BID DESIGN AND ITS INFLUENCE ON THE STATED WILLINGNESS TO PAY IN A CONTINGENT VALUATION STUDY

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Contributed paper prepared for presentation at the International Association of Agricultural Economists Conference, Gold Coast, Australia, August 12-18, 2006

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1. Introduction

Contingent Valuation (CV)[1] is a method, which has been proposed within the framework of environmental economics, to estimate the monetary value that specific changes in the provision of goods and services - especially non-market ones - represent for the individuals of a society.

Its basic tool is a survey to a representative sample of the affected population by the proposed change. In the questionnaire, a market is simulated where this change is offered and where the respondents are asked about their Willingness To Pay (WTP) for it, according to their budget and individual preferences, like in real markets.

The elicited contingent values provide useful quantitative information to public decision makers concerned with environmental policy, regulation, and litigation (Holmes and Kramer, 1995). Therefore, a careful design and administration of the questionnaire is considered a fundamental requirement in order to avoid or reduce potential biases, which would artificially influence the elicited contingent values (Arrow, 1993).

One of these biases is the Starting Point Bias, which affects the answers to elicitation question when a guide value of WTP (known as starting point or bid value) is offered to the respondents. The bias is due to the fact that the respondent could perceive it as an appropriate value, perhaps what "society" or the "expert" believes this value should be. Therefore, the starting point would act as a focal point or anchor for their true value. If this happens, the estimated social benefits may result biased or distorted. (Herriges and Shogren, 1996)

[1] Some classical references for a methodological revision of CV are Cummings et al. (1986), Mitchell and Carson (1989), Bateman and Turner (1993), Hausman (1993), Bishop et al. (1995), and Hanemann (1995).

Many CV studies found that their WTP estimates are sensitive to the bid design. Some authors consider the possible existence of starting point bias serious, because it arises in a consistent and systematic way (Whittington et al., 1990; Cooper and Loomis, 1992; Whitehead et al, 1995; StÅlhammar, 1996; Phillips et al., 1997; Onwujekwe and Nwagbo, 2002). On the other hand, other authors suggest that this sensitivity is in indeed partially caused by the researcher's choice of bid design and so, that it is possible to reduce considerably the magnitude of the bias. (Kanninen, 1995; Brookshire et al., 1980; Whittington et al., 1992; O'Brien and Viramontes, 1994; O'Brien et al., 1998)

In any case, it seems to be important to pay attention to the bid design in CV studies with Starting Points. Thus, in this paper, how this subject has been treated in a particular case study will be presented. In concrete, with the aim of investigating the existence of starting point bias, three specific objectives have been pursued: (1) Designing, in a rational way, the questionnaire, in a manner that enable us to detect a potential starting point bias and minimize it; (2) Detecting the presence of a possible anchor effect of the stated WTP of respondents with respect to the offered bid values; and (3) Simulating the influence of different bid designs on the population mean WTP.

2. Case study: Application of the CV to the conservation of Iberian lynx

The treatment of the Starting Point Bias presented here has been carried out in a CV study which aims to estimate the social benefit derived from an efficient conservation plan of the Iberian Lynx (*Lynx pardina*) in Spain (Spanish Project INIA-SC-096).

Iberian lynx (Rodriguez and Delibes, 1990) is a feline species, different from the rest of lynx species. It is an endemic species to the Iberian Peninsula, and its current situation is so endangered that is accepted that Iberian lynx's existence depends on the development of an effective preservation programme (Blanco and Gonzalez, 1992). Therefore, the valuation of

an efficient conservation plan of the Iberian Lynx is quite similar to the valuation of its conservation.

The format used to elicit WTP consisted in a dichotomous choice question, with five different starting points, followed by an open-ended question. Thereby, we have attempted to achieve the advantages of both techniques and reduce their drawbacks. The dichotomous choice question format entails asking respondents whether or not they are willing to pay a fix sum of money, the starting point value for the proposed change in the provision of goods or services they are valuing. Despite the risk of committing starting point bias, the dichotomous choice format is the most commonly used technique for the CV of non-market goods and services (Herriges and Shogren, 1996; Onwujekwe and Nwagbo, 2002). In fact, its use has been recommended (e.g. by NOAA's report in Arrow, 1993) because the "take-it-or-leave-it" approach is incentive-compatible and more similar to real markets. Moreover, the use of a guide value reduces largely the higher number of "don't know" answers and the disorientation that the open-ended format involves. In the open-ended question format the respondents are asked for their maximum WTP, providing us with a considerable amount of information with no so many interviews as in dichotomous choice.

As regards the administration of the questionnaire, a pre-test survey with just open-ended format was previously conducted over 50 individuals, in order to obtain enough information about WTP distribution for the bid design. Subsequently, the survey was completed up to the total sample of 1047 people, which is representative of the Spaniards aged over 18. In this second stage, the explained dichotomous choice followed by open-ended question format was used. The sample was divided into different sub-samples, one for each starting point, according to the information collected in the pre-test, as it will be detailed bellow.

3. Results

Previously to the exposition of the main results obtained, three short observations about the data analysis must be pointed out. Firstly, the answers to the open-ended question have been used in order to determine the mean WTPs, and not the answers to the dichotomous question, thus enabling us to use and compare the means from the different sub-samples. Secondly, although the amounts are shown here in euros, the original monetary unit was pesetas, in which the sums of money were round numbers (e.g., 6.01 euros are equal to 1,000 pesetas. 1 euro = 166.386 pesetas). And finally, only the positive WTP (WTP>0) will be analyzed here. "Zero values" (WTP=0) and "protest responses" happen before the starting point be offered, so they are not affected by this value, and they just could disguise the differences among mean WTPs from the sub-samples.

3.1 Design of the dichotomous choice question

The first of the formulated objectives is the design of the dichotomous choice question, in the explained elicitation format, so that, it enable us to detect a potential starting point bias and minimize it, if that is the case. With this purpose, it has been paid a special attention to the choice of both the particular starting values and the proportions in which they are presented to the respondents.

3.1.1 Choosing the starting points

To choose the starting points in the dichotomous choice question, the information gathered in the pre-test questionnaire (with open-ended format and to 50 individuals) was used. The obtained positive WTP distribution is shown in the Figure 1, in particular, the relative and accumulated frequencies of the stated WTPs.

According to these frequencies, the quartiles 25^{th}, 50^{th} and 75^{th} were taken as appropriate starting values covering the central range of the WTP distribution. As it can be observed (Figure 1) the limits of this range match up with the two maximum relative frequencies.

In the literature, several studies can be found suggesting that, for an optimal bid design in dichotomous choice contingent valuation, it is not necessary a large number of bid points (Kanninen, 1993; Alberini, 1995) and that it is advisable to avoid starting bids at the upper and lower ends of the distribution of the WTP distribution (Kanninen and Kriström, 1993; Kanninen, 1995). However, due to the methodological nature of the present CV study, another two starting points from the tails were set. In the lower tail, the chosen value was 3 euros, which is the only one, and besides, it represents just the percentile 15^{th}, as it is recommended by Kanninen, (1995). In the upper tail, the value that represents the highest relative frequency was chosen, that is to say, 60 euros, which percentile (95^{th}) it is probably a little high, according to the same source.

3.1.2 Choosing the proportions of the starting points

In most studies which use just dichotomous choice question, the total number of interviews is allocated evenly among the various bids (Júdez et al, 2000). In this work, something unusual was done with regard to the proportion in which each starting point were offered to the respondents, in other words, the number of questionnaires in each sub-sample. It is known that, in the open-ended format, every stated WTP contributes, in the same way, to construct the sample mean WTP. However, if the anchor effect occurs, the WTPs from the sub-samples, whose starting points are higher (lower), will be, on average, above (bellow) the mean WTP. And so, they will tend to over (under) estimate the mean WTP. In our opinion, a suitable way to reduce the effect of this possible bias could be weigh up the WTPs from different sub-samples by means of choosing the number of observations carried out in each sub-sample. In

fact, Júdez (2000) found that in some cases sample allocation among the various bid levels may have a greater impact on the results than the number and magnitude of the chosen bid values. Therefore, in this study, it has been used proportions, for each starting point, similar to the obtained ones in the pre-test, instead of assigning them equal proportions as usual in dichotomous format. In the Figure 2, it can be observed that these proportions were determined by taking five intervals in the pre-tested WTP distribution, whose mean values correspond to the starting values.

3.2 Detection of the presence of a potential starting point bias

In order to detect the presence of a possible anchor effect of the stated WTP of respondents with respect to the offered bid values, in each sub-sample, several non-parametrical statistical tests has been carried out. The non-parametric analysis of stated WTP>0 in the whole survey shows that, in effect, in each sub-sample the values are clustered around its starting point, making the means significantly different among sub-samples.

In the Figure 3, it can be seen a graph representing the WTP aggregated into the five intervals *vs* the five starting points. A clear diagonal highlights how each starting point clustered around itself the highest percentage of WTP, in its sub-sample. In the same Figure 3, a contingency table shows how these percentages are indeed significantly higher. These results were confirmed at 99.9% confidence level by the *Chi-squared test* and the directional and symmetric test (ordinal *vs* ordinal) (Table 1). In the same way, *Kruskal-Wallis* and other non-parametrical tests proved statistical differences among means and medians in the sub-samples (also in Table 1).

Even the best ordered multinomial logit model to explain and predict the aggregate WTP>0 just needs to consider the starting point as independent variable (Table 2). In other words, the

starting point shows itself to be the best explicative and predictive variable for the stated WTP.

3.3 Influence of bid designs on the population mean WTP

As far as the last objective is concerned, to analyze the influence of different bid designs, regarding the chosen starting values and their relative frequencies, on the population mean WTP>0, different bid designs have been simulated. The mean WTP within each sub-sample is known, that is to say, the mean associated with each starting point. Therefore, it is possible to simulate the sample mean WTP>0 that would have been obtained with some other bid designs different from the used one, such as: equal proportions for each starting point; the dropping or no-consideration of the lower, median or upper starting-point; or any combination regarding the chosen starting points and its proportions. Moreover, since the variance of the whole sample is also known, we could approximately construct the interval for population mean WTP (at 95% confidence level, in this case). In the Figure 4, some of these simulations are shown, in both numerical and graphical ways. It is possible to draw some conclusions observing the proportions and comparing the obtained WTP intervals, which will be detailed in the next section.

4. Conclusions

In this paper a Contingent Valuation experiment has been implemented to the case of the Iberian Lynx conservation with the aim of analyze the possible influence of the bid design in the stated preferences of interviewees.

In effect, in this application, as in many other that use guide values in their elicitation technique, the presence of starting bias in the sub-samples has been detected. As expected, the stated WTPs in the sub-samples, whose starting points are above (below) population mean WTP>0, contribute to produce the over (under) estimation of this mean. The greater the

difference between starting point and mean is, the more intensive the influence results. Thus, the choice of the most suitable starting values is of fundamental importance.

In this kind of elicitation technique (dichotomous choice followed by open-ended question), it is foreseeable that, choosing sizes of sub-samples, for each starting point, similar to the pre-tested proportions, instead of equal or other different sizes, should minimize the starting point bias on the population mean WTP>0. However, in our case study, it has not been possible to provide clear evidences for this reduction. We find as possible reasons that: (1) the proportions of the starting points are symmetric in both cases ("Pre-tested WTP" and "Equal proportions"); and (2) the proportions for their starting points in the tails, which affect, in a more intensive way, to the mean WTP, are very similar in both cases too (0.17 and 0.20).

Since neither WTP distribution nor its mean value, are *a priori* known, carrying out a pre-test is considered essential to achieve a suitable design of this kind of the elicitation question, in the way it has been shown.

Thereby, the CV study to the conservation of the Iberian Lynx in Spain seems support the idea of the great importance of the questionnaire design and posterior analysis that enables us to identify and minimize the starting point bias before the estimation of social benefits.

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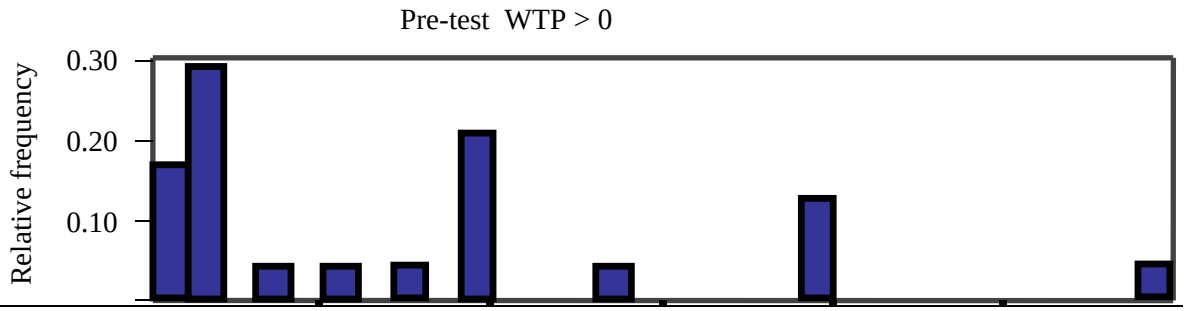
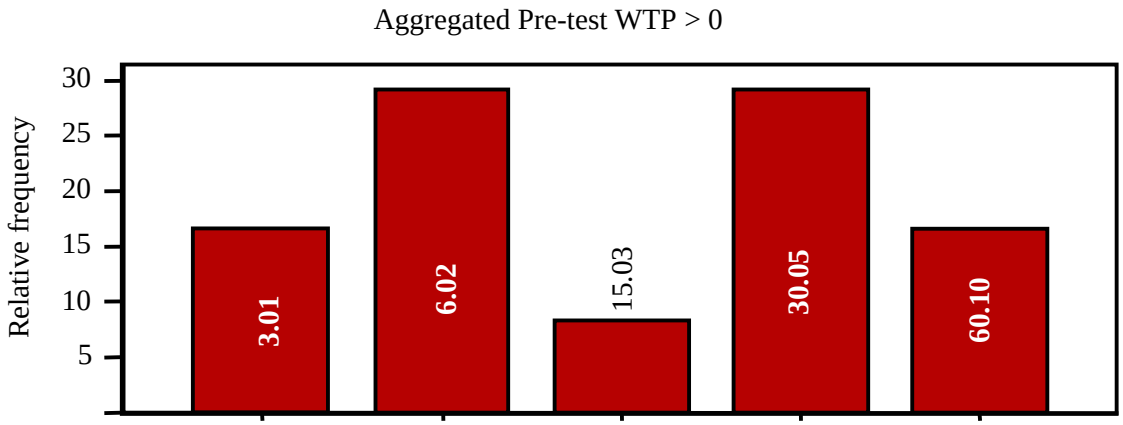
FIGURES

Figure 1. Distribution of pre-tested positive WTP and the chosen starting points



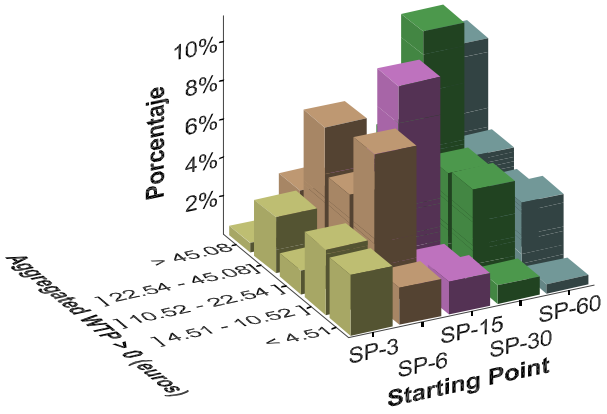
WTP	Pesetas	500	1,000	2,000	3,000	4,000	5,000	7,000	10,000	15,000
	Euros	3.01	6.01	12.02	18.03	24.04	30.05	42.07	60.10	90.15
Relative frequency		16.7	29.2	4.17	4.17	4.17	20.83	4.17	12.50	4.17
Accumulated rel. fr.		16.7	45.8	50.0	54.2	58.3	79.17	83.33	95.83	100
Starting Points		**3.01**	**6.01**		**15.03**		**30.05**		**60.10**	

Figure 2. Established proportions for each of the starting points



WTP						
	Pesetas	< 750	] 750 - 1,750]	] 1,750 - 3,750]	] 3,750 - 7,500]	> 7,500
	Euros	< 4.51	] 4.51 - 10.52]	] 10.52 - 22.54]	] 22.54 - 45.08]	> 45.08
Relative frequency		16.67	29.17	8.33	29.17	16.67

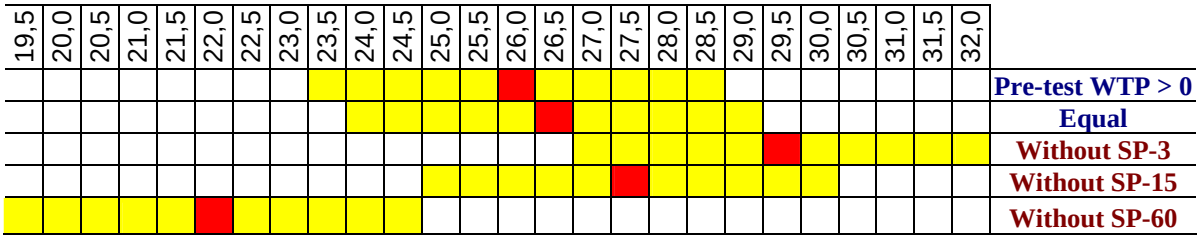
Figure 3. Aggregated WTP>0 vs Starting points (Graph and Contingency Table)



			Aggregated WTP > 0 (euros)					Tot (%)
		Contingency Table	<4.51	]4.51-10.52]	]10.52-22.54]	]22.54-45.08]	>45.08	
Starting Point	SP-3	% of total	3.2	3.4	1.2	2.9	0.5	11.2
		Adj. Std. Residual	**5.2**	1.7	-2.1	-0.6	-2.6	
	SP-6	% of total	1.9	7.8	4.6	7.0	2.7	24.0
		Adj. Std. Residual	-0.1	**3.2**	-1.0	-0.1	-2.1	
	SP-15	% of total	1.7	1.2	9.7	4.9	2.4	19.9
		Adj. Std. Residual	0.1	-3.7	**6.2**	-1.2	-1.6	
	SP-30	% of total	1.0	4.9	4.6	10.9	4.1	25.5
		Adj. Std. Residual	-1.9	-0.5	-1.4	**3.4**	-0.6	
	SP-60	% of total	0.5	3.6	2.9	3.9	8.5	19.4
		Adj. Std. Residual	-2.1	-0.5	-1.9	-2.1	**6.6**	
Total (%)		% of total	8.3	20.9	23.1	29.6	18.2	100

Figure 4. Simulation of the influence of different bid designs on the population mean WTP > 0

Sub-Samples		SP-3	SP-6	SP-15	SP-30	SP-60	Sampling Mean WTP>0	95% Confidence Interval for Population Mean WTP > 0
Sub-sampling Mean WTP>0		14.93	21.19	24.52	27.96	43.09		
Pre-test WTP > 0	Sampling Proportions	0.17	0.29	0.08	0.29	0.17	**26.05**	[23.60 - 28.50]
Equal		0.20	0.20	0.20	0.20	0.20	**26.34**	[23.89 - 28.79]
Without SP-3		0	0.25	0.25	0.25	0.25	**29.19**	[26.74 - 31.64]
Without SP-15		0.25	0.25	0	0.25	0.25	**26.79**	[24.35 - 29.24]
Without SP-60		0.25	0.25	0.25	0.25	0	**22.15**	[19.71 - 24.60]



TABLES

Table 1. Chi-squared, directional, symmetric (ordinal vs ordinal), and other non-parametric tests

Starting Point vs Aggregated WTP > 0			Value	Sig.
Chi-square Test	Pearson Chi-Square	(d.f.=16)	124.50	0.000
Directional Test (Ordinal vs Ordinal)	Somer's d	Symmetric	0.26	0.000
		Depend. SP	0.27	0.000
		Depend. WTP	0.26	0.000
Symmetric Test (Ordinal vs Ordinal)	Kendall's Tau-b		0.26	0.000
	Kendall's Tau-c		0.26	0.000
	Gamma		0.33	0.000
	Spearman's correlation		0.31	0.000

Starting Point *vs* Continuous WTP > 0 (Non-Parametric Test)			Value	Sig.
Kruskal-Wallis Test	Chi-2	(d.f.=4)	41.43	0.000
Median Test	Chi-2	(d.f.=4)	24.77	0.000
Jonckheere-Terpstra Test	J-T Standard Statistic		6.53	0.000

Table 2. Ordered Multinomial Probit Model for Aggregated WTP >0

Ordered Multinomial Probit Model

Variable	Coefficient (β)	Std. Error	t-ratio (β/e)	t-ratio Signif.
Constant	0.7305	0.1528	4.781	0.0000
StartP-6	0.5225	0.1797	2.908	0.0036
StartP-15	0.6987	0.1927	3.626	0.0003
StartP-30	0.9078	0.1824	4.977	0.0000
StartP-60	1.3119	0.1806	7.263	0.0004

Dependent variable: Willingness to Pay (WTP >0); Data: 412

Restricted -2 Log: -635.1710; -2 Log Likelihood Function: -610.1217

Chi-square: 50.0985 (d.f.=4); Signif.: α < 0.0E-6 (p > 99.9%)

Correct classification percentage: 30.10%

Expected probabilities

WTP > 0	**<4.51**	**]4.51-10.52]**	**]10.52-22.54]**	**]22.52-45.08]**	**>45.08**
StartP-3	**0.23**	**0.36**	**0.22**	0.17	0.04
StartP-6	0.11	**0.26**	**0.25**	**0.28**	0.12
StartP-15	0.08	**0.22**	**0.24**	**0.30**	0.15
StartP-30	0.05	0.18	**0.23**	**0.33**	**0.21**
StartP-60	0.02	0.11	0.18	**0.35**	**0.34**