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IS INTERNATIONAL FREE-RIDING IMMANENT TO TRANSBOUNDARY SPATIAL CONSERVATION?

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Is international free-riding immanent to transboundary spatial conservation?

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Abstract: Despite their recent global expansion in nominal terms, many transboundary nature protected areas tend to avoid hands-on cross-border co-operation. One common explanation which is widely seen a major obstacle towards the concerted transboundary conservation is international free riding on the centralised decision-making level. I examine empirically whether international free-riding is embedded in citizens' stated preferences for extended protection in the case of two transboundary nature protected areas Białowieża Forest and Fulufjället. I scrutinise a sub-set of merged survey samples from the four countries involved, including only the citizens assumingly incentivised to free-ride on unilateral foreign country's conservation action. I apply attitudinal indicators to form effect-coded variables that measure free-riding, and control for use value, nationality, individual socioeconomic characteristics, and incentive compatibility of the survey design. The results indicate no widespread tendency of international free-riding; the conclusion is maintained with varying modelling approaches or sampling strategy employed.

Keywords: transboundary nature protected areas, stated preferences, public good, free-riding, binary logit, negative binomial regression

JEL codes: H41, Q23, Q28, Q51, Q57, Q58

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1. Introduction

1.1. Free-riding in transboundary spatial conservation

Since nature does not recognise political borders, and effective conservation often calls for concerted actions undertaken by more than one country, transboundary nature protected areas (TNPA) are being designated to conserve precious ecosystems divided by the state borders. TNPA have become a widespread phenomenon of international conservation involving particular challenges (Sandwith et al. 2001, Lanfer et al. 2003, Vasilijević & Pezold 2011) with their global number and surface exhibiting steady growth (Lysenko et al. 2007, Vasilijević et al. 2015). The overwhelming majority of institutionalised TNPA are located in the Americas and in Africa (e.g., Wolmer 2003, Duffy 2006, Dressler & Büscher 2008, King & Wilcox 2008, Lunstrum 2011, Bhatasara et al. 2013, Chiutsi 2014, Muzeza et al. 2016). In Europe, there have been several projects designed to establish TNPA including regional initiatives aimed at international co-operation, such as protection of the Wadden Sea undertaken by the Denmark, Germany, and Netherlands, in mountain areas (e.g., the Pyrenees: Spain and France; the Alps: France and Italy, Switzerland and Italy; the East Carpathians: Poland, Slovakia, and Ukraine) as well as in lowland areas (e.g., in West Polesia: Belarus, Poland, and Ukraine; in the Danube Delta: Romania and Ukraine).

Although the main argument behind TNPA establishment and functioning is rooted in a biocentric view on biodiversity conservation in the cross-border context (e.g. Oksanen 1997), they are also supposed to fulfil a complex of functions aimed at sustainable regional/rural development, tourism, and cross-border co-operation (Hanks 2003). Apart from obvious benefits, establishment and stewardship of TNPA generates direct costs as well as lost profits in the natural material resources–dependent sectors (e.g., forestry, agriculture or mining) and imposes restrictions on local communities of mutually adjoining constituencies (e.g., Kachena & Spiegel 2018). Transboundary distribution of benefits and costs might be uneven with respect to state borders, leading to the problem of disproportionate burden sharing for the provision of public goods (e.g., Boadway & Hayashi 1999). Furthermore, transboundary co-operation technically depends on matching capacities on either side of a boundary. For example, in order to create a greater parity, a stronger party is often supposed to leverage its support to a weaker one (Sandwith et al. 2001). Therefore, economic reasons might cause that despite the formal TNPA designation many mutually adjoining nature protected areas tend to minimise or avoid hands-on cross-border co-operation (e.g., Zbicz 2003, McCallum et al. 2015).

First, it is not *a priori* clear if and to what extent the TNPA functions in accordance with public preferences as an *international* public good (Hausken & Plumper 1999, Markowska & Żylicz 1999, Żylicz 2000, Ferroni & Mody 2002, Tisdell 2010, Schoon 2011, Grunewald & Bastian 2015) or rather as a combination of two or more *purely national* goods lacking cross border positive welfare spill overs. Second, the *free-riding* phenomenon is widely seen a major obstacle towards the concerted transboundary conservation (Xepapadeas 1995, Berge 2006, Touza & Perrings 2011, Kark et al. 2015, McPherson & Boyer 2016). Free-riding, i.e. a tendency of economic agents to understate their willingness to pay for a good if they expect it to be provided by someone else is the commonly acknowledged essence of market failure in public goods' provision (Samuelson 1954). Since designation of national parks belongs to the centralised decision-making domain, free-riding there shows up at the inter-governmental level where it precludes the mutually adjacent countries from co-operation on TNPA (as in the extreme no country may act) or at least leads towards a suboptimal provision of the public good (Olson 1965, Sandler 1998). Therefore, assuming that centralised decisions should theoretically reflect public preferences, the question arises if inter-governmental level free-riding is underpinned by the free-riding tendencies prevailing amongst the country's population. Although extensive empirical, game-theoretical, and experimental evidence exists of free-riding towards various public goods (e.g., Bohm 1972, Delmas & Keller 2005, Fuest & Kolmar 2013), free-riding embedded in the public preferences does not seem to be as complete as theory suggests (Carson & Czajkowski 2014); for instance, altruistic or co-operative motives can prevail (which do not contradict rationality of preferences either).

These two economic aspects of the transboundary spatial conservation are interconnected. Following Schwartz et al. (2022), lack of positive transboundary welfare spill overs should deter domestic consumers of a constituency A from free-riding regarding the segment of the TNPA lying in an adjoining constituency B. At the same time, although positive transboundary welfare spill over effects in the case of TNPA (e.g., transboundary migration corridors, transboundary habitats' connectivity or higher resilience of the bigger intact forest massive 'island' surrounded by the human-transformed landscapes) definitely exist in the real world (Brosius & Russell 2003), they may not be adequately reflected in the consumers' observable preferences towards transboundary conservation, say because of their poor awareness or strategic behaviour. The latter explanation might still imply a potential international free-riding. Since centralised or bilateral decisions on public goods' provision under these circumstances can be biased through international free-riding occurring in the

underlying public preferences they reflect, a transboundary conservation may be underdelivered and/or underfunded (e.g., Hanamatsu 2012, Muzeza et al. 2016, Sjöstedt & Linell 2021) due to the fact that one country's agents expect the adjoining country to contribute unilaterally.

1.2. Case study and background

To explore international public goods, two examples of TNPA located at the EU outer borders, namely the Białowieża Forest shared by Poland and Belarus (Valasiuk et al. 2017) and Fulufjället shared by Norway and Sweden (Valasiuk et al. 2018) have previously been brought under scrutiny following a Discrete Choice Modelling approach (McFadden 1974). They have rejected the hypothesis that people's willingness to pay (WTP) for protecting a sq.km of the forest ecosystem across the border does not differ from the WTP for protecting the same area in the home country, thus rendering neither of the two TNPA under consideration a pure international public good. When seeking to find attitudinal determinants for this tendency using the hybrid modelling framework, Valasiuk et al. (2023) have detected some signs pointing at *international* free-riding, where a greater difference in stated WTP for domestic and foreign protection co-variated in the case of the Polish respondents with a stronger anticipation of the TNPA unilateral extension by adjoining Belarus. However, the reverse tendency was found in Sweden, thus demonstrating a mixed pattern.

The aim of this study is to further investigate free-riding problem empirically elaborating on the same dataset. First, assuming that positive transboundary welfare spill overs might not be observable via stated preferences, I explore a more general version of international free-riding where the respondents anticipating a unilateral foreign provision of TNPA understate their WTP *for the TNPA total extension* instead of the WTP for the extension abroad exclusively. With this purpose, I model empirically to what extent the frequency of total abstaining from pay for the TNPA extension (regardless of the border side) can be explained by the consumers' confidence that the TNPA will unilaterally be extended by the adjoining country – simultaneously controlling for other potential factors, e.g. consumers' use value record or expectations, citizenship, individual socioeconomic characteristics, and incentive compatibility of the survey design.

2. Materials and methodology

2.1. Research problem definition and dataset

In this study I re-visit the data collected in the two original case studies in order to test for international free-riding in a more general sense. The essence of the free-riding phenomenon is the strategic behaviour by rational consumers (be they real market agents or respondents surveyed in a stated preference valuation study) understating their observed WTP_o for the good if they anticipate that the good will be provided by someone else regardless of their contribution. Assuming that positive cross-border welfare spill overs in the case of TNPA may not necessarily be adequately observable via stated preferences, one cannot rule out that free-riding does not limit to its foreign extension but to some extent affects accession of a TNPA domestic segment too. Therefore, here, when unilateral extension of the TNPA by the foreign party is expected, domestic consumers are assumed of being incentivised to deliberately understate their observed WTP_o for its *total* (rather than exclusively foreign) provision thus revealing signs of the international free-riding behaviour in a more general sense (cf. Valasiuk et al. 2023 p.9). In the stronger version of free-riding their observed $WTP_o = 0$, whereas in a more general sense free-riding means that the respondents' true $WTP_t > WTP_o \geq 0$.

In stated preferences studies, a difficulty of empirical investigating free-riding arises from the fundamental problem of asymmetry of information which is immanent to survey data, i.e. the respondents' true WTP_t for the good is typically not observed, or it is supposed to be observed under certain conditions only. Therefore, to test for free-riding using the data on respondents' stated WTP_o exclusively (and in order to avoid making assumptions on relation between the observed/stated WTP_o and the true WTP_t), a behavioural approach similar to that of Voltaire et al. (2017) was used: assuming free-riding, the more respondents believe that someone else will unilaterally pay for the public good supply, the lower is the likelihood of their participating in the market (and, correspondingly the higher is their frequency of abstaining from pay). In our case, this tendency would point at international free-riding, whilst the reverse would mean a tendency to international co-operation.

For the testing purposes, I pooled the four country-specific survey datasets collected in the two discrete choice experiments (DCE) (Valasiuk et al. 2017, 2018). Contrary to those for whom the public goods under scrutiny were unwanted or neutral, self-declared consumers of the extended TNPA are assumed of being theoretically incentivised to international free-riding behaviour. Therefore, the pooled dataset was subsequently truncated to comprise only the

consumers of TNPA i.e., respondents who have explicitly supported TNPA spatial extension answering the survey questions prior to the main DCE exercise (hereinafter in the text referred to as "extenders" for the sake of brevity). The full dataset of extenders (Table 1) includes 2,712 individuals from four countries. Identical models were also estimated using a dataset stripped of the observations where extenders answering debriefing questions asked on the later stages of surveying (after the main DCE exercise) explicitly stated other reasons for abstaining from pay than free-riding (e.g., confusion, protest or indifference)[1]. The truncated dataset of extenders totals 2,347 individuals in four countries.

Table 1 – Share of extenders in the four national subsamples.

Country	Total number of respondents	Number of extenders	Share of extenders
Poland (PL)	1,001	550	55.0%
Belarus (BY)	997	589	59.1%
Sweden (SE)	1,348	859	63.7%
Norway (NO)	1,184	715	60.4%

2.2. International free-riding modelling

2.2.1. Indicators of abstaining from pay (dependent variables)

In the original DCE exercise, every respondent had faced sixteen choice-sets (Fig.1) each comprising a status quo option for picking as their best choice by those respondents who abstain from pay in one or several or all the choice-sets. I assume that international free-riding is one of possible incentives for extenders' abstaining from pay *ceteris paribus* rendering the status quo option a respondents' more frequent choice. Therefore, considering frequency of picking

[1] Some of those respondents have apparently changed their minds in the course of answering the survey questionnaire: they first (i.e., prior to the DCE exercise) expressed their explicit support to the extended spatial conservation programme in the TNPA, then systematically stated zero WTP in the DCE, then answering the debriefing question about their reasons for consistent abstaining from pay they picked the options "*I would not like that my money are spent on the Białowieża Forest/ Fulufjället protection" or "I do not care what will happen with the Białowieża Forest/ Fulufjället in future".* Along with the deliberate protesting *("It is the government who must finance protection programmes, not me"*), such a respondents' behaviour is still legitimate, as people are free to change their minds at any moment of time – not necessarily because of their free-riding. Our sampling strategy purpose however, has been to account (through the extenders' full sample analysis) for the possibility that free-riding still motivated their incoherent behaviour.

status quo an indicator of abstaining from pay I used it as a dependent variable in the modelling. In the DCE results elicited for all countries, an overall frequency of picking status quo options as the best choice far outnumbered a proportion of respondents systematically picking status quo in all sixteen choice sets (Table 2).

Therefore, both respondent's systematic choice of the status quo option in all the sixteen choice-sets she faced and the count of status quo options picked by her in the entire DCE exercise were assumed here to be the indicators of her potential free-riding behaviour. With this in mind, I used both of them as the dependent variables in the modelling. Correspondence between the choice of the dependent variable and overall approach to modelling is presented in the Table 3. The former approach rests on a stronger assumption that a respondent who picked at least one programme alternative other than status quo throughout the DCE exercise shows no signs of free-riding behaviour and leads to a binary choice model. The latter approach relaxes this assumption and leads to a count data model.

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)	+ 0 km^2 (35%)	+ 105 km^2 (51%)	+ 70 km^2 (46%)	+ 0 km^2 (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)	+ 0 km^2 (37%)	+ 105 km^2 (44%)	+ 0 km^2 (37%)	+ 35 km^2 (40%)
Additional sum of taxes, imposed on your income annually during the five next years	None	100 PLN	50 PLN	75 PLN
Please, pick your best variant	☐	☐	☐	☐

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

Table 2 – Frequency of abstaining from pay (full sample).

Sample	Number of extenders (SQ=16)	Total number of extenders	Share of extenders (SQ=16)	Number of choice sets (SQ as best choice)	Total number of choice sets	Share of choice sets (SQ as best choice)
PL	126	550	22.9%	4,349	8,800	49.4%
BY	120	589	20.4%	5,099	9,424	54.1%
SE	104	859	12.1%	3,835	13,744	27.9%
NO	69	715	9.7%	2,796	11,440	24.4%

2.2.2. Explanatory variables

The debriefing block of attitudinal questions followed the DCE part of the survey questionnaire asking respondents to indicate their level of disagreement or agreement with the statements addressing possible reasons to value the TNPA domestic and foreign segments differently, e.g., anticipation of unilateral foreign provision or use value expectations regarding particular segments of the TNPA under scrutiny. I used the data comprising the extenders' stated attitudes as explanatory variables in the modelling. For instance, in order to capture the effect of confidence in unilateral foreign TNPA extension on the frequency of extenders' abstaining from pay, i.e. as a potential predictor of international free-riding, a target explanatory variable ***DEB_FREE*** was used on the models' right-hand side. It reflects a score assigned to the debriefing statement as follows: *I expect that the neighbouring country will extend the passive protection zone of the Białowieża Forest/Fulufjället on its side of the border whether or not the bilateral programme discussed in the questionnaire is implemented.* The score was recoded from the original 5-point Likert scale into 3-point effect-coded variable ($DEB\_FREE = 1$ denoting positive attitude to the statement, $DEB\_FREE = 0$ denoting neutral or no attitude, $DEB\_FREE = -1$ denoting negative attitude) used in the dataset. Correspondingly, a positive co-variation of the target explanatory variable DEB_FREE and the dependent variable in any of the estimated models/used samples would be considered empirical evidence in favour of international free-riding.

Table 3 – Free-riding modelling approach and dependent variables.

Indicator of abstaining from pay	Dependent variable	Modelling approach
Systematic choice by the extender of status quo option in all the 16 choice-sets	$\boldsymbol{SQ16} \in [0,1]$ denoting if the respondent systematically abstained from pay by choosing status quo in all 16 choice-sets ($SQ16 = 1$), otherwise $SQ16 = 0$	Binary logit model
Picking of the SQ as an extender's best choice at least once throughout 16 choice-sets	Dependent variable $\boldsymbol{NSQ} \in [0,16]$ denoting the number of choice-sets where status quo was picked as a respondent's best choice	Negative binomial regression model

In addition to the target free-riding behaviour predictor, I used in the model right-hand side explanatory variables rooted in the survey data and capturing other factors potentially explaining the extenders' frequency of abstaining from pay. Since in the previous analysis, visiting expectations appeared to be a sound factor shifting the preferences closer to the state of international public good (Valasiuk et al. 2023, p.9), their potential impact reducing the frequency of abstaining from pay was accounted for in the modelling in the form of $\boldsymbol{DEB\_OWN5}$ and $\boldsymbol{DEB\_FOR5}$ – two effect-coded explanatory variables marking extenders' stated expectations to visit respectively domestic and foreign part of the appropriate TNPA in the next five years (each of the two variables equals 1 in the case of extender's positive expectations, 0 in case of her neutral or no expectations, or -1 for her negative expectations). Additionally, in order to capture a potential impact of the TNPA past visiting record on the frequency of abstaining from pay, a dummy variable $\boldsymbol{WAS} \in [0,1]$ was introduced marking the extenders having visited the Białowieża Forest/ Fulufjället during the recent five years ($WAS = 1$) or not ($WAS = 0$). Compared to prospective visiting in the future, an impact of past visiting record on frequency of abstaining from pay might be less unambiguous. On the one hand, extenders having visited the TNPA might presumably have sentimental reasons to participate in the market. On the other hand, however, intangible values (e.g., sentimental memories) might appear weaker incentives than the use value expectations – resulting in the neutral stand. Finally, those less satisfied with their past journey impressions might even be more inclined to abstain from pay.

The appropriate potential impact of the extenders' sociodemographic characteristics on their frequency on abstaining from pay was captured by the variables $\boldsymbol{AGE}$ (y.o.), $\boldsymbol{MALE} \in [0,1]$, $\boldsymbol{HKIDS}$ (number of children under 18 y.o.), $\boldsymbol{SETTL}$, $\boldsymbol{EDU}$, $\boldsymbol{IDINC}$ denoting correspondingly, respondent's settlement type with regard to its population size (taking levels from 1 to 6), education (taking levels from 1 to 6), and income (taking levels from 0 to 12) being coded in the ascending order. Finally, the country-specific dummies $\boldsymbol{BY}$, $\boldsymbol{NO}$, $\boldsymbol{PL}$, $\boldsymbol{SE} \in [0,1]$ entered the model right-hand side denoting the extenders' citizenship, where BY was used as a baseline in the modelling.

Additionally, I examine empirically how incentive compatibility of the survey affects the propensity to abstain from pay of extenders believing in TNPA unilateral foreign provision. With this purpose, I introduce in the models' right-hand side interactions of the variable DEB_FREE with two variables reflecting incentive compatibility of the survey for extenders. Respondents in the original DCE exercise had faced choice-sets with the different number of alternatives k in them. About a third of respondents had faced a sequence of binary choices ($k = 2$) between one programme alternative vs status quo, whereas the remaining ca 2/3 had faced a sequence of choice-sets with $k > 2$ alternatives (status quo included). Whilst a sequence of independent binary choices is considered an incentive compatible preferences elicitation format in the case of public goods (Carson & Groves 2007, p.197), elicitation formats with repeated choices out of $k > 2$ alternatives are seen as lacking this property. The respondents had been asked to treat every choice-set as an independent from the other choice-sets in the sequence when picking their best choice. Although it is rather difficult to judge if and to what extent they obeyed this guidance, I assume that the design with $k = 2$ alternatives was (at least, theoretically) incentive compatible while the design with $k > 2$ definitely was not. Therefore, in order to explore impact of the incentive compatibility of the survey design on the extenders' tendency to free-ride, I introduced an interaction $\boldsymbol{DEB\_FREE} * \boldsymbol{INC\_COM}$, i.e. – a product of the effect-coded target explanatory variable by the dummy $INC\_COM \in [0,1]$ denoting if the experimental design faced by the extender comprised the sequence of binary choices with one programme alternative plus status quo (hence $INC\_COM = 1$), or not (hence $INC\_COM = 0$).

Besides, another predictor of the survey incentive compatibility was used in order to elicit its impact on extenders' propensity to free-ride, namely $\boldsymbol{DEB\_FREE} * \boldsymbol{INC\_COMP}$ – a product of the target explanatory variable by the dummy $INC\_COMP \in [0,1]$ denoting a perceived consequentiality of the experiment stated by the extender herself. In accordance

with the original survey scenario, its payment vehicle was designed as higher taxes paid through a target bilateral fund. In order to reveal if the extenders believe that the programme will have financial consequences to them, a debriefing attitudinal question: *I do believe that in the event of the implementation of the new protection programme I will be charged its costs (in the form of higher taxes)*[2] was asked. Positive answer thereto meaning perceived consequentiality of the survey by an extender implied that $INC\_COMP = 1$, otherwise $INC\_COMP = 0$.

2.2.3. Econometric framework

First, a simple Binary logit model (e.g., Green 2012) was estimated to quantify effects of the above variables on the likelihood of total refraining from the participation in the market y^* by the function of the kind $y^* = \boldsymbol{\beta}'\boldsymbol{X} + \varepsilon$, where ε is the model random component. Binary dependent variable y is used in the binary choice modelling as a proxy for the unobservable random continuous dependent variable y^*, such that $y = \begin{cases} 1 \; if \; y^* > 0 \\ 0 \; if \; y^* \leq 0 \end{cases}$. Hence, probability of total refraining from participation in the market:

$$Prob[y = 1|\boldsymbol{X}] = Prob[y^* > 0] = Prob[\boldsymbol{\beta}'\boldsymbol{X} + \varepsilon > 0] = Prob[-\varepsilon < \boldsymbol{\beta}'\boldsymbol{X}] = F(\boldsymbol{\beta}'\boldsymbol{X})$$

where $F(\boldsymbol{\beta}'\boldsymbol{X})$ is a distribution function of the ε. Assuming independent, identically distributed (IID) ε, leading to Binary logit model specification, yields this probability in the closed form as follows:

$$Prob[y = 1|\boldsymbol{X}] = \frac{e^{\boldsymbol{\beta}'\boldsymbol{X}}}{1+e^{\boldsymbol{\beta}'\boldsymbol{X}}} \quad (1)$$

Second, a model was estimated following count data specification of the dependent variable in order to accommodate for the relaxed assumption that a respondent who participated in the market at least once does not free-ride. The most commonly used count data models are Poisson regression models and Negative binomial (NEGBI) models being a special case of the former. In the NEGBI model (e.g., Cameron & Trivedi 1986) the probability of individual i refraining from participation in the market y_i is given by:

$$Prob(y_i|y_i{>}0) = y_i \frac{\Gamma(y_i+\alpha_i^{-1})}{\Gamma(y_i+1)\Gamma(\alpha_i^{-1})} \alpha_i^{y_i} \lambda_i^{y_i-1} (1+\alpha_i\lambda_i)^{-(y_i+\alpha_i^{-1})}, y_i = 1, \dots, N, \quad (2)$$

[2] In the Fulufjället case this debriefing question sounded a bit differently, namely: *I believe that the tax values presented in the questionnaire, connected with different options of Fulufjället protection programme are real tax rates that may be introduced* – though bearing the same message as in the Białowieża case.

where Γ represents the gamma function, λ_i is the mean, which is modelled here as a multivariate linear function of explanatory variables, and α_i is the over-dispersion parameter. All the models were estimated in NLogit 5.

3. Results and discussion

The descriptive statistics of the variables entering the models (estimated both for the full and truncated samples of extenders) presented in the Table 4 suggest that regardless of the sample, the majority of extenders have stated their trust in the unilateral conservation action of the foreign party.

The modelling results are presented in the Table 5. In accordance with the model fit characteristics (e.g., McFadden Pseudo R^2 and AIC/N), estimated NEGBI models demonstrate a better fit into the dataset compared to the Binary logit models. Moreover, Vuong (1989) likelihood ratio tests for the non-nested models suggest that estimated NEGBI models outperform Binary logit models[3]. The overall pattern seems robust across the modelling approaches employed and the samples analysed with explanatory power only sporadically stronger in the case of full sample compared to the truncated sample. Note, that as direct interpretation of quantitative modelling coefficients' estimates in these models is difficult only the signs and statistical significance of all the estimated parameters do matter.

Table 4 – Descriptive statistics of extenders' data samples used in the modelling.

Variable	Mean (Standard deviation)		Min	Max
	Full sample (N=2,712)	Truncated sample (N=2,347)		
SQ16	0.154 (0.361)	0.023 (0.150)	0.0	1.0
NSQ	5.933 (6.153)	4.368 (5.052)	0.0	16.0
INC_COM	0.280	0.276	0.0	1.0

[3] The Vuong test retrieves merely an information that one of the two non-nested models estimated through likelihood function optimisation performs better than the other (or they perform similarly). Thus, in the case of models estimated on the full sample Vuong test yields the statistic corrected for different number of parameters (Schwarz 1978) v = -106.84; for the models estimated on the truncated sample v = -79.64 suggesting an unambiguous superiority of estimated NEGBI models over their Binary logit counterparts. However, Vuong test alone does not judge on the correctness of any model under consideration.

	(0.449)	(0.447)		
INC_COMP	0.423	0.452	0.0	1.0
	(0.494)	(0.498)		
DEB_FREE	0.405	0.425	-1.0	1.0
	(0.595)	(0.597)		
WAS	0.194	0.199	0.0	1.0
	(0.396)	(0.400)		
DEB_OWN5	0.008	0.034	-1.0	1.0
	(0.770)	(0.767)		
DEB_FOR5	-0.323	-0.300	-1.0	1.0
	(0.705)	(0.709)		
AGE	56.839	57.699	18.0	97.0
	(20.700)	(20.824)		
MALE	0.500	0.494	0.0	1.0
	(0.500)	(0.500)		
EDU	2.815	2.834	1.0	6.0
	(1.271)	(1.282)		
SETTL	3.637	3.701	1.0	6.0
	(1.652)	(1.635)		
HKIDS	0.537	0.514	0.0	12.0
	(1.003)	(0.916)		
IDINC	4.277	4.256	0.0	12.0
	(3.660)	(3.615)		

3.1. No evidence in favour of the international free-riding found in stated preferences towards TNPA under consideration

As the results suggest, in none of the models a greater trust in foreign unilateral action covariates with the higher frequency of abstaining from pay by extenders (be it a consistent picking of status quo as the best choice in all 16 choice-sets in the Binary logit models, or higher count of choosing status quo in the NEGBI models). Therefore, contrary to what was hinted by Valasiuk et al. (2023) evidence in favour of *international* free-riding effect was found in none of the estimated models regardless of the sample analysed. On the contrary, in the NEGBI models – relaxing a strong assumption that picking a programme alternative other than status-quo in at

least one choice-set of sixteen by a respondent excludes her free-riding behaviour – negative signs of coefficients with the target variable DEB_FREE (being statistically significant at 95% confidence interval) mean that a greater trust in the unilateral foreign conservation action clearly rendered the extenders' preferences (on average) more internationally co-operative by reducing frequency of their picking status-quo.

A possible limitation of this approach to testing might arise from the use of stated free-riding predictor based on declarations made by the respondents themselves whereas their real level of trust in the unilateral conservation action is not observable. Furthermore, the selection of extenders itself was exclusively based on the respondents' self-declaration too. In principle, self-declarations by the respondents should be treated with caution, however the conclusions made on their basis are not necessarily wrong. For instance, there is no apparent motivation for the respondents to systematically over- or understate their stated trust in the unilateral conservation action of the adjoining party. Moreover, in order to mitigate for the potential bias caused by extenders' self-declaration, the truncated sample of extenders was analysed along with their full sample in order to account for the individuals who have explicitly declared their reasons for consistent abstaining from pay other than free-riding; according to Table 5, neither sample of the two exhibits signs of free-riding.

Therefore, it is not *international* free-riding embedded in the citizens' preferences what underpins discrepancies in citizens' stated preferences for extended protection domestically vs abroad nor does it underpin insufficient cross-border co-operation in the case of TNPA under consideration (at least given this study design and under its assumptions). In principle, lack of free-riding in the case of transboundary Białowieża Forest and Fulufjället is rather in line with the theoretically-driven expectations, as according to Schwartz et al. (2022), the (earlier detected) home bias (if taken at face value) should rather deter domestic consumers from free-riding *regarding the foreign segment* of the TNPA. Nevertheless, lack of free-riding is a major empirical finding of this contribution, as it shows that a widely observed free-riding at the centralised decision-making level being an economic factor responsible for underdelivery and/or underfunding of TNPA (e.g., Muzeza et al. 2016, Linell et al. 2019, Sjöstedt & Linell 2021) is not necessarily underpinned by the free-riding embedded in public preferences. On the contrary, anticipation of unilateral foreign extension of the TNPA positively co-variates with inclination towards international co-operation in the NEGBI models regardless of the sample analysed. The latter tendency is consistent with Voltaire et al. (2017) who found in their contingent valuation (though not a transboundary) study – a positive correlation between the

respondent's trust in other agents' monetary contribution into conservation of the salt marshes in Brittany and their likelihood of participating in the market. However, here this co-operative tendency did not prevail over home bias (detected in the four countries), over disutility from prospective TNPA extension abroad (detected in Belarus and Poland), and over the citizens' propensity to maintain status quo found in Belarus (Valasiuk et al. 2023) – which altogether translates into insufficient cross-border co-operation in the Białowieża Forest case (Wesołowski 2005, Lethier & Avramoski 2016, Debonnet & Ossola 2018, Giergiczny et al., forthcoming).

Table 5 – Modelling results.

Variable	Coefficient (Standard Error)							
	Binary Logit				Negative Binomial (NEGBI)			
	Full sample		Truncated sample		Full sample		Truncated sample	
Constant	0.097		-0.916		2.678	***	2.256	***
	(0.290)		(0.734)		(0.203)		(0.221)	
DEB_FREE	-0.229	*	-0.543	*	-0.202	**	-0.214	**
	(0.126)		(0.326)		(0.081)		(0.090)	
WAS	-0.002		0.002		0.000		0.006	
	(0.001)		(0.015)		(0.001)		(0.047)	
DEB_OWN5	-0.388	***	-0.355		-0.164	**	-0.112	
	(0.092)		(0.225)		(0.066)		(0.072)	
DEB_FOR5	-0.010		0.320		-0.073		-0.106	
	(0.100)		(0.227)		(0.065)		(0.071)	
Sociodemographic variables								
AGE	-0.011	***	-0.014		-0.002		0.001	
	(0.003)		(0.009)		(0.002)		(0.002)	
MALE	-0.115		- 0.341		- 0.025		-	
	(0.112)		(0.292)		(0.069)		0.099	
							(0.077)	
EDU	-0.206	***	-0.287	**	-0.090	***	-	*
	(0.050)		(0.132)		(0.031)		0.064	
							(0.033)	

SETTL	-0.054		-0.090		-0.017		-0.012	
	(0.039)		(0.103)		(0.023)		(0.026)	
HKIDS	0.191	***	0.313	***	0.073	*	0.076	*
	(0.048)		(0.105)		(0.038)		(0.045)	
IDINC	0.008		-0.019		0.009		0.012	
	(0.015)		(0.040)		(0.010)		(0.011)	
Country-specific variables								
PL	0.013		-0.214		-0.109		-0.207	
	(0.159)		(0.376)		(0.150)		(0.165)	
SE	-0.848	***	-1.143	**	-0.806	***	-1.006	***
	(0.187)		(0.471)		(0.147)		(0.167)	
NO	-1.170	***	-2.120	**	-1.037	***	-1.214	***
	(0.204)		(0.624)	*	(0.156)		(0.173)	
Interactions								
*INC_COM*DEB_F*	0.246		1.281	**	0.589	***	0.742	***
REE	(0.168)		(0.398)	*	(0.125)		(0.134)	
*INC_COMP*DEB_*	-0.763	***	-0.994	**	-0.503	***	-0.447	***
FREE	(0.163)		(0.393)		(0.108)		(0.118)	
Dispersion parameter for count data model								
Alpha	–		–		1.792	***	1.950	***
					(0.070)		(0.089)	
Model characteristics								
Log-likelihood	-1,067.032		-224.456		-7,354.351		-5,648.124	
N (respondents)	2,712		2,347		2,712		2,347	
K (parameters)	16		16		17		17	
McFadden Pseudo R^2	0.086		0.125		0.379		0.345	
AIC/N	0.799		0.205		5.436		4.828	

***, **, * significance at 1%, 5%, 10% level.

3.2. Other factors of refraining from participation in the market

An effect of the visiting experience in the past (WAS) on the frequency of extenders' abstaining from pay proved irrelevant as the appropriate coefficient statistically does not differ from zero regardless of the modelling approach and sample analysed. This finding co-exists with the relatively small proportion (Table 4) of the extenders (less than 1/5 in the both samples) having visited the TNPA under consideration in the past (be it a domestic or foreign segment thereof). Intuitively, future visiting expectations might have been a stronger driver of participating in the market compared to visiting experience in the past – since an individual intending to visit a natural site in the future might be incentivised to find it in a more intact condition and thus enjoy a greater use value thereof. Our results appeared only partly consistent with these (use value driven) expectations as the negative and significant effect on the frequency of abstaining from pay was found only in the case of expected visiting of the TNPA domestic segment and only in the models estimated on the full sample of extenders. This finding is somewhat counterintuitive since visiting (i.e., use value) expectations towards the TNPA foreign segment appeared a major home bias mitigator in the stated preferences (Valasiuk et al. 2023). Furthermore, this result coincides with the low overall expectations amongst extenders to visit the TNPA foreign segment in the coming five years since – unlike the although low but positive (on average) TNPA domestic segment visiting expectations – the relevant variable means appeared negative in both the full and truncated samples analysed (Table 4).

Coefficients with the country-specific variables enable a clear distinguishing between the two dyads, whereas positive and highly significant coefficients estimated for Sweden and Norway show that the preferences are far more co-operative in the Scandinavian case (as compared to the Belarusian reference level) regardless of the modelling approach and sample analysed. Simultaneously, the relevant coefficient estimated for Poland differs from the baseline in neither model for both the full and truncated samples. This finding is consistent with the DCE models estimated on the full datasets comprising representative samples of citizens (rather than extenders exclusively) collected in the four countries (Valasiuk et al. 2017, 2018, 2023) where unlike Belarusians and Poles, Scandinavian respondents' preferences reflected positive cross-border spill overs arising from TNPA functioning and – correspondingly – their reciprocal more internationally co-operative behaviour. This tendency might be explained with differences in socioeconomic context or border regime between the two dyads. Thus, impact of the border dividing the national segments of TNPA provides an obvious explanation as the hard frontier/visa regime and institutional differences across the border impeding the cross-border

tourist traffic[4] 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.

Of all the sociodemographic variables, apart from the respondents' age which appeared negative and significant just in the Binary Logit model estimated on the full sample, only education and number of minor children in extenders' care proved relevant. The direction of their impact on abstaining from pay is rather consistent with *a priori* expectations. Thus, a higher level of formal education negatively and significantly covariates with the frequency of the extenders' abstaining from pay for all the models except NEGBI estimated for the truncated sample. Simultaneously, the opposite is true for the variable indicating the number of children under 18 y.o. which positively covariates with the extenders' frequency of abstaining from pay for the greater spatial protection of TNPA in the case of Binary logit models regardless of the sample analysed. The latter regularity might be explained with a less tough budget constraint after funding their primary family responsibilities with those having a fewer number of materially dependent children.

Interactions of the target independent variable DEB_FREE with the two different indicators of incentive compatibility, demonstrate the opposite patterns, where positive and highly significant coefficients with the variables' interaction $INC\_COM * DEB\_FREE$ increase the frequency of abstaining from pay in the three models out of four (except the Binary logit estimated for the full sample of extenders) while negative and highly significant coefficients with the interaction $INC\_COMP * DEB\_FREE$ reduces it for all the four models.

In accordance with the theory of incentive compatibility, a single binary choice is an incentive-compatible elicitation format in the case of public goods (Carson and Groves 2007), whereas a sequence of binary choice questions – implying $INC\_COM = 1$ – retains incentive compatibility property under condition that choices in the sequence are independent from each other (Vossler et al. 2012, Weng et al. 2021). At the same time, in accordance with the Gibbard-

[4] 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. Moreover, 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.

Satterthwaite necessary condition for incentive compatibility (Gibbard 1973, Satterthwaite 1975), a sequence of multinomial choice questions with $k > 2$ alternatives (though obeying the same condition of independence of choices) is by default not incentive-compatible. As the modelling results suggest, in three models out of the four the extenders who simultaneously (1) stated their trust in unilateral foreign provision of the public good and (2) faced a theoretically more incentive compatible design (implying $INC\_COM * DEB\_FREE = 1$) *ceteris paribus* abstained from pay more frequently compared to their counterparts having faced a less incentive-compatible design. At the same time, a combination of higher perceived consequentiality of the valuation exercise with higher trust in unilateral foreign provision of the public good under consideration – implying $INC\_COMP * DEB\_FREE = 1$ – further reduces the extenders' frequency of picking status quo in the DCE exercise.

Thus, the two incentive compatibility indicators affect their frequency of the abstaining from pay by pushing it in opposite directions, whereas the former indicator seems more reliable of the two as it rests on the theoretically-driven assumptions. Since by definition, respondents in an incentive-compatible setting cannot do better than answering truthfully (Vossler et al. 2012), extenders believing in the unilateral foreign designation of the TNPA might overstate their willingness to participate in the market if facing a DCE design other than repeated binary choice. Overstating environmental preferences compared to weaker actions of the same group in voluntarily engaging in environmental behaviours has been widely considered a tendency explained through free-riding concept (e.g., Foster et al. 1997, Wiser 2007) as in case of stated preferences studies with voluntary payment vehicle, an initial survey positive response helps to set up the later opportunity to free ride with respect to the actual contribution (Carson & Groves 2007, Zawojska & Czajkowski 2017). However, a coercive payment vehicle used in the original DCE surveys points at other possible reasons for overstating their willingness to co-operate. For instance, their motives might be rooted in social conformism (i.e., be influenced by the supposedly socially approved patterns), altruism, and/or in a warm glow effect (e.g., Hartmann et al. 2017)[5]. On the contrary, the extenders having faced the incentive compatible experimental design might behave more in line with their true preferences when stating their best choices, hence a more frequent abstaining from pay.

Although, as our results hint, the extenders' co-operative tendency in response to anticipated unilateral foreign provision prevailed in the case of the two TNPA under

[5] In this regard, a statement of perceived consequentiality of the survey might follow the same pattern, since it might be considered 'wiser' to believe in possibility of new taxes than doubt therein.

consideration, if taken standalone, the concurring tendency to abstain from pay more frequently when facing the incentive-compatible design might point at a respondents' more pronounced inclination towards refraining from the market, had the entire experimental design be theoretically incentive-compatible (i.e., if every choice set in the sequence was comprising a single programme alternative put against status quo).

4. Conclusions

First and foremost, no empirical evidence of *international* free-riding (modelled as a dependence between an individual's higher trust into unilateral foreign provision of the TNPA and her more frequent abstaining from pay for it as a whole) was found in the sample of those respondents who have explicitly supported spatial extension of their binational TNPA (i.e. Białowieża Forest in the case of Belarusians and Poles or Fulufjället in the case of Norwegians and Swedes) regardless of the modelling approach and sample analysed. Instead, according to the NEGBI models a greater trust in the unilateral foreign extension of the TNPA covariates with more co-operative preferences of the respondent.

Second, a tendency of extenders believing in unilateral provision of TNPA by the adjoining party towards a more frequent refraining from the market under a more incentive-compatible experimental design was detected. This hints at a possibility of less co-operative preferences provided a fully incentive-compatible experimental design of the original stated preferences valuation studies. At the same time, a higher self-declared trust in consequences of the stated preference survey leads to a more co-operative behaviour of extenders who trust in foreign unilateral conservation action.

Third, use value expectations, which have proved crucial as the home bias determinant in preferences stated by the representative samples of citizens towards TNPA, demonstrated a weaker relevance with regards to frequency of refraining from the market among subsample of those respondents who have explicitly supported TNPA spatial extension. Visiting experience in the past proved irrelevant in this respect.

Fourth, socio-demographical characteristics demonstrated a limited impact though consistent with the *a priori* expectations. Whilst a higher education co-variated with the higher propensity of participating in the market, a higher number of dependent minor children proved a mitigator thereof.

Fifth, a general context embedded in the country-specific dummy variables points at the significantly less frequent abstaining from pay by the self-declared supporters of TNPA extension in the Scandinavian case compared to the Białowieża case which is totally consistent with the earlier findings thus pointing at their robustness.

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