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Motivations matter: Behavioural determinants of preferences for remote and unfamiliar environmental goods

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Abstract: Discrete choice experiments (DCE) are one of the main methods for the valuation of non-market environmental goods. However, concerns regarding the validity of choice responses obtained in such surveys remain, particularly in surveys dealing with environmental goods remote from and unfamiliar to respondents. This study assesses behavioural determinants of preferences for conservation benefits of a marine protected area on the Dogger Bank, a shallow sandbank in the southern North Sea in an attempt to assess construct validity of survey responses. The Theory of Planned Behavior (TPB) and the Norm Activation Model (NAM) are employed to empirically measure constructs that predict stated choices. The study finds that identified protest respondents score significantly lower on most TPB and NAM components than non-protesters. Results further show that components of both the TPB and the NAM robustly predict choice behaviour. The inclusion of the TPB components improves the predictive power of the estimation model more than the NAM components. In an additional latent class logit model, TPB and NAM components plausibly explain different patterns of WTP for conservation benefits of an offshore marine protected area. These findings support construct validity of stated choice data regarding the valuation of remote and unfamiliar environmental goods.

Keywords: Environmental valuation, discrete choice experiment, theory of planned behavior, norm activation model, latent class model, error component model

1. Introduction

Discrete choice experiments (DCE) are an increasingly popular method for eliciting willingness to pay (WTP) for non-market environmental goods. DCEs are a stated preference technique in which respondents to a survey are asked to make choices between alternatives of different environmental programmes at different costs (Hanley et al. 1998, Adamowicz et al. 1998, Louviere et al. 2000, Kanninen 2006). From respondents' stated choices the value they attach to the different attributes, by which these environmental programmes are described, can be inferred and expressed as their marginal WTP. These WTP estimates can be interpreted as indicators of the change in well-being respondents expect from a change in the provision of any of these choice attributes. In recent years, DCE alongside contingent valuation (Carson and Hanemann 2005) have increasingly been used to value non-market environmental goods, including those that are remote from and unfamiliar to survey respondents.

Criticism of DCE, and stated preference techniques in general, has focused on the validity of responses. Validity of stated preference data, or more specifically construct validity, can be established by identifying whether respondents' choices are internally consistent and whether the relationship between WTP and explanatory variables is consistent with that predicted by theory (Kling et al. 2012). Research in contingent valuation has tried to improve construct validity by understanding the underlying motivations behind respondents' WTP statements (e.g. Meyerhoff 2006, Liebe et al. 2011, Rosenberger et al. 2012). Research into DCE is following suit.

Attitudes are often included in contingent valuation and DCE studies in an ad hoc way, for example, focusing on issues of general environmental concern (Milon and Scrogin 2006), on the good to be valued in the study (e.g. Ahlheim et al. 2015) or represented by membership of an environmental group (e.g. Jobstvogt et al. 2014, Yao et al. 2014). They often fail to appreciate the full complexity of attitude development and its association with behaviour. Consequently, despite demonstrating a strong correlation with WTP, environmental attitudes alone have been shown to be poor predictors of behaviour (Meyerhoff 2006; Ajzen and Fishbein 2005, Kaiser et al. 1999). This lends support to Kahneman et al. (1993) who suggest that respondents may apply a contribution model rather than a purchase model when making WTP decisions. The environmental good in question is considered to be a cause worth supporting, rather than something an individual is willing to pay for. The size of the contribution

reflects the perceived seriousness of the problem and might therefore be higher for smaller but more immediate changes than for larger-scale but more remote goods (Guagnano 1994). In this interpretation, stated WTP or choices are merely an expression of ranking of importance or urgency rather than a quantitative metric of the expected utility change.

Understanding what determines WTP may be particularly relevant in the context of remote and unfamiliar goods where preferences may not be clearly held for the good to be valued in the survey (Bateman 2011). This is of considerable importance when it comes to the marine environment and the valuation of the environmental goods that it provides. A major difficulty in marine valuation studies is that, unlike the valuation of terrestrial environmental goods, many respondents lack experience and knowledge regarding the good to be valued (Aanesen et al. 2015, Jobstvogt et al. 2014, McVittie and Moran 2010). Attitude surveys have shown that the marine environment is regarded by many as remote and unfamiliar (Jefferson et al. 2014, Rose et al. 2008, Steel et al. 2005). Consequently concern exists about the validity of valuations derived from surveys on marine environmental goods (Hanley et al. 2015). The criticism is particularly strong when it comes to existence values, which are likely to be the dominant value category of offshore and deep sea environmental goods.

Using a DCE, this study values the ecological changes resulting from the implementation of a management plan for the Dogger Bank, a shallow sandbank located in the southern North Sea. The remoteness of the location and the likelihood that respondents have limited knowledge of the area raises questions over what determines the choices respondents make and their consequent WTP, as well as the validity of their responses. It also provides an opportunity to examine which model respondents' use when making their choices, the purchase or the contribution model. To investigate validity, two behavioural models are incorporated into the study: the Theory of Planned Behavior (Ajzen 1991) and the Norm Activation Model (Schwartz 1970, 1977). The aim of this study is, therefore, to explain the variation in preferences for a set of marine conservation benefits as expressed by respondents' stated choices by means of behavioural concepts originating in social psychology.

The Theory of Planned Behavior (TPB) acknowledges that behaviour (including ecological behaviour) is susceptible to a range of influences beyond an individual's control, including personal abilities and social constraints. Focusing on attitudes towards paying for the Dogger Bank management plan and these additional influences, the TPB is used to assess the

motivations that lead survey respondents to state choices for different levels of conservation benefits provided by the sandbank ecosystem. Assuming that the WTP expressed through stated choices in a DCE is a behavioural intention, it is straightforward to apply components of the TPB as predictors of those stated choices. It is therefore hypothesised that this inclusion improves the predictive power of choice models. In contrast, the Norm Activation Model (NAM) can be used to assess to what extent stated choices are motivated by altruistic concerns. According to the economic theory expressed through the purchase model, the effect of the changes to be valued on other people, society as a whole, or future generations should not affect the level of stated WTP or the stated choices. If they do construct validity would be undermined. While both the NAM and the TPB have been employed to explain direct WTP statements in contingent valuation surveys (e.g. Liebe et al. 2011, Bernath and Roschewitz 2008, Guagnano et al. 1994) and the TPB in a DCE relating to food-choice (Nocella et al. 2012), the application of TPB and NAM to predict stated choices in a DCE survey in the environmental field is still very rare (Kenter et al. 2014). The present study thus responds to the recent call for more research in this area (López-Mosquera et al. 2014).

The remainder of the paper is structured as follows. Section 2 introduces the TPB and the NAM, their components and their respective links to stated preference environmental valuation from which the research hypotheses are derived. Section 3 explains the methodological approach before Section 4 presents the results. Section 5 provides some discussion, and Section 6 concludes.

2. Behavioural theories and the elicitation of environmental preferences

2.1. The Theory of Planned Behavior (TPB)

The Theory of Planned Behavior (TPB) states that intentions to carry out a certain behaviour can be predicted by attitudes towards that particular behaviour, subjective norms and perceived behavioural control (Ajzen 1991). The more positive an individual's attitude, subjective norm and perceived behavioural control, the greater the likelihood that the individual intends to carry out the behaviour when the opportunity arises. Based on the expectancy-value model (Fishbein 1963) attitudes, subjective norms and perceived behavioural control are considered to be comprised of two components: beliefs and an evaluation of those beliefs (i.e.

belief strength). Attitudes (ATT), subjective norms (SN) and perceived behavioural control (PBC) are considered latent variables that cannot be observed, but must be inferred from observed responses. These variables can be assessed both directly and indirectly. Direct measures focus on the global assessment of ATT, SN and PBC, while indirect measures focus on beliefs and their evaluation. Both can be used to predict behavioural intentions. Measurement of beliefs is thought to provide additional insight into why people hold certain attitudes, SN and PBC. As the objective of this study is not to explore these cognitive foundations, but to gain insights into individuals' choices, only direct measures are made.

There has been a growing interest in the use of the TPB in the field of stated preference valuation, mainly in contingent valuation surveys (López-Mosquera and Sánchez 2012, 2014, Liebe et al. 2011, Spash et al. 2009, Bernath and Roschewitz 2008, Meyerhoff 2006, Ajzen et al. 2004, Werner et al. 2002, Pouta and Rekola 2001, Luzar and Cossé 1998, Ajzen and Driver 1992). Ajzen and Driver (1992) find that all three TPB components correlate strongly with stated WTP a user fee for different outdoor leisure activities. This finding is partly confirmed by subsequent studies which find that attitudes and PBC influence WTP (Pouta and Rekola 2001, Werner et al. 2002, Ajzen et al. 2004) and another set of studies which detect effects of attitude and subjective norms on WTP (Luzar and Cossé 1998, Bernath and Roschewitz 2008). Based on these results, Pouta and Rekola (2001) conclude that WTP statements can be interpreted as behavioural intentions with respect to contributing, but also constitute an attitudinal expression regarding the good or policy to be valued. Spash et al. (2009) include ethical statements and the three TPB components in a regression model of WTP for restoring biodiversity within a river catchment. They find that the inclusion of the TPB components extraordinarily improves explanatory power (adjusted R^2 increases from 0.23 to 0.48), with ATT, PBC and SN explaining the greatest part of the variance in WTP. Most of the above studies find an improvement in model fit when TPB components are included. Elsewhere, Bernath and Roschewitz (2008) include components of TPB to explain protest responses and WTP in a study valuing urban forests. They find that attitudes towards the payment vehicle and negative subjective norms increase the probability of a protest response.

Using structural equation modelling (SEM) Meyerhoff (2006) finds that all three TPB components influence stated WTP for improved river ecosystem benefits. His results demonstrate that only attitudes towards the behaviour (i.e. paying money) rather than attitudes

towards the environmental good or general environmental attitudes directly influence behavioural intentions and the predictive power of the model. López-Mosquera and Sánchez (2012) apply SEM to test the explanatory power of the TPB and the norm-value-belief theory (Stern et al. 1999) for WTP for an urban park. They find that the components of both theories motivate respondents' intention to pay for conservation, although TPB provide greater explanatory power of WTP. López-Mosquera et al. (2014) further extend the TPB to show that moral and personal norms affect both the attitude component of the TPB and stated WTP.

Application of TPB in DCE surveys is scarce with only one example in the published literature (Nocella et al. 2012). By measuring TPB constructs Nocella et al. (2012) aim to improve the identification of different groups of consumers with homogeneous preferences and corresponding behavioural intentions. The authors include interaction effects between ATT, SN, PBC and an additional ethical component with the price attribute for animal-friendly food products. They find that most of these interaction effects in a latent class model are significant. The direction of the interaction effect varies with class. Although the authors fail to interpret the direction of these interaction effects, they conclude that components of the TPB serve to better explain consumer choice of animal-friendly food products, in particular preference heterogeneity.

2.2. The Norm Activation Model (NAM)

The Norm Activation Model (NAM) is a process model that was developed to describe how altruistic and non-altruistic motivations influence behaviour (Schwartz 1970, 1977, Schwartz and Howard 1981). NAM suggests that when faced with behavioural choices, individuals' value systems are activated. Individuals must then weigh the implications of possible actions against their internal value systems. This stimulates personal norms and feelings of moral obligation to perform, or not, a particular action. If the action requires a substantial cost (e.g. economic, social or psychological) to the individual, the outcome may be emotional conflict. Such conflict results in defensive actions that modify self-expectations and are aimed at reducing the costs of inaction.

Awareness of the need (AN) for an action or behaviour is the driving force behind the model (Schwartz and Howard 1981). The salience of the need and its seriousness will influence the level of attention given to it. For personal moral norms to be stimulated, however, Schwartz

(1968a, 1968b) states that two conditions are necessary. First, individuals need to be aware that their actions have consequences for the welfare of others (AC, awareness of consequences), and second, individuals must ascribe responsibility to themselves for these actions and their consequences (AR, ascription of responsibility). It is only when AC and AR are accepted, that there will be correspondence between individuals' personal norms and their behaviour. If individuals do not recognise or misinterpret the consequences of their potential action on the welfare of others, or consider that action is not their responsibility, personal norms will not be activated. If norms are activated and moral and non-moral obligations favour action, then action occurs. Many decisions, however, do not have a moral component and the perceived costs and benefits of acting are similar. In such situations, decisions to act are delayed and defensive redefinition occurs. This redefinition may include denial of responsibility, whereby individuals reduce their perceived personal responsibility for the consequences of their actions. By denying responsibility, individuals may not behave consistently with their personal moral norms because they no longer perceive that they are facing a moral choice (Schwartz and Howard 1981, Schwartz 1968b).

Given the complexity of the NAM, it is difficult to test empirically (Liebe et al. 2011). This has resulted in different specifications of the model being applied in different situations (Steg and de Groot 2010). Nevertheless, it has been used in a number of environmental settings, focusing on beliefs about general environmental conditions (e.g. Stern et al. 1999) as well as specific environment-related behaviours. Specific environmental behaviour studies include yard burning behaviour (van Liere and Dunlap 1978); reducing car use (Eriksson et al. 2006; Nordlund and Garvill 2003); reducing emissions from diesel cars (Steg and de Groot 2010); recycling (Bratt 1999; Hopper and Nielsen 1991); and general pro-environmental behaviour (Schultz et al. 2005, Nordlund and Garvill 2002). It has also been applied in relation to WTP for environmental goods (Kenter et al. 2014, Liebe et al. 2011, Guagnano et al. 1994, Guagnano, 2001, Blamey 1998), but only in the context of contingent valuation. To our knowledge no study uses the NAM in connection with a DCE.

Guagnano et al. (1994) use the NAM in an assessment of WTP a price premium for different types of consumer goods to protect the environment. Their results show that WTP increases with both AR and AC. In light of the distinction between the purchase and contribution models for WTP (Kahneman et al. 1993), the authors conclude that WTP statements for these goods

follow the contribution model rather than the purchase model because they are driven by altruistic concerns. Guagnano (2001) found similar effects with respect to the WTP to buy recycled toilet paper. The main effect on WTP is exerted directly by AR, whereas the awareness of consequences influences WTP indirectly via its effect on AR. Through a series of nine focus groups, Blamey (1998) uses the NAM framework in conjunction with contingent valuation to study individuals' WTP to prevent a decline in riverine environmental quality in Australia. His analysis identifies multiple ways that AC and AR manifest themselves, leading the author also to conclude that respondents adopt the contribution model when processing the scenario information included in the contingent valuation method. In a contingent valuation study to value forest biodiversity Liebe et al. (2011) compare the NAM with other competing theories that have been used to explain WTP, including TPB. They identify that standard economic variables (such as use) and those of the NAM have higher explanatory power than those of the TPB, and conclude that economic models of WTP need to be complemented with models from social psychology.

2.3. Research hypotheses

Drawing from the TPB and NAM literature in general, and the definition of the relevant components of each theory in particular, a set of research hypotheses can be developed. It is expected that the likelihood that respondents are willing to pay for changes in the choice attributes is affected positively by: a favourable attitude towards contributing (Hypothesis 1a), a positive subjective norm regarding this behaviour (Hypothesis 1b) and strong perceived behavioural control over contributing to the programme (Hypothesis 1c).

Following Blamey (1998), three components of the NAM are employed to assess motivations for stated choices. This approach is justified as the intention is not to test the full NAM, but identify which components can be deemed relevant for the explanation of stated choices and WTP (Liebe et al 2011). It is hypothesised that the awareness of need for environmental action (AN) (Hypothesis 2a), an awareness of one's own responsibility for these measures (AR) (Hypothesis 2b) and an awareness of the consequences these measures entail (AC) (Hypothesis 2c) moderate the influence of personal norms on stated choice and therefore have a positive effect on the likelihood that a respondent is willing to contribute to a management plan for the Dogger Bank.

It can be expected that an inclusion of additional explanatory variables of choice behaviour provided by TPB and NAM will increase the predictive power of the statistical models (Hypothesis 3). This has been partially shown in a contingent valuation survey (Bernath and Roschewitz 2008) and will be tested here for a discrete choice experiment.

3. Methods

3.1. The survey instrument

The valuation scenario was developed against the backdrop of the designation of the Dogger Bank as a transnational Special Area of Conservation (SAC) by the UK, Germany and the Netherlands. A management plan is being developed to regulate human activities and conservation efforts on the site. Fishing and future energy generation are the two sectors with the greatest potential to impact local environmental conditions. The choice attributes therefore reflect the impact on the Dogger Bank resulting from differing regulations on these two sectors. Attribute levels were chosen based on regulations being proposed by the different stakeholders for the Dogger Bank in recent negotiations and scaled to the UK section (Table 1).

Regulating bottom trawling on the Dogger Bank will potentially result in an increase in the diversity of species found there. This is captured in the first attribute. Controlling the use of net fishing on some parts of the Dogger Bank will protect certain charismatic species such as harbour porpoises, seals and seabirds. Depending on the spatial extent of the regulation these animals could be protected on 25% or 50% of the UK section of the Dogger Bank area. The installation of wind farms in the area might increase the spread of invasive species through the potential provision of new habitats on the turbine foundations. Changing turbine and wind farm design could reduce the spread of invasive species, which is captured in the third attribute.

The valuation scenario further specified that the implementation, monitoring and enforcement of the Dogger Bank management plan will come at a cost. Marine management within the UK is the responsibility of the Marine Management Organisation, funded through the Department for Environment Food and Rural Affairs (Defra) and ultimately by taxpayers. The payment vehicle used in the DCE was therefore an increase in annual tax for UK households over the next 5 years. This attribute was given seven levels. Further details of the valuation scenario and the choice attributes can be found in Börger et al. (2014).

- Table 1 -

Questionnaire design was based on test interviews, a focus group meeting as well as a pilot survey. The survey was conducted online by a market research company which drew respondents from a panel of over 700,000 adult UK residents. Using a quota sampling approach, the sample collected was reflective of the UK Census population on the basis of age and gender; however the sample cannot be considered to be fully representative of the UK Census population due to self-selection bias.

A Bayesian D-efficient design (Scarpa and Rose 2008) was developed in the software package Ngene (ChoiceMetrics 2012) based on priors obtained through random parameters logit models of pilot survey choice data. Policy options which yield the status quo for each attribute at non-zero cost were excluded because this option would be dominated by the no-change specification. The resulting set of 24 choice tasks are blocked into four sets of six tasks per respondent. Respondents were randomly allocated to one of the four blocks. Each choice task contains a 'no change' or business-as-usual (BAU) option at zero cost and two alternative management plans ('change options') at positive cost.

3.2. Measuring relevant attitudes

For the TPB Ajzen (2010) provides comprehensive instructions for the construction of survey questions. Importantly, the behaviour of interest must be framed using the same target, actions, context and time (TACT), which in this case refers to making a monetary contribution towards the Dogger Bank management plan. As interest lies in understanding individual's choices rather than the specific components of ATT, SN and PBC, only direct measures are developed for each of the constructs. Direct measures for SN and PBC still follow the expectancy value model approach, while attitude measures focus on both instrumental (readiness to engage) and experiential (openness to engage) aspects. The terms used in each of the measures reflect findings from the pilot stages of questionnaire development and the wider literature on TPB in relation to environmental goods. Items included for measurement of the NAM follow Liebe et al. (2011), focusing on AN, AC and AR. Table 2 provides an overview of all TBC and NAM items and their respective response scale. Responses to items making

up one TBC or NAM component are multiplied and the resulting product is normalised to a range from 0 to 1. Higher individual scores correspond with a more positive association with the concept.

- Table 2 -

3.3. Identifying determinants of choice behaviour and WTP

The theoretical framework for analysing discrete choice data is the random utility model (McFadden 1974, Ben-Akiva and Lerman 1985). According to this model, the utility of respondent n from selecting choice alternative i in choice occasion t is given by

$$U_{nit} = \beta' x_{nit} + \varepsilon_{nit} \, . \quad (1)$$

U_{nit} consists of an observable component $\beta' x_{nit}$ and a non-observable component ε_{nit} which is assumed to be independent and identically distributed following a Type I Extreme Value distribution (Train 2009). The observable utility component is assumed to be determined by a vector of respondent- and choice-specific characteristics x_{nit} and a corresponding parameter vector β to be estimated. Different variants of this basic model were applied (1) to analyse the respondents' decision whether to contribute or not and (2) to study the effect of TPB and NAM components on preferences and WTP. To allow for correlation between choice alternatives an error component e_{ni} can be introduced (Scarpa et al. 2005, Train 2009) as in

$$U_{nit} = \beta' x_{nit} + \gamma_i e_{ni} + \varepsilon_{nit} \, . \quad (2)$$

It is assumed that the coefficient γ_i of the error component is random and independently normally distributed with mean zero, i.e. $\gamma_i \sim N(0, \sigma_k)$ .The resulting model is the error component (EC) logit model (Scarpa et al. 2005) which produces coefficient vector β indicating the influence of respondent- and choice-specific characteristics on choice probabilities and estimates of the error variance σ_k specific to the two change options.[1] The EC model allows for a decomposition of the unobservable component of utility. Respondent-specific variables can be interacted with attribute-specific variables to detect different coefficient estimates for

[1] This model was applied since the analysis focuses on the decisions between contributing and not contributing to the Dogger Bank management plan rather than on preference heterogeneity (for which a random parameters logit would have been more appropriate).

respondent subgroups (Train 2009). In this study respondent-specific variables are interacted with a dummy indicating the change options. Since the error component is random, the estimation employed simulated maximum likelihood with 500 Halton draws (Scarpa et al. 2005).

An alternative model for exploring heterogeneity in preferences and WTP across respondents is the latent class (LC) model (Pacifico and Yoo 2013, Colombo et al. 2009, Scarpa and Thiene 2005, Boxall and Adamowicz 2002). This model estimates discrete sets of coefficients β_c, which are indexed over classes c. The choice probability of alternative i out of J alternatives in situation t,

$$P_{nit}(\beta_c) = \frac{exp(\beta_c{}' x_{nit})}{\sum_{j=1}^{J} exp(\beta_c{}' x_{njt})}, \quad (3)$$

is dependent on class c. The probability of respondent n being assigned into class c out of all classes $c = 1, \dots, C$ is given by

$$\pi_{cn}(\theta) = \frac{exp(\theta_c{}' z_n)}{\sum_{l=1}^{C} exp(\theta_l{}' z_n)}. \quad (4)$$

Membership to a class with homogeneous preferences depends on a set of respondent characteristics z_n and a coefficient vector θ_c.[2] In both of the above models, WTP is computed according to $WTP_a = -(\beta_a/\beta_{COST})$, where WTP of attribute a is the negative fraction of the coefficient of this attribute β_a and the cost coefficient β_{COST}.

As Bernath and Roschewitz (2008) note, respondents to an environmental valuation survey have to make three decisions: (i) whether they accept the proposed scenario; (ii) whether they want to state a positive WTP; and (iii) how much exactly they are willing to pay. These tasks are also present in a DCE setting albeit decision (iii) might not be as explicit as in the contingent valuation setting. Following the three decisions, the analysis begins by comparing the mean scores of all TPB and NAM components between respondents who have and have not been identified as protesters. Protesters are respondents who do not accept the fact that they are asked to pay or want to express opposition against any other feature of the survey and valuation exercise. Consequently these respondents state they are not willing to pay for the

[2] For model identification θ_C, the class membership model parameter for the last class, must be normalised to zero (Pacifico and Yoo 2013).

good on offer although they expect an increase in utility from its consumption (Jorgensen et al. 1999, Meyerhoff and Liebe 2010, Meyerhoff et al. 2014). To examine decisions (ii) and (iii) the attitudinal variables have to be included into the choice models. Three approaches to this are found in the literature. (1) They can be interacted with choice-specific variables to investigate preference heterogeneity (Train 2009). (2) Attitudinal variables have been used in latent class models to explain class membership (Milon and Scrogin 2006, Nocella et al. 2012, Soliño and Farizo 2014). (3) Concerns for potential endogeneity bias have led to the development of approaches that include functional forms of latent variables in the class membership function rather than direct variables or factor scores (Hess et al. 2012, Hess and Beharry-Borg 2012, Hoyos et al. 2013). While acknowledging the concerns about endogeneity bias, the present study follows approaches (1) and (2) because the analysis is not concerned with the quantitative effect of the measures of TPB and NAM on WTP but rather on the decision to pay or not to pay. Direct measures of TPB and NAM components are assessed, which yield component scores that can be used as explanatory variables in the choice models. In particular, interactions of TPB and NAM components with a dummy indicating the change options are used in the EC logit model to investigate the respondent's decision between supporting the Dogger Bank management plan and opting out. Subsequently, the TPB and NAM components are included in the class membership function of an LC model. As coefficient vectors β_c are class-specific, WTP patters are expected to differ between classes. This approach allows an investigation of whether and how the TPB and the NAM explain the sorting of respondents into classes with different WTP estimates for the choice attributes. Consequently it identifies the quantitative effects of these concepts on WTP.

4. Results

4.1. Sample characteristics and attitudinal variables

An online survey was conducted in early December 2013. Of the 2,425 who initiated the survey, 1,022 complete responses were obtained, representing a response rate of approximately 42%. Of the 1,621 partially completed responses, 599 were due to the quota for the age-gender class in which the respondent fell being full, 7 were excluded because they were under 18, while the remainder dropped out due to unknown reasons. This unknown drop-

out rate of 33% could, in part, be a consequence of questionnaire frustration as respondents could only proceed to the next page in the questionnaire after answering all questions on the current page. Scores for the TPB and NAM components were calculated as described in Section 3.2 and the correlation between scores were examined. Items comprised contributing to one component are expected to correlate strongly. Correlation coefficients between the single items are reported in Table 3. While the correlations between items in any component are highly significant, there is also a strong correlation between many items across components.

- Table 3 -

Resulting from the high correlation between many of the questionnaire items, the TPB and NAM components are also highly correlated (Table 4). When these variables are used as predictors in regression models, multicollinearity problems might arise (Pouta and Rekola 2001). As many studies assessing TPB components find high and significant correlations between the TPB components (e.g. Karppinen 2005, Onwezen et al. 2013, López-Mosquera et al. 2014), care needs to be taken when interpreting outputs of choice models in the following subsections.

- Table 4 -

Table 4 also shows significant correlations between the TPB and NAM components and respondent age. While older respondents score lower on subjective norm and awareness of consequences, they exhibit stronger awareness of need and ascription of responsibility. An additional series of Mann-Whitney U-tests detect that male (as opposed to female) respondents score higher on PBC and respondents with a university degree (as opposed to those without) score higher on PBC and AN. No other TPB or NAM component show significant differences between these groups.

4.2. TPB and NAM and protest respondents

49 respondents (4.8% of the sample) who chose the BAU option in every choice occasion were identified as protesters based on responses to a set of attitudinal questions and discarded from the sample.[3] Non-parametric Mann-Whitney U-tests were performed to analyse whether protesters and non-protesters scored differently on the TPB and NAM variables (Table 5).

- Table 5 -

Scores of all TPB components (ATT, SN and PBC) are significantly higher among non-protesters than among protesters. The 973 respondents remaining in the sample hold more positive attitudes towards contributing to the Dogger Bank management plan, they perceive stronger subjective norms and stronger behavioural control. Of the NAM components, the ascription of responsibility (AR) score does not differ between the two groups. Both protesters and non-protesters ascribe the same level of responsibility to themselves. They do, however, differ in their awareness of need (AN) and consequences (AC) scores. Protesters are less aware of the need to implement the proposed management measures and the consequences thereof.

4.3. Determinants of choosing to contribute to a Dogger Bank management plan

All choice models are performed with the remaining sample of 973 respondents after excluding protest cases. Model 1 in Table 6 is the baseline model.[4] As expected, two non-monetary choice attributes positively affect choices. An increase in species diversity on the Dogger Bank by 10% and 25% (SPEC10 and SPEC25) and the protection of porpoises, seals and seabirds on 25% and 50% of the Dogger Bank area (PROT25 and PROT50) provide utility to respondents. A wider spread of invasive species (INVASIVE) on the Dogger Bank compared to the BAU scenario, however, negatively affects choice probability, indicating a loss in utility

[3] These are respondents who chose the no-cost status quo option in all six choice tasks and agreed to the statements (1) “Taxes and fees are already too high, so there should be no additional financial burden”, (2) “I already pay enough for other things”, (3) “It is my right to have a well preserved Dogger Bank and I should not have to pay extra for it” and (4) “The government should cut public spending on other things instead of expecting a contribution from me”. Statements (2)-(4) are adapted from Jorgensen and Syme (2000).

[4] Based on a Hausman-McFadden test (Hausman and McFadden 1984) the assumption of independence from irrelevant alternatives (IIA) has to be rejected for this data set ($\chi^2(7) = 80.55, p < .001$). Therefore, the EC logit which does not rest on this assumption is appropriate.

resulting from this development. The coefficient of the cost attribute (COST) is significantly negative too, meaning that respondents prefer options at lower costs to more costly options with all other attributes held constant. The dummy indicating any of the change options (ASC_CHANGE) is significant in this model. Even with all attributes held constant respondents tend to prefer the two change options to the BAU alternative. Some demographic variables were included in the model to test their effect on stated choices. While male respondents have a lower likelihood of preferring any of the change options (MALE), respondent income (INCOME) and the fact that the respondent has got a university degree (UNI) do not affect choices. Respondents who have taken a ferry (FERRY) of a flight (FLIGHT) over the study area, the North Sea, are more likely to contribute to the management plan.

- Table 6 -

The TPB components are included in interactions with ASC_CHANGE as additional explanatory variables in Model 2. Attitudes towards the behaviour of interest (ATT) and subjective norm (SN) positively affect choices. Higher scores on these components explain significantly higher likelihood of preferring a change option over the BAU option. That is, respondents with a more positive attitude towards the behaviour and strong subjective norms are more likely to contribute to the Dogger Bank management plan. The model does not, however, detect any effect of perceived behavioural control. While this does not support Hypothesis 1c, Hypotheses 1a and 1b are supported. An additional model with only PBC (not reported here) shows a significantly positive effect of this component on choice probability. The lack of significance of PBC in Model 2 likely stems from the high correlation of the three TPB components (Table 4). Consequently, Hypothesis 1c cannot be rejected completely. The explanatory power of Model 2 improves compared to Model 1 without the TPB components as indicated by the higher adjusted McFadden R^2 and the lower BIC, which lends partial support to Hypothesis 3. A likelihood ratio (LR) test ($\chi^2_{m1,m2} = -2(LL_{model1} - LL_{model2})$) shows that the improvement in model fit is significant ($\chi^2_{m1,m2}(3) = 481.42$, $p < .001$).

Model 3 includes the three NAM components in interactions with ASC_CHANGE. While ascription of responsibility (AR) does not affect choices, higher awareness of need (AN) and consequences (AC) lead respondents to prefer a change option more often. While model fit

also significantly improves over the baseline model ($\chi^2_{m1,m3}(3) = 262.95$, $p < .001$), it does not reach the level of Model 2. Additional models were also run including the personal norm measure [5] in interaction with ASC_CHANGE (not reported here). Personal norm also significantly affects choices with respondents with a stronger personal norm preferring the change option. In the model including personal norm, the coefficient of subjective norm (SN) is insignificant. This could be the result of correlation between variables, but may also reflect findings elsewhere in the literature that suggest that SN is a predictor of personal norms (Bamberg and Möser, 2007). Testing the activation of the personal norm if all other NAM components are present, however, proved to be too complex for this choice model. This variable is therefore dropped from this and subsequent models. The implications of which are taken up in the discussion.

The behavioural effects found in Models 2 and 3 persist in Model 4 which includes both the sets of TPB and NAM components. A favourable attitude and subjective norms towards paying for the Dogger Bank management plan as well as having an awareness of consequences and the need for action all explain the choice of contributing to the management plan. In addition, in this model the AR component also affects choices in a positive way. A stronger ascription of responsibility leads respondents to prefer any of the change options. Both model fit (BIC and adjusted R^2) and the share of correct choice predictions are highest in this model. LR-tests show that improvements in model fit over Models 2 and 3 are significant ($\chi^2_{m2,m4}(3) = 112.37$, $p < .001$; $\chi^2_{m3,m4}(3) = 330.84$, $p < .001$).

The variances of the error components for the BAU option (Sigma_BAU) and the two change options (Sigma_CHANGE) are insignificant in all above models. That is, the above models do not detect any difference in error variance between the (supposedly more familiar) BAU scenario and the (supposedly less familiar) change options. Consequently, no status quo effect in the form of a lower error variance for the BAU option can be found in this data set.

A suite of random parameter logit (RPL) models (not reported here but available on request) with attribute coefficients assumed to follow a normal and the cost coefficient a truncated triangular distribution were run as robustness checks. Results are the same as those in Table

[5] This measure is derived from responses to the statement “Making a monetary contribution to ensure an effective Dogger Bank management plan is a moral obligation” on a 5-point agreement scale.

6, except for the coefficient of subjective norm which is insignificant in the RPL models. This is likely to result from high correlation between the components as models including one TPB component at a time, however, show significant effects of all of them.

To address endogeneity concerns (Section 3.3) we ran a series of conditional logit models in which all explanatory variables of choice were interacted with a dummy variable indicating high and low-scorers on each TPB and NAM component. Results consistently show that high-scorers on every component except AR are more likely to prefer any of the change options. This supports the findings in Table 6. Similarly, low-scorers on all six components exhibit a significantly higher (absolute) cost coefficient, i.e. they are more cost-sensitive, which provides a potential explanation for their weaker intentions to contribute to the Dogger Bank management plan.[6]

4.4. Determining latent classes of preference patterns

When applying a LC model the number of classes needs to be determined before fitting the model. Applying usual indicators of model fit, such as the Bayesian (BIC) and the Akaike Information Criteria (AIC) and adjusted McFadden R^2 to a series of models with increasing numbers of classes from 2 to 10 (Scarpa and Thiene 2005), no univocal decision of the optimal number of classes could be made. While the BIC indicated a five-class model to be optimal, the AIC and the adjusted McFadden R^2 showed nine- and ten-class models to maximise model fit. Such a high number of classes leads to problems of interpretability of preference parameters and WTP. In addition, some models yield classes with either near-zero respondents or virtually the same parameter patterns in two or more classes. To facilitate interpretation, the number of classes is restricted to four. The four-class model outperforms models with two or three classes in terms of model fit and yields interpretable and distinct patterns of utility parameters.

The four-class LC model is presented in Table 7. The top section of the table reports utility parameters and WTP estimates for all attribute dummies. As Class 4 has the largest share of respondents (0.432) it is therefore used as the reference class. Coefficients of explanatory variables in the class membership function for Classes 1 to 3 refer to changes from the

[6] Detailed model results and Wald-tests of coefficients are available from the authors on request.

reference Class 4. In Class 4, utility parameters and thus WTP estimates for all but one attribute dummy are significantly different from zero. Respondents are willing to pay £35 (£47) per year for the protection of porpoises, seals and seabirds on 25% (50%) of the Dogger Bank area. WTP for an increase in species diversity is only significant for a 25% change (£11), whereas WTP for a 10% change is not significant. The negative WTP of -£13 for INVASIVE indicates a loss of utility resulting from a wider spread of invasive species in the area.

Respondents in Class 1 are only concerned about the spread of invasive species as indicated by the significantly negative coefficient of INVASIVE. Species diversity and the protection of charismatic species do not affect choices in this class. The covariates in the class membership function provide a profile of the respondents in this class as compared to Class 4. In terms of the TPB, these respondents have significantly less favourable attitudes towards contributing to the management plan (ATT) and weaker subjective norms (SN). Of the NAM components, respondents in Class 1 are less aware of the need (AN) for and the consequences (AC) of the proposed management plan and ascribe less responsibility to themselves compared to Class 4.

The pattern of WTP estimates in Class 2 is similar to that in Class 4, with significant WTPs for all non-monetary attributes. The expected utility loss, however, from a wider spread of invasive species (INVASIVE) as indicated by the negative WTP of £-67 is extraordinarily high. Respondents in this class (and to a lesser extent in Class 1) appear overly concerned about this environmental threat. Looking at the class membership function, respondents in Class 2 have less favourable attitudes and weaker subjective norms with respect to contributing to the management plan but stronger awareness of consequences than respondents in Class 4. This last effect might explain the high negative WTP for INVASIVE, which is potentially caused by a strong concern for the environmental and societal consequences if the proposed Dogger Bank management plan is not implemented. The share of this class amounts to almost 19% of the total sample.

Class 3 shows the most irregular pattern and lowest value of WTP estimates. While WTP for a 10%-increase in species diversity is £4, WTP for a larger increase of 25% is insignificant. Respondents are willing to pay the same amount for the protection of charismatic species on 25% and 50% of the Dogger Bank area (PROT25 and PROT50). WTP for a wide spread of invasive species is significant but lowest across all classes in absolute terms (£-7).

Respondents in this class make up one quarter of the sample and score significantly lower on the ATT and AC scores but higher on the AR score. Compared to Class 4, these respondents exhibit less favourable attitudes towards contributing, greater ascription of responsibility and lower awareness of consequences, which might all explain the described pattern in WTP estimates as follows. These respondents are willing to contribute modest amounts despite their less favourable attribute towards contributing and thus act as 'dutiful citizens'. This might be the result of a compromise between the less favourable attitude and the stronger ascription of responsibility for the problem. Another possible explanation is that these respondents feel responsible, but do not think that paying is a solution to the problem. However, the data do not allow investigating this further.

The fit of the LC model to the data is an improvement on any of the EC logit models, as indicated by a lower BIC and higher adjusted R^2 (Tables 6 and 7). The share of correctly predicted choices in the LC model increases to almost 84%.

5. Discussion

In three steps the above analysis investigates the influence of two social psychological concepts on responses in a DCE to value benefits from marine conservation. The analysis shows that respondents discarded from the sample as protesters score significantly lower on all TPB and all but one NAM components. This effect of some TPB components on protest responses has been found in earlier studies (Bernath and Roschewitz 2008). Protesters have less of an intention to make a payment for the proposed environmental project as assessed by the TPB, which confirms the deletion of these cases from the sample.

In the EC logit models, two of the three TPB components independently explain support for the Dogger Bank management plan (supporting Hypotheses 1a and 1b). Respondents with more favourable attitudes towards contributing and stronger subjective norms regarding this behaviour are more likely to prefer the management plan over the BAU scenario. PBC does not affect these choices when attitudes and subjective norms are also included in the model, which supports findings in López-Mosquera et al. (2014) and Fielding et al. (2008). Following the interpretation of López-Mosquera at al. (2014), this indicates a high degree of self-sufficiency on the part of the respondents because their decision to pay or not to pay hinges

on their intentions rather than their control over this behaviour. However, PBC is significant when included on its own, suggesting that this relationship is more complex and that Hypothesis 1c cannot be completely rejected.

The NAM model is a more complicated to test empirically due to the moderator effects of the different components on personal norms and hence behaviour. Nevertheless, there is evidence that the three components of NAM measured in this study explain preferences for the change options (supporting Hypotheses 2a-c). Although a measure of personal norm is not included in this analysis (and represents a weakness of this study, not least because it may be a stronger predictor of intentions that SN from the TPB model; Bamberg and Möser, 2007), the result suggests that contributing financially to the Dogger Bank management plan is viewed as a moral obligation, with respondents attributing responsibility to themselves and the action of contributing being seen as beneficial to the welfare of others. This finding supports those of Guagnano et al. (1994), Guagnano (2001) and Liebe et al. (2011), that there is a positive relationship between components of NAM and WTP.

Looking at changes in the predictive power, the inclusion of both TPB and NAM components significantly improves model fit (supporting Hypothesis 3). Inclusion of the TPB components alone in the model leads to a larger improvement than the inclusion of the NAM components alone. The improvement of fit, however, is greatest when both TPB and NAM components are included. This result confirms the findings reported by Bernath and Roschewitz (2008), but is contrary to the findings of Liebe et al (2011). In terms of the comparison between the contribution and purchase model, including TPB components leads to a larger improvement in model fit indicating that TPB has a stronger explanatory power. While it is likely that both the TPB and NAM are at work and influence the statement of behavioural intentions through choice responses, the content of the components affecting choices lets us conclude that the influence of the purchase model as expressed by the TPB and some NAM components is stronger.

Further analysis into the preference structure of this data was undertaken using an LC model. The LC model provides support for the conclusion that both TPB and NAM components influence class membership. The influence of TPB and NAM varies by class, however, helping to identify and explain preference heterogeneity. For example, in Class 3 components of NAM (AR and AC) are significantly different from the reference class (Class 4), but show different signs. This may indicate that defensive redefinition is occurring in respondents in Class 3

whereby they deny responsibility for paying for the Dogger Bank management plan. Taken together, the consistency of results over different model types (EC, RP and LC logit) emphasises their robustness.

The present study only tested the direct effect of the TPB and NAM on stated choices and as explanatory variables in class membership functions. Studies testing the influence of these constructs on stated WTP in contingent valuation surveys increasingly use SEM (e.g. Meyehoff 2006, López-Mosquera and Sánchez 2012). Future research should make use of recent advances in choice modelling techniques and apply hybrid models that can account for latent variables (e.g. Hess and Beharry-Borg 2012, Hess et al. 2012). It would then be possible to test the influence of TPB and NAM components on each other. This approach would enable research suggested by Meyerhoff (2006) and Liebe et al. (2011) on the relative impact of alternative behavioural theories on WTP statements in contingent valuation surveys to be applied to DCE as well.

TPB and NAM may not be the only behavioural theories to affect stated choices. In particular, the roles of environmental attitudes, moral norms and moral emotions (such as guilt and shame) both as direct influence on choices and as potential mediator of the effects of TPB and NAM should be investigated. It is also likely that some TPB components are linked to or interact with other variables potentially affecting choices (e.g. perceived behavioural control and disposable household income as an indicator of ability to pay). Identifying these interactions may be important if interventions are to be designed based on survey findings as it will allow them to be targeted more effectively.

Similarly, components of the TPB might impact other moderators of stated choices, such as choice certainty (Brouwer et al. 2010, Olsen et al. 2011, Hensher et al. 2012). These relationships were not tested in the framework of this study but should be investigated further when testing for construct validity in stated preference surveys, especially when regarding remote and unfamiliar environmental goods. The findings from this study are encouraging, however. The inclusion of TPB components in a DCE supports the idea that stated choices can be likened to behavioural intentions, reflecting the interpretation of choices in the underlying economic model. As suggested by Ajzen and Driver (1992), individuals can in part be seen to base their decisions of whether or not to pay on cognitive heuristics, in the absence of full information on the economic value of the goods in question. There may still be a

discrepancy, however, between whether individuals would pay in a real life situation and the amount that they would actually be willing to pay. Such hypothetical bias (e.g. Cummings and Taylor 1999, Murphy et al. 2005, Loomis 2014) and the role that TPB can play in its explanation requires further investigation. Nevertheless, the influence of all NAM components on the decision to contribute to the proposed management plan, suggests respondents may have mixed motivations when responding to choice tasks.

6. Conclusions

This study responds to the call for a more thorough investigation of the behavioural determinants of preferences for environmental goods (López-Mosquera et al. 2014). Components of the TPB and the NAM are employed to explain stated choices and estimated WTP for conservation benefits of an offshore marine protected area in the North Sea – a set of particularly remote and unfamiliar environmental goods. The findings with respect to the TPB are encouraging as they support the idea that choices between measures to conserve the offshore marine environment constitute behavioural intentions. Even in this case of remote and unfamiliar environmental goods, results with respect to the TPB favour the purchase model interpretation of WTP estimates. These findings reinforce the construct validity of stated choices for the valuation of marine environmental goods.

The findings regarding at least two of the NAM components support the meaningfulness of choice responses in a similar way. Respondents who are aware of the need for management of the Dogger Bank and those feeling personally responsible for contributing to this effort are more likely to support this effort. Such response motivations suggest that stated choices do indeed validly represent preferences which are in line with the theory underpinning stated preference valuation. Merely the effect of the awareness of consequences implies that altruistic motivations also lie behind stated choices. This means that respondents take into account the positive effect of the proposed changes not only on themselves (which the traditional interpretation of WTP presupposes) but also on other people and society as a whole. As the results of the LC model show, different respondents will use different models, i.e. they have different behavioural motivations, when making their choices. More work is needed with respect to identifying in which circumstances which model components take precedence or whether there will always be a mix.

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Table 1: Choice attributes (business as usual level in italics)

Attribute	Description	Attribute levels
Species diversity on the Dogger Bank	Relative change in species diversity on the Dogger Bank	*No change* 10% increase in species diversity 25% increase in species diversity
Protection of charismatic species (porpoises, seals and seabirds)	Percentage of area of Dogger Bank where these species are protected	*Not protected* Protected on 25% of the Dogger Bank area, Protected on 50% of the Dogger Bank area
Spread of invasive species	Likelihood of the introduction of invasive species on the Dogger Bank	*Restricted spread* Wide spread
Payment vehicle: Additional tax	Additional tax to be paid annually by every household to fund the Dogger Bank management plan	*£0*, £5, £10, £20, £30, £40, £60

Table 2: Questionnaire items for the measurement of components of the TPB (ATT, SN and PBC) and NAM (AN, AR and AC)

Construct	Item	Response scale
ATT: Attitude towards the relevant behaviour	ATT_1: For you, making a monetary contribution towards the Dogger Bank management plan is:	Unpleasant – pleasant (1-7)
	ATT_2: For you, making a monetary contribution towards the Dogger Bank management plan is:	Not worthwhile – worthwhile (1-7)
SN: Perceived social pressure to perform or not perform the behaviour	SN_1: My friends and family would support my making a monetary contribution to the Dogger Bank management plan.	Agree (1-5)
	SN_2: That you will be able to make a monetary contribution to the Dogger Bank management plan is...	Likely (1-5)
PBC: Perceived ease or difficulty of performing the behaviour	PBC_1: It is easy for me to make a monetary contribution to the Dogger Bank management plan.	Agree (1-5)
	PBC_2: That your friends and family would influence your intention to make a monetary contribution to the Dogger Bank management plan is...	Likely (1-5)
AN: Awareness of need	AN_1: I think a Dogger Bank management plan is not necessary. (reversed)	Agree (1-5)
	AN_2: Without a management plan the diversity of species on the Dogger Bank will continue to decrease.	Agree (1-5)
	AN_3: Porpoises, seals and seabirds need protecting through the management plan.	Agree (1-5)
AR: Ascription of responsibility	AR_1: The government should provide more resources to ensure an effective Dogger Bank management plan. (reversed)	Agree (1-5)
	AR_2: Industries involved in the exploitation of marine resources should be responsible for ensuring the Dogger Bank management plan is effective. (reversed)	Agree (1-5)
AC: Awareness of consequences	AC_1: An effective Dogger Bank management plan is important to ensure that the benefits from the marine environment are available for me and my family in the future.	Agree (1-5)
	AC_2: An effective Dogger Bank management plan is important to ensure that the benefits from the marine environment are available to society in the future.	Agree (1-5)

Table 3: Pearson correlation coefficients of individual TPB and NAM questionnaire items (N=1,022)

		ATT		**SN**		**PBC**		**AN**			**AR**		**AN**	
		ATT_1	ATT_2	SN_1	SN_2	PBC_1	PBC_2	AN_1	AN_2	AN_3	AR_1	AR_2	AN_1	AN_2
ATT	ATT_1	1												
	ATT_2	0.59***	1											
SN	SN_1	0.51***	0.51***	1										
	SN_2	0.42***	0.30***	0.40***	1									
PBC	PBC_1	0.44***	0.29***	0.48***	0.38***	1								
	PBC_2	0.55***	0.53***	0.60***	0.50***	0.58***	1							
AN	AN_1	0.14***	0.39***	0.21***	0.01	0.00	0.18***	1						
	AN_2	0.21***	0.38***	0.27***	0.05*	0.07**	0.22***	0.37***	1					
	AN_3	0.21***	0.37***	0.23***	0.06*	0.02	0.16***	0.33***	0.49***	1				
AR	AR_1	-0.11***	-0.24***	-0.16***	-0.06*	-0.01	-0.11***	-0.26***	-0.39***	-0.40***	1			
	AR_2	0.05*	-0.10***	-0.02	0.10***	0.13***	0.03	-0.24***	-0.27***	-0.27***	0.40***	1		
AC	AC_1	0.24***	0.43***	0.36***	0.12***	0.11***	0.27***	0.44***	0.45***	0.47***	-0.47***	-0.42***	1	
	AC_2	0.21***	0.42***	0.36***	0.04**	0.08**	0.23***	0.47***	0.48***	0.50***	-0.47***	-0.43***	0.76***	1

***, ** and * indicate 1%-, 5%- and 10%-level of confidence. Shaded boxes indicate intra-component correlation.

Table 4: Pearson correlation coefficients of TPB and NAM components (N=1,022)

	ATTITUDE	SN	PBC	AN	AC	AR	Respondent age
ATTITUDE	1						-0.04
SN	0.53***	1					-0.16***
PBC	0.55***	0.62***	1				-0.02
AN	0.34***	0.14***	0.14***	1			0.15***
AC	-0.09***	-0.03	0.00	-0.40***	1		-0.17***
AR	0.34***	0.23***	0.21***	0.62***	-0.54***	1	0.19***

*** indicate 1%--level of confidence. Shaded boxes indicate correlation within the TPB and NAM, respectively.

Table 5: Mann-Whitney U-tests of mean scores of TPB and NAM components between protesters and non-protesters

	Protest	N	Mean	p-value
ATT score (0,1]	No	973	0.394	0.000
	Yes	49	0.151	
SN score (0,1]	No	973	0.316	0.000
	Yes	49	0.158	
PBC score (0,1]	No	973	0.307	0.000
	Yes	49	0.137	
AN score (0,1]	No	973	0.465	0.000
	Yes	49	0.306	
AR score (0,1]	No	973	0.167	0.150
	Yes	49	0.169	
AC score (0,1]	No	973	0.624	0.006
	Yes	49	0.523	

Table 6: Error component logit models including different sets of TPB and NAM variables

	Model 1		Model 2		Model 3		Model 4	
	Coef.	**s.e.**	**Coef.**	**s.e.**	**Coef.**	**s.e.**	**Coef.**	**s.e.**
ASC_CHANGE	0.452***	(0.133)	-0.804***	(0.134)	-1.181***	(0.169)	-1.872***	(0.180)
SPEC10	0.219***	(0.077)	0.231***	(0.077)	0.219***	(0.078)	0.223***	(0.078)
SPEC25	0.291***	(0.056)	0.292***	(0.056)	0.288***	(0.056)	0.289***	(0.056)
PROT25	1.081***	(0.069)	1.092***	(0.068)	1.087***	(0.069)	1.098***	(0.068)
PROT50	1.365***	(0.073)	1.380***	(0.071)	1.375***	(0.073)	1.391***	(0.071)
INVASIVE	-0.935***	(0.055)	-0.943***	(0.054)	-0.940***	(0.054)	-0.949***	(0.054)
COST	-0.041***	(0.002)	-0.041***	(0.002)	-0.041***	(0.002)	-0.042***	(0.002)
MALE [a]	-0.374***	(0.067)	-0.311***	(0.066)	-0.307***	(0.066)	-0.290***	(0.067)
INCOME [a]	-0.002	(0.017)	0.004	(0.017)	-0.004	(0.017)	0.001	(0.017)
UNI [a]	-0.102	(0.068)	-0.102	(0.068)	-0.089	(0.068)	-0.100	(0.068)
FERRY [a]	0.280***	(0.069)	0.146**	(0.067)	0.191***	(0.068)	0.102	(0.068)
FLIGHT [a]	0.265***	(0.071)	0.201***	(0.069)	0.232***	(0.070)	0.192***	(0.069)
ATT [a]			2.846***	(0.204)			2.458***	(0.199)
SN [a]			0.713***	(0.234)			0.613***	(0.235)
PBC [a]			0.050	(0.214)			0.209	(0.218)
AN [a]					0.998***	(0.263)	0.660**	(0.262)
AR [a]					0.191	(0.182)	0.583***	(0.189)
AC [a]					2.066***	(0.195)	1.107***	(0.180)
Variances of error components								
Sigma CHANGE	-0.544 *	(0.301)	-0.039	(3.129)	-0.385	(0.399)	-0.039	(3.337)
LL_m	-5,507		-5,267		-5,376		-5,211	
Observations	5,838		5,838		5,838		5,838	
Respondents	973		973		973		973	
Halton draws	500		500		500		500	
BIC	11,128		10,672		10,891		10,586	
adj. MF r2	0.140		0.178		0.161		0.186	
Correct Pr.	0.534		0.569		0.557		0.575	

*** indicate 1%-level of confidence. [a] interacted with ASC_CHANGE. Adjusted R^2 is computed as $R^2 = 1 - (LL_m - k)/LL_0$, where LL_m and LL_0 are the log-likelihoods of the full model and the intercept-only model, respectively, and k the number of parameters. Bayesian Information Criterion (BIC) is calculated as $BIC = -2LL_m + k \cdot \ln(N)$ with N denoting the number of respondents. The use of BIC is preferred to Akaike Information Criterion because it imposes a stronger penalty on the inclusion of more parameters in the model.

Table 7: Latent class model

	Class 1			Class 2			Class 3			Class 4		
	Coeff.	**s.e.**	**WTP**	**Coeff.**	**s.e.**	**WTP**	**Coeff.**	**s.e.**	**WTP**	**Coeff.**	**s.e.**	**WTP**
ASC_CHANGE	-1.216 *	(0.704)		1.736 ***	(0.457)		0.844 ***	(0.326)		2.358 ***	(0.244)	
SPEC10	-0.564	(0.493)	-10	0.536	(0.359)	7	0.689 ***	(0.251)	4	0.135	(0.161)	4
SPEC25	0.562	(0.416)	10	1.138 ***	(0.284)	16	0.177	(0.213)	1	0.335 ***	(0.084)	11
PROT25	0.196	(0.458)	3	1.839 ***	(0.317)	25	2.078 ***	(0.250)	13	1.105 ***	(0.103)	35
PROT50	0.097	(0.539)	2	3.381 ***	(0.451)	46	2.133 ***	(0.257)	13	1.481 ***	(0.103)	47
INVASIVE	-1.239 ***	(0.388)	-21	-4.890 ***	(0.478)	-67	-1.060 ***	(0.178)	-7	-0.393 ***	(0.094)	-13
COST	-0.059 ***	(0.018)		-0.073 ***	(0.010)		-0.159 ***	(0.012)		-0.031 ***	(0.003)	
Class membership function												
Constant	4.622 ***	(0.677)		-0.875	(0.543)		1.168 **	(0.483)		0.000		
ATTITUDE	-6.719 ***	(1.263)		-1.295 **	(0.577)		-2.491 ***	(0.599)		0.000		
SN	-2.503 **	(1.146)		-2.530 ***	(0.756)		-0.947	(0.706)		0.000		
PBC	0.722	(0.967)		1.064	(0.669)		-0.536	(0.720)		0.000		
AN	-2.327 *	(1.361)		-0.892	(0.990)		0.554	(0.826)		0.000		
AR	-1.869 **	(0.808)		-0.266	(0.670)		1.047 *	(0.578)		0.000		
AC	-2.616 ***	(0.825)		2.194 ***	(0.654)		-1.803 ***	(0.584)		0.000		
Class share	0.131			0.187			0.250			0.432		
Log-likelihood	-4,359											
Observations	5,838											
Respondents	973											
BIC	9,144											
Adjusted R^2	0.317											
Correct pred.	0.836											

***, ** and * indicate 1%-, 5%- and 10%-level of confidence. Adjusted R^2 is computed as $R^2 = 1 - (LL_m - k)/LL_0$, where LL_m and LL_0 are the log-likelihoods of the full model and the intercept-only model, respectively, and k the number of parameters. Bayesian Information Criterion (BIC) is calculated as $BIC = -2LL_m + k \cdot \ln(N)$ with N denoting the number of respondents. The use of BIC is preferred to Akaike Information Criterion because it imposes a stronger penalty on the inclusion of more parameters in the model. WTP is reported in GBP £.