The Economic Valuation of the Recreational Benefits of Dichato Beach (Tome-Chile)[4]

Introduction. I. Characteristics of the estimators. II. Methodology. III. Econometric Results. IV. Benefit Estimates. Conclusions. References.

Introduction

Recently, an unusual interest has come about in relation to the economic value given to environmental goods. The importance of economic value given to this type of good lies in the possible impact that certain projects or the enforcement of certain measures of regulation may have, basically corresponding to their availability and quality. In relation to the quantification of recreational benefits, derived from public goods, a substantial amount of theoretical and methodological development can be found. At present it is feasible to refer to what is known as the economics of outdoor recreation.

From an economic point of view, recreational services provided by natural resource systems such as lakes, rivers, streams, estuaries and forests, display two important characteristics. First, the conditions

4 Investigation presented in the International Seminar on ***"Economía Ambiental y Biodiversidad"***, held on October 3, 1996 in Concepción (Chile).

and quality of natural resources are fundamental for the determination of the economic value associated to recreational services. Second, the access to resources that offer different alternatives of recreation cannot be assigned through the market (Freeman III, 1993). Due to this, in the later part of 1970, the need to give economic value to recreational benefits has gained greater relevance, with the idea of contributing to a better allocation of soil and water resources on public land[5]. Growing concern for environmental quality reformed the wish to find plausible forms of determining the flows of recreational services that come from natural resources. Under these terms, a refined methodological process has been generated. This method seeks to contribute to the configuration of demand models, perfectly valid for the determination of the value of recreational activities, as well as the possible changes in the values associated with environmental quality alteration. One of the models of recreational demand to be found is the ***travel cost method (TCM)***.

The ***TCM*** assumes that for each individual that visits a site, an "implicit transaction" takes place. This transaction relates the travel costs with the entrance fee that should be paid by the visitor for the access to a given site. Freeman (1993), sustains that decisions taken in relation to differences in travel costs by people have been modeled from two different perspectives. The first perspective assumes that individuals choose a determined number of trips to be taken in a certain period of time. In models that use these types of decisions, it is possible to estimate a demand function that relates the number of trips and their respective costs, which vary according to the distance. In the second perspective of modeling, people decide if they want to visit a site for recreational purposes, if this is so, then the site or sites will be determined. Models that use this scheme of decision are identified with discrete choice making models or ***models of random utility*** (***RUM***).

This article will emphasize on the first of the above mentioned

5 In the words of Bockstael, McConnell and Strand (1991), the history of the development of recreational economics reflects the role of economics in the assignment of natural resources.

perspectives, with the intention of estimating demand functions using individual (or household) observations[6]. The natural conditions and substructure of existing services at Dichato beach in Chile, allow a considerable number of households to visit this location for recreational activities during the summer season. This study estimates an economic valuation of recreational benefits associated with the beach, given the number of visitors during the season[7]. The general model of the travel cost can be expressed as:

$$y_{ij} = f(p_{ij}, s_{ik}, d_i, q_i, m_i, e_{ij}) \quad (1)$$

where $\boldsymbol{y_{ij}}$ is the number of trips carried out by the person (or household) $\boldsymbol{i}$ to the site $\boldsymbol{j}$ during one season or year, $\boldsymbol{p_{ij}}$ is the implicit price or travel cost of the person (or household) $\boldsymbol{i}$ to the site $\boldsymbol{j}$, $\boldsymbol{s_{ik}}$ is the price faced by person (or household) $\boldsymbol{i^{th}}$ in substitute for the place $\boldsymbol{j}$, $\boldsymbol{d_i}$ is the vector of demographic characteristics of the person (or household), $\boldsymbol{q_i}$ is the vector of the site environmental quality $\boldsymbol{j}$[8], $\boldsymbol{m_i}$ is the income of the $\boldsymbol{i^{th}}$ person (or household) and $\boldsymbol{e_i}$ is a stochastic or random error term. Equation ***(1)*** can be treated as Marshallian demand in the implicit prices of travel costs.

The data used in the econometric estimation, was obtained by the application of a survey to 628 households that visited the beach during the months of February and March of 1996. Relying only on the information from participants creates a sample of a ***"truncated"*** nature. As various authors show (Shaw, 1988; Hellerstein, 1995), truncated samples may be subject to possible bias related to the discrete and positive nature of the dependent variable (the number of trips or visits is always a positive integer); truncation (only those households that have taken at least one trip have been sampled, and all the information of the non

6 Hellerstein (1995), states that the greater availability of data at a micro level, accompanied by a better knowledge of the bias of aggregation, have reduced the use of the demand model for the travel cost by zones of origin.

7 According to conservative data given by the tourism office of Tomé, the number of visitors to the beach of Dichato was 40,000 people per week during 1996. If an effective season of 10 weeks and an average **4** people per household is assumed, this is equivalent to approximately 100,000 households.

8 The argument of the demand function, in relation to the environmental quality, is considered constant. In synthesis, the basic idea is to get acces value.

participants is not considered in the estimation); and the endogenous stratification (the possibility of being sampled is a function of the amount demanded, meaning that persons or households that assist the place frequently have a greater possibility ofbeing chosen for the sample, in comparison to others that visit the place occasionally).

This document presents and discusses the results of point estimation of the consumer surplus for the following statistical models: ordinary least squares from a functional linear form (***OLSL***), and a semi-log form (***OLSS***); maximum likelihood from a functional linear form (***MLEL***), from a semi-log (***MLES***), from a Poisson distribution, general (***POIS***) and truncated (***TPOIS***), and finally a negative binomial distribution, general (***BNEG***) and truncated (***TBNEG***). Eight models have been employed, of which the ***OLSL***, ***OLSS***, ***MLEL*** and ***MLES*** models are known to be based on continuous probability distributions. The models ***POIS***, ***TPOIS***, ***BNEG*** and ***TBNEG***, correspond to discrete distributions. The most important statistical aspects of the different estimators are presented in section 2. Section 3 describes the methodology of sampling and the basic model of demand used. The econometric results and the economic benefits obtained are presented in sections 4 and 5, respectively. Finally, in section 6 the conclusions and some recommendations are presented.

I. Characteristics of the estimators

The principle or ordinary least squares method (***OLS***) is well known and consists of the selection of estimators that ensure reaching a feasible minimum sum of the squared residuals. The procedure of maximum likelihood tries to find estimators that can account for the maximum probability of obtaining the observed data in the empirical work. Each model contains basic expressions and descriptions outlined as follows.

The linear demand function can be expressed in a matrix form as:

$$Y = X\beta + \xi \tag{2}$$

where Y is a vector $Nx1$ that represents the value of the number of trips for a sample of size N, X represents a NxK matrix of exogenous variables (implicit price of travel cost, substitute prices, socio-economic characteristics, etc.); β is a vector of parameters ***Kx1*** and ξ is a vector ***Nx1*** of random errors which have a normal distribution with mean ***0*** and variance σ^2. According to Amemiya (1984), the likelihood function for equation ***(2)*** and truncated samples is given by:

$$L = \Pi\ (1/\sigma)\phi\ (Y - X\beta\ /\sigma)\ \Phi\ (X\beta\ /\sigma)^{-1} \qquad (3)$$

where Φ and ϕ indicate the cumulative distribution and density functions respectively of a standard normal variable. The logarithm of the likelihood function of equation ***(3)*** can be written as:

$$\begin{aligned} Log\text{-}L = & -N \log [\sigma\ (2\prod)^{1/2}] \\ & - (1/2\sigma^2)\sum (Y - X\beta)^2 \\ & - \sum \log \Phi\ (X\beta\ /\sigma) \qquad (4) \end{aligned}$$

In the same way the matrix equation of the semi-log demand function, its likelihood function and their corresponding logarithms are presented in equations ***(5)***, ***(6)*** and ***(7)*** respectively:

$$Y = exp\ (X\beta + \xi) \qquad (5)$$

$$\begin{aligned} L = & \ \Pi\ (1/\sigma)\ \phi\ (\ln Y - X\beta\ /\sigma) \\ & \ \Phi\ (X\beta\ /\sigma)^{-1} \qquad (6) \end{aligned}$$

$$\begin{aligned} Log\text{-}L = & -N \log [\sigma\ (2\prod)^{1/2}] \\ & - (1/2\sigma^2)\sum (\ln Y - X\beta)^2 \\ & - \sum \log \Phi\ (X\beta\ /\sigma) \qquad (7) \end{aligned}$$

It is worth pointing out that up to now only estimators that are based on continuous distributions like the normal distribution have been taken into consideration. In this sense, and for data that only contemplates the participants in the recreational experience, the classic example is the ***Tobit*** maximum likelihood estimator in its truncated version. The procedure consists in maximizing equations ***(4)*** and ***(7)*** in terms of β and σ^2 for the semi-log and linear functional forms[9]. This type of estimator is very sensible for the established assumptions about the probability distributions of demand, which can be interpreted in biased results when the ***TCM*** is employed. Also, Creel and Loomis (1990) recommend using discrete distributions when the dependent variable in recreational demand

9 In the recreational demand literature it can be seen the sensitivity of welfare measures to the different functional forms. In this study the linear and semi-log forms are employed, because the log-log specification allows an infinitive number of visits when the site implicit price or travel cost is zero.

studies take very small values, ocurring when the quantity of trips in one year is not relatively large. In some investigations, the Poisson model of travel cost is used. The model assumes that the distribution of the demand of trips for a person ***i*** is a positive integer and is expressed as[10]:

$$f_i(n) = [\exp(-\lambda_i)\lambda^n_i] / n!\,; \quad n = 0,1,2,.. \qquad (8)$$

where the most frequent functional form for λ_i is $\lambda_i = \exp(Xi\beta)$[11]. Another important characte-ristic of the general Poisson model is the equivalence of the mean and variance. In equations ***(9)*** and ***(10)*** the versions reported by Hellerstein (1995) are presented. The truncated Poisson model developed by Grogger and Carson, and the Poisson expression in the endogenous stratification suggested by Shaw, are respectively:

$$f_i(n) = \lambda^n_i / [\exp(\lambda_i) - 1]\, n!\,; \quad n = 1,2,... \qquad (9)$$

$$f_i(n) = [\exp(-\lambda_i)\,\lambda^{(n-1)}_i] / (n-1)! \quad n = 1,2,.. \qquad (10)$$

The expected values of ***(9)*** and ***(10)*** are $l / (1-e^{-\lambda})$ ***and*** $\lambda+1$. These Poisson models, just like the continuous distribution models, make assumptions about the distributions. For example, equations ***(9)*** and ***(10)*** are based on equation ***(8),*** which assumes the equivalence of the mean and the variance, without which it is likely that the estimators will be biased. The truncated Poisson estimator can be perfectly biased and inconsistent in the presence of ***overdispersion***[12], which is considered for practical effects as a form of heteroscedasticity. In conditions of this nature, it's recommended to use a Negative

10 As Haab and McConnell (1996) point out, in estimated demand functions using traditional methods (***OLS***, ***Tobit***, etc.), the distribution of the dependent variable (quantity demanded) is derived from the assumptions about the distribution of the random error term. In discrete models, such as the Poisson model, the dependent variable directly indicates a distribution. Therefore, the quantity demanded in a discrete model is a random variable, which is contrary to the consideration of regression models where the quantity demanded is a function of a random variable (the error).

11 Hausman, Hall and Griliches (1984), point out that ***li*** is a deterministic function of ***Xi*** and the randomness in the model comes from the Poisson specification for ***n.***

12 Defined as the conditional variance excess over the corresponding conditional mean of the dependent variable, when the variance-mean ratio is greater than ***1***.

Binomial distribution, considered as an expression of a Poisson. For the Negative Binomial the typical functional form of λ_i is:

$$\lambda_i = exp\ (X_i \beta + \xi),$$

where $exp(\xi)$ has a gamma distribution with mean 1 and variance α[13]. The next section describes the application of the different analysed estimators.

II. Methodology.

The data for this investigation was obtained by the application of a survey to 628 visitors to Dichato beach during the months of February and March of 1996. The survey consisted of approximately eight pages which included questions related to origin, travel motives, preferences, costs, travel time and socio-economic characteristics of the households that visited the beach[14]. The data indicated a great variability in the duration of the trips. The visitors from sites further away prefered to make fewer trips but for longer periods of time.

Recreational trips are heterogeneous and when vary in length the literature recommends the estimation of different demand functions, given that is important to compare the same good. An overnight trip is very different from a one day trip. Initially, it was decided to take into account only those visitors whose trip time was less than or equal to a day, and also that they used a car as a means of transportation. With this in mind, and with the objective of avoiding possible bias in the final results, the households that matched these characteristics were chosen. Out of the initial 628 observations, 161 fit these requirements. The statistical results reported here are based on those 161 observations[15].

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13 In the negative binomial the mean of the dependent random variable is λ and its variance is $\lambda + \alpha\lambda^2$. the variance-mean ratio is $1+\alpha\lambda$, in such a way that the degree of overdispersion is not only a function of α but also of λ. If $\alpha \rightarrow 0$, the gamma distribution looses significance and the negative binomial distribution is reduced to a Poisson distribution.

14 In addition, a part related to contingent valuation was carried out, with the idea of calculate the willingness to pay for a project that intends to enhance the water quality. The results of this method constitutes another investigation.

15 Estimations that take into account the original 628 observations took place, giving inconsistent results with the economic theory between the different models and estimations. This is due to the heterogeneous nature of the data, in what relates basically to the length of the trip.

The decision process of each household consists of two states. First, it is decided which site should be visited, and later how many trips will be taken to the site. This document emphasizes the modeling of the second state of the decision process. The travel cost model estimated was:

$$TRIPS_i = \beta_0 + \beta_1 TCP_i + \beta_2 TCS_{ij} + \beta_3 ACCESS_i + \beta_4 WATER_i + \beta_5 INCOME_i + \xi_i \qquad (11)$$

Where ***TRIPS***$_i$ represent the number of trips taken to the beach of Dichato during 1996 by the i^{th} household; ***TCP***$_i$ is the variable cost for access the beach by the i^{th} household; ***TCS***$_{ij}$ is the cost of a trip to the j^{th} substitute site; ***ACCESS***$_i$ is a dummy variable that takes the value of ***1*** if the household reported the easy access to the beach as its most important preference, and ***0*** in any other case; ***WATER***$_i$ is another dummy variable that takes on the value of ***1*** if the household prefers more water at the beach, and ***0*** if not; ***INCOME***$_i$ is the households monthly net income and ξ_i is the stochastic or random error.

Equation ***(12)*** was used to calculate the variable cost of a trip to Dichato ***(TCP***$_i$***)*** for the demand function ***(11)***.

$$TCP_i = Dist\,[\,Cost\text{-}Km + \%w\,[\,Income/2000\,]/\,Veloc] \qquad (12)$$

where ***Dist*** is the round-trip distance in kilometers from the respondent's home to the beach. ***Cost-Km*** represents the cost per kilometer travelled and is equal to the performance of the car (lt/km) multiplied by the value of a litre of fuel ($/lt) at prices of March 1996; ***%w [Income/2000]*** is the opportunity cost of the travel time, valued as a percentage of the salary per hour and ***Veloc*** indicates the average speed, here is equivalent to 60 km/hr. The opportunity cost of the travel time was evaluated in 30, 40 and 50% of the salary per hour, with the purpose of analysing the sensibility of the welfare measures at these values.

Travel costs to substitute sites, were calculated by equation ***(12)***. The majority of the people interviewed reported as alternative places ***Playa Blanca*** or ***Cobquecura***. It is important to point out that a significant number of people interviewed suggested alternative sites relatively distant from the normal site of residence. This indicates that those sites would have higher travel costs than the costs of Dichato. Therefore, for these visitors the highest value reported in the sample for alternative sites such as Playa Blanca or Cobquecura as a substitute cost was inputed[16]. The following is a summary of the eight models applied to the available data:

OLSL: $Y \sim N(X\beta, \sigma^2)$
Y is observed only if Y>0

OLSS: $Y \sim N(\exp(X\beta), \sigma^2)$
Y is observed only if Y>0

MLEL: $Y \sim N(X\beta, \sigma^2)$
Y is observed only if Y>0

MLES: $Y \sim N(\exp(X\beta), \sigma^2)$
Y is observed only if Y>0

POIS: $Y \sim Poisson(\lambda = \exp(X\beta))$

TPOIS: $Y \sim Poisson(\lambda = \exp(X\beta))$
Y is observed only if Y>0

BNEG: $Y \sim BinNega(\lambda = \exp(X\beta), \alpha)$

TBNEG: $Y \sim BinNega(\lambda = \exp(X\beta), \alpha)$
Y is observed only if Y>0

III. Econometric Results.

Table 1 represents the principal descriptive statistics of the variables that were used in the different regressions. In theoretical terms, the signs of the travel cost and substitute cost variables coefficients should be negative and positive respectively. The inclusion of the dummy variable ***ACCESS***, as a fundamental part of the preferences and tastes of the visitors of Dichato beach, was considered largely as a result of the current construction projects that will provide new road substructures in the area under study[17]. Water quality and natural conditions that prevent large waves are both attractive qualities of Dichato beach. These characteristics warrented the inclusion of the dummy ***WATER***. Positive signs are expected for both the access and water variables. Finally, it is considered that the Dichato beach can be viewed

16 A similar procedure was employed by Wilman and Perras, (1989).

17 It specifically refers to the new highway between Chillán and Concepción, that will reduce the travel time between the two cities and an element that will be taken into consideration in the future, in what relates to a possible growth of the recreational demand of Dichato. In perspective it is worth pointing out for future investigations, in the case of temporary demand analyses.

as a normal good, which gives a positive sign to the income variable[18].

The results of the estimation of the different statistical models were obtained by the use of the ***LIMDEP 6.0*** program, and are shown in tables 2, 3 and 4. The coefficients in all the models have the expected sign. The significance of some exogenous variables would be higher if there had been a more in-depth process of specification. Other variables could have been taken into account in the basic model that may contribute to explaining more efficiently the travel frequency decision. However, it is important to point out that in recreational demand investigations, a general specification of the model is not privileged.

It is fundamental to obtain robust statistical coefficients of the travel cost variable for the calculation of measures of welfare, and even more so for point estimations of consumers' surplus. In tables 2, 3 and 4 it can be seen that the ***TCP*** variable coefficient is statistically significant in all of the models. The significance of the ***ACCESS*** and ***WATER*** variables is variables is relative, but they constitute factors that can in part explain the wish of going to the beach of Dichato by households. What is uncertain in the modeling, are the differences found between the continuous and discrete distributions, which will be better seen in the calculation of the measures of welfare.

Referring to the discrete distributions, the ***POIS*** model results are similar to the ***BNEG*** model, but the parameter that denotes overdispersion is significant. Therefore, a test based on regressions, as recommended by Cameron and Trivedi (1990) took place. The result of the test confirmed the existence of overdispersion evidence in the Poisson model[19].

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18 It's important to point out that many enquiries require extra efforts in the interviewing with the idea of obtaining household income. It seems that there is a tendency in the people interviewed to restrain the information about monthly salary. However, this aspect is out of the reach of the present investigation.

19 The test consists basically of running regressions that use variables built with values given by the Poisson model. In addittion, using a ***t*** test the following hypothesis can be verified, $\mathbf{H_0}$:var[y_i]=u_i and $\mathbf{H_a}$:var[y_i]=$u_i+\alpha g(u_i)$. In this case $\mathbf{H_0}$ is rejected, which means that ***a*** is important and there is overdispersion, considered like heteroscedasticity in linear regression models.

Table 1. Variables used in the regressions

VARIABLE	*STANDARD MEAN*	*DEV.*	*MINIMUM*	*MAXIMUM*
TRIPS	4.42*	3.9789	1.0	19.0
TCP-30	3001.6	1978.3	330.0	11490.0
TCP-40	3486.6	2366.3	370.0	13720.0
TCP-50	3971.7	2764.9	400.0	16200.0
TCS-30	12371.0	4853.5	1188.0	14910.0
TCS-40	15233.0	6140.7	1353.0	18460.0
TCS-50	18095.0	7431.1	1518.0	22010.0
ACCES	0.16149	0.36913	0.000	1.000
WATER	0.39130	0.48957	0.000	1.000
INCOME	560870.0	396180.0	100000.0	2000000.0

Observations =161. TCP-30, indicates the travel cost to Dichato beach with a valuation of the opportunity cost of the travel time considered at 30% of the salary per hour. TCS-30 is the travel cost to the substitute location with an opportunity cost of the time valuation in 30% of the salary per hour.

** This relatively low average of trips per year, suggests the use of discrete distributions.*

This implies that the standard errors in the ***POIS*** and ***TPOIS*** models will be bias toward zero and therefore lead to obtaining relatively high absolute values of the ***t*** statistic, in the same way that shown by the results. The ***TBNEG*** model is the best suited of the models studied to estimating demand and benefits for this data.

Table2. Econometric result of the different models, for the opportunity cost of travel time equivalent to 30% of the salary per hour.

Parameter	OLSL	OLSS	MLEL	MLES	POIS	TPOIS	BNEG	TBNEG
Constant	3.1053**	1.2289**	-13.7210	1.1837**	1.1370**	1.0809**	1.0742**	0.54941
	(3.118)	(7.464)	(-1.390)	(6.474)	(7.793)	(6.778)	(4.126)	(1.250)
TCP-30	-0.00056864**	-0.000087179**	-0.0031267*	-0.000099454**	-0.00015241**	-0.00017222**	-0.00012506**	-0.00015011**
	(-3.363)	(-3.119)	(-2.345)	(-3.099)	(-5.969)	(-6.131)	(-5.206)	(-3.696)
TCS-30	0.00013063*	0.000017790	0.00070383	0.000019674	0.000033229**	0.000036997**	0.000033650*	0.000049151
	(2.053)	(1.691)	(1.679)	(1.699)	(3.612)	(3.683)	(2.026)	(1.844)
ACCES	1.1539	0.15948	4.1299	0.17221	0.22929*	0.23865*	0.20358	0.25715
	(1.409)	(1.178)	(1.233)	(1.198)	(2.428)	(2.468)	(1.128)	(0.694)
WATER	0.70745	0.13645	3.1381	0.15005	0.16230*	0.17480*	0.14636	0.19679
	(1.118)	(1.304)	(1.096)	(1.331)	(2.050)	(2.126)	(1.111)	(0.807)
INCOME	0.000001673	0.000000355*	0.000008592	0.000000395*	0.000000428**	0.000000477**	0.000000413*	0.000000579
	(1.903)	(2.442)	(1.869)	(2.513)	(3.863)	(4.118)	(2.140)	(1.519)
σ	-	-	7.7313**	0.64609**	-	-	-	-
			(4.619)	(15.439)				
α	-	-	-	-	-	-	0.37565**	1.17410**
							(4.197)	(2.728)
R^2 ajusted	0.08641	0.07504	-	-	-	-	-	-
log-L	-	-	-387.9332	-148.1669	-452.1419	-446.8533	-393.4177	-370.9551

Values of ***t*** in parenthesis. ** indicates that it is statistically significant at a level of 99%. * indicates that it is statistically significant at a level of 95%.
n = 161 observations

Table 3. Econometric result of the different models, for the opportunity cost of travel time equivalent to 40% of the salary per hour.

Parameter	*OLSL*	*OLSS*	*MLEL*	*MLES*	*POIS*	*TPOIS*	*BNEG*	*TBNEG*
Constant	3.0075**	1.2106**	-14.5410	1.1622**	1.1119**	1.0529**	1.0538**	0.51508
	(3.089)	(7.520)	(-1.428)	(6.494)	(7.810)	(6.767)	(4.146)	(1.188)
TCP-40	-0.00047795**	-0.000072582**	-0.0026422*	-0.000082730**	-0.00012770**	-0.00014407**	-0.00010449**	-0.00012528**
	(-3.265)	(-2.998)	(-2.298)	(-2.980)	(-5.803)	(-5.964)	(-5.043)	(-3.568)
TCS-40	0.00010381*	0.000014252	0.00056902	0.000015789	0.000026481**	0.000029499**	0.000026844*	0.000039692
	(2.058)	(1.709)	(1.678)	(1.719)	(3.639)	(3.713)	(2.063)	(1.893)
ACCES	1.1592	0.16012	4.2206	0.17292	0.23089*	0.24051*	0.20451	0.25869
	(1.413)	(1.180)	(1.239)	(1.200)	(2.446)	(2.488)	(1.130)	(0.694)
WATER	0.70492	0.13573	3.1887	0.14946	0.16256*	0.17526*	0.14746	0.20104
	(1.112)	(1.295)	(1.095)	(1.323)	(2.052)	(2.131)	(1.118)	(0.821)
INCOME	0.000001838*	0.000000378*	0.000009441	0.000000421**	0.000000467**	0.000000519**	0.000000444*	0.000000615
	(2.018)	(2.509)	(1.917)	(2.574)	(4.059)	(4.312)	(2.272)	(1.590)
σ	-	-	7.7934**	0.64743**	-	-	-	-
			(4.563)	(15.427)				
α	-	-	-	-	-	-	0.37834**	1.18820**
							(4.202)	(2.721)
R^2 *ajusted*	0.08327	0.07147	-	-	-	-	-	-
log-L	-	-	-388.2877	-148.4891	-453.1584	-447.9947	-393.7561	-371.2263

Values of ***t*** in parenthesis. ** indicates that it is statistically significant at a level of 99%. * indicates that it is statistically significant at a level of 95%.
n = 161 observations

Table 4. Econometric result of the different models, for the opportunity cost of travel time equivalent to 50% of the salary per hour.

Parameter	OLSL	OLSS	MLEL	MLES	POIS	TPOIS	BNEG	TBNEG
Constant	2.9299** (3.058)	1.1966** (7.553)	-15.2060 (-1.455)	1.1459** (6.499)	1.0920** (7.806)	1.0309** (6.743)	1.0380** (4.149)	0.48975 (1.138)
TCP-50	-0.00041077** (-3.187)	-0.000061899** (-2.904)	-0.0022808* (-2.260)	-0.000070492** (-2.887)	-0.00010943** (-5.672)	-0.00012330** (-5.830)	-0.000089438** (-4.905)	-0.00010717** (-3.461)
TCS-50	0.000086257* (2.066)	0.000011909 (1.725)	0.00047910 (1.678)	0.000013211 (1.736)	0.000022044** (3.664)	0.000024562** (3.740)	0.000022355* (2.091)	0.000033288 (1.925)
ACCES	1.1626 (1.415)	0.16056 (1.182)	4.2917 (1.242)	0.17340 (1.202)	0.23200* (2.458)	0.24181* (2.502)	0.20523 (1.133)	0.25980 (0.694)
WATER	0.70217 (1.106)	0.13507 (1.287)	3.2242 (1.092)	0.14887 (1.315)	0.16249* (2.050)	0.17530* (2.131)	0.14809 (1.122)	0.20406 (0.831)
INCOME	0.000001951* (2.083)	0.000000393* (2.538)	0.000010042 (1,937)	0.000000438** (2.598)	0.000000493** (4.167)	0.000000548** (4.417)	0.000000465* (2.354)	0.000000639 (1.632)
σ	-	-	7.8443** (4.518)	0.64847** (15.417)	-	-	-	-
α	-	-	-	-	-	-	0.38045** (4.207)	1.20040** (2.713)
R^2 ajusted	0.08078	0.06870	-	-	-	-	-	-
log-L	-	-	-388.5663	-148.7381	-453.9635	-448.8997	-394.0173	-371.4365

Values of ***t*** in parenthesis. ** indicates that it is statistically significant at a level of 99%. * indicates that it is statistically significant at a level of 95%.
n = 161 observation

IV. Benefit Estimates.

The determination of the welfare measures constitute a fundamental aspect in economic valuation of environmental goods studies, or of recreational facilities given by natural resources or public goods. Some results may be used in decision making that relates to the future management of these type of goods. Even some calculations could be included in the traditional cost-benefit analysis. Point estimations of the average consumers' surplus[20] per household for all the models, and as well as per trip and per year, are presented in table 5. For the ***OLSL*** and ***MLEL*** models the $-X_0 /2\beta_{TCP}$ formula was employed, where X_0 is the annual amount of trips observed on average for the complete sample and β_{TCP} is the travel cost variable coefficient. In the rest of the models, the average consumer surplus per household formula used was $-1/ \beta_{TCP}$. For the calculation of the annual benefits per household, the consumer surplus per trip was multiplied by the average number of trips of the sample (X_0). The discrete models obtain the expected value of the consumer surplus because the dependent variable is random.

The general tendency is that at greater opportunity cost of the travel time, the demand function is inelastic and therefore higher benefits will be estimated. The modeling assumption is that the head of the household has the possibility of choosing the hours of work. With this trade-off between leisure and labour, a percentage of the salary per hour has been inputed into the travel time. In this study, a percentage of 0.3 was used, for a situation that considers that the visitor obtains utility during the trip to the beach. In the same way, a percentage of 0.5 represented a contrary situation in terms of a certain disutility during the trip. In the existing literature a common criteria doesn't exist for the treatment of this aspect. The truth is, that the consumer surplus estimates are very sensible to this assumption of modeling.

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20 Bockstael (1995), points out that it's not possible to build confidence intervals for welfare measures, due to the lack of knowledge of their statistical distributions. Other authors like Kling and Sexton (1990), recomend ***bootstrapping*** techniques for the calibration of the feasible bias of point estimations.

corresponding non-truncated models. The resulting consumer surplus estimators in the non-truncated models are higher. In the continuous distributions and the linear functional form, the ***OLSL*** model that has as a base a procedure of ordinary least squares, gives benefits that are five times superior than those obtained in the ***MLEL*** model with maximum likelihood. This characteristic indicates the real possibility of overestimation when the ***OLS*** estimators are used. In the semi-log functional form the difference is less clear.

Table 5. Average consumer surplus per household

Average consumer surplus per household and per trip ($)								
	OLSL	***OLSS***	***MLEL***	***MLES***	***POIS***	***TPOIS***	***BNEG***	***TBNEG***
TCP-30	3886.47	11470.65	706.82	10054.90	6561.25	5806.53	7996.16	6661.78
TCP-40	4623.91	13777.52	836.42	12087.51	7830.85	6941.07	9570.29	7982.12
TCP-50	5380.14	16155.35	968.96	14186.01	9138.26	8110.30	11180.93	9330.97

Average consumer surplus per household and per year ($)								
	OLSL	***OLSS***	***MLEL***	***MLES***	***POIS***	***TPOIS***	***BNEG***	***TBNEG***
TCP-30	17178.20	50700.27	3124.14	44442.66	29000.73	25664.86	35343.03	29445.07
TCP-40	20437.68	60896.64	3696.98	53426.79	34612.36	30679.53	42300.68	35280.97
TCP-50	23780.22	71406.65	4282.80	62702.16	40391.11	35847.53	49419.71	41242.89

Even if there is no possibility to choose the hours worked, given the conditions in the labour market or the use of effective time of holidays for recreational activities by households, a trade-off can be established between leisure and leisure where the opportunity cost may not be related to the salary, but this not necessarily mean it is zero[21].

The results of the discrete models of distribution (***POIS***, ***TPOIS***, ***BNEG*** and ***TBNEG***), also reflect that the demand functions of the truncated models, are more elastic than the corresponding non-truncated models. The resulting consumer surplus estimators in the non-truncated models are higher. In the continuous distributions and the linear functional form, the ***OLSL*** model that has as a base a procedure of ordinary least squares, gives benefits that are five times superior than those obtained in the ***MLEL*** model with maximum likelihood. This characteristic indicates the real possibility of overestimation when the ***OLS*** estimators are used. In the semi-log functional form the difference is less clear.

The benefits of the semi-log functional forms of the continuous distributions are greater, when compared to the linear specifications. The latter is consistent with the results of other studies. If the estimated benefits of the semi-log functional forms of continuous distributions (***OLSS*** and ***MLES***), are compared with the discrete models of distribution (***POIS***, ***TPOIS***, ***BNEG*** and ***TBNEG***), it can be seen that the latter represent given benefits that are approximately 30 or 40% lower. The source of bias in the discrete distributions is due to the overdispersion in the ***POIS*** and ***TPOIS*** models, which can be translated to inconsistent estimators from a statistical point of view.

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21 According to Shaw (1992), it's pertinent to consider that those individuals that are not in the labour market, don't necessarily have a low or zero ***value*** of time. These could be in this situation due too involuntary unemployment, or in a labour market that doesn't have to pay in a monetary form. For Shaw it's important to difference the meaning of ***value*** and ***opportunity cost***. Value refers to the net benefit of time spent on a activity. On the other hand, opportunity cost indicates the net benefit of the time spent on the best alternative activity sacrificed. As Shaw concludes, this can be a very important semantic subtleness.

For the analysed data the model with best fit in the estimation would be the ***TBNEG*** model. But the truncated negative binomial estimator will be consistent if the data-generating process is truly negative binomial, and $\lambda_i = exp\ (X_i\ \beta)$ is a correct specification of the population mean. If an opportunity cost of the trip time equivalent to 40% of the salary per hour is established for the ***TBNEG*** model, a gross figure of approximately ***$3,528*** millions of Chilean pesos could be reached for the 100000 households that visit the beach annually. This figure is equivalent to ***US $ 8,820,000*** if a ***$400*** pesos per dollar exchange rate is considered. The estimation of benefit per person or per household in many cases can be low, but if these are aggregated between the different visitors, it reaches an important monetary quantity[22].

Conclusions.

The ***TCM*** is a valid method for modeling and valuing the benefits of outdoor recreation. Considerations related to the techniques of sampling, the model specification and the econometric estimations, constitute relevant aspects in the economic valuation of recreational benefits. For the data used, the recommended model for the estimation of demand and social benefits associated ***only to the use*** of the beach, is the ***TBNEG*** model.

It is necessary and pertinent to explore in an exhaustive manner the statistical advantages that the discrete distributions offer, with expectations to the realisation of future investigations. This is the first attempt to impose a series of methodologies and tools with the purpose of contributing to a more efficient assignment of the

22 Logically the aggregation of benefit must be done considering the maximun beach carrying capacity. Equally, the procedure of the estimation of benefits can give a bias of the form [1/t-ratio^2], where t-ratio represents the ***t*** statistic of the travel cost coefficient in the respective demand function. In the case of aggregate benefits , it's possible to outline a confidence interval as E[EC] ± E[EC][1/t-ratio^2]. E[EC] is the expected value of the consumer surplus per household and per year for the ***TBNEG*** model. Therefore, the total value could move between **$3,250** and **$3,805** millions of Chilean pesos.

resources destined to the management of public goods such as parks, lakes, rivers or beaches. These methods may rely on a certain number of operational and interpretative difficulties, but in truth they form part of partial answers to very complex problems.

Finally, it is important to mention that we are dealing with preliminary results of a process of investigation that is directed toward a conceptual and methodological refinement. The idea is to include the information related to the non participants, meaning households that are not yet in the ***recreational market of Dichato beach***. Equally, it is intended to explore the combination of the travel cost method, together with the contingent behaviour that count on hypothetical scenarios in correspondence with changes in the environmental quality or the access cost of the beach[23].

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23 In this perspective it is important to mention the work of Layman, Boyce and Criddle (1996), as well as the work of Englin and Cameron (1996).

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