*Journal of Leisure Research*
*2006, Vol. 38, No. 2, pp. 133-142*


# *Articles*

## A Multi-Attribute Extension of Discrete-Choice Contingent Valuation for Valuation of Angling Site Characteristics

Thomas Laitila
Department of Statistics
Umeå University
Anton Paulrud
Department of Forest Economics
Swedish University for Agricultural Sciences

An extended version of the discrete choice contingent valuation method for valuation of angling site attributes is considered in this paper. The respondent is asked to choose among existing angling sites and a described hypothetical site. A new contribution is the approach suggested for modeling this kind of data where hypothetical alternatives are compared with existing ones. A major advantage of this new modeling approach is that it avoids the substantial need for information on existing angling sites. Results from an application of the method and the modeling approach are also presented.

KEYWORDS: *Binary response models, logit, value of recreation, WTP, RUM.*

The Contingent Valuation Method (CVM) (e.g. Bateman, et al. 2002; Venkatachalam, 2004) is an established method for the valuation of recreational activities such as angling. A popular version of the method is the discrete choice CVM (Bishop & Heberlein, 1979) whereby the respondent accepts or rejects bids. Different approaches for modeling such data have been proposed by Hanemann (1984) and Cameron (1988). Also, Kriström (1997) presented a "spike" model accounting for potential individuals with zero willingness to pay.

The CVM has mainly been used for measuring values of the gross effects (use and/or non-use values) of environmental projects or damages (e.g.

Address correspondence to: Thomas Laitila, Department of Statistic, Umeå University, SE-901 87 Umeå, Sweden. Email: *Thomas.Laitila@stat.umu.se.*

Author note: Thomas Laitila is Associate Professor in Statistics at Umeå University. Anton Paulrud, Ph.D, is presently Resource Economist and Researcher at the Swedish National Board of Fisheries, Gothenburg.

This research was funded by the European Union's structural funds (Goal 1 and 6) as part of the Kaitum Project, and the Swedish Research Council for Environment, Agricultural Sciences and Spatial Planning (FORMAS) as part of the project Demand Analysis of Recreational Angling. We also thank the county council of Jämtland, especially Ingmar Näslund, for funding the costs for the questionnaire, helping with collecting addresses, and helping with information about angling in Jämtland. Our work has greatly benefited from comments by Bengt Kriström and two anonymous reviewers.

Carson, et al. 1992). However, it is a frequent interest to managers of wildlife areas to obtain information about angler's valuations of different angling site attributes. The CVM could be used for this purpose but several alternative stated preference methods are available. The use of choice experiments was proposed by Boxall, Adamowicz, Swait, Williams, and Louviere (1996) and Adamowicz, Boxall, Williams, and Louviere (1998). Another alternative is contingent ranking (e.g. Garrod & Willis, 1999). Also, Haefele and Loomis (2001) proposed a stated preference method based on ratings of alternatives. Among the alternatives to CVM, the choice experiment method has received most attention and is increasingly applied in research on environmental valuation.

This paper focuses on a version of the CVM method in which the attributes in the scenario, in addition to the bid, is varied over respondents. CVM designs of this kind have earlier been employed (e.g. Boyle, Welsh, and Bishop, 1993). The name MACVM (Multiple Attribute Contingent Valuation Method) is here suggested and the method is proposed for valuation of angling site attributes. An alternative would be to consider the method as a special case of the choice experiment method. In a choice experiment the respondent considers a choice set with a number of hypothetical alternatives (usually two) and a base case alternative. The MACVM corresponds to a choice set containing only one hypothetical alternative apart from the base case scenario. However, while a choice experiment can for some purposes be designed without the base case alternative, the MACVM is built on the comparison between the base case and the hypothetical alternative. This is also the idea behind the CVM wherefore the interpretation of the method as an extension of the CVM is preferred.

When choosing to accept or reject the suggested bid of a new angling site, the respondent needs to evaluate the new site in relation to the existing set of angling sites. The traditional approach to this problem is to collect data on the sites available and develop a model for site choice (e.g. McFadden, 1978). We suggest a new and simpler approach. A model of respondents' choice behavior is developed by treating the maximum utility over the set of available angling site as a random variable. In this way estimation of the utility function can be done without data on the existing set of alternatives. This is a considerable simplification allowing cost-effective analysis of preference.

The MACVM is presented in the next section with a derivation of a statistical model within the random utility maximization framework. Section 3 reports the results of an application of the MACVM and the CVM to the valuation of angling site attributes in the county of Jämtland in Sweden. A discussion of results and potential advantages of the MACVM is saved for the final section.

## Methodology

In a discrete choice CVM, a hypothetical scenario is offered to the respondent at a cost ($c$) and the task of the respondent is to accept or reject this cost. By offering the scenario at different costs to different respondents, the population mean willingness-to-pay can be estimated using statistical analyses of responses (Hanemann, 1984; Kriström, 1990).

Suppose the utility associated with the scenario offered at cost $c_i$ equals $U_{1i} = U_i(X_1,c_i)$ while the utility in the status quo (base case) at zero cost equals $U_{0i} = U_i(X_0,0)$. Here $X_1$ is a vector of attribute levels characterizing the scenario and $X_0$ is the corresponding attribute vector describing the base case alternative. According to the principle of utility maximization, an individual accepts the bid if $U_{1i} > U_{0i}$. Furthermore, an individual's willingness-to-pay for a change from $X_0$ to $X_1$ is here denoted by $wtp_i$ and is defined as the value of $c$ equalizing the utilities, i.e. $U_i(X_1,wtp_i) = U_i(X_0,0)$ (Hanemann, 1984).

Using a linear utility function and extreme-value distributed utilities Hanemann (1984) derived the model:

$$\Pr(U_{1i} > U_{0i}) = \exp(\alpha + \beta c_i)/[1 + \exp(\alpha + \beta c_i)], \quad (1)$$

where $\alpha$ equals the change in utility due to the change of the attributes from $X_0$ to $X_1$, and $-\beta$ is the marginal utility of income. For notational convenience we have digressed from the convention of a negative sign for the cost variable in (1). Under this model the population mean willingness-to-pay is defined as

$$E(WTP) = -\alpha/\beta.$$

In an extension of the CVM we make use of an experiment in which a hypothetical angling site is described by a vector $X_j$ of attributes (e.g. expected catch, bag-limit and license fee). The hypothetical site is presented to the respondent who is asked whether he or she would visit the hypothetical site on the next angling trip if it were available. $J$ different vectors $X_j$ ($j = 1, \ldots, J$) are used and each respondent responds to only one question.

Let $U_{ij}$ denote the utility of the hypothetical site presented and let $U_i^*$ denote the maximum utility of the existing sites available. Under the utility maximization principle, the selection rule is

*The respondent selects the hypothetical site presented if* $U_{ij} > U_i^*$.

This states that the hypothetical site presented will, according to the maximum utility principle, be chosen only if its utility exceeds the maximum of utilities of the existing sites. The linear utility function is defined as $U_{ij} = X_{ij}\beta + \varepsilon_{ij}$, where $X_{ij}$ is the vector of characteristics of the site presented, and $\varepsilon_{ij}$ is a random term. Using $\nu_{ij} = \varepsilon_{ij} - U_i^*$, the selection rule can be restated as

*The site presented is selected if* $X_{ij}\beta + \nu_{ij} > 0$

The distribution for $\varepsilon_{ij}$ is in many CVM applications assumed as extreme value distributed. This assumption is also made here and, in addition, $U_i^*$ is assumed to be extreme value distributed with mode $B_i$. Here $B_i + 0.5772$ (0.5772 is Euler's constant) equals the expected value of $U_i^*$. The distributions for $\varepsilon_{ij}$ and $U_i^*$ imply a logistic distribution with mode $-B_i$ for $v_{ij} = \varepsilon_{ij} - U_i^*$. The distribution assumption made on $U_i^*$ is less "ad hoc" than it may seem. Suppose the utility of the $s^{th}$ available angling site equals $U_{is} = V_{is} + \varepsilon_{is}$. If $(s=1, \ldots, S)$ are i.i.d. extreme value distributed with mode zero, then $U_i^* = \max_s(U_{is})$ is extreme value distributed with mode $B_i = \log \Sigma_{s=1}^{S} \exp(V_{is})$.

These results show that the MACVM data can be modeled and analyzed by using the familiar logit model. This result is new and somewhat surprising since the choice made by the respondent is between the hypothetical alternative presented and all available, existing alternatives. This is not equal to the derivation of the logit model for the modeling of choice between two alternatives (e.g. Hanemann, 1984).

Let $A$ denote the event "the respondent chooses the *hypothetical* site presented". Then the model

$$P(A) = \exp(X_{ij}\beta - B_i)/\lfloor 1 + \exp(X_{ij}\beta - B_i)\rfloor \quad (2)$$

is to be used for the analysis of the data. The term $B_i$ is unknown and represents the mode of the distribution for the maximum utility among existing angling sites. One option is to model the mode as a function of individual characteristics such as age, gender, location of residence, etc. If repeated responses for each respondent are collected, then the mode could be treated as a random individual effect, using a random effect logit model.

Suppose one of the attributes in the vector $X_{ij}$ is a cost variable $(c_i)$ and assume that all attributes except the cost variable is constant over the profiles. Then $X_{ij}\beta$ can be written as $X_{ij}\beta = \alpha + \beta c_i$ and (2) equals

$$P(A) = \exp(\alpha + \beta c_i - B_i)/[1 + \exp(\alpha + \beta c_i - B_i)]. \quad (3)$$

This model is almost equal to Hanemann's (1984) discrete choice CVM data model (cf. eq. (1)). The difference is the term $B_i$, which is motivated in (2) and (3) by the existence of additional choice options. Without alternative choice options $B_i$ equals zero.

## Empirical Results

### *The Survey*

The data were collected in 1998 in a mail survey in the county of Jämtland in Sweden. A random sample of 200 anglers was chosen from a register of buyers of angling licenses for four different areas.[1] The questionnaire was sent by mail and the final response rate was 67%.

The questionnaire contained background questions on socio-economic variables and questions on the angler's previous angling trip to Jämtland. The questionnaire also contained a CVM and a MACVM question. In the

[1]The areas were angling sites with fish species Grayling (*Thymallus thymallus*) and Brown Trout (*Salmo trutta*).

CVM question,[2] the respondents were asked if they would be willing to accept a cost for receiving twice the catch they had experienced during their previous visit to Jämtland.[3] In the MACVM question[4] a hypothetical site was described using eight characteristics: two characteristics were fixed and six characteristics were varied among respondents. The fixed characteristics were type of water (river) and type of fish species (grayling and brown trout). The characteristics varied were accessibility from car-road, bag-limit, catch per day, distance from residence, congestion, and fee. Each characteristic was varied on three levels. Using a combination of Latin square designs for three factors, an orthogonal design with 18 descriptions of hypothetical angling sites was developed and used in this study.

Among those responding to the questionnaire, four respondents did not answer the CVM question. Approximately 15% of the respondents reported zero catch during the actual trip. Approximately 6% of the respondents did not answer the MACVM question. In total, there were 110 responses to the

---

[2]The CVM question (translated version):

*XX. The following question requires some careful consideration. We would like you to help us gain a general understanding of an angler's valuation of increased catch.*

*Suppose that by different management actions the catch would be twice the (average) catch for an angling day at the same site. Would you be willing to pay SEK 25/50/100/200/300 as an extra fee if the catch would be increased as described above?*
*[ ] Yes*
*[ ] No* *[ ] It's not worth the cost*
*[ ] The improvement should be financed in another way*
*[ ] Another reason, namely* ________________

[3]Five bids were used in the study (SEK 25, 50, 100, 200, and 300) based on preliminary studies.
[4]The MACVM question (translated version):

XX. Except for those angling sites you already know of, suppose that the following site is accessible.

| **Description** | **Angling site A** |
|---|---|
| Water type | River water |
| Fish species | Grayling and Brown Trout |
| Accessibility from car-road | < 500/500-1000/1000-2000 meters |
| Bag-limit | 3/5 fishes/None |
| Expected catch | 1/5/10 fishes over min. size per day |
| Distance from residence | 50/100/200 kilometers |
| Congestion | You see nobody/5/10 persons during a day |
| License fee | SEK 50/100/200 per day |

The next time you will go for a day of angling would you choose angling site A or some other angling site that you know of?

Choose one of the following alternatives.

☐ I would visit angling **site A.**
☐ I would visit **another angling site.**

CVM question from respondents reporting non-zero catch, and 122 completed MACVM questions.

*Models*

The model

$$P(\text{Bid accepted}) = \exp(\alpha z + \beta c)/[1 + \exp(\alpha z + \beta c)] \quad (4)$$

is used for the analysis of the CVM data. Here, $z$ = number of fish caught during the actual angling trip in Jämtland and $c$ = bid. Note that the scenarios evaluated by the respondents depend on the number of fish caught during their previous angling trip to Jämtland. This is why the variable $z$ enters into the model for the CVM data. The maximum likelihood estimator is used for estimation of the model, and an estimate of the mean willingness-to-pay for one extra caught fish is obtained by substitution for estimated coefficients in the ratio $E(WTP) = -\alpha/\beta$.

The model for the analysis of the MACVM data is given by (1) and is formulated as

$$P(A) = \exp(\gamma_0 + \gamma_1 x_1 + \ldots + \gamma_{11} x_{11})/[1 + \exp(\gamma_0 + \gamma_1 x_1 + \ldots + \gamma_{11} x_{11})] \quad (5)$$

where:

| | | | |
|---|---|---|---|
| $x_1$ | = | Residence | (Dummy for residents in the south of Sweden[5]) |
| $x_2$ | = | Household | (Number of people in household) |
| $x_3$ | = | Experience | (Number of river angling days last year |
| $x_4$ | = | Income | (Disposable income per household member (SEK)) |
| $x_5$ | = | Accessibility | (Walking distance, in meters, from car road) |
| $x_6$ | = | No bag-limit | (Dummy for bag-limit; 1 if no bag-limit restriction) |
| $x_7$ | = | Bag | (Bag limit per day; 0 if no bag-limit restriction) |
| $x_8$ | = | Catch | (Expected catch per day) |
| $x_9$ | = | Distance | (Distance to site, in kilometers, from residence) |
| $x_{10}$ | = | Congestion | (Observed number of persons at the site) |
| $x_{11}$ | = | Fee | (Fee per day (SEK)) |

The intercept and the variables $x_1$-$x_4$ are used for modeling the $B_i$ term. The variables $x_5$-$x_{11}$ are used for describing the angling site. Under a linear utility function, it can be shown that the coefficient for the fee attribute, $\gamma_{11}$, measures the marginal utility of income, although income is included as an

[5]The variable equals 1 if home residence is in southern Sweden, here defined as the counties Skåne, Halland, Västra Götaland, Blekinge, Kalmar, Kronoberg, Jönköping, Gotland, Östergötland, Södermanland, Stockholm, and Uppsala.

variable for the modeling of the $B_i$ term. The coefficient for the income variable only measures the dependence of $B_i$ on income. Notice that the log-sum formula for the $B_i$ term can be rewritten so that the income component in the linear utility function comes out as an additive component.

The model (5) is estimated with ML estimation, and estimates of valuations of site characteristics are obtained by substitution for estimates in the ratios $-\gamma_j/\gamma_{11}$. For instance, mean willingness to pay for one extra expected caught fish is measured by $E(WTP_8) = -\gamma_8/\gamma_{11}$.

The CVM and the MACVM data sets were also analyzed in a pooled model. In the pooled model, the coefficients in the model for the CVM data, $\alpha$ and $\beta$, are restricted to equal the coefficients $\gamma_8$ and $\gamma_{11}$, respectively, in the model for the MACVM data. The pooled model can be compared with the separate CVM and MACVM models in order to test for equal coefficients. If the hypothesis of equal coefficients is rejected, evidence against the similarity of the methods is obtained.

*Model Estimates*

Obtained estimates of the coefficients in model (4) and (5) are shown in Table 1 under the headings CVM and MACVM, respectively. The CVM estimation results are as expected with a negative bid coefficient, implying positive marginal utility of income, and positive sign on the catch coefficient. Both estimated coefficients are significant according to associated t-test statistics. The pseudo-$R^2$ measure (Laitila, 1993) is low as is the percentage of correct predictions. The coefficient estimates obtained gives the estimate SEK 46.61 of mean willingness-to-pay for one extra caught fish. A 95% confidence interval gives the interval estimate SEK 14.64 to SEK 78.58.

Two additional CVM models were estimated. One included the individual characteristics variables residence, household, experience and income. The other included interactions between the individual characteristics variables and the catch variable. Obtained log-likelihood values for these two models were −67.9 and −69.2, respectively. Comparisons of these values with the log-likelihood value reported in Table 1 shows that the inclusion of these extra variables is insignificant. Thus, inclusions of individual characteristics in the CVM model do not significantly improve the fit of the model.

The MACVM estimation results are also in line with what is expected. The intercept and the variables Residence, Household, Experience, and Income are motivated by the modeling of the utility of alternative angling sites, i.e. the $B_i$ part in model (5). These variables are all significant (or nearly significant) according to separate t-test statistics. Of special interest is the significant positive estimate for the Residence. The estimate suggests that anglers in southern Sweden would visit a new angling site more frequently than would anglers in the rest of Sweden.[6]

[6]A type of site within the distance that is described does not exist in southern Sweden.

*TABLE 1*
*Maximum Likelihood Estimates of Coefficients in Models (3a) and (2a)*
*(T-Values in Parenthesis)*

| Variable | CVM | MACVM | POOLED |
|---|---|---|---|
| Intercept-MACVM | | −5.3167 | −5.4159 |
| | | (−2.64) | (−2.86) |
| Residence | | 1.6655 | 1.5798 |
| | | (3.18) | (3.17) |
| Household | | 0.8977 | 0.8572 |
| | | (3.39) | (3.44) |
| Experience | | 0.0387 | 0.0316 |
| | | (1.56) | (1.34) |
| Income | | 0.0001 | 0.0001 |
| | | (2.25) | (2.04) |
| Accessibility | | 0.0012 | 0.0011 |
| | | (2.29) | (2.22) |
| No Bag-Limit | | 1.6363 | 1.4478 |
| | | (1.26) | (1.15) |
| Bag-Limit | | 0.3392 | 0.3199 |
| | | (1.15) | (1.11) |
| Catch | 0.1686 | 0.1643 | 0.1556 |
| | (2.69) | (2.27) | (3.41) |
| Distance | | −0.0070 | −0.0068 |
| | | (−1.66) | (−1.70) |
| Congestion | | 0.0249 | 0.0005 |
| | | (0.40) | (0.01) |
| Fee | −0.0036 | −0.0105 | −0.0041 |
| | (−2.55) | (−2.58) | (−3.19) |
| Observations* | 110 | 116 | 226 |
| Pseudo $R^2$ | 0.12 | 0.44 | 0.32 |
| Log-likelihood | −71.18 | −55.27 | −128.72 |
| % Correct predictions | 64.5 % | 75.0 % | 68.6 % |

*16 observations out of the total 130 had zero catches and there was therefore no answer the CVM question. In addition, four catch observations were missing; Four observations had missing income, one observation had missing number of river days last year, and eight observations had not answered the MACVM question.
#See Laitila (1993)

The sign of the estimated coefficients for site characteristics are as expected. The estimates are significant except for[7] the bag limit variables and

[7]A simultaneous likelihood ratio test statistic of the two variables equals 1.62 ($[(-55.27) - (-56.08)] * 2 = 1.62$). This is based on 2 degrees of freedom and the critical value at the 5% significance level is 5.99. Thus, the coefficient estimates are insignificant.

the congestion variable. The pseudo-$R^2$ for the MACVM model is relatively high as is the percentage of correct predictions. The MACVM model was also tested for omitted quadratic terms. For each attribute, a quadratic term was added to the model and the significance of the added terms was tested using a t-test. None of the included quadratic terms were significant.

Using the MACVM estimates obtained for the variables Catch and Fee, the estimate SEK 15.60 of mean marginal willingness-to-pay for one extra caught fish is obtained. A 95% confidence interval for mean marginal willingness-to-pay equals SEK −0.30 to SEK 31.50. Note that this interval intersects the interval obtained from the CVM estimates.

The result for the pooled model is similar to the results for the CVM and the MACVM models. However, a comparison of the joint model with the separate models gives a likelihood ratio test statistic equal to 4.53.[8] The statistic is based on 2 degrees of freedom and the critical value at the 5% significance level is 5.99. Thus, the coefficient estimates for the catch and fee variables are not significantly different between the two methods.

## Discussion

This paper considers an extended version of the CVM which here has been called the MACVM. The method is easily applied in terms of both the design and the administration of the questionnaires. For example, a choice experiment includes two or more hypothetical alternatives. This increases the complexity of the design of the choice experiment questions. The modeling problem is also simpler for the MACVM compared with the choice experiment. Models of dichotomous choices are needed for MACVM data while models accounting for three or more choice alternatives are needed for choice experiment data. Another aspect is that only one MACVM question per respondent is used. This makes it feasible to administrate the questionnaires through letter surveys. Although multiple MACVM or choice experiment questions per respondents may give potentially more information, such designs are more difficult to administrate in order to make simple statistical models feasible. One important assumption in most models is the independence among responses within a respondent. Finally, the choice response format used here mimics individuals' real life behavior and provides input for direct modeling of choice probabilities, an aspect simplifying predictions of visitation frequencies.

An important contribution of this paper is the suggestion of representing unknown choice alternatives through an unknown variable expressing the maximum utility among the unknown alternative sites. Using this approach the demanding task of collecting data on alternative sites is circumvented. This also means that it is not necessary to decide on the size of the choice set used by the respondent. Although we have used the approach

[8] $[(-71.18) + (-55.27) - (-128.72)] * 2 = 4.53$

here for the modeling of the MACVM data, it is expected that the approach can be employed for the modeling of more general choice experiments.

The merits of the MACVM approach needs to be further explored. One topic to be considered is the dependency of results on the choice of the distribution of utilities. Another topic is the options for modeling provided by using repeated responses. A third topic is the potentials of the MACVM to measure non-use values. In this paper it is suggested for measuring use values like angler's valuations of angling site attributes since the question posed is which site to choose on the next angling trip. Of special interest for future evaluations is to compare the merits of the MACVM with those of the choice experiment method.

## References


Adamowicz, W., Boxall, P., Williams, M., & Louviere, J. (1998). Stated preference approaches for measuring passive use values: Choice experiments and contingent valuation. *American Journal of Agricultural Economics, 80,* 64-75.

Bateman, I. J, Carson, R. T., Day, B., Hanemann, M., Hanley, N., Hett, T., et al. (2002). *Economic valuation with stated preference techniques: A manual.* Cheltenham, USA: Edward Elgar.

Bishop, R. C., & Heberlein, T. A. (1979). Measuring values of extramarket goods: Are indirect measures biased? *American Journal of Agricultural Economics, 61,* 926-930.

Boxall, P. C., Adamowicz, W. L., Swait, J., Williams, M., & Louviere, J. (1996). A comparison of stated preference methods for environmental valuation. *Ecological Economics, 18,* 243-256.

Boyle, K. J, Welsh M. P., & Bishop, R. C. (1993). The role of question order and respondent experience in contingent valuation studies. *Journal of Environmental Economics and Management, 25,* S80-S90.

Cameron, T. A. (1988). A new paradigm for valuing non-market goods using referendum data: Maximum likelihood estimation by censored logistic regression. *Journal of Environmental Economics and Management, 15,* 355-379.

Carson, R., Mitchell, R., Hanemann, W. M., Kopp, R., Presser, S., & Ruud, P. (1992). *A contingent valuation study of lost passive use value from the exxon valdez oil spill* (Reprint: a report to the attorney general of Alaska). La Jolla, CA: Natural Resource Damage Assessment, Inc.

Garrod, G., & Willis, K. G. (1999). *Economic valuation of the environment—Methods and case studies.* Cheltenham, USA: Edward Elgar.

Haefele, M. A., & Loomis, J. B. (2001). Using the conjoint analysis technique for the estimation of passive use values of forest health. *Journal of Forest Economics, 7,* 9-28.

Hanemann, W. M. (1984). Welfare evaluations in contingent valuation experiments with discrete responses. *American Journal of Agricultural Economics, 66,* 332-41.

Kriström, B. (1990). A non-parametric approach to the estimation of welfare measures in discrete response valuation studies. *Land Economics, 66,* 135-39.

Kriström, B. (1997). Spike models in contingent valuation. *American Journal of Agricultural Economics, 79,* 1013-1023.

Laitila, T. (1993). A pseudo-$R^2$ measure for limited and qualitative dependent variable models. *Journal of Econometrics, 56,* 341-356.

McFadden, D. L. (1978). Modelling the Choice of Residential Location. In A. Karlqvist, L. Lundqvist, F. Snickars, and J. Weibull (Eds.) *Spatial Interaction Theory and Planning Models* (pp. 75-96). Amsterdam: North-Holland.

Venkatachalam, L. (2004). The contingent valuation method: A review. *Environmental Impact Assessment Review, 24,* 89-124.