Hiking/ Italian Alpine Club	Mixed Logit Models	From the increase of alpine shelters in all sites, which gave an average consumer surplus (CS) in the sample of 8.57$ per visitor

Source: Own elaboration

Table 2.1: Non-Market Literature Review

Author(s)	Location	Date	Sample Size	Technique	Recreational Activity	Model	Results (in dollars/ adjusted for inflation for 2019 prices)
Grilli, De Meo and Paletto	Italian Alps	2013	321,059 tourists	Benefit Transfer	tourism/game recreation	Meta-analysis	The recreation in forest is an important ES with a value of 60.97$/ha/year for outdoor activities and 5.62$/ha/year for game activities
Paletto, Geltner, Grilli, et al	Austrian Alps	2012	No data	Benefit Transfer	Cultural services (recreational value)	Meta-analysis	The mean recreational value obtained is for 10.91$ per visit per person in mountain forest areas
Stoeckl and Mules	Australian Alps	2001-2002	4971 visitor	Travel Cost Method	Recreation use	Ordinary Least Squares	Average consumer surplus between 412$ and 1241$ per visitor per year
Scarpa, Thiene and Thempesta	Italian Alps	1999	866 members	Travel Cost Method	Hiking - Italian Alpine Club	Poisson and Negative Binomial / Latent Class	Two plausible classes for which the years of experience play an important role in class membership probability. With a consumer surplus of 2.83$ (33%) and 6.56$ (67%)
Filippini and Martínez-Cruz	Switzerland Alps	2014	373 surveys	Travel Cost/ Contingent Behaviour	Winter off-site activities	Negative Binomial/ Latent class	The average consumer surplus were of 11.73$ for occasional visitors and 450 for avid visitors. Also, under a contingent scenario, an increase in the surplus for about 27$ per person.
Russi	Switzerland Alps	2014	429 individuals	Travel Cost Method	Summer Activities	Semi-Log Model	An individual consumer surplus of 218$

Source: Own elaboration

Table 2.1: Non-Market Literature Review

Author(s)	Location	Date	Sample Size	Technique	Recreational Activity	Model	Results (in dollars/ adjusted for inflation for 2019 prices)

Chapter 3

Methodology

3.1 Travel Cost Method

The different methods used to value natural resources and environmental goods can be classified into two criteria. Revealed preferences refers to data gathered through the observation of the individuals interacting in real markets; while declared preferences refers to the data obtained through hypothetical questions. The next task is to observe the behaviour of the individuals when they interact in the markets. It is possible to infer the preferences of the market participants through the observations, assuming the individuals act as from their preferences.

Since in some of this markets there is not monitoring from the government or other institution; it is necessary to make a case study from surveys, equivalent to observe on an indirect way the behaviour of the individuals acting on the market; this is where the Travel Cost Method is located. The TCM is applied to value natural areas such as the Swiss Alps due the use of this areas to produce a recreational value in the utility function. The analysis of TCM departure from the quantity of trips made to a specific area of study, building a demand function from this data; where the authors are willing to assume that the travel cost.[7] After the demand function have been adjusted, the next step is to calculate the consumer surplus of the place in study.[8]

[7] This value is integrated by travel cost and opportunity cost measured in the time that the travel took.
[8] The consumer surplus is conformed by the area under the demand function builded.

There are several ways to approach to demand function of the trips to a natural area using TCM with individuals characteristics. This set of characteristics depends directly on how the survey was made and how the data was treated; there are two classifications that rely on the previous characteristics, the first one refer to the study of the demand on one site or estimate the demand of one site between several alternatives. The second clasification refers to the method of how was the survey applied, where the surveys can be classified into in situ samples and ex situ samples.

As a result of the survey made and applied by (Russi, 2017) and the objective of the current analysis, it will be used the demand of one site with an in situ sample. For this kind of samples, there are two models used for this specifications: truncation error models (Creel and Loomis,1990) and count models. Truncation error models have failure since data recollection since the survey is made on the study place, it is impossible to recollect information from the individuals that demand zero trips; in the same way, this model present a stratification error since it is more probable to recollect information from frequent visitors rather than occasional visitors, producing that the sample is not representative. To avoid truncation and stratification error, count models are used, which can correct both errors (Haab and McConnell, 2002). This kind of models is the one used in this study, where the model will be detailed theoretically in the next section.

3.2 Count Model Specifications

To show the results of TCM empirically by count data models, the starting point as in any micro problem is that people always maximize their utility subject to income constrains.[9] Where the models that departure from a discrete distribution such as poisson and negative binomial, truncated and corrected by endogenous stratification are the best theoretically approach to the

[9] Where the key to maintain the link between the theoretically and empirically model is in the quantity of visits made by the visitors (y_i), have to be a non-negative number.

study. The decision between both models is around the existence of overdispersion.[10]

3.2.1 Poisson Model

The basic count model is expressed as:

$$Pr(x_i = n) = f(n, z_i\beta), \quad n = 0, 1, 2, ... \tag{3.1}$$

where x_i, the demand variable, can take values from 0 to any number. The most common count model is the Poisson. In this model, the probability density function is build as:

$$P(x_i = n) = \frac{e^{-\lambda_i}{\lambda_i}^n}{n!} \tag{3.2}$$

where the parameter of the distribution, λ_i, is at the same time the mean and the variance of the distribution; this idea is often violated in recreational demands. Hence, it is necessary to ensure that $\lambda_i > 0$, assuming that λ_i behave in an exponential form:

$$\lambda_i = exp(z_i\beta) \tag{3.3}$$

where z_i is a vector of exogenous variables and β a vector of parameters. Due to its nature, the Maximum Likelihood Function (MLF) can be estimated in terms of the β parameters.

$$L(\beta/z_i x) = L = \prod_{i=1}^{T} f(n, z_i\beta)$$

$$lnL = \sum_{i=1}^{R} ln(\frac{e^{-\lambda_i}{\lambda_i}^n}{n!})$$

$$lnL = \sum_{i=1}^{R} ln(e^{-\lambda_i}) + ln({\lambda_i}^n) - ln(n!)$$

[10] Overdispersion refers to the existence of a difference between the mean and the variance. If this difference exist, the negative binomial model i preferred; while if this difference is statistically zero, the poisson model is the correct.

$$lnL = \sum_{i=1}^{R} -\lambda_i + n\, ln(\lambda_i) - ln(n!)$$

$$lnL = \sum_{i=1}^{R} -exp(z_i\beta) + n\, ln(exp(z_i\beta)) - ln(n!)$$

$$lnL = \sum_{i=1}^{R} -exp(z_i\beta) + nz_i\beta - ln(n!) \tag{3.4}$$

The equation (3.4) shows the log-likelihood function, which is concave in the parameter, making that this estimation converges quickly.

3.2.2 Marginal effects

Remembering that the mean and variance of a Poisson is λ, the conditional expected trips are given by:

$$E[x_i|z_i\beta] = \lambda_i = exp(z_i\beta) \tag{3.5}$$

The derivative of expected trips with respect to an independent variable, denoted by z_{ij}, is:

$$\frac{\delta\, E[x_i|z_i\beta]}{\delta\, z_{ij}} = \beta_j exp(z_i\beta)$$

Where the slope of the expected demand function varies respect number of trips. At a high level of expected trips, the slope is steep; while at a low level of expected trips, the slope of the expected demand functions is verily flat. The half elasticity is denoted by:

$$\frac{\delta\, E[x_i|z_i\beta]}{\delta\, z_{ij}} \frac{1}{E[x_i|z_i\beta]} = \beta_j$$

From this half elasticity, the parameter estimated, β_j, can be interpreted as the percentage change in dependent variable for a unit change in co variate.

3.2.3 Welfare Measurement

The Willing to Pay (WTP) for access to the area studied can be estimated by taking the area under expected demand function. Remembering the principal specification of Poisson model where expected demand function is:

$$E[x_i] = \lambda_i = exp(z_i\beta)$$

The value of the WTP access equals the area under the demand curve. With a simple demand specification $\lambda_i = e^{\beta_0+\beta_1 TC}\delta C$, where β_0 is a constant and TC is the travel cost variable. The consumer surplus to access is defined as:

$$WTP(access) = \int_{C_0}^{\infty} e^{\beta_0+\beta_1 C}\delta C$$

$$WTP(access) = \frac{e^{\beta_0+\beta_1 C}}{\beta_1}\Big|_{C=C^0}^{C\longrightarrow\infty}$$

$$WTP(access) = -\frac{x}{\beta_1} \tag{3.6}$$

when $\beta_1 < 0$. In this expression, C^0 is assumed as the cost of the actual trip. Nevertheless, in Val Bedretto, there are no fees to practice any activity, so the actual cost $C^0 = 0$. Up to here, the basic poisson model had been explained, the same as the estimation of its consumer surplus. Regardless, there are missing some modifications to this models to correct truncation and endogenous stratification; this modifications are explained in detail in the next section.

3.3 Models On-site sampling

As it was explained in the section before, this study will focus on the on site models based on the nature of the survey and the methodology used. On this section, it will be explained how truncation an endogenous stratification is corrected in count models, including poisson and negative binomial models.

3.3.1 Truncation

On the paper of (Shaw, 1988), he is the first one that analyze this problem on on-site samples; he described truncation as "Only those people who have taken at least one trip are sampled, and all information about non-users is truncated from the sample" This implied that demands for the individuals observed will have a truncated error.

For any on-site count model, lets define $g(x_i)$ as the probability density function for trips. At the same time, lets define the probability that an individual will have a non-negative number of trips $g(x_i) > 0$. While the conditional density function for an individual with non-negative trips is defined as:

$$g(x_i|x_i > 0) = \frac{g(x_i)}{Pr(x_i > 0)} \tag{3.7}$$

Normalizing by the probability of a positive observation ensures that the density function of the truncated model integrates to one

3.3.2 Endogenous Stratification

Just like the truncation error, (Shaw, 1988) explain that the endogenous stratification error is originated in cases where "people who go to the site frequently are more likely to be sampled than people who go to the site only occasionally." This endogenous stratification is originated through the selection of individuals that are surveyed, that is based on a stratified sample design. The stratum is defined by the endogenous variable, number of trips.

In other words, stratification occurs wen the proportion of sampled individuals systematically varies from the population proportion. The on-site sample proportion of individuals taking x trips, $h(x)$ is:

$$h(x) = \frac{xN_x}{\sum_{t=1}^{\infty} tN_t} \tag{3.8}$$

where N_x is the number of individuals in population that takes x trips; and N is the population of users. Now, lets define the expected number of trips:

$$E_p(x) = \sum_{x=0}^{\infty} xP_x$$

where P_x is the population proportion of individuals taking x trips. In the case of on-site samples, the expected number of trips is:

$$E_s(x) = \sum_{x=0}^{\infty} xh(x)$$

For the correct likelihood function, it is needed to account for the over sampling of frequent visitors. Dividing the equation (3.8) by N:

$$h(x) = \frac{x(\frac{N_x}{N})}{\sum_{t=1}^{\infty} t(\frac{N_t}{N})}$$

$$h(x) = \frac{xP_x}{\sum_{t=1}^{\infty} tP_t}$$

where the population proportions are unknown; the number of trips taken by an individual in the populations can be thought as a discrete random variable with the following probability function:

$$P_x = Pr(trips = x) = g(x) \quad x \in \{0, 1, 2, 3, ...\}$$

where it gives the sample probability of observing x trips as a function of the population probability:

$$h(j) = \frac{jg(j)}{\sum_{t=1}^{\infty} tg(t)}$$

For a non-negative integer value random variable x, lets see that:

$$\sum_{t=1}^{\infty} tg(t) = \sum_{t=0}^{\infty} tg(t) = E(x)$$

In this case, the probability of observing j trips from an individual in an on-site sample is given by:

$$h(j) = \frac{jg(j)}{E_p(x)} \tag{3.9}$$

Taking into account the equation (3.7) where the truncation error is corrected:

$$h(j) = \frac{j\frac{g(j)}{Pr(x>0)}}{\sum_{t=1}^{\infty} t\frac{g(j)}{Pr(x>0)}}$$

$$h(j) = \frac{jg(j)}{\sum_{t=1}^{\infty} tg(t)}$$

where $\frac{g(j)}{Pr(x>0)}$ have no effect on $h(j)$. This shows that correcting the model through endogenous stratification, the truncation demand is corrected.

3.3.3 Poisson

In this section, it will be showed the econometric model of the Poisson , corrected by truncation an endogenous stratification. First of all, the probability density function of the poisson model is in equation (3.2) as:

$$g(x_i) = \frac{e^{-\lambda_i}{\lambda_i}^{x_i}}{x_i!}$$

and

$$E_p(x_i) = \lambda_i$$

Following the equation (3.9) from the section before, the truncated and endogenous stratification poisson probability function will be:

$$h(x_i|x_i > 0) = \frac{x_i g(x_i)}{E_p(x)}$$

$$h(x_i|x_i > 0) = \frac{\frac{x_i\ e^{-\lambda_i}\lambda_i{}^{x_i}}{x_i!}}{\lambda_i}$$

$$h(x_i|x_i > 0) = \frac{x_i\ e^{-\lambda_i}\lambda_i{}^{x_i}}{x_i!\lambda_i}$$

$$h(x_i|x_i > 0) = \frac{e^{-\lambda_i}\lambda_i{}^{x_i-1}}{(x_i-1)!}$$

This last expression can be written as:

$$h(x_i|x_i > 0) = \frac{e^{-\lambda_i}\lambda_i{}^{w_i}}{w_i!} \tag{3.10}$$

where $w_i = x_i - 1$. The equation (3.10) can be estimated as an usual poisson model with the difference that all the new trips variable will be the trips observed less one; this specification simplified the model estimated and give more flexibility when it is estimated.

3.3.4 Negative Binomial

The next step after estimating the Poisson model is to estimate a negative binomial model corrected by truncation and endogenous stratification to test over dispersion process and prove if the poisson specification is the correct. So, it will be showed the econometric model of the Negative binomial , corrected by truncation an endogenous stratification. First of all, the probability density function of the negative binomial model is given by:

$$g(x_i) = \frac{\Gamma(x_i + \frac{1}{\alpha})}{\Gamma(x_i + 1)\Gamma(\frac{1}{\alpha})} \left(\frac{\frac{1}{\alpha}}{\frac{1}{\alpha} + \lambda_i}\right)^{\frac{1}{\alpha}} \left(\frac{\lambda_i}{\frac{1}{\alpha} + \lambda_i}\right)^{x_i}$$

which yields to the endogenous stratification and truncated negative binomial distribution as:

$$h(x_i|x_i > 0) = \frac{x_i\Gamma(x_i + \frac{1}{\alpha})}{\Gamma(x_i + 1)\Gamma(\frac{1}{\alpha})} \left(\frac{\frac{1}{\alpha}}{\frac{1}{\alpha} + \lambda_i}\right)^{\frac{1}{\alpha}} \left(\frac{1}{\frac{1}{\alpha} + \lambda_i}\right)^{x_i} \lambda_i^{x_i - 1}$$

It is important to emphasize that this expression do not yields to any recognizable density function, just as the Poisson do. Thus, the likelihood function have to be programmed into a maximum likelihood routine.

3.4 Latent Class Models

The last section of the methodology section will explained the theory of the Latent Class Model (LCM) that explained that individual behaviour depends on observable attributes and on latent heterogeneity that varies with factors that are observed by the analyst (Greene and Hensher,2003).

In the same way, unobserved heterogeneity in the distribution of the trips is assumed to impact the mean and variance (λ_i) (Hynes and Greene, 2013). The distribution of hetereogenity is estimated using what (Greene, 2008) refers to as a finite numbers of "points of support". The distribution is approximated by estimating the location of the support points in each interval. This estimations is interprated as producing a sort of individuals into C classes. Taking the density function of an on-site model:

$$Pr(x_i|\beta z_i, on - site) = \frac{x_i Pr(x_i|\beta z_i)}{\sum_{s=1}^{\infty} Pr(s_i|\beta z_i)}$$

The selection of the latent sorting of individuals into the classes can be expressed as:

$$Pr(x_i|\beta z_i, on - site, class = c) = F(x_i|\beta z_i)$$

While the unconditional prior probability attached to the Latent class:

$$\pi_c = Pr(class = c) = \frac{exp(\tau_c)}{\sum_{q=1}^{C} exp(\tau_q)}$$

Defining the prior probability attached to the assignment of the individuals to the latent classes, the probability density function will by given by:

$$Pr(x_i|\beta z_i, on - site) = \sum_{c=1}^{C} \pi_c Pr(x_i|\beta z_i, on - site, class = c)$$

while the log likelihood function is can be estimated from:

$$LogL = \sum_{i=1}^{N} log\{\sum_{c=1}^{C} \pi_c Pr(x_i|\beta z_i, on - site, class = c)\} \tag{3.11}$$

As it is shown, the Latent Class Model is flexible with any count model, poisson or negative binomial. Nevertheless, taking into account the truncated and endogenous stratified models, the Poisson is more flexible and compatible with the computers programs, rather than with negative binomial model. In the next section, it will be described the area of study, to understand the purpose of this study.

Chapter 4

Study Area and Data

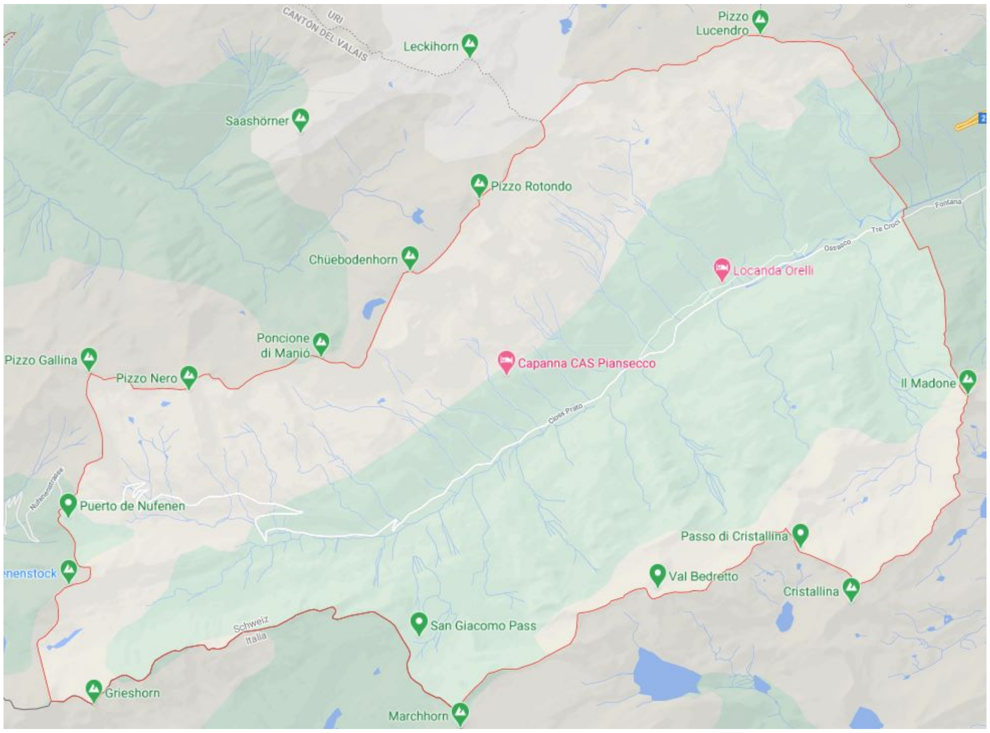
4.1 Bedretto Valley and Piansecco Alpine

The Bedretto valley lies in the northern part of the canton of Ticino, at the south of Switzerland. As it was mentioned before, it is an alpine valley that extends from Airolo up to the Nufenen Pass which is the border between Ticino and Valais cantons. Val Bedretto also boundaries Italy to the South as it is presented in the Figure 4.1.

Before being a touristic area, the valley was only a cattle and farming area. This changed due to the new road in 1964 over the Nufenen Pass since the valley became a connection between the Valais and Ticino Canton bringing new inhabitants and tourism. Nowadays during summer season, the valley offers different hiking and mountaineering areas and amazing panoramic routes. In winter, it is a popular region to practice ski mountaineering and other snow sports.

On the other hand, the Piansecco alpine area is located at the southern slopes of Val Bedretto (Figure 4.2). This alpine area consist of mountains, creeks, the mountain lake, and the alpine hut Capanna Piansecco, offering overnight space for 48 people since 1995. The hut is open during all the year to allow people enjoy all summer and winter activities. On Figure 4.1, the Bedretto valley have different departure areas where visitants do their activities. Nevertheless, Cappana piansecco is the only point where visitors can be surveyed and most visitors visit this hut as a meeting point so they go at least one time per visit.

Figure 4.1: Map of Bedretto Valley



source: www.googlemaps.com

4.2 Data

Val Bedretto host hundreds of visitors per summer/autumn season that goes from July to September. This alpine zone is popular due to the activities as hiking since the environment offers several panoramic routes as well as good weather conditions. Considering the size of the valley, it exist three principal starting points for hiking, biking, and mountaineering excursion which are All´Acqua, San Gottardo and Nufnen.

The questionnaire closely follows the one implemented by Zélie Kössler (2014) for her thesis recollecting data from winter activities in 2014. The questionnaire used for this thesis were distributed at Capanna Piansecco on paper format from the last week of July to the first week of September in 2016, during the week days and weekend. The total sample consisted of 429

Figure 4.2: Capanna Piansecco

source: www.googlemaps.com

observations and was well balanced with male and female respondents. The questionnaire used had 22 questions divided into 3 categories.

The first category included questions about visitors´ preferences of summer activities in the area and information about their visit to Val Bedretto. The objective of this section was to recollect information about the frequency of their visits and other data use in the calculation of the valuation of the area for the visitors. The second category obtain information about the preferences of the visitors for the renovation project of Capanna Piansecco and the willingness to pay for a night in the hut (This section of the survey is not used in this analysis). The third section focus on the socio-economic information of the visitors. These information is used to prove if their preferences may be influenced by their characteristics. A total of 316 observations were considered due to the missing values of some variables, for which individual travel cost was calculated as follows:

$$TC_i = \frac{Distance_i \times costperKM}{groupSize_i} + \frac{annualIncome_i \times Ttime_i}{AnnualHoursofWork_i \times 4 \times householdSize_i} \quad (4.1)$$

Where $Distance_i$ is the trip distance for the individual from the area where the individual start their ride to Piansecco, $Ttime_i$ is the travel time in hours for each one from area where the individual begin the trip to Piansecco, CostperKMi is the average cost per kilometer and $groupSize_i$ is the total of travellers that go to the valley in any private transport. The opportunity cost of travel time is recorded in the variable of TC as a fraction of the salary per time - i.e. $\frac{annualIncome_i}{AnnualHoursofWork_i}$

Table 4.1 presents the summary statistics of the proposed variables from the econometric section. In the first section of the table, it is included the number of trips, where the average for each summer season is approximately of 2.03 trips, with a maximum of 22 and a minimum of 1. The actual trips consist of the summation of the trips made on week and weekends. The second group of variables in Table 4.1 contains the descriptive statistic of the travel cost to Bedretto Valley with a mean of 39.36 CHF, and a range from 0 CHF to 571.85 CHF, and a standard deviation of 42.90. Also, is include an alternative travel cost variable where the visitors where asked to give 2 alternative mountain huts, the most mentioned alternatives where: Piotta, Realp, Bogno and Chironico. The purpose of the alternative travel cost variable is fore robustness in the models.

The characteristics of the summer sports participation are expected to be a relevant factor that determined the number of trips made by the visitors.In this category, the fist variable proposed is wether the visitor is affliliated to a season club; the next variable correspond to the number of sports paracticed in the area and the popularity of each one, if the individual visit the valley only on weekends o at weekend and week days, and the different locations where the individuals start their activities/sports.

The third set of variables -described above- shows in Table 4.1 that 37% of the visitors on Val Bedretto are affiliated to a season sport club. Also, the visitors practiced in average 1.14

Table 4.1: Summary statistic of variables proposed (n=316)

Variables	Units	Mean	Std.Dev	Min	Max
Trips					
Number of trips	Frequency	2.03	2.33	1.00	22.00
Travel costs					
Travel cost to Val Bedretto	CHF	39.36	42.90	0.00	571.85
Travel cost to alternative destination	CHF	30.42	40.76	0.00	483.50
Type of summer sport participation					
Subscribed to a club	(0/1)	0.37	0.48	0.00	1.00
Number of summer sports practiced	Frequency	1.14	0.41	0.00	3.00
Practice hiking	(0/1)	0.95	0.23	0.00	1.00
Practice climbing	(0/1)	0.06	0.24	0.00	1.00
Practice biking	(0/1)	0.04	0.21	0.00	1.00
Practice mountaineering	(0/1)	0.08	0.27	0.00	1.00
Collect berries	(0/1)	0.02	0.13	0.00	1.00
Eat or drink activities	(0/1)	0.01	0.11	0.00	1.00
Other activities	(0/1)	0.02	0.15	0.00	1.00
Visit Val Bedretto on weekend days	(0/1)	0.43	0.50	0.00	1.00
Visit Val Bedretto on week and weekend days	(0/1)	0.19	0.39	0.00	1.00
Start excursions from All'Acqua	(0/1)	0.46	0.50	0.00	1.00
Departure point from San Gottardo	(0/1)	0.15	0.36	0.00	1.00
Departure point from Nufnen	(0/1)	0.24	0.43	0.00	1.00
Departure point from Airolo	(0/1)	0.01	0.10	0.00	1.00
Departure point from Cioss Prato	(0/1)	0.01	0.11	0.00	1.00
Departure point from Oberalp	(0/1)	0.09	0.29	0.00	1.00
Socio-economic characteristics					
Age		51.95	13.93	18.00	82.00
Female	(0/1)	0.49	0.50	0.00	1.00
Non-Swiss	(0/1)	0.11	0.31	0.00	1.00
College education	(0/1)	0.36	0.48	0.00	1.00
Number of family members	Frequency	2.47	1.21	1.00	7.00
Annual household income above 75,000 CHF	(0/1)	0.53	0.50	0.00	1.00

CHF= Swiss Franc

Source: Own elaboration

different activities with a minimum of 0 and a maximum of 3. Analyzing each activity separately, 95% of the respondant have practiced hiking while 6% practiced climbing, 4% biking, 8% mountaineering, 2% collect berries, and 1% have food in the valley.[11] The majority of the visitors go on weekends days, a 43% visit the valley only on weekends and a 19% go on weekends and week days. Most visitors start their excursions from All´Acqua with a 46%, 24% start thei excursions from Nufnen, 15% from San Gottardo, 9% from Oberalp, 1% from Cioss Prato, and 1% from Airolo.

The last group of variables reported the socio-economic characteristics of the individuals. The mean of the age of the visitors is of 52 years with a standard deviation of 13.93 where the range of the age is from 18 to 82 years. Also, 49% of the respondents where females and 11% where Non-Swiss respondents, taking into account the the most non-swiss visitors are from Italy due to Val Bedretto is in the border of Switzerland and Italy. College educated visitors cover 36% of the population surveyed. Finally, the average number of family members per visit is of 2.47 with a standard deviation of 1.21. where the minimum was of 1 member and the maximum of 7 members; also 53% of the respondents have a income over 75,000 CHF for each household annually.

[11] It is important to explain that the sum of the percentages of the activities do not sum 100% because each respondent can select that practice more that one activity, even all of them, so the selection of each activity is not exclusively for the rest.

Chapter 5

Results

5.1 Demand Function

Through the econometric analysis, three econometric models were suggested are the best to fit according to the data and the available computer capacity: an on-site poisson (OSP), an on-site negative binomial(OSNB), and a on-site poisson model with a latent class specification (LTPOSP). The OPS and OSNB models were report as a standard to emphasize the application of latent class models. The preferred latent class model was chosen by its fitting attributes dimensioned by the Akaike Information Criterion (AIC).

Table 5.1 shows results from the OSP model. In order to find the model more accurate, several models were used, changing the explanatory variables. Therefore, the table 5.1 is divided in two sections, the first two columns only use the travel cost variable; while the last two columns use another travel cost variable measured from alternative staring point. From each division, it was estimated two models, the first only use socio-economic variables, while the second include all the variables (socio-economic, sport practicing, and travel frequency).

Table 5.2 shows the outcome from the OSNB models. This table has the same sections as Table 5.1. Just as in the OSP, the parameter from the travel cost variable is negative and significant on the four models. Also, the parameter from the alternative travel cost variable

Table 5.1: Poisson models correct by endogenous stratification

	Travel Cost		Alternative Travel Cost	
Variables	Socio-economic	All variables	Socio-economic	All variables
Intercept	0.57**	-0.39	0.58**	-0.34
	(0.24)	(0.30)	(0.24)	(0.31)
Travel cost to Val Bedretto	-0.0061***	-0.0048***	-0.0043**	-0.0036*
	(0.0014)	(0.0015)	(0.0018)	(0.0020)
Alternative travel cost			-0.0033*	-0.0017
			(0.0018)	(0.0021)
Age	0.0021	0.0069**	0.0025	0.0071**
	(0.0033)	(0.0034)	(0.0033)	(0.0035)
Female	-0.063	-0.087	-0.085	-0.098
	(0.086)	(0.088)	(0.086)	(0.089)
Non-Swiss	0.34***	0.25*	0.37***	0.26*
	(0.13)	(0.14)	(0.13)	(0.14)
College education [a]	0.085	-0.014	0.100	-0.0078
	(0.092)	(0.094)	(0.092)	(0.094)
Number of family members	0.017	-0.014	0.013	-0.016
	(0.036)	(0.036)	(0.036)	(0.036)
Annual income > 75,000CHF [b]	0.22**	0.12	0.23***	0.12
	(0.089)	(0.091)	(0.089)	(0.091)
Affiliated to a club		0.038		0.034
		(0.089)		(0.090)
Number of sports practiced		0.23***		0.24***
		(0.088)		(0.088)
Visit Bedretto on weekends [c]		0.34***		0.34***
		(0.11)		(0.11)
Visit Bedretto week & weekends [c]		0.43***		0.43***
		(0.11)		(0.11)
Start excursions from All'Acqua [d]		0.36**		0.31*
		(0.16)		(0.17)
Start excursions from Gottardo/Nufnen [d]		0.25		0.19
		(0.16)		(0.18)
AIC	1063.81	997.41	1062.52	998.71
BIC	1093.47	1049.31	1095.89	1054.31
Num. obs.	301	301	301	301

Standard error in parenthesis. Coefficient significance: *** p<0.01, ** p<0.05, * p<0.1
[a] Reference category: Basic education, middle school education or technical education
[b] Reference category: annual income < 75,000 CHF
[c] Reference category: visiting Piansecco during the week
[d] Reference category: Start excursions from Airolo, Cioss Prato, Oberalp or other locations
Source: Own elaboration

Table 5.2: Negative Binomial models corrected by endogenous stratification

	Travel Cost		Alternative Travel Cost	
Variables	Socio-economic	All variables	Socio-economic	All variables
Intercept	-14.7	-17.7	-14.5	13.2
	(188)	(319)	(192)	(261)
Travel cost to Val Bedretto	-0.018***	-0.014***	-0.013***	-0.011**
	(0.0035)	(0.0039)	(0.0044)	(0.0052)
Alternative travel cost			-0.0093**	-0.0060
			(0.0047)	(0.0056)
Age	0.0054	0.018**	0.0066	0.019**
	(0.0077)	(0.0085)	(0.0077)	(0.0085)
Female	-0.13	-0.00050	-0.16	-0.034
	(0.18)	(0.20)	(0.18)	(0.20)
Non-Swiss	0.86***	0.70**	0.94***	0.75**
	(0.28)	(0.31)	(0.29)	(0.32)
College education [a]	0.23	0.071	0.24	0.082
	(0.19)	(0.21)	(0.19)	(0.21)
Number of family members	0.025	0.054	0.023	0.049
	(0.078)	(0.085)	(0.078)	(0.085)
Annual income > 75,000CHF [b]	0.52***	0.23	0.52***	0.22
	(0.19)	(0.20)	(0.19)	(0.20)
Affiliated to a club		0.047		0.039
		(0.21)		(0.21)
Number of sports practiced		0.52**		0.53**
		(0.22)		(0.22)
Visit Bedretto on weekends [c]		0.71***		0.71***
		(0.25)		(0.25)
Visit Bedretto week & weekends [c]		0.90***		0.89***
		(0.26)		(0.26)
Start excursions from All'Acqua [d]		1.09***		0.94**
		(0.37)		(0.40)
Start excursions from Gottardo/Nufnen [d]		0.64		0.49
		(0.39)		(0.42)
AIC	777.31	713.88	775.13	714.67
BIC	810.68	769.49	812.20	773.98
Ln Overdispersion parameter	14.49	14.57	14.26	13.23
Num. obs.	301	301	301	301

Standard error in parenthesis. Coefficient significance: *** $p<0.01$, ** $p<0.05$, * $p<0.1$

[a] Reference category: Basic education, middle school education or technical education

[b] Reference category: annual income < 75,000 CHF

[c] Reference category: visiting Piansecco during the week

[d] Reference category: Start excursions from Airolo, Cioss Prato, Oberalp or other locations

Source: Own elaboration

is significant and negative exclusively in the model with socio-economic variables. The best model is the one with all that variables and not including the alternative travel cost with an AIC of 713.88, a BIC of 769.49 and the parameter of the TC variable of -0.0014. Nonetheless, the number from the overdispersion parameter is exceptionally large and possibly insignificant (Hilbe, 2007). The magnitude from the overdispersion value suggest that OSNB model do not incorporate adequate the variation in the visits to the area.

On Table5.1 The value from the travel cost variable is negative and significant on the four models, just as the theory expect; also, it is plausible that an increase in the travel cost will decrease the number of trips. The parameter can be understood as an elasticity (the proportional reduction in the trips made due to an increase in one monetary unit in the TC variable) (Haab and McConnell, 2002). On the other hand, the parameter of the alternative travel cost variable is significant and negative exclusively in the model with only socio-economic variables. However, the models with only travel cost variable have a AIC and a BIC lower,indicating a better statistical fit with the variables; where the best model is the one with all that variables and not including the alternative travel cost with an AIC of 997.4, a BIC of 1049.3 and the parameter of the TC variable of -0.0048.

Table 5.3: AIC and BIC from Latent Class Models

Model	LL model	Df	AIC	BIC
1	-484.7067	14	997.4133	1049.313
2[a]	-439.12	29	936.24	1043.746
3	-439.12	44	966.24	1129.353
4	-439.12	59	996.24	1214.96
5	-439.12	74	1026.24	1300.566

[a] Preferred specification, reported in Table 5.6

Source: Own elaboration

Table 5.3 reports the Loglikehood, AIC and BIC from five latent class specifications. According to AIC values the poorest statistical fit is for the OSP with five latent classes; while the latent class specification that fit better is the two class model which yields an AIC from 936.24 and a BIC from 1043.746.

Table 5.4: Latent Class Marginal Means

Class	Mean	Std. Err	[95% Conf.	Interval]
1				
Number of visits	1.61744	0.0819	1.4568	1.7720
2				
Number of visits	7.036348	2.3383	2.4532	11.6194

Source: Own elaboration

After choosing the LCPOSP model, Table 5.4 shows the means of the quantity of visits made by each class. The fist class will include the occasional visitors with a mean of 1.61 trips per season; while the second class include the frequent visitors with a mean of 7.03 trips per season. The marginal means of both classes are statically significant at a 95% of confidence.

Table 5.5: Latent Class Marginal Probabilities

Class	Margin	Std. Err	[95% Conf.	Interval]
1	(270)			
Number of visits	0.8973848	0.0313607	0.817725	0.944589
2	(31)			
Number of visits	0.1026152	0.0313607	0.055410	0.182274

Number of individuals in each class in parenthesis

Source: Own elaboration

Table 5.5 include the proportion of individuals that belong to each class. The ocasional visitors represent a 89.7% of the sample (270 visitors); while the frequent visitors represent a 10.2% of the sample (31 visitors). It is important to emphasize that both proportions are significant at a 95% of confidence.

Table 5.6 finally detail the outcomes from the best statistically fit OSNB, OSP and the LT-POSP. The parameter from the travel cost variable have a bigger magnitude on the poisson model rather than the negative binomial model.

The third model showed in Table 5.6 is LTPOSP specification with two classes. This model afford evidence from the unobserved heterogeneity in preferences, inducing a huge overdispersion value from the On-site negative binomial model that would not fit. Also, Latent class model have a fewer AIC compared with the OSP with 936.24 and 997.41.

Table 5.6: Econometric Specification on number of trips

Variables	On-site models		LTPOSP	
	Neg Binomial	Poisson	Class 1	Class 2
Intercept	-17.7	-0.39	-0.49	-0.68
	(319)	(0.30)	(0.36)	(1.47)
Travel cost to Val Bedretto	-0.014***	-0.0048***	-0.0015	-0.0166***
	(0.0039)	(0.0015)	(0.0012)	(0.0058)
Age	0.018**	0.0069**	0.0072*	0.0098
	(0.0085)	(0.0034)	(0.0041)	(0.017)
Female	-0.0005	-0.087	0.1634	-1.031***
	(0.20)	(0.088)	(0.1083)	(0.3401)
Non-Swiss	0.70**	0.25*	0.1953	2.095***
	(0.31)	(0.14)	(0.1677)	(0.5294)
College education [a]	0.071	-0.014	-0.014	0.2549
	(0.21)	(0.094)	(0.112)	(0.3308)
Number of family members	0.054	-0.014	-0.0014	0.1426
	(0.085)	(0.036)	(0.043)	(0.1414)
Annual income > 75,000CHF [b]	0.23	0.12	0.038	0.69**
	(0.20)	(0.091)	(0.108)	(0.32)
Affiliated to a club	0.047	0.038	-0.01	-0.119
	(0.21)	(0.089)	(0.1089)	(0.277)
Number of sports practiced	0.52**	0.23***	0.05	0.36
	(0.22)	(0.088)	(0.12)	(0.309)
Visit Bedretto on weekends [c]	0.71***	0.34***	0.1259	-0.162
	(0.25)	(0.11)	(0.133)	(0.405)
Visit Bedretto week & weekends [c]	0.90***	0.43***	0.521***	0.898**
	(0.26)	(0.11)	(0.149)	(0.397)
Start excursions from All'Acqua [d]	1.09***	0.36**	0.411**	-0.382
	(0.37)	(0.16)	(0.19)	(0.621)
Start excursions from Gottardo/Nufnen [d]	0.64	0.25	0.218	-0.81
	(0.39)	(0.16)	(0.196)	(0.618)
AIC	713.88	997.41	936.24	
BIC	769.49	1049.31	1043.74	
Num. obs.	301	301	301	301

Standard error in parenthesis. Coefficient significance: *** p<0.01, ** p<0.05, * p<0.1

[a] Reference category: Basic education, middle school education or technical education

[b] Reference category: annual income < 75,000 CHF

[c] Reference category: visiting Piansecco during the week

[d] Reference category: Start excursions from Airolo, Cioss Prato, Oberalp or other locations

Source: Own elaboration

According to Table 5.6, visitors from the second class were more sensitives to variations in TC variable than the first class. Highlighting that the parameter from the travel cost variable is different from zero only in frequent visitors class. This shows that the price elasticity from the first class is too high that changes in travel cost, will not have an impact on the number of visits for occasional visitors.

5.2 Consumer Surplus

The estimation of consumer surplus are presented in Table 5.7 for all the models presented in the last section, including LC specification and a weighted LC estimation. First of all, negative binomials models show negative results in consumer surplus; -804.2 CHF for the model adjusted only with socio-economics parameters and travel cost variable; a CS of -1.047.4 CHF for the model with all the parameters; -1,144.6 CHF using travel cost and alternative travel cost (only socio-economics variables); lastly, the model with all the parameters and both travel cost variables show a consumer surplus of -1,299 CHF. None of the values presented by the negative binomial are statistically significant due to the confidence interval that contains negative values. This results are directly related with the over dispersion parameter that was too big.

The second part of the table shows the results of poisson models, including the latent class models. The results of the models with jut the travel cost varibales are statistically significant with a CS of 314.6 CHF per season for the model using only socio-economics parameters, and a CS of 403.5 CHF for the one using all parameters. Nevertheless, the poisson models with travel cost and alternative travel cost is stastistically significant just for the model that use socio-economics parameters with a CS of 451.6.

At the bottom of Table5.7 is the latent class panel on-site Poisson where it shows that the second class of visitors (frequent ones) accumulate a consumer surplus of 421.8 CHF per season; while the occasional visitors remains at around 1,014 CHF per season where the result is not statistically significant for this class (looking back to the econometric result where the coefficient for travel cost variable was neither statistically significant. At the end, the table present a LT-POSP weighted Consumer surplus where the specifications of each class were weighted by the proportion of visitors included in each class. The result of this specification was of 708.6 CHF per season for all visitors.[12] This results are completely different contrasted with the models without using latent classes.

Table 5.7: Consumer surplus specification per season

Model	Consumer Surplus	Standard Error	[95% Conf.	Interval]
Negative Binomial				
TC soc-econ	-804.2015	152.6668	-1103.423	-504.9801
TC all var	-1,047.437	279.6075	-1595.457	-499.4159
Alt-TC Soc-econ	-1,144.621	397.0375	-1922.801	-366.4423
Alt-TC all var	-1,299.094	631.7923	-2537.384	-60.80397
Poisson				
TC soc-econ	314.6362***	74.302	169.0069	460.2655
TC all var	403.5992***	125.3928	157.8338	649.3646
Alt-TC Soc-econ	451.6342***	188.4409	82.29686	820.9715
Alt-TC all var	530.4240	294.7592	-47.2934	1108.142
LTPOSP - class 1	1014.01	821.1232	-595.3617	2623.382
LTPOSP - class 2	421.8219***	147.8797	131.9831	711.6607
LTPOSP - weighted	708.6414***	293.5887	133.2182	1284.065

Coefficient significance: *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Source: Own elaboration

Table5.8 shows the travel cost coefficient (Beta), expected value of predicted total numbers of visits (Lambda), the consumer surplus of the visitants per season, and the consumer surplus of the visitants per visit for the same models as in Table 5.7.[13] For negative binomial models, this table shows that the negative value of the consumer surplus come from the results of lambda. The negative value of lambda do not have a realistic meaning due to the assumptions of the models where the number of visits have to be a positive number; this result is nearly related to the large overdispersion parameter founded in all the negative binomial models.

[12] The consumer surplus of the weighed model is statistically significant even when the first class is included due to the weights of each class, ranging the lower limit to positive values.

[13] The consumer surplus of each visitant per visited is calculated by a portion between the consumer surplus per season and the mean of visits per season (Lambda).

Table 5.8: Consumer Surplus from Poisson Models

Model	Beta	Lambda[a]	CS	CS per visit
Negative Binomial				
TC soc-econ	0.018	-14.7677	-804.20 CHF	—
TC all var	0.014	-15.1231	-1047.43 CHF	—
Alt-TC soc-econ	0.013	-14.5639	-1144.62 CHF	—
Alt-TC all var	0.011	-13.7917	-1299.69 CHF	—
Poisson				
TC soc-econ	0.0061	1.9302	314.63 CHF***	163 CHF***
TC all var	0.0048	1.9302	403.59 CHF***	209.09 CHF***
Alt-TC soc-econ	0.0043	1.9302	451.63 CHF***	233.97 CHF***
Alt-TC all var	0.0036	1.9302	530.42 CHF	274.79 CHF
LTPOSP - class 1*	0.0015	1.6174	1,014.01 CHF	626.92 CHF
LTPOSP - class 2	0.0166	7.0363	421.82 CHF***	59.94 CHF***
LTPOSP - weighted	0.0034	2.2273	708.64 CHF***	318.15 CHF***

Coefficient significance: *** p<0.01, ** p<0.05, * p<0.1

[a] Expected value of the predicted total number of visits

Source: Own elaboration

On the Poisson models, the table shows that the Betas founded are smaller than the betas from negative binomial specification. In other words, the effect of the travel cost in the number of visits is smaller in Poisson models rather than negative binomial. Otherwise, lambda is constant for the first four models in the table with a mean of 1.93 visits per season. This lambda results in a proportional value of consumer surplus per visit from 163 CHF to 274.8 CHF. Lastly, lambda values for LTCPOSP models are the ones shows in Table5.4 with the marginal means of each latent class. Class 1 (Occasional visitors) have a mean of 1.61 visits per season while class 2 (frequent visitors) have a mean of 7.03 visits per season; the weighted latent class model has a mean of 2.2 visits per season. This values remains in a CS per visits of 626.9 CHF for the occasional visitors, 60 CHF for the frequent visitors and 318.15 for the weighted LC model.

Chapter 6

Conclusion and Discussion

This thesis estimates a travel cost model for recreation demand in Val Bedretto - specifically in Piansecco Alpine area- during summer and autumn season. This estimations was controlled by econometric tools such as truncation and endogenous stratification for the on-site problem due to the surveys; and latent class models due to the unobserved heterogeneity in preferences.

The results explored that Val Bedretto have two classes of visitors in summer, frequent and occasional. Frequent visitors only represent approximately 10% of the visitors while the occasional represents almost the 90% of it. The frequent visitors visit this area on average seven time per season, while occasional less than two times per season. It was obtained a consumer surplus of 458.6$ per season for the frequent visitors, and the consumer surplus for the occasional visitors was not statistically different from zero. This result gives a completely different perspective compared with the previous analysis where all the visitors where considered as one type of visitors. In public policies, any economic decision have to be taking into account the consumer surplus obteined by the frequent visitors which are only 10% of the visitors in the summer/autumn season.

The results obtained in this thesis can be joined with the results founded by (Filippini,Greene, and Martinez-Cruz, 2017), where they found a consumer surplus of 555.16$ for the frequent visitors per winter season (21% higher than the same class in summer); this class represents the

13% of the visitors during winter. This was an expected outcome, presuming that the consumer surplus from winter season would be higher due to the popularity of the winter sports practiced in Val Bedretto.

With both results, it can be estimated the consumer surplus of visitants all over the year in Val Bedretto. With this information, the authorities could create policies or projects around this area to preserve this natural area and improve the facilities to visitors for practicing off-site activities. This join of proposals can have an effect of a positive externality both for sport-tourism and the local people that benefits from the visitors

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