Modeling 'No-choice' Responses in Attribute Based Valuation Surveys

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Summary

We examine the impact of providing a 'no-choice' option in an attribute based valuation experiment. The aim of the experiment was to assess monetary values of cockle fishery management practices in the Dutch Wadden Sea for different stakeholder groups, namely Dutch citizens, local residents, and tourists. The current policy debate about the management of the Wadden Sea stresses the fact that individual preferences with respect to cockle-fishery differ. The aim of this paper is to analyze the individual preferences in an objective way. Special attention is given to the influence of including a 'no-choice option', which is analyzed using a nested logit model. We test whether the full set of policy options can be considered as close substitutes. The estimation results show that the influence of including the no choice option differs among the stakeholders considered.

Keywords: Stakeholder valuation, Stated choice method, Multinomial logit model, Binary logit model

JEL Classification: C25, C29, Q22, Q25, Q51

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1. Introduction

Attribute based valuation studies are increasingly being used in non-market valuation, and in environmental valuation in particular. An important methodological issue is whether or not a no-choice option should be added in attribute based valuation experiment (Banzhaf et al., 2001). An important motivation in favor of this option is that in this way a respondent is not being forced to make a particular valuation choice. The reason for this can be either that the respondent has no interest in any of the alternative options or that she is indifferent between them. There are few empirical applications in the field of environmental valuation that have modeled and estimated the 'no-choice' option in the context of an attribute-based choice experiment. One of the first attempts to deal with this issue empirically concerned an application to health economics (Ryan and Skåtun, 2004).

The main focus of this paper is methodological. We aim to systematically examine the structure of preferences of different stakeholder groups regarding the 'no-choice' option. This has the advantage that a comparison of preferences is possible among stakeholders within a single valuation context, which allows for a more robust testing of the effect of include a 'no-choice' option. The application context is one where respondents are confronted with alternative management practices regarding the cockle fishery activities in the Dutch Wadden Sea. This concerns a problem that most Dutch citizens will be very familiar with, which contributes to the relevance and reliability of the valuation exercise. The 'no-choice' option will be modeled simultaneously with the fishery management options in a stated choice experiment. A nested logit model will be used for this purpose. The stakeholder groups include (i) Dutch citizens, (ii) local residents, and (iii) tourists.[i] Separate nested logit models will be estimated for each stakeholder group. In

addition, we compare the predictions of each stakeholder model and find that the parameters of these models differ significantly across the stakeholders. This gives a signal that there is heterogeneity in the structure of preferences, in this case with respect to alternative fish management practices.

The reminder of the paper is organized as follows. Section 2 describes the current situation concerning the management of the Wadden Sea. Section 3 presents the survey instrument, and identifies the alternative management scenarios in the survey. Section 4 sets the theoretical framework for analyzing the no-choice option exploring the use of the three different models in Figure 1. These will in turn be applied to the data provided by Wadden Sea valuation exercise. Section 5 presents the empirical results. Section 6 concludes.

2. Application context

Shell-fishery causes important negative impact on overall marine environmental quality. The environmental impact of cockle-fishery, an important economic activity in the Dutch Wadden Sea, has been subject to much public and scientific concern. According to environmental organizations, the process of mechanical shell fishing altered the sediment structure of seabeds in an irreversible way (De Waddenvereniging[ii]; Stichting Odus, 2001[iii]). An additional negative impact of cockle fishery is withdrawing a great amount of cockles from the food web in the Wadden Sea. In particular, cockles constitute an important element of the diet of the bird population in the Wadden Sea (EVAII., 2003). In order to minimize the negative environmental impact of cockle fishery, the current fishery is regulated by the central government. The overall objective is to define precise food requirements, on the advice of biological experts, for bird populations spending the winter-time in the

Wadden Sea. These requirements can be translated into harvest standards for cockle fishery. The current cockle-fishery policies involve two main restrictions for fishermen: 1) in some areas it is not allowed to fish; and 2) a quota is set on total fish catch by the sector to reserve food for birds. These conditions do not imply, however, that the relationship between cockle fishery and environmental quality in the Wadden Sea is fully understood. The current public debate about cockle fishery management plans in the Wadden Sea makes very clear that the opinions as to whether current cockle fishery is ecologically sustainable differ considerably. This makes the incorporation and comparison of stakeholders in a valuation exercise the more interesting.

3. The survey instrument

To assess individual preferences with respect to alternative cockles fishery management practices, and to identify which policy measures are the most preferred across the different stakeholders, we make use of the attribute based stated choice method (Louviere et al., 2000). The stated choice (SC) valuation method asks respondents to make a choice between alternative goods, defined in terms of their attributes. In the present experiment, goods are described in terms of cockle fishery management plans. Each management plan in turn is characterized by a set of attributes or characteristics. The identification of the range of attributes to be considered in the valuation exercise, as well the accompanying attribute levels, were set in deliberation with natural scientists. Three groups of policy measures emerged as relevant in the design of fishery management options for the cockle fishery in the Wadden Sea: 1) *area* policy measures: this refers to any change the surface area where fishing is allowed; 2) *quota* policy measures: this refers to any reduction in the

amount of cockles the fishery sector is allowed to fish; and 3) *rotation* policy measures: this refers to any policy that involves rotation of the areas where fishing is (not) allowed. A fourth attribute variable indicates the changes in the number of birds, which are interpreted as a proxy for marine ecosystem quality. A fifth, monetary attribute variable refers to a one time lump-sum amount that would be introduced as an implementation of a national *Wadden Sea* tax, which would be linked to the management scenario described in the survey. This gives a total of five distinct variables for our stated choice valuation exercise, which are summarized in Table 1.

< Insert Table 1>

The combination of all stated choice attributes, and respective attribute levels, allowed us to create a full factorial design. The outcome of such a procedure results in a very large choice set. We resized this by eliminating (1) the dominant alternatives and (2) all policy combinations that reveal to be internally inconsistent. Furthermore, we only constructed choice questions consisting of the current situation (status quo), an alternative scenario and the no-choice option. This resulted in 168 different choice sets. Presenting each respondent with 168 choice questions is definitely not feasible. We choose to present only eight different choice questions to each respondent. The 168 sets are then divided over 21 versions of eight questions, which were distributed randomly among respondents. Figure 1 gives an illustration of our stated choice valuation questions.

<Insert Figure 1>

We propose introduce an innovative aspect of the attribute based stated choice methodology by taking into account different stakeholder groups, including (i) Dutch citizens, (ii) local residents, and (iii) tourists. Table 2 summarizes some characteristics of the respondents within each stakeholder group.

<Insert Table 2>

4. Econometric analysis

In a stated choice exercise involving two alternatives and a no-choice option, the correct method of analyzing depends on the cross-elasticities between the three different choice options. In the Wadden Sea valuation experiment, we consider two survey described alternatives, which correspond to two fishery management policies: the current fishery management practice (option A) and the alternative management scenario (option B). Following the line of reasoning of Ryan and Skatun (2004), we can identify three possible model formulations that capture response behavior in the current survey design setting.

<Insert Figure 2>

One model formulation regards the no-choice option as an additional option in the choice set. This implies that the researcher is interpreting all the three options as close substitutes. If this is the case, the correct estimation method is the multinomial logit model (MNL) (see Figure 2). In the present valuation exercise, this implies that while answering the valuation question, respondents make a joint decision of whether and which fish management practice should be introduced in the

Wadden Sea. In other words, according to this model formulation, each respondent considers the choice of one out of three options, A, B and no-choice option, simultaneously. For this reason an increase in the probability of choosing option B, i.e. the adoption of the alternative management scenario, results in an equal proportional decrease in the probability of choosing option A and no-choice option.

A second model formulation regards the two management alternatives as closer substitutes with each other than each of these alternatives and the no-choice option. Nevertheless, the no-choice option is still seen as a substitute for option A and option B. This implies that any increase in the probability of choosing A, for example, will result in a larger decrease in the probability of choosing B than in the probability of selecting the no-choice option. This substitution pattern is reflected in the nested logit model (NLM) (see Figure 2).

A third model formulation regards choosing the no-choice option as completely independent from choosing between the management alternatives. In this case only the management alternatives are considered as substitutes. In other words, the probability of choosing the current situation will affect the probability of choosing the alternative management scenario, but not the probability of choosing the no-choice option. If this is the case, this substitution pattern can be modeled as two separate binary logit models (SBL) (see Figure 2). The first logit model analyses the decision whether or not to choose a management scenario. The second logit model analyses, for the respondents who decided to make a choice, the decision regarding the fishery management scenario.

For the decision regarding which fishery management scenario to choose, the deterministic part of the utility function can be described as follows:

$$V_{i,p|y} = \beta A_p \tag{1}$$

where i denotes the individual respondent, p represents the management program chosen for the Wadden Sea given the respondents choice to participate in the valuation question, y. The vector A_p describes the attributes of the Wadden Sea management programs as describes in the survey instrument. Finally, β represents the parameters of the model to be estimated.

The deterministic component of the decision regarding whether to participate (or not) in the stated choice valuation exercise can be formulated in terms of both individual characteristics, and the expected utility of the chosen management program for the Wadden Sea. Formally, the expected utility for each individual is defined as follows:

$$\ln \sum e^{V_{i,p|y}} \tag{2}$$

The overall individual pay-off can then be modeled as:

$$V_{i,y} = \delta X_i + \theta E\left(\ln \sum e^{V_{i,p|y}}\right) \tag{3}$$

Here X_i represents the characteristics of the individual and δ is a vector of the parameters to be estimated. The parameter θ is referred in the literature as the Inclusive Value (IV) parameter. It denotes the degree of substitution between alternatives, and ranges between 0 and 1 (see Louviere et al., 2000). This model is a generalized model that captures all three specific models as indicated in Figure 1. The level of θ indicates which model is the most appropriate for the data.

As can be seen from Equation 3, in the scenario where θ equals 1, the decision of whether or not to participate in the valuation question is explained not only by the characteristics of the individual, but also by the expected utility associated with a choice of a given management plans for the Wadden Sea. In this scenario, the MNL model delivers the most suitable model specification. On the contrary, when θ equals 0, the expected utility of making a choice among the management plans does not influence the decision regarding whether or not to answer the valuation question. In this situation, SBL is the most appropriate model. Finally, when $0 < \theta < 1$, the decision of whether or not to answer the valuation question is influenced by the expected utility associated with a choice of a given management plan. In this situation, the NLM is the most appropriate. The empirical validity of these model formulations will be tested against the data that we obtained from the Wadden Sea valuation exercise. These will be discussed in the next section.

5. Data set

The sample of the Dutch population consists of 1558 respondents. The data was retrieved between 12 and 17 March 2004 via an Internet questionnaire. The respondents were members of a survey panel (n=45.000) that is representative of the Dutch population for a range of socio-economic characteristics, including age, income and residence. The sample size was set at 1500 respondents. To reach this size 2256 members of the panel were contacted. Once 1558 (69%) respondents had answered the questionnaire, admission to the internet based questionnaire was closed. All the respondents faced the nine stated choice valuation questions. Among this stakeholder group, 21% of the respondents have chosen the no-choice option at least once. The remaining 79% of the respondents have never chosen the no-choice

option. 13% of the respondents chose only on one occasion for the no-choice option. Finally, none of the respondents systematically chose the no-choice option. This can be interpreted as an indication of good design and execution of the survey.

In addition, 420 local residents of the Dutch Wadden Sea area were personally interviewed in October 2003 on the islands of Ameland, Terschelling and Schiermonnikoog as well as along the Dutch coastline of Friesland, Groningen and North-Holland. In total 857 residents were contacted to obtain this sample, which implies a response rate of 49 percent. Among this stakeholder group, 88% of the respondents have chosen the no-choice option at least once. Finally, tourists were personally interviewed during the summer of 2003 on the Wadden Islands of Texel and Vlieland, as well on the ferries that departure from Den Helder to Texel. The sample consists of 336 respondents. Due to the fact that not all interviewers registered the number of contacted persons, we do not know the response rate. Among this stakeholder group, 88% of the respondents have chosen the no-choice option at least once.

A preliminary conclusion based on these descriptive statistics is that the introduction of the no-choice option in the questionnaire is relevant. In fact, the no-choice response rate ranges from 12 to 21 percent, depending on the stakeholder group under consideration. If the survey design would not have provided room for the no-choice option, individuals would have been ‘pushed’ to give a response, which would not reflect their own preferences, resulting in biased data. Furthermore, ignoring the nested structure of consumer behavior would increase the risk of estimating an incorrect model specification (Louviere et al., 2000).

6. Empirical results

In order to formally test the empirical significance of the no-choice option, we fit a nested logit model specification for each of the stakeholder groups under consideration. The results are shown in Table 3.[iv] As far as the Dutch population is concerned, the estimation results show that the structure of preferences are well described by a nested (logit) model. This is reflected by the value of the IV parameter being statistically significant at one percent. We found a comparable preference pattern for the tourists. This means that the respondents belonging to the Dutch residents and the tourists stakeholder groups do not regard the no-choice option and the proposed management scenarios as close substitutes. We can interpret this result as signaling that any increase in the probability of choosing the "Management scenario" will result in a larger decrease in the probability of choosing "Current situation" (status quo) than in the probability of selecting the no-choice option.

The estimation results for the local residents show that the underlying mapping of preferences is well described by the two separate binary (logit) models – see that the value of the IV coefficient is statistically significant at ten percent. Unlike before, this means that local residents look at the two options, "Current situation" (status quo) and "Management scenario", as substitutes, acknowledging that a 'no-choice' decision is not competing with them. In other words, for this stakeholder group, the model that best describes the data is characterized by two independent, separate steps: one capturing the decision to participate (or not) in the valuation exercise, and the other the decision regarding management option for the Wadden Sea. One possible way to interpret these results is that none of the described management programs for the Wadden Sea, including the current management

situation and the alternative management scenario, is acceptable for the local residents. One could think, for example, that a more extreme alternative – such as the possibility to ban all kinds of cockle-fishing activities the Wadden Sea – would be preferred. This is, however, rather unlikely since this fishery management scenario has been included in the stated choice valuation exercise. But then again, this stated choice question has been proposed as the last valuation question in the survey. If the respondent has decided to always chose the no-choice option, independently of the attribute levels in the stated choice question, then we can interpret this answering behavior as signaling a strong emotional attitude, namely as a valuation refusal or protest.

<Insert Table 3>

Finally, we can combine the value of the NLM coefficient estimates and compute marginal prices for the range of attributes under consideration, as shown in Table 4. According to estimation results, any policy measure that is characterized by proposing the ban of cockle-fishing activity is associated with a welfare loss for all stakeholders groups. Second, all stakeholders also incur a welfare loss if policy makers decide to expand current cockle-fishing activity to the whole area of the Wadden Sea. Third, reduction of the harvest to half of the current quota is welcomed by all except the local residents. The latter will incur a welfare loss of about fifty euro cents with the change to harvesting half of the current quota. This result may signal the fact that a part of 'local resident' respondents work, or have members of the family that work, in the cockle-fishing sector and for this reason the reduction in capture would be interpreted in a reduction of their available income.

Equally interesting are the estimation results associated with the different levels of the bird population. As one would expect, if the adoption of a policy proposal puts forward the reduction of the current level of birds, then this will imply a significant welfare loss, ranging from 148 Euro to the tourists, to 95 Euro to the Dutch citizens, and to 58 Euro to local residents. The difference between valuation by tourists and Dutch citizens in general can be interpreted as an outcome of the use value component regarding the protection of the bird population, such as bird watching, which only accrues to the visitors of the area. The smallest magnitude of welfare loss is associated with the local residents, some of whom work in the fishing industry or have family members who do so. For this reason, the respondents can interpret a reduction in the bird population as an increase in the harvest productivity of the sector and therefore a guarantee of employment for themselves or family members.

Finally, estimation results show that the different stakeholders show different preferences with respect to alternative policies. Dutch citizens are willing to pay for any policy option that brings along with it more birds in the Wadden Sea. However, this WTP magnitude is about the same for any other policy option that brings along with it many more birds in the Wadden Sea. In other terms, increasing the number of birds with different amounts gives the same, constant welfare gain. One can interpret this result as that it is sufficient to guarantee the survival of the species in their local habitat, which is associated with a certain minimum increase. As a result then, any additional increase in the bird population will not further increase welfare. On the contrary, tourists show continuously increasing welfare gains with continuously increasing number of birds.

7. Conclusions

The inclusion of a no-choice option in an experiment is necessary to retrieve the preferences of the respondents. Otherwise, respondents are forced to give an answer, even when they do not have a clear preference. Therefore, the aim of this paper was to select an empirical model that best fits the data, including the no-choice option. This approach reveals to be essential in order to yield unbiased WTP estimates. We analyzed three different stakeholder groups, namely Dutch citizens, local residents and tourists. All three sub-samples contain respondents that select the no-choice option. This implies that forcing them to make a choice would have resulted in biased data. The nested logit model allows to determine which particular model specification best describes the data in our application. The results show that the relevance of the no-choice option is determined by the socioeconomic characteristics of the different stakeholder groups. For the local residents, the decision to select the no-choice option is completely independent from the management plans whereas for the Dutch citizens and the tourists the probability to select the no-choice option depends on the attribute levels of the management plans. Finally, WTP valuation results confirm this two-tier type of preferences.

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Table 1: Attributes and their levels as used in the survey

Attribute	Levels
Area Policy measure that refers to the surface area where fishing on cockles in the Wadden Sea is allowed.	- The totality of the Wadden Sea - Current level - Half of the current level - Nowhere (banning the fishing activity)
Quota Policy measure that refers to the total harvest of cockles that is permitted by law.	- Current level - Lower level
Rotation Policy measure that requires rotation among areas where fishing is allowed.	- Rotation - No rotation (current situation)
Environmental quality of the marine ecosystem Number of birds in the Wadden Sea.	- Lower level - Current level - More than in current situation - Much more than in current situation.
Financial cost per household A one-time lump-sum interpreted as a national *Wadden Sea* tax.	Nine different monetary amounts between 0 and 250 Euro

Table 2: Information about the three stakeholder groups

	Tourists	Local residents	Dutch citizens
Sample size	332	420	1558
Income			
Low (<1500 euro)	14 %	25 %	28 %
Middle	39 %	46 %	54 %
High (>3000 euro)	33 %	12 %	18 %
Consume fish	90 %	85 %	90 %
Consume cockles	4 %	6 %	11 %
Know fisherman	13 %	51 %	11 %
Member of environmental association	56 %	45 %	34 %
Average age (in years)	42.7	43.4	40.2

Table 3: Nested Logit Model estimation results [1]

Variable	Dutch citizens	Local residents	Tourists
Whether answer (or not) to the valuation question			
Constant	-1.86***	-1.39***	-2.99***
	(-13.49)	(-2.55)	(-10.91)
Income	-0.88***	-0.14***	
	(-4.72)	(-3.02)	
Never visit the Wadden Sea	0.27***		
	(3.74)		
Member of environmental organization		0.26*	
		(1.77)	
Related to a fisherman		-1.61**	
		(-8.68)	
Utility related with the choice of a give management program for the Wadden Sea			
Alternative specific constant	0.57***	0.72***	0.26**
	(8.07)	(6.25)	(2.05)
Area where it is allowed to fish			
Banning	-0.22***	-0.36***	-0.44***
	(-6.91)	(-5.54)	(-6.68)
Half the current area	0.20***	0.15***	0.20***
	(6.45)	(2.52)	(3.14)
Whole area	-0.34***	-0.32***	-0.28***
	(-7.33)	(-4.08)	(-3.31)
Quota			
Half the current quota	0.01	-0.05	0.05
	(0.52)	(-1.28)	(1.04)
Rotation of the fishing area			
Present	0.11***	0.08*	0.10**
	(4.44)	(1.95)	(2.03)
Level of birds			
Less birds	-0.95***	-0.58***	-1.48***
	(-8.55)	(-2.95)	(-6.14)
More birds	0.68***	0.51***	0.80***
	(15.09)	(6.21)	(8.32)
Much more birds	0.70***	0.35***	0.97***
	(14.00)	(3.85)	(9.03)
Price	-0.01***	-0.01***	-0.01***
	(-33.17)	(-11.80)	(-16.19)
IV parameter	0.25***	0.31	0.41*
	(2.91)	(0.86)	(1.80)
Log likelihood	-11178	-2880	-2121
No. of observations	14022	3780	3024
Adjusted ρ^2	0.402	0.428	0.485

[1] Significance is indicated by ***, ** and *, referring, respectively, to the 1%, 5% and 10% level, with t-value between brackets.

Table4: Marginal price estimation results (in Euro)

	Dutch citizens	Local residents	Tourists
Area where it is allowed to fish			
Banning	– 22	– 36	– 44
Half the current area	20	15	20
Whole area	– 34	– 32	– 28
Quota			
Half the current quota	1	– 0.5	5
Rotation of the fishing area			
Present	11	8	10
Bird population			
Less birds	– 95	– 58	– 148
More birds	68	51	80
Much more birds	70	35	97

	Current situation	Possible policy proposal
Policy measures		
Surface area where it is allowed to fish on cockles	Current area	Half of the current level
Allowed number of cockles harvest	Current level	Lower level
Rotation or fixed areas where it is allowed to fish on cockles	No rotation	No rotation
Likely effect: Change in number of birds	Current level	More than in current situation
Costs: Costs per household	0 euro	50,- euro
	❑ A	❑ B

❑ No choice

Figure 1: Illustration of a stated choice question

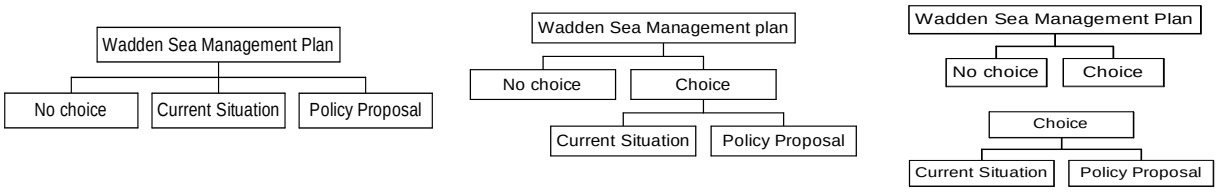

Figure 2: Alternative models of response behavior

Source: Adapted from Ryan and Skåtun, 2004

End notes

[i] We also interviewed local politicians and natural scientists. However, the resulting samples were too small to make them suitable for inclusion in the analysis here. We also tried to interview the local fishermen, but they refused to participate.

[ii] Source: http://www.waddenvereniging.nl.

[iii] Source: http://www/wildekokkels.nl.

[iv] A more detailed interpretation of the signs and significance of the remaining variables is presented in de Blaeij et al. (2004).

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(lxvi) This paper has been presented at the 4th BioEcon Workshop on “Economic Analysis of Policies for Biodiversity Conservation” organised on behalf of the BIOECON Network by Fondazione Eni Enrico Mattei, Venice International University (VIU) and University College London (UCL) , Venice, August 28-29, 2003

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