Applying A Modified Contingent Valuation Method (CVM) For The Preservation/Restoration Of The Lake Kastoria In Northern Greece

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Abstract. The preservation/restoration of natural environment is frequently entailing excessive cost (paid by people through taxation) while it is a source of additional income for both, the State and the people, due to tourism. Since the evaluation of this good cannot be in market terms, we apply herein a modified version of the Contingent Valuation Method (CVM), which is used in Experimental Economics in order to investigate the significance that people put on this good and how much they might be willing to pay (WTP) for supporting activities concerning the preservation/restoration of Lake Kastoria. The WTP dependence on (i) external diseconomies, (ii) the expectations for property values' rise as a result of the restoration, (iii) the proximity of interviewees' residence to the lake, (iii) the opinion of the interviewee on the time and money spent to visit the lake, (iv) the time and money the interviewees spent to visit the lake, as well as other dependencies (all taken as independent variables) are estimated by means of Logit, Probit, Logistic and Linear Regression Models.

Keywords: Contingent Valuation Method (CVM), Environmental impact, Willingness To Pay (WTP), Logit Model, Parametric Approach, Non-Parametric Approach, Probit Model.

INTRODUCTION

Lake Kastoria covers an area of 28 Km^2 at an altitude of 630 m in the Kastoria Prefecture, northwestern Greece (Fig. 1), extending to the Municipalities of Kastoria, Makedni and Vitsi. The lake, subject to the provisions of the Bern Convention (1979), the Bonn Convention (1979), and Council Directives 79/409 and 92/43, is part of the Natura 2000 network. Lake Kastoria is a very fragile shallow aquatic ecosystem, long stressed by the various rural (logging, agricultural wastes, stockbreeding, etc.), craft (tanneries, fur/leather production), and urban (e.g., sewer discharges, rubble depositions and extensive littering) activities of the area. The nearby wastewater treatment plant of Dispilio, which operates since 1991, managed to reduce to some extent wastewater inflows, yet the lake faces increasing water pollution problems, ecological degradation of the coastal line and loss in its aesthetic value [1].

The aim of this study is to provide policy-makers with much needed information on the economic value of the benefits generated by the sustainable management of the Lake Kastoria. The preservation/restoration of natural environment is frequently entailing excessive cost (paid by people through taxation) while it is a source of additional income for both, the State and the people, due to tourism. Since the evaluation of this good cannot be in market terms, we apply herein a modified version of the Contingent Valuation Method (CVM), which is used in Experimental Economics in order to investigate the significance that people put on this good and how much they might be willing to pay (WTP) for supporting activities concerning the preservation/restoration of Lake Kastoria. The WTP dependence on (i) external diseconomies, (ii) the expectations for property values' rise as a result of the restoration, (iii) the proximity of interviewees' residence to the lake, (iii) the opinion of the interviewee on the time

FIGURE 1. Photo (left) and satellite image (right) of Lake Kastoria. Nine rivulets flow into the lake; its depth varies from nine to ten meters which defines the lake as a shallow one.

and money spent to visit the lake, (iv) the time and money the interviewees spent to visit the lake, as well as other dependencies (all taken as independent variables) are estimated by means of Logit, Probit, Logistic and Linear Regression Models.

METHODOLOGY

Members of the public were randomly intercepted in city and town centres, cafes and markets, and were interviewed face-to-face. The sample size was 80 questionnaires. For the processing of answers in stages 10, 12, 17 (pilot, main, follow-up study, respectively) we use the following measures/indices [2-4]: R^2, Efron's R^2, MacFadden's log likelihood of the intercept model, Cox & Snell's R^2, adjusted Cox & Snell's R^2. The non-linear regression models we used are the Probit and the Logit ones. Probit is a popular specification for an ordinal or a binary response model that employs a link function. In this model, the response variable y is binary and may represent a certain condition. A generalized form of this model is the following:

$$\Pr(y = 1/x) = \Phi(x'\beta) \tag{1}$$

where Pr denotes probability and Φ is the cumulative distribution function of the standard normal distribution. The parameters β are typically estimated by maximum likelihood. There exists an auxiliary random variable:

$y^* = x'\beta + \varepsilon$, where error $\varepsilon \in N(0,1)$

Then y can be considered as an indicator for whether this latent variable is positive:

$$y = 1_{\{y^*>0\}} = \begin{cases} 1 & if \quad y^*>0, \quad i.e., -\varepsilon<x'\beta \\ 0 & otherwise \end{cases} \tag{2}$$

The Logit model gives the logistic function:

$$f(z) = \frac{e^z}{e^z + 1} = \frac{1}{1 + e^{-z}} \tag{3}$$

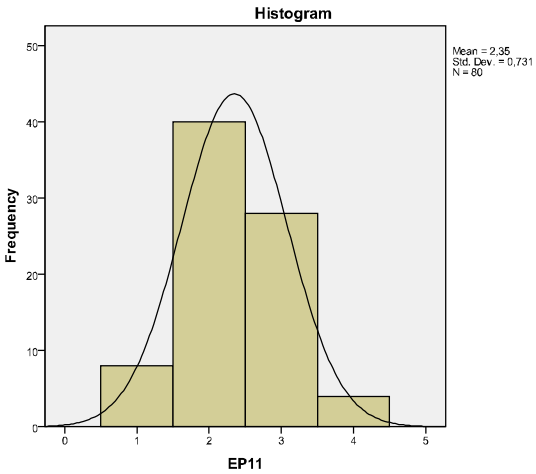
where the variable z is usually defined as: $z = \beta_0 + \beta_1 x_1 + ... + \beta_k x_k$ where β_0 is the intercept and $\beta_1,...,\beta_k$ are the regression coefficients of $x_1,...,x_k$, respectively. Actually, R^2, the coefficient of determination, is the relative power of the Probit and the Logit models.

RESULTS AND DISCUSSION

The survey sample consisted of 51.25% women and 48.56% men, the majority between 26 and 35 years old, since young people were more willing to participate in the survey; 27.5% of the respondents hold a university degree, whereas 37.50% had high school education. The majority of the interviewees belonged to the intermediate income class and enjoy full-time employment. About 50% of the respondents live or work in close proximity of the lake; however, average WTP does not differ significantly with proximity or distance. Given that extensive media coverage during the recent years, most people were well aware about the problems of the lake. When respondents

were asked to assign a level of importance to the protection of the lake on a 3-point scale (very, enough and slightly), 93.75% placed it at the highest scale and only 5% at the lowest.

The present survey examined, among other factors, the attitude of citizens towards the general environmental problems of the area and the benefits that would derive from restoring the lake's ecosystem. The majority of the interviewees allocate the responsibility of environmental degradation to the failure or limited capacity of the State and local authorities, whereas they support all of the restoration activities we proposed, with 69.03% giving high priority to biological agriculture for decreasing the input of chemical contaminants. The participants were also asked to determine the amount of money, among six fixed alternatives and a seventh open option, that each was willing to pay for 12 months to help maintain or even improve the state of the lake, taking into consideration that the subsidy which was given by the government and the local authorities should remain the same. The proportion of all respondents who expressed a willingness to pay any amount was 90% (Fig. 2); the mean WTP was 13.16€, while the amount of 5€ was most frequent.



Statistics

(N)	80
Mean	2,35
Std. Error of Mean	0,082
Median	2
Mode	2
Std. Deviation	0,731
Variance	0,534
Skewness	0,142
Std. Error of Skewness	0,269
Range	3
Min	1
Max	4

FIGURE 2. Distribution of WTP and sample summary statistics.

Regression analysis was also used to investigate the relationship between WTP and socio-economic factors; the Durbin–Watson statistic of ca. 2 is indicative of small residual autocorrelation (Table 1), whereas the ANOVA is shown in Table 2. The analysis results found which independent variables are statistically significant at the 5% significance level: X_9: the importance of lake Kastoria; X_{12}: willingness to pay IFF the respondent was living close to lake; X_{14}: accept a compensation to forgo an improvement in lake; X_{19}: own property close to lake; X_{28}: household income in relation to that of residents of Kastoria. The reduced form of the resulting Linear regression function becomes: $WTP=1.164-0.27X_9+0.82X_{12}-0.14X_{14}-0.01X_{19}+0.11X_{28}$.

TABLE 1. Regression Analysis Model Summary

R	*R Square*	*Adjusted R Square*	*Std. Error of the Estimate*	*Durbin-Watson*
0.929	0.863	0.819	0.311	1.885

TABLE 2. The ANOVA results, with predictors: $X_1, \ldots, X_{16}$ and WTP-value as the dependent variable.

Model	*Sum of Squares*	*df*	*Mean Square*	*F*	*Sig.*
Regression	36.408	19	1.916	19.851	0.00
Residual	5.792	60	0.097		
Total	42.200	79			

The results of the Logit and Probit regression analysis are shown in Table 3. The independent variables, statistically significant at the 5% significance level, for Probit regression are X_{12} and X_{14}, whereas Logit regression adds also the variable X_{19}.

TABLE 3. Probit and Logit Regression Analysis

Probit			
	Chi-square test	df	Significance
Pearson	35.065	218	1.000
Deviance	42.050	218	1.000
	Chi-square test		
Cox & Snell	0.888		
Nagelkerke	1.000		
McFadden	1.000		
Logit			
	Chi-square test	df	Significance
Pearson	28.297	218	1.000
Deviance	27.774	218	1.000
	Chi-square test		
Cox & Snell	0.888		
Nagelkerke	1.000		
McFadden	1.000		

DISCUSSION AND CONCLUDING REMARKS

Economic valuation is a two-part process in which the first part (demonstration) displays and measures the economic value of environmental assets, while the second part (appropriation) finds ways to capture the value of such. The present survey has managed to demonstrate the economic value of preserving Lake Kastoria; the appropriation of this value requires policies, rules, and regulations on the part of concerned agencies and institutions.

The willingness to pay, a so-called 'restoration fee', which is actually a 'user's fee' [5], indicates the possibility of fund raising from the community, especially when lake restoration is linked to tourist economy. On the other hand, non-use values for the lake, which this study shows to be substantial, can be captured through appropriate policy instruments. Designing appropriate policy instruments is one big task in itself and there are possible options to be considered like voluntary contribution or council taxation. Since education is a determinant that increases WTP in the medium/long-run, future surveys should target schools, colleges, and universities in the area, so as to increase potential 'capturable' non-use values and acquire relevant information useful for sensitizing young people.

In conclusion, our analysis demonstrates that social science research can provide useful information for complex environmental policy problems such as the restoration of a lake system. Policy analysis for such cases is especially difficult because these systems provide multiple, interdependent services that vary by type of lake, location, ecohydrological management, and other factors. The work presented herein has been proven a useful comprehensive tool for determining the realistic cognitive burden for stakeholders and third parties.

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