Comparison between Willingness-to-Pay expressed by a panel of forestry experts and by a sample of non-expert respondents in a pilot survey conducted for a Contingent Valuation Study*

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1. Introduction

A growing interest in the valuation of environmental resources has been apparent in recent years both in the academic world and in the public administration, while these same resources have been providing a minimal contribution to the wealth of the majority of industrialised countries, 5% on an average estimate (World Bank, 1997).

The reasons for this increasing interest in environmental resources are also due to their many important alternative functions, for example, the provision of recreational and countryside activities, the maintenance of bio-diversity and the physical environment, and the assimilation of the harmful outputs of economic activities. These functions are distinctive in not having a 'price' as they are carried out without reference to market forces.

Awareness has thus arisen that the functions undertaken by environmental resources could be evaluated in monetary

Abstract

This work deals with an empirical analysis designed to check the possibility to substitute a panel of forestry experts for a sample of non-expert respondents in a pilot survey for a CVM study. This methodology in the case study has focussed on the estimate of the economic value associated with the reduction in wood fire risk in a protected area of southern Sicily.

The experiment consisted in carrying out two surveys by means of the same questionnaire with an open-ended elicitation question for WTP. The first survey was addressed to a sample of 227 "non-expert" respondents, whereas in the second one 15 forest technicians working in Sicily were interviewed in their quality of experts in forest fire issues.

The results from these statistical tests decidedly pointed out the different provenience of the two samples, consequently discouraging from the use of the expert panel in the pre-testing phase for the reduction of pre-testing costs

Résumé

Une analyse empirique a été réalisée pour évaluer la possibilité d'avoir recours à un panel d'experts forestiers dans le cadre d'une enquête pilote menée au cours d'une étude d'Evaluation Contingente. Dans le cas à l'étude, cette méthodologie a été employée pour estimer la valeur économique attribuée à la réduction du risque d'incendie dans un bois situé à l'intérieur de la Sicile du sud.

L'expérience a été axée sur deux enquêtes parallèles utilisant le même questionnaire ouvert portant sur le Consentement à Payer : dans la première enquête, ont été interviewés 227 personnes qui habitent en Sicile, alors que dans la deuxième, 15 techniciens forestiers, experts en incendies de forêt, ont été interrogés.

Les résultats de ces tests statistiques mettent clairement en évidence l'origine différente des deux échantillons retenus et ils permettent, donc, de conclure que pour réduire les coûts de l'enquête pilote, il vaut mieux éviter de s'adresser au groupe d'experts

terms, so that an economic value might be attributed to them. One of the most widespread approaches is the 'Total Economic Value' (Randall & Stoll, 1983; Boyle & Bishop, 1988), which states that a comprehensive estimate must include all the types of benefit that can accrue from the environmental resource under investigation.

One of the greatest difficulties in evaluating environmental resources is linked to the impossibility of quantifying the extent of supply and demand when identifying a price; in particular, some authors (Pearce & Turner, 1994; Bishop & Woodward, 1995) maintain that the methods available lead broadly to two approaches, which correspond to two distinct groups of methodologies.

Those of the first group will arrive at the value of the resource by developing a demand curve obtained from the relation between the environmental resource – without market forces – and another market resource (indirect method), while the second group prefers to question consumers directly about the value they place on the qualitative and quantitative variations of the resource under consideration (direct method).

In this study one of the techniques of the second group is used, better known as the "Contingent Valuation Method" (CVM). The CVM was introduced at the beginning of the 1950's (Ciriacy-Wantrup, 1952), and applied for the first

time about ten years later (Davis, 1963). Since then it has given rise to ever-increasing interest, due particularly to its versatility and ability to estimate the 'use' as well as the 'non-use' values of resources.

This study was prepared in the context of a pilot survey carried out for a Contingent Valuation Study of the environmental problem of forest fires in Sicily and, more specifically, in the Nature Reserve 'Bosco Santo Pietro' in the district of Caltagirone, province of Catania, an area severely affected by fires.

2. Aims of the study

Forest fires have attained alarming dimensions during recent years, particularly in the Mediterranean area. Sicily is one of the regions where a significant number of severe fires occur in wooded areas each year.

In this study we attempt to estimate the economic value of a reduction in fire risk of a specific forest resource, as perceived by the community, by using the CVM in the context of a Sicilian territory which is particularly liable to such an event, the Nature Reserve 'Bosco Santo Pietro'.

The CVM provides for direct questioning of users/consumers about their Willingness to Pay (WTP) so that a negative qualitative and quantitative change does not come about in the resource being studied[1]. This process of enquiry is carried out by describing a hypothetical scenario of the resource under study within a questionnaire.

In the present study the problem is presented as based on the forest fires which have severely damaged the area of the Reserve and the scenario provides for the establishment of an Auxiliary Plan for the Prevention of and Protection from Forest Fires, to be financed however by the users/consumers and not by public authorities.

In particular, this research has focussed on some aspects of the operational working of CVM, most specifically on one of the critical points of the process which is the number of respondents necessary to carry out a pre-test. Where financial resources are limited, the minimum size of a pilot sample could result in restricting the outcome of the survey.

An experiment was conducted bearing this drawback in mind and consisting of carrying out two pre-tests. The first used a sample of 227 non-expert residents of Sicily approached in an informal manner and the second a lower number of opinion leaders, 15 forestry experts working in Sicily. In both cases a questionnaire making open-ended enquiries was used.

The scope of this double pilot survey was to provide verification of possible agreement between the two samples when testing the questionnaire and to provide information on price vectors to be used in a questionnaire with a dichotomous-choice question for eventual adoption in a survey using a wider sample.

The same questionnaire was distributed to these same sample groups with the aim of evaluating possible distinctions in the attribution of WTP. However, in accordance with the Delphi procedure, the questions, with some additional information, were repeated twice more to the forestry experts.

Comparisons were thus made between the data collected from the double enquiry with the aim of evaluating, through statistical tests, whether the replies provided by the two groups of interviewees could be considered statistically similar, with evident repercussions on the reduction of time and expense involved in carrying out the pre-test with 'ordinary' respondents.

3. Territorial features of the area surveyed
3.1 Agriculture

Three local authorities border the Reserve: Caltagirone, Mazzarrone and Acate. The Reserve lies mostly within the territory of Caltagirone with a small area in that of Mazzarrone; Acate has no administrative responsibilities for the Reserve.

Of the three authorities, Caltagirone is the most important in socio-economic and territorial terms, with 37,373 inhabitants and 13,257 resident families.

The total farmland area amounts to 18,876.9 hectares (43.3% of the municipal area) divided among: arable (55.9% of the total), tree crop cultivation (16.8%), permanent meadow and pasture (4.7%), arboriculture for timber production (0.1%), woods (16.1%), unused agricultural land and other areas (6.4%).

Among the tree crops grown the most important are olives (1,112 hectares) and vines (1,027 hectares), followed by citrus (611 hectares) and fruit trees (405 hectares).

There are 3,595 farms within the district of Caltagirone, with an average land area of 5.25 hectares and with an overall labour requirement equivalent to 240,106 working days per year.

The population of the Acate district, with 8,000 inhabitants and 2,741 resident families, is almost a fifth that of Caltagirone.

The total farmland area, amounting to 7,251 hectares, represents 71.5% of the whole district area and is mostly divided between arable (37.0%, which includes large amounts of glasshouse horticulture) and tree crops cultivation (35.5%); woods and areas intended for tree cultivation are at 3.6% of the land area, permanent meadows and pasture represent a minimal share at 0.1%, and the remaining 23.8% represents non-used agricultural land.

The largest area of land used for tree crop cultivation is that of citrus (1,281 hectares), vines (683 hectares) and olives (504 hectares).

The overall number of farms equals 1,853, with an average land area of 3.91 hectares and an overall labour requirement of 546,737 working days per year, greatly influenced by the extent of horticulture in protected environment.

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[1] Willingness to Accept (WTA) could be used as an alternative, where the user is prepared to accept a sum of money in order that an adverse qualitative/quantitative change is evident

Mazzarrone with its 3,685 inhabitants and 1,302 resident families is the smallest of the three districts considered. Total agricultural land area amounts to 2,670 hectares and represents 80.0% of the district's entire land area. Tree crop cultivation, at 1,649 hectares, represents 61.8% of agricultural land area and mainly consists of vines (1,304 hectares) for the production of table grapes.

Arable land is 21.7% of total land area, while permanent meadows and pasture land, woods and other non-used agricultural land represent 16.5% of the total. The overall number of farms is 481, with an average area of 5.55 hectares and with labour requirement of 104,960 working days per year, consisting largely of vine cultivation for table grapes.

3.2 The Nature Reserve "Bosco Santo Pietro"

The Nature Reserve "Bosco Santo Pietro" is about 20 kilometres from the centre of Caltagirone and is one of the largest and most thriving green areas of the region, which lies on the south-east side of the province of Catania.

The Reserve is notable for the remains of a cork oak forest in an area where the survival of the oak species is far from secure. It consists of 6,430 hectares (Zone A is 2,528 hectares and Zone B, the pre-reserve, is 3,902 hectares), lies mainly in the southern part of the territory of Caltagirone and to a smaller extent in the territory of Mazzarrone and it is considered to be one of the largest stretches of Mediterranean scrub vegetation in central southern Sicily.

The area became a Nature Reserve by Decreto Istitutivo No. 116/44 of 23rd March 1999, published in G.U.R.S. on 21st January 2000. At present the Reserve is managed by the regional board "Azienda delle Foreste Demaniali".

Following the establishment of the Reserve, economic activities permitted within Zones A and B were limited according to the regulations of the Reserve.

This has resulted in several cases of severe friction between the managing body and the local population. For example, some owners of private land now falling within the Reserve protest about the impossibility of changing land use from woods into high-income crops such as table grapes, intensive horticulture and protected cultivation. The prohibition of hunting activities has also led to opposition to the Reserve by the hunting lobby.

Episodes of uncontrolled exploitation, negligence, vandalism, fires and decline of various kinds have contributed to changes in the configuration of the Reserve's wooded areas.

In spite of this, the vegetation of Bosco Santo Pietro remains extremely varied, thanks to the various environments and landscapes of which it consists. The luxuriant flora of the wood includes numerous plant species, some of them very interesting from a naturalistic point of view due to their rare or limited habitat, their longevity or large size.

There are currently about 315 plant species, composed of 43 trees, 25 shrubs and 247 herbaceous and/or bulb species.

A history of the fires involving the wooded surface areas falling within the Reserve for the period 1986-2003 has been prepared using data supplied by the Anti-fire Service for Wooded Areas of the Region of Sicily.

The average amount of wooded area affected by fire during the whole period is recorded as about 91 hectares.

The trend, identified with the aid of a three-year moving average, shows an increase in burnt areas since 1994 (when a figure almost four times greater than the average was registered) followed by a decrease which continued until 2002; although a reverse trend was in evidence in 2003.

Referring to the causes of the fires, the period under consideration shows that an average of 82.0% were caused by arson, compared to 13.0% caused by negligence. In 5.0% of cases no definite cause could be found, although some of these fires could also well have been caused by arson.

Those fires caused by arson involved, on average, 84.9% of the wooded land area which was burnt; the remainder can be attributed to negligent fires (9.4%) and those of uncertain cause (5.7%).

4. The design of the sample and questionnaire used

When using the CVM, collection of data depends inevitably upon the involvement of a sample of individuals to whom a questionnaire is administered with the aim of eliciting their particular Willingness to Pay.

The general design of the present survey provides for a double pre-test, aimed respectively at a wide sample of non-expert respondents and a limited group of Sicilian forestry experts, with the task of completing an identical questionnaire with an open-ended elicitation question.

In the absence of a market for this resource, no financial references were available and interviewees had to establish their own notion of an economic value for this environmental resource in relation to the hypothetical scenario proposed in the questionnaire.

The questionnaire administered to both sample groups was devised as a booklet and divided into four parts.

The first part describes the objectives of the research and provides practical information for completing the questionnaire. It also contains a short description of the area being studied with reference to various aspects of its natural history.

The second part seeks the opinion of the respondents on the importance of the services provided by Bosco Santo Pietro, with the aim of identifying those values which are recognised by the community, e.g. recreation, animal and plant diversity, heritage, sources of employment, scenic beauty, wood and cork production.

The third part presents the problem of fires in the Reserve with particular reference to the lands involved during the period 1994-2002, giving data on the areas of woodland affected by the fires and the damage caused. The respondent is then required to provide an opinion on the relationship between the fires and the different functions of the wood.

Here the respondent gives his/her opinion using a 3-point Likert scale.

Following this, the hypothetical scenario is given, with a description of the proposed creation of an Auxiliary Plan for Prevention of and Protection against Woodland Fires, to be financed exclusively from private resources, and its potential effects in terms of reducing fire risk, possibly causing a 50% decrease in the area of woodland destroyed by fire each year. The question is then raised as to whether or not an annual sum might be paid, by the interviewees themselves, for the establishment and management of the antifire plan.

To be specific the query is couched in the following terms:

"Considering the benefits for the Reserve 'Bosco Santo Pietro' (a reduction of 50% in the area of woodland damaged each year by fire), and bearing in mind all the costs you already incur for everyday expenses, would you be willing to pay a certain amount each year to maintain an organisation which, with local labour, will have the task of realising this Auxiliary Plan for the Prevention of and Protection against woodland fires?"

In the case of a positive response, the interviewee is requested to write a specific sum in the space under the query. For a negative response, they are requested to indicate a reason for their refusal from a given list[2].

Finally, the fourth part of the questionnaire requests socio-economic information such as the sex, age, qualifications, state of employment, type of employment and status within the family of the respondent, as well as number of family members, number of earning members and monthly income of the respondent.

5. The results of the experiment

5.1 Values assigned by the "non-expert" respondents

Of the 227 people who were given the questionnaire, 201 (88.5% of the total) completed and returned it, while 26 (11.5%) did not give it back.

The sample who collaborated with the pre-test was composed of adults, 51.0% male and 49.0% female, with an average age of 40 and with an education of 33.0% with degree, 46.7% with diploma and the remainder, 20.3%, with compulsory schooling.

With regard to monthly income, 39.6% of the interviewees declared an income up to € 1,000, 43.8% between € 1,001 and 2,000, 13.5% between € 2,001 and 3,000, 2.1% between € 3,001 and 5,000, and only 1.0% over € 5,000[3].

Table 1 shows the WTP assigned by 201 respondents. Of

these, slightly more than 50% expressed a WTP of zero. However, it must be emphasised that this group of zero values also forms part of the 'protest no' who are usually numerous in Contingent Valuation studies and which will be more extensively discussed in the next paragraph. It is also clear that in most cases round figures have been assigned which usually results from a simplification of the interviewee's thought processes when attempting to complete the

Table 1. *Distribution of absolute and relative frequencies of WTP shown by the sample*

Willingness to pay (€)	Absolute frequency (n.)	Relative frequency (%)
0.00	101	50.25
0.80	1	0.50
1.00	11	5.47 ·
2.00	6	2.98
2.50	1	0.50
3.00	8	3.98
5.00	16	7.96
10.00	20	9.95
12.00	1	0.50
15.00	6	2.98
20.00	6	2.98
25.00	2	0.99
30.00	4	1.99
50.00	14	6.97
100.00	3	1.50
200.00	1	0.50
Total	201	100.00

form with the least possible effort.

The average WTP expressed by 201 respondents is € 9.56, with a 95% confidence interval between € 6.49 and € 12.64. The values of the kurtosis (30.41) and skewness (4.66) express a distribution of WTP which is decidedly more accentuated than a normal distribution and strongly asymmetrical towards the right.

5.1.1. The treatment of strategic responses
5.1.1.1 WTP equal to zero: the 'protest' responses

The responses equal to zero can be attributed to strategic behaviour as well as to protest.

In the first case these no-data responses may be due to the interviewee considering that the resource has no intrinsic value, that he is unable to pay or that he believes that another will pay; this last refusal can be described as 'lexicographic' (Spash & Hanley, 1995).

The protest responses are given by those individuals who, although able to pay, refuse to declare their own WTP because, for example, they have no knowledge of the resource being valued, they refuse the proposed hypothetical scenario for ethical reasons, or they believe they are already entitled to full rights over this public land.

Whatever the reason for the zero responses, the identification and the statistical treatment of protest responses are

[2] The alternatives proposed are: 1. I maintain that this Antifire Programme is not worthwhile; 2. I would be prepared to contribute but I am unable to do so; 3. It is not right that I should pay for such an enterprise; 4. Other – please specify.
[3] The relative percentages of the variable Monthly Income refer to 194 individuals, as 7 respondents gave no information relative to their income.

of importance given that even in more elaborate studies their occurrence in all questionnaires submitted varies from 15% to 30% (Romer, 1992).

In order to evaluate and classify these responses in this work, the respondents who indicated a zero WTP were asked to give their reason by choosing from the following options:

- *I maintain that this Antifire Programme is not worthwhile;*
- *I would be prepared to contribute but I am unable to do so;*
- *It is not right that I should pay for such an enterprise;*
- *Other - please specify.*

The first two were considered to be valid options for the assignment of a zero WTP, while the third was considered a valid justification for a 'protest zero' since the individual refuses to assign a value from the beginning. The last option was instead evaluated case by case and chiefly represented various forms of protest.

The analysis of all zero WTP's produced 79 results classifiable as 'protest zero', 78.2% of all the zero replies and 39.3% of the sample responding to the enquiry.

The average WTP calculated after excluding the 79 'protest zeros', i.e. working with 122 respondents, resulted in a figure of € 15.76, with a 95% confidence interval between € 10.98 and € 20.53. The kurtosis and skewness values of 19.73 and 3.74 respectively, express a leptokurtic distribution of WTP, when compared to a normal distribution and with a positive asymmetry even if the values are slightly reduced due to the original distribution relating to 201 respondents.

During subsequent statistical calculations 4 respondents were eventually excluded from the sample of 122 as they had expressed a willingness to pay a contribution but did not declare their monthly income[4].

Table 2. *Distribution of absolute and relative frequencies of WTP after removal of 79 'protest zero' and 4 respondents who did not declare their monthly income*

Willingness to pay (€)	Absolute frequency (n.)	Relative frequency (%)
0.00	22	18.64
0.80	1	0.85
1.00	11	9.32
2.00	6	5.08
2.50	1	0.85
3.00	8	6.78
5.00	15	12.71
10.00	18	15.26
12.00	1	0.85
15.00	6	5.08
20.00	6	5.08
25.00	2	1.70
30.00	4	3.39
50.00	13	11.02
100.00	3	2.54
200.00	1	0.85
Total	118	100.00

The useful respondents were therefore reduced to 118 and provided an average WTP of € 15.66, with a 95% confidence interval between € 13.17 and € 18.13. The kurtosis and skewness values of 19.76 and 3.77 indicate a distribution of WTP entirely similar to what is described above. The relative distribution of WTP frequencies is shown in Table 2.

5.1.1.2 Identification and removal of outliers from the sample

By definition outliers are classified as those replies which appear improbable, given their presumed distribution. The phenomenon can partly be attributed to the types of question used in the current enquiry and particularly to their 'open' format, where the presence of outliers is known to be frequently encountered.

The identification and resulting removal of these 'abnormal' observations is an important activity aimed at improving the value of the estimated average WTP, in addition to the standard deviation.

In this enquiry a procedure was used for the identification and removal of those replies which unites the approaches relating to two schools of thought which have become well known in recent years (Gios & Notaro, 2001). This procedure involves in its first stage the use of statistical techniques for identifying the most influential observations within the sample. These are then analysed in detail, maintaining account of socio-economic variables and of the opinion the individual holds of the resource, thus excluding only those WTP which make little sense according to the covariates analysis.

The first step in identifying the outliers in chronological order is the application of a linear regression to a monoparametric model, using the method of ordinary least squares (OLS), with the following functional form:

$$Y = \alpha + \beta X + \varepsilon \qquad (1)$$

where Y indicates the value of WTP, X the value of the variable Income, a the constant coefficient, b the estimated parameter and e the stochastic error. As shown in (1), the model displays a single independent variable to explain the

Table 3. *Regression of WTP on the Monthly Income variable*

	Intercept	Monthly Income
Coefficient	7.35	6.20^{-3}
Standard Error	4.24	3.00^{-3}
t-statistic	1.73	2.39
p-value	0.086	0.019
$R^2=0.047$; Standard Error=26.37; Degrees of Freedom = 116; Observations=118.		

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[4] The remaining 3 respondents who did not declare a monthly income reappear among the 79 replies placed under 'protest zero'.

values of WTP as assigned by the respondents. Any other covariate could in fact be used, and indeed more than one at a time, to establish a regression with more parameters. In reality, income is considered the most significant among all the covariates in defining the WTP assigned by an individual.

In Table 3 the most important results and statistics relating to the linear monoparametric regression used are shown.

Even if the coefficient relative to income is positive and significant to 98% probability, the model has a low capacity of explaining the sample variance, as R^2 is equal to 0.047.

The intercept value indicates that a person with no income would be prepared to pay a sum of € 7.35 to enable the Auxiliary Antifire Plan proposed in the hypothetical scenario to function, with a standard error of 4.24. Even if the coefficient referring to the intercept is not significant at 95% probability ($t < +1.96$), it is possible that the value of this coefficient can reasonably be expected to be still lower.

Several statistical methods of diagnostic regression (Studentised Residuals, Leverage, Covratio, DfFits, DfBetas)

Table 4. *Values of averages obtained after removal of outliers' responses identified with various statistical techniques*

Method utilized	Rejected observations (n.)	Average of WTP's (€)
Studentized Residuals*	4	11.82
Leverage 2 p/n	4	14.98
Leverage 3 p/n	4	14.98
Covratio	7	11.78
DfFits	29	6.42
DfBetas	1	14.93
DfBetas (standardized)	6	11.85
Average value (n=118)		**15.66**

$^+\alpha/2 = 0.025$, t= 2;

can thus be applied to this first model, with the aim of identifying possible outliers.

Sample averages calculated following exclusion of the outliers' responses, which were identified by the application of various statistical procedures, are shown in Table 4[5].

The Studentised Residuals in particular identifies 4 responses as outliers with an average of € 11.82, obtained from the sample cleared of these influential responses.

Leverage identifies the same 4 responses with both exclusion thresholds (L2p/n and L 3p/n), producing the same average of € 14.98.

The Covratio diagnostic regression excludes 7 responses, leading to an average of € 11.78.

The DfFits identifies the highest number of response outliers, 29, which, once they are removed, reduce the average to € 6.42.

The DfBetas only removes a single response, achieving an average of € 14.93. Finally, the standardised DfBetas recognises 6 responses as important, with an average WTP, calculated on the remaining data set, of € 11.85.

The various diagnostic regressions have identified in more than one case the same number and the same responses, except in the case of DfFits. Rather than one response being of greater importance than others is the probability that it can be identified as an outlier by more than one regression diagnostics. Therefore, a now well-established criterion will consider all those responses indicated by more than one diagnostic tool as 'strong' candidates for the status of outlier.

To conclude, the analysis of the average values obtained with the different techniques has led to a unanimous observation. The choice of one statistical method over another for the removal of important responses is not unimportant. Indeed, the average values vary from a minimum of € 6.42 with DfFits to a maximum of € 14.98 with the Leverage diagnostic regression with both exclusion thresholds.

Following the approach proposed by Gios and Notaro (op. cit.), the analysis is continued by comparing the single WTP's of all the observations identified by more than one tool of diagnostic regression, with other covariates, suggested by economic theory and/or emerging from empirical evidence, which are considered determining in the attribution of willingness to pay.

Some of the variables examined in this phase to identify the outliers belong to the socio-economic-demographic profile of the respondent (age, level of education, occupation and income) and others indicate the attitude of the respondent toward the Reserve, both for the importance attributed to it for the present generation as much as for the future, and their opinion on the effects of fires relating to the functions it carries out[6].

The analysis of the data carried out according to this procedure has led to the identification of an initial group of 29 responses to the elicitation question defined as highly influent; within this group, 6 observations have definitely been identified as outliers through the analysis of the covariates mentioned above. The other 23 questionnaires are

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[5] Those responses valued at higher than 1.96 by the Studentised Residuals will be considered important (Carson & Ruud, unpublished memo, 1991); for Leverage with a rejection threshold equivalent to 2p/n (where 'p' is the number of regressors used in the model, including the constant, while 'n' indicates the number of the sample size) a value higher than 0.035, for Leverage with refusal threshold of 3p/n a value higher than 0.053, for Covratio a value higher than 1.053 and lower than 0.947, DfFits a value higher than 0.265, for DfBetas a value higher than 0.00186 and for standardized DfBetas a value higher than 0.1873. All these threshold values, with the exception of that relating to Covratio, are considered absolute values.

[6] There also exists a discretionary margin in this second step, quite absent from the first phase, but reduced with regard to other more subjective approaches.

Table 5. *Regression of WTP on the variable Monthly Income, before and after removal of the outliers*

	No.=118	No.=112
R²	0.047	0.103
Overall Standard Error	26.37	16.95
Degrees of Freedom	116	110
Observations	118	112
Intercept	7.35	2.73
Standard Error	4.24	3.20
t-Statistic	1.73	0.88
p-Value	0.086	0.396
Monthly Income	0.0062	0.0079
Standard Error	0.003	0.002
t-Statistic	2.39	3.55
p-Value	0.019	0.001

instead re-entered in the sample which will later be compared with the panel of forestry experts.

The 6 identified outliers were therefore removed from the sample, which finally consists of 112 observations.

With regard to the sample of 118 replies, the value of the average WTP decreased from € 15.66 to € 12.57, with a 95% confidence interval between € 9.23 and € 15.90; skewness and kurtosis are notably reduced, the first from 3.77 to 2.10 and the second from 19.76 to 4.99.

The removal of the outliers also produced beneficial effects on the monoparametric model used as a departure point for identifying the outliers themselves. The results are illustrated in Table 5, where the two models are compared, the first with a data set of 118 replies, deriving from the original sample with the exclusion of 79 'protest zero' and 4 respondents who did not give information on monthly income, and the second with a sample of 112 respondents, deriving also from removal of the 6 outliers.

The data indicate a notable improvement in the model as a whole. It is necessary to emphasise the increase in variance revealed by the model after removal of the outliers. In fact R² moves from 4.7% to 10.3%, which is not a particularly high figure but represents satisfactory value for research of this type. The Standard Error of the estimate also decreases, moving from 26.37 to 16.95, and providing yet another factor to demonstrate the improvement of the model.

The value of the intercept coefficient moves from 7.35 to

2.73, with a relative decrease of the Standard Error from 4.24 to 3.20. However in both models this coefficient is not statistically significant.

The coefficient linked to the variable Income remains as expected, displaying a reduced Standard Error and a higher level of significance.

In conclusion, it is possible to demonstrate that the removal of the outliers had positive effects on the regression model and, consequently, on the value of the average WTP which represents more precisely the average of the sample of non-expert respondents.

5.2 The values assigned by the panel of forestry experts

Bearing in mind the considerable difference in the size of the two sample groups of respondents (227 non-experts and 15 experts), the Delphi procedure was used to ascertain the data relevant to the panel of forestry experts after submission of the questionnaire (Dalkey, 1963). This procedure permits the repeated submission of questions to those members of the group, without revealing their identity, who declared a WTP greater than or equal to zero but not definable as 'protest zero', and allowing for a difference in data on the second repeat from that of the first response (minimum and maximum value, average and standard deviation).

Repeating the procedure several times achieves a high degree of convergence in the replies, indicating a central value which seems to have a greater degree of objectivity.

Using the Delphi method has various advantage[7] and, in spite of various criticisms (Delbecq et al., 1975), its exten-

Table 6. *Values of WTP assigned by forest experts*

Expert No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
WTP assigned (€)															
1st repetition	0	0	0	0	100	50	10	50	10	1	50	50	100	60	50
2nd repetition	-	-	-	-	100	50	10	50	5	1	50	50	50	60	10
3rd repetition	-	-	-	-	50	50	10	50	5	1	50	50	50	60	1

sive use in different applications testifies to its reliability (Linstone & Turoff, 1975) as well as its adaptability to the particular circumstance.

In the present study the procedure is carried out by submitting the questionnaire (identical to the one given to the non-expert respondents) and repeating the request twice in succession, providing additional information, as mentioned above.

[7] According to Dalkey (1969) the positive aspects of the model can be thus summarized: speed and relative efficiency in consulting every opinion leader; reduced effort for respondents in providing the required information compared to other alternative methods (discussions, interviews etc.); greater interest on the part of respondents due to their increased knowledge of the topic under discussion; minimal inhibition in making a response due to anonymity and the awareness that the final result is the sum of all the responses provided.

In this way the forestry experts had the opportunity to examine the whole group's replies after the first repeat and were able to use and evaluate this information when providing a new response. Table 6 shows the values of WTP assigned by the panel of experts during the three repeats.

Apart from the 4 experts who declared a zero WTP in the first submission of the questionnaire, who were not given repeated questions because their zero values were interpreted as 'protest zero's', the responses provided by the 11 respondents in the second and third repeats tend to converge in a certain way.

Table 7 shows the statistics referring to the 11 forestry experts in the three repetitions. The average WTP moves from € 48.27, in the first repeat, to € 34.27 in the third repeat; the value of the standard deviation decreases from € 32.70 to € 24.10. The minimum value of WTP declared remains unchanged (€ 1.00), while the maximum decreases on the third repetition moving from € 100.00 to € 60.00. The mode and the median (each with a value of € 50.00) remain invariable in the three repeats.

From the descriptive statistics of central tendency and dispersion listed above, it is clear how the frequency distribution of the WTP changes from the first to the third repeat. Initially the data appear to be distributed almost symmetrically[8], in that average and median are very close, € 48.27 and € 50.00 respectively. With the second repeat, WTP shows a slightly asymmetrical distribution (left skewed) with most of the data concentrated among the higher values as shown by the comparison between average (€ 39.64) and median (€ 50.00). Responses to the third repetition show a further inclination to skewness, from the median remaining unchanged (€ 50.00) while the sample average decreases further, standing at € 34.27.

The values of the WTP assigned by the panel of forestry experts in the third repetition are compared in the following paragraph with the values of WTP assigned by the sample of 112 non-experts, with the aim of establishing whether or not the respective averages can be defined as statistically equal.

5.3 Comparison of averages between the sample of non-expert respondents and the panel of forestry experts

The origins, in statistical terms, of the two groups of respondents were determined in order to make the comparison between the averages of the two samples. If it is possible to demonstrate that both form part of a single sample,

Table 7. *Descriptive statistics of the WTP assigned by 11 forestry experts*

	Average WTP (€)	Standard deviation (€)	Min. (€)	Max (€)	Mode (€)	Median (€)
1st repetition	48.27	32.70	1.00	100.00	50.00	50.00
2nd repetition	39.64	30.70	1.00	100.00	50.00	50.00
3rd repetition	34.27	24.10	1.00	60.00	50.00	50.00

then they can be interchanged without compromising the e-valuation.

To achieve this, various tests were considered from among those existing in the literature, devised to verify the equivalence of the averages of two independent samples.

To select a test it is necessary to make assumptions based on the data distribution and on the statistical variance (σ^2_1, σ^2_2) of the two populations being compared. Considering that of the two samples we know both the arithmetical averages and the standard deviations $(\overline{x}_1, \overline{x}_2; s_1, s_2)$, it can be hypothesised that the populations from which the two samples derive have normal distributions and equal variances, then the test normally used will be the t-test[9] with degrees of freedom equal to the sum of the two samples sizes minus two (n + n − 2). In the event that the equivalence of the averages between the populations from which the two samples are derived should be tested (Ho:$\mu_1 = \mu_2$), it will be a bilateral type test, where an internal interval of confidence must be calculated when the null hypothesis Ho will be accepted.

If the assumptions about the two samples (normality of data and equivalence of variances) are not verified, the t-test loses its power particularly when the second condition is not fulfilled.

In such cases the statistical problem known as 'the Behrens-Fisher problem' occurs and can be solved using a test developed by Cochran and Snedecor (1980), which has a slightly different form to the t-test, known as t-test for separate variances:

$$t' = \frac{(\overline{x}_1 - \overline{x}_2)}{\sqrt{\left(\dfrac{s_1^2}{n_1} + \dfrac{s_2^2}{n_2}\right)}} \qquad (2)$$

[10, 11]

In the first instance a test was carried out, with results shown in Table 8, to verify whether the two groups have equal or different variances (Levene test). The results of this test are given on the line 'equal variances' or ' different variances'. As the significance value of Levene's test was less than 0.05 (0.019) in this case, the hypothesis that the two samples had equal variances was rejected and reference

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[8] Nearly equal values of the average and the median are typical of a symmetrical distribution of data. Higher (or lower) values of the average to those of the median indicate a right skewed (or left skewed) or positive (or negative) distribution.

[9]
$$t = \frac{(\overline{x}_1 - \overline{x}_2) - (\mu_1 - \mu_2)}{\sqrt{s_p^2 \left(\dfrac{1}{n_1} + \dfrac{1}{n_2}\right)}} \quad \text{where} \quad s_p^2 = \frac{(n_1 - 1)s_1^2 + (n_2 - 1)s_2^2}{n_1 + n_2 - 2}$$

represents the variance associated to the two groups, X_1 = sample average of population 1; X_2 = sample average of population 2; μ_1 = population average of group 1; μ_2 = population average of group 2; s^2_1 = sample variance in population 1; s^2_2 = sample variance in population 2; n_1 = sample size for population 1; n_2 = sample size for population 2.

Table 8. *Results of the test for equivalence of averages*										
		Levene test for the equivalence of variances		t-test for the equivalence of the averages						
		F	Sig.	t	Df	Significance (two-tailed)	Differences between the averages	S.E. of the differences between the averages	Confidence interval of the differences (95%)	
									Lower	Higher
WTP	Equal Variances	5.675	0.019	-3.732	121	0.0003	-21.71	5.817	-33.22	-10.19
	Different Variances			-2.911	11	0.0140	-21.71	7.458	-38.10	-5.31

t-test, and its results are shown on the line 'equal variances' in Table 8; it must be recorded that in this context the results were not usable given the results of the Levene test on the equality of the variances. In this instance also the Ho of equivalence of the averages (t= -3.732, p-value=0.0003) was rejected.

From the initial assumption of both equal and different variances, the tests revealed the impracticality of the attempt to substitute the panel of forestry experts for the sample of non-expert respondents with the aim of directing the choice of a set of WTP values to be used in the dichotomous-choice questions of the survey.

was made to the t-test values for the equivalence of averages in the case of 'different variances'.

The t-test is equal to −2.911, with a significance value of 1.4%; the confidence interval obtained according to (3) indicates that H0 is rejected if t'>+2.22 or if t'<-2.22. The conclusion therefore is that for t=-2.911, falling outside the confidence interval, the H_0 of the equivalence of averages must be rejected.

As other tests to verify the H_0 of equivalence of variances between two samples do exist in the literature, a cross analysis, apart from that of Levene, was applied to this work.

6. Final considerations

The now widespread use of 'close-ended' questions to elicit WTP (or WTA) specified in the application of CVM has rendered the carrying out of a pilot survey ever more important, whether it is aimed at adjusting the questionnaire for the survey or at identifying a values interval of WTP from which to select the bids to be used in dichotomous-choice questions to the respondents in the enquiry.

Table 9. *Results of various tests to verify the equivalence of the variances*			
Test	D.F.	Test value	Prob.
F-test	(111.10)	1.832	0.2922
Siegel-Tukey		1.877	0.0605
Bartlett	1	1.926	0.1652
Brown-Forsythe	(1.121)	1.551	0.2153
Levene	(1.121)	5.680	0.0187
N_1=112; N_2=11			

The values obtained are shown in Table 9 and indicate how Levene's test alone rejects the null hypothesis of equivalence between variances of two samples, while the F-test, Siegel-Tukey, Bartlett and Brown-Forsythe tests produce diametrically opposed results.

Given these contrasting results, it was considered opportune to repeat the test on equivalence of averages, this time treating the two samples as if they had equal variances.

The most suitable test for this kind of enquiry must be the

The extent of the statistical universe is due both to the environmental resource which is the subject of the study and to the values (use, existence, heritage etc.) which are to be estimated, with resulting variation, sometimes considerable, in the optimal sample size in relation to the pre-test and to the survey.

In studies relative to environmental resources with potential importance on an international, national, or regional level, the carrying out of the pre-test alone can be unworkable in terms of time and costs.

The impossibility of achieving a sample size sufficient to guarantee a minimum level of representativity therefore implies limitations which can challenge in different ways the reliability of evaluation, theoretical validity of the study and the use of results.

The present study has sought to identify an alternative but equally valid method to the one traditionally followed to distinguish a series of values of WTP to use in the dichoto-

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[10] Confidence interval for (2), even in this case two-tailed, necessary in order to reject or accept the null hypothesis Ho, is calculated in the following way:

$$\text{if} \quad t' > \frac{+(t_1 W_1 + t_2 W_2)}{W_1 + W_2} \quad \text{or} \quad t' < \frac{-(t_1 W_1 + t_2 W_2)}{W_1 + W_2}$$

(3) then the null hypothesis (Ho) is rejected. In the above formulae, t_1 and t_2 represent the critical values at a significance level, respectively, with (n_1-1) and (n_2-1) degrees of freedom, while W_1 and W_2 represent respectively $\frac{s_1^2}{n_1}$ and $\frac{s_2^2}{n_2}$

[11] Given that the expected difference is 0 (that is m1-m2=0), the numerator of the formula reported in the footnote 9 becomes thus obtaining the formula (2) where the variances of the two groups are calculated separately.

mous-choice questions of the questionnaire.

The specific objective was to verify the possibility of conducting a pre-test with a reduced number of privileged witnesses, able to produce results analogous to those of a sufficiently numerous sample of 'non-experts'.

The hypothetical scenario presented intervention by an Auxiliary Antifire Programme, to be financed entirely by private resources, and its potential effects in reducing fire risk in a specific area of central-south Sicily known as the Nature Reserve 'Bosco Santo Pietro'.

It was therefore decided to carry out a pilot survey in parallel with the normal pre-test (conducted with a sample of 227 individuals randomly chosen), which would make use of a group of opinion leaders, represented by 15 technical forestry experts working in Sicily and thus used to confronting the problems of preventing and protecting woodland from fires.

Statistical processing was carried out on the data obtained with the object of verifying the hypotheses of equivalence of averages between the two samples, cleared both of replies classified as 'protest zero' and of outliers in the case of the non-expert respondent sample.

The statistical tests used led to the rejection of the null hypothesis of statistical equivalence of the respective sample averages, suggesting therefore that any eventual successive extended enquiry should be based on a large sample using a closed-question questionnaire, using data from the non-expert respondent sample, for which considerably greater financial means and time were required than for the group of privileged witnesses.

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