Using conjoint analysis to quantify public preferences over the environmental impacts of wind farms.

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1. Introduction

The Kyoto Protocol established an objective for the European Commission of increasing the fraction of electricity consumption derived from renewable sources to 12% (by the 2010) against the 6% of today (European Commission, 1997). Few countries have accomplished this objective as of the present. Spain has a high wind energy potential, due not only to excellent wind resources but also the high level of technology development which has occurred. Spain has increased its share of total electricity production attributable to wind energy since the end of the 1980s, becoming the third highest-share (1358 Mw) country in Europe in power installed after Germany and Denmark with 4443 Mw and 1751 Mw respectively. This share is planned to increase in the next years, but there are two aspects of this that deserve closer attention.

One concerns the institutional changes needed to make possible this move towards a more sustainable production of energy, in terms of market regulation and subsidies. The other is concerned with the environmental impacts, both positive and negatives, associated with this move. Both aspects are closely related through the preferences of producers and consumers. With liberalisation of the electricity market, certain types of consumers (called qualified consumers) can choose their supplier of electricity and in the medium term this possibility will be extended to all consumers. Environmental concerns may play an important role in the decision process over the choice of suppliers, along with other considerations such as cost and length of contract. In this paper, we report on research designed to provide insight into these preferences[1].

[1] For a detailed analysis for the US, see Train et al (2000).

2. Wind energy in Spain

The benefits of producing renewable energy from wind are well known. Relative to other non-fossil fuel sources, the technology does not require the same high level of investments[1] as nuclear, tidal or thermal power. Wind energy investments also have the potential to enhance economically depressed rural areas (Hanley and Nevin, 1999). Spanish wind farm investments have mainly been undertaken by the electric utilities, regional energy agencies and manufacturers (Varela, 1999). Since 1998, Spanish producers have three options to sell their electricity: directly in the market; to a consumer (only if qualified[2]), and/or to distributors. Almost all of the energy produced from existing wind energy plants supplied to the network is in the hands of big distributors (two of them control the 76% of the electricity market[3]). Power installed in wind farms represents 3.11% of total installed capacity in Spain at 43,662 MW, accounting for 1.8% of the total energy consumed in the peninsula in 1999. Production from wind energy is around 40% of total Spanish renewable energy output. Power installed, production and the number of wind farms have all been increasing over the last decade, particularly since 1992 (Figure One), stimulating a growing debate on the environmental effects of this fast growth.

Figure One. Trends in Spanish Wind Power

Increasing opposition to the development of new wind farms has mainly come from those living close to developments; in contrast, attitudes towards renewable energy on the part of the general public is generally positive. The perception of the visual impacts of new wind farms, as well of the perceived benefits of an energy production pattern with avoids fossil fuel use, is likely to be strongly influenced by social factors and attitudes. The quantification of impacts will thus depend on these social aspects, as well as on environmental and technical factors. The environmental benefits of electricity production from renewables are well recognised and accepted, but the environmental costs are less known (EC, 1995; Hanley and Nevin, 1999). One of the most difficult-to-quantify of these environmental costs is visual impacts, whether from wind, solar or hydropower developments. Such costs are likely to be highly case-specific. However, any comprehensive economic assessment of the case for expanding wind energy must at least attempt to incorporate the value of environmental impacts (Rozakis et al., 1997;

Stevenson and Peasley, 1995; Stirling, 1997). Perceived impacts will also affect resistance to wind energy developments at the local level. In this paper, we apply conjoint analysis techniques to understand public preferences towards wind energy developments, including environmental impacts as one of the "attributes" of energy investments. Our application relates to a particular prospective development in the Zaragoza regime of Spain.

3. Choice of Methodology

Conjoint analysis techniques have been widely applied in marketing, psychology and transportation research, and environmental economics (Green and Srinivasan, 1978,1990; Louviere, 1988; Hensher, 1994; Hensher et al., 1988). A central feature of this approach is that the utility derived from a good or service can be decomposed into part-worths relating to different attributes of that good or service (Lancaster, 1966). The approach can equally be applied to project or policy evaluation. This means that, in our case, it is possible to determine simultaneously the relative importance of the different environmental factors affecting wind farms development, where these are viewed as separate attributes of the service "energy supply".

The term "Conjoint Analysis" is used to describe a number of related stated preference techniques, which have in common a number of features:

1) They are based on a set of attributes or features describing the good, service, project or policy, each taking a number of pre-specified levels;
2) These levels and attributes are combined to build up descriptions of hypothetical bundles, using experimental design techniques;
3) Individuals are asked to state their preferences over these alternatives, using a number of different protocols;
4) Responses are then analysed using statistical models.

From (4), part-worths can be estimated which measure the marginal utility associated with any particular attribute. The economic value of changes in the value of a good, service, project or policy as its attribute levels change can also, in most cases, be estimated. As Hanley and Mourato (2001) note, there are many variants of conjoint analysis, which vary both in terms of how they are applied and in terms of the degree to which the estimates of value they produce are consistent with economic theory. In this study, two conjoint analysis techniques were used: contingent rating and choice experiments.

3.1 Contingent rating

This approach has been extensively applied in psychology (Anderson, 1982) and marketing (Wittink and Cattin, 1989). It has recently been applied within environmental and agricultural economics, for example in Sánchez et al, (1997); Álvarez-Farizo, (1998); Álvarez-Farizo et al. (1999); and Sánchez and Pérez y Pérez, (1998). A contingent rating exercise (CR) consists of scoring alternative options (hypothetical products, projects, policies or services) using a rating scale. Options are not directly compared with each other, but are evaluated sequentially. Anderson (1982), Lynch (1985) and Louviere (1988) proposed information integration and social judgement theories as a theoretical basis for this approach, which basically are concerned with the process by which individuals form holistic evaluations from this kind of information.

This holistic evaluation is then expressed through a scale with cardinal information. Scores are often assumed to be linearly related to an underlying utility function.

Recently, however, critics have questioned this transformation from a rating score to utility equivalents (Roe et al, 1996). Cardinality of the scale assumes that unit differences are the same no matter the numerical value of that scale. That is the increase (or decrease) in one point has the same value from any point of departure. Furthermore, there is another difficulty regarding the comparability of the rating across alternatives. Roe et al (1996) suggest the use of centring points, such as the status quo, and build up an independent variable of differences from the status quo[4]. This can be useful to set the origin point for each individual but we still will not know if the units are the same for every individual or if any score represents the same utility for any two people.

Another problem with contingent rating is when respondents value one option higher than another but it is the latter the one which they can afford (Morrison et al., 1999). Stevens et al (1997) provided some evidence of the biases in the estimated coefficients that can take place. If the individual takes account of his budget during the scoring process this problem can, however, be notably reduced.

Typically, indirect utility U (as a function of a vector of attributes of the good in question (x) and a vector of socio-economic characteristics(s)) is related to the ratings the individual makes through a transformation function:

$$r_i(x,z,s,p) = f[U_i(x,z,p,s)] \qquad (1)$$

where r_i is the *rating* for good *i*, *z* is a composite good, and *p* are prices. Ratings are regressed on the attributes describing the alternatives,

$$R = b_0 + b_1 x_1 + ... + b_k x_k \qquad (2)$$

If ratings do not satisfy the assumption of equality of scale of unit differences, then simple OLS will yield biased and inefficient estimates (Mackenzie, 1992). We used the doubled censored Tobit method (Lin et al., 1996 and Sánchez et al., 1997) due to the censored nature of the data. The rating value assigned by the individual to any given alternative has a continuous character[5] and follows the form as shown below

$$Rating = \begin{cases} 0 \text{ if } rating^* \leq 0 \\ rating^* \text{ if } 0 < rating < 10 \\ 10 \text{ if } rating^* \geq 10 \end{cases} \qquad (3)$$

where "rating" is the term r_i from above and "rating*" a hidden slack variable which is related to the explanatory variables.

3.2 Choice experiments

In choice experiments, individuals are faced with a series of choices over pairs or three-way combinations of alternatives. From each choice set, respondents must choose their preferred option, taking into account that the status quo is typically included in the choice set. As with the previous approach, the indirect utility function is expressed as a function of a vector of attributes of the (environmental) good (x), a composite good (z), a vector of socio-economic characteristics and prices:

$$[U^n(x,z,p,s)] \qquad (4)$$

where the superscript *n* refers to the individual.

Choice experiments are consistent with random utility theory, which assumes that individuals seek to maximise their utility probabilistically, recognising certain randomness due the inability of the analyst to identify all aspects affected by choices[6] (Thurstone, 1927; McFadden, 1973). From this, the utility can be decomposed in two parts, one deterministic (*V*) and one stochastic (*e*). The deterministic, or explainable, part of utility (*V*) is assumed to be determined by individual (s) and attribute-specific (x) characteristics:

$$V_i(x,s) + e_i \qquad (5)$$

It is then possible to predict which option will be selected by the individual from the universal choice set C. The probability of choosing option i against any other option j, can be expressed as:

$$P\left[\left(U_i > U_j\right)\forall j \neq i\right] = P\left[\left(V_i - V_j\right) > \left(e_j - e_i\right)\right] \qquad (6)$$

Assumptions about the error distribution (*e*) determine a specific expression for this probability. A general practice in applied studies is assuming a Weibull (extreme value) distribution which is independent and identically distributed (Hanley and Mourato, 1999). This leads to the expression of the probability of choosing i in terms of the logistic distribution (McFadden, 1973), specified as a conditional logit model:

$$P\left[\left(U_i > U_j\right)\forall j \neq i\right] = \frac{\exp\left(mV_i\right)}{\sum_j \exp\left(mV_j\right)} \qquad (7)$$

Here *m* is a scale parameter, inversely related to the standard deviation of the error term. This parameter is not separately identifiable from the vector of *b* parameters and it is typically assumed to equal one. An important implication of using the conditional logit model is that any choice must satisfy the property of Independence of Irrelevant Alternatives (Luce, 1959), which states that the relative probability of selection of any two options will not be affected by introducing or subtracting any other. This property derives from the independence of the error term through all the choice set.

Estimates of (7) yield parameters for each attribute, which can be interpreted as part worths. The parameter on cost, if cost is included as an attribute, is interpreted as the marginal utility of income. Typically, alternative specific constants (ASCs) are also estimated (Train, 1986). ASCs capture the unobserved factors that can explain choice, reflecting the mean of the differences in the error terms (Ben-Akiva and Lerman, 1985). This gives a zero mean for the non observed utility and the average probability of selecting each alternative in the sample being equal to the proportion of respondents who have chosen that option. Individual characteristics (such as income or age) can be included in the model interactively with ASCs (Swallow et al 1994).

Welfare estimates can be derived from multinomial logit models in the form of compensating surplus (CS) (Hanemann, 1984; Parsons and Kealy, 1992). Superscripts in V represent utility in the initial (0) and posterior (1) change:

$$CS = \frac{1}{b_y} \ln \left\{ \frac{\sum_i \exp\left(V^1\right)}{\sum_i \exp\left(V^0\right)} \right\} \quad (8)$$

which can be simplified as

$$CS = -\frac{b_c}{b_y} \quad (9)$$

with b_c as the coefficient of any attributes, and $\hat{a}_y$ is the coefficient on cost, if we are only interested in the value of marginal changes in specific attributes. This welfare measure will be theoretically correct so long as the status quo is included among the options in the choice set, since otherwise individuals will be forced to choose even if they prefer no change.

We now describe the case study to which these two methods (contingent rating and choice experiments) were applied.

4. Description of the case study site

La Plana of Zaragoza is a limestone plateau some 600 meters in height, with a very important natural heritage. Between 20 and 30 million years ago, the Ebro basin was filled up with incoming water which had no route of escape to the sea. When it dried up, the salts precipitated into gypsum, forming what is known as the *Formación Zaragoza*. As the basin drained, up to 5 million years ago, tributaries excavated these sediments and limestone ledges appeared flanking the river. These are now known as Borja, La Muela and La Plana in the south and La Bárdena, El Castellar and Alcubierre in the North.

La Plana appears as an island in Ebro´s valley, with its own microclimate and characteristic fauna and flora. A great part of its ecological value derives from the existence of birds of prey including several species of eagle, goshawk, eagle owl, sparrowhawk, who nest in the gypsum cliffs or in old pines. These gypsum areas are included in the European Directive of Habitats. To the south, La Plana is the last undeveloped remnant of the limestone tableland; the remainder has become covered with wind farms and illegal second residences. However, plans exist to develop new wind farms on La Plana.

5. Design of the questionnaire

In conjoint analysis, the analyst creates the descriptions of the options in terms of what she considers to be the main descriptive characteristics of the good. The only information about the good provided by the respondent is his choice or rating of these options. The respondent's overall preferences are then decomposed into the value of each attribute and level. This is what makes the design of the questionnaire in general and the selection of attributes in particular so important. Following Lancaster (1991), selected attributes must be relevant, that is, 'if ignoring its existence would change our conclusions about choice or ordering of the goods by the consumer'. Blamey et al (1997), state that priority must be given to demand-relevant, policy-relevant and measurable attributes. In selecting attributes and their levels is more than convenient to have the co-operation of experts and stakeholders (focus groups), including policy makers, in a guided discussion to provoke people to express their attitudes and opinions on the topic in question. Our aim in this study was to identify and then evaluate attributes relevant to preferences over alternative wind energy developments in the La Plana area.

5.1 Survey information and design

Following focus group work, a pilot survey was used to identify the appropriate bounds and levels for the cost attribute, using contingent valuation (Bateman and Willis, 1999). Cost levels chosen were 500, 1000 and 1500 PTAs per annum. Consultations with experts and concerned groups help us to identify the main non-cost attributes and their possible levels. Attributes selected were impacts on cliffs, fauna and flora and the landscape. Due to the characteristics of the soils no other levels could be considered except protection or loss (that is, two level per environmental attribute). Erosion occurs due to construction of roads and installation of turbines, etc. Effects on habitat are due to bird fatalities from impacts, and lower nesting success due to increased habitat disruption. Combining all these options we have three attributes with two levels each and a fourth with three levels. This gives a maximum possible number of 24 combinations, which is too many for respondents to cope with. Following Addelman's (1962) methodology we can identify a minimum efficient set of combinations with an orthogonal factorial experimental design. This yielded eight possible combinations for wind energy development at La Plana. These are shown in Appendix 1, along with the rest of the questionnaire. Fractional factorial designs allow main effects to be identified (that is, the effect on utility of each attribute acting alone), but do not allow cross-effects to be studied.

The questionnaire comprised three parts. The first asked a series of questions regarding peoples' attitudes towards the environment; the second introduced information concerning electricity production from renewable sources, and contained the contingent rating and choice experiment questions; whilst the third collected socio-economic information. Four pictures were shown to respondents before the preferences questions were asked, two real ones and two manipulated with Adobe Photo Shop showing the likely effects from the installation of windmills in La Plana. Before respondents were given the choice questions, they were told the following:

"There is a wind farm project planned for La Plana. Production of energy from windmills does not pollute, but, due to the large amounts of land required (to install all the windmills) involves the following effects:

- lost of a natural area
- Increasing development threats through provision of access roads
- visual impacts
- loss of a migratory birds corridor

Now, please read each of these cards carefully. Each of them refers to the different options for La Plana protection. At the bottom there is an amount in pesetas which corresponds to the cost per household for the implementation of that option. This amount would be collected via an increase in taxes."

Cards like that shown in Figure Two were shown to respondents. In the contingent rating sample, respondents were asked to rate each option on a scale of one to ten (from least to most preferred). In the choice experiment, respondents were asked to choose which option they preferred most from a series of three-way choices (option A, option B or the status quo), where "A" and "B" varied over choice occasion. This choice task was repeated four times for each respondent.

Figure 2 here

The survey was implemented using personal interviews during December 1998 in Zaragoza. Some 488 usable questionnaires were obtained.

5.2 Sample description.

Individuals were asked about principal concerns related to the environment as well their interest in ecology. Less than 6% stated a direct interest in ecological matters, although 64% were indirect "consumers" of natural science through TV programs. With this information we created a dummy variable *attitude* taking the value one when individuals were concerned or at least interested in the state of nature in general. Only 19% of the sample had visited the La Plana area at any point in the past. From this we constructed another dummy *know* being equal to one when the respondent had visited the site. *Know* and *attitude* are the two variables which were interacted with the attributes to obtain a stratified valuation by interest group.

Information about attitudes towards ecology and the environment was related to knowledge on what people saw as the main environmental problems at a global scale. In general, all the groups stated as the two main problems ozone layer depletion and drought, followed by species extinction. It is interesting to notice that for those not especially concerned and/or interested in the environment the main problem was the drought[7]. Figure 3 shows interactions between attitudes and concerns.

Figure 3. Public Attitudes & Concerns

Table 1 presents socio-demographic information for the sample.

6. Results

6.1 Choice Experiment

Equation (7) was estimated using the following attributes to describe the energy investment alternatives:

- Cliffs: 1 if protection of cliffs, 0 loss

- Fauna & Flora: 1 if protection, 0 loss

- Landscape: 1 if protection, 0 loss

- Cost: cost of the alternative to the individual (500, 1000 or 1500 PTAs.)

- Asca, Ascb: are Alternative Specific Constants for option a and b.

- Attitude: Coded from 1 to 5 (deeply concerned about environmental issues to not concerned at all)

- Income: Monthly respondent's household net income

Results are given in Table 2. As may be seen, all three environmental attributes are strongly significant. Given that each of these attribute parameters is positively signed, we can also infer (as expected) that protection is valued more highly than loss. From the relative size of the parameters, we can also observe that conserving flora and fauna from wind farm developments is ranked more highly than either preserving the landscape (ranked second) and protecting the unique cliffs (ranked third). Implicit prices for each of these attributes are simply obtained from equation (9), and are shown in the last column of Table 2. These show the marginal willingness to pay (WTP) to go from one level of the attribute to the other. The parameter on *cost* is only weakly significant, although it does have the correct sign. This shows that respondents preferred cheaper designs to more expensive ones.

For the multinomial logit model we have tested for the IIA Property with the Haussman and McFadden test (1984), resulting in a chi-squared statistic of 176.97 with four degrees of freedom. This implies that the null hypothesis that IIA holds for this data set cannot be rejected.

6.2 Contingent Rating results

From section 3.1, we know that rating scores can be related to attribute levels. The approach taken was to estimate:

$$Rating^* = b_T + b_1 * Cliffs + b_2 * Habitat + b_3 * landscape + b_4 * \text{cost} + know\_cliffs + know\_hab + know\_land + know\_money + atti\_cliff + atti\_hab + atti\_land + atti\_money$$

(10)

where:

$$Rating = \begin{cases} 0 \; if \; rating^* \leq 0 \\ rating^* \; if \; 0 < rating < 10 \\ 10 \; if \; rating^* \geq 10 \end{cases}$$

In this case, we assume that random perturbations are distributed for each observation with zero mean and constant variance (s^2), coinciding with the variance of the hidden slack variable, which in turn is scattered according to a normal distribution. We used the doubled censored Tobit method (Lin et al., 1996 and Sánchez et al., 1997) due to the censored nature of the data. Variables for this model were coded as for the choice experiment reported above, apart from *attitude*, coded here as 1 for those concerned or interested (as stated above) and 0 for those not concerned, and *know* coded here as 1 if the respondent had already visited the site, and 0 otherwise.

Table 3

Table 3 gives results for the model in equation (10). This shows consistency with the choice experiment results in two important respects. First, all three environmental attributes are again significant determinants of preferences for wind energy investments. Second, impacts on flora and fauna are rated higher in terms of preferences than impacts on landscape or on cliffs. Cost is more significant than in the choice experiment, and again negatively signed: the higher significance level of cost in the contingent rating exercise seems to imply that respondents paid more attention to the cost parameter when evaluating alternatives in the rating exercise than in the choice experiment.

In Table 4, we compare implicit prices (that is, values) for the three environmental attributes using the two different methods. As may be seen, the choice experiment method gives higher values than contingent rating. This is not a comparison which has been drawn so far in the environmental economics literature. It is also interesting to make a distinction between individuals especially concerned with the environment in general and those who are not, in terms of their implied values for protecting this particular part of the environment from wind farm developments. Results from such a comparison are given in Table 5, where *concerned* is constructed from the same data as the *attribute* variable referred to above. As may be seen, those who were concerned about the environment in general have higher WTP to protect the environment from wind farm developments than those who are not concerned: this makes sense.

7. Conclusions

In this paper, we have shown how two alternative choice modelling techniques can be used to estimate the effect on people's utility of the potential environmental impacts of windfarm developments. In both cases, impacts on flora and fauna are valued more highly than impacts on landscape or on the geologically-rare cliff sites. Taken together, our results show that signficant social costs in the form of environmental impacts can be associated with wind farm developments. As relative environmental values are revaled by these methods, it would be possible develop wind farms in such a way that minimises the total social costs of the investment and which maximises its net benefits. Such an exercise is an intersting avenue for future research. Methodologically, we found that choice experiments gave higher estimates of willingness to pay to prevent environmental damages than contingent rating. This may be because respondents do not appear to have given as much attention to the price characteristic in the choice experiment study as in the contingent rating study in this case.

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Figure 1. Spanish Wind Evolution

Figure 2. Sample choice card

Option A	Option B
Protection of cliffs	**Protection of cliffs**
Loss of Habitat and Flora	**Protection of Habitat and Flora**
Protection of Landscape	**Loss of Landscape**
Cost: 1000 Ptas	**Cost: 1500 Ptas**

Figure 3. Public Attitudes & Concerns

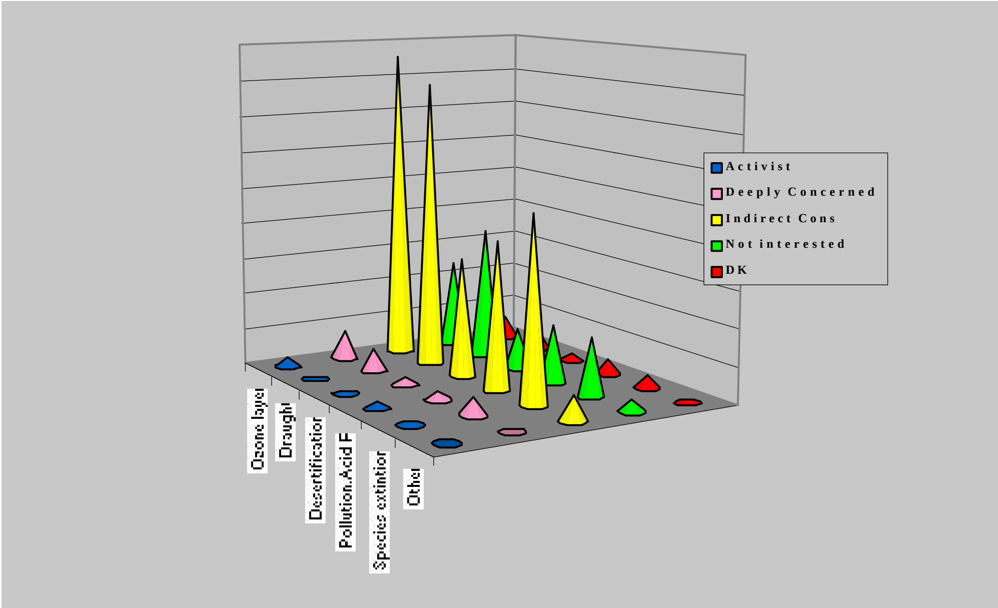

Table 1

Sample characteristics

Age			Income			Household size	
Up to 30	42.5%		**Up to 25,000**	1.64%		**1**	4.9%
Up to 40	18.9%		**25,000-100,000**	11.7%		**2**	17.0%
Up to 50	14.0%		**100,000-200,000**	43.0%		**3**	23.8%
Up to 60	14.8%		**200,000-300,000**	26.8%		**4**	34.4%
Up to 80	7.8%		**More than 300,000**	16.4%		**5**	15.0%
More than 80	1.0%					**More than 5**	3.5%

Education			Profession	
Primary	26.4%		**Employed**	39.6%
Secondary	33.0%		**Self Employed**	12.9%
University	40.6%		**Business men**	2.9%
			Retired	5.9%
			Housewife	10.9%
			Students	21.3%
			Unemployed	6.5%

Table 2

Choice experiments results from conditional logit model

	Parameter estimate (t-statistic)	Implicit Price, Pta. /yr
CLIFFS	1.11 (11.8)	3,580
FAUNA & FLORA	1.95 (22.9)	6,290
LANDSCAPE	1.91 (13.9)	6,161
MONEY	- 0.00031 (-1.5)	
ASCA	-3.15 (-9.5)	
ASCB	-1.8 (-4.9)	
ASCA_INCOME	0.06 (2.0)	
ASCB_INCOME	0.03 (1.0)	
ASCA_ATTITUDE	0.103 (1.5)	
ASCB_ATTITUDE	-0.122 (-1.7)	
Log-L function **R^2 no coefficients** **R^2 constants**	-1540.026 0.282 0.25	

n = ??? 488 individuals (1952 choice sets)

Table 3

Contingent rating model estimates

	Parameter estimate (t-statistic)
CONSTANT	-0.72 (-4.7)
CLIFFS	2.96 (16.7)
FAUNA & FLORA	3.94 (22.2)
LANDSCAPE	3.34 (18.9)
MONEY	-0.99 (-5.6)
KNOW_CLIFF	0.67 (2.8)
KNOW_FAUN	0.26 (1.1)
KNOW_LAND	0.12 (0.5)
KNOW_MONEY	-0.25 (-1.1)
ATTI_CLIFF	-0.03 (-0.2)
ATTI_FAUN	0.004 (0.2)
ATTI_LAND	-0.07 (-0.3)
ATTI_MONEY	0.35(1.9)
Sigma	2.9 (70.3)

n = 463 individuals (3704 obs.)

Table 4: Comparing choice experiment and contingent rating estimates of environmental costs

	Choice Experiment	**Contingent Rating**[1]
Cliffs	3,580	3,062
Fauna and Flora	6,290	3,978
Landscape	6,161	3,378

Notes: all values in pesetas
1: weighted average across all groups in sample

Table 5 Contingent Rating values by group

	Concerned & Know	**Not concerned & Know**
Cliffs	4,042	2,928
Fauna & Flora	4,723	3,387
Landscape	3,802	2,787

Endnotes

[1] The costs per kW installed have been decreasing since 1986 due to a reduction in production, operativity and maintenance costs; to higher windmills which can receive faster winds; better knowledge of the technology; higher efficiency and availability of windmills (Varela, 1999).
[2] From October 1999 consumers above 1 Gwh and from July 2000 those with (tension?) above 1000 volts independently of the level of consumption.
[3] This concentration is partly due (OECD) to the objective of Spanish government of favourishing size and power of companies in the European market.
[4] There is no possible to apply the difference model to any collection of data, for that is necessary to have the status quo among the options being evaluated.
[5] The individual can give any score between 0 and 10, not necessarily an integer.
[6] The analyst cannot ‘observe’ the utility. She can get information about the choice and the observable part is referred with the attributes and characteristics of the good and the individual, respectively.
[7] Drought is a cyclic problem in Spain.