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Contingent Valuation Method (CVM) for Urban Restoration in the Centre of Athens

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In the case of restoration of the urban environment in the centre of Athens in Greece, the author uses the Willingness to Pay (WTP) method to compute approximate external economies. 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 here in 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 for supporting activities concerning the preservation/restoration of the urban environment of the centre of Athens. It is proved that there is no significant linear correlation between WTP and WTA (Willingness to Accept), in spite of what is suggested in certain theoretical aspects; thus, not only the WTA-WTP disparity, reported also by some authors (in cases other than aesthetic pollution), is confirmed but, furthermore, the lack of correlation is proved.

Keywords: environmental impact, Willingness to Pay (WTP), Willingness to Accept (WTA), Contingent Valuation Method (CVM)

The purpose of the paper is to present a modified model of an internalizing external costs caused by the operation of a manufacturing unit in conjunction with the new reality created. The environment is characterized as a public good. Public goods are goods that provide benefits for society as a whole or part of it, usually regardless of whether the individual people are willing to pay to have these benefits. All entities, whether individuals or businesses or public agencies, have some financial resources with which they seek to achieve specific objectives (e.g. profit maximization).

In the author's analysis, he considers the natural environment as a public good and environmental pollution as an external economy fails the price mechanism to internalize. In all three cases, the approach of foreign trade was with the Willingness to Pay (WTP) method and calculated the external costs generated by the degradation of the environment from the responses of respondents in monetary units. Respondents answered without knowing it was the environment to its original condition and not expect it to return to its original form. In the case of archaeological monuments, residents have built their buildings. In the case of three areas, respondents have developed an urban way of life around the areas. In the case of industrial units, residents have supported throughout the local economy on them.

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The initial state of the environment is unknown and undefined. Also the urban environment is altering the original state, which cannot be determined. Human works and buildings create new values in the region, and therefore, the external costs can be measured only with the expected quality of the environment and are not lost. Allowances, taxation, and value of land use are calculated solely on the expected image of the landscape. Therefore, the Pareto Optimal socioeconomic lines status is defined according to the new form of environment created after the regeneration of areas and not according to the initial state of the environment. Also in Kaldor, compensation should be determined based on the economic valuation of public goods by their own people, who judge based on expectations rather than on the past. The expected form of natural environment varies from respondent to respondent and its approach to social welfare units can only be done through alternative scenarios best and worst scenario.

In any case, the society wants to reach the minimum point of the charge received from the pollution and what can be achieved by the "invisible hand", but the regulation and government intervention. History has shown that the charge received by the society because of pollution varies with the socioeconomic status of citizens. The more low-income residents are more elastic, which is the loss of the urban environment. The elasticity of citizens is deprived of or not, the urban environment is measurable size.

Methods

During the last three decades, there has been growing interest in developing methods for assessing the preferences (of experts, stake holders, community/organization members, independent individuals) for environmental quality. Among them, the Contingent Valuation Method (CVM) is frequently applied to economic valuation of environmental projects or works/activities (planned or in operation) with a significant environmental impact and damage assessment after environmental accidents, i.e., after incidents that deteriorate environmental quality. This method is heavily relied on survey-based estimation of WTP, which is the maximum amount of money a person would be willing to pay, sacrifice or exchange for a public good, and Willingness to Accept (WTA), which is the minimum amount of money a person would be willing to accept in order to abandon a good. WTP is bounded by income while WTA is potentially unlimited. Whether WTP or WTA is appropriate, depends on the prior distribution of property rights and the direction of change under consideration. The CVM is a survey-based technique, frequently used in Experimental Economics, especially useful for the valuation of non-market resources/goods/services, and cultural heritage objects (of aesthetic, historic, scientific or social value), such as conservation of monumental remains and preservation of the physical and anthropogenic environment (Bedate, Herrero, & Sanz, 2004; Hanemann, 1991; Bateman, Munro, Rhodes, Starmer, & Sugden, 1997). The current endowment of an environmental commodity is often taken as implying legal right to an increase in the quantity of an environmental amenity and should be valued using WTP, whereas reductions should be valued using WTA. If WTP and WTA were evaluated at the same level of utility, they should be identical, but empirical evidence consistently demonstrates that WTA may exceed WTP by an order of magnitude (Bedate et al., 2004; Hanemann, 1991; Bateman et al., 1997; Horowitz & McConnell, 2003). Therefore, WTP provides a purchase price, relevant for valuing the proposed gain of the good, while WTA provides a selling price, relevant for valuing the proposed loss of the good. According to Classic Economic Theory, a significant difference between WTP and WTA should not occur, on condition that there is: (1) no transaction cost; (2) perfect information about goods/services and corresponding prices; (3) no income effect; (4) a market that engenders truthful revelation of preferences. Although these conditions were generally

met in several economic experiments that used inexpensive market goods with readily available substitutes, the ratios WTA/WTP obtained were significantly greater than that unity. This result was attributed to the fact that participants in these experiments lacked market experience (Horowitz & McConnell, 2003).

The aim of this work is to present a dynamic methodological framework for evaluating environmental impact caused by human activities by means of the CVM, referring to alternative routes of investigation and including successive levels of information granularity in continuous interaction with a dedicated local Knowledge Base (KB) created ad hoc. Results from three case studies are also presented.

In case that the CVM is applied for monumental remains, certain specific problems arise, because: (1) The "good" under examination has a subjective value, dependent on the cultural level of each reviewer; (2) The intangibles associated with this "good" are related to the present political behaviour of each individual as regards his/her attitude to the local authorities or the central government; (3) As a result, the answers may be biased, a matter that becomes evident only after final statistical processing, thus calling for supplementary information, possibly by means of an additional post-questionnaire; and (4) The adopted/developed (for elicitation of people's WTP) technique itself should be revised (possibly by means of a meta-questionnaire) by the same group of experts who processed the answers in order to improve the questionnaire and store it into a dedicated KB for future usage, since each monument is unique and the results coming from examining quasi-similar cases are of limited value.

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 street. Conducting pilot research involves small numbers of four, so as to determine some basic parameters, which could help to formulate some of the questions in the questionnaire.

In the contingent valuation part of the questionnaire, participants were asked to determine the amount of money that each respondent was willing to pay for 12 months to help maintain or even improve the state of each area near the street. Taking the subsidy which was given by the government into consideration and the local authorities cannot increase.

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 240 questionnaires, consisted of 52.5% women and 47.5% men and the majority of people age were between 26 and 35 years old. This was put down to the fact that young people were more willing to participate in the survey.

In addition, survey respondents were educated to a higher level, 36.5% had finished high school and 28.5% had attended university. The majority of survey respondents belonged to the intermediate income class. These results can be explained by the fact that most of the respondents came from urban areas, where education and full-time employment levels are higher. About half of the sample lives or works in close proximity of those areas. However average willingness to pay does not differ significantly between respondents of close proximity or of no proximity.

When respondents were asked to assign a level of importance to the protection of the area on the 3-point response scale, 93.75% considered it very important to protect the urban environment, 13.2% said protection was enough important and only 5% thought that the preservation of the area was slightly important.

The questionnaire examined, among other factors, the attitudes of citizens toward the city's environmental problems. In addition, the majority of participants report that the main reason of environmental problems arises from the failure or limited capacity of governments and local authorities.

Furthermore, the WTP question asked the respondent to select an option from a range of values, seven values were presented, ranging from 0€ to 25€ and the seventh option was opened (see Figure 1). The proportion of all respondents who expressed a willingness to pay some amount was 90%. The descriptive statistics provide helpful information on the percent frequency of the WTP-value: 10% of the sample suggested *WTP* = 0€, 50% agreed with *WTP* = 1-10€, 35% accepted *WTP* = 11-25€, 26% mentioned *WTP* = 26-50€.

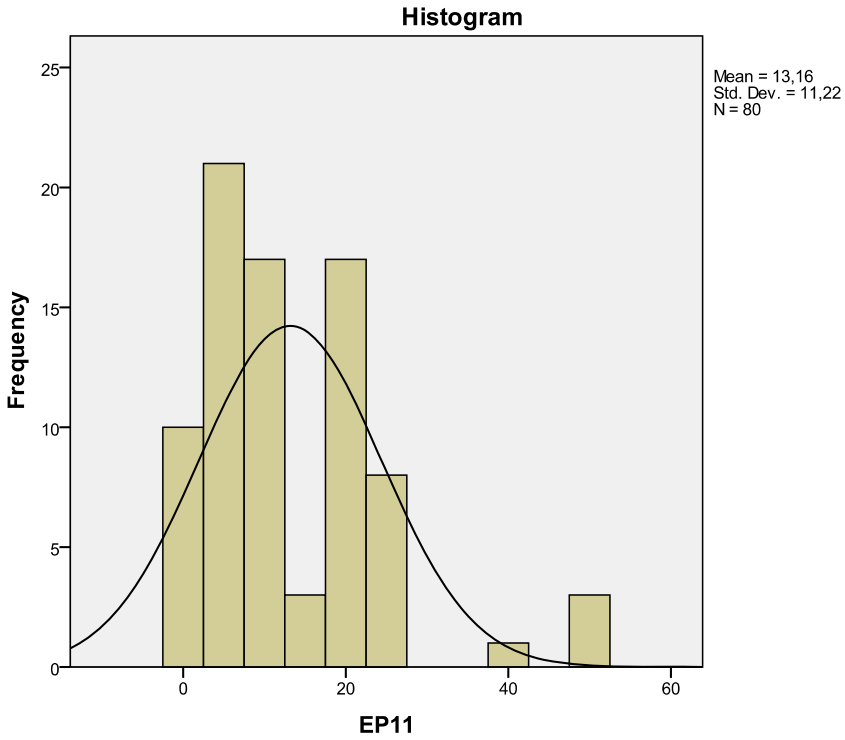

Figure 1. Frequency chart of the Willingness to Pay.

Based on these questions can make a regression analysis giving an equation of WTP the respondent made specific linear regression analysis for correlation of question 11 (amount WTP to classes—dependent variable) and all other questions (independent variables).

$$R^2 = 1 - \frac{\sum_{i=1}^{N} \left(y_i - \hat{y}_i\right)^2}{\sum_{i=1}^{N} \left(y_i - \bar{y}\right)^2} \tag{1}$$

where, N is the number of observations, y is the dependent variable, $\bar{y}$ is the mean of the y values, and $\hat{y}$ is the value predicted by the model. R^2 is the determination coefficient that ranges from 0 to 1, as we can see in Table 1. According to the Efron's R^2:

$$R^2 = 1 - \frac{\sum_{i=1}^{N} \left(y_i - \hat{\pi}_i\right)^2}{\sum_{i=1}^{N} \left(y_i - \bar{y}\right)^2} \tag{2}$$

where, $\hat{\pi}$ = model predicted probabilities, the dependent variable in a logistic regression is not continuous while the predicted value (a probability) is. MacFadden introduced the log likelihood of the intercept model.

$$R^2 = 1 - \frac{\ln \hat{L}(M_{Full})}{\ln \hat{L}(M_{Intercept})} \tag{3}$$

where, M_{Full} is the model with predictors, $M_{Intercept}$ is the model without predictors, and $\hat{L}$ is the estimated likelihood. A likelihood falls between 0 and 1, so the log of likelihood is less than, or equal to zero. If a model has a very low likelihood, then the log of the likelihood will have a larger magnitude than the log of a more likely model. Cox and Snell present the R^2 as a transformation of the $2\ln\left[L(M_{Intercept})/L(M_{Full})\right]$ statistic that is used to determine the convergence of a logistic regression.

$$R^2 = 1 - \left\{\frac{L(M_{Intercept})}{L(M_{Full})}\right\}^{\frac{2}{N}} \tag{4}$$

Note that Cox and Snell's pseudo-R^2 has a maximum value that is not 1, if the full model predicts the outcome perfectly and has a likelihood of 1, then, we have:

$$1 - L(M_{Intercept})^{\frac{2}{N}} < 1 \tag{5}$$

Nagelkerke, Cragg, and Uhler, adjust Cox and Snell's R^2, so that the range of possible values extends to 1.

$$R^2 = \frac{1 - \left\{\frac{L(M_{Intercept})}{L(M_{Full})}\right\}^{\frac{2}{N}}}{1 - L(M_{Intercept})^{\frac{2}{N}}} \tag{6}$$

Table 1

Coefficients of Determination

R^2	Area 1	Area 2	Area 3
Cox and Snell	0.888	0.746	0.705
Nagelkerke	0.852	0.837	0.766
McFadden	0.877	0.618	0.481

The non-linear regression model the author used was 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:

$$\Pr(y = 1/x) = \Phi(x'\beta) \tag{7}$$

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

$$y^* = x'\beta + \varepsilon \text{, where error } \varepsilon \in N(0,1) \tag{8}$$

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

$$y = 1_{\{y^*>0\}} = \begin{cases} 1 & if \quad y^*>0, \quad i.e., -\varepsilon < x'\beta \\ 0 & otherwise \end{cases} \tag{9}$$

The Logit model gives the logistic function:

$$f(z) = \frac{e^z}{e^z + 1} = \frac{1}{1 + e^{-z}} \tag{10}$$

where, the variable *z* is usually defined as:

$$z = \beta_0 + \beta_1 x_1 + ... + \beta_k x_k \tag{11}$$

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 model.

For the Lake of Kastoria, the coefficients which are statistically significant are those variables X_9, X_{12}, X_{14}, X_{19}, and X_{28}. The constant (1.164) is the price at which the straight line (least squares) intersects the vertical axis of coordinates. The model that is adapted to these data is:

$$WTP = 1.164 - 0.279X_9 + 0.82X_{12} - 0.147X_{14} - 0.173X_{19} + 0.113X_{28} \tag{12}$$

More specifically, the amount will be paid by the respondent (*WTP*) change significantly when you consider that: The protection of the urban environment is very important (X_9), increases the amount you will pay if you lived here (X_{12}), the amount received by the respondent as compensation reduced (X_{14}), the respondent has property (X_{19}), and the income is high compared with the average (X_{28}).

Specifically, the division into classes is as follows:

Class 1: 0€;

Class 2: 1-10€;

Class 3: 11-25€;

Class 4: 26-50 €.

For the Area 1, the coefficients which are statistically significant are those variables X_{1A}, X_{4A}, X_6, X_{10}, and X_{12}. The constant (0.182) is the price at which the straight line (least squares) intersects the vertical axis of coordinates.

The above table contains estimates of the model. The model that is adapted to these data is:

$$WTP = 0.182 - 0.228X_{1A} + 0.205X_{4A} + 0.367X_6 - 0.183X_{10} + 0.607X_{12} \tag{13}$$

More specifically, the amount will be paid by the respondent (*WTP*) change significantly when: The frequency of visits is high (X_{1A}). A significant problem is the appearance of the area (X_{4A}), striving to be paid by the competent bodies is not satisfactory (X_6), strengthening energy to improve the lake is organic farming (X_{10}), increasing the amount of the contribution (*WTP*) if lived here (X_{12}). In Figure 2, it is shown frequency chart of WTP and in Figure 3, it is shown the histogram for WTP.

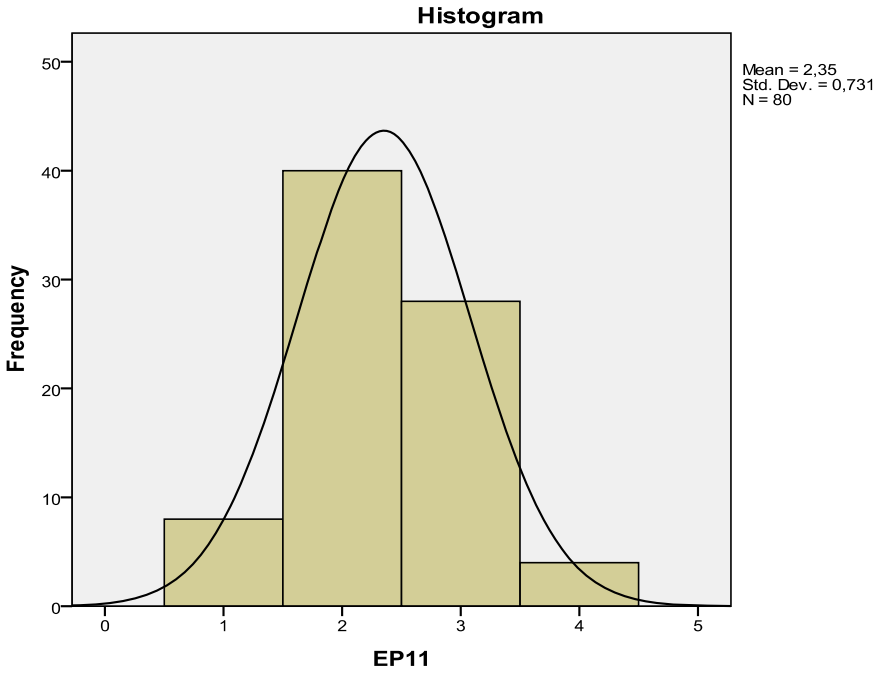

Figure 2. Frequency chart of WTP.

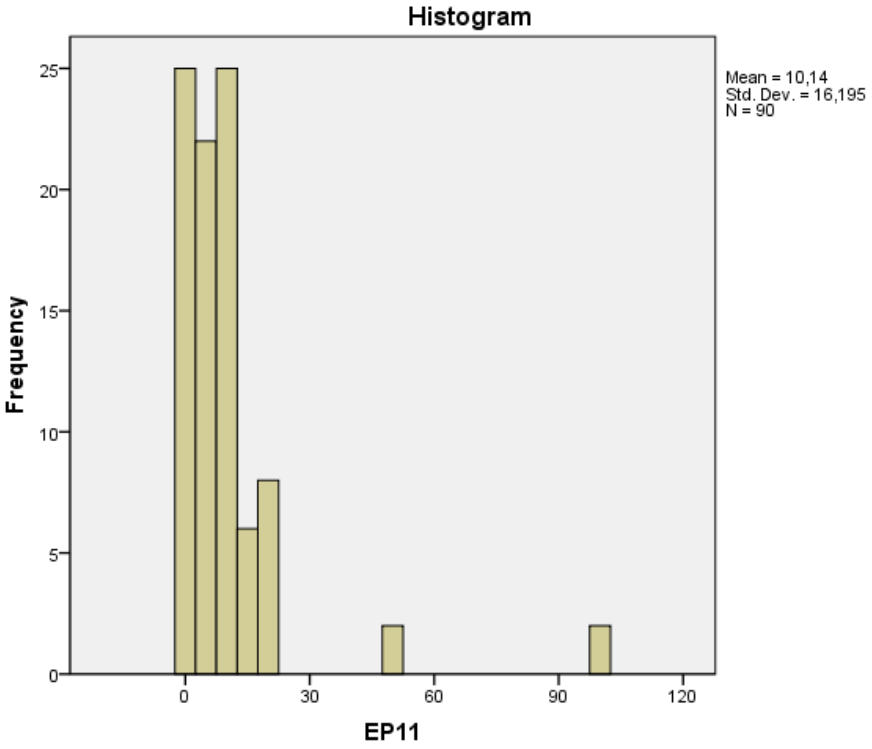

Figure 3. Histogram for WTP.

According to the frequency histogram (Histogram), the financial contribution of the sample (*WTP*), the distribution of the amounts designated as right-skewed (positive asymmetry). This means that at the right price,

there is a shortfall in relation to left, and so the distribution is not normal.

For the Area 2, the coefficients are statistically significant are those variables X_3, X_{12}, and X_{24}. The constant (2.016) is the price at which the straight line (least squares) intersects the vertical axis of coordinates. The model that is adapted to these data is:

$$WTP = 2.016 - 0.271X_3 + 0.774X_{12} - 0.437X_{24} \quad (14)$$

More specifically, the amount will be paid by the respondent (*WTP*) change significantly when considering that: The environmental condition of the area is poor (X_3). Increase the amount of the contribution (*WTP*) if they lived here (X_{12}), marital status married states (X_{24}). The author observes that the improvement of the area, the estimated average annual contribution for all respondents is 8.22€ (median 5€), while the amount of 5€ is the most common offer (central tendency).

According to the frequency histogram (Histogram) the financial contribution of the sample (*WTP*), the distribution of the amounts designated as right-skewed (positive asymmetry). This means that at the right price, there is a shortfall in relation to left, and so the distribution is not normal.

The author concludes that, according to survey results, the WTP is nearly identical for the three study areas. The highest WTP is the area of Area 2—13.16€, while it has the smallest percentage (10%) denied contribution from the people surveyed. Second comes the region of Area 1 with the amount of 10.14€, and the third region of Area 3, the amount of 8.22€.

Conclusions

The survey results show that the protection and enhancement of wetlands is a latent economic value. Now its value is confirmed not only by the intrinsic self-worth as inherent good that we enjoy with our senses, but according to modern principles of economic theory, which applied, wetlands can be viewed as a commodity which can be costed on a fairly large sum. The response of the sample to improve the wetland was satisfactory, since a significant proportion of respondents, who are willing to contribute on a voluntary basis, an amount even though surveys of this type are something completely new for the Greek reality. From this survey, it is very important to understand the social importance of wetlands.

For these reasons, although it costs to maintain wetlands for residents and local authorities, it would begin to believe that it will provide a basis for development than others. The interest of the residents for maintenance and improvement of wetlands is a message for further mobilization of the local community. At the same time, it is given a large responsibility on local authorities by the residents themselves, as most protest denials based on powers have the municipality to conserve wetlands.

Since education is a crucial factor that increases WTP medium/long term, future research should be aimed at schools, colleges, and universities in the region to increase the value of non-use and to obtain useful information related to awareness of young people. Research using the hypothetical assessment has been used successfully overseas and now recognized as a valid argument. The survey can be a powerful tool in the hands of local and regional authorities for claiming generous funding for the purpose mentioned above.

In conclusion, the author’s analysis shows that social science research can provide useful information about the complex issues of environmental policy, such as restoring an urban ecosystem. The analysis of policy for such cases is particularly difficult because these systems provide multiple, interrelated services which vary depending on the type of urban area, location, and other factors. The work presented here has proved a useful

integrated tool for determining the realistic cognitive burden on stakeholders and third parties.

References

Bateman, I., Munro, A., Rhodes, B., Starmer, C., & Sugden, R. (1997). A test of the theory of reference—Dependent preferences. *Quarterly Journal of Economics, 112*(2), 479-505.

Batzias, F., & Kopsidas, O. (2009). Introducing a conditional "Willingness to Pay" index as a quantifier for environmental impact assessment. Proceedings from *the 8th International Conference of Computational Methods in Sciences and Engineering*. 29 September-4 October, Rhodes, Greece.

Bedate, A., Herrero, L. C., & Sanz, J. A. (2004). Economic valuation of the cultural heritage: Application to four case studies in Spain. *Journal of Cultural Heritage, 5*, 101-111.

Brown, T. C. (2005). Loss aversion without the endowment effect, and other explanations for the WTA-WTP disparity. *J. Econ. Behav. Org., 57*, 367-379.

Hanemann, W. M. (1991). Willingness to pay and willingness to accept: How much can they differ? *American Economic Review 81,* 635-647.

Horowitz, J. K., & McConnell, K. E. (2003). Willingness to accept, willingness to pay and the income effect. *Journal of Economic Behavior and Organization, 51*(4), 537-545.

Hosmer, D. W., & Lemeshow, S. (2000). *Applied logistic regression* (2nd ed.). USA: John Wiley & Sons.

Kopsidas, O., & Batzias, F. (2011). Improvement of urban environment and preservation of cultural heritage through experimental economics by a modified Contingent Valuation Method (CVM). In S. Chen, N. Mastorakis, et al. (Eds.), *Recent researches in energy, environment, devices, systems, communications and computers* (pp. 157-162). USA: WSEAS Press.

Liao, T. F. (1994). *Interpreting probability models: Logit, probit, and other generalized linear models*. USA: SAGE Publications, Inc.

Mantzafleri, N., Psilovikos, A., & Blanta, A. (2009). Water quality monitoring and modeling in Lake Kastoria, using GIS. Assessment and management of pollution sources. *Water Resources Management, 23*(15), 3221-3254.

Menard, S. (2001). *Applied logistic regression analysis* (2nd ed.). USA: SAGE Publications, Inc.