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Analysis

Support for Transnational Conservation in a Gain-Loss Context

Mathias Vogdrup-Schmidt*, Niels Strange, Bo Jellesmark Thorsen

Department of Food and Resource Economics, University of Copenhagen and Center for Macroecology, Evolution and Climate, University of Copenhagen, Rolighedsvej 25, 1958 Frederiksberg C, Denmark

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ABSTRACT

Efficient biodiversity conservation may rest on support for transnational cooperation; particularly for migratory species. Support for transnational conservation efforts may hinge on key issues like the potential outcomes and whether any collaboration aspect is highlighted. We designed an experiment focused on conservation of open land habitats in Denmark and the Netherlands. We tested how support of Danish households depends on framing in a context of possible losses of habitats and on possible contributions from Dutch households to the conservation case. We further tested for presence of loss aversion in outcomes and income. We found that the willingness-to-pay (WTP) for gains in open land habitats at home tended to increase when habitat losses were possible. Framing in the context of others, Dutch households, contributing consistently affected Danes' WTP for increasing protected habitat areas and for avoiding habitat losses. And the less Dutch households contributed, the more Danish households contributed with the converse also being true. Our results suggest that overall support for habitat conservation for migratory birds may be higher in cases where a risk of habitat losses exists. Results also suggest that support for conservation at home increase when respondents perceive that they share the challenge with other countries.

1. Introduction

Migratory birds have always fascinated humans. Their seasonal movements cover regions, continents and vast arrays of habitats (Svensson et al., 2009). The annual return of some species has significance in various cultures, but despite this 40% of migratory bird species globally are in decline (BirdLife International, 2017). Protection of migratory species is particularly challenging, as it requires conservation and protection efforts along their entire migratory routes. Intergovernmental agreements such as the Bonn Convention to protect migratory species travelling across national borders (UN, 1979) aim to address this challenge and coordinated efforts across countries are more cost-efficient than single country action (Rodrigues and Gaston, 2002; Kark et al., 2009; Wells et al., 2010; Moilanen and Arponen, 2011).

However, public support to pay for conservation efforts is generally higher the closer they occur to home (Bateman et al., 2006; Campbell et al., 2009; Nielsen et al., 2016), and public support for conservation investments in foreign countries is usually lower than for investing at home. Nevertheless, the public generally are willing to support conservation efforts in other countries too (Hoyos et al., 2009; Ressurreição et al., 2012; Dallimer et al., 2014; Bakhtiari et al., 2018).

None of the above studies addressed the issue of conservation efforts to help migratory species which constitute a special case exactly because conservation success may depend on willingness to collaborate. Most studies focus on options to enhance conservation and protection of habitats against a cost, yet reductions in international conservation efforts and losses of protected habitats are pervasive in policy too. Furthermore, while several studies have investigated support for collaboration in different countries, few have studied what information about the level of contributions from others may affect support and willingness to pay (Vogdrup-Schmidt et al., 2019). We designed a choice experiment to evaluate these questions among a sample of Danes. Focusing on open land natural habitats for migratory birds, we presented them to various conservation alternatives targeting open land in Denmark (DK) and the Netherlands (NL). These countries are of similar size and harbor many habitat types that are ecological substitutes for many migratory species. To obtain a coherent framework for evaluating our hypotheses we designed the experiment using a split-sample approach. This allowed us to test how WTP for conservation outcomes may depend the framing in a context of possible losses as well as gains in protected habitats at home and abroad, and on framing in a context of collaboration in the form of alternatives with varying changes in contributions made by households in the Netherlands. As we allowed for both income tax increases and reductions for households in DK and

* Corresponding author at: Rolighedsvej 23, 1958 Frederiksberg C, Denmark.
E-mail addresses: mvs@ifro.ku.dk (M. Vogdrup-Schmidt), nst@ifro.ku.dk (N. Strange), bjt@ifro.ku.dk (B.J. Thorsen).

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NL, and hence variations in burden sharing, we can evaluate also the presence of loss aversion in the environmental outcome variable as well as income, and the direct effect on Danish respondents' WTP from information on Dutch contributions.

We draw upon several strands of literature to formulate expectations about the outcome of testing our hypotheses. The role of information and framing is one of several design decisions investigated at length in the stated preference literature and known for its role in affecting preference expressions (Johnston et al., 2017). Framing outcomes in a context of possible losses by offering respondents choice alternatives with habitat changes that are either only positive (gains) or both positive and negative (loss of habitats) likely influence their willingness-to-pay (WTP)/willingness-to-accept (WTA) (Johnson et al., 2010, Knetsch, 2010).

Framing in a context of others contribution (or lack thereof) was investigated by providing information about Dutch households' contributions in the form of changes in their tax payments. Different aspects may play a role and unfortunately, they may counter each other, e.g. what other people contribute in a given case has been found to influence peoples' contributions in a positive direction, (Croson and Shang, 2008), but can also result in free riding (Isaac and Walker, 1988). We note that in our design, we could evaluate both the framing effect on the Danish households' WTP for the outcome variables at home and in NL, as well as the direct effect on overall WTP from the NL household contributions. We note that because Denmark and the Netherlands are both part of the EU, we are able to enhance scenario plausibility by referring to current EU practices in coordinating conservation.

Finally, the inclusion of both negative and positive outcome levels (habitat gains or losses), as well as both negative and positive changes in income (tax) allowed us to investigate potential loss aversion. Loss aversion is a commonly accepted human trait expressed through a general higher utility change from a marginal loss than a marginal gain in the same outcome variable (Kahneman and Tversky, 1979; List, 2004). Loss aversion in money is debated and we contribute to this literature too (Bateman et al., 2005; Novemsky and Kahneman, 2005).

2. Related literature and our hypotheses

Valuation studies in a cross-country setting have been relatively few and all of the studies have applied a WTP/gain frame. Bakhtiari et al. (2018) used a choice experiment to evaluate the marginal WTP for comparable biodiversity protection efforts and outcomes in Denmark and Sweden, using samples of Danish and Swedish respondents. Their case and design allowed them to disentangle distance effects from country of policy site effects. They found clearly higher WTP estimates for efforts in the home than foreign country suggesting that respondents viewed biodiversity as a local more than a global or regional public good. Dallimer et al. (2014) used a choice experiment in a three country setting in the Baltic Sea region to study WTP for habitat conservation among other attributes in any of the three countries. The overall pattern of their study was that the respondents in all countries were more likely to choose and more willing to pay for alternatives in their own country compared to any foreign country. A transnational setting is an extreme case of testing for distance decay in WTP, which is often found in choice experiments on environmental impacts (Bateman et al., 2006; Campbell et al., 2009). Compared to these previous studies, we investigate the framing effect of including contributions from households in other countries as an attribute in the choice sets. We furthermore expand on previous research by including the negative domain of all attributes in a two-country setting.

Several studies have addressed the role of framing and other forms of information provision in stated preference research (Johnston et al., 2017). It is well-known that framing a public good around its positive effect increases mean WTP for the good (Munro and Hanley, 2002). Kragt and Bennett (2012) in their choice experiment on water catchment management in Tasmania tested for differences in estimates using either positive or negative contextual descriptions of the same attribute levels (valence-based framing). They found significantly higher WTP estimates when they described attribute levels in a loss framing (e.g. as an avoided loss) rather than a gain framing. In our experiment, we used a split design offering one sample choice alternatives with habitat changes that were only positive (gains) and another sample alternatives with both positive and negative changes (loss of habitats). We tested for differences in WTP estimates for gains across this difference in framing, which we hypothesized likely to affect the valence of the positive changes in habitat (Tversky and Kahneman, 1981).

The second framing we investigated concerned the presence or absence of information in choice alternatives about NL households' participation in the burden sharing through changes in their tax payments. The effect of this framing appears harder to predict, based on the literature. Croson and Shang (2008) found that participants' donations were dependent on others' contribution and that respondents changed their contributions when faced with social information about other respondents' contributions to match the lower or higher figure. Frey and Meier (2004) found evidence on conditional giving in a field experiment on charitable giving. On the other hand, free riding is a common phenomenon in an individual, group, and even state setting (Albanese and Van Fleet, 1985; Isaac and Walker, 1988; List et al., 2002). Social information, e.g. what other people contribute in a given case has been found to influence peoples' contributions in a positive direction, a form of conditional giving (Croson and Shang, 2008). However, such information can also result in reduced contributions and free riding (Isaac and Walker, 1988). In general, effects of social information are complex issues and other factors may play a role too, such as commitment (Croson, 2007), warm glow or status effects (Griskevicius et al., 2010). We note that in our design, we will be evaluating both the effect on the Danish households' WTP for the outcome variables, as well as the effect on overall WTP from the Dutch household contributions. In either case, it is not clear if the effect of information on contributions by Dutch households will push up or decrease stated WTP.

The inclusion of both negative and positive outcome levels (habitat gains or losses), as well as both negative and positive changes in income (tax) allowed us to investigate potential loss aversion. Loss aversion is a commonly accepted human trait expressed through a general higher utility change from a marginal loss than a marginal gain in the same outcome variable (Kahneman and Tversky, 1979; Tversky and Kahneman, 1991), and loss aversion in outcomes has been documented at length in experimental decisions regarding traded goods (e.g. List, 2004). Despite the widely discussed disparity between estimates of WTP and WTA, environmental valuation studies testing for differences in estimates for attribute gains versus losses have been somewhat scarce (Horowitz and McConnell, 2002; Knetsch, 2010). In our context, we evaluated the loss aversion effect in two forms of splits, for outcome variables related to conservation at home as well as abroad. Loss aversion in money is debated, with some evidence suggesting it is absent in standard exchange decisions (List, 2004; Novemsky and Kahneman, 2005), and other evidence suggesting it exists in non-standard decision situation, as e.g. in environmental valuation studies (Bateman et al., 2005; Bartczak et al., 2017). Because we allowed for negative outcome for our habitat conservation variable, it was natural to allow also for negative payments (reduction in household taxes). Therefore, we contribute further to this literature, while noting also that loss aversion in money represents a potential challenge for valuation methods, where marginal utility of income is assumed constant over the range of change considered.

3. Case study design and experimental methods

3.1. Open land habitats and migratory birds in the EU: the transnational conservation case

We chose open land habitats as our conservation case because they in their various forms are among the most endangered habitats in the EU (EU Council, 2007), and are key habitats for a range of endangered and threatened migratory birds. These include the three case birds we presented to respondents: the Common Crane (*Grus grus*), the Montagu's Harrier (*Circus pygargus*), and the Golden Plover (*Pluvialis apricaria*). They are all listed in the EU Bird Directives Annex I and therefore subjects to special conservation measures (EU Council, 2009). The three species have known migratory patterns within Europe and beyond; the Common Crane and Golden Plover being regional migrants with the Montagu's Harrier being a long distance migrant (Svensson et al., 2009). The reason for picking the Netherlands included the fact that the species appear in similar habitats in both Denmark and the Netherlands and can occur in both countries over the course of a year. The purpose was to present respondents with species that can be protected in either country and can change resting grounds between those countries due to changes in conservation efforts. Habitats in the countries are credible substitutes in both an ecological and economic sense, unlike e.g. winter grounds for the species travelling to West-Africa that are complementary in function. Great ecological variation within the EU exists. The basket of species and general term “open land habitats” was applied to maintain focus on the migratory and transnational aspect of the subject instead of very specific habitats and species, hence avoiding a risk of iconizing species and areas (Jacobsen et al., 2008).

A second reason for picking the Netherlands is that they are also a member of the EU. The EU Life (the Financial Instrument of the Environment) program is an existing EU regulation with conservation projects running in many EU countries. The program is funded by the EU on six-year budgets and thus by EU citizen taxes (EU Commission, 2013). This allowed us to present participant with a plausible institution for ensuring the changes proposed in the choice experiment and using taxes as an appropriate payment vehicle.

3.2. Survey and experimental design

Our survey instrument had three main parts. In the first part, participants were asked about their recreational habits and experiences as well as their familiarity with birds. Second, the species, habitats, conservation case and payment vehicle were introduced. In the second part, the three bird species were presented to the participants along with their migratory nature and their habitats. We then informed respondents about the threat posed to open land habitats and that conservation in both Denmark and the Netherlands would contribute to their protection. The EU Life program and household tax payment were described to participants, and they were asked to undertake a set of choices across 12 choice sets, where each included the status quo and a single policy alternative, see Fig. 1. Third, participants filled in a questionnaire on socio-demographics, attitudes towards conservation, and trust in institutions (see Appendix A for details). Thus, this general structure was shared across splits but while the first and the third part where identical also in the detail, the second part of the questionnaire, the framing of the choices and the choice sets themselves, differed according to the split design.

Choice alternatives in all splits included possible gains in protected open land hectares in Denmark (HDK), as well as changes in the Netherlands (HNL). Choices in all splits also contained the possibility for an increase in the (income) taxes for Danish households connected to the selected conservation effort. The splits differed, however, in the following ways.

In Split 1, respondents were presented only with the potential for positive changes in open land hectares ($_{pos}$) in both countries and negative changes in income ($_{neg}$). Thus, this is a standard format for evaluating WTP for gains in habitat protection across countries (e.g. Bakhtiari et al., 2018; Dallimer et al., 2014). In Split 2, respondents were introduced to choice sets where all these three variables could take on values both in the positive and negative domain. Across split 1 and 2 we could test the effect on WTP for gains in habitats of framing in a context where habitat losses are also possible. Within the split we could test for loss aversion in outcome and income variables. Split 3 was identical to Split 1, except that the contributions made by Dutch households towards the conservation effort were introduced to the respondents and as an attribute in the choice sets. Thus, across split 1 and 3, we could evaluate the effect of framing in a context of others constituting on Danes WTP for gains in habitats. Finally, Split 4 differed from Split 3 in allowing all attributes to be both in the negative and positive domain, i.e. respondents where explained and presented to choice sets that allowed for increasing and decreasing habitat areas in both countries and for positive and negative income changes for both countries, depending in the specific alternative conservation policies. Comparing split 3 and 4 we could test for the effect of adding the framing in a context of potential loss on the WTP for gains in habitats. Comparing split 2 and 4, we could test for the effect on WTP (WTA) for gains (loss) of habitats from framing in a context of others contributing.

	Change	Status Quo
Change in extent of open land habitats in Denmark	+/- X ha	No change
Change in extent of open land habitats in the Netherlands	+/- Y ha	No change
Change in your annual house hold income	+/- Z DKK	No change
Change in annual household income for the Dutch	+/- W DKK	No change
Your choice	□	□

Fig. 1. Example of a choice set.

We designed the experiment such that there were no technical correlations between the attributes. Thus, a positive change in protected open land habitat area in Denmark was not automatically accompanied by a negative change in annual household income in Denmark. However, we did constrain the experimental design model to eliminate choice sets likely to considered unrealistic as e.g. the ones presenting negative changes in open land habitat area in both countries and also negative changes in annual household income in both countries, and vice versa. We discuss this choice under caveats below.

We used the software Ngene (https://www.choice-metrics.com) for the experiment design. Each participant responded to 12 choice sets with a change scenario and a status quo. Participants in split 2 were divided into two blocks and participants in split 4 were divided into three blocks in order to achieve a higher number of evaluated choice sets. The design within each split was optimized according to D-efficiency with D-errors for the four splits between 0 and 5e–06. The optimization relied on priors obtained from pilots of the survey. We collected our choice experiment data online via the online survey provider Userneeds (www.userneeds.dk) in November 2017. In total 1618 participants completed the questionnaire. The survey provider aimed to balance samples for representativeness in the sample and was responsible for all sampling and data collection. The experiment was carried out in accordance with the scientific and ethical guidelines of the University of Copenhagen, Faculty of Science's Good Scientific Practice, which follows the European Code of Conduct for Research

Table 1
Choice experiment attributes, units, and levels for Split 1 through 4.

Attribute		Unit	Split 1	Split 2	Split 3	Split 4
HDK_{pos}	Change in ha in Denmark, positive domain	Hectare	0, 500, 1000	0, 500, 1000	0, 500, 1000	0, 500, 1000
HDK_{neg}	Change in ha in Denmark, negative domain	Hectare	–	−1000, −500	–	−1000, −500
HNL_{pos}	Change in ha in the Netherlands, positive domain	Hectare	0, 500, 1000	0, 500, 1000	0, 500, 1000	0, 500, 1000
HNL_{neg}	Change in ha in the Netherlands, negative domain	Hectare	–	−1000, −500	–	−1000, −500
INL_{neg}	Change in income in the Netherlands, negative domain	DKK	–	–	−2000, −1000, −500, −100	−2000, −1000, −500, −100
INL_{pos}	Change in income in the Netherlands, positive domain	DKK	–	–	–	0, 100, 500, 1000, 2000
IDK_{neg}	Change in income in Denmark, negative domain	DKK	−2000, −1000, −500, −100	−2000, −1000, −500, −100	−2000, −1000, −500, −100	−2000, −1000, −500, −100
IDK_{pos}	Change in income in Denmark, positive domain	DKK	–	0, 100, 500, 1000, 2000	–	0, 100, 500, 1000, 2000

Split 1 included the potential for positive changes in open land hectares ($_{pos}$) in Denmark and the Netherlands and negative changes in income ($_{neg}$) in Denmark.
Split 2 included the potential for positive and negative changes in open land hectares ($_{pos}$ and $_{neg}$) in both countries and negative as well as positive changes in income ($_{neg}$ and $_{pos}$) in Denmark.
Split 3 included the potential for positive changes in open land hectares ($_{pos}$) in both countries and negative changes in income ($_{neg}$) in both countries.
Split 4 included the potential for positive and negative changes in open land hectares ($_{pos}$ and $_{neg}$) in both countries and negative as well as positive changes in income ($_{neg}$ and $_{pos}$) in both countries.

Integrity. Experiment instructions were initially written and presented in Danish to participants and have been translated for reviewer's convenience (Appendix A). The attribute levels are presented in Table 1.

3.3. Econometric method

Choice experiments, as a preference elicitation method, builds on Lancaster's (1966) demand theory, which assumes respondents to evaluate all characteristics and choose the good or alternative that gives them the highest utility subject to their budget constraint. The econometric model of choice is based on the Random Utility framework (McFadden, 1974) where the utility of individual n of choosing alternative i consists of an observable part x_{ni} and part unobservable for the analyst, the random error term ε_{ni}. For individual n, the utility of choosing alternative i become:

$$U_{ni} = \beta x_{ni} + \varepsilon_{ni} \tag{1}$$

Here, β is a vector of parameter coefficients to be estimated, X is a vector of attributes that describes the alternatives and may also contains characteristics for the individual. If we assume the error term ε_{ni} is independent and identically distributed (i.i.d.) of extreme value type I, we can model the choice probability of an alternative among known others using a multinomial logit (MNL) model (McFadden, 1974; Train, 2003). In the MNL model the probability P of individual n choosing alternative i, among J known alternatives across a set of T choice sets can be described as:

$$P_{ni} = \prod_{t=1}^{T} \frac{\exp(\beta x_{nit})}{\sum_{j=1}^{J} \exp(\beta x_{njt})} \tag{2}$$

The MNL model assumes all respondents share the same preference structure. As a robustness check, we further evaluated our hypotheses in a so-called Mixed Logit or Random Parameter Logit model. This model handles preference heterogeneity by describing and estimating the distribution of each preference parameter. An assumption has to be made about the form of the distribution, and we assumed all parameters to be normally distributed except price, which we kept fixed following the argument by Revelt and Train (1998) of simplifying the interpretation of heterogeneity. Assuming again the unobserved error terms is i.i.d. extreme value distributed, choice probabilities in the mixed logit becomes integrals of standard conditional logit functions evaluated at different β's, and with a density function as the mixing distribution (Train, 2003). The mixed logit can allow for repeated choices by the same respondent, i.e., a panel structure, by letting k be a sequence of alternatives, one for each choice occasion. Thus, the utility coefficients for each variable vary over respondents, n, but they are assumed constant over the K choice occasions for each respondent. Letting Φ represent the distribution function for β, with mean b and covariance W, the choice probabilities can be calculated as:

$$P_{nk} = \left(\prod_{k=1}^{K} \left[\frac{\exp(\beta x_{nik_n})}{\sum_{j=1}^{J} \exp(\beta x_{njk_n})} \right] \right) \Phi(\beta \mid b, W) d\beta \tag{3}$$

3.4. Specifying hypotheses evaluation

As the changes in the four main attributes, as well as the price attributes, in our models stretch over both the negative domain ($_{neg}$) and the positive domain ($_{pos}$), we created four dummy variables and made interaction terms with these and the attribute variables. That way, we divided each main attribute into two attributes; one with positive (and zero) changes (the positive domain); and another with negative changes (the negative domain). Therefore, coefficients results in the negative domain appear with a positive sign as it changes from a negative level going towards zero. Likewise, the changes in the positive domain appear with a positive sign as it covers the changes from zero going into

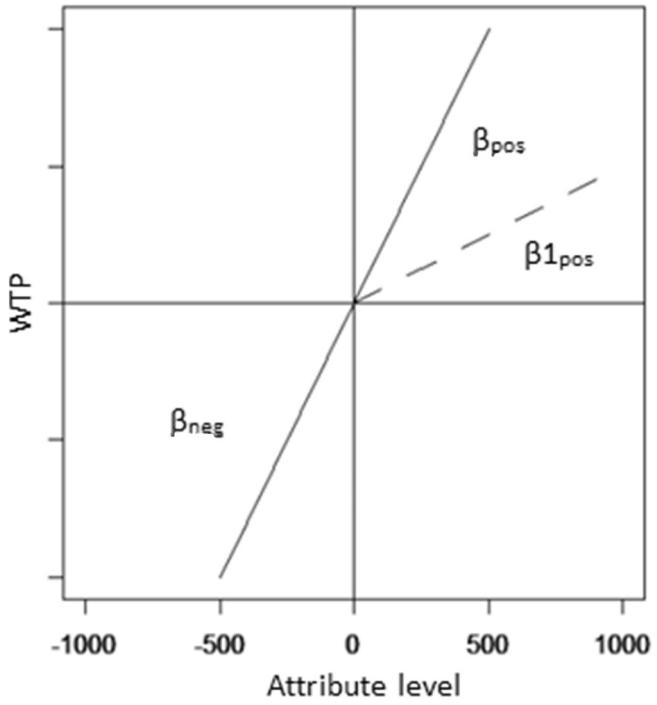

Fig. 2. Utility graph in both the negative and positive domain.

the positive domain (see a graphic illustration in Fig. 2). This feature allowed us to test for differences in slope estimates between changes in the negative vs the positive domain for each main attribute, and to compare variables in the positive and negative domain across splits.

As outlined above we had four hypotheses. We used the split-sample approach to test for these. Split 1 included changes in habitat in both DK and NL in the positive domain, whereas split 2 also included the negative domain for habitat changes. Split 3 included habitat changes in the positive domain only, but included also NL monetary contributions towards conservation. Split 4 included changes in habitat in both the positive and negative domain and NL contributions in both the positive and negative domain:

1. We tested framing effects in a context of loss using the treatment variations between split 1 & 2 and split 3 & 4 with the possible loss context hypothesized to induce higher WTP for the gains in habitat.
2. We tested framing effects in a context of other people (Dutch people in our case) contributing to the good, using treatment variations between split 1 & 3 and split 2 & 4.
3. We tested for loss aversion in the outcome and money domain in split 2 and in split 4 using the parameters of negative and positive domain variables.
4. Finally, in split 3 and in 4 we evaluated the direct effect on WTP of changes in NL contributions.

The utility function of the simple treatment in split 1 is:

$$U_1 = \alpha_0 + \beta_1 HDK_{pos} + \beta_2 HNL_{pos} + \beta_3 IDK_{neg} + e$$

where HDK_{pos} is the change in hectares of open land habitat in Denmark in the positive domain; HNL_{pos} is the change in hectares of open land habitat in the Netherlands in the positive domain; and IDK_{neg} is the change in annual household income in Denmark in the negative domain.

In split 2, we introduced the possibility of changes in annual household income in Denmark in the positive domain (IDK_{pos}) and changes in hectares in both countries also potentially in the negative domain. Therefore, the utility function in split 2 includes attribute changes in both the negative and positive domain:

$$U_2 = \alpha_0 + \beta_1 HDK_{pos} + \beta_2 HDK_{neg} + \beta_3 HNL_{pos} + \beta_4 HNL_{neg} + \beta_5 IDK_{neg} + \beta_6 IDK_{pos} + e$$

The pairwise differences between WTP estimates derived from attribute coefficients in split 1 and 2 in the positive domain (that is β_1/β_3 of split 1 compared to β_1/β_5 of split 2), would thus be due to framing in the context of both potential gains and losses. A test of $\beta_1/\beta_5 < \beta_2/\beta_5$in split 2 could be interpreted as loss aversion in the outcome in Denmark, likewise for the outcome in NL. Loss aversion in money would be a test of $\beta_5 > \beta_6$ in split 2.

In split 3, changes in annual household income in the Netherlands in the negative domain were introduced to examine the effect of framing in a context of other people participating.

$$U_3 = \alpha_0 + \beta_1 HDK_{pos} + \beta_2 HNL_{pos} + \beta_3 IDK_{neg} + \beta_4 INL_{neg} + e$$

The pairwise differences between WTP estimates derived from attribute coefficients in split 1 and 3 would be due to framing in the context of other people participating. The same applied to the pairwise differences in WTP estimates between split 2 and 4. The coefficient INL_{neg} could indicate either behavior of conditional giving or free riding, or other reactions to the level of NL contributions indicated in the choice alternative.

The combined effects were examined in split 4 where changes in all main attributes could be in the positive or negative domain:

$$U_4 = \alpha_0 + \beta_1 HDK_{pos} + \beta_2 HDK_{neg} + \beta_3 HNL_{pos} + \beta_4 HNL_{neg} + \beta_5 IDK_{neg} + \beta_6 IDK_{pos} + \beta_7 INL_{neg} + \beta_8 INL_{pos} + e$$

The pairwise differences between WTP estimates derived from attribute coefficients in split 3 and 4 would be due to framing in the context of loss. The pairwise differences in WTP estimates derived from attribute coefficients between split 2 and 4 would be due to framing in the context of other people contributing. The difference between WTP derived from the coefficients in the positive vs negative domain of split 4 would be due to loss aversion in the outcome variable. As in split 2, loss aversion in money was tested with coefficients for the Danish income changes in split 4. As in split 3 the INL_{pos} and INL_{neg} coefficients could indicate either behavior of conditional giving or free riding or similar reactions.

4. Results

Though the polling agency pursued representativeness of the sample relative to the Danish population, measured on major demographics, it did not achieve this entirely. Gender and income matched the population fairly well, but average age of the samples (46 years for all splits) was higher than the population mean of 41, reflecting standard difficulties in obtaining responses from enough young and younger households. Our samples had higher average educational levels than the population in general. Only 6 or 7% of respondents stated primary education as their highest obtained education compared to 26% in the Danish population. Again, this in part reflected the absent responses from younger Danes undertaking e.g. secondary education, including skill-based and professional educations. People having secondary and vocational educational levels as their highest obtained matched fairly well the population, but typical for surveys like this between 53 and 59% of our respondent across the splits had a tertiary education compared to only 32% of the population. The implication of these imbalances was that while our results may give an indication about the likely behavior of Danes, the exact parameters and WTP measures may not be entirely representative for the population and extrapolations from the sample should be avoided see Table 2).

We ran a multinomial logit (MNL) model in R (Henningsen and Toomet, 2011; Train, 2003) as well as a mixed logit (MXL) for each of the four splits (Hensher and Greene, 2003). The estimates of the latter are presented in Table 3, while the MNL model is presented in Appendix

Table 2
Socio-demographic characteristics of the splits and the population of Denmark.

	Split 1	Split 2	Split 3	Split 4	Population of Denmark
Females, %	49	50	51	50	50
Age, years	46	46	46	46	41
Household income[a]	400,000–499,999 kr.	400,000–499,999 kr.	400,000–499,999 kr.	400,000–499,999 kr.	500,550 kr.
Education –tertiary, %	53	57	56	59	32
Education – secondary, %	11	13	14	14	12
Education –vocational, %	30	23	24	21	30
Education – primary, %	6	7	6	6	26
N	201	406	201	810	–

[a] Median household income stated by respondents and average family income before tax. Source: Statistics Denmark.

B.

We note that in all models, several parameters are significant and significant parameters have the expected sign. The price parameters for the Danish households (IDK_{neg} and IDK_{pos}) are both positive, which for a routine glance may appear at odds with expectations. However, it is not. It is a result of the model specification, where utility of income changes are potentially kinked linear function over the entire state space from −2000 to +2000 DKK/year. Thus, the parameter is to be multiplied with the income change, and in the negative domain, this result in a negative utility effect of parting with money. We also note considerable heterogeneity in the respondent population with respect to all random parameters of the model. We also note that R^2 vary somewhat with model complexity, and between 0.12 and 0.52, the latter being a fairly high value in a choice experiment context.

We calculated the WTP estimates for each attribute of the four splits (Table 4). As we in split 2 and 4 have an income change for our participants in both the positive and negative domain, we calculated the WTP using both coefficients.

For Split 1, the estimated mean WTP for an additional hectare of open land habitat in Denmark was 0.73 DKK per hectare.[1] The estimated mean WTP for an additional hectare of open land habitat in the Netherlands was 0.0074 DKK per hectare, however not significantly different from zero (Table 4). Thus, our participants valued additional hectares in Denmark, but in this split they were unaffected by changes in open land habitat area in the Netherlands. For Split 2, we found only significant coefficient estimates. In this split, participants had an average WTP for an additional hectare of open land habitat in Denmark of 1.06 DKK in the positive domain compared to 0.13 DKK per hectare in the negative domain. The estimates for increasing habitat or avoiding losses of habitat in NL are both positive and significantly larger than zero. For Split 3, we found significant and positive estimates of mean WTP for increasing habitat areas in both countries. We found a positive effect on the Danish samples mean WTP from Dutch reducing their contribution to the program, and vice versa. Finally, in Split 4 we found positive and significant mean WTP for increases or reduced losses of habitat in DK, as well as losses in the Netherlands, whereas the mean WTP for gains in the NL is again insignificant. Again the mean estimated WTP effect of the Dutch reducing their contributions is positive.

4.1. Testing hypotheses

We tested our framing hypotheses regarding differences in WTP estimates between splits with varying framings using the *Z*-test (Clogg et al., 1995). The IDK_{neg} estimate in each split was used for WTP estimation. For the hypotheses regarding loss aversion, we applied within-split evaluation. We calculated the pairwise differences in slope estimates between changes in the positive and negative domain for each main outcome and cost attribute within split 2 and within split 4 using the Delta method in R (Weisberg, 2014).

4.1.1. Framing in a context of loss

We tested the effect of framing in a context of loss as the differences between WTP estimates for additional hectares of habitat (HDK_{pos}) in Denmark and in the Netherlands between split 1 & 2 and between split 3 & 4. Recall, that the only treatment difference between these splits was the introduction of potential reductions in habitat area, but that both split 3 and 4 had the additional framing of Dutch potentially contributing to the conservation program. The tests are summarized for the null hypothesis of no difference in the second and third column of Table 5. Between the simpler split 1 and 2, we reject the null hypothesis, as the WTP estimate for gains in hectares in Denmark (HDK_{pos}) was significantly higher in split 2 (1.06 DKK per hectare) than in split 1 (0.73 DKK per hectare). Furthermore, HNL_{pos} in split 2 (0.35 DKK per hectare) was significantly higher than in split 1 (0.0074 DKK per hectare (itself insignificant)). Thus, in the context of only Danes contributing, the WTP for gains increased when framed in a context of potential losses. Between split 3 and 4, where the framing in both splits included potential Dutch contributions, the results are inconclusive. We cannot reject the null hypothesis, that there is no significant difference in WTP for gains in Denmark between splits 3 and 4. For gains in the Netherlands, the WTP estimates are lower in split 4 than in split 3, and thus the null hypothesis is rejected, but with the opposite conclusion: The WTP for gains in the Netherlands seem to decrease in the context of framing. Thus, framing in a context of loss affects WTP for gains only when Danes contribute on their own. In the context of potential Dutch contributions, the effect of framing in a context of loss appears inconclusive.

4.1.2. Framing in a context of other people contributing

We tested the effect of framing in a context of other people contributing to the provision of the good between split 1 & 3 and split 2 & 4, as the treatment differences between these splits was the potential for contributions from Dutch households being presented in the choice sets. Note that in the splits 2 & 4 also include the framing context of potential losses, but this is constant across splits. In column 4 and 5 of Table 5, we summarize the tests of the hypothesis of no effects on WTP of framing in a context of other contributing. We see that for the simpler splits 1 & 3, we reject the null hypothesis. The difference in mean WTP estimates for increased habitats in Denmark, HDK_{pos}, between split 1 & 3 of 0.73 and 1.68 DKK per hectare (see Table 4) was significant. Likewise, we rejected the null hypothesis for the mean WTP for increased habitats in the Netherlands. In the more complicated splits 2 and 4 we reject the null hypothesis for three out of four mean WTP estimates, namely WTP for increased hectares in Denmark and for reduced losses of hectares in Denmark and the Netherlands. We note that the significance levels are quite high, implying clear and rather robust conclusions. We thus found positive effects of framing in a context of other people contributing for average WTP for gains in habitat area in own country, and in several cases the WTP for another hectare of habitat increases by several

[1] Note that the attribute varied between 0 and 1000 ha, and thus the mean WTP for 1000 ha would be 730 DKK. This size corresponds well with the ranges found for nature and biodiversity conservation in earlier studies (Dallimer et al., 2014; Bakhtiari et al., 2018).

Table 3
Mixed logit results for split 1 through 4; coefficient estimates and their corresponding standard deviations are presented with SE in brackets and N is the number of participants.

Coefficient	Unit	Split 1	Split 2	Split 3	Split 4
Constant	–	−2.83e–01	8.71e–02	2.42e+00***	6.05e–01***
		(1.9e–01)	(1.8e–01)	(1.07e–01)	(1.29e–01)
HDK_{pos}	Hectare	2.01e–03***	6.67e–03***	3.54e–02***	1.52e–03***
		(2.10e–04)	(2.26e–04)	(3.39e–04)	(1.38e–04)
HDK_{neg}	Hectare	–	8.42e–04**	–	2.95e–03***
			(2.91e–04)		(1.98e–04)
HNL_{pos}	Hectare	2.01e–05	2.18e–03***	2.17e–02***	1.77e–04
		(2.36e–04)	(2.64e–04)	(2.44e–04)	(1.33e–04)
HNL_{neg}	Hectare	–	2.71e–03***	–	2.09e–03***
			(1.87e–04)		(1.96e–04)
INL_{neg}	DKK	–	–	1.38e–02***	4.37e–04***
				(2.20e–04)	(7.59e–05)
INL_{pos}	DKK	–	–	–	1.43e–04.
					(7.82e–05)
IDK_{neg}	DKK	2.73e–03***	6.30e–03***	2.11e–02***	9.51e–04***
		(1.68e–04)	(1.25e–04)	(1.50e–04)	(7.61e–05)
IDK_{pos}	DKK	–	8.75e–04***	–	5.33e–04***
			(1.35e–04)		(7.39e–05)
$sd.HDK_{pos}$	Hectare	4.13e–03***	2.07e–02***	1.00e–01***	2.43e–03***
		(3.23e–04)	(4.57e–04)	(1.31e–04)	(1.99e–04)
$sd.HDK_{neg}$	Hectare	–	1.68e–02***	–	3.16e–03***
			(6.58e–04)		(1.69e–04)
$sd.HNL_{pos}$	Hectare	3.23e–03***	1.46e–02***	9.77e–02***	1.16e–03***
		(2.70e–04)	(5.71e–04)	(1.69e–04)	(1.64e–04)
$sd.HNL_{neg}$	Hectare	–	2.66e–02***	–	2.33e–03***
			(6.56e–04)		(1.74e–04)
$sd.INL_{neg}$	DKK	–	–	9.97e–02***	6.90e–04***
				(6.46e–05)	(1.14e–04)
$sd.INL_{pos}$	DKK	–	–	–	4.84e–04***
					(1.41e–04)
Log-likelihood	–	−1056.7	−3217.3	−2536.5	−4225.5
McFadden R^2	–	0.33914	0.11669	0.51774	0.20408
N	–	201	406	201	810

Significance codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1.

Table 4
WTP estimates from the mixed logit model for Split 1 through 4 with SE in brackets. For Split 2 and 4 the WTP estimate using the estimate for the change in annual household income in the positive domain is also presented. Significance codes: '***' 0.001, '**', 0.01 '*', 0.05 and '.' 0.1.

	Unit	Split 1	Split 2 ($_{neg}$)	Split 2 ($_{pos}$)	Split 3	Split 4 ($_{neg}$)	Split 4 ($_{pos}$)
HDK_{pos}	DKK/ha	0.73***	1.06***	7.62***	1.68***	1.60***	2.86***
		(0.082)	(0.034)	(1.05)	(0.012)	(0.16)	(0.39)
HDK_{neg}	DKK/ha	–	0.13***	0.96***	–	3.11***	5.54***
			(0.045)	(0.36)		(0.31)	(0.83)
HNL_{pos}	DKK/ha	0.0074	0.35***	2.49***	1.03***	0.19	0.33
		(0.087)	(0.041)	(0.47)	(0.008)	(0.14)	(0.26)
HNL_{neg}	DKK/ha	–	0.43***	3.10***	–	2.21***	3.94***
			(0.028)	(0.45)		(0.23)	(0.57)
INL_{neg}	DKK/DKK	–	–	–	0.66***	0.46***	0.82***
					(0.0078)	(0.071)	(0.13)
INL_{pos}	DKK/DKK	–	–	–	–	0.15***	0.27*
						(0.084)	(0.15)

factors.

4.1.3. Loss aversion in environmental outcome and money

We tested the hypotheses of loss aversion in outcome variables and in income using within-model tests of equality of parameters in the negative and positive domain of each variable, where a rejection of the H0 of no difference with a positive sign suggests loss aversion. Results are mixed regarding outcome variables. A summary of the results are shown in Table 6. In split 2, the difference between HDK_{neg} and HDK_{pos} is negative and significant, thus in the opposite direction of what loss aversion would imply. For the Dutch hectare outcomes in split 2, the difference is positive and insignificant. Only in the more complete split 4 model where Dutch outcomes are also balanced by Dutch contributions do we see significant and positive differences between the WTP of HNL_{neg} and HNL_{pos}. Thus, overall the results for loss aversion in outcomes is somewhat mixed.

Regarding loss aversion in income, results are more consistent. In both split 2 and split 4, we found the marginal utility of income parameters significantly larger in absolute terms in the negative domain, than in the positive – suggesting a larger utility loss from parting with an amount of money than receiving it. Thus, in the mixed logit model, we found evidence suggesting loss aversion in income in both splits.

4.1.4. Responding to Dutch contributions

Behavior related to the Dutch contributions in split 3 and in 4 was evaluated using the WTP estimates from Table 4 regarding changes in Dutch income (INL_{neg} and INL_{pos}). In split 3, the WTP estimate for an increase in INL_{neg} was 0.66 DKK per DKK. As the estimate was for a

Table 5
Testing the hypotheses related to framing in the context of loss, and the context of other people contributing. T-values of z-test results between splits of the mixed logit model. For splits 2 and 4 the WTP used is calculated using parameter estimates from the negative domain of IDK, see Tables 4 and 5.

	Testing H0: framing in loss context does not affect WTP for hectare gains ($_{pos}$)		Testing H0: framing in the context of other people contributing does not affect WTP for hectare gains ($_{pos}$) or avoiding hectare loss ($_{neg}$)	
	1 vs 2	3 vs 4	1 vs 3	2 vs 4
HDK_{pos}	3.80	0.50	11.74	3.30
HDK_{neg}	–	–	–	9.51
HNL_{pos}	3.56	–5.99	11.70	–1.10
HNL_{neg}	–	–	–	7.68

Table 6
Testing the hypotheses related to loss aversion in environmental outcome and money. T-values of *t*-test results within splits 2 and 4 of the mixed logit model. For both splits the WTP is calculated using parameter estimates from the negative domain of Table 4.

	Split 2	Split 4
HDK_{pos} vs. HDK_{neg}	–16.49	4.33
HNL_{pos} vs. HNL_{neg}	1.61	7.50
IDK_{pos} vs. IDK_{neg}	30.24	3.51

variable in the negative domain the interpretation is that our respondents would pay more the less the Dutch contribute. The other way around, the more the Dutch contribute the less our participants felt obliged to pay. We found the same behavior in split 4 with an INL_{neg} estimate of 0.46 DKK per DKK. Interestingly, our participants in split 4 stated a lower willingness to pay of only 0.15 DKK more for conservation efforts, for every DKK the Dutch received in the positive domain (INL_{pos}).

4.2. The robustness of results

As noted earlier we also ran simple MNL models of all splits and evaluated our hypotheses in these models. We found that results largely remain the same, though inference strength varies a bit across hypotheses. The main models and tests are presented in Appendix B. We found that the MNL results suggested a slightly stronger confirmation of the effect of framing in a context of loss on the WTP for gains, than we do in the mixed logit results above. Turning to effect of framing in a context of others contributing, the results are weaker, possibly a result of the larger unexplained variance in these larger models and hence weaker inference. Regarding loss aversion the two models are quite unison in that evidence for loss aversion in outcome is mixed whereas loss aversion in income seems pervasive.

We are not concerned with possible systematic components of preference heterogeneity in the population in this paper. However, we did evaluate the robustness of parameters in the base MNL model using sociodemographic variables interacted with the ASC. We found that the parameters of outcome and significance variables was largely unaffected by the inclusion of such variables to explain ASC (status quo) preference. As a curiosity, we found in most models that being male and older tended to imply higher preference for the ASC (status quo), whereas knowing more about birds tended to imply lower preference for status quo.

5. Concluding discussion

We should start by pointing out that our results showed that in prioritizing between benefits and costs across own and a foreign country our Danish participants were affected foremost by positive changes in own country. In all splits, WTP estimates were higher for gains in habitat area in respondents' own country compared to changes in the foreign country included. These findings are completely in line with existing literature (Hoyos et al., 2009; Ressurreição et al., 2012; Dallimer et al., 2014; Bakhtiari et al., 2018), and thus suggest we tap into the same underlying preference structures.

5.1. Discussion of hypotheses test results

Our first hypothesis concerned the effect of framing outcomes in a context where both gains and losses were presented as possible relative to a context where only gains were presented as outcomes. Evaluating our hypothesis, we find that the WTP for gains in open land habitats at home increases consistently, with a factor of up to two, when framed in context of loss, and only Danes contributing. This is consistent across MNL and mixed logit models. The effect on WTP for gains abroad, here the Netherlands, was also positive. This was in line with earlier findings in other branches of the literature (Munro and Hanley, 2002; Kragt and Bennett, 2012. We note that when evaluating this hypothesis in context where also Dutch contributions appeared (testing between splits 3 and 4), the results are more mixed, in particular with respect to hectare gains in the Netherlands. This suggests a counteracting of the additional framing.

Our finding, nevertheless, may be of importance for economic valuation studies of nature conservation. They suggest that when outcomes in the negative domain are in reality also possible, it may be advisable to allow for this outcome in the design of valuation surveys. In particular, it raises the question if it is valid to assess welfare cost of reductions in the area of protected habitats using WTP results extracted from studies addressing enhanced conservation.

Turning to our second hypothesis, we found that framing in a context of other people, here households in the Netherlands, contributing to the overall conservation effort had a significant positive effect on WTP for increased habitat in own country, in both MNL and Mixed logit models. This indicates that involving other countries in transnational conservation schemes likely increase the support for actions at home positively. Addressing regional conservation challenges in plenum, as indeed done e.g. in the EU, could thus increase the overall funding acquired. Transnational conservation planning compared to single state efforts would thus not only be cost-efficient (Kark et al., 2009; Moilanen and Arponen, 2011); but could even have a double positive effect if national support grows. The effects on the WTP for habitat conservation abroad were less convincing, but when significant it was positive.

Evidence for our hypothesis, that respondents may exhibit loss aversion in the outcome variables, was mixed, both within and across the two different model specifications. Specifically, evidence of loss aversion was found strongest when Danes related to the NL outcome variables, where their WTP for losses where always higher than for gains, and in most cases significantly so. The results for the outcome variables in the Danish open land habitats were more mixed with a few combinations of splits and models showing results in line with loss aversion, and others the opposite. Rose and Masiero (2010) found loss aversion to be present in WTP/WTA space, and found that symmetric specifications of model fits were preferred to the reference point dependent specifications. Opposite findings, however, also exists in the still rather limited literature on the subject (Train and Weeks, 2005; Hensher and Greene, 2009; Hess et al., 2008). Thus, our results add to the mixed picture found in the literature and leave for further studies to examine what drives this variance in results.

We found loss aversion in money in several of our splits and across both MNL and mixed logit models as also found in earlier studies (e.g. Bateman et al., 2005; Bartczak et al., 2017). It remains an uncomfortable phenomenon for economic analyses including environmental valuation studies, where the analysts assumes marginal utility of

income is assumed constant across the relevant interval of any analysis. Some studies (such as Aravena et al., 2014), however, did not find loss aversion in money. It remains an open question how such loss aversion, if consistent or widespread, should be addressed both in research and policy advice. Taken at face value the results, however, will likely induce significantly more loss aversion effects into policy evaluation and advice. For example, we may imagine that reduced payments, e.g. reduced income taxes resulting from reduced efforts in environmental policies is likely linked to a reduction, a loss, of environmental quality. Our utility models suggest that reductions in environmental quality have a negative utility impact – often larger than for a similar sized increase. At the same time, the monetary gain from reduced taxes comes at a lower marginal utility of (gains in) income, than a corresponding payment (loss). The results is a substantially higher WTP for avoiding a reduction in spite of receiving a positive effect on income, compared with the case where environmental quality is increased (at a positive, but lower utility effect) and a payment asked for (with a higher marginal utility of income).

As already discussed, the framing effect of informing respondents about other nations contributing to the overall conservation effort was generally to increase WTP for outcome variables. This finding in itself suggested that free riding was not overall an issue resulting from such framing. The direct effect of the actual contribution made was significant in several models, but not all. The finding was that the more the Dutch contributed the less our participants were willing to pay. We can only speculate as to the reasons for the pattern we see here. While not a perfect example of it this observation in isolation could indicate a tendency to overall free ride when Dutch contributions were high (Isaac and Walker, 1988). However, the reverse side of that behavior is that when the Dutch contributed less, and perhaps even received tax deductions, our respondents were generally willing to pay more for the conservation efforts. This behavior is somewhat opposite to the established behavior of conditional giving (Croson and Shang, 2008), and may reflect a form of responsibility towards the conservation case.

5.2. Caveats

We drew our respondents from the Danish population, and while the sample represented the population fairly well in some aspects, they had a relatively higher educational level and were older. The implication of these imbalances is that while our results may give an indication about the likely behavior of Danes, the exact parameters and WTP measures may not be entirely representative for the population and extrapolations from the sample should be avoided (Buchan et al., 2011). More generally, we have investigated our hypotheses in one nation, and nation may matter with respect to the main novelty: What you contribute when others contribute too. Danes have previously been found to exhibit a significantly more cooperative and trusting nature than other nations (Engelmann and Normann, 2010; Abatayo and Thorsen, 2017). Thus, the tendency to give more to a common public good in response to others giving less may not be something that can be extrapolated to say other European nations.

As a research instrument, the choice experiment has a number of methodological limitations such as the cognitive burden of dealing with changes in multiple attributes. Another is the sensitivity of welfare estimates to the study design. Our split-sample design implies that respondents did not all face the same level of cognitive challenge, which must be noted, but cannot be controlled for. A major novelty in our study is introducing the split between the negative and positive domain of outcome and cost variables. An implication of the split design and the domain split is that of course each split has its own optimized experimental design. A worry could be that experimental design affect results themselves across splits. However, both *ex ante* and *ex post* measures of the experimental design efficiency suggest that this is not an issue.

Some critics argue that the hypothetical nature of the choice experiment setting obscure the results (Rakotonarivo et al., 2016). However, these limitations hold for all stated preferences techniques. The choice experiment is particularly and better suited to dealing with trade-offs between multiple attributes than for example contingent valuation approaches and is more informative as respondents in effect answer more choice sets (Hanley et al., 2001).

Specifically for the evaluation of loss aversion, we note that all loss aversion is measured relative to a concept of reference point. In our experiment, the reference point in all splits includes the core status quo of no additional habitat areas in neither countries, and no additional Danish contributions. However, as we introduce new variables in each split, visible in the choice sets and the accompanying framing, it may be that respondents in different splits perceive reference points of different dimensions. However, the tests of loss aversions are all within-split tests, and hence reflect the same perception of the reference point. The framing tests are influenced by such variations, but this is exactly the point of the framings.

Our study involved a 2×2 experimental treatment design, aiming to address several complicated questions. While our findings add new insights into these questions, and fairly firm such insights on e.g. the framing questions, it is also clear that the mixed results on e.g. loss aversion calls for further research. Our mixed results here contribute to a pool of existing mixed results studies on loss aversion in income, and does so in a rigidly setup environmental valuation study. What remains open for further research and debate is how this phenomenon should be handled, both in research and in policy analysis.

5.3. Policy implications

This study offers insights into how a sample of Danish respondents are willing to prioritize in the distribution of costs and conservation benefits across own and a foreign country and indicates to what extent Danes are willing to contribute to joint conservation efforts with other countries. This could be both in an EU setting as well as bilateral and multilateral programs with other countries, also outside the EU. Further studies are required to examine the prevalence of similar behavior in other countries in the EU and beyond in order to fully understand the intertwined mechanisms of transnational cooperation in conservation. This would be valuable in the design and management of e.g. future EU Life program budgets, how the funds would be distributed across Europe and the communication about it as well as for international NGO's implementing conservation programs aimed at migratory species. Our study confirms that the public generally prefer conservation to happen in their own country rather than abroad. Our results suggest that WTP for improving environmental outcomes may be sensitive to awareness of possible losses from policy change as well as knowledge of other nations contributing in the case of international public goods. Thus, environmental valuation and policy evaluation of such cases should account for this.

Instructions for the choice experiment (Appendix A) are available online as are the results and WTP estimates of our MNL model (Appendix B). The authors are solely responsible for the content and functionality of these materials. Direct any queries (other than absence of the material) to the corresponding author. Supplementary data to this article can be found online at doi:https://doi.org/10.1016/j.ecolecon.2019.04.026.

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