





# Attitudinal drivers of home bias in public preferences for transboundary nature protected areas

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## Highlights

- Hybrid choice model showed home bias attitudinal determinants in public preferences.
- A harder border regime increases home bias in transboundary nature protection.
- Foreign part visiting expectations mitigate home bias in binational good provision.
- Support of international justice and altruism are home bias attitudinal mitigators.

## Abstract

We assess what drives the lower valuation of nature protection on the other side of the border in two European transboundary nature areas, the Białowieża Forest (Poland and Belarus), and Fulufjället (Norway and Sweden). Applying hybrid choice modelling, we account for people's attitudes when eliciting their preferences for extensions of transboundary nature protected areas. We examine the impact of attitudes on a so-called 'home bias' effect appearing in public preferences stated towards transboundary nature protected areas; that is the inclination towards preferring the domestic part. We find that concerning the intention of visiting the foreign part of the transboundary area, the appreciation of transboundary justice and altruism are the main systematic mitigators of home bias. Suspicious attitude towards the neighbouring country, the anticipation of unilateral foreign provision, and the manifestations of 'patriotism' apply as home bias drivers only to a limited degree. Facilitating visits to the foreign part by enhancing cross-border access can be expected to shift peoples' preferences towards transboundary co-operation.

## Keywords

Home bias; Transboundary nature protected areas; International public goods; Public preferences; Willingness to pay; Discrete choice experiment; Hybrid choice modelling

## Abbreviations

TNPA, Transboundary nature protected area; IPG, International public goods; WTP, Willingness to pay; DCE, Discrete choice experiment; MIMIC, Multiple indicators and multiple causes; MXL, Mixed logit model; HMXL, Hybrid mixed logit model; MNL, Multinomial logit model; CAPI, Computer-assisted personal interview; CAWI, Computer-assisted web interview

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## 1. Introduction

Conserving remaining intact ecosystems and their natural heritage is part of the European Commission's new bioeconomy and forest strategies, part of the [Paris Agreement](#) and the UN [Sustainable Development Goals](#), as well as, the proposed nature restoration law. Maintaining functional habitat networks as green infrastructure relies in particular on having sufficiently large protected areas as core areas. A considerable part of the remaining high conservation value nature areas in many regions of the world are located between two or more jurisdictions within border areas, which are economically peripheral, and thus less intensively managed, less fragmented, or less disturbed ([Angelstam et al., 2004](#), [Angelstam et al., 2017](#); [Pieck and Havlick, 2019](#); [Liu et al., 2020](#)). Given that national strictly protected areas in Europe are few, small and scattered ([Parviainen et al., 2000](#)), [transboundary cooperation](#) has, therefore, been considered a necessity ([European Commission, 2013](#)). A transboundary nature-protected area (TNPA) is “an area of land and/or sea that straddles one or more boundaries between states...beyond the limits of national sovereignty or jurisdiction...dedicated to the protection and maintenance of biological diversity” ([Sandwith et al., 2001](#), p.3).

Many TNPAs have been established, based on purely ecological reasoning for biodiversity conservation (e.g. [Oksanen, 1997](#)), but also based on reasons such as promoting sustainable regional and rural development and tourism ([Hanks, 2003](#)). However, TNPAs create particular challenges in cross-border co-operation to ensure their maintenance ([Sandwith et al., 2001](#); [Lanfer et al., 2003](#); [Vasiljević and Pezold, 2011](#)). Global surveys of TNPA management units ([Zbicz, 2003](#); [McCallum et al., 2015](#)) have indicated that in a high proportion of the TNPAs, cross-border cooperation is limited or virtually non-existent. Although this tendency might well have economic explanation in the context of international public goods (IPG) provision, to date, TNPAs have rather seldom been addressed by the economic literature explicitly (but see, e.g., [Busch, 2008](#), [Schwartz et al., 2022](#)).

Therefore, in order to examine empirically the extent to which TNPAs are IPG ([Ferroni and Mody, 2002](#); [Ferroni, 2002](#); [Morrissey et al., 2002](#)), [Valasiuk et al., 2017](#), [Valasiuk et al., 2018](#) compared the citizens' economic valuation of extended protection of two binational TNPAs situated on the EU outer borders: namely the Białowieża Forest on the Polish-Belarusian border ([Blicharska et al., 2020](#)), and the Fulufjället National Park on the Swedish-Norwegian border ([Garms et al., 2017](#)). Assuming that TNPAs as IPG must be abiding the summation [technology](#) of supply aggregation ([Sandler and Sargent, 1995](#); [Sandler, 1998](#)), in the case of pure IPG the citizens should be indifferent between expansion in their own country vs. in the neighbouring country ([Levaggi, 2010](#)). Hence, their willingness to pay (WTP) for protecting a spatial unit of the ecosystem across the border should be equal to the WTP for protecting a similar area in the home country. Instead, for the Białowieża Forest ([Valasiuk et al., 2017](#)) as well as for Fulufjället National Park ([Valasiuk et al., 2018](#)) a significant home bias was found i.e. citizens stated on average higher WTP for extended area protection in their home country rather than in the neighbouring country, rendering neither of the two TNPAs under consideration a pure IPG.

Home bias as agents' tendency to *ceteris paribus* buy or invest inside (rather than outside) their home constituencies<sup>1</sup> is scrutinised in trade (e.g. [Helliwell, 1995](#), [Helliwell, 1998](#); [Wolf, 2000](#)) and financial (e.g., [Feldstein and Horioka, 1980](#); [Hnatkovska, 2010](#)) literature, however, the home bias phenomenon might also be relevant for public goods' provision (see, e.g., [Ogura, 2006](#)). Obvious candidates for home bias drivers in marketed goods' allocation are frictions in relevant markets imposing higher transaction costs, such as formal and informal trade barriers, tax competition, institutional, cultural or language differences ([Wolf, 2000](#)). Thus, 'bias' in this sense, might be thought of as (rational) inclination towards preferring the domestic, rather than an 'error', even though the goods or services considered do not differ in their measurable qualities as such. However, the bias towards the domestic is particularly relevant to assess for TNPAs, as a considerable part of welfare generated by TNPAs arise from their existence value ([Krutilla, 1967](#)), i.e. the value derived from mere knowledge that the good exists. If utility from TNPA creation, or extension (or prevented loss), to some extent is derived independently from visits/usage, then one could hypothesise

that the home bias would be minor, a predominant part of the values could be intrinsic values which are less subjected to 'market frictions'. For the protection and economic valuation of our common preserved nature, it is relevant to assess what drives home bias in the case of TNPA.

The aim of this study is to explore potential attitudinal determinants of home bias in preferences stated towards IPG (expressed as difference in WTP for spatial protection in the home country versus in the neighbouring country) suggesting that TNPAs are not pure international public goods. Building on previously unused survey data, we analyse and compare the impact of attitudes as potential drivers (or mitigators) of home bias in the two different binational cases: Białowieża Forest ([Valasiuk et al., 2017](#)) and Fulufjället National Park ([Valasiuk et al., 2018](#)). In the surveys across both cases, after the main Discrete Choice Experiment (DCE), the respondents were asked to express their attitudes towards various statements, potentially underlying the home bias (or the lack thereof) in preferences. As all surveys had similar attitudinal questions, they provide together a rich material for the assessment of the attitudinal impacts on home bias in the comparative setting. The statements that the respondents considered addressed the issues of distributional justice in financing of bilateral IPG provision, the trust in the neighbour country's institutions, the anticipation of IPG unilateral foreign provision, the intended visits to the national or foreign part of the TNPA, and the patriotic considerations (see a comprehensive review of the attitudinal questions in the Methodology section). Such responses yield measurements of latent attitudinal variables ([Jöreskog and Goldberger, 1975](#)). Our analysis of latent drivers of the home bias is based on a hybrid choice modelling approach, which enables simultaneous estimation of a DCE component and a latent variable component (see, e.g., [Hess and Beharry-Borg, 2012](#)).

## 2. Materials and methods

### 2.1. Two transboundary case studies in four countries

#### 2.1.1. Białowieża case area

The transboundary Białowieża Forest is shared by Poland and Belarus ([Agrawal, 2000](#)). It is considered one of the last intact lowland temperate forests in Europe ([Blavascunas, 2014](#)), and is one of the best known nature protected areas in Europe ([Blicharska et al., 2020](#)). The reason is that the area has retained a natural composition, structure and function of its forest ecosystems. Since 1946 the Białowieża Forest has been divided by a new state border into the Polish (about one third) and the Belarusian (the remaining two thirds) segments. Due to the hard border/visa regulations and divisive fencing constructed in 1980s,<sup>2</sup> the two adjacent National Park areas constitute two physically separated natural sites with a limited possibility of crossing the state border by visitors.<sup>3</sup>

In the Polish part, a total ban on human interference with the natural ecosystems and processes applies to the Białowieża National Park and twenty-four scattered nature reserves, amounting to 225km<sup>2</sup> or approximately 35% of total forest area. In the Belarusian part a passive protection regime applies to the strict conservation core zone of the National Park and makes up a total of 570km<sup>2</sup> or about 37% of the Belarusian segment. In both countries, forests outside the strict reserve zones of the protected areas are subject to active management including wood harvest and salvage logging (e.g. [Lethier, 2017](#); [Mikusiński et al., 2018](#)). Both a strengthened transboundary regulation and an increase of the strictly protected area have been proposed for the Białowieża Forest as a result of the latest UNESCO World Heritage monitoring mission ([Lethier and Avramoski, 2016](#); [Debonnet and Ossola, 2018](#)).

#### 2.1.2. Fulufjället case area

The transboundary Fulufjället is a mountain area situated to the south and east of the Scandinavian mountain range (the Scandes). A relatively large bare rock area, above ca. 900m, is surrounded by forest areas at the lower altitudes; near-natural boreal forests that are important habitats for rare species ([Angelstam and Manton, 2021](#)). The Swedish Fulufjället National Park (385km<sup>2</sup>) was established in 2002 ([Dalarna, 2011](#)), inspiring the creation of the adjacent smaller national park on the Norwegian side (86km<sup>2</sup>), some ten years later ([Norwegian Environment Agency, 2014](#)). The Swedish protection is based on a zoning system: a wilderness zone; a low-intensity activity zone; a high-intensity activity zone; and a development zone with infrastructure and visitor facilities. The Norwegian protection system lacks zoning; it resembles more the Swedish low-intensity activity zone. Logging is banned in the whole TNPA, but single trees can be cut along trails, for access and safety. Some of the forest areas outside Fulufjället TNPA are managed intensively for wood production; but a few forest areas adjacent to the TNPA, in both countries, could be considered as candidates for park extension and landscape restoration. Unlike the Białowieża case, there is no border fence and visitors can hike freely across the border to the neighbouring country's side.

### 2.2. Survey questionnaire and experimental design

Our study uses the stated preference studies concerning Białowieża from [Valasiuk et al. \(2017\)](#) and Fulufjället from [Valasiuk et al. \(2018\)](#), and combines their discrete choice data with previously unpublished attitudinal questions aimed at measuring home bias drivers. Both questionnaires consisted of five parts: (1) introductory questions about respondents' past visitation to forests, the functions of natural and wood-production forests, and a description of the TNPA, including whether or not respondents had visited the case area; (2) scenarios about the TNPAs, extending the national parks and the natural forest areas, and the specified protection attributes (sizes of new natural forest area on domestic and foreign part of border) and costs for the citizens; (3) the DCE, choices of park extension alternatives, including a status quo

(SQ) alternative (Table 1, Fig. 1); (4) a debriefing block of attitudinal questions; and (5) questions about respondents' socioeconomic characteristics. The two questionnaires were initially developed in English, translated into the four local languages by professional translators, and then proof-read by environmental economists fluent in both languages in the dyad for correctness and consistency. The English originals of the two questionnaires are included in the Supplementary material.

Table 1. Programme attributes and their levels.

Programme attribute	Levels in the Fulufjället survey		Levels in the Białowieża survey	
Passive protection extension on the domestic side	+0 sq.km		+0 sq.km	
	+20 sq.km		+35 sq.km	
	+40 sq.km		+70 sq.km	
	+60 sq.km		+105 sq.km	
	SQ=+0		SQ=+0	
Passive protection extension on the foreign side	+0 sq.km		+0 sq.km	
	+20 sq.km		+35 sq.km	
	+40 sq.km		+70 sq.km	
	+60 sq.km		+105 sq.km	
	SQ=+0		SQ=+0	
Additional amount of income tax, which you would have to pay annually during five years	Norway	Sweden	Poland	Belarus
	125 NOK	100 SEK	25 PLN	3 USD [5 USD]
	250 NOK	200 SEK	50 PLN	6 USD [10 USD]
	375 NOK	300 SEK	75 PLN	9 USD [15 USD]
	500 NOK	400 SEK	100 PLN	12 USD [20 USD]
	SQ=0	SQ=0	SQ=0	SQ=0

Note: SQ refers to “status quo”. NOK is Norwegian kroner, SEK is Swedish kronor, PLN is Polish złoty, and USD is US dollars. Monetary levels in square brackets in the Belarusian study were used in the pilot survey. For Belarus, accounting for a higher volatility of the then national currency BYR, the bids were instead denominated in USD, a currency being routinely used by the country's residents for transactions and saving purposes.

Variants comparison 1	Status quo	Variant 1	Variant 2	Variant 3
Additional area in the Polish part of the Białowieża Forest covered by passive protection regime  (Total proportion of passive protection zone in the Polish part of the Białowieża Forest)	<b>+ 0 km<sup>2</sup></b>  (35%)	<b>+ 105 km<sup>2</sup></b>  (51%)	<b>+ 70 km<sup>2</sup></b>  (46%)	<b>+ 0 km<sup>2</sup></b>  (35%)
Additional area in the Belarusian part of the Białowieża Forest covered by passive protection regime  (Total proportion of passive protection zone in the Belarusian part of the Białowieża Forest)	<b>+ 0 km<sup>2</sup></b>  (37%)	<b>+ 105 km<sup>2</sup></b>  (44%)	<b>+ 0 km<sup>2</sup></b>  (37%)	<b>+ 35 km<sup>2</sup></b>  (40%)
Additional sum of taxes, imposed on your income annually during the five next years	<b>None</b>	<b>100 PLN</b>	<b>50 PLN</b>	<b>75 PLN</b>
Please, pick your best variant	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

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Fig. 1. Example of the choice card from the Polish Białowieża questionnaire.

Respondents were asked questions regarding their preferences with respect to improved conservation of the ecosystem protected by the two spatially adjacent National Parks: one located in their country and the other one located in the neighbouring country. In each case, choice problems were phrased as a trade-off between higher taxes and number of square kilometres put under protection.<sup>4</sup> The protection could be accomplished by expanding the domestic park (implying higher taxes) and/or by expanding the neighbouring park (implying higher taxes and international money transfers via devoted bilateral fund).<sup>5</sup>

It was communicated to the respondents that all the forest areas considered at either side of the border had the same protection potential in terms of providing natural forest habitat for rare and endangered species in the long term. Hence, any square kilometre, contemplated for additional protection was presented as identical for conservation purposes, supposedly diminishing biologically-founded reasons for systematically picking additional areas for conservation on one or the other side of the border. Changes in spatial extension attributes were provided in both absolute and relative terms (Fig. 1).

The payment vehicle was designed as a compulsory tax paid by each tax-payer in both countries, similarly for both dyads, during a five-year period to a specific bilateral fund. The fund was described as established exclusively in order to finance the common programme of spatial extension of the national park regime regardless of the particular side of the state border. It was stated that financial means were necessary for the implementation of the new Białowieża and Fulufjället protection programmes, including payments to compensate the current owners of the new protected areas.

### 2.3. Attitudinal questions

The debriefing block of attitudinal questions followed the DCE part of the questionnaire asking respondents to tick a number from 1 to 5, which indicated level of disagreement or agreement. The exhaustive list of attitudinal questions is available in the survey questionnaires in the Supplementary material. In this study, to address the potential attitudinal determinants of home bias, a selection of questions (presented in Table 2) was used building on the literature, as explained below.

Table 2. Attitudinal statements addressed in the subsequent analysis.

Attitudinal statements		A priori expectations for home bias
Białowieża (Poland/Belarus)	Fulufjället (Norway/Sweden)	
Use value expectations		
<i>I expect to visit the Polish side of the Białowieża Forest in the next 5 years</i>	<i>I expect to visit the Norwegian side of Fulufjället in the next five years</i>	Driver, for Poles/ Norwegians Mitigator, for Belarusians/ Swedes
<i>I expect to visit the Belarusian side of the Białowieża Forest in the next 5 years</i>	<i>I expect to visit the Swedish side of Fulufjället in the next five years</i>	Driver, for Belarusians/ Swedes Mitigator, for Poles/ Norwegians
Inter-country size disparities		
<i>I believe that the participation of Poland in the programme funding should be higher than the participation of Belarus because the Polish population is greater than the Belarusian population</i>	<i>I believe that the participation of Sweden in the programme funding should be higher than the participation of Norway because the Swedish population is greater than the Norwegian population</i>	Mixed
<i>I believe that participation of Poland in the funding of passive protection extension programme should be higher than the participation of Belarus because Poles are wealthier</i>	<i>I believe that the participation of Norway in the programme funding should be higher than the participation of Sweden because Norwegians are wealthier</i>	Mixed
Suspicious towards the foreign party		
<i>I am afraid that the money spent on the protection on the Belarusian/Polish side* of the Białowieża Forest could be embezzled (stolen)</i>	<i>I am afraid that money spent on the protection on the Swedish/Norwegian side* of Fulufjället could be misused</i>	Driver
<i>I expect that Poland/Belarus** will comply with the international agreement to a larger extent than Belarus/Poland*</i>	<i>I expect Norway/Sweden** to comply with the international agreement to a larger extent than Sweden/Norway*</i>	Driver



Attitudinal statements		A priori expectations for home bias
Białowieża (Poland/Belarus)	Fulufjället (Norway/Sweden)	
Anticipation of unilateral foreign provision		
<i>I expect that Belarus/Poland* will extend the passive protection zone of the Białowieża Forest on its side of the border whether or not the bilateral programme discussed in the questionnaire is implemented</i>	<i>I expect Sweden/Norway* to extend the National Park of Fulufjället on its side of the border whether or not the bilateral programme discussed in the questionnaire is implemented</i>	Driver
'Patriotic' considerations		
<i>I prefer to pay more for passive protection of the Polish/Belarusian side** of the Białowieża Forest because it belongs to Poland/Belarus**</i>	<i>I prefer better to protect the Norwegian/Swedish side** of Fulufjället because it belongs to Norway/Sweden**</i>	Driver
* Specified side is a foreign side for the respondent.		
** Specified side is a domestic side for the respondent.		

### 2.3.1. Use value expectations

Assumed predominance of the non-use value component should by default make respondents more indifferent between any additional spatial unit of the TNPA to be designated domestically or abroad. At the same time, presence of use value typically increases stated WTP for spatial protection of biodiversity (Richardson and Loomis, 2009, Czajkowski et al., 2014, Brahic and Rambonilaza, 2014). Hence, visiting (i.e., use value) expectations might shift respondent's preferences in favour of the part which she expects to visit and enjoy directly. Correspondingly, respondent's expectation to visit a domestic segment of TNPA is an expected driver of home bias in her stated preferences, whereas her expectation to visit a foreign segment is an expected mitigator thereof. Moreover, given the substantially stricter border regime in the Białowieża case, the impact of visiting expectations might be stronger there compared to the Fulufjället case.

### 2.3.2. Inter-country economic size disparities

Taken at face value, an idea that a more populous and/or more wealthy country should contribute more to a binational public good's provision seems consistent with a common sense notion of international justice and implying a tendency to maximise the public good provision. However, economic theory under a multilateral public good provision amidst inter-country size disparities is somewhat counter-intuitive. Thus, according to the Warr (1983) neutrality theorem, when individuals (say, representative consumers of IPG-contributing countries) behave as atomistic utility maximisers, the distribution of income has no effect on the level of a single public good provision in the interior solution, regardless of differences in individuals' marginal propensities to contribute. Furthermore, according to Boadway and Hayashi (1999) who provide a game-theoretical argument for the disproportionate burden sharing hypothesis for non-equal IPG-contributing countries: if one country in the dyad has a larger population and a lower per capita income than the other (e.g., Sweden vs. Norway, in the Fulufjället case), the country's economic size cannot be unambiguously related to the share of the burden borne. On the other hand, it is not a priori clear if a respondent's knowledge of the above economic argument necessarily shifts her preferences towards home bias. For instance, the respondent's rationale could depend on whether her home country appears disproportionately burdened or not. Moreover, altruistic motives might predominate among the disproportionately burdened country's respondents. With all above in mind, we have got mixed a priori expectations regarding the impact of attitudes related to inter-country size disparities on home bias in stated preferences.

### 2.3.3. Suspensions towards the foreign party

Suspensions towards the foreign party are expected to be a driver of home bias in the stated preferences. Obviously, respondents could exhibit aversion towards contributing to a bilateral IPG provision programme implying tax money transfers abroad if they are suspicious towards the adjoining foreign party. Given the comparative performance of the countries under consideration with respect to their overall transparency and corruption levels (e.g. Transparency International Corruption perceptions index in 2018 was 85/100 for Sweden, 84/100 for Norway compared to 60/100 for Poland and 44/100 for Belarus),<sup>6</sup> one could a priori expect this factor to be more pronounced in the Central European case as compared to the Scandinavian case.

### 2.3.4. Anticipation of unilateral foreign provision

Free-riding is the commonly acknowledged essence of market failure in public goods provision (Samuelson, 1954). In this study, we addressed a special case of an *international* free-riding, where respondents might understate their real WTP for the foreign segment of the binational public good in anticipation of its unilateral foreign provision, thus free-riding on the actions of neighbouring country. Like [Voltaire et al.](#)

(2017), we verified if the respondents' trust in the other agents' contribution to conservation action (in this case – unilateral designation by the foreign party) reduces their stated preferences towards the foreign segment of TNPA thus being a driver of home bias.

### 2.3.5. 'Patriotic' considerations

Finally, home bias in the case of TNPA might be explained with the greater preferences of the country citizens towards their domestic segment simply because it belongs to their country. Considering history of the two actual EU borderlands under consideration as well as their present state (i.e. the frontier regime and overall interstate relations in between EU and two different non-EU countries) we have mixed a priori expectations regarding in which of the two cases patriotism is a stronger home bias driver.

The responses in terms of the indicated level of disagreement or agreement with the statements, using a five-point Likert scale, provide measurements of each of the latent variables. Even if a (latent) variable is measured by the responses to each attitudinal statement (only one measurement variable, item, per latent variable), the (latent) variable as such (e.g., suspicion or patriotism) remains unobservable. The use value expectations might be considered behavioural intentions rather than attitudes, but we analyse all responses to statements in [Table 2](#) as measurements of latent variables.

## 2.4. Econometric framework

To analyse our respondents' stated preferences we use the hybrid mixed logit model (HMXL), a structural econometric model that allows us to link ordinal (attitudinal) responses to respondents' economic choices ([Ben-Akiva et al., 2002](#)). In our case, attitudinal questions concerning various issues related to home bias and preferences for international public goods were asked using ordinal (Likert scale) questions. At the heart of our modelling approach lies the assumption that each respondent's preferences can be linked to several drivers that cannot be directly observed and hence they are being modelled as latent variables. However, they can be indirectly measured, because they drive responses to attitudinal questions included in our survey. The hybrid choice model uses latent variables to link ordered choice models or attitudinal responses with mixed logit (MXL) model of discrete (economic) choices. As a result, our model can be seen as linking standard mixed logit models ([Revelt and Train, 1998](#)) with Multiple Indicators and Multiple Causes (MIMIC) model ([Jöreskog and Goldberger, 1975](#)). The former links some assumed decision process (e.g., utility maximisation) and observed explanatory variables (attributes of alternatives, socio-demographics) with observed choices, whereas the latter identifies latent factors linked with observed indicator variables, for example, answers to attitudinal survey questions.

The hybrid choice framework has been applied to better understand the attitudes and psychological factors that drive individuals' preferences towards non-market goods and policies. Applications in environmental economics include coastal water quality improvements, land-use policies, conservation policies, and recycling rules ([Hess and Beharry-Borg, 2012](#), [Hoyos et al., 2015](#), [Lundhede et al., 2015](#), [Mariel et al., 2015](#), [Bartczak et al., 2016](#), [Czajkowski et al., 2017b](#), [Grilli et al., 2018](#), [Boyce et al., 2019](#), [Zawojka et al., 2019](#)). The latent variables can represent psychological measures, such as attitudes towards chargeable policy, awareness of consequences, outcome uncertainty, risk preferences, social norms, morals, personality, perceived survey consequentiality and many others.<sup>7</sup>

The econometric framework we use has several advantages. First, the attitudinal question responses were collected using 5-point Likert scales. Instead of imposing an absolute interpretation on these Likert-scale responses, our structural model uses an ordered probit to model the answers, and hence recovers the ordinal nature of the response scale without imposing other restrictions. This way we do not misinterpret the responses and avoid potential bias resulting from modelling responses using, for example, linear regression ([Greene, 2017](#)).<sup>8</sup> Second, use of a hybrid choice model is one way of responding to concerns over measurement bias ([Budziński and Czajkowski, 2023](#)). Finally, all components of our structural model are estimated jointly – the model is estimated using full information log-likelihood function. Some other studies have employed a two-step approach, in which for example individual factor scores are derived first and then interacted with utility function parameters (e.g., [Salomon and Ben-Akiva, 1983](#); [Boxall and Adamowicz, 2002](#); [Nunes and Schokkaert, 2003](#); [Milon and Scrogin, 2006](#)). In a sequential approach the fitted latent variables are (erroneously) treated as non-stochastic; thus, by estimating the choice model and the structural model simultaneously, we ensure that our model is statistically more efficient (see, e.g., [Raveau et al., 2010](#)).

The following sections describe the discrete choice and the measurement component of the model and outline its identification and estimation.

### 2.4.1. Discrete choice component

The theoretical foundation for the discrete choice model is random utility theory, which assumes that the utility a person derives depends on observed characteristics and unobserved idiosyncrasies, represented by a stochastic component. As a result, individual  $i$ 's utility resulting from choosing alternative  $j$  in choice set  $t$  can be expressed as:

$$V_{ijt} = a_i c_{ijt} + b'_i X_{ijt} + e_{ijt}, \quad (1)$$

where the utility expression is assumed additively separable in the cost of the alternative,  $c_{ijt}$ , and other attributes,  $X_{ijt}$ ;  $a_i$  and  $b_i$  denote





### 2.4.3. Estimation

Finally, after combining equations, we obtain the full-information likelihood function for our HMXL model, where for ease of exposition we stack the parameter vectors  $\Lambda, \theta, \Gamma, \alpha$  into the single vector  $\Omega$ :

$$L_i = \int P(y_i | X_i, \beta_i^*, \lambda_i^*, \Omega) P(I_i | \Omega) f(\beta_i^*, \lambda_i^* | \theta) d(\beta_i^*, \lambda_i^*). \quad (10)$$

As random disturbances of  $\beta_i^*, \lambda_i^*$  are not directly observed, they must be integrated out of the conditional likelihood. This multidimensional integral can be approximated using a simulated maximum likelihood approach.<sup>11</sup>

For a more detailed description of the hybrid choice modelling framework please refer to [Hess and Beharry-Borg \(2012\)](#), [Kim et al. \(2014\)](#), [Mariel and Meyerhoff \(2016\)](#), [Czajkowski et al., 2017a](#), [Czajkowski et al., 2017b](#), and [Budziński and Czajkowski \(2023\)](#).

### 2.5. Data and survey administration

We recap main elements of the data and survey administering originally described in [Valasiuk et al., 2017](#), [Valasiuk et al., 2018](#). After pre-testing the questionnaires in in-depth interviews in Warsaw and Minsk and focus group sessions in Stockholm and Oslo, pilot surveys were carried out in the four countries. As the questionnaires were found to work well in the pilot, they were carried over to the main survey without further changes, except for adjustments in the design of the choice attribute levels in order to improve statistical efficiency.

The Białowieża questionnaire was operationalised in the form of an offline [software tool](#) and administered as a series of computer-assisted personal interviews (CAPI) to samples of Belarusian and Polish respondents, interviewed at their homes by the local survey market agencies: IP Kavaloš and Kantar Polska S.A. respectively.<sup>12</sup> The survey was administered during July–December 2015 in Belarus and during December 2015 – February 2016 in Poland. The pilot sample included 100 Belarusian and 100 Polish complete interviews, while the main sample included 900 and 901 complete interviews, respectively. After removal of protesters<sup>13</sup> (i.e. respondents explaining systematic picking of the status-quo as their best choice and indicating that it is the “government who must finance nature restoration programmes”, not themselves personally) the dataset (main surveys plus pilots) was reduced to 763 Belarusian, 755 Polish respondents ([Valasiuk et al., 2017](#)).

The Scandinavian questionnaire was adapted to an Internet-consistent format (CAWI), and pilot-tested in September and October 2015 with a sample of 458 Swedes and 282 Norwegians recruited from an Internet panel (IQS Sp. z o.o.). The main survey, carried out in November and December 2015, comprised 889 Swedes and 902 Norwegians. After removal of protesters, the dataset (main surveys plus pilots) was reduced to 1001 Norwegian respondents and 1167 Swedish respondents ([Valasiuk et al., 2018](#)).

## 3. Results

The results of the four country-specific HMXL models are reported in [Table 3](#), where the top panel presents the main effects, i.e. the estimated means and [standard deviations](#) of the distributions of WTP for each DCE component of the model. The bottom panel of [Table 3](#) represents the measurement component of the model including the coefficients of the latent variables. All models were estimated in WTP-space ([Scarpa et al., 2008a](#)), and therefore the estimated choice coefficients may readily be interpreted as marginal WTP for attribute levels (in PPP-corrected 2015 Euros).

Table 3. Structural model linking preferences for the extensions of the national parks abroad with attitudinal questions aimed at explaining the reasons for home bias.

Choice attributes		Norway (Fulufjället)	Sweden (Fulufjället)	Belarus (Białowieża)	Poland (Białowieża)
Status quo (alternative specific constant)	Mean	-23.62***	-35.95***	40.34***	-11.86***
	(S.E.)	(0.84)	(1.06)	(13.61)	(0.36)
Extension [100km <sup>2</sup> ]	St. dev.	53.07***	73.08***	233.37***	24.05***
	(S.E.)	(2.03)	(1.59)	(43.82)	(0.67)
Extension abroad [100km <sup>2</sup> ]	Mean	38.11***	33.51***	6.59	8.10***
	(S.E.)	(1.40)	(1.32)	(4.56)	(0.52)
Extension abroad [100km <sup>2</sup> ]	St. dev.	47.80***	36.52***	38.92***	15.81***
	(S.E.)	(1.63)	(0.85)	(7.80)	(0.65)
Extension abroad [100km <sup>2</sup> ]	Mean	-31.39***	-17.50***	-39.25***	-14.76***
	(S.E.)	(1.36)	(1.09)	(8.46)	(0.62)
Extension abroad [100km <sup>2</sup> ]	St. dev.	11.78***	11.56***	18.71**	4.87***
	(S.E.)	(1.35)	(0.58)	(7.46)	(0.43)

Choice attributes		Norway (Fulufjället)	Sweden (Fulufjället)	Belarus (Białowieża)	Poland (Białowieża)
Latent variables					
LV <sub>1</sub> – I expect to visit the domestic side of the site under consideration in the next five years	Interaction with Extension abroad	-15.30*** (1.02)	4.43*** (0.70)	n.s.	n.s.
	Measurement component	3.49*** (1.06)	0.69** (0.32)		
LV <sub>2</sub> – I expect to visit the foreign side of site under consideration in the next five years	Interaction with Extension abroad	24.03*** (1.34)		20.54*** (6.45)	6.09*** (0.44)
	Measurement component	0.67*** (0.14)	n.s.	0.77*** (0.23)	1.21*** (0.36)
LV <sub>3</sub> – I believe that the participation of Poland (Sweden) in the programme funding should be higher than the participation of Belarus (Norway) because the Polish (Swedish) population is greater than the Belarusian (Norwegian) population	Interaction with Extension abroad	2.04** (0.87)	5.47*** (0.83)	-13.79** (5.87)	n.s.
	Measurement component	0.90*** (0.31)	0.35* (0.19)	4.29*** (1.64)	
LV <sub>4</sub> – I believe that the participation of Poland (Norway) in the programme funding should be higher than the participation of Belarus (Sweden) because Poles (Norwegians) are wealthier	Interaction with Extension abroad	14.63*** (1.14)		n.s.	n.s.
	Measurement component	0.27** (0.13)	n.s.	n.s.	n.s.
LV <sub>5</sub> – I am afraid that money spent on the protection on the foreign side of the site under consideration could be misused	Interaction with Extension abroad	-3.12*** (0.93)		n.s.	n.s.
	Measurement component	0.41** (0.20)	n.s.	n.s.	n.s.
LV <sub>6</sub> – I expect the domestic party to comply with the international agreement to a larger extent than the foreign party	Interaction with Extension abroad			n.s.	n.s.
	Measurement component	n.s.	n.s.	n.s.	n.s.
LV <sub>7</sub> – I expect the foreign party to extend the passive protection regime on its side of the border whether or not the bilateral programme discussed in the questionnaire is implemented	Interaction with Extension abroad		7.24*** (0.57)		-4.67*** (0.34)
	Measurement component	n.s.	0.52*** (0.20)	n.s.	0.81** (0.33)
LV <sub>8</sub> – I prefer to protect the domestic side of the site under consideration than its foreign side because it belongs to my country	Interaction with Extension abroad		-13.93*** (0.77)		
	Measurement component	n.s.	1.06*** (0.26)	n.s.	n.s.
Model diagnostics					
LL at convergence		-19,252.96	-21,623.45	-16,859.44	-14,521.75
LL at constant(s) only		-26,407.73	-30,147.70	-19,207.89	-19,636.19
McFadden's pseudo-R <sup>2</sup>		0.2709	0.2827	0.1223	0.2605
Ben-Akiva-Lerman's pseudo-R <sup>2</sup>		0.5680	0.5784	0.4897	0.6016
AIC/n		2.4120	2.3226	2.7712	2.4135
BIC/n		2.4388	2.3461	2.8052	2.4478
n (observations)		16,011	18,668	12,208	12,080
r (respondents)		1001	1167	763	755
k (parameters)		56	56	56	56

\*\*\*, \*\*, \* significance at 1%, 5%, 10% level. Standard errors provided in parentheses, n.s. represents not significant effects. Detailed results (including estimated cost\*scale parameters that are not interpretable and thresholds of the ordered probit models) are presented in the Supplementary materials.

Our model uses the following specification of the utility (WTP) function:

$$U = \beta_1 \cdot \textit{Status quo} + \beta_2 \cdot \textit{Extension} + \beta_3 \cdot \textit{Extension abroad} + \lambda_1 \cdot \textit{Cost } t, \quad (11)$$

where:  $\beta_3 = \beta_3^* + \sum_{n=1}^8 \alpha_n \cdot LV_n$ . Note that in this specification respondents' preferences (WTP) depend on the total extension of the national park (domestic or abroad) and, additionally, on the extension abroad. The coefficient of the extension abroad can either be positive (if extension abroad are valued more than domestic extension) or negative (in the opposite case). In the extreme case, when extension abroad is seen as a 'bad', the coefficient of the extension abroad would be negative and its absolute value would be larger than that of the coefficient of extension. Finally, note that the coefficient of the *Extension abroad* depends on the eight latent variables associated with its potential drivers measured with our attitudinal statements. Since these latent variables are normalised for zero mean and unit standard deviation in the population, they do not change the interpretation of  $\beta_3^*$ , however, the significance and relative value of the coefficients of the interactions with latent variables allow for insight into what drives respondents' preferences for the extension abroad, relative to extension in general.

The WTP estimates associated with the alternative specific constant for the status quo alternative show, that citizens of all countries except Belarus preferred a new policy incorporating some form of extension of the national park. In all cases, however, the estimated WTP shows a considerable heterogeneity, as indicated by high standard deviations, relative to means. This is especially pronounced for Belarus and indicates that there are strong supporters as well as strong opponents of a proposed policy. Each 100km<sup>2</sup> extension of the Fulufjället national park is valued at 38 EUR by Norwegians and 33 EUR by Swedes.<sup>14</sup> Polish respondents would, on average, be willing to pay 8 EUR for the same scale of extension of the passive protection regime in the Białowieża Forest. For Belarus, the mean WTP associated with the total extension of the national park was not statistically significantly different from zero, which means that respondents from Belarus, on average, favour the current policy and are negative towards any extension abroad. Once again, in all countries a large heterogeneity of preferences is evident.

Additional WTP assigned to the extension abroad was negative and significant in all the country-specific models, indicating that respondents value national park extensions abroad less than in their own country. The latter finding rejects again immediately the research hypotheses that TNPA are pure IPG in the Białowieża (Valasiuk et al., 2017) and Fulufjället (Valasiuk et al., 2018) cases.<sup>15</sup> Preferences for extension abroad exhibited heterogeneity in all countries involved, as the corresponding standard deviations are statistically significant. Interestingly, whilst for Norwegian and Swedish respondents the absolute value of an extension abroad was still positive, approximately 6.72 EUR for Norwegians and 16.01 EUR for Swedes, for Polish and Belarusian respondents a policy aiming at extending the national park on the other side of the border would lead to loss of human welfare.

We now turn to investigating the main attitudinal drivers of home bias. In all the countries except for Sweden respondents stating that they expect to visit the foreign part of the park were willing to pay more for extensions abroad. Although, the intention to visit the national park in their own country was a significant home bias driver for Norwegians, the opposite was true for Swedes – those Swedish respondents who reported their intention to use the domestic part of the national park had significantly higher WTP for the park extension abroad. No significant effect in this regard was found among Belarusians and Polish respondents.

Considering the factors that justify one country's higher contribution, both Swedes and Norwegians who agree that Sweden should bear a larger part of the cost of Fulufjället because of its larger population were also less negative towards paying for extensions abroad. The reverse effect is observed in Belarus, where those who agree that more populous Poland should pay more are also more negative about the Białowieża park extensions abroad. When the differences of wealth between countries are considered, agreeing that it plays a role is a significant explanatory factor for different valuation of extensions abroad only in Norway, making it slightly less negative.

Being afraid that money spent on the protection on the foreign side of the site under consideration could be misused showed a significant effect only among Norwegians, reducing (as expected) the willingness to pay for extension of the park on the other side of the border. The expectation that foreign party may comply with the extension program to a lesser extent appeared significant in none of the considered countries. Another expected home bias explanation is that the foreign country would introduce an extension irrespectively of the program. This was found a significant home bias mitigator in Sweden, whereas in Poland, – on the contrary – it leads to stronger home bias. Finally, the national ownership of the extended part was a significant home bias driver in the case of Sweden only.

#### 4. Discussion

Using the standard DCE framework, Valasiuk et al., 2017, Valasiuk et al., 2018 showed that neither the Białowieża TNPA nor the Fulufjället TNPA are pure IPGs. However, the WTP difference was considerably more pronounced for Białowieża where – unlike the Fulufjället case involving Norway and Sweden – positive welfare spill overs across the border in the Białowieża case were neither enjoyed by the citizens of Poland nor Belarus. The Białowieża case thus represented a combination of two pure national public goods (Bjorvatn and Schjelderup, 2002; Levaggi, 2010). This finding provides an economic explanation for the poor level of transboundary co-operation, since in accordance with Busch (2008),

national welfare is necessarily not greater under the transboundary equilibrium than under the isolated equilibrium if positive spill over effect condition does not hold. Hybrid DCE models' main effects demonstrate the same pattern, pointing at the robustness of the results.

We have examined the people's considerations, which might appear potential drivers of home bias, by means of the hybrid DCE modelling linking the respondents' preferences to their attitudes and beliefs. The set of statements (items) related to each latent attitude/belief was limited. While that yields no limitation for the MIMIC as such, the resulting analysis might be somewhat more prone to measurement error, to the extent that the selected statements were perceived differently across nationalities. However, we found no apparent misconceptions of statements that explain the differences that we have presented.

Presence of visiting expectations shifted respondents' preferences in favour of the part which they expect to enjoy directly in the case of Norwegians, Poles, and Belarusians. Interestingly, use value expectations demonstrated a similar pattern of influence on preferences of Norwegians and Poles, whereas [Brown et al. \(2015\)](#) found higher propensity towards use values of natural goods among Norwegians than among Poles. Norway is the only case where expectations to visit the domestic part of the TNPA under consideration appear a driver of home bias. This can be explained by the lowest proportion of the Norwegian respondents who claimed visiting the domestic part of the TNPA in the past –7% compared to 12% in the Swedish sample, 16% in the Polish sample, and 37% in the Belarusian sample. One possible explanation for the reverse pattern observed in the case of the domestic part visiting expectations in the Swedish sample, is a notion of the positive cross-border welfare spill over effect in TNPA ([Busch, 2008](#)).

Impact of the border dividing the national segments of TNPA on the home bias in stated preferences thereto is at the same time twofold and central to the issue. On the one hand, the hard frontier/visa regime and institutional differences across the border impeding the cross-border tourist traffic might be a legitimate explanation of the mutual disutility derived by both Belarusians and Poles from the additional protection abroad. This phenomenon was not observed in the Scandinavian case where a visitor can freely cross the border to enjoy the foreign segment of Fulufjället. Hard border regime implies higher transactional costs in the case of Białowieża, which is in line with literature on home bias in trade and finances. The difference between the two borders translates into the visiting evidence: whilst the number of Polish respondents who claimed visiting their domestic part of Białowieża in the past was 26.5 times higher than those having visited its foreign part and the same ratio for Belarusians was 28 times, for the Fulufjället this ratio was 3.1 times for Swedes and 2.6 times for Norwegians, respectively. Besides the physical isolation, the hard border regime in Białowieża restricts the cross-border informational exchange, whilst informational barriers lead to home bias in the case of trade (e.g., [Wolf, 2000](#)). The same seems to apply to the TNPA, especially assuming the non-use value predominance.

On the other hand, expectations to visit the foreign segment of TNPA mitigate home bias in stated preferences regardless of the border character – i.e. likewise for Poles, Belarusians, and Norwegians. Removing the physical border fence installations and promoting increased cross-border visits could therefore be expected to shift people's preferences towards more close transboundary co-operation and interest in the protection of the foreign side of the Białowieża Forest.

Regarding the inter-country size disparities, in the Fulufjället case, the more respondents agreed with the propositions of unequal financing of the TNPA due to the countries' disparities in terms of wealth or population, the more mutually co-operative preferences they stated. Thus, in this case, where according to [Boadway and Hayashi \(1999\)](#) countries' economic size cannot be unambiguously related to the share of the burden borne, consent with the common-sense international justice underpinned a lower home bias. A less apparent observation was made in the Białowieża case, where Poland clearly dominates over Belarus in terms of both population and per capita income, which means that, following [Boadway and Hayashi \(1999\)](#), contributing Poland would unambiguously be disproportionately burdened in the Nash equilibrium; whilst Polish citizens would be worse off in terms of individual level welfare compared to Belarusians. In these conditions, the less Belarusian respondents agreed that Poland should contribute more to the funding of the programme, (i.e. presumably, the better they saw the hypothetical disproportionate burdening of Poland and the less they agreed to it) – the lower home bias was found in their stated preferences. Therefore, the latter pattern might be interpreted as a manifestation of conscious altruism and preferences in favour of international justice which seems an attitudinal home bias mitigator across the cases. These attitudes however did not prevail over the Belarusians' propensity to maintain status quo. Additionally, the fact that inter-country size disparities appeared significant in three of four countries amidst mixed a priori expectations might hint that they are a proxy for some other determinants common for the both cases, which were not addressed in the study explicitly (e.g. cultural/language barriers or ethno-confessional issues which are considered home bias drivers in trade and finances (e.g., [Wolf, 2000](#), [Beugelsdijk and Frijns, 2010](#), [Anderson et al., 2011](#)).

As the simulation results suggest, Swedish and Polish respondents showed the reverse patterns of preferences in respect to their propensity to free-ride on the unilateral foreign provision, where Swedish respondents chose to co-operate rather than to free-ride. In principle, free-riding alone might preclude the mutually adjacent countries from co-operation on TNPA, as in the extreme no country may act. However, a more likely scenario seems suboptimal provision of the public good carried on by a more wealthy country ([Olson, 1965](#); [Sandler, 1998](#)), which might be applicable to Poland in the case of Białowieża.<sup>16</sup>

Other attitudinal factors appeared as home bias determinants only sporadically. As expected, suspicions towards the foreign party's integrity appeared as a home bias driver. However, contrary to more generic a priori expectations, this tendency was only found in the case of

Norwegian respondents. Moreover, surprisingly, a lower trust in the ability of foreign countries' institutions (compared to the domestic institutions) to comply with the international agreement showed no significant relationship with home bias.

Finally, regarding the 'patriotic' considerations, [Dallimer et al. \(2015\)](#) found (although not focussing on TNPA in their international DCE on ecosystem services of semi-intact grasslands) that individuals would on average be most concerned about policies affecting their domestic nature sites. However, although 'patriotic' considerations could have been a quite generic and legitimate explanation of home bias, surprisingly, in our study we found 'patriotic' considerations to be a home bias driver in the Swedish sample only.

## 5. Conclusions

Our comparative analysis using the data from [Valasiuk et al. \(2017\)](#) and [Valasiuk et al. \(2018\)](#) (in the hybrid setting accounting for the previously unused answers to attitudinal questions) have corroborated the rejection of the hypothesis that Transboundary Nature Protected Areas (TNPA) in EU outer borders are pure international public goods (IPG). Home bias was indeed found in the valuation of extended nature protection for both the Białowieża and Fulufjället case studies.<sup>17</sup> Hence, our results demonstrate robustness irrespective of modelling approach. As indicated, in general there might exist a good reason for a 'home bias', even if there are no apparent differences in measurable qualities of the domestic and foreign alternative. In this paper, we have investigated what drives the inclination towards preferring TNPA extension on the domestic part rather than the foreign part of the TNPA. We found appreciation of transboundary justice and [altruism](#) to be a ubiquitous home bias mitigator, and a driver of more co-operative nature conservation, especially in the Scandinavian Fulufjället case. Additionally, the trust in unilateral foreign IPG provision appeared as a home bias mitigator for Swedish citizens, whilst being a home bias driver for Polish citizens. Manifestation of 'patriotism' applied as home bias driver only to a limited degree. The clearest driver of IPG-consistent preferences was, however, use value expectations regarding the foreign segment of TNPA as in three countries out of four, expectations to visit the foreign part of the TNPA proved to be a home bias mitigator.

This pattern coincides with the Białowieża case study area at the Polish-Belarusian border being divided by a strict border with a fence and visa limitations, while Swedes and Norwegians are free to cross the national border dividing the Fulufjället case study area. The limited physical access between Poland and Belarus implies weaker cross-border exchange of information and knowledge entailing poorer awareness of the Białowieża's transboundary nature. Assuming potentially high non-use value, the latter circumstance translates into the lost positive transboundary welfare spill overs elicited via citizen's preferences. Consistent with [Busch \(2008\)](#), enhancing transboundary co-operation contemplated by international organisations in the case of Białowieża ([Debonnet and Ossola, 2018](#)) is not incentivised economically. Thus, in order to reduce home bias and shift peoples' preferences towards transboundary co-operation, incentives to visit the segments abroad should be created symmetrically in the countries sharing a TNPA, whilst the existing limitations of its transboundary accessibility should be relaxed or totally removed.

## Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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## Appendix A. Supplementary data

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## Data availability

Data will be made available on request.

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2023, Land

- 1 With this in mind we find a term '*homeland* bias' (meaning 'a person's or a people's native land' under the term 'homeland') a more appropriate expression in this particular case. Nevertheless, because of the terminology established in the economic literature for this phenomenon, we refer to 'home bias'.
- 2 In 2022 Poland started construction of the second divisive fence line parallel to existing border installations (including across Białowieża Forest) because of border and political tensions between Belarusian regime and the EU.
- 3 Since the time of field survey administering, Belarus has been gradually relaxing unilaterally its frontier and visa regulations to facilitate short and mid-term international touristic visits to its territory using its national segment of the transboundary Białowieża Forest as one of the pilot grounds. However, at the time of manuscript submission this tendency is impeded by COVID19 pandemic restrictions as well as by political tensions between Belarus and the EU. No symmetric regulations were implemented by Poland.

- 4 In the Białowieża case, the wording was 'extension of the area covered by the passive protection regime' and no specific areas were used to illustrate potential alternatives (Valasiuk et al., 2017). In the Fulufjället case, the wording was 'park extension' and in the description preceding the DCE, specific areas were named as potential alternatives (Valasiuk et al., 2018).
- 5 An efficient experimental design of the DCE was generated using NGENE software. Three types of the experimental design with zero priors having a different number of programme alternatives (one, two or three) plus SQ option, were prepared for the pilot survey with sixteen choice-cards for each type. The number of alternatives was varied in treatments and remained constant for the same respondent. Efficient experimental design for the main survey was generated using priors from the pilot experiment. Three types (the same as in the pilot study) times four blocks in each type yield twelve modifications of the experimental design, so a particular respondent faced one set of sixteen choice-cards being chosen randomly out of the twelve possible sets. Specifically, each design was optimised for median Bayesian D-error of the MNL model (Scarpa and Rose, 2008). The order of choice tasks presented to each respondent were randomized to counter-balance possible ordering effects.
- 6 <https://www.transparency.org/cpi2018> accessed 6th October 2019
- 7 Notably, incorporating perceptions and cognitive processes is just one of the many possibilities allowed by hybrid choice models. For example, several studies in health economics have combined best-worst scaling and discrete choice (see, e.g., Zhang et al., 2015), while Pascoe et al., 2019 used hybrid choice framework to combine a choice experiment with a non-utility-theoretic analytic hierarchy process.
- 8 Instead, many studies assume linear relationship between responses (i.e. assume equal distance between response scales), for example interpreting 'I disagree strongly' as 1, 'I disagree moderately' as 2 and so on. This is a very strong assumption to impose, since the differences between response categories are much subtler and while there could be very little difference between 'I disagree strongly' and 'I disagree moderately', there could be much more difference between 'Neither agree nor disagree' and 'Agree a little'. Using the ordered probit model does not impose this assumption – it uses ordinal scale to interpret responses and flexibly sets the thresholds between neighbouring responses.
- 9 We assumed a normal distribution for the non-monetary random parameters, whilst the cost coefficient was assumed log-normally distributed to impose the theory-driven restriction that marginal utility of money is positive. A restriction of non-correlation between parameters has been imposed on the models.
- 10 It is important to note that the number of measurement equations need not equal the number of latent variables. For instance, cases may arise where more than one indicator for a latent variable may be available (this framework can accommodate such a setting by specifying multiple measurement equations for a single latent variable).
- 11 The models were estimated using maximum simulated likelihood techniques, using 10,000 scrambled Sobol draws (Czajkowski and Budziński, 2019). The software used here (estimation package for DCE data) was developed in Matlab and is available at <https://github.com/czaj/DCE> under CC BY 4.0 license. The dataset, additional results and estimation codes are available from <http://czaj.org/research/supplementary-materials>.
- 12 Both national survey samples followed multi-stage stratified random national-wide sampling with quotas on gender, age and education of respondents, while the sample structure and sampling quotas were based on the official statistical information. Both the Belarusian and Polish final samples were calculated with the same sample error of no more than 3.1% at the confidence probability of 95%. The rejection rate was about 7% of the Belarusian sample while it was about 20% of the Polish sample.
- 13 There exist different approaches to the handling of respondents who indicate protest against the individual choice/valuation context (e.g., Lancsar and Louviere, 2006). In our case, investigating what drives differences in WTP for TNPA extension domestically vs. abroad, the issue of removal (or not) of potential protesters was of less importance. Naysayers who did not reveal signs of the protesting behaviour were not excluded from the analysed dataset and their stated WTP = 0 is accounted for in our results.
- 14 While we express the WTP results for 100 km<sup>2</sup> extension, note that such an extension was not always possible in the experimental design - this is the result of scaling used in the model to facilitate estimation. The study design only included realistic extension levels and, as always, extrapolations outside that range should be made with caution.
- 15 Note, that according to standard z-test, the statistical hypothesis stating that the country-specific coefficient with the extension abroad is equal to zero, is rejected for all countries involved. In mixed logit model specification in the two case papers (Valasiuk et al., 2017, Valasiuk et al., 2018) the research hypotheses that TNPA are pure IPG has been unanimously rejected by the series of LR-tests.
- 16 A stronger version of international free-riding where respondents understate their real WTP for the *whole* (i.e., not only foreign segment of) binational public good in anticipation of its unilateral foreign provision, will be scrutinised in a separate contribution.
- 17 In spite of home bias, there is WTP for nature preservation in the neighbouring country, particularly in the Scandinavian countries, in our case. WTP for nature protection abroad, also beyond the neighbouring country, has been estimated in other applications (e.g., Loureiro and Loomis, 2013).





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