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TESTING THE VALIDITY OF WTP VALUES FROM A CONTINGENT VALUATION SURVEY IN PORTUGAL

by

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Testing the Validity of WTP values from a Contingent Valuation Survey in Portugal

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Abstract:

This paper explores the statistical validity of the willingness to pay (WTP) answers from a contingent valuation (CV) survey concerning value assessment of recreation and biodiversity protection programs. Firstly, we use a non-parametric testing approach as to evaluate the whether (a) different information levels concerning the government costs with the Park and (b) different payment vehicles influence the stated WTP responses. Secondly, we use a parametric model specification as to investigate the impact of the elicitation question format on the stated WTP responses.

The likelihood ratio test results, at 95% confidence level, confirm the validity of the proposed survey a measurement instrument. Nevertheless, the presence of *free riding* turns out to be statistically significant in one of the survey versions. The parametric model results suggest that the differences in the mean WTP estimates across the two question formats are not statistically different. Furthermore, the double bounded dichotomous choice model value estimates point out that the WTP for the recreation protection program is lower than the WTP for the biodiversity protection program, thus confirming the importance of non-use value component of the Natural Area.

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INTRODUCTION

In this paper we perform an extensive statistical analysis of the results of a national Contingent Valuation (CV) experiment focused on the valuation of the recreation and biodiversity benefits of the Alentejo Natural Park. Combining the use of computer generated scenarios, different payment vehicles, elicitation question formats and levels of information we design a set of seven survey formats. The interviewees are asked about their willingness to pay (WTP) to prevent tourism development as described in the survey scenario.

The paper is divided into two major sections. In the first section we describe the different protection scenarios as proposed to the respondents. In the second section we perform non-parametric testing as to verify the validity of the CV responses. On the one hand we test the independency hypothesis of the refusals and zero-protest distributions. On the other hand, we test the impact of the payment vehicle and the level of information on stated WTP answers. As far as the level of information is concerned we distinguish two survey formats: in the first format the respondent is informed about the financial costs spent by the government in keeping the Natural Park as a protected area; in the second format the respondent is not informed about that. As for the payment vehicle we identify two survey formats which are respectively associated to two payment schemes: a national tax and a national voluntary contribution. Finally we compute univariate parametric estimates for the different protection programs by fitting the log-normal distribution to the double referendum and open-ended WTP responses.

1. THE CONTINGENT VALUATION SURVEY

Before putting the final survey instrument into the field, we engaged in an extensive up-grading fine-tuning process over a ten-month period. We used state-of-the-art techniques in developing questionnaires and followed closely the guidelines recommended by the NOAA panel (Arrow et al., 1993), including the use of focus groups, field pre-testing and one-to-one interviews. The national survey was implemented in September and executed by the survey department of the Portuguese Catholic University. The interviewer teams rang the bell of 3597 households but 21% of them were not reachable since they were not at home. From the households that were successfully contacted, we received a total of 1678 completed interviews. For a personal interview, the present study reveals a rather high non participation response, around 40%[1]. To better mimic price taking in market behavior, the respondents are asked whether they are willing to pay a given monetary amount as to continue the protection of the Park. The monetary amount is stated in the instrument survey and varies randomly from respondent to respondent. We used the same bid design across the three survey versions. This question format is referred to as take-it-or-leave-it (TIOLI), i.e., a dichotomous-choice or referendum format question (Cameron and James, 1987; Cameron, 1988). To improve the statistical efficiency, we include a follow-up valuation question: the double dichotomous choice response model. The sequence of responses will be used to infer the respondent's maximum WTP (Hanemann et al., 1991; Cameron and Quiggin, 1994) - see Table 1.

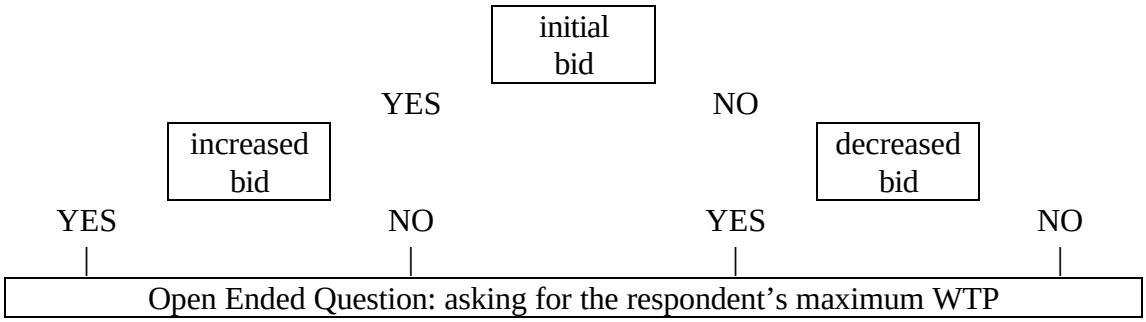
[1] The CV in-person interviews are characterized by higher response rates than, for example, mail surveys. The latter typically range between 20% and 60% (Whitehead et al., 1993). Nevertheless, survey researchers have been facing an increasing non-cooperative trend over time, especially in developing countries (Deaton, 1997).

Table 1: **Bid designs used in the CV experiment (in PTE[2])**

Initial Bid		Increased Bid	Decreased Bid
B1	1200	3600	600
B2	2400	4800	1200
B3	4800	9600	2400
B4	9600	24000	4800

After having answered both referendum questions, each respondent is asked to state, through an open ended question (OE), her maximum willingness to pay. Box 1 describes the complete elicitation procedure common to all survey versions.

Box 1: Elicitation Question format: double DC with an OE follow-up



If a respondent faces a bid design type B2 she will be asked if her household *"would agree to pay 2400 escudos"* for the described protection program; if she answers positively then she faces a follow-up question with a higher amount *"would your household still agree to pay 4800 escudos"*; if she refuses the initial bid then in the second round she will be asked for a smaller amount *"would your household still agree to pay 1200 escudos"*. Independently of the respondent's answering pattern, she is always asked to state *"what is the maximum that your household is willing to pay"*.

[2] 180 PTE ≅ 1 USD.

1.1. THE SURVEY VERSIONS

The Alentejo coast line constitutes one of the least urbanised littoral areas of Portugal. Like in many coastal areas, we have been assisting to an intensification of the efforts from the tourism industry, together with the local municipalities, who claim for the development of the tourism potential of the natural area. In this context, the Portuguese Institute for the Conservation of the Nature established the *Parque Natural do Sudoeste Alentejano e Costa Vicentina*[3] as to continue to guarantee the preservation of such coast line. Given the present zoning (*Ministério do Ambiente e Recursos Naturais*, 1995) we are able to characterise the Alentejo Natural Park in terms of two major zones: the Wilderness Areas (WA) and the Recreational Areas (RA). The first refers to the geographical area of the Park that is allocated to the protection of the local biodiversity: the visitors' access is here restricted. Roads, commercial development, mechanical equipment and other improvements are here prohibited - the Park's nonuse value component. The second category refers to the geographical area of the Park that is allocated to the human use: it is open to all visitors and they are here able to enjoy a set of recreational activities in a natural environment - the Park's use value component. Given that, we design three survey versions corresponding to three protection policy options. On one hand we have the WA tourism development scenario; on the other hand we have the RA tourism development scenario. Finally we consider a scenario version which is characterized by the tourism development of both WA and RA - see Box 2.

[3] Shortly, the Alentejo Natural Park. Please see enclosed map in Appendix A.

Box 2: Questionnaires Versions

Version 1: Preventing Tourism Development in WA
Version 2: Preventing Tourism Development in RA
Version 3: Preventing Tourism Development in both WA and RA

Since we are interested in verifying the degree of validity of the WTP answers we design two variants for each version reflecting two different payment vehicles. We refer to the national tax (TAX) and the voluntary contribution (VC) schemes. As far as the Version 3 is concerned we come up with an extra variant which captures two levels of survey information. In one survey format, the respondent is explicitly informed about the level of government costs in keeping the Natural Park as a protected area (ON); in the other one the respondent is not provided with such information (OFF) - see Table 2. In all survey versions it is clear to the respondents that the current governmental expenditures allocated to the Alentejo Natural Park are insufficient to continue guaranteeing to all Portuguese that there will not be any tourism development in the Park.

Table 2: **Survey Versions**

	Version 1		Version 2		Version 3		
information level	ON	ON	ON	ON	OFF	OFF	ON
payment vehicle	TAX	VC	TAX	VC	TAX	VC	VC
Survey	A	B	C	D	E	F	G
N	230	241	220	242	173	194	378

2. VALIDITY OF THE STATED WTP ANSWERS: TESTING PROCEDURES

In this section we investigate the degree of accuracy of the CVM as a measurement instrument. As far as the level of information is concerned we distinguish two survey formats: format type "ON" and "OFF". As for the payment vehicle, we also refer to two survey types, "TAX" and "CV". We wish to test the following propositions:

Hypothesis 1: the WTP distribution in survey format "OFF" and "ON" is the same.

Hypothesis 2: the WTP distribution in survey format "TAX" and "VC" is the same.

These tests are carefully discussed in the following sub-sections.

2.1. THE INFORMATION LEVEL

The present study distinguishes two survey formats corresponding to two different levels of the information. The formats differ at the introduction of the elicitation section[4]. Both survey formats are applied to the scenario version three, which focuses on preventing the tourism development on both WA and RA of the Alentejo Natural Park. In both versions we present to the respondents a voluntary contribution scheme as the payment vehicle. In the presence of information bias we might expect a WTP_{ON} distribution with fatter tail than the WTP_{OFF} distribution since we could expect that informing the respondent about the large government financial effort spent on the protection of the Park might be interpreted and used by her as a "cue" or signal about the Park monetary valuation and, this way, might influence upwards her stated WTP response. The elicitation format used in the survey allows to perform two types of non-parametric tests. The first deals with the stated WTP answers on the first question of the referendum, i.e., the single bounded response model; the second approach deals

[4] Please see enclosed Appendix B.

with the stated WTP answers to both the first question and the follow-up question of the referendum, i.e., the double bounded response model.

2.1.1. THE SINGLE BOUNDED RESPONSE MODEL

We test Hypothesis 1 in a nonparametric fashion by calculating the "no" response rate at each initial bid for both survey types. The proportion of respondents rejecting the identified bids in the survey type "OFF" is then compared with the observed proportion of rejections in the survey type "ON" expecting that the underlying distribution remains unchanged (Kriström, 1990). The results are reported in Table 3. For testing the null hypothesis the standard Pearson chi-square test is used[5]. Table 8 gives the response results for both survey types. The computed test statistics have one degree of freedom with a critical value of 3.84 at the 5% confidence level. The empirical evidence fails to reject the hypothesis that the underlying response distribution is the same across the two information types (all the c^2 values are insignificant).

Table 3: response distributions to the initial WTP question

bid		Survey Format		Statistic
		information "ON"	information "OFF"	c^2
1200	total responses	78	40	
	percentage of "yes"	60.26	65.00	0.2522
2400	total responses	81	41	
	percentage of "yes"	49.38	65.85	2.983
4800	total responses	86	41	
	percentage of "yes"	38.37	36.59	0.0377
9600	total responses	77	39	
	percentage of "yes"	40.24	35.88	0.2075

2.1.2. THE DOUBLE BOUNDED RESPONSE MODEL

We use the Turnbull likelihood estimation approach[6] (Turnbull, 1976) for estimating the cumulative density of the WTP into the intervals defined by the monetary thresholds used in the different bid designs. The contribution to the likelihood function from one respondent is defined in the following way (Cameron and Quiggin, 1994),

$$r_{nn}{}^{j} \ln F\left(b_l{}^{j}\right) + r_{ny}{}^{j} \ln\left[F\left(b_i{}^{j}\right) - F\left(b_l{}^{j}\right)\right] + r_{yn}{}^{j} \ln\left[F\left(b_h{}^{j}\right) - F\left(b_i{}^{j}\right)\right] + r_{yy}{}^{j} \ln\left[1 - F\left(b_h{}^{j}\right)\right]$$

where

F cumulative density function;

$b_i{}^{j}$ denotes the initial bid presented to respondent *j*;

$b_l{}^{j}$ denotes the lower follow-up bid presented to respondent *j*;

$b_h{}^{j}$ denotes the higher follow-up bid presented to respondent *j*;

the response patterns are coded as indicators variables with

$r_{nn}{}^{j}$ denotes a "no-no" answer from respondent *j*;

$r_{ny}{}^{j}$ denotes a "no-yes" answer from respondent *j*;

$r_{yn}{}^{j}$ denotes a "yes-no" answer from respondent *j*;

$r_{yy}{}^{j}$ denotes a "yes-yes" answer from respondent *j*;

The sum of these contributions over the sample is maximized subject to the constraint that the density function F is non-declining. Table 4 gives the results for the two survey formats[7]. Included in the table is a sample in which all the stated WTP answers in excess of five percent of the reported income are excluded - 5% trimmed (Diamond et al., 1993). This way we are able to exclude the outliers and therefore improve the

[5] We use Monte Carlo algorithms provided by the StaXact*3 for Windows*® to calculate the exact test statistics.

statistical power of our test. For both samples the stated WTP data is brought in one single "sample", this is captured by the *pool* column.

Table 4: response distributions to the double WTP question

bid intervals		change in the cumulative density function					
		all sample			5% trimmed		
lower bound	upper bound	format "ON"	format "OFF"	Pool	format "ON"	format "OFF"	Pool
0	600	.39	.31	.36	.44	.37	.41
600	1200	.39	.37	.38	.44	.43	.43
1200	2400	.48	.45	.47	.54	.52	.53
2400	3600	.66	.67	.67	.73	.65	.73
3600	4800	.66	.67	.67	.73	.65	.73
4800	9600	.81	.78	.80	.85	.74	.84
9600	24000	.99	.99	.99	.99	.99	.99
	N	322	161	483	287	138	425
	Ln N	-392.55	-198.50	-594.14	-327.04	-153.54	-484.59
	LR			6.18			8.02

The maximum logarithm likelihood statistic is estimated for each type of data. We test if the estimated cumulative distributions of the WTP are the same across the survey formats and run the Likelihood Ratio test (LR). The computed test statistics are c^2 distributed with ten degrees of freedom with a critical value of 20.48 for the overall sample, and eight degrees of freedom with a critical value of 17.53 for the trimmed subsample. Both tests clearly fail to reject the hypotheses of equal distributions for the two types of surveys. Therefore we are able to conclude that the stated WTP answers are independent of the fact that the respondent is (not) provided with information concerning the governmental expenditures in keeping the Alentejo Natural Park as a protected area. Therefore we may pool the data across the two survey formats, "ON" and "OFF", and work with a single *pooled* data set.

[6] As before this is a nonparametric estimation approach and therefore this technique makes no assumption about the shape of the underlying WTP distribution.

2.2. THE PAYMENT VEHICLE

In this sub-section we are interested in the analysis of the payment vehicle impact on the stated WTP answers. This test is a rather crucial point in testing the convergent validity of the CV answers. We follow the mainstream of CVM discussion and propose the investigation of two vehicles: we refer to the National Park Tax (TAX) and Voluntary Contribution (VC) schemes. The payment schemes are presented to the respondent in the survey elicitation section[8]. In both cases the respondent was informed about the current level of governmental expenditures spent in the Park, i.e., information "ON". As before, we test the Hypothesis 2 by making no assumption about the shape of the underlying distribution. Since now we need to control for the protection program, we test the impact of the payment vehicle on the stated WTP answers across the three environmental protection plans individually. Therefore we rewrite the Hypothesis 2 in the following way,

Hypothesis 2a: the WTP distribution for the WA protection program under "TAX" payment scheme is the same as under "VC"

Hypothesis 2b: the WTP distribution for the RA protection program under "TAX" payment scheme is the same as under "VC"

Hypothesis 2c: the WTP distribution for the WA and RA protection program under "TAX" payment scheme is the same as under "VC"

The literature suggests that these two payment vehicles have different incentive properties. The individual voluntary contribution as proposed in the "VC" payment

[7] We used a *Gauss* program developed by Olvar Bergland.
[8] Please see enclosed Appendix C.

vehicle gives an incentive for free riding. The referendum rule with *"parametric individual costs"* as proposed in the "TAX" payment vehicle is incentive compatible (Hoehn and Randall, 1987). Therefore we may expect that the distributions of the WTP answers are not invariant with respect to the payment vehicle. The question we address is then the following: do the stated WTP responses reflect a payment vehicle bias? Or equivalently, is free riding behavior statistically significant in our sample? If free riding is present, then we expect a WTP_{TAX} distribution with fatter tail than the WTP_{VC} distribution. Once more the elicitation format used in the national survey allows to perform two nonparametric testing procedures: the first deals with the single bounded response model; the second approach deals with the double bounded response model.

2.2.1. THE SINGLE BOUNDED RESPONSE MODEL

We tested Hypothesis 2a, Hypothesis 2b and Hypothesis 2c by calculating the "no" response rate to each initial question contained in the bid card. The proportion of respondents rejecting the identified bids in the survey type "TAX" is then compared with the observed proportion of rejections in the survey type "VC" expecting that the underlying distribution remains unchanged. Again the standard Pearson chi-square test and the respective test statistic was used. Table 5 gives the response results for the three environmental protection plans.

For all bid levels the percentage of individuals saying "yes" to the initial bid is systematically higher in the "TAX" survey format than in the "VC" format. This may suggest the presence of "free-riding" behavior in our sample. For both WA and WA+RA protection programs, the empirical evidence fails to reject the hypothesis that

the underlying response distribution is the same across the payment schemes (all the c^2 values are insignificant), thus giving support to the convergence of stated WTP answers across the voluntary contribution and national tax payment vehicles[9].

Table 5: **response distributions to the initial WTP question**

		Environmental Protection Plan								
		WA			RA			WA+RA		
bid	responses	VC	TAX	c^2	VC	TAX	c^2	VC	TAX	c^2
1200	total	53	46		49	49		40	39	
	% of yes	60.4	73.9	2.03	71.4	71.4	1.00	65.0	58.9	.02
2400	total	55	44		53	41		41	31	
	% of yes	47.3	65.9	3.44	49.1	70.7	4.74**	65.8	80.6	.30
4800	total	51	48		55	43		41	34	
	% of yes	45.1	56.2	1.23	43.6	72.0	7.94*	36.7	52.9	1.92
9600	total	56	38		52	41		39	31	
	% of yes	44.6	47.3	0.07	26.7	20.8	10.9*	35.8	58.0	2.02

* = indicate significantly different at 5% level
** = indicate significantly different at 10% level

The percentage of individuals saying "yes" to the initial bid is only statistically higher in the "TAX" survey format than in the "VC" format in the RA protection program at the last two bid prices. This confirms our initial suggestion concerning the presence of *free riding* in our sample. For a further analysis we propose to study the double response model and this way check the respondent answering behavior in the follow-up question.

2.2.2. THE DOUBLE BOUNDED RESPONSE MODEL

[9] All the chi-square test statistics estimates have one degree of freedom with a critical value of 5.02 at the 95% confidence level (two-sided tests).

We use the Turnbull likelihood estimation approach for estimating the cumulative density of the WTP into the intervals defined by the monetary thresholds used in the different bid cards. The estimated nonparametric distributions for the two types of payment vehicles across the different protection plans are reported in Table 6. Included in the table is a single distribution which is constructed by pooling the data across the national tax and voluntary contribution.

Table 6: **response distributions to the double WTP question - full sample**

bid intervals		Environmental Protection Plan								
		WA			RA			WA+RA		
lower bound	upper bound	TAX	CV	Pool	TAX	CV	Pool	TAX	CV	Pool
0	600	.18	.40	.30	.16	.40	.27	.23	.31	.28
600	1200	.24	.40	.33	.20	.40	.30	.23	.36	.30
1200	2400	.36	.47	.42	.29	.52	.41	.32	.44	.38
2400	3600	.59	.62	.60	.49	.70	.60	.59	.66	.63
3600	4800	.59	.63	.60	.49	.70	.60	.59	.66	.63
4800	9600	.79	.79	.78	.69	.83	.76	.75	.78	.76
9600	24000	.99	.99	.99	.98	.97	.98	.96	.99	.97
	N	176	215	391	174	209	383	135	161	296
	Ln N	-232.2	-278.5	-518.9	-232.8	-238.3	-485.2	-190.9	-198.5	-393.6
	LR			16.48			28.10*			8.54

*= indicate significantly different at 5% level

For each protection plan, we test if the estimated cumulative distributions of the WTP are the same across the "TAX" and "VC" survey formats by calculating the LR test. These test statistics are c^2 distributed with 10, 12 and 10 degrees of freedom, respectively, for the RA, WA and WA+RA protection programs. For all bid intervals the cumulative density of distribution is systematically higher for the "TAX" format, nevertheless such differences are not statistically significant for both WA and WA+RA protection programs. As in the single response model setting, we are not able to reject

Hypothesis 2a and Hypothesis 2c. Moreover, the hypothesis of equal distributions for the two payment vehicles continues to be rejected at 5% level for the RA protection program: the value of LR=28.10 is still significant at 1% significance level. We can verify that in this subsample the estimated cumulative distribution of the WTP shows a heavy right tail, at 9600$00 there is about 69% of accumulated density: much less than in other sub-samples, all above 75%. This is often associated with the presence of outliers in the sample, i.e., the presence of respondents who state very high WTP answers. To improve the robustness of the presented non-parametric tests, we exclude such extreme values by truncating the right-hand tail of the distribution. The sample selection criterion is characterized by excluding the respondents who stated a high WTP response. In this context, we construct a sub-sample of the WTP distribution in which we exclude all the stated WTP answers that are more than 5% of the reported income of the respondent (Diamond et al., 1993). The Turnbull estimates of the distributions across the two types of payment vehicles for the three protection plans are reported in Table 7.

Controlling for the RA protection, we test if the estimated cumulative distributions of the WTP are the same across the two payment schemes by calculating the LR test. The computed c^2 test statistic has 10 degrees of freedom with a critical value of 20.48 at the 5% level. Now it is clear that we fail to reject the hypothesis that the underlying response distribution is the same across the two payment schemes, the c^2 value is insignificant. Again, the computed c^2 test statistics associated to the WA and WA+RA protection programs, respectively distributed with 10 and 8 degrees of freedom, are insignificant and thus confirm the non-rejection of the Hypothesis 2a, Hypothesis 2b and Hypothesis 2c. Therefore we are able to conclude that there is no

strong empirical evidence to reject independency of the stated WTP responses with respect to the payment vehicle.

Table 7: **response distributions to the double WTP question - 5% trimmed**

bid intervals		Environmental Protection Plan								
		WA			RA			WA+RA		
lower bound	upper bound	TAX	CV	Pool	TAX	CV	Pool	TAX	CV	Pool
0	600	.21	.49	.36	.21	.47	.34	.29	.36	.34
600	1200	.28	.49	.40	.27	.47	.38	.29	.43	.37
1200	2400	.43	.58	.52	.40	.62	.52	.40	.52	.47
2400	3600	.67	.73	.70	.65	.80	.73	.69	.75	.73
3600	4800	.67	.73	.70	.65	.80	.73	.69	.75	.73
4800	9600	.87	.88	.87	.83	.89	.86	.87	.84	.85
9600	24000	.98	.99	.98	.98	.98	.98	.97	.99	.97
	N	146	175	321	129	178	307	109	138	247
	Ln N	-179.3	-207.3	-395.8	-168.1	-176.0	-353.6	-146.2	-153.5	-305.7
	LR			18.4			18.9			11.9

In further statistical work we may pool the data across the two survey formats, “TAX” and “VC”, and work with a single data set. Special attention is allocated to the RA protection program where pooling of the data across the payment vehicles is done with a 5% trimming.

3. UNIVARIATE WTP ESTIMATES

In this section we perform an econometric analysis of the stated WTP responses as to compute welfare estimates from the described protection programs. The proposed estimation approach is anchored in the dichotomous choice elicitation format. The underlying idea is that the respondent evaluates her utility in two stages, with and without protection plan, and if she thinks that her willingness to pay for the described scenario exceeds the stated bid, then she would accept to pay or else she refuses it. We fit a log-normal distribution to the double referendum responses. For a parametric model with a log-normal distribution, the mean WTP is given by $WTP = e^{\hat{b}+\frac{1}{2}\hat{s}^2}$ where b and s denote the location and scale parameters of the distribution. The goal is to compute the Maximum Likelihood estimates of the location, $\hat{b}$, and scale, $\hat{s}$, and use them to estimate the mean of the population distribution. Maximizing the likelihood function for the double-bounded WTP data yields the parametric estimates for the stated WTP responses[10]. The estimation results are presented in Table 8. In the same table we present the estimation results provided by the open ended WTP responses.

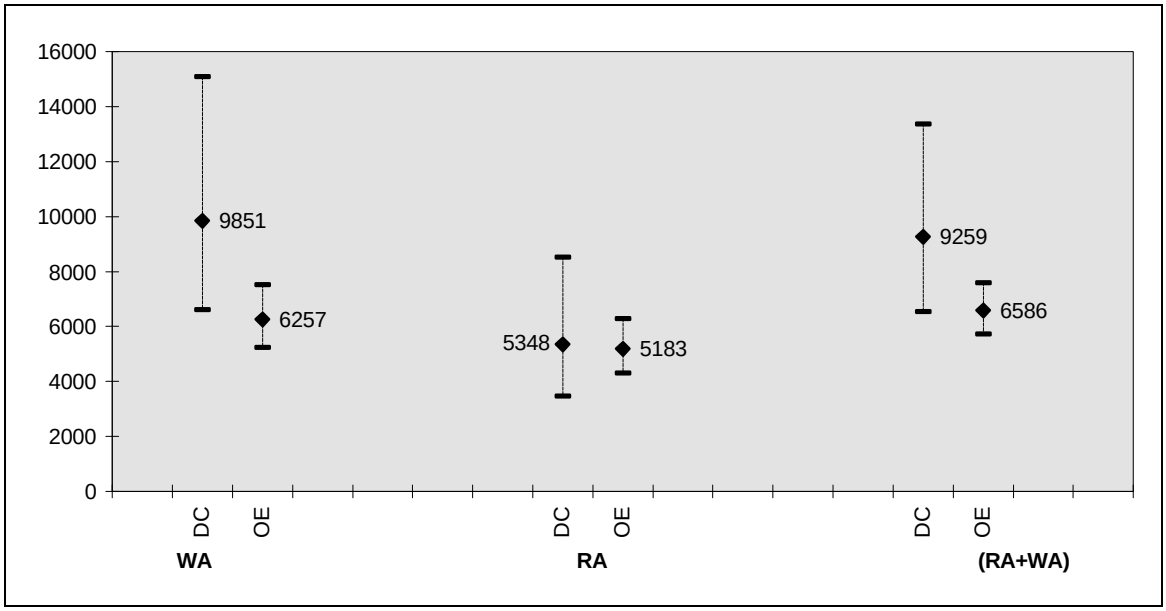
Table 8: WTP estimates (in PTE)

survey versions	mean estimates		median estimates	
	point	90% IC	point	90% IC
Double Bounded Dichotomous Choice Model				
WA	9851	[6606-15087]	2746	[2360-3196]
RA	5348	[3470-8530]	1744	[1467-2074]
WA+RA	9259	[6535-1374]	2326	[2047-2642]
Open Ended Model				
WA	6257	[5241-7512]	3915	[3518-4356]
RA	5183	[4305-6283]	3663	[3252-4125]
WA+RA	6586	[5737-7588]	4221	[3882-4591]

We concentrate our attention in comparing the WTP mean estimates across the elicitation question format. The estimation results are illustrated in Figure 1.

[10] Calculations are performed using the PROC LIFEREG procedure in *SAS*®.

Figure 1: DC Vs. OE Parametric WTP Estimates (in PTE)



We can observe four important results. Firstly, the point estimate of the mean associated with the OE elicitation question is, for all the survey versions, lower than the point mean estimate resulting from the DC. This is in accordance with the state-of-art CVM literature which considers the OE as a conservative elicitation question format[11]. Secondly, the width of the mean estimate confidence interval is, for all survey versions, wider in the DC format than in the OE format. This reflects the statistical inefficiency of the DC which requires substantially larger samples for the same level of precision. In this context, and for the same sample dimension, the DC format provides a lower level of estimation precision when compared to the OE elicitation format. Thirdly, we observe, at each protection program, an overlapping of the confidence intervals for the estimated mean across the two elicitation question formats. Such

[11] The DC format may be associated to symbolic choices in favour of the protection program, not because the respondent would pay the posted bid, but rather to register her support for providing the public program (Brown et al., 1996). As we have seen the DC may also encourage the "yea saying" where the posted bid is accepted as a hint of what is a reasonable payment (Kannimen 1995).

overlapping suggests that the difference in estimates may not be statistically significant. Finally, we observe that the respondents are willing to pay more for the preservation of the WA than for the preservation of the RA. Moreover, they are willing to pay approximately the same for the WA protection program and the WA+RA jointly. If we combine the three final estimation results we may suggest that the respondents are only willing to pay for the preservation of the RA if, and only if, the preservation of the WA is also guaranteed.

4. CONCLUDING REMARKS

The present study makes use of different information levels, payment vehicles and elicitation question formats as to investigate the internal validity of the stated WTP answers. Using a non-parametric testing approach, and controlling for a 95% confidence interval, the LR test results suggest that: (a) the stated WTP distribution in a scenario where the respondent is informed about the governmental expenditures is not statistical different from the WTP distribution associated to the scenario where the respondent is not provided with such information. Therefore we may pool the data across the two survey formats and for further econometric work deal with a single *pooled* data set; (b) the test statistics provided when comparing the stated WTP associated to the national tax and the stated WTP associated to the voluntary contribution distributions are insignificant, suggesting that the stated WTP is independent of the payment vehicle used in the survey. Therefore we may pool the data across the two survey formats and work with a single data set. Special attention is allocated to the RA protection program where due to the presence of outliers pooling of the data is done after a 5% trimming. The parametric mean WTP estimates across the two elicitation question formats confirm that the OE estimates are more

conservative and statistically more efficient than the DC estimates. These tests results confirm the validity of our contingent valuation experiment and, this way, constitute an important indicator supporting the quality of the proposed survey as a measurement instrument.

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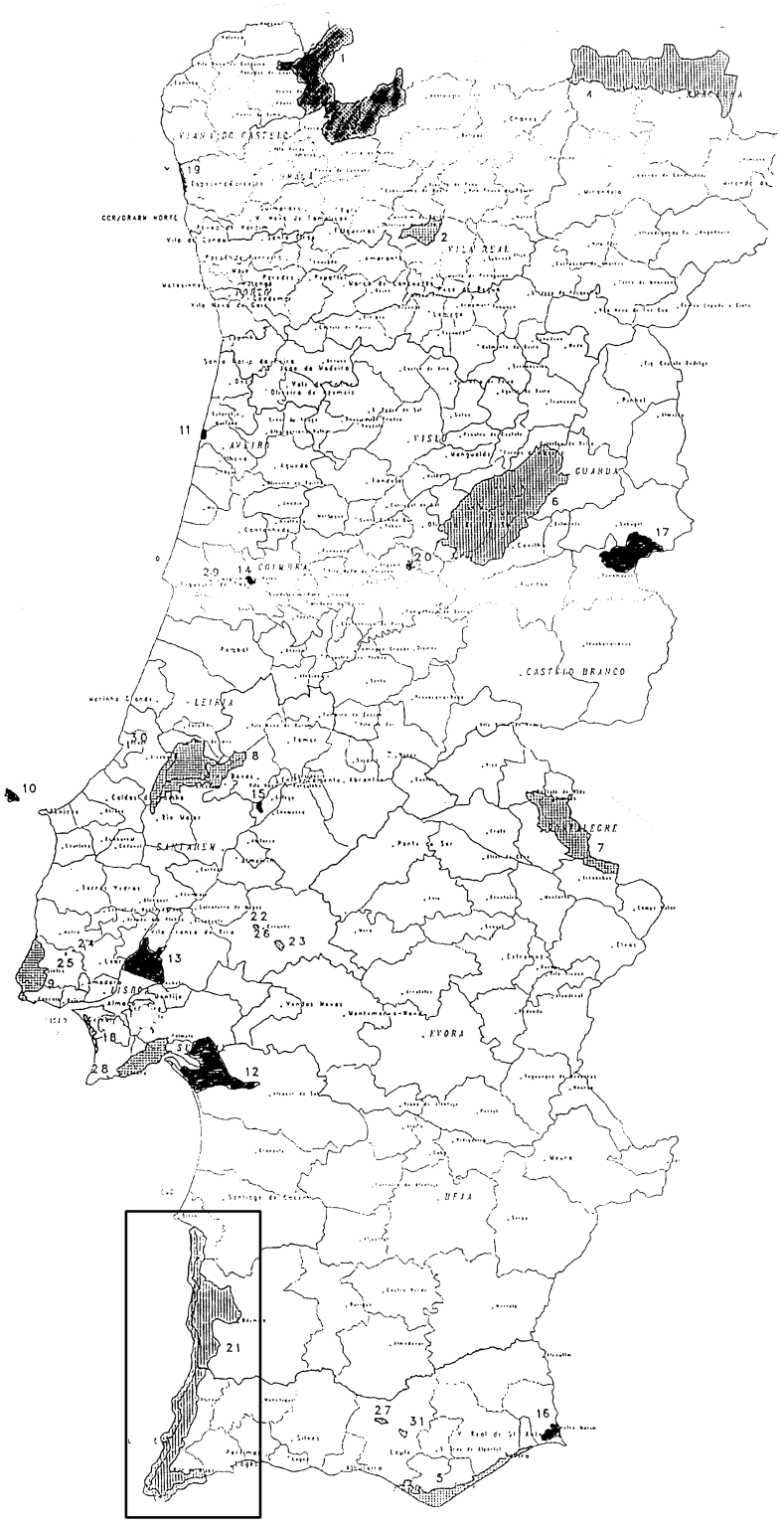
Appendix A: Localization of the Alentejo Natural Park in Portugal



Appendix B: Information Level

In the introduction of the elicitation question of the survey format type "ON" we have the following paragraph:

> *The Portuguese government invested in the last three years 560.000.000$00*[12] *in running the Alentejo Natural Park as a protected area. Nevertheless, such budget is not sufficient to continue guaranteeing to all Portuguese that there will not be any tourism development of the Park.*

and, in format type "OFF", the respondent is not provided with any information about the governmental costs and this paragraph is omitted.

Appendix C: Payment Vehicles

When applying the "TAX" the respondent is asked for her opinion about paying a National Park Tax:

> *In order to continue guaranteeing to all Portuguese that there will not be any tourism development of the Alentejo Natural Park, the government proposes a national referendum about the introduction, and only during one year, of the Park National Tax. The tax revenue will be exclusively applied to continue keeping the Alentejo Natural Park free from any tourism development. All the Portuguese households will have to pay the Park National Tax if the majority of the families votes YES to its introduction.*
>
> ⇨ **PROBE: item to be added to the annual IRS value of the household**
>
> *Please think about:*
> - *Your current household income*
> - *Your current household expenses*
> - *The existence of other Natural Areas*

[12] Around 3,2 million US$.

> ***P-9.*** *Keeping this factors in mind, would your household agree to pay a tax of* ***1200$00*** *to protect WA and RA and this way CONTINUE going to the beach and enjoy a natural environment as well as GUARANTEE the non-extinction of local wildlife such as the Iberian Lynx and the Fishing Eagle?*

Under the "CV" payment scheme the respondent is confronted with a National Money Raising Campaign and she is asked to make a voluntary contribution:

> *In order to continue guaranteeing to all Portuguese that there will not be any tourism development of the Alentejo Natural Park, the Park Management Agency, together with the national organizations of environmental protection, launched a National Money Raising Campaign which funds will be exclusively applied to keep the Alentejo Natural Park free from any tourism development.*
>
> *Please think about:*
> - *Your current household income*
> - *Your current household expenses*
> - *The existence of other Natural Areas*
>
> ***P-9.*** *Keeping this factors in mind, would your household agree to contribute with a donation of* ***1200$00*** *to protect WA and RA and this way to CONTINUE going to the beach and enjoy a natural environment as well as GUARANTEE the non-extinction of local wildlife such as the Iberian Lynx and the Fishing Eagle?*

References:

Arrow, K., R. Solow, E. Leamer, P. Portney, R. Radner. and H. Schuman. (1993), "Report of the National Oceanic and Atmospheric Administration Panel on Contingent Valuation" Federal Register, Vol. 58, no. 10, US, Pages 4601-4614

Brown T., P. Champ, R. Bishop and McCollum (1996) “Which Response Format Reveals the Truth about Donations to a Public Good”, Land Economics, Vol. 72(2), Pages 152-166.

Cameron, T. A. and M. D. James (1987) "Efficient estimation methods for closed-ended contingent valuation surveys" American Journal of Agricultural Economics, Pages 269-276

Cameron, T. A. (1988) "A new paradigm for valuing Non-Market goods Using Referenda Data: Maximum Likelihood Estimation by Censored Logistic Regression" Journal of Environmental Economics and Management, Vol. 15, Pages 355-379

Cameron, T. A. and J. Quiggin (1994) "Estimation using Contingent Valuation Data from a Dichotomous Choice with Follow-up "questionnaire"" Journal of Environmental Economics and Management, Vol. 27, Pages 218-234

Deaton, Angus (1997) “The design and content of household surveys”, “The Economic Analysis of Household Surveys: a microeconomic approach to development theory”, The Johns Hopkins University Press, Pages 7-39

Diamond, P. A. et al. (1993) "Does Contingent Valuation Measure Preferences? Experimental Evidence", Contingent valuation: A critical assessment. Contributions to Economic Analysis, ed. Hausman, J. A., New York, North-Holland, Pages 41-85

Hanemann, M. W., J. Loomis and B. Kanninen (1991) "Statistical Efficiency of Double-bounded Dichotomous Choice Contingent Valuation" American Journal of Agricultural Economics, Vol. November, Pages 1255-1263

Hoehn, John and Allan Randall (1987) "A Satisfactory Benefit Cost Indicator from Contingent Valuation" Journal of Environmental Economics and Management, Vol. 14, Pages 226-247

Kanninen, B. (1995) “Bias in Discrete Response Contingent Valuation” Journal of Environmental Economics and Management, Vol. 28(1), Pages 114-125

Kristöm, B. (1990) "A non-parametric approach to the estimation of welfare measures in discrete response valuation questions" Land Economics, Vol. 66, Pages 135-139

Ministério do Ambiente e Recursos Naturais, 1995. Decreto Regulamentar n. 26/95 de 21 de Setembro, Diário da República, série B, n. 219.

Turnbull, Bruce W. (1976) "The Empirical Distribution Function with Arbitrarily Grouped, Censored and Truncated Data" Journal of the Royal Statistical Society, Vol. B38, Pages 290-295.

Whitehead, J. C., P. A. Groothuis and G. C. Blomquist (1993) "Testing for Non-response and Sample Selection Bias in Contingent Valuation: Analysis of a Combination Phone/Mail Survey" Economics Letters, Vol. 41(2), Pages 215-20

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