Do we choose differently after a discussion?
Results from a deliberative valuation study in Ireland

Margrethe Aanesen*, Thomas van Rensburg#, Claire Armstrong*

Abstract

A criticism against traditional stated preference surveys is that people often make choices as members of social groups and as a result of deliberation. To explore the effects of deliberation and the robustness of traditional techniques a choice experiment was implemented as a series of valuation workshops where respondents were given information and an opportunity to discuss. They made their choices individually both before and after the group discussion. Although stated preferences turned out to be relatively stable across the two elicitation situations, on average respondents did state different preferences after the discussion compared to before. The stated preferences became more homogenous after the discussion. Somewhat surprisingly, people being well informed about the good and people stating they were certain of their choices were the ones that to the largest degree changed their stated preferences after the discussion.

JEL: Q51, Q57

Key words: stated preferences, discrete choice experiment, deliberative methods, stated certainty, knowledge of good

Corresponding author: Margrethe Aanesen, UiT – Arctic University of Norway, PO box 6050 Langnes, N-9037 Tromsø, Margrethe.aanesen@uit.no
*UiT – Arctic University of Norway, # National University of Ireland - Galway, Ireland

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Introduction

Stated preference (SP) methods are a non-market valuation method used extensively to value a wide variety of public goods and non-market goods and services (Haneman, 1994; Carson et al., 1998). SP techniques rely on the provision of information and an explanation of the good being valued (Hoehn and Randall, 1987). Different formats have been used to convey information including stand-alone individual surveys (Haneman, 1994), experiments (List and Gallet, 2001; Lusk and Norwood, 2009) and deliberative techniques (Lienhoop and MacMillan, 2007). Advocates of conventional individual SP surveys argue that carefully crafted surveys provide consistent reliable data (Haneman, 1994). However, their critics maintain that deliberative techniques, also known as deliberative monetary valuation (DMV) are superior because they allow respondents time to ask questions and reflect on their preferences (Spash, 2008). Recent perspectives on discovered and constructed preferences from the DMV literature has challenged the assumption that individuals have well-formed, stable preferences (see e.g. Matthews et al., 2017). The DMV literature posits that information exchange between participants may change an individual's preferences and may influence the consistency of choices made by respondents (Lienhoop and Völker, 2016) but this has so far not been verified.

We attend to these unresolved questions by investigating how information and increased social interaction influences elicited preferences, and the certainty with which they are stated. As an empirical case we use results from a CE to elicit a subject's WTP to protect CWC, an unfamiliar public good in Ireland. Our data allows us to evaluate whether an individuals' preferences and the certainty with which they are stated differ before and after deliberation and to test whether stated certainty and the respondent's knowledge about the good prior to

deliberation affects changes in stated preferences and the consistency with which they are stated. More specifically, we test the hypotheses listed below.

Hypothesis H_0^1: Respondents in an SP-survey state their preferences for an unfamiliar public good with equal degree of consistency in various elicitation situations.

Hypothesis H_0^2: Respondents in an SP-survey state equal preferences for an unfamiliar public good in various elicitation situations.

Hypothesis H_0^3: Better informed individuals regarding the good under consideration and those more certain of their initial choices are equally likely to change their stated preferences in subsequent elicitation situations as those less informed and individuals less certain of their initial choices.

Hypothesis H_0^4: Better informed individuals and those more certain of their initial choices state subsequent preferences with equal consistency as those less well informed and individuals less certain of their initial choices.

We do not identify a causal link between differences in stated preferences before and after deliberation and the fact that respondents had time to think and deliberate. The reason is that, although not scientifically proven, it is thought that respondents gradually discover their preferences in response to discussion and time to reflect, but also that individuals gain experience in answering hypothetical questions and thereby become more certain about the choice task. For either of the reasons the actual inconsistencies in the choices might decrease (Rose et al., 2015). Hence, differences in stated preferences and the consistency with which they are stated before and after deliberation may be due to i) better informed choices due to time to think and deliberation, and ii) experience with the elicitation technique.

The rest of the paper is organized as follows: Section 2 provides some background on SP methods, the organization of the valuation workshops and the good to be valued, cold-water coral. Section 3 presents the methodology and the data. In section 4 the results are given, and section 5 discusses and summarizes our findings.

Literature

A wide variety of DMV survey approaches have been deployed, including market stall (MacMillan et al, 2002, Lienhoop and MacMillan, 2007), valuation workshops (Hensher et al., 2011; Aanesen et al., 2015; Lienhoop and Volker, 2016), and repeated elicitation tasks (MacMillan et al, 2006). While valuation workshops are usually conducted in a single session over a few hours, the market stall approach includes two (or more) group sessions whereby respondents receive the survey at two different times, spaced a week or more apart, with the time for discussion and reflection with family and friends and an opportunity to re-consider their choices.

Within the SP-literature there is a well-established "information effects" literature (Hoehn and Randall, 1987, Samples et al., 1986; Bergstrom et al. 1990) demonstrating that information presented in contingent markets results in more valid WTP estimates compared to when information is not provided. Economic theory suggests that individuals who are well informed about a good are less likely to change their preferences having been provided with new information compared to less well-informed respondents (Hoehn and Randall, 1987, Schläpfer and Fischhoff, 2012). While it is suggested that information presented in SP studies enhances the external validity of the estimated willingness to pay (WTP), reduces respondent

uncertainty and the divergence between reported WTP and true WTP, there are few empirical studies that demonstrate such effects (Hoehn and Randall, 1987; Paradiso and Trisorio, 2001). How information is provided may also matter, and the two main procedures for information provision are; i) to provide respondents with factual data about the good under consideration (Johnston et al., 2017), and ii) allowing the respondent to ask questions, and deliberate on the topic (Aanesen et al., 2015). While the former can be included in internet surveys, the latter demands in-person surveys. Needham et al. (2018) demonstrates that ex ante knowledge does matter for the value people place on non-market goods, in contrast to exogenous increase in knowledge as part of the survey.

A number of studies have evaluated respondent certainty[1] which is thought to be influenced by choice task learning, engagement, experience with the hypothetical good and group decision making (Brouwer et al., 2010; Hensher et al., 2011). However, with a few exceptions (LaRiviere et al., 2014) most empirical studies on respondent certainty tend to focus either on the effects of information provided by the SP analyst on consumer preferences (Shapansky et al., 2008; Ladenburg, 2013), or the implications of the information states – what a subject knows about the good in question prior to being surveyed on WTP (Paradiso and Trisorio, 2001). LaRiviere et al., (2014) and Aanesen et al (2015)[2] do record the information state in their use of valuation workshops to elicit well-informed choices for the preservation of cold-water coral (CWC), but in these papers respondents do not exchange information with each other. On the other hand, Lienhoop and Volker (2016) test the hypothesis that discussion amongst participants and time to reflect on information provided by the SP analyst does lead

[1] Choice certainty can either be self-reported in the survey or derived statistically

[2] These two papers are based on the same dataset.

to more certain choices after deliberation. In this test respondents' self-reported certainty of making choices increased significantly after deliberation, however, statistical tests of choice certainty based on choices made before and after deliberation did not support this result.

Cold- water coral (CWC) – an unfamiliar public good

CWCs are found in all of the world's oceans and the Mediterranean Sea (Fossaa and Buhl-Mortensen, 1999) with a global coverage that may exceed that of shallow water tropical coral reefs. CWC are colonies that consist of tiny animals that are related to and look like sea anemone (Fossaa and Buhl-Mortensen, 1999). Unlike tropical corals, CWCs do not need sunlight to survive, because they do not rely on the symbiotic relationship with photosynthetic algae (ibid), and so can live at depths below the photic zone. CWCs live in the dark and require a hard substrate on which to settle. They prey on zooplankton and are associated with strong currents which aid in the supply of food, egg and larval dispersal as well as removal of waste products. Reefs occur at depths of 39 – 3000 meters and a temperature range of 4° - 13°C. CWC reefs grow slowly at about 4-25mm per year and they are slow to recover from damage by human activity. Some of the larger reefs around the world are estimated to be more than 8000 years old (Freiwald et al, 2004). CWC reefs are impacted by bottom-trawling and other human sea-bed activities (Fossaa and Buhl-Mortensen, 1999), which is an argument for protection.

Methods and data

Survey

The design of the survey was informed by five focus groups; three scientific groups with experts in marine biology, ecology, oceanography, resource economics and

business/administration, and two public groups. Based on input from the focus groups four attributes were chosen; size of protected area, commercial activities located in the area, area as important habitat for fish, and cost. The *size* attribute refers to the total area protected, and takes three levels; 2445 km^2, which is the status quo (SQ), 5000 km^2 and 10,000 km^2. There are a number of commercial offshore activities, fisheries and oil and gas exploration being the most important. Areas suggested for CWC protection may clash with areas where these activities are taking place, implying that industrial activities will be hampered if protection is extended. The attribute *commercial* distinguishes between whether areas eligible for CWC protection are either attractive fishing grounds, attractive areas for the oil and gas industry, or both. The *habitat* attribute makes a distinction between areas considered very important as habitat for fish compared to areas of less importance. The *cost* attribute was described as an additional amount of money people would pay as a federal tax. With no increase in protection this additional tax will equal 0, while for alternatives with increased CWC protection the tax will vary between 7 - 75 Euros per household per year. The attributes and the various levels they take are reported in Table 1. An example of a choice card is given in the appendix. The CE design included 12 choice cards. The questionnaire was tested in a pilot survey, which provided the priors to inform the final design. We deployed a d-efficient design for a multinomial logit model, which has the property that it increases the precision of the parameter estimates and reduces the potential for parameter estimate misspecification (Scarpa and Rose, 2008).

Table 1 *Attributes and attribute levels*

Attribute	*Size of protected area (km^2)*	*Protected area attractive for oil/gas and fisheries activities*	*Protected area important as habitat for fish?*	*Additional costs of protection*
Reference level	2.445	Partly	Partly	0
Level 1	5.000	Attractive for the fisheries	Not Important	7
Level 2	10.000	Attractive for oil/gas activities	Important	15
Level 3		Attractive for both fisheries and oil/gas activities		38
Level 4		Neither attractive for fisheries nor for oil/gas activities		75

Sampling

A professional recruitment agency was employed to recruit participants. The respondents were informed that the survey was about managing marine resources in Ireland and that they would be offered €50 if they completed the survey. In total 7 valuation workshops in 7 Irish municipalities were conducted. The recruitment was stratified on gender and age in order to be representative for the municipality. Each workshop had 20 participants, except for one which had 19 participants. Table 2 indicates respondent characteristics.

Table 2 *Individual specific variables*

	Lowest value	*Highest value*	*Mean*	*National average*
Gender	0 (male)	1 (female)	0.489	0.494
Age	18 years	72 years	44.9 years	37.4
ENGO*	0 (not ENGO member)	1 (ENGO member)	0.02	
Education	1 (only obligatory)	4 (higher deg. Univ.)	3.45	1.85
Labor force participation	0	1 (in labor force)	64%	62.2
Working in the marine sector	0 (other industries)	1 (the marine sector)	7.2%	1.5%**
Household size (cont. var.)	1	8	3.34	2.75
Annual personal income	1 (below 7800 EUR)	9 (above 117k EUR)	3.63 (25,430)	36,508
Annual household income	1 (below 7800 EUR)	8 (above 117k EUR)	4.88 (43,991)	56,346

Source: Central Statistics Office (CSO), 2014

*ENGO = Environmental Non-Governmental Organization

**Vega and Hynes, 2016

Compared to the socio-demographics for the Irish population our sample respondents reside in larger households, are somewhat older, have lower income and are better educated. With respected to gender, labor force participation and household size our sample is quite representative of the Irish population.

The survey was conducted in two rounds as follows: Each valuation workshop started with a power point (PP) presentation of CWC, lasting about 10 minutes, and providing some basic information about the life and distribution of CWC. Next, the participants were asked to fill in a CE survey, including 8 quiz questions on CWC and a stated certainty question on a scale from 1 (very little certain) to 10 (very certain). After the first elicitation exercise, respondents were asked to form into groups of 5 individuals, to discuss the topic, CWC protection, in a systematic way for about 20 minutes. After the discussion, the participants were asked to individually fill in the choice cards and a stated certainty question from the original survey a second time. After the second individual elicitation process, there were some group tasks, which are not relevant for the results presented in this paper. Each valuation workshop lasted about 2 hours.

Econometric model

Random utility theory suggests that the utility a person receives from a good can be divided into a determined part, which can be observed by the researcher, and a random part (Train, 2009). The utility to person *n* of choosing alternative *j* in choice situation *t* is thus given by;

$$U_{njt} = b \cdot X_{jt} + e_{njt} \quad (1)$$

where X_{njt} is a vector of attributes specifying the good, b is a vector of estimated coefficients for the attributes, and e_{njt} is an i.i.d. extreme value (usually Gumbel) error term.

The variance of the error term is given by $\sigma_n(\frac{\pi^2}{6})$, where σ is a scale parameter, possibly individual specific. The scale parameter is inversely correlated with the variance of the error term, and can be interpreted as how consistent respondents are when making their choices (Czajkowski et al., 2014a). Dividing (1) through by σ we get;

$$U^*_{njt} = \frac{b}{\sigma} \cdot X_{jt} + \varepsilon_{njt} \quad (2)$$

where $\varepsilon_{njt} = \frac{e_{njt}}{\sigma}$, and this new error term has constant variance given by $\frac{\pi^2}{6}$.

Equation (2) assumes constant preferences and scale across individuals, and the two are confounded and can not be estimated separately. We modify the model in two respects. First; we allow preferences to be heterogeneous across individuals, assuming them to be randomly and continually allocated according to a well-specified distribution. Throughout the paper we use the normal distribution. This implies that the vector of attribute coefficients, *b*, is respondent dependent, i.e. b_n. Hence,

$$b_n = b + \mu_n \cdot C \quad (3)$$

where *b* is the mean estimated coefficient for the specified attribute and μ_n is the vector of person *n* specific deviations from the mean (lower triangle of Cholesky matrix), and *C* is draws from a specified distribution. Second, we allow scale to differ according to whether a

choice was made before or after the group discussion. As it is not possible to estimate separately scale parameters for choices made before and after the discussion, we normalise scale for choices made before the group discussion, denoted σ_B, and set it equal to 1. Then we can estimate σ_A , which is the scale for choices made after the group discussion relative to scale for choices made before.

When the error terms are distributed extreme value and independent over *n*, *j* and *t*, the difference between two extreme value distributed error terms is logistically distributed, such that the choice probability when preferences are individual is given by;

$$P(j|X_{nt}) = \frac{1}{D}\sum_{d=1}^{D} \frac{exp^{(\frac{bn}{\sigma A})*Xjt)}}{\sum_k exp^{(\frac{bn}{\sigma A})*Xkt)}} \quad (4)$$

where *d* is an index for the numbers of draws from a specified (the normal) distribution. The simulated probability of observing person *n* choosing a sequence of *t* choices is given by;

$$P(j|X_{nt}) = \frac{1}{D}\sum_{d=1}^{D} \prod_{t=1}^{T} \prod_j \left[\frac{exp^{(\frac{bn}{\sigma A})*Xjt)}}{\sum_k exp^{(\frac{bn}{\sigma A})*Xkt)}}\right]^{ynjt} \quad (5)$$

where y_{njt} is a dummy variable taking the value 1 if alternative *j* is chosen and 0 otherwise. Summarising over all respondents and alternatives, and taking the log of (5) yields the log likelihood function.

$$LL(b) = \sum_{n=1}^{N}\sum_j y_{njt} ln P_{njt} \quad (6)$$

(6) is maximised w.r.t. the ***X*** vector in order to find estimates of the vector of attribute preferences, ***b***. The parameter vector, ***b***, and the relative scale, σ_A, are estimated by simulation, using the maximum likelihood procedure, as the derivative of the expression in 6 w.r.t. X_{jt} does not have a closed form solution (Train, 2009).

To test for statistically significant deviations in stated preferences based on choices made before and after the group discussion, we use of an extension of (2);

$$U^*_{njt} = \frac{bn}{\sigma A} \cdot X_{njt} + \frac{gn}{\sigma A} \cdot X_{njt} \cdot D + \varepsilon^T_{njt} \quad (7)$$

where *D* is a dummy taking the value 1 for choices made after the group discussion and 0 for other choices, σ is the scale parameter, $g_n \; and \; b_n$ are vectors of parameters to be estimated, σ_A is the relative scale parameter for choices made after the discussion, and ε^T_{njt} is an error term. Estimated coefficients of g_n significantly different from 0 indicates that stated preferences after the discussion are significantly different from stated preferences before the discussion. This procedure corresponds to a t-test for parameter equality. Estimated σ_A significantly different from 1 indicates that the consistency with which choices are made differ between the two elicitation situations.

Finally, given the interest in establishing estimates of WTP for the non-monetary attributes Y_{njt}, it is convenient to introduce the following modification, which is equivalent to estimating the parameters in WTP space (Train and Weeks, 2005)

$$U_{njt}^{**} = \frac{bc}{\sigma A}(p_{njt} + \beta_n Y_{njt}) + \varepsilon_{njt}^{WTP} \quad (8)$$

Note that under this specification the vector of parameters $\beta_n = \frac{bn}{bc}$ is now(1) scale-free and (2) can be directly interpreted as a vector of implicit prices for the non-cost attributes. p_{njt} is the cost attribute.

IV. Results

The 139 respondents, in 7 valuation workshops, made 12 individual choices each, totaling 1668 choices, before the group discussion. The same number of choices were made after the discussion. The 12 choice cards applied in each round were identical. Table 3 shows the number of respondents who change 0, 1 and 2 choices in the choice tasks after deliberation.

Table 3 *Number of respondents changing their choices from the first individual tasks to after deliberation, N=139*

No of choice tasks changed after discussion	*0*	*1*	*2*	*>2*
No of respondents	19	25	24	73

After the discussion, 120 of the 139 respondents (86%) changed at least one of their choices, while 19 (14%) kept all choices unchanged. Out of the 1668 choices before the discussion, 417 (25%) were altered after the discussion.

The crucial question is whether these changes imply that different preferences were stated before and after the group discussion, and whether the consistency of the choices changed after the discussion. Table 4 yields results from the mixed MNL model for each elicitation situation separately. The models are estimated in R, using normal distribution for all non-cost attributes and lognormal distribution for the cost attribute, with 1000 Halton draws from these distributions.

Table 4 *Estimated preference intensities (t-values) based on individual choices before and after deliberation*

Attribute	*Mixed MNL model Before*	*Mixed MNL model After*	*Pooled model, equal scale*
small size (mean)	0.27 (0.78)	0.32 (0.86)	0.31 (1.23)
large size (mean)	0.12 (0.41)	0.16 (0.39)	0.21 (0.82)
Oil (mean)	-0.80 (-3.35)	-0.52 (-1.46)	-0.68 (-3.50)
Fish (mean)	-0.12 (-0.57)	-0.25 (-1.06)	-0.13 (-0.83)
Habitat (mean)	1.93 (7.31)	2.31 (8.30)	2.14 (9.30)
Cost (mean)	0.03 (4.08)	0.02 (3.27)	0.03 (5.83)
small size (st.dev.)	-1.28 (-3.19)	1.36 (4.10)	-1.06 (-4.97)
large size (st.dev.)	-1.32 (-3.38)	-1.96 (-6.11)	-1.44 (-6.30)
Oil (st.dev.)	2.05 (7.29)	2.41 (7.45)	2.19 (8.28)
Fish (st.dev.)	1.43 (6.82)	1.70 (5.68)	1.5 (9.35)
Habitat (st.dev.)	2.00 (7.98)	3.25 (7.80)	2.43 (11.23)
Cost (std.dev)	-0.21 (-5.68)	-0.27 (-6.95)	-0.24 (-9.14)
Log-Likelihood value	-1232.7	-1104.8	-2348.3
N, k	1668, 12	1668, 12	3336, 12
R-squared	0.31	0.38	0.36

The very significant standard deviations for the parameters confirm the assumption of preference heterogeneity in the sample. This is valid for choices made both before and after deliberation. For choices made before deliberation, preferences for the oil and habitat attributes, in addition to costs, are significantly different from zero. The negative sign of the oil parameter implies that people are not willing to protect CWC if this hampers oil and gas activities. The positive sign of the fish parameter indicates that people are more likely to protect CWC if the reefs are important fishing grounds, but the estimate of this attribute is not significant. Neither of the two size-attributes are significant. The positive sign of the habitat attribute means that if a coral reef is supposed to serve as habitat for fish it is more likely that a respondent is willing to pay to protect the coral area. Habitat is the single most important attribute to explain why respondents choose to protect coral reefs. The cost parameter is significant, indicating that on average respondents did take the cost of protecting further coral reefs into consideration when making their choices. For choices made after deliberation, only preferences for the habitat attribute, in addition to costs, are significantly different from zero.

Running a paired t-test on the estimated coefficients for choices made before and after the group discussion rejects the null-hypothesis of parameter equality at 10%-level, but not on 5%-level (test-statistic = -1.75, d.f. = 12, p-value = 0.08). The LR-test (test-stastistic = 21.6, d.f. 13, p-value= 0.03), rejects the null at 5% level, but not at 1% level. Hence, with an acceptable degree of uncertainty we conclude that there are differences in preferences stated before and after the group discussion.

Comparing stated preferences from two elicitation rounds there are two issues that must be controlled for; scale and marginal utility of money. The former is important because mean estimated parameters are always confounded with the scale of the model, and the second is important because if the marginal utility of money vary between two situations so will the monetary value of the stated preferences, even if preference intensities are similar (ref).

Allowing for variances in the marginal utility of money in the two elicitation situations, we derive willingness-to-pay (WTP) estimates. Table 5 yields the mean WTP and 90% confidence interval for each of the attributes. The bottom line shows that there is no significant difference in the marginal utility of money across the two elicitation situations. Applying a t-test for comparing means shows that only for the habitat attribute stated preferences has changed, and the change is significant at 10% level.

Table 5 WTP mean and 90% confidence intervals in Euro, and test for difference

	WTP Mean-before	*90% CI*	*WTP Mean-after*	*90% CI*	*Test-stat*
Small size	-26.6	(-64, 10)	-16.73	(-36, 2)	-0.39
Large size	-34.97	(-63, -6)	-37.32	(-63, -12)	0.10
Oil	2.85	(-10, 16)	2.26	(-19, 24)	0.04
Fish	6.88	(-6, 20)	0.42	(-6, 6)	0.75
Habitat	44.60	(34, 55)	29.41	(18, 40)	1.68*
Cost*	-0.15	(0.04)	-0.19	(0.04)	0.75

*in preference space, std.error in brackets

Taking into account possible variation in scale across the two elicitation situations we run the extended version of the model on the pooled dataset with relative scale for choices made after the discussion. Distributions and draws were the same as in the first models. Table 6 shows the mean coefficients in the middle column while column 3 yields the coefficients for the mean difference in attribute preferences stated before and after the group discussion.

Table 6 *Mean coefficients and t-values (in brackets) based on pooled choices, mean deviation and t-values (in brackets) in attribute preferences stated before and after deliberation, and relative scale (t-value in brackets)*

Attribute	*Mean preference coefficient (t-value)*	*Mean deviation coefficient (t-value)*
Cost_mean	-0.187 (-6.64)	-0.167 (-1.37)
Small_mean	0.288 (0.88)	0.11 (0.18)
Large_mean	0.128 (0.45)	-0.086 (-0.14)
Oil_mean	-0.597 (-2.76)	-0.347 (-0.84)
Fish_mean	-0.21 (-1.02)	-0.012 (-0.03)
Habitat_mean	2.014 (8.09)	1.774 (1.88)
Cost_std.dev	0.22 (7.22)	0.263 (1.63)
Small_std.dev.	-1.55 (-2.49)	-0.534 (-0.65)
Large_std.dev.	1.367 (5.48)	-2.339 (-3.04)
Oil_std.dev.	-1.763 (-6.78)	-3.237 (-4.04)
Fish_std.dev.	1.485 (5.35)	-1.675 (-2.32)
Habitat_std.dev.	1.909 (7.41)	-4.293 (-3.38)
Scale for choices made after discussion	0.6811 (-1.61)	
LL-value	-2339	
N, k	3336, 24	
Adj. R-squared	0.35	

As can be seen from Table 6 none of the mean deviation coefficients are significant at the 5%-level, but the habitat attribute has significant mean deviation at 10% level. Furthermore, four of the six attributes have significant changes in standard deviation, and this is significant at 1% level. This is true for the large_size, oil, fish and habitat attributes. For all these attributes the standard deviation has become smaller implying that stated preferences have become less heterogeneous after the group discussion. For two attributes, small_size and costs, the standard deviation has remained unchanged. The latter, however, is very close to be significant at 10% level, indicating more heterogeneous preferences for the cost attribute after the groups discussion.

Next, we explore how stated preferences varies across the two elicitation situations for high score vs low score respondents, and for respondents certain of their choices and less certain of their choices. Table 6 yields the results for the respondents' self-reported degree of certainty when making their choices and quiz score. On average the certainty-score was 7.52 for the responses before the group discussion, and 7.57 for the responses after the group discussion. This indicates a somewhat higher certainty when making choices after the group process, but running a t-test on the difference between two means, we cannot reject the null hypothesis of equal stated certainty of choices made before and after the group discussion on 10% level. The mean number of correct answers out of 8 was 6.24. The quiz was only conducted once. We take the quiz score as a proxy for the respondents' information level of the issue under consideration at the time of the survey.

Table 7 *Stated certainty before and after the group discussion and quiz score as measured before the group discussion*

	Mean stated certainty/score	*Sd.error of stated certainty/score*	*95% CI for stated certainty*
Before group discussion	7.52	0.164	7.19 - 7.84
After group discussion	7.57	0.158	7.26 - 7.88
mean quiz score	6.24	0.075	6.09 - 6.39

From Table 1A in the appendix we can see that the subsets do differ when it comes to socio-demographic characteristics. Respondents certain of their choices and high-score respondents are on average younger, better educated, have higher personal and household income, and are more likely to be in the labor force compared to respondents more uncertain of their choices and low score respondents. They also belong to slightly larger households, and there is a female majority in both these sub-groups. Respondents less certain of their responses, together with high-score respondents, are more likely to be a member of an Environmental Non-Governmental Organization (ENGO). Respondents certain of their choices and low-score respondents are more likely to work in the marine sector (fisheries and oil and gas activities). Such socio-economic differences must be kept in mind when comparing the changes in choices across sub-groups before and after deliberation.

Applying a procedure identical to that for the pooled dataset above,[3] we test whether there is a difference between respondents certain and less certain of their choices when it comes to stated preferences before and after a group discussion, and the consistency with which choices are made. The results are given in table 8.

[3] We choose to use the model correcting for scale across the two elicitation situations as this model work on the pooled dataset and thus make use of more observations.

Table 7 *Estimated mean attribute parameters and t-values (in brackets) for the pooled dataset (_C), mean deviation in attribute preferences stated before and after deliberation and t-values (in brackets), and relative scale (t-value in brackets) for "certain" and "uncertain" respondents*

Attribute	*certain*		*uncertain*	
	mean	*T-value*	*mean*	*T-value*
small_mean_C	0.14	0.29	0.68	1.65
large_mean_C	0.10	0.24	0.44	1.18
Oil_Mean_C	-0.17	-0.42	-0.98	-3.30
Fish_mean_c	-0.12	-0.38	-0.22	-0.95
Habitat_mean_c	2.75	7.36	1.21	4.73
Cost_mean_c	-0.21	-4.36	-0.21	-7.94
small_st.dev_C	1.58	5.38	-0.98	-4.31
large_st.dev_c	1.27	3.84	1.10	5.33
Oil_st.dev_c	-2.49	-6.27	-1.53	-6.74
Fish_st.dev_c	1.46	5.73	-1.21	-4.44
Habitat_st.dev_c	3.15	4.78	0.96	5.50
cost_std.dev._C	0.26	4.26	0.25	8.38
small_mean_D	-1.58	-1.52	0.39	0.69
large_mean_D	-0.32	-0.34	-0.02	-0.03
oil_mean_d	-0.55	-0.71	0.32	0.81
fish_mean_d	0.34	0.47	-0.16	-0.42
habitat_mean_d	3.84	3.17	0.09	0.26
cost_mean_d	-0.19	-3.82	-0.00	-0.29
small_std.dev_D	2.95	4.33	-1.61	-4.64
large_std.dev_D	6.10	3.83	1.42	4.27
oil_std.dev_D	-5.90	-3.28	0.15	0.57
fish_std.dev_D	-2.56	-2.13	-1.53	-4.12
habitat_st.dev_d	-5.20	-4.22	1.34	5.77
cost_std.dev._D	0.31	4.45	-0.03	-2.66
rel.scale_A*	0.62	-2.99	1.3913	1.46
Likelihood value	-1255.6		-1045.8	
N, k	1944, 25		1392, 25	
Adj. R-squared	0.4		0.28	

*the t-value in brackets is the test-statistic when testing against 1.

Table 7 shows that respondents certain of their choices (in the first elicitation situation) exhibit the larger changes. First, respondents certain of their choices make less consistent choices after the discussion compared to before. This is shown by the relative scale (rel.scale_A), which is significantly smaller than one. Further, for two of the attributes, cost and habitat, stated preferences are different after the discussion compared to before, and while it is lower for the cost attribute it has become higher for the habitat attribute. The standard deviation has changed for all attributes. It has increased for the two size attributes and costs, indicating larger heterogeneity among respondents, and decreased for the oil, fish and habitat attributes. Turning to subjects uncertain of their choices they don't change stated preferences for any of the attributes. This is indicated by the insignificant "attribute"_mean_D parameters. On the other hand they have become more heterogeneous w.r.t. stated preferences for the habitat and large_size attributes, and less heterogeneous regarding the small_size, fish and cost attributes. Interestingly, the relative scale parameter is above one, indicating that choices have become more consistent. This latter result is, however, not statistically significant at 10% level.

Table 8 presents corresponding results for high score vs low score respondents.

Table 8 *Estimated attribute mean parameters and t-values for the pooled dataset (_C), mean difference (deviation) in attribute preferences stated before and after deliberation, and relative scale for high-score and low-score respondents respectively*

Attribute	*high-score*		*low-score*	
	mean	*t-value*	*mean*	*t-value*
small_mean_C	0.86	-0.33	-0.28	-0.57
large_mean_C	0.34	0.93	0.04	0.09
Oil_Mean_C	-0.71	-1.69	-0.57	-2.21
Fish_mean_c	-0.33	-0.91	0.12	0.46
Habitat_mean_c	2.83	7.81	1.44	4.97
Cost_mean_c	-0.19	-7.03	0.04	4.74
small_st.dev_C	0.96	1.71	0.60	3.16
large_st.dev_c	-1.04	-4.22	-1.23	-5.60
Oil_st.dev_c	-2.47	-5.15	-1.36	-5.18
Fish_st.dev_c	1.68	6.41	-1.06	-4.69
Habitat_st.dev_c	2.71	5.51	1.71	6.52
small_mean_D	-0.24	-0.34	0.57	0.97
large_mean_D	-0.04	-0.06	0.37	0.72
oil_mean_d	0.31	0.47	0.14	0.45
fish_mean_d	-0.22	-0.46	-0.20	-0.57
habitat_mean_d	0.72	0.51	-0.14	-0.31
cost_mean_d	0.09	5.64	0.00	0.14
small_std.dev_D	-1.57	-1.25	-0.10	-0.34
large_std.dev_D	-1.69	-1.75	1.07	5.27
oil_std.dev_D	-2.28	-2.44	-0.36	-1.60
fish_std.dev_D	0.69	2.41	0.54	1.95
habitat_st.dev_d	-0.07	-0.16	1.47	4.44
cost_std.dev._D	-0.17	-2.84	-0.04	-2.74
rel.scale_A*	0.95	-0.21	1.52	1.77
Likelihood value	-1116.2		-1182.9	
N, k	1608, 25		1728, 25	
Adj. R-squared	0.35		0.34	

*the t-value is the test-statistic when testing against 1.

Table 8 shows that low-score respondents make more consistent choices after the group discussion compared to before, but this is not the case for high score respondents. Further, while low score respondents don't change stated preferences for any of the attributes after the discussion, high score respondents change their stated preferences for the cost attribute, for which they have increased their preferences after the discussion. Both groups have changed the heterogeneity of the stated preferences. While high score respondents have become less heterogeneous in their preferences for the large_size, oil and cost attribute and more heterogeneous regarding the fish attribute, low score respondents have become more heterogeneous in their stated preferences for the large_size, fish and habitat attribute. Only for the cost attribute the low score respondents have stated less heterogeneous preferences after the discussion.

The results in Tables 7 and 8 can also be divided into sub-sections like high-score respondents certain of their choices and uncertain of their choices. This may explain some of the unexpected results. For example; regarding high-score respondents, those who stated they were certain of their choices (N=43) did not change stated preferences for any of the attributes, and got more homogenous in their stated preferences. High score respondents uncertain of their stated preferences (N=24) changed stated preferences for the cost attribute, and became more homogenous regarding preferences for the cost and small_size attribute, but less homogenous regarding preferences for the large_size attribute. Regarding those respondents who stated they were certain of their choices in the first elicitation situation, low-score respondents (N=38) changed their stated preferences for the cost attribute, became more homogenous regarding the cost and the habitat attribute, and less

homogenous regarding the two size attributes and oil. These results can be found in tables A2-A4 in the appendix.

Table 9 sums up the results from the merged dataset and the four subsets regarding relative scale and class assignment.

Table 9 *Summary of Relative scale factor for choices made after the group discussion and changes in estimated attribute coefficients (stated preferences) after deliberation*

	Pooled dataset	*High-score subset*	*Low-score subset*	*Certain subset*	*Uncertain subset*
Relative scale (t-value)	0.68 (-1.61)	0.95 (-0.21)	1.52 (1.77)	0.62 (-2.99)	1.39 (1.46)
Small_mean	No change	No change	No change	No change	No change
Large_mean	No change	No change	No change	No change	No change
Oil_mean	No change	No change	No change	No change	No change
Fish_mean	No change	No change	No change	No change	No change
Habitat_mean	Positive change	No change	No change	Positive change	No change
Cost_mean	No change	Positive change	No change	Negative change	No change
Small_std.dev.	No change	No change	No change	Positive change	Negative change
Large_std.dev	Negative change	Negative change	Positive change	Positive change	Positive change
Oil_std.dev	Negative change	Negative change	No change	Negative change	No change
Fish_std.dev.	Negative change	Positive change	Positive change	Negative change	Negative change
Habitat_std.dev	Negative change	No change	Positive change	Negative change	Positive change
Cost_std.dev	Positive change	Negative change	Negative change	Positive change	Negative change

V. Discussion

Overall, the respondents make less rather than more consistent choices after the group discussion, although we cannot reject H_0^1 since it is not statistically significant at 10% level (t-value =1.61). This result is, unexpectedly, driven by respondents stating they were certain of their choices in the first round. Low score and uncertain respondents, on the other hand, tend to make more consistent choices after the discussion, but this is statistically significant only for low-score respondents (at 10% level). This implies that we can reject H_0^4. A relative scale parameter above 1, as we demonstrate for low-score respondents, does not necessarily imply that discussing the matter under consideration makes people more certain of their choices. This could also be a result of respondents being more familiar with the elicitation procedure, i.e. filling out the choice cards. For example Brouwer et al. (2010) let respondents fill in choice cards one-by-one and immediately after each choice make a statement on how certain they were of their choice. They reveal that although the self-reported certainty increased significantly over the series of 6 choices, the actual certainty, measured as the relative scale parameter did not change significantly. The same is the case for (Lienhoop and Völker (2016) and Völker and Lienhoop (2016), who reports a tendency that self-reported certainty of choices increases after deliberation, but this is not consistent with a higher scale parameter. Matthews et al (2017b), on the other hand, find a higher scale parameter when using a video-enhanced compared to a traditional survey, but this does not correspond with higher self-reported certainty. Given our findings, these highly ambiguous results give reason to question the use of self-reported statements of certainty of choices as signals of choice consistency in CEs. Recent work by Bobinac (2019) on kidney patients in Croatia also suggests certainty adjusted willingness to pay measures should be treated with caution.

On average respondents do change stated preferences for the attributes of an unfamiliar public good across elicitation rounds. This said, the conclusion is reached with the smallest possible margin as respondents only change their preferences for one out of six attributes. The change concerned the attribute with the largest marginal sensitivity, and the stated preference for this attribute, habitat, was reinforced after the group discussion. Hence, we can reject H_0^2 at 10% level but not at the 5% level. Note that on average, stated preference for the cost attribute did not change after the group discussion. This is important given the cost attributes role in the calculation of willingness-to pay (WTP). On average, stated preferences for all but two attributes become more homogenous after the discussion. The cost attribute become more heterogeneous, while the small_size attribute remain unchanged. Hence, while after the discussion people are more in concert regarding the environmental attributes, they are more antagonistic when it comes to the importance of money. The result that preferences for the cost attribute has (almost) become more heterogeneous can explain why changes in preferences come out differently when we correct for marginal utility of money (see table 5) and scale (see table 6) respectively. The relative scale parameter for choices made after deliberation is below one, indicating that the respondents made less consistent choices in the second elicitation round. This is an unexpected result worth noticing, even if it is not statistically significant at 10% level.

A novel aspect of this present study is that we are able to distinguish between sub-groups based on both their knowledge of the good and certainty of their stated choices. This revealed some interesting and unexpected results. High-score and “certain” respondents change their stated preference most across the two elicitation situations. Both groups

change stated preferences for the cost attribute, and while high score respondents increase their preferences for this attribute (less negative) respondents certain of their choices reduce it (more negative). This result implies that we can reject H_0^3. LaRiviere et al (2014), show that high-score respondents who are told their high score are willing to pay more to protect CWC in Norway compared to low score subjects or high score subjects who are not told their scores. This result is in concert with our result, as higher (less negative) cost attribute results in higher willingness to pay measures. Hence, more knowledgeable persons seems to both state higher preferences for a non-market good and be more swayable in a positive direction to new information regarding the good under consideration.

A first impression appears to indicate quite a substantive change in choice behavior during the second round compared with the first. Some 73 respondents, or 52.5%, changed more than 2 (out of 9) choices between the first and the second round. Only 19 respondents, or 13.7% did not alter any choice (see Table 3). Closer inspection of the data reveals quite small behavioral changes. Although many respondents changed their choices from the first to the second elicitation round, the distribution of choices of the three alternative scenarios on the choice cards remained largely unaffected. Before deliberation the SQ accounted for 41.1% of choices yet after deliberation this share represented 42.1%. A similar pattern was apparent for choice alternative 1 which represented 30% of choices before the discussion and 27.5% after. This result has implications for the sampling procedure in SP surveys. Very small samples, and/or non-representative samples may not be able to reproduce this stability result. On the other hand, our sample of 139 respondents, making a total of 1668 choices in each elicitation round, is not very large. This indicates that the CE valuation workshop technique is relatively robust even with a limited number of respondents.

VI. Conclusions

Is deliberation necessary in order to value unfamiliar public goods using SP techniques? According to our findings we can conclude that time to reflect and discuss the matter does alter stated preferences, although not to a very large degree. We demonstrate that on average respondents changed their stated preferences for one out of six attributes in a choice experiment across two elicitation rounds separated by a group discussion. Our results also show that after deliberation stated preferences become more homogenous. Four of the six attributes are more homogenous after deliberation, and one is more heterogeneous.

On average the respondents make less consistent choices in the second elicitation round compared with the first. However, with the smallest possible margin we cannot reject the hypothesis that respondents make equally consistent choices before and after a group discussion (t-value = 1.61).

Sampled respondents were analyzed according to sub-groups which included self-reported choice certainty and how well informed they were about the public good. Our results show that less informed subjects make more consistent choices after deliberation. In terms of preferences, contrary to findings by Matthews et al. (2017a) stated preferences do not change for respondents uncertain of their choices (in the first elicitation round) and for low score respondents, whereas they change for high score respondents and for respondents certain of their choices.

The valuation workshop format allowed us to inform respondents about the good under consideration and to address some of the difficulties respondents face in valuing unfamiliar public goods (LaRiviere et al., 2014, Aanesen et al., 2015). The analysis of sub-groups suggests that consideration of a subjects' knowledge may be important in developing a better understanding of how different individuals react to a discussion in forming their preferences. Self-reported certainty scores is a subjective measure. In this vein we speculate on the relative merits of self-reported certainty indices vs. the scale parameter as a means of evaluating the validity of WTP estimates. These are both tasks for future research.

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Appendix

Figure A1 Example of choice card

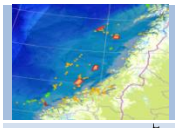
Attribute		*Alternative 1*	*Alternative 2*	*Alternative 3 (same as today)*
Size of the protected area		*5.000 km2*	*10.000 km2*	*2.445 km2*
Attractiveness to business activity		*Attractive both to oil/ gas and fisheries*	*No, not attractive to any business activity*	*Some attractiveness both to oil/gas and fisheries*
Importance as habitat and hiding place for fish		*Not important*	*Important*	*Some importance*
Costs per household per year		*100 kr/year*	*1000 kr/year*	*0*
I prefer				

Table A1 Socio-demographic characteristics of the sub-sets

	Respondents certain of their choices	Respondents less certain of their choices	High score respondents	Low score respondents
Male share	0.4	0.67	0.39	0.60
Age	42	48.9	43	46.67
ENGO member	1.2%	3.45%	3.0%	1.4%
Education	3.49	3.28	3.55	3.26
Labor force participation	71.6%	53.3%	70%	58%
Working in the marine sector	6.2%	1.7%	3%	5.5%
Household size (cont. var.)	3.33	3.26	3.37	3.28
Annual personal income	3.815	3.37	4.03	3.25
Annual household income	5.05	4.65	5.35	4.45
N	81	58	67	72

Table A2 Results for high-score respondents certain of their choices (before the discussion)

```
Number of decision makers: 86
Number of observations: 1032
Number of inter-person draws: 1000 (halton)
Number of intra-person draws: 0 (mlhs)

LL(0)     :  -1133.768
LL(C)     :  -1133.202
LL(final) :  -656.5412
Estimated parameters:  25

Rho-sq (0)     :  0.42
Adj. rho-sq (0):  0.4
Rho-sq (C)     :  0.42
Adj. rho-sq (C):  0.4
AIC:  1363.08
BIC:  1486.56

Time taken:  01:18:10.08
Iterations:  49

Estimates:
               est     se trat_0 trat_1  robse robtrat_0 robtrat_1
cost_mu     -0.2000 0.0342  -5.84 -35.05 0.0512     -3.91    -23.45
cost_sig     0.2390 0.0427   5.59 -17.81 0.0654      3.65    -11.63
small_mu     0.3575 0.4896   0.73  -1.31 0.6296      0.57     -1.02
small_sig    1.2762 0.2593   4.92   1.07 0.3190      4.00      0.87
large_mu     0.2265 0.3883   0.58  -1.99 0.4658      0.49     -1.66
large_sig    1.3129 0.3099   4.24   1.01 0.4261      3.08      0.73
oil_mu      -0.3463 0.4957  -0.70  -2.72 0.5244     -0.66     -2.57
oil_sig     -3.0566 0.4896  -6.24  -8.28 0.6513     -4.69     -6.23
fish_mu     -0.3582 0.3551  -1.01  -3.82 0.4364     -0.82     -3.11
fish_sig     1.4936 0.2797   5.34   1.76 0.3342      4.47      1.48
hab_mu       3.6533 0.6523   5.60   4.07 0.7908      4.62      3.36
hab_sig      2.7659 0.4423   6.25   3.99 0.6091      4.54      2.90
cost_D_mu   -0.0415 0.0164  -2.53 -63.39 0.0179     -2.32    -58.23
cost_D_sig   0.0866 0.0208   4.16 -43.90 0.0238      3.63    -38.30
small_D_mu  -0.4765 0.5714  -0.83  -2.58 0.7509     -0.63     -1.97
small_D_sig  0.1322 0.2202   0.60  -3.94 0.1649      0.80     -5.26
large_D_mu  -0.0416 0.4941  -0.08  -2.11 0.5865     -0.07     -1.78
large_D_sig -0.8195 0.2597  -3.16  -7.01 0.2757     -2.97     -6.60
oil_D_mu    -0.1692 0.5628  -0.30  -2.08 0.6081     -0.28     -1.92
oil_D_sig   -0.8444 0.2809  -3.01  -6.57 0.3711     -2.28     -4.97
fish_D_mu    0.5167 0.4162   1.24  -1.16 0.4931      1.05     -0.98
fish_D_sig  -0.7707 0.2278  -3.38  -7.77 0.2079     -3.71     -8.52
hab_D_mu    -0.2326 0.5227  -0.45  -2.36 0.5223     -0.45     -2.36
hab_D_sig   -0.0128 0.1515  -0.08  -6.68 0.1275     -0.10     -7.95
relscale_A   1.8787 0.4619   4.07   1.90 0.6595      2.85      1.33
relscale_B   1.0000 0.0000     NA     NA 0.0000        NA        NA
```

table A3 Results for high-score respondents uncertain of their choices (before the discussion)

```
Number of decision makers: 48
Number of observations: 576
Number of inter-person draws: 500 (halton)
Number of intra-person draws: 0 (mlhs)

LL(0)     :  -632.8007
LL(C)     :  -632.331
LL(final) :  -436.11
Estimated parameters:  25

Rho-sq (0)     :  0.31
Adj. rho-sq (0):  0.27
Rho-sq (C)     :  0.31
Adj. rho-sq (C):  0.27
AIC:  922.22
BIC:  1031.12

Time taken:  00:26:15.97
Iterations:  76

Estimates:
               est     se trat_0 trat_1  robse robtrat_0 robtrat_1
cost_mu     -0.2040 0.0425  -4.80 -28.35 0.0492     -4.14    -24.46
cost_sig     0.2295 0.0473   4.85 -16.28 0.0523      4.39    -14.73
small_mu     1.4551 0.5004   2.91   0.91 0.6579      2.21      0.69
small_sig    0.2977 0.5684   0.52  -1.24 1.4270      0.21     -0.49
large_mu     0.5120 0.4112   1.25  -1.19 0.5774      0.89     -0.85
large_sig   -0.8876 0.2927  -3.03  -6.45 0.2854     -3.11     -6.61
oil_mu      -1.1114 0.5582  -1.99  -3.78 0.6943     -1.60     -3.04
oil_sig     -2.0255 0.4463  -4.54  -6.78 0.5840     -3.47     -5.18
fish_mu     -0.2458 0.3473  -0.71  -3.59 0.3904     -0.63     -3.19
fish_sig     1.7561 0.4679   3.75   1.62 1.0089      1.74      0.75
hab_mu       1.6891 0.4314   3.92   1.60 0.6595      2.56      1.04
hab_sig      1.2337 0.5436   2.27   0.43 1.0846      1.14      0.22
cost_D_mu   -0.0763 0.0262  -2.91 -41.05 0.0429     -1.78    -25.07
cost_D_sig   0.1740 0.0428   4.06 -19.29 0.0519      3.35    -15.92
small_D_mu   0.2046 0.6477   0.32  -1.23 0.7809      0.26     -1.02
small_D_sig  2.2169 0.6851   3.24   1.78 1.1645      1.90      1.05
large_D_mu   0.5030 0.6380   0.79  -0.78 0.8173      0.62     -0.61
large_D_sig -2.2470 0.5686  -3.95  -5.71 0.6780     -3.31     -4.79
oil_D_mu    -0.1155 0.5581  -0.21  -2.00 0.6856     -0.17     -1.63
oil_D_sig    1.0973 0.4610   2.38   0.21 0.8612      1.27      0.11
fish_D_mu   -0.6550 0.6570  -1.00  -2.52 1.4760     -0.44     -1.12
fish_D_sig  -0.7558 0.6015  -1.26  -2.92 1.5520     -0.49     -1.13
hab_D_mu     1.2326 0.7509   1.64   0.31 0.8593      1.43      0.27
hab_D_sig   -2.3216 0.8366  -2.78  -3.97 1.7123     -1.36     -1.94
relscale_A   1.1745 0.3344   3.51   0.52 0.5119      2.29      0.34
relscale_B   1.0000 0.0000     NA     NA 0.0000        NA        NA
```

Table A4 Results for certain respondents with low score

```
Number of decision makers: 76
Number of observations: 912
Number of inter-person draws: 1000 (halton)
Number of intra-person draws: 0 (mlhs)

LL(0)     :  -1001.934
LL(C)     :  -983.8349
LL(final) :  -574.4014
Estimated parameters:  25

Rho-sq (0)     :  0.43
Adj. rho-sq (0):  0.4
Rho-sq (C)     :  0.42
Adj. rho-sq (C):  0.39
AIC:  1198.8
BIC:  1319.19

Time taken:  01:12:39.08
Iterations:  54

Estimates:
               est     se trat_0 trat_1  robse robtrat_0 robtrat_1
cost_mu     0.0342 0.0140   2.44 -69.02 0.0147      2.32    -65.63
cost_sig   -0.1929 0.0340  -5.67 -35.07 0.0396     -4.87    -30.11
small_mu   -0.9906 0.5173  -1.91  -3.85 0.7535     -1.31     -2.64
small_sig   1.1696 0.2798   4.18   0.61 0.2650      4.41      0.64
large_mu   -0.5453 0.5436  -1.00  -2.84 0.6685     -0.82     -2.31
large_sig  -2.1110 0.4356  -4.85  -7.14 0.5157     -4.09     -6.03
oil_mu     -0.2811 0.3998  -0.70  -3.20 0.4427     -0.63     -2.89
oil_sig    -1.9481 0.3394  -5.74  -8.69 0.3344     -5.83     -8.82
fish_mu     0.2834 0.3492   0.81  -2.05 0.4808      0.59     -1.49
fish_sig   -1.1342 0.3026  -3.75  -7.05 0.3457     -3.28     -6.17
hab_mu      2.6347 0.5335   4.94   3.06 0.4731      5.57      3.46
hab_sig     2.9745 0.5265   5.65   3.75 0.6353      4.68      3.11
cost_D_mu  -0.0198 0.0176  -1.13 -57.95 0.0155     -1.28    -65.73
cost_D_sig  0.0125 0.0185   0.68 -53.48 0.0092      1.36   -107.69
small_D_mu  0.2982 0.7267   0.41  -0.97 0.9326      0.32     -0.75
small_D_sig 1.1372 0.4657   2.44   0.29 0.3855      2.95      0.36
large_D_mu  0.5001 0.6547   0.76  -0.76 0.7452      0.67     -0.67
large_D_sig -1.5854 0.4573  -3.47  -5.65 0.4178     -3.79     -6.19
oil_D_mu    0.3722 0.5073   0.73  -1.24 0.5119      0.73     -1.23
oil_D_sig  -0.2340 0.3520  -0.66  -3.51 0.2238     -1.05     -5.51
fish_D_mu  -0.6997 0.4708  -1.49  -3.61 0.5444     -1.29     -3.12
fish_D_sig  0.8630 0.2308   3.74  -0.59 0.1956      4.41     -0.70
hab_D_mu    0.4332 0.6622   0.65  -0.86 0.5689      0.76     -1.00
hab_D_sig  -1.8541 0.5716  -3.24  -4.99 0.3940     -4.71     -7.24
relscale_A  1.4043 0.2951   4.76   1.37 0.2998      4.68      1.35
relscale_B  1.0000 0.0000     NA     NA 0.0000        NA        NA
```