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Subjective well-being and stated preferences: Explorations from a choice experiment in Norway

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ABSTRACT

Subjective well-being valuation has recently grown in use with applications in the fields of environment, health, and cultural heritage. With this methodology values are based on how non-market goods impact on self-reported measures of well-being such as life satisfaction. Despite the differences in theoretical foundations of subjective well-being and preference-based valuation methods, recent applications have attempted to integrate both approaches without the complete understanding of the effects of subjective well-being on stated preference elicitation. The present study investigates the extent to which subjective well-being impacts the responses to a choice experiment in Norway. The results indicate that momentary subjective well-being does not induce a higher level of randomness in the stated choices but rather affects the preferences for attribute. We also find that self-reported well-being measures respond differently to the cost attribute in the choice experiment. Furthermore, we compute marginal willingness-to-pays for various subjective well-being categories and discuss the implications of these results for an integrated modelling of subjective well-being and preference-based valuation methods.

1. Introduction

Non-market valuation methods are applied to provide estimates of ecosystem service values not found in markets, and the outputs from such studies are incorporated in environmental and health policies and programmes (see e.g. Navrud and Pruckner, 1997; Hanley and Barbier, 2009). Stated and revealed preference methods have been the main approaches adopted in non-market valuation to date (Kling et al., 2012; Baker and Ruting, 2014). Whereas stated preference methods (i.e. contingent valuation and choice experiments) rely on constructed hypothetical scenarios to elicit respondent preferences, revealed preferences (i.e. travel cost method, hedonic pricing) use observations from actual human behavior to infer preferences for non-market goods and services. An alternative to these preference-based valuation methods is the life satisfaction approach which was first introduced in the 2000s (OECD, 2018). In this approach values are based on how non-market goods impact on self-reported measures of well-being.

The main advantage of this subjective well-being (SWB) valuation approach is that self-reported measures of well-being are widely viewed as a better measure of welfare and do not require the strict rationality axioms of preference-based valuation methods. Since the first application of the SWB approach to valuation in 2002 (Ferrer-I-Carbonell and Van Praag, 2002), the adoption of the method has grown rapidly (OECD, 2018). Applications of the approach can be found in the areas of air quality (Luechinger, 2009), drought (Carroll et al., 2009), adult learning (e.g. Fujiwara and Dolan, 2012), health behavior (Shi et al., 2019), culture and sports (Fujiwara and Dolan, 2014), social relationships (Mackie and Smith, 2015), job satisfaction (Georgantzis and Vasileiou, 2013), flood disasters (Luechinger and Raschky, 2009) and terrorism (Frey et al., 2009). OECD (2018) provides a comprehensive review of SWB valuation applications in the literature.

One main trend that defines the rapid growth of SWB valuation in the literature is the increasing integration of SWB valuation and stated preference valuation methods. OECD (2018) identifies three new developments regarding integration of SWB valuation applications and stated preference frameworks. The first development is the adoption of improved ways of modelling income such as the use of relative income in SWB equations. In this regard, Fujiwara and Dolan (2012) compared the willingness-to-pay (WTP) values for an adult learning course that improves life satisfaction using both contingent valuation and an alternative SWB valuation approach. It was found that an adult learning course that improves life satisfaction had non-market value of between of £947

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based on the results of the contingent valuation approach, while according to the results of the SWB valuation method it was estimated to be worth £754.

The second development in integrating SWB valuation and stated preference methods is through "anchoring vignettes" studies where the SWB exercise is framed as a (hypothetical) stated preference scenario. The respondents are required to evaluate the overall effect of a hypothetical event on SWB (OECD, 2018). Bakhshi et al. (2015) use the "anchoring vignette" approach to determine and value the life satisfaction effect of visiting the National History Museum in London. Other studies using a similar approach include Kapteyn et al. (2011) and Angelini et al. (2012). OECD (2018) argues that vignette-based SWB valuation is similar to stated preference where a policy change is presented to respondents and this scenario serves as basis for the valuation of non-market goods and services. However, the "anchoring vignettes" approach to SWB valuation exposes the technique to many of the same problems and criticisms as stated preferences valuation approaches.

Thirdly, the SWB valuation and stated preference valuation frameworks have been integrated through a hybrid SWB-contingent valuation approach (SWB-CV). This is proposed in Bakhshi et al. (2015) as a measure to address some of the problems in using willingness-to-accept (WTA) welfare measures. The procedure involves asking respondents about the monetary compensation required to forgo visiting a cultural heritage institution for one year. The compensation is only applicable to the respondents who had earlier indicated that their SWB would be negatively affected by the hypothetical closure of the cultural institution. Based on the existing applications, Bakhshi et al. (2015) conclude that the WTA estimated from the hybrid SWB-contingent valuation is generally close to the WTP. It is argued that the hybrid SWB-contingent valuation approach may reduce the WTA-WTP disparity observed in stated preference valuation. A similar procedure was adopted by Lau et al. (2013) where respondents in the UK, China and Hong Kong were asked about their WTP to recreate the experience of feeling a positive mood (e.g. happiness, love) or to avoid a negative mood (e.g. fear, sadness) for a specified duration.

To date, the integration of SWB and stated preference valuation frameworks has been pursued without fully understanding how subjective well-being at the time of preference elicitation may affect choices of respondents in preference-based valuation. Meanwhile, behavioural economics points to the possible importance of context dependence for the welfare measures derived from stated preference studies (Carlsson, 2010). Furthermore, the Discovered Preference Hypothesis (Plott, 1996) suggests preference formation through learning and repetition rather than through the existence of predeveloped stable preferences. Lane (2017) reviews the existing literature on how SWB could affect economic behaviour through selfishness, trust and reciprocity and punishment. Specifically, Lane (2017) point to a negative relationship between happiness and selfishness; positive relationship between happiness and trust; and to the fact that short-term unhappiness leads to negative reciprocity. Similarly, unhappiness is argued to enhance the degree to which economic agents are willing to engage in negative reciprocity. Therefore, understanding the relationship between happiness and economic behaviour is of intrinsic interest to economists.

There is also a growing number of studies investigating the effects of emotions and personality on stated preferences. For instance, Hanley et al. (2017) explore the impacts of individuals' emotional state (i.e. incidental emotions) on preferences in stated choice experiments for environmental goods. The authors used three different emotion treatments (sadness, happiness and neutral emotions) combined with a stated preference choice experiment. These treatments were induced through short films and were implemented prior to participation in the choice experiment. The results indicated that there were no significant differences in preference parameters or WTP estimates between the treatment groups.

Similarly, Boyce et al. (2019) investigate the effects of personality on economic choices in stated preferences. Specifically, a hybrid choice econometric framework was used to examine the effects of personality on preferences for the status quo, changes in environmental quality, and costs of undertaking the environmental improvements. Boyce et al. (2019) found that personality traits have effects on the choice of status quo and in terms of the sensitivity to the cost of the environmental management option (marginal disutility of cost). In two out of the three samples, Boyce et al. (2019) find that the respondents who are more open to experiences are less likely to choose the status quo and more likely to be sensitive to the cost of environmental improvement. In addition, the personality traits were found to be associated with variations in the WTP for environmental goods.

Within this paper we therefore investigate the effects of the self-reported SWB of the respondents on preferences and WTP at the time of choosing options in a stated preference discrete choice experiment. If differences exist, the implication is that studies which integrate subjective well-being frameworks with preference-based valuation methods may have to consider the differences in WTP values of different SWB categories. An ordered logit model is also employed to investigate the factors that determine the self-reported SWB categories.

The rest of the paper is structured as follows. In the next section, the theoretical foundations of how SWB enter preferences is presented and this is extended to random utility modelling. The choice experiment method and sampling issues are discussed in section three. The results from the analysis are presented in section four. Finally, the discussions of the results as well as the conclusions are provided in section five.

2. Theoretical and econometric modelling of SWB in random utility model

There is a basic difference between the treatment of SWB and preferences as modelled in the theory of consumer behaviour. Preference-based valuation models are derived assuming well-behaved preferences with a strict set of axioms. SWB valuation on the other hand relies on direct expressions of utility by individuals. The general discussions of the differences and similarities between SWB and standard preferences satisfaction, based on the neo-classical theory of consumer behavior, is reviewed by MacKerron (2011). Despite differences between subjective well-being and standard utility theory, there have been only a few attempts to integrate these two conceptualisations of human welfare (see e.g. Kimball and Willis, 2006). For instance, Kimball and Willis (2006) distinguish that utility reflects peoples' choices and SWB is how people feel after these choices. Moreover, part of SWB is derived from the temporary response to changes in utility. SWB can also be viewed as an argument of the utility function and can affect other dimensions of utility (OECD, 2018). We follow this argument and specify that the utility of a respondent depends on the quantities of goods consumed and SWB. The utility function is then given as:

$$u_n = u(x_n; z_n) \tag{1}$$

where $u$denotes utility, $x$refers to both the price and non-price attributes of goods and services, and $z$refers to the momentary SWB of the consumer n. The above formulation of the utility function follows the suggestion of Richard Easterlin that happiness is relative (Oswald, 1997). This means that utility is also derived from comparisons of oneself with those who are close.

Three dimensions of subjective well-being have been identified in the literature and these are evaluative subjective well-being, eudaimonic subjective well-being and momentary subjective well-being. Evaluative subjective well-being refers to a self-evaluation of one's life according to some positive criterion (Kahneman et al., 1999). Eudaimonic subjective well-being is the assessment of the process of achieving what one perceives to be important in life (Waterman, 1993; Ryan and Deci, 2001). Momentary subjective well-being measures feelings and mood at a given point in time (MacKerron and Mourato, 2013). This study focusses on momentary subjective well-being because we are interested in

circumstances around the time of choices in a stated preference study rather than evaluative subjective well-being[1]. This is the same as Hanley et al. (2017) in which emotional state at the moment of elicitation of preferences is studied.

The random utility maximization of McFadden (1974) is a standard framework for modelling discrete choice experiments. According to Train (2009), the most widely used of the discrete choice models is the logit; this is because the probabilities from these logit models take a closed form and are readily interpretable. The utility of an economic agent (n) from alternative (i) during choice occasion (t) is given as:

$$u_{nit} = v_{nit} + e_{nit} \tag{2}$$

where utility $(u_{nit})$is made up of a deterministic component of utility (v_{nit}) and the random component (ε_{nit}). Following the Lancaster (1966) theory of value in which utility is derived from attributes of the goods rather than the quantities of goods themselves being the objects of utility, we can re-state equation 2 with the deterministic component of utility being specified to depend on the attributes as:

$$u_{nit} = \mathbf{x_{nit}}\beta_{\mathbf{n}} + e_{nit} \tag{3}$$

Where $\mathbf{x_{nit}}$ represents a matrix of attribute levels, $\beta_{\mathbf{n}}$represents a vector of parameters of the attributes and e_{nit} is the stochastic term. The stochastic term is unknown but generally assumed to be heteroscedastic and individual-specific with variance$(\text{var}(e_{nit}) = s_n^2)$ and $s$being the standard deviation. A normalization of the variance is required to ensure identification of the model. For this, we can write the error term to be $\varepsilon_{nit} = e_{nit}\sigma_n$with $\sigma_n = \pi/\sqrt{6s_n}$ with σbeing the scale parameter. The error term is assumed to be identically, independently, and extreme value type I distributed with constant variance as$\text{var}(e_{nit}) = \pi^2/6$.

In the stated preference method of choice experiments, the respondents choose their preferred alternative from a choice set. Within the random utility maximization modelling framework (RUM), an individual is likely to choose an alternative i when $u_{nit} > u_{njt}$ for $i \neq j$. With the above assumptions about the error term, the probability that an individual will choose an alternative i is given as:

$$P(i|I) = \frac{\exp(x_{nit}(\sigma_n\beta_{\mathbf{n}}))}{\sum_{j=1}^{I}\exp\left(x_{njt}(\sigma_n\beta_{\mathbf{n}})\right)} \tag{4}$$

It should be noted that σ_n and $\beta_{\mathbf{n}}$are confounded. Because of this, the parameters estimated from the model specified above cannot be directly interpreted as utility measures.

The basic RUM model has been extended to address some of its weaknesses and to capture heterogeneity in preferences. One of the restrictions of the basic formulation of the choice model is independence from irrelevant alternatives in which the choice probabilities are proportional across alternatives. In response, generalized extreme value models have emerged over the years (Train, 2009). One such generalized extreme value model is the nested logit where the alternatives from which the economic agents choose from can be partitioned into subsets. Another extension of the standard logit frame is the mixed logit models which allows for random taste variations, unrestricted substitution patterns, and correlation in unobserved factors over time (Train, 2009).

Hanley et al. (2017) used this mixed logit framework to examine the effects of human emotions on the responses in choice experiments. Given the similarities between emotions and SWB, we adapt the framework of Hanley et al. (2017) to examine the effects of SWB within the RUM framework. Similar to the modelling of emotional state within the utility function, we explicitly model SWB as entering the utility function expressed in equation (1). There are two ways through which SWB enters the utility function and these are through the effects of SWB on the utility parameters (β) and the scale parameter (σ). Based on this, we test for the effects of SWB on the utility parameters through the interactions between SWB and the attributes. Following Czajkowski et al. (2016) and Hanley et al. (2017), we specify the individual-specific deviations from the means as $\beta_n = b + z_n\varphi + v_n\exp(z_n\psi)$ where b is the population means of the individual specific taste parameters, φ captures the effects of SWB on the means of the individual specific taste parameters, and ψ represents the effects of SWB on the standard deviations of the random taste parameters. Furthermore, we also test whether SWB influences the scale parameters. This can be operationalized by specifying the scale parameter to depend on the SWB levels (Hanley et al., 2017). The SWB-adjusted scale parameter can be specified as $\sigma_n = \pi/(\sqrt{6s_n})\exp(\mathbf{z_n}\zeta)$ with ζrepresenting the effects of SWB on the scale parameter. There is an inverse relationship between the scale parameter and the variance of the error term. This means that a relatively higher scale parameter corresponds to relatively low uncertainties in choice experiments and vice-versa. Since we have four response categories for the self-reported SWB, we constructed three dummy variable response categories of SWB with the base category being "very happy"[2]. According to Hess and Rose (2012), dummy coded variables cannot enter scale terms and at the same time be interacted with means and standard deviations. As a result of this, we separately test for the effects of SWB on the scale parameter (ζ) as well as on the mean and variation of taste parameters $(\varphi$ and $\psi)$.

3. The survey, sampling, and the choice experiment

The data that was used to explore the effects of SWB on choice behaviour in this paper is from a survey on valuing kelp forest restoration in Norway. A questionnaire was developed for this and preliminary versions of the questionnaire were piloted among a selection of respondents who were invited to three focus group meetings in Tromsø, Norway. The survey was implemented in the spring of 2018 by a survey company among a panel of respondents who had volunteered and registered to be sampled for surveys, from which we received 1,013 responses. Since each of the 1,013 respondents made 6 choices in the choice experiment, we have a total of 6,078 observations. The main results of the survey in the form of marginal WTP estimates for the attributes associated with kelp forest restoration were analysed in Hynes et al. (2021). The present study uses the same dataset and the questions on self-reported happiness to investigate the effects of SWB on the stated choices.

The questionnaire started with general information about kelp forest restoration in Norway. The survey also contained general questions relating to the socio-economic information of the respondents as well as attitudinal questions on marine ecosystem restoration. The questionnaire also asked about seaside visitation rates, awareness of marine protected areas in Norway, perceptions of respondents on the quality of water bodies in Norway and extent to which the respondents support ecosystem restoration. In addition, a choice experiment (CE) was implemented as part of the survey. In the CE, respondents were requested to choose their preferred options for kelp forest restoration. The options were described by attributes and these attributes took on different attribute levels. The attributes and attribute levels used are presented in Table 1 below. As noted in Hynes et al. (2021) the final attributes and levels were based on discussions with marine ecologists in the Norwegian Institute for Water Research. Focus groups and pilot testing ensured that the description of the attributes and levels was understandable for the general public. The final choice experiment had four attributes; biodiversity, the extent to which the restored kelp forest

[1] In the analysis that follows all references to 'SWB' refers to momentary subjective well-being.

[2] There were actually 5 SWB levels in the survey but the scale of 'somewhat unhappy' and 'very unhappy' were combined for the purpose of the analysis under the heading of 'not happy'. The scale is discussed in more detail in the following section.

Table 1
Attributes and attribute levels adopted for the choice experiment

Attribute	Description	Levels
Biodiversity	Number of species present per m^2	Low abundance (approx. 10 species) Medium abundance (approx. 75 species). High abundance (approx. 250 species).
Nurseries for juvenile fish	Juvenile fish abundance per m^2	Low abundance (max 10 juveniles) Medium abundance (max 20 juveniles) High abundance (max 30 juveniles)
Area restored	Total area of kelp forest restored	40,000m^2 (5.5 soccer pitches) 20,000m^2 (3 soccer pitches) 10,000m^2 (1.5 Soccer pitches) None
Cost	Amount paid per person per year through higher tax payments.	€0, €5, €10, €20, €30, €45, €60

provides nurseries to juvenile fish, area of kelp restored and cost.

The biodiversity attribute and nursery for juvenile fish attribute each had 3 levels. For the biodiversity attribute the levels were low abundance corresponding to about 10 species, medium abundance corresponding to about 75 species and high abundance corresponding to about 250 species. The attribute levels of nurseries for juvenile fish included low abundance corresponding to a maximum of 10 juveniles, medium abundance corresponding to a maximum of 20 juveniles and high abundance corresponding to a maximum of 30 juveniles. Despite the ordinal scales adopted for biodiversity and nursery attributes, approximate corresponding numerical figures for each level used were also specified. The attribute levels for kelp area restored were 10,000 m^2 (approximately 1.5 soccer fields), 20,000 m^2 (approximately 3 soccer fields), 40,000 m^2 (approximately 4.5 soccer fields) and the status quo attribute level of none of the kelp area being restored. The cost attribute was framed as the amount paid per person through higher tax payments. The attribute levels in this case were €5, €10, €20, €30, €45, €60 and the status quo cost attribute level was €0[3]. The latter value meant that if no kelp forest restoration option is chosen, the respondents will not pay any additional payments in the form of higher tax.

As part of the same survey, information on the stated happiness of the respondents was also collected. This question was asked immediately after the respondents answered the choice experiment. For this, the classification system of the World Values Survey was adopted (Inglehart et al., 2014). The question was framed, as "*We are interested in exploring whether levels of self-reported life satisfaction impact the responses in the survey. Could you therefore tell us how happy you are at the moment?*" The self-reported happiness was elicited in five categories of 'very happy', 'somewhat happy', 'neither happy nor unhappy', 'somewhat unhappy' and 'very unhappy'. The time and date on which respondents answered the internet survey were used to determine whether the respondent answered the survey during the weekend or not.

The attributes and associated levels were assigned to alternatives within the choice cards using an efficient design process. The NGENE software (ChoiceMetrics, 2014) was used to generate a Bayesian efficient design (Hess et al., 2008; Scarpa and Rose, 2008). The mean value of the D-error for the design was 0.55. There were two blocks of six cards in the design meaning two sets of choice cards were employed. Each respondent was asked to make 6 choices; that is, 6 choice cards, each with three alternative restoration options were presented to each respondent[4]. Respondents were required to select their preferred alternative on each of the cards. An example of a choice card is shown in Fig. 1.

4. Results

4.1. Descriptive statistics

The descriptive statistics of the four SWB categories of the sample are presented in Table 2 below. Since there were too few data points for the 'very unhappy' SWB category, it was combined with the category 'somewhat unhappy' to form the new SWB category of 'not happy'. As a result, we present the summary statistics for the four SWB categories: 'very happy', 'somewhat happy', 'neither happy nor unhappy' and 'not happy'. All subsequent analysis also uses these four SWB levels.

Overall, about 47% of the respondents are males and the gender compositions do not differ among the four SWB categories. The average age of the respondents is 47 years and according to an F test there is a statistically significant difference in age across the four SWB categories. The proportions of respondents who answered the survey questions on weekends and on public holidays are on the average about 22% and 21% respectively. Both proportions do not vary statistically across the four SWB categories. The respective percentages of the respondents who are single and divorced/separated/widowed are on average 24% and 9%. The proportions of these two variables are found to be statistically different across the SWB categories. Similarly, the average proportion of the respondents who are married is 66% and again this share differs statistically across the four SWB categories.

The proportion of the respondents who have children is 0.58 and this differs across the four SWB response categories with a higher proportion of persons with children indicating that they are somewhat or very happy compared to the other SWB levels. The percentage of the respondents who completed high school/university is 63% and this differs significantly among the four SWB categories. The average household size is 2.3 and the respondents with bigger household sizes appear to be happier. Slightly less than 10% of the respondents are members of an environmental non-government organization (ENGO) and this proportion does not differ significantly across the four SWB categories. On average about 47% of the respondents are employed fulltime and about 10% are employed part-time. Students and retirees constitute about 11% and 18% respectively of the sample. The proportion of the respondents who are unemployed due to disability is less than 7% of the sample.

The proportion of respondents who are unemployed across the entire sample was less than 2% and this is statistically insignificant across the four SWB categories. The unemployment rate for the Norwegian population was 3.8% in 2017 (SSB, 2018). The median income for Norway is estimated to be 510,000 NOK (SSB, 2018). Based on this median income, we constructed the proportion of the respondents who reported income categories to be the same or above this median income. Table 2 shows that the incomes of 37% of the respondents are above the median income. In total, 62% of the respondents indicated that they visited the seaside within the past 12 months and these proportions differ across the four SWB categories. Similarly, the participation in water activities is high among the respondents. About 55% of the respondents participated in water activities such as swimming, snorkeling, diving, sailing, boating, canoeing, kayaking, etc.

[3] The cost of each option on the choice cards was shown in Norwegian Kroner but all subsequent analysis was carried out using the Euro equivalent to allow for comparison to other studies.

[4] For further information on the design of the choice experiment see Hynes et al. (2021).

	Option A	Option B	No Change
Biodiversity (abundance of macroinvertebrate species) per m2	Medium Abundance (max. 75 species).	Medium Abundance (max. 75 species).	Low Abundance (max. 10 species)
Nurseries for juvenile fish: Juvenile fish abundance per m2	Medium Abundance (max 20 juveniles)	High Abundance (max 30 juveniles)	Low Abundance (max 10 juveniles)
Total area of kelp forest restored	20,000m2 (3.0 Soccer pitches)	40,000m2 (5.5 Soccer pitches)	None
Annual increase in personal income tax	NOK 450	NOK 600	€0

Fig. 1. Example choice card

The average number of times respondents visited the seaside and engaged in water-based recreation in the previous year was 12 and 27 respectively; and these figures are similar across the four SWB categories. The percentage of the respondents who are aware of marine protected areas (MPAs) in Norway was 28% and weakly differs statistically across the four SWB categories. A smaller percentage of the respondents (9%) are aware of any marine ecosystem restoration activity in Norway. Only 19% of the respondents know the location of any kelp beds/forests. The proportion of respondents who were aware of invasive species in Norwegian waters was 63% and the corresponding percentage of the respondents who were aware of endangered species in Norway was 38%, while 30% of the respondents perceived the quality of estuaries to be satisfactory. A similar percentage of the respondents also perceived the quality of the coastal waters to be satisfactory and a slightly lower percentage (27%) of the respondents perceived the quality of deep sea to be satisfactory. Of the awareness variables, only perceived quality of the coastal waters and perceived quality of estuaries were statistically different at the 5% level across the four SWB categories.

The responses to the subjective well-being question show that 125 respondents (12.3% of the sample) indicated that they were 'very happy' at the time of the survey while 491 respondents (48.5% of the sample) indicated that they were 'somewhat happy'. Taken together, more than 60% of the respondents indicated that they were in some manner happy at the moment of the survey. Approximately 33% of the respondents indicated that they were 'neither happy nor unhappy'. A small percentage of the respondents indicated unhappiness. Specifically, 46 respondents indicated that they were 'somewhat unhappy' whilst 12 respondents indicated that they were 'very unhappy'. Overall, therefore 5.7% of the sample, indicated that they were in some way unhappy ('not happy') at the time when they were making the stated choices.

Although the level of happiness was obtained at the time of the survey, we would like to compare the responses from the happiness question with previous happiness studies. Hellevik (2003) analyzes the trend for happiness for selected years starting from 1985 to 2001 and found that the level of happiness in the Norwegian population was stable despite improvements in financial and material possessions between 1985 and 2001. Taking average percentages of the figures for all the years in Hellevik (2003), we compute an average percentage of 21% for what Hellevik referred to as "very happy", 68% for what the author called "quite happy", 10% for "not particularly happy" and 10% for "not happy". It can be seen from the observation totals for each SWB category presented in table 2 that the share in the happiness measures in the current study are similar in percentage terms to the equivalent categories in Hellevik (2003).

4.2. *Results from ordered logit estimation*

Prior to the analysis of SWB on stated choice behaviour, the factors that determine the choice of different SWB categories was assessed. This is achieved through the estimation of an ordered logit model. The predicted probabilities for each of the SWB levels of the variables specified are presented in Table 3. From these results, we can see that the respondents who answered the survey during the weekends are not statistically happier than those who answered the questionnaire on weekdays. However, the respondents who answered the survey questions while on holidays are statistically more likely to report higher subjective well-being, at least at the 10% significance level. Respondents who are single or divorced are more likely to choose happiness categories from the lower end of the subjective wellbeing spectrum. Similarly, respondents who indicated that they are unemployed are more likely to be 'not happy'. The respondents who support comparable kelp forest restoration projects are more likely to choose the subjective happiness categories of 'somewhat happy' and 'very happy'.

Some of the results from the ordered logit model support findings in the existing literature. First, the statistical significance of the unemployment and divorce parameters in determining the self-reported SWB levels and the fact that respondents in these situations tend to be more unhappy are similar to the findings of Dolan et al. (2008) and MacKerron (2011). In addition, NCM (2018) established an association between unemployment and suffering in Nordic countries. Similarly, the finding that respondents who support comparable kelp forest restoration projects are happier appears to support Skianis (2012)'s view that connectedness with nature affects SWB. On the other hand, having children does not appear to influence the category of momentary SWB chosen. Also, the well-documented significance of age (OECD, 2018) in SWB regressions is not found in our sample.

The choice of kelp forest restoration for the explorations of SWB on response behaviour in the choice experiment appears to have been effective. As Ejelov et al. (2018) note emotions are less intense with increased psychological distance. It can, therefore, be argued that psychological distance between SWB and kelp forest restoration is suitable

Table 2
Descriptive statistics under various subjective happiness categories and the total sample

Variable	Very happy	Happy	Neither happy nor unhappy	Not happy^	F statistic	Total sample
Average age of respondents (years)	45.60	47.81	46.99	39.10	13.14 ***	46.76
	(1.54)	(0.81)	(0.94)	(1.84)		(0.55)
Proportion of respondents who answered the questionnaire during the weekend	0.22	0.21	0.22	0.26	0.22	0.22
	(0.04)	(0.02)	(0.02)	(0.06)		(0.01)
Proportion of respondents who answered the questionnaire during the holidays	0.14	0.22	0.22	0.19	1.64	0.21
	(0.03)	(0.02)	(0.02)	(0.05)		(0.01)
Gender (=1 if male)	0.47	0.49	0.46	0.36	1.07	0.47
	(0.04)	(0.02)	(0.03)	(0.06)		(0.02)
Proportion who visited seaside in the past 12 months	0.60	0.67	0.56	0.57	3.58**	0.62
	(0.04)	(0.02)	(0.03)	(0.07)		(0.01)
Average number of times respondent visit the seaside in the past year	12.59	13.20	11.45	9.15	0.20	12.38
	(2.18)	(2.44)	(1.69)	(2.04)		(1.40)
Average number of times respondents engage in seashore, on-water and in-water activities	28.51	27.82	25.02	20.64	0.40	26.67
	(3.89)	(2.78)	(2.94)	(4.52)		(1.78)
Proportion of respondents who are aware of marine protected area in Norway	0.22	0.32	0.24	0.24	3.53**	0.28
	(0.04)	(0.02)	(0.02)	(0.06)		(0.01)
Proportion of respondents who are aware of marine restoration in Norway	0.07	0.09	0.09	0.05	0.52	0.09
	(0.02)	(0.01)	(0.02)	(0.03)		(0.01)
Proportion of respondents who are aware of invasive species in Norwegian waters	0.65	0.66	0.58	0.55	2.20*	0.63
	(0.04)	(0.02)	(0.03)	(0.07)		(0.01)
Proportion of respondents who are aware of endangered species in Norwegian waters	0.38	0.38	0.37	0.40	0.21	0.38
	(0.04)	(0.02)	(0.03)	(0.07)		(0.02)
Proportion of respondents who know of kelp forest	0.21	0.22	0.15	0.17	1.99	0.19
	(0.04)	(0.02)	(0.02)	(0.05)		(0.01)
Proportions of respondents who perceive quality of estuaries to be satisfactory	0.31	0.33	0.26	0.22	2.48*	0.30
	(0.04)	(0.02)	(0.02)	(0.06)		(0.01)
Proportions of respondents who perceive quality of coastal waters to be satisfactory	0.32	0.33	0.26	0.16	3.52**	0.29
	(0.04)	(0.02)	(0.02)	(0.05)		(0.01)
Proportions of respondents who perceive quality of deep sea to be satisfactory	0.26	0.31	0.24	0.16	3.04**	0.27
	(0.04)	(0.02)	(0.02)	(0.05)		(0.01)
Proportion of the respondents who completed university/high school	0.55	0.69	0.60	0.52	5.33***	0.63
	(0.05)	(0.02)	(0.03)	(0.07)		(0.01)
Proportion of the respondents who are married or live with partner	0.78	0.74	0.55	0.33	23.94***	0.65
	(0.04)	(0.02)	(0.03)	(0.06)		(0.01)
Proportion of the respondents who are single	0.16	0.18	0.32	0.47	14.85***	0.24
	(0.03)	(0.02)	(0.03)	(0.07)		(0.01)
Proportion of the respondents who are divorced/separated/widowed	0.05	0.08	0.10	0.21	4.90***	0.09
	(0.02)	(0.01)	(0.02)	(0.05)		(0.01)
Proportion of the respondents who have children	0.61	0.62	0.55	0.36	5.26***	0.58
	(0.04)	(0.02)	(0.03)	(0.06)		(0.02)
Household size	2.46	2.46	2.18	1.98	6.15***	2.34
	(0.10)	(0.05)	(0.06)	(0.18)		(0.04)
Proportion of respondents who are members of ENGOs	0.10	0.10	0.08	0.19	2.18*	0.10
	(0.03)	(0.01)	(0.02)	(0.05)		(0.01)
Proportions of respondents with fulltime employment	0.48	0.51	0.43	0.35	2.96**	0.47
	(0.05)	(0.02)	(0.03)	(0.06)		(0.02)
Proportions of respondents who are students	0.11	0.11	0.12	0.17	0.76	0.11
	(0.03)	(0.01)	(0.02)	(0.05)		(0.01)
Proportions of respondents who are pensioners	0.14	0.20	0.19	0.05	3.09**	0.18
	(0.03)	(0.02)	(0.02)	(0.03)		(0.01)
Percentage of respondents who are unemployed including unemployed due to sickness/disability	0.06	0.06	0.11	0.24	9.49***	0.08
	(0.02)	(0.01)	(0.02)	(0.06)		(0.01)
Proportion of respondents who at least earn the median income	0.38	0.43	0.33	0.12	8.45***	0.37
	(0.04)	(0.02)	(0.03)	(0.04)		(0.01)
Number of observations	125	491	339	58		1013

*** implies 1% significant level, ** implies 5% significant level and * implies 10% significant level. Standard deviations are in the parentheses.
^ Note that the "very unhappy" category was combined with "somewhat unhappy" category under the heading 'not happy'.

for investigating the effects of SWB on stated preference for kelp forest restoration. This is because the variables associated with marine ecosystem including kelp forest restoration are statistically insignificant in the ordered logit models of SWB.

The results from the ordered logit model were used to compute the probabilities for various happiness categories. The results from this estimation indicate that the probability of choosing the 'very happy' category is about 0.11. This figure appears to be close to the percentage of the respondents who choose 'very happy' category reported earlier. The probability of a respondent choosing the 'very happy' subjective well-being response decreases with the questionnaire being answered during the holiday, the respondent being single, respondent being divorced, respondent being unemployed and increases in respondent supporting kelp forest restoration. The probability of choosing 'somewhat happy' subjective well-being response is about 0.50; and this follows the 'very happy' subjective well-being response. The probability of choosing the 'neither happy nor unhappy' subjective well-being category is 0.34. This figure compares with the 33% discussed earlier for the

Table 3
Estimation results from ordered logit model

	Estimates	Marginal effects Very happy	Somewhat Happy	Neither happy nor unhappy	^Not happy
Age of respondent (years)	-0.01	0.01	0.01	-0.01	0.001
	(0.01)	(0.001)	(0.001)	(0.001)	(0.001)
Gender (=1 if male)	0.066	-0.01	-0.01	0.01	0.001
	(0.15)	(0.01)	(0.02)	(0.03)	(0.01)
Respondents who are unemployed because of disability	-0.43	0.05	0.05	-0.08	-0.02
	(0.55)	(0.07)	(0.05)	(0.10)	(0.02)
Respondents who answer the survey during holidays	0.23	-0.02*	-0.03	0.04	0.01
	(0.14)	(0.01)	(0.02)	(0.03)	(0.01)
Respondents who answer the survey during weekends	0.05	-0.01	-0.01	0.01	0.001
	(0.15)	(0.01)	(0.02)	(0.03)	(0.01)
Respondents with income above the median personal income	-0.11	0.01	0.02	-0.02	-0.01
	(0.14)	(0.01)	(0.02)	(0.03)	(0.01)
Respondents who are member of ENGO	0.04	-0.01	-0.01	0.01	0.001
	(0.23)	(0.02)	(0.03)	(0.04)	(0.01)
Respondent is single	0.90***	-0.07***	-0.15***	0.17***	0.05***
	(0.18)	(0.01)	(0.03)	(0.03)	(0.01)
Respondent is divorced	0.92***	-0.07***	-0.16***	0.16***	0.06**
	(0.25)	(0.01)	(0.05)	(0.03)	(0.02)
Respondents with children	0.08	-0.01	-0.01	0.01	0.001
	(0.19)	(0.02)	(0.03)	(0.04)	(0.01)
Respondent completed university/high school education	0.02	0.001	0.001	0.001	0.001
	(0.13)	(0.01)	(0.02)	(0.02)	(0.01)
Respondent visit seaside	-0.09	0.01	0.01	-0.02	0.001
	(0.13)	(0.01)	(0.02)	(0.02)	(0.01)
Respondent is unemployed	1.14**	-0.08***	-0.20**	0.19***	0.08
	(0.49)	(0.02)	(0.09)	(0.06)	(0.05)
Household size	-0.04	0.001	0.01	-0.01	0.001
	(0.07)	(0.01)	(0.01)	(0.01)	(0.01)
Respondent support complete ecosystem restoration	-0.30**	0.03**	0.04**	-0.06**	-0.01**
	(0.13)	(0.01)	(0.02)	(0.02)	(0.01)
Respondents who perceive quality of estuaries to be satisfactory	-0.22	0.02	0.03	-0.04	(0.01
	(0.16)	(0.02)	(0.02)	(0.03)	(0.01)
Respondents who perceive quality of coastal waters to be satisfactory	-0.24	0.02	0.03	-0.05	-0.01
	(0.17)	(0.02)	(0.02)	(0.03)	(0.01)
Respondent who perceive quality of deep sea to be satisfactory	-0.03	0.001	0.001	-0.01	0.001
	(0.15)	(0.02)	(0.02)	(0.03)	(0.01)

*** Significant at 1% level; ** significant at 5% level; * significant at 10% level. The standard errors are in parentheses. Note that the "very unhappy" category was combined with "somewhat unhappy" category under the heading 'not happy'.

percentage of respondents choosing 'neither happy nor unhappy'. The probability of choosing this category increases with the answering of the questionnaire during the holiday, being single, being divorced, being unemployed and decreases with support for comparable kelp forest restoration. The probability of choosing the last subjective well-being categories of 'not happy' is 0.04. This probability increases with being single, being divorced, being unemployed and decreases with the support for comparable kelp forest restoration.

4.3. Results from multinomial logit (MNL) and mixed logit (MXL) models

The effects of SWB on stated choice behaviour was explored using various estimations of the multinomial logit (MNL) and mixed logit (MXL) models. The results from two different estimation procedures are presented in Table 4 below. In Table 4, model 1 is the basic MNL with scale parameter differences for various SWB categories, model 2 is the MNL model with SWB interactions with ASC and cost attribute, model 3 is the standard MXL model without scale parameter differences and interactions with SWB categories, model 4 is the MXL model with scale parameter differences among SWB categories, model 5 is the MXL model with SWB interactions with means of ASC and cost attribute and model 6 is the MXL model with SWB interactions with means and standard deviations of ASC and cost attribute. It is important to note that the MNL estimation results are presented for comparison purposes only. Therefore, the results that were adopted for the final analysis are based on the MXL models. The MXL estimations are simulated by averaging over draws from an assumed distribution (Revelt and Train, 1998). In the estimation, this is approximated in the log-likelihood function by numerical simulation using 500 Halton draws.

Given the similarities between models 5 and 6, we adopt model 5 for further analyses. Means and standard deviations of all attributes and their levels are presented. All parameters are significant except the standard deviations of the medium nursery and area of the kelp forest restored. This suggests that the preferences for all attributes except medium nursery and area of kelp forest restored vary considerably among the respondents. The relative scale parameters are statistically different from zero at the 1% level[5]. The relevant hypotheses as to whether momentary SWB induces more randomness in the stated choices involves testing whether the scale parameters are statistically significant different from one. In this case, we fail to reject the null hypotheses that the three relative scale parameter values are different from one. This implies that the degree of randomness in the stated choices does not differ among the four states of SWB.

The overall model specifications for the MXL appear to be satisfactory especially when compared with the MNL model. The likelihood ratio test indicates that the MXL model is a better fit than the MNL model. The adjusted rho-squared for MXL models are between 0.32 and

[5] As described by Hanley et al. (2017) "Observing an effect for the scale parameter is equivalent to observing a simultaneous and equal effect for all preference parameters (means and standard deviations), or interpreted differently, an effect for the error term of the utility function which can be thought of as the level of randomness of the choices, as observed by a researcher."

Table 4
Estimation results from MNL and MXL models with subjective well-being

	1	2	3	4	5	6
Mean of alternative specific constant (ASC)	0.05	0.52***	-2.46***	-2.29***	-1.89***	-2.34***
	(0.06)	(0.15)	(0.21)	(0.33)	(0.48)	(0.59)
Interactions between ASC and 'somewhat happy'		-0.66***			-1.05	0.17
		(0.16)			(0.58)	(0.32)
Interactions between ASC and 'neither happy nor unhappy'		-0.08***			0.46	-0.21
		(0.17)			(0.57)	(0.25)
Interactions between ASC and 'not happy'		-1.08***			-1.54	0.14
		(0.29)			(0.87)	(0.40)
Standard deviation (SD) of ASC			4.62***	4.02***	4.24***	-6.30***
			(0.53)	(0.93)	(0.38)	(1.07)
Interactions between SD of ASC and 'somewhat happy'						-0.40***
						(0.12)
Interactions between SD of ASC and 'neither happy nor unhappy'						-0.20
						(0.17)
Interactions between SD of ASC and 'not happy'						-0.69***
						(0.11)
Mean of medium level of biodiversity	0.36***	0.48***	0.99***	0.89***	0.97***	0.96***
	(0.06)	(0.05)	(0.08)	(0.12)	(0.08)	(0.08)
Standard deviation of medium level of biodiversity			1.12***	1.08***	1.25***	1.16***
			(0.14)	(0.21)	(0.14)	(0.13)
Mean of high level of biodiversity	0.48***	0.63***	1.36***	1.22***	1.32***	1.31***
	(0.08)	(0.04)	(0.12)	(0.16)	(0.11)	(0.11)
Standard deviation of high level of biodiversity			-0.76***	0.83***	0.92***	0.76***
			(0.09)	(0.17)	(0.10)	(0.10)
Mean of medium level of nursery	0.22***	0.29***	0.67***	0.62***	0.68***	0.64***
	(0.05)	(0.05)	(0.09)	(0.11)	(0.09)	(0.09)
Standard deviation of medium level of nursery			0.25	0.23	-0.12	-0.11
			(0.18)	(0.24)	(0.27)	(0.16)
Mean of high level of nursery	0.31***	0.40***	1.07***	0.96***	1.06***	1.01***
	(0.05)	(0.04)	(0.11)	(0.16)	(0.11)	(0.10)
Standard deviation of high level of nursery			0.04	0.31***	0.29***	0.01
			(0.21)	(0.12)	(0.09)	(0.08)
Mean of area	0.12***	0.16***	0.29***	0.27***	0.29***	0.28***
	(0.02)	(0.01)	(0.03)	(0.05)	(0.03)	(0.03)
Standard deviation of area			0.01	0.01	0.08	0.01
			(0.12)	(0.04)	(0.06)	(0.04)
Cost	-0.17***	-0.10***	-0.70***	-0.66***	-0.42***	-0.45***
	(0.02)	(0.04)	(0.04)	(0.08)	(0.10)	(0.11)
Interactions between cost and 'somewhat happy'		-0.13***			-0.30**	-0.25**
		(0.04)			(0.11)	(0.12)
Interactions between cost and 'neither happy nor unhappy'		-0.11***			-0.32**	-0.30**
		(0.04)			(0.12)	(0.13)
Interactions between cost and 'not happy'		-0.29***			-0.52**	-0.40**
		(0.07)			(0.10)	(0.20)
Relative scale for 'very happy' (Fixed)	1.00			1.00		
	NA			NA		
Relative scale for 'somewhat happy'	1.50***			1.07***		
	(0.23)			(0.14)		
Relative scale for 'neither happy nor unhappy'	1.05***			1.09***		
	(0.18)			(0.15)		
Relative scale for 'not happy'	1.50***			1.09***		
	(0.32)			(0.29)		
Model diagnostics						
LL (final)	6297.21	-6265.01	-4493.40	-4506.03	-4478.92	-4473.67
LL (0)	-6677.37	-6677.37	-6677.37	-6677.37	-6677.37	-6677.37
Adj. rho-sq	0.06	0.06	0.32	0.32	0.32	0.33
AIC/n	2.08	2.07	1.49	1.49	1.48	1.48
BIC/n	2.09	2.08	1.51	1.52	1.52	1.52
n (observations)	6078	6078	6078	6078	6078	6078
r (respondents)	1013	1013	1013	1013	1013	1013
k (parameters)	10	13	23	26	29	32

*** Significant at 1% level; ** significant at 5% level; * significant at 10% level. The robust standard errors are in parentheses. Results for interactions of SWB levels with standard deviation parameters in the final model are not provided here but are available upon request. Note that the "very unhappy" category was combined with "somewhat unhappy" category under the heading 'not happy' in the analysis.

0.33. The average final log-likelihood value for MXL models is -4422 and the average final log-likelihood value for MNL models -6281.11. The values of the information criteria statistics, AIC and BIC, are lower under the MXL as compared to the corresponding values from the MNL model.

In addition to testing for the effect of SWB on the degree of uncertainty, we also test for the interactions between SWB levels and various parameters from both the MNL and MXL models. The results of these estimations are presented in columns 5 and 6 of Table 4. Since we have four categories of SWB, we introduce three dummy variables with 'very happy' being the base category. Specifically, we interact the three dummy variables for SWB (i.e. 'somewhat happy', 'neither happy nor unhappy' and 'not happy') with ASC, non-price attributes and the price attribute. In the preliminary estimations, none of the SWB interactions with non-price attributes were statistically significant. Therefore, we only interact the SWB levels with the ASC and the price attributes as can be seen from Table 4.

Although the three ASC interaction variables for SWB are statistically significant in the MNL model, none of the SWB interactions with the ASC is statistically significant in the MXL model. However, two of the interactions with standard deviation of ASC is statistically significant. This suggests that these respondents do not behave differently from the base category in terms of choosing ASC but there are variations in these reactions among the SWB categories. All of the three cost interaction variables for SWB are negative and statistically significant at the 5% significance level in both the MNL and MXL models. This means that, as compared to the base category, the respondents who reported 'somewhat happy', 'neither happy nor unhappy' and 'not happy' SWB categories are much more sensitive to the cost attribute and are more likely to change the choice of alternatives because of changes in the cost of the kelp forest restorative plan.

In addition, formal tests to assess whether the parameter estimates from the interactions between SWB and the cost attribute are statistically significant from each other were performed. The results show that the coefficient for the interactions between cost attribute and 'somewhat happy' SWB is not statistically different from the coefficient for 'neither happy nor unhappy'. Also, the cost interaction coefficient for the 'not happy' SWB is not statistically different from both coefficients for 'somewhat happy' and 'neither happy nor unhappy'. This means that the price sensitivity of those who are 'somewhat happy', 'neither happy nor unhappy' and 'not happy' are similar but they are different from the base category of 'very happy'.

Likelihood ratio tests were carried out using the results presented in Table 4. A standard MXL model (i.e. model 3) was adopted as the restricted model in the tests. The null hypothesis is that additional coefficients of the less restricted model are simultaneously equal to zero. For the MXL with scale parameter adjustments, we reject the null hypothesis. Similarly, we reject the null hypotheses for MXL models with SWB interactions meaning that the results accounting for SWB categories are better fitting models. This means that the parameters of MXL models with SWB interactions are not simultaneously equal to zero. The implication is that the preference heterogeneity among the respondents are different under the four SWB categories. Furthermore, we performed a likelihood ratio test between MXL with mean interactions and MXL with mean and standard deviation interactions and again reject the null hypothesis. This result means that the MXL with interactions with means and standard deviations of ASC and cost attribute provides a better fit. These results support the earlier findings that the interaction terms are statistically different from zero, but the relative scale parameters are not statistically different from unitary.

The estimation results from model 5 were used to compute the marginal WTPs for various attributes among the four SWB categories and these results are presented in Table 5. We use the Krinsky and Robb (1986) procedure in the computation of marginal WTPs. All the marginal WTPs are statistically significant at less than 1%. One can conclude from Table 5 that marginal WTPs for high levels of biodiversity and nursery are higher than marginal WTPs for medium levels of biodiversity and nursery. In addition, all the corresponding marginal WTPs for 'very happy' SWB category are higher than the marginal WTPs for 'somewhat happy' SWB category. Similarly, the corresponding marginal WTPs for all attributes for 'somewhat happy' SWB category is greater than the corresponding marginal WTPs for 'neither happy nor unhappy' SWB category. Finally, the corresponding marginal WTPs among 'neither happy nor unhappy' SWB category for all attributes are greater than the corresponding marginal WTPs for 'not happy' SWB category. We can therefore conclude that there are differences in marginal WTPs among the four SWB categories. Given that the interactions between means and standard deviations of non-cost attributes are largely not statistically significant, these differences in marginal WTPs are because of differences in sensitivities to the cost attribute in the choice experiment.

Table 5
Marginal willingness-to-pay for various attributes from MXL model (Euros)

	Categories of subjective well-being			
	Very happy	Somewhat happy	Neither happy nor unhappy	Not happy
Medium biodiversity	22.78***	13.36***	13.00***	10.23***
High biodiversity	31.03***	18.21***	17.72***	13.94***
Medium nursery	16.15***	9.47***	9.22***	7.25***
High nursery	24.94***	14.63***	14.24***	11.20***
Area (m2)	6.84***	4.01***	3.90***	3.07***

*** Significant at 1% level

5. Discussion and conclusions

There are a number of implications of these results for stated preferences surveys and choice experiments in particular. The increasing adoption of internet panels for stated preference surveys provides flexibility to the respondents in terms of when they complete the questionnaire but the analysist may not have information relating to the circumstances surrounding the moment the respondents provide their answers. According to Johnston et al. (2016), one of the main concerns with internet surveys is the extent to which respondents 'take care' when answering the questionnaire. The authors point out that such surveys also generally do not reveal extreme emotions and feelings at the time of completion of the surveys. Furthermore, the integration of SWB into stated preference valuation frameworks, provides the analysist with a greater understanding of how wellbeing might impact the choices made. Our results indicate that differences in SWB do not cause increased uncertainty in the stated choice experiments. Rather, the different SWB categories result in differences in the preferences for attributes. For instance, the 'not happy' respondents are more sensitive to the cost of kelp forest restorations in Norway compared to their 'very happy' counterparts.

These results are in line with some of the results in the existing literature on the estimations of WTP among different states of SWB. For instance, some of the existing studies (e.g. Fujiwara and Dolan, 2012) find that WTP values differ across stated preference and SWB valuation methods and this difference can be explained by the fact that differences in SWB impact on preferences and may lead to increased preference heterogeneity. The differences in preferences between SWB categories and the differences in unobserved preference heterogeneity within the SWB categories is likely to account for the differences in WTP values. In addition, some of the results in our study support the findings of Hanley et al. (2017) and Boyce et al. (2019) regarding the effects of emotions and personality on choices in the choice experiment. Also, the interactions between SWB with standard deviations are significant and this means that SWB may induce increased levels of unobserved preference heterogeneity for non-market goods and services.

The results of the present study have implications for various ways through which SWB and stated preferences have been integrated in the existing literature. First, given that SWB does not appear to cause increased uncertainty in stated choices, studies comparing SWB valuation and stated preferences need not be overly concerned about the possibility of differences in the level of randomness of the choices. However, in making these comparisons one should be aware that since different SWB categories may correspond with different marginal WTPs. The direct implication of this finding is that the similarities in populations as well as in sampling and representation of SWB categories need to be accounted for to secure reliable conclusions.

For both 'anchoring vignettes' and hybrid SWB-CV modelling, one is also required to control for the differences in marginal WTPs. The hybrid SWB-CV procedure involves asking respondents about the monetary

compensation required for forgoing improved environmental scenarios adopted in stated preferences, for instance, in foregoing visits to cultural heritage institutions for one year caused by a hypothetical closure. The results from the present study suggest that the different SWB categories could be associated with differences in marginal WTPs. The implication of this for hybrid SWB-CV is that these differences should be controlled for in the modelling of the hybrid SWB-CV response. This also applies to 'anchoring vignettes' since changes in SWB as a result of policy changes will be associated with differences in marginal WTPs and their heterogeneities and these must explicitly be modelled in order to minimize the effects of these differences in welfare analyses. **S**tudies which integrate subjective well-being valuation frameworks with preference-based valuation methods may have to consider the differences in the WTP values. In our work we have assessed SWB in stated preferences within one country. How general these results are across nations and cultures remains to be seen. Studies in various regions could be useful to test the effects of SWB on stated preferences. With the increasing emphasis on SWB as an index for measuring human progress coupled with the tendency of self-reported well-being measures to differ among cultures, an important area of future research will be to investigate the effects of SWB on stated preferences across different cultures.

References

Angelini, V., Cavapozzi, D., Corazzini, L., & Paccagnella, O. (2012). Age, Health and Life Satisfaction Among Older Europeans. *Social Indicators Research, 105*, 293–308. https://doi.org/10.1007/s11205-011-9882-x.

Baker, R., & Ruting, B. (2014). Environmental Policy Analysis: A Guide to Non-Market Valuation. *Productivity Commission Staff Working Paper*.

Bakhshi, H., D. Fujiwara, R. Lawton, S. Mourato and P. Dolan, 2015. Measuring Economic Value in Cultural Institutions. A report commissioned by the Arts and Humanities Research Council's Cultural Value Project. Swindon: Arts and Humanities Research Council.

Boyce, C., Czajkowski, M., & Hanley, N. (2019). Personality and economic choices. *Journal of Environmental Economics and Management, 94*, 82–100.

Carlsson, F. (2010). Design of stated preference surveys: Is there more to learn from behavioral economics. *Environmental and Resource Economics, 46*, 167–177.

Carroll, N., Frijters, P., & Shields, M. A. (2009). Quantifying the costs of drought: new evidence from life satisfaction data. *Journal of Population Economics, 22*(2), 445–461.

ChoiceMetrics. (2014). *Ngene 1.1.2: User Manual and Reference Guide*.

Czajkowski, M., Hanley, N., & LaRiviere, J. (2016). Controlling for the effects of information in public goods discrete choice model. *Environmental and Resource Economics, 63*(3), 523–544.

Ejelov, E., Hansla, A., Bergquist, M., & Nilsson, A. (2018). Regulating Emotional Responses to Climate Change – A Construal Level Perspective. *Frontiers in Psychology, 9*, 629.

Ferrer-I-Carbonell, A., & van Praag B, M. S. (2002). The Subjective Costs of Health Losses Due to Chronic Diseases. An Alternative Model for Monetary Appraisal. *Health Economics, 11*, 709–722.

Frey, B. S., Luechinger, S., & Stutzer, A. (2009). The Life Satisfaction approach to valuing Public Goods: the case of terrorism. *Public Choice, 138*, 317–345.

Fujiwara, D., & Dolan, P. (2012). Valuing adult learning: Comparing Well-being Valuation to Contingent Valuation. *BIS Research Paper, 85*. Innovation and Skills.

Fujiwara, D., & Dolan, P. (2014). *Valuing mental health: How subjective well-being approach can show just how much it matters. UK Council for Psychotherapy*.

Georgantzis, N., & Vasileiou, E. (2013). *Are dangerous jobs paid better? European evidence*. In S. W. Polachek, & K. Tatsiramos (Eds.).

Hanley, N., & Barbier, E. (2009). *Pricing Nature: Cost-benefit Analysis and Environmental policy*. Cheltenham: Edward Elgar Publishing Limited.

Hanley, N., Boyce, C., Czajkowski, M., Tucker, S., Noussair, C., & Townsend, M. (2017). Sad or Happy? The Effects of Emotions on Stated Preferences for Environmental Goods. *Environmental and Resource Economics, 68*(4), 812–846.

Hellevik, O. (2003). Economy, values and happiness in Norway. *Journal of Happiness Studies, 4*, 243–283.

Hess, S., & Rose, J. M. (2012). Can scale and coefficient heterogeneity be separated in random coefficients models? *Transportation, 39*(6), 1225–1239.

Hynes, S., Chen, W., Vondolia, K., Armstrong, C., & O'Connor, E. (2021). Valuing the ecosystem benefits from kelp forest restoration: A choice experiment from Norway. *Ecological Economics, 179*(2021), Article 106833.

Johnston, R. J., Boyle, K. J., Adamowicz, W., Bennett, J., Brouwer, R., Cameron, T. A., Hanemann, W. M., Hanley, N., Ryan, M., Scarpa, R., Tourangeau, R., & Vossler, C. A. (2016). Contemporary Guidance for Stated Preference Studies. *Journal of Association of Environmental and Resource Economists, 4*(2), 319–405.

Kapteyn, A., Smith, J. P., Soest, V., & Arthur, Vonkova, H. (2011). Anchoring Vignettes and Response Consistency. SSRN Scholarly Paper No. ID 1799563. *Social Science Research Network*. Rochester, NY.

Kling, C. L., Phaneuf, D. J., & Zhao, J. (2012). From Exxon to BP: Has Some Number Become Better than No Number? *Journal of Economic Perspectives, 26*(4), 3–26.

Krinsky, I., & Robb, A. L. (1986). On approximating the statistical properties of elasticities. *Review of Economics and Statistics, 68*(4), 715–719.

Lane, T. (2017). How does happiness relate to economic behaviour? A review of the literature. *Journal of Behavioural and Experimental Economics, 68*, 62–78.

Lau, H. P. B., White, M. P., & Schnall, S. (2013). Quantifying the Value of Emotions Using a Willingness to Pay Approach. *Journal of Happiness Studies, 14*, 1543–1561.

Luechinger, S., & Raschky, P. A. (2009). Valuing flood disasters using the life satisfaction approach. *Journal of Public Economics, 93*, 620–633.

Luechinger, S. (2009). Valuing air quality using the life satisfaction approach. *Economic Journal, 119*(536), 482–515.

MacKerron, G. (2011). Happiness Economics from 35 000 feet. *Journal of Economic Surveys, 26*(4), 705–735.

MacKerron, G., & Mourato, S. (2013). Happiness is greater in natural environments. *Global Environmental Change, 23*(5), 992–1000.

Navrud, S., & Pruckner, G. J. (1997). Environmental Valuation – To Use or Not to Use? A Comparative Analysis of the United States and Europe. *Environmental and Resource Economics, 10*, 1–26.

NCM (Nordic Council of Ministers). (2018). *In the shadow of happiness. Copenhagen: Nordic Council of Ministers*.

OECD (Organisation of Economic Cooperation and Development). (2018). *Cost-Benefit Analysis and the Environment: Further Developments and Policy Use*. Paris: OECD Publishing. https://doi.org/10.1787/9789264085169-10-en.

Oswald, A. J. (1997). Happiness and economic performance. *Economic Journal, 107*(445), 1815–1831.

Plott, C. (1996). Rational individual behavior in markets and social choice processes: the discovered preference hypothesis. In K. Arrow, E. Colombatto, M. Perleman, & C. Schmidt (Eds.), *Rational foundations of economic behaviour* (pp. 225–250). London: Macmilan.

Revelt, D., & Train, K. (1998). Mixed logit with repeated choices: households' choices of appliance efficiency level. *Review of Economics and Statistics, 80*(4), 647–657.

Shi, Y., Joyce, C., Wall, R., Orpana, H., & Bancej, C. (2019). A life satisfaction approach to valuing the impact of health behaviours on subjective well-being. *BMC Public Health, 19*, 1547.

Train, K. E. (2009). *Discrete Choice Methods with Simulations*. Cambridge: Cambridge University Press. Second edition.

Inglehart, R., C. Haerpfer, A. Moreno, C. Welzel, K. Kizilova, J. Diez-Medrano, M. Lagos, P. Norris, E. Ponarin & B. Puranen et al. (eds.). 2014. World Values Survey: Round Six - Country-Pooled Datafile Version: www.worldvaluessurvey.org/WVSDocumentationWV6.jsp. Madrid: JD Systems Institute.