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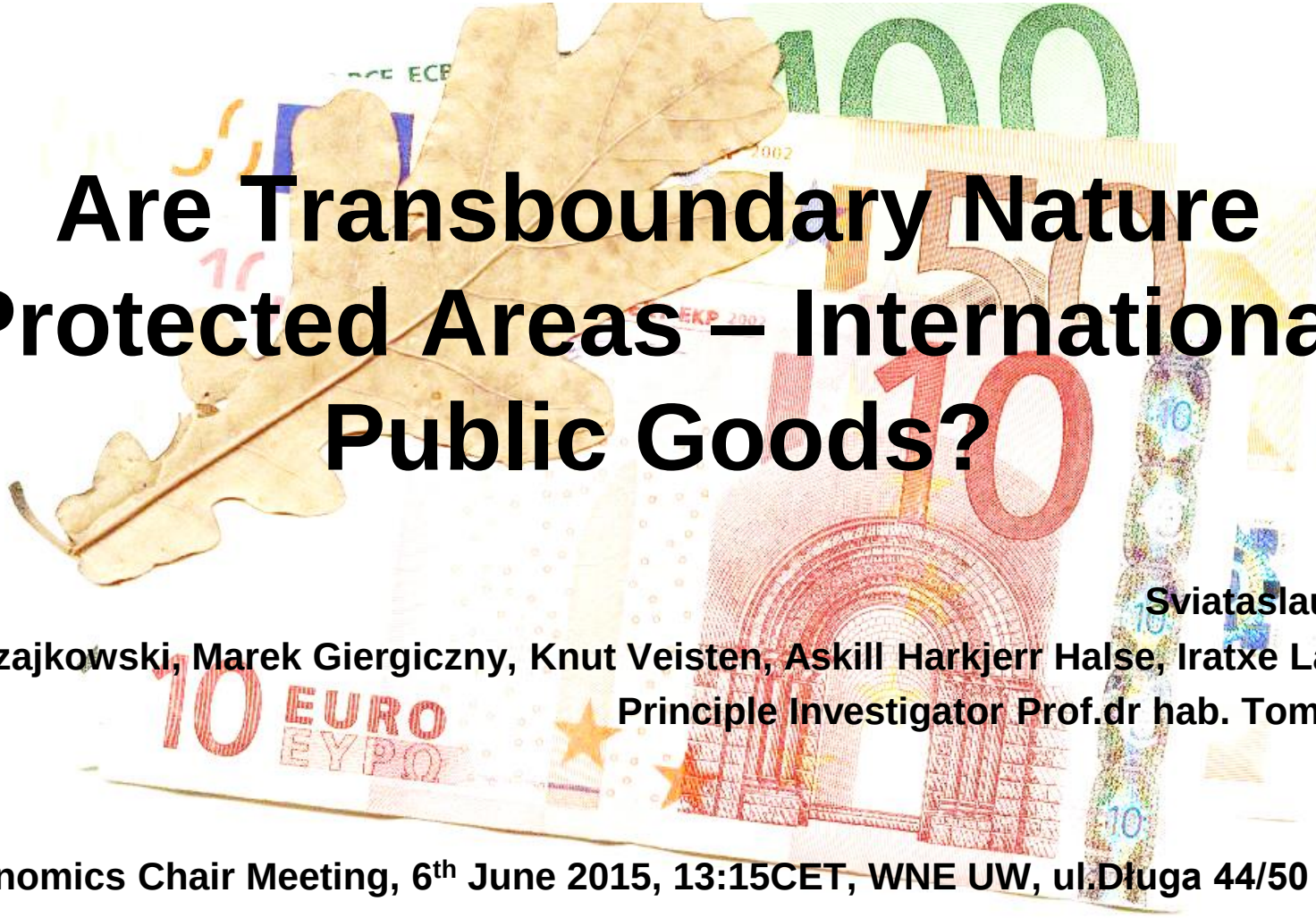

Are Transboundary Nature Protected Areas – International Public Goods?

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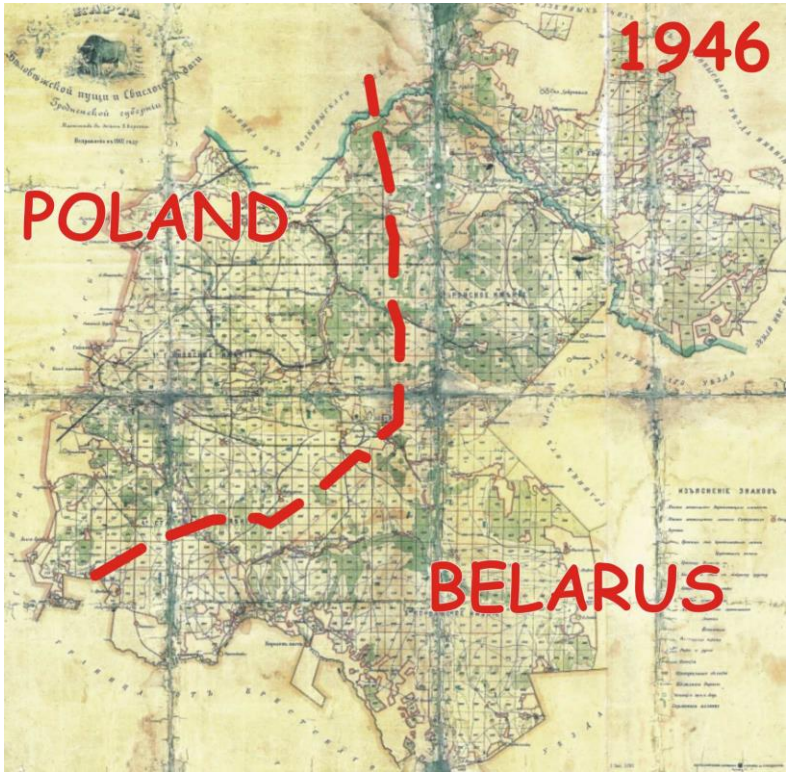
Motivation

Transboundary Nature Protected Areas (TNPA) – contiguous natural complexes, artificially divided with the state borders and protected on every side of the border

- 188 TNPA in 112 countries S=3.2mio sq.km (≅India), 17% of total PAs' [Chester, 2008]
- Significant scientific and popular literature in natural disciplines
- Scarce literature in economics [Busch, 2007] including empirical studies
- Idea of passive protection
- Białowieża/Biełavieskaja Pušča



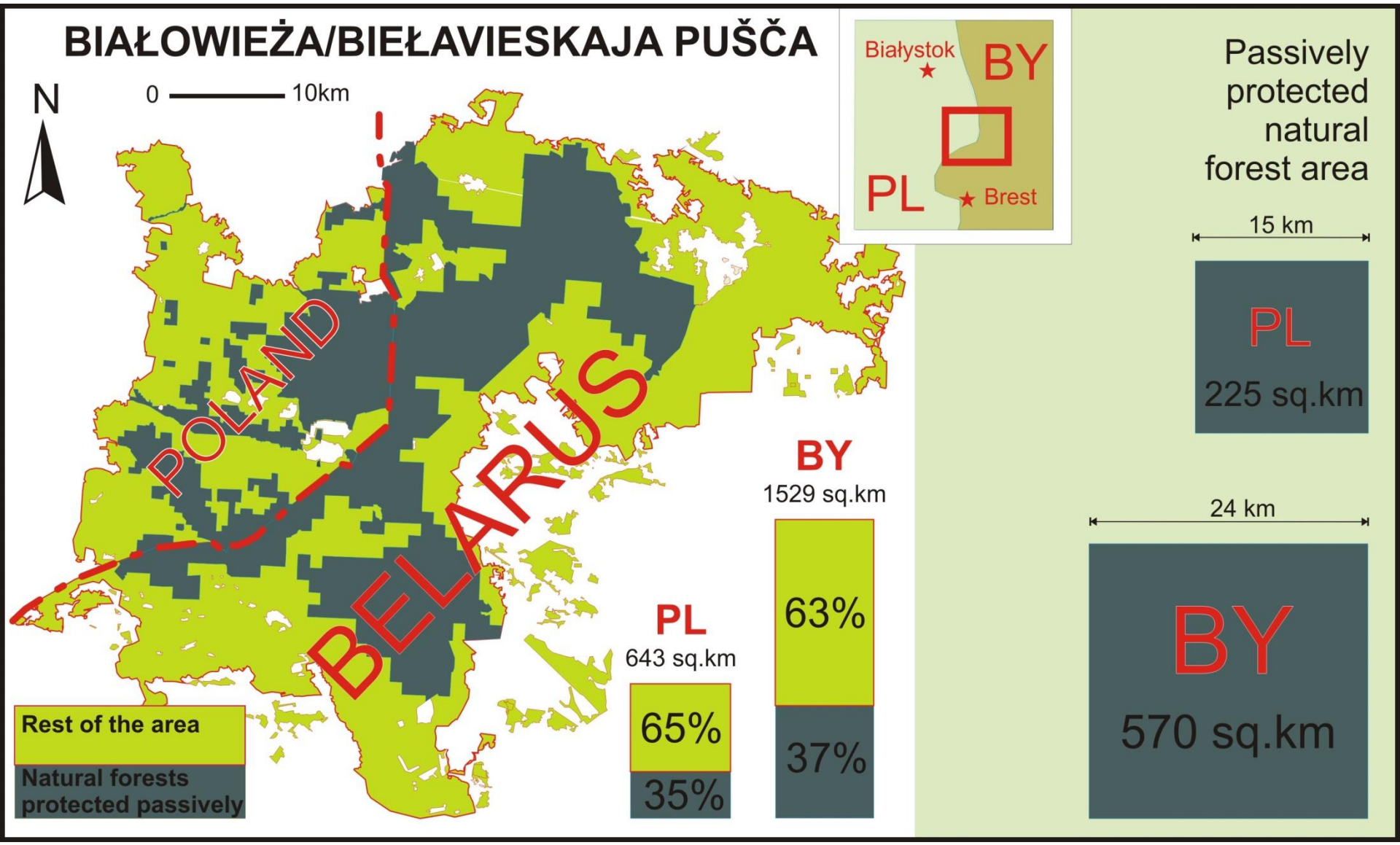
Are TNPAs **international public goods?**

- Natural sciences: definitely
- Economics: far from trivial
  - Non-exclusion principle applies;
  - Non-rivalry principle applies;
  - Not being sold out or exchanged on regular markets => no market prices for them exist.

  Many natural goods theoretically qualify for being the international public goods…

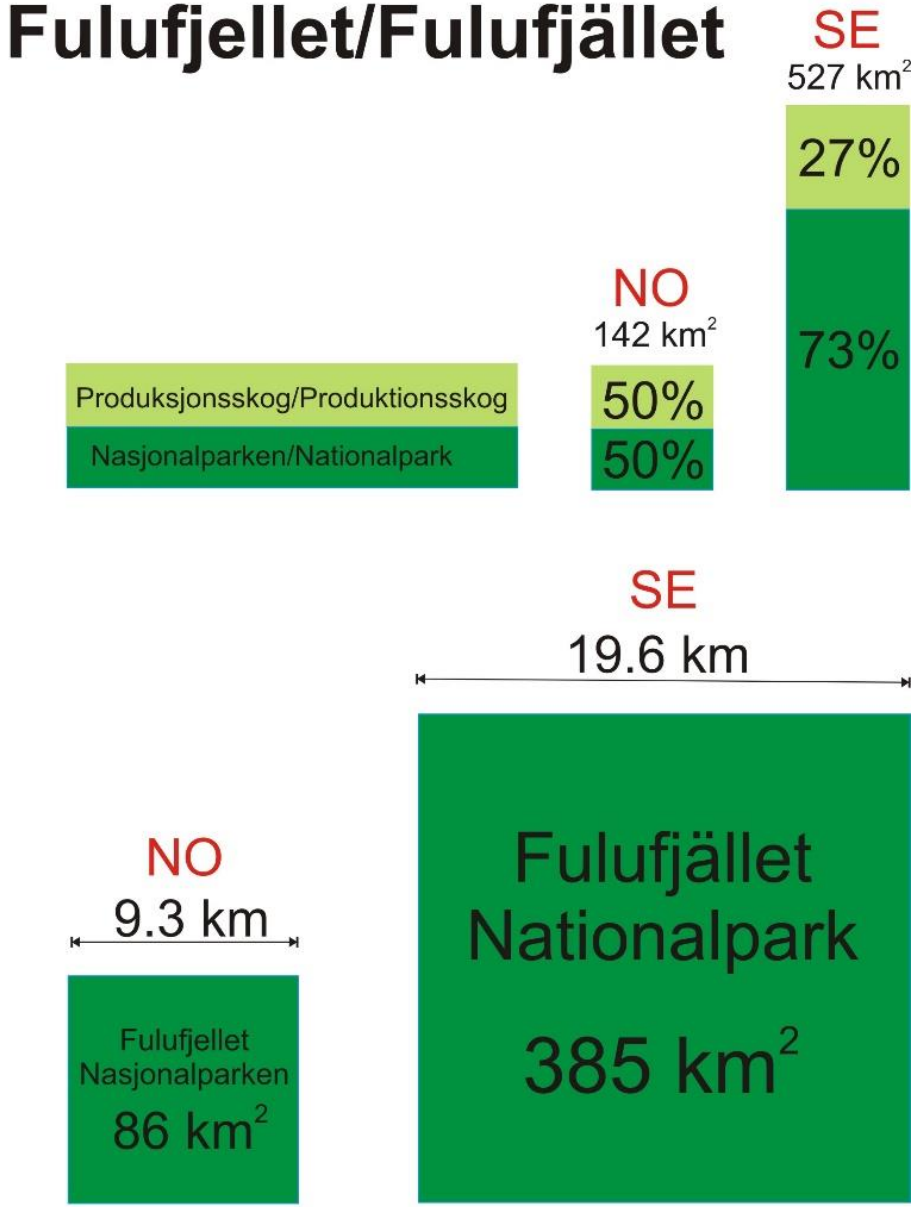
  …but empirical evidence is needed if the theory is consistent with people's real preferences.

Study sites

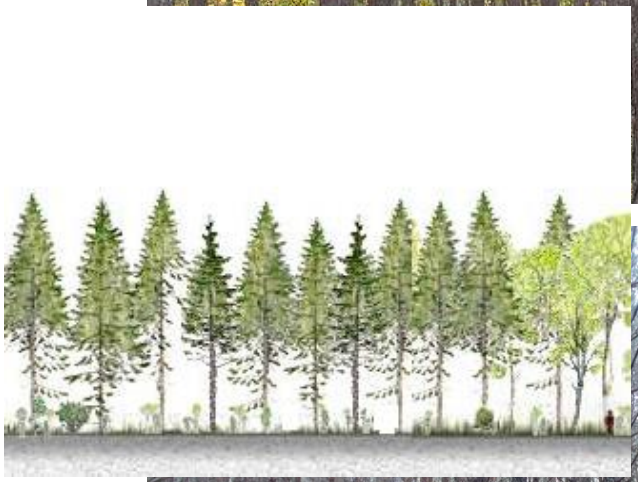

BIAŁOWIEŻA/BIEŁAVIESKAJA PUŠČA
N
0
10km
POLAND
BELARUS
Białystok
BY
PL
Brest
Passively protected natural forest area
15 km
PL
225 sq.km
24 km
BY
570 sq.km
BY
1529 sq.km
63%
37%
PL
643 sq.km
65%
35%
Rest of the area
Natural forests protected passively

Study sites


Lilladålen NR
Mörkret
N
S
Fulan
Fulufjället
Nationalpark
Gördalen
SVERIGE
Linnes
Bergaå
Morkbäckssätern
Fregn NR
Fulufjellet
Nasjonalparken
NORGE
NO
SE
0
10 km


Fulufjellet/Fulufjället
SE
527 km²
27%
73%
NO
142 km²
50%
50%
Produksjonsskog/Produktionsskog
Nasjonalparken/Nationalpark
SE
19.6 km
NO
9.3 km
Fulufjellet
Nasjonalparken
86 km²
Fulufjället
Nationalpark
385 km²

Intact Natural Forest vs. Production Forest



Empirical study setting

Methodology – stated preferences, DCM

Comparative study – two mutually consistent bilateral surveys of people's preferences:

- Białowieża/Biełavieskaja Pušča (PL/BY, CAPI, N=1000+1000);
- Fulufjellet/Fulufjället (NO/SE, CAWI, N=1000+1000).

Payment vehicle – compulsory income tax increase, introduced and charged nationally and then transferred to bilateral target fund (initially thought about voluntary contributions as payment vehicle).

Survey scenario:

- introduces transboundary nature protected area as a common good of the both nations involved;
- contemplates enlargement of the existing passive protection zone in order to provide restoration of semi-intact forest ecosystems in distant future.

Empirical study setting: survey scenario

Core idea of the scenario: passive protection regime expansion => forest ecosystems' restoration in a long run.

Every spatial unit (sq.km) of the to-be-protected area is the same, regardless of its particular location on either side of the border.

Survey design

Attribute	Levels for the national versions of the questionnaire (main survey)			
	PL	**BY**	**NO**	**SE**
Expansion of the strict reserve protection regime in the domestic part of the site under consideration SQ= +0 sq.km	+ 0 sq.km + 35 sq.km + 70 sq.km + 105 sq.km	+ 0 sq.km + 35 sq.km + 70 sq.km + 105 sq.km	+ 0 sq.km + 20 sq.km + 40 sq.km + 60 sq.km	+ 0 sq.km + 20 sq.km + 40 sq.km + 60 sq.km
Expansion of the strict reserve protection regime in the foreign part of the site under consideration SQ= +0 sq.km	+ 0 sq.km + 35 sq.km + 70 sq.km + 105 sq.km	+ 0 sq.km + 35 sq.km + 70 sq.km + 105 sq.km	+ 0 sq.km + 20 sq.km + 40 sq.km + 60 sq.km	+ 0 sq.km + 20 sq.km + 40 sq.km + 60 sq.km
Additional sum of income tax paid annually during the next five years (2015 prices) SQ= 0	25 PLN 50 PLN 75 PLN 100 PLN	3 USD 6 USD 9 USD 12 USD	125 NOK 250 NOK 375 NOK 500 NOK	100 SEK 200 SEK 300 SEK 400 SEK

Design versions:

SQ+1 – incentive compatible version – 1/3;

SQ+2 – standard version – 1/3;

SQ+3 – more informative (however complicated) version – 1/3.

Sixteen choice-sets for every respondent; best choice question.

Choice-set appearance example (SQ+3 version)

Wybór wariantów 1	Stan obecny	Wariant 1	Wariant 2	Wariant 3
Dodatkowe obszary w polskiej części Puszczy Białowieskiej objęte ochroną bierną (Łączny procent ochrony biernej w polskiej części Puszczy Białowieskiej	+ 0 km^2 (35%)	+ 105 km^2 (51%)	+ 70 km^2 (46%)	+ 0 km^2 (35%)
Dodatkowe obszary w białoruskiej części Puszczy Białowieskiej objęte ochroną bierną (Łączny procent ochrony biernej w białoruskiej części Puszczy Białowieskiej)	+ 0 km^2 (37%)	+ 105 km^2 (44%)	+ 0 km^2 (37%)	+ 35 km^2 (40%)
Dodatkowa kwota podatków od Pana/Pani dochodów pobierana raz do roku przez pięć lat	Brak	100 PLN	50 PLN	75 PLN
Proszę wybrać najlepszy wariant	☐	☐	☐	☐

Respondent's utility function specification

linear:

$V=\beta_{SD}*S_D + \beta_{SF}*S_F + \beta_{COST}*Bid,$

where

SD – additional strict reserve area on domestic side, km^2

SF – additional strict reserve area on foreign side, km^2

Bid – additional annual sum of income tax during five years to finance the conservation programme, PLN (NOK, SEK, USD)

or non-linear:

$V=\beta_{D1}*S_{D1} + \beta_{D2}*S_{D1} + \beta_{D3}*S_{D3} + \beta_{F1}*S_{F1} + \beta_{F2}*S_{F2} + \beta_{F3}*S_{F3} + \beta_{COST}*Bid$

where

S_{D1} … S_{D3} - dummy variables for the particular programmes of additional strict reserve area on domestic side, km^2

S_{F1} … S_{F3} - dummy variables for the particular programmes of additional strict reserve area on foreign side, km^2

Bid – additional annual sum of income tax during five years to finance the conservation programme, PLN (NOK, SEK, USD)

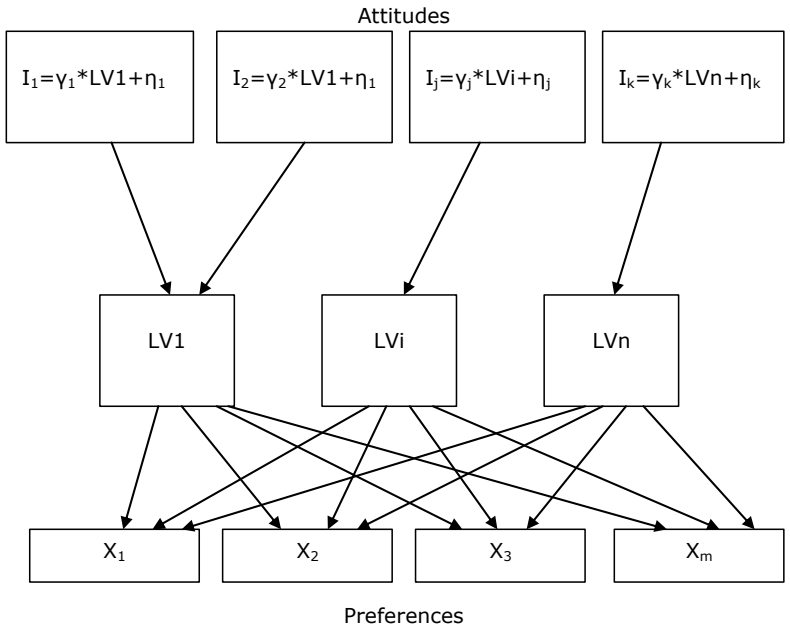
Hypothesis testing: if statistically $\beta_D = \beta_F$ =>

H0: *transboundary NPA qualifies as the* ***international public good*** *in accordance with the preferences of the appropriate population* – **cannot be rejected**

Otherwise two separate national public goods exist instead of the common one

Hybrid modelling

Hybrid choice models allow analysts to incorporate perceptions and cognitive processes into a Random Utility Model (RUM) framework. In this study we develop a Hybrid Mixed Logit (HMXL) model which combines the framework widely adopted for analysing DCE data, the Mixed Logit [Revelt and Train, 1998], with the Multiple Indicators and Multiple Causes (MIMIC) model.



I expect to visit the domestic side of the site under consideration in the next five years	LV1
I expect to visit the foreign side of site under consideration in the next five years	
I believe that the participation of Poland (Sweden) in the programme funding should be higher than the participation of Norway (Belarus) because the Polish (Swedish) population is greater than the Belarusian (Norwegian) population	LV2
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	
I am afraid that money spent on the protection on the foreign side of the site under consideration could be misused	LV3
I expect the domestic part to comply with the international agreement to a larger extent than the foreign part	
I expect the foireign 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	LV4
I prefer better to protect the domestic side of the site under consideration than its foreign side because it belongs to my country	LV5

Econometric Modelling: DCM component

RUM [McFadden, 1974]: $U_{ni} = V_{ni} + \varepsilon_{ni}$ $\quad P_{ni} = \Pr(V_{ni} + \varepsilon_{ni} > V_{nj} + \varepsilon_{nj} \forall j \neq i)$

Under IID assumption – MNLModel $\quad P_{ik} = \dfrac{e^{\beta' x_{ni}}}{\sum_j e^{\beta' x_{nj}}}$

x explanatory variables' vector, a *β* – parameters' vector. [Train, 2003].

Under assumption of preferences' heterogeneity MXL model (panel version) $\quad P_{ni} = \int \prod_{t=1}^{T} \left[\dfrac{e^{\beta_n' x_{nit}}}{\sum_j e^{\beta_n' x_{njt}}} \right] \phi(\beta | b, \Omega) d\beta,$

Modelling in WTP space

[Train and Weeks, 2005] $\quad U_{ijt} = \sigma_i a_i \left(c_{ijt} + \dfrac{\boldsymbol{b}_i'}{a_i} \boldsymbol{X}_{ijt} \right) + \varepsilon_{ijt} = \lambda_i \left(c_{ijt} + \boldsymbol{\beta}_i' \boldsymbol{X}_{ijt} \right) + \varepsilon_{ijt}$

For normally distributed parameters β_i: $\quad \boldsymbol{\beta}_i = \boldsymbol{\Lambda}' \mathbf{L} \mathbf{V}_i + \boldsymbol{\beta}_i^*$

for log-normally distributed parameters (cost): $\quad \lambda_i = \exp\left(\boldsymbol{\tau}' \mathbf{L} \mathbf{V}_i + \lambda_i^* \right)$

the conditional probability of individual i's choices in choice set t is given by:

$$P(y_i \mid X_i, \boldsymbol{\beta}_i^*, \lambda_i^*, LV_i, \Lambda, \boldsymbol{\tau}, \boldsymbol{\theta}) = \prod_{t=1}^{T_i} \frac{\exp\left(\lambda_i \left(c_{ijt} + \boldsymbol{\beta}_i' \boldsymbol{X}_{ijt} \right) \right)}{\sum_{k=1}^{C} \exp\left(\lambda_i \left(c_{ikt} + \boldsymbol{\beta}_i' \boldsymbol{X}_{ikt} \right) \right)},$$

WTP_{LV} are given for the respondent being one σ to the right from the mean, LVi~N(0,1); therefore LVi=1

Econometric Modelling: Measurement Equations

The measurement component of the hybrid choice model can be specified as follows: $\mathbf{I}_i^* = \boldsymbol{\Gamma}'\mathbf{LV}_i + \boldsymbol{\eta}_i$

Under this specification, the relationship between and (for the i-th indicator variable which takes possible, ordered values) becomes:

$$\begin{array}{lll} I_{il} = 1, & \text{if} & I_{il}^* < \alpha_{1l} \\ \vdots & \vdots & \vdots \\ I_{il} = k, & \text{if} & \alpha_{k-1l} \le I_{il}^* < \alpha_{kl} \\ \vdots & \vdots & \vdots \\ I_{il} = J, & \text{if} & \alpha_{J-1l} \le I_{il}^* \end{array}$$

where the α's are the threshold parameters to be estimated for each indicator.

This specification leads to the ordered probit likelihood form for I_i:

$$P\left(I_i \mid \mathbf{LV}_i, \boldsymbol{\Gamma}, \boldsymbol{\alpha}\right) = \prod_{l=1}^{L}\left(P\left(I_{il} \mid \mathbf{LV}_i, \boldsymbol{\Gamma}_l, \alpha_l\right)\right) = \prod_{l=1}^{L}\left(\Phi\left(\alpha_{kl} - \boldsymbol{\Gamma}_l'\mathbf{LV}_i\right) - \Phi\left(\alpha_{k-1l} - \boldsymbol{\Gamma}_l'\mathbf{LV}_i\right)\right)$$

where $\Phi(\cdot)$ denotes the normal cdf, Γ_l and α_l are the l-th row of the $\boldsymbol{\Gamma}$ matrix and the vector of the threshold parameters for the l-th indicator variable, respectively.

Survey Administeting & Sample

Pilot surveys

- BY: CAPI, N=100, July 2015
- PL: CAPI, N=100, January 2016
- NO: CAWI, N=282, September 2015
- SE: CAWI, N=458, September 2015

Main surveys

- BY: CAPI, N=900, October-December 2015
- PL: CAPI, N=901, February 2016
- NO: CAWI, N=902, October-November 2015
- SE: CAWI, N=889, October-November 2015

Total sample after protesters' removal

- BY: N=755,
- PL: N=763,
- NO: N>1000
- SE: N>1166

Results and Discussion

The following models' results will be presented and discussed below:

- MNL for the entire datasets of PL/BY and NO/SE cases without protesters (non-linear specification)
- MXL for the entire datasets of PL/BY and NO/SE cases without protesters (non-linear specification)
- Hybrid MXL for BY/PL and NO/SE cases, without protesters (linear specification)

Results and Discussion: Białowieża

	MNL						MXL					
	Poland			Belarus			Poland			Belarus		
var.	coef.	st.err.	p-value	coef.	st.err.	p-value	coef.	st.err.	p-value	coef.	st.err.	p-value
SQ	-0,3567	0,0873	0,0000	6,7204	2,0048	0,0008	-0,9981	0,0455	0,0000	7,0416	2,2804	0,0020
BY +35 km2	-0,0715	0,0676	0,2903	0,9255	0,5475	0,0910	-0,0332	0,0320	0,3002	1,2140	0,5530	0,0282
BY +70 km2	-0,1164	0,0703	0,0980	1,9372	0,6775	0,0042	-0,0611	0,0376	0,1045	2,3148	0,7064	0,0011
BY +105 km2	-0,2776	0,0731	0,0001	0,9527	0,5491	0,0827	-0,1483	0,0447	0,0009	0,8009	0,5846	0,1707
PL +35 km2	1,0203	0,0789	0,0000	0,6553	0,4891	0,1804	0,6499	0,0420	0,0000	0,6292	0,4894	0,1986
PL +70 km2	1,2595	0,0779	0,0000	-2,6681	0,7613	0,0005	0,9386	0,0472	0,0000	-2,6637	0,7544	0,0004
PL +105 km2	1,5597	0,0784	0,0000	-1,7155	0,6007	0,0043	1,1855	0,0557	0,0000	-1,7987	0,6055	0,0030
-COST (10 EUR PPP)	0,6440	0,0152	0,0000	0,0926	0,0210	0,0000	0,7096	0,0673	0,0000	-2,3243	0,2213	0,0000
							Standard deviations					
SQ							3,0682	0,1289	0,0000	25,6804	5,7572	0,0000
BY +35 km2							0,0160	0,0328	0,6256	0,2632	1,3485	0,8452
BY +70 km2							0,1324	0,0515	0,0101	0,1811	1,6173	0,9109
BY +105 km2							0,3954	0,0523	0,0000	4,5209	1,1350	0,0001
PL +35 km2							0,3512	0,0279	0,0000	2,3018	1,0096	0,0226
PL +70 km2							0,6080	0,0449	0,0000	0,2605	1,3899	0,8513
PL +105 km2							1,0041	0,0396	0,0000	0,0670	1,9732	0,9729
-COST (10 EUR PPP)							1,3377	0,0742	0,0000	0,4513	0,0840	0,0000
Model characteristics												
LL0		-12095,3422			-12067,9768			-12095,3422			-12067,9768	
LL		-10880,2726			-12060,2191			-7116,8255			-9710,7829	
McFadden R2		0,1005			0,0006			0,4116			0,1953	
Ben-Akiva R2		0,4325			0,3988			0,5979			0,4906	
AIC/n		1,8027			1,9771			1,1809			1,5935	
n		12080 (755)			12208 (763)			12080 (755)			12208 (763)	
k		8			8			16			16	

Results and Discussion: Fulufje/ället

	MNL						MXL					
	Norway			Sweden			Norway			Sweden		
var.	coef.	st.err.	p-value	coef.	st.err.	p-value	coef.	st.err.	p-value	coef.	st.err.	p-value
SQ	0,2000	0,1052	0,0574	0,5164	0,1276	0,0001	-2,2359	0,1175	0,0000	-2,1731	0,2043	0,0000
NO +20 km2	1,5467	0,0916	0,0000	0,8388	0,0911	0,0000	1,2322	0,0565	0,0000	0,6039	0,0514	0,0000
NO +40 km2	2,4660	0,0974	0,0000	0,9170	0,0976	0,0000	1,9547	0,0659	0,0000	0,6627	0,0550	0,0000
NO +60 km2	2,8792	0,1012	0,0000	1,2176	0,0920	0,0000	2,2979	0,0792	0,0000	0,8482	0,0535	0,0000
SE +20 km2	0,5888	0,0781	0,0000	1,7009	0,1088	0,0000	0,3669	0,0450	0,0000	1,0850	0,0464	0,0000
SE +40 km2	0,7983	0,0821	0,0000	2,4973	0,1130	0,0000	0,5979	0,0542	0,0000	1,6121	0,0493	0,0000
SE +60 km2	0,8892	0,0779	0,0000	2,8648	0,1166	0,0000	0,6562	0,0551	0,0000	1,9568	0,0675	0,0000
COST (10 EUR PPP)	0,4411	0,0130	0,0000	0,3540	0,0105	0,0000	0,0031	0,0440	0,9433	0,0347	0,0505	0,4921
							Standard deviations					
SQ							7,3737	0,3335	0,0000	7,9508	0,6947	0,0000
NO +20 km2							0,7054	0,0590	0,0000	0,2403	0,0631	0,0001
NO +40 km2							0,8682	0,0569	0,0000	0,7230	0,0504	0,0000
NO +60 km2							1,5723	0,0807	0,0000	0,7918	0,0608	0,0000
SE +20 km2							0,1841	0,0644	0,0042	0,4159	0,0656	0,0000
SE +40 km2							0,5073	0,0591	0,0000	0,5674	0,0475	0,0000
SE +60 km2							0,6936	0,0501	0,0000	1,1679	0,0532	0,0000
COST (10 EUR PPP)							1,0094	0,0453	0,0000	1,1978	0,0472	0,0000
Model characteristics												
LL0			-17276,3682			-20010,4524			-17276,3682			-20010,4524
LL			-16326,0857			-19114,6512			-10386,5666			-11862,1357
McFadden R2			0,0550			0,0448			0,3988			0,4072
Ben-Akiva R2			0,3734			0,3708			0,5603			0,5701
AIC/n			2,0404			2,0487			1,2994			1,2726
n			16011 (1000,69)			18668 (1166,75)			16011 (1000,69)			18668 (1166,75)
k			8			8			16			16

Results and Discussion: Białowieża case

PL:

- considerable heterogeneity of preferences;
- willingness to depart from status quo;
- positive preferences and indifference towards programmes domestic extension of the passive protection;
- almost linear (slightly decreasing per sq.km) WTP;
- indifference and negative preferences towards the foreign part

BY

- preferences dominated by status quo;
- though parameters with some of programmes are posistive and significant, none of them alone outweights utility loss caused by departure from SQ;
- negative preferences towards any of the foreign part extension programmes

In accordance with LR-test, IPG hypothesis failed, therefore two separate public goods exist instead

Results and Discussion: Fulufje/ället case

Both NO&SE:

- similar and mirror-like performance;
- considerable heterogeneity of preferences;
- willingness to depart from status quo;
- positive preferences towards both domestic and foreign side extension of passive protection regime;
- WTP slightly decreasing per sq.km;
- though unlike PL&BY, Scandinavian countries' respondents state mutually co-operative preferences, IPG hypothesis failed with them too.

Verifying LVs compatibility with the IPG-state

Utility function modified for the HMXL: $U = WTP_t *(S_d + S_f) + WTP_{af} * S_f$

IPG criterion: $WTP_{af}=0$ (z-test for WTP_{af} should hold);
additional criterion (strong assumption):
$WTP_t=WTP_d>0$, $WTP_f = WTP_t + WTP_{af} >0$

Latent variables' impact:
$U = WTP_t*(S_d +S_f)+ WTP_{af}*S_f + WTP_{LVt}*LV*(S_d +S_f) + WTP_{LVaf}*LV*S_f$
or
$U = (S_d +S_f)*[WTP_t + WTP_{LVt}*LV] + S_f*[WTP_{af} + WTP_{LVaf}*LV]$

$[WTP_t + WTP_{LVt}*LV]$ and $[WTP_{af} + WTP_{LVaf}*LV]$ – simulated impact of LVs (and attitudes – via appropriate measurement equations' indicators)

If $WTP_t(LV_i) = WTP_t + WTP_{LVit}*LV_i > 0$
$WTP_f(LV_i) = [WTP_t + WTP_{LVit}*LV_i] + [WTP_{af} + WTP_{LViaf}*LV_i] >0$
and $|WTP_{af}| > |WTP_{af} + WTP_{LViaf}*LV_i|$ – then LV_i is true IPG-driver

Hybrid Modelling and Simulation: Poland

		Latent variables				
		LV1	LV2	LV3	LV4	LV5
Correlation of LV with attitudinal questions						
Intention to visit own part		-0,92224				
Intention to visit foreign part		-1,81435				
PL should protect more (population)			-0,30736			
PL should protect more (wealth)			-0,62626			
Foreign side will misuse money				-0,76153		
Own side will comply more				-0,55969		
Foreign side will extend anyway					-0,15749	
Willing to protect own just because it is own						-0,34155
Interactions of LV with programme attributes						
SQ	-1,42362	0,176272	-0,23048	-1,288	-0,51543	0,919471
Total extension (100 sq.km)	1,07675	-0,24297	0,425304	0,710191	-1,04361	-1,42857
Foreign extension (100 sq.km)	-1,37366	-0,08804	-0,40599	-0,26452	1,05562	1,45814
Total WTP for foreign extension (WTP_f=WTP_t + WTP_{af})	-0,29691					
WTP_d - WTP_f	1,373656					
Simulated model parameters						
LV-shifted SQ		-1,24734	-1,65409	-2,71162	-1,93905	-0,50414
LV-shifted total extension (100 sq.km)		0,833781	1,502055	1,786942	0,033144	-0,35182
LV-shifted foreign extension (100 sq.km)		**-1,46169**	**-1,77965**	**-1,63817**	**-0,31804**	**0,084484**
LV-shifted total WTP for foreign extension (WTP_f=WTP_t + WTP_{af})		-0,62791	-0,27759	0,148768	-0,28489	-0,26734
LV-shifted WTP_d - LV-shifted WTP_f		1,461695	1,779648	1,638173	0,318037	-0,08448

Simulation outcomes: Poland

LV4 and LV5 shift preferences towards IPG-state, however

- LV5 sets $WTP_t = WTP_{PL} < 0$, the goods turns into bad;
- LV4 retains $WTP_f = WTP_{BY} < 0$.

LV4: less PL respondents believe in BY unilateral action → smaller $WTP_{PL} – WTP_{BY}$, whilst $WTP_{PL} = WTP_t$ decreases considerably.

LV1, LV2, LV3 shift preferences out from IPG-state:

LV1: weaker intension to use → less profound preferences toward protection (the Poles on average have weaker chance/intension to visit BY segment)

LV2: less consent with greater contribution of PL → greater $WTP_{PL} – WTP_{BY}$ (difficult to explain)

LV3: less doubts in BY reliability → greater $WTP_{PL} – WTP_{BY}$ (shouldn't it be reverse?)

However, at the same time LV3 sets $WTP_f = WTP_{BY} > 0$

Hybrid Modelling and Simulation: Belarus

		Latent variables				
		LV1	LV2	LV3	LV4	LV5
Correlations of LV with attitudinal questions						
Intention to visit own part		-0,60639				
Intention to visit foreign part		-2,77675				
PL should protect more (population)			1,71295			
PL should protect more (wealth)			1,050399			
Foreign side will misuse money				0,534364		
Own side will comply more				0,521459		
Foreign side will extend anyway					-0,08689	
Willing to protect own just because it is own						-0,24923
Interactions of LV with programme attributes						
SQ	17,11199	11,63155	3,304628	10,24532	28,20141	24,57952
Total extension (100 sq.km)	0,877193	-0,84312	-1,33632	0,742984	-0,78298	3,365815
Foreign extension (100 sq.km)	-7,76269	-0,58804	0,535258	-1,2867	-2,81553	-4,26314
Total WTP for foreign extension (WTP_f=WTP_t + WTP_{af})	-7,76269					
WTP_d - WTP_f	7,76269					
Simulated model parameters						
LV-shifted SQ		28,74354	20,41662	27,35731	45,3134	41,69151
LV-shifted total extension (100 sq.km)		0	-1,33632	0	0	3,365815
LV-shifted foreign extension (100 sq.km)		**-7,76269**	**-7,76269**	**-7,76269**	**-10,5782**	**-12,0258**
LV-shifted total WTP for foreign extension (WTP_f=WTP_t + WTP_{af})		-7,76269	-9,09901	-7,76269	-10,5782	-8,66001
LV-shifted WTP_d - LV-shifted WTP_f		7,762687	7,762687	7,762687	10,57822	12,02583

Simulation outcomes: Belarus

LV4 shifts preferences out from IPG-state, however it exhibits no correlation with appropriate attitude (there must be some unobserved driver)

LV5 also shifts preferences out from IPG-state

LV5 – the weaker ‘patriotic’ declaration → the greater WTP_{BY} - WTP_{PL}

(it should definitely be reverse!)

LV1, LV2, LV3 do not influence preferences in a IPG-relevant way.

All the LVs strongly push upwards preferences for retaining status quo.

Hybrid Modelling and Simulation: Norway

		Latent variables				
		LV1	LV2	LV3	LV4	LV5
Correlations of LV with attitudinal questions						
Intention to visit own part		-2,56478				
Intention to visit foreign part		-3,65719				
SE should protect more (population)			-0,14642			
NO should protect more (wealth)			-0,13681			
Foreign side will misuse money				1,659765		
Own side will comply more				0,238319		
Foreign side will extend anyway					0,333442	
Willing to protect own just because it is own						0,11652
Interactions of LV with programme attributes						
SQ	-3,26455	1,296234	-0,09961	-0,07533	-3,30098	-0,19502
Total extension (100 sq.km)	3,914297	-1,12194	1,824798	-1,07011	5,16585	1,566146
Foreign extension (100 sq.km)	-3,21773	0,266302	-1,93102	0,252599	-2,87557	-2,46956
Total WTP for foreign extension ($WTP_f=WTP_t + WTP_{af}$)	0,696568					
$WTP_d - WTP_f$	3,217728					
Simulated model parameters						
LV-shifted SQ		-1,96832	-3,26455	-3,26455	-6,56553	-3,45957
LV-shifted total extension (100 sq.km)		2,79236	5,739095	2,84419	9,080147	5,480443
LV-shifted foreign extension (100 sq.km)		**-2,95143**	**-5,14875**	**-2,96513**	**-6,0933**	**-5,68729**
LV-shifted total WTP for foreign extension ($WTP_f=WTP_t + WTP_{af}$)		-0,15907	0,590348	-0,12094	2,986851	-0,20685
LV-shifted WTP_d - LV-shifted WTP_f		2,951426	5,148748	2,96513	6,093296	5,687292

Simulation outcomes: Norway

LV1 and LV3 shift preferences towards IPG-state, however the both set $WTP_{SE}<0$, so they both turn good into bad;

LV2, LV4, LV5 shift preferences out from IPG-state:

LV2: less consent with greater contribution of either NO or SE (because of wealth/population disproportions → greater $WTP_{NO} – WTP_{SE}$
(difficult to interpret)

LV4: more convinced of unilateral protection in SE →almost doubled $WTP_{NO} – WTP_{SE}$ (however WTP_{SE} also increased)

LV5: support to 'patriotic' declarations → greater $WTP_{PL} – WTP_{BY}$, , a patriotic premium' (a finding, consistent with the literature, e.g. Dallimer et al., 2015)

Hybrid Modelling and Simulation: Sweden

		Latent variables				
		LV1	LV2	LV3	LV4	LV5
Correlations of LV with attitudinal questions						
Intention to visit own part		2,139756				
Intention to visit foreign part		2,156328				
PL(SE) should protect more (population)			-0,2844			
PL(NO) should protect more (wealth)			-0,17362			
Foreign side will misuse money				-0,52569		
Own side will comply more				-0,79847		
Foreign side will extend anyway					-0,39016	
Willing to protect own just because it is own						-0,26934
Interactions of LV with programme attributes						
SQ	-3,4947	-1,0381	1,622078	1,131504	2,619522	2,276317
Total extension (100 sq.km)	3,521841	0,93185	-1,47107	0,044363	-3,46425	-3,67945
Foreign extension (100 sq.km)	-2,27067	-0,41163	-0,03346	0,324167	0,587516	3,298114
Total WTP for foreign extension (WTP_f=WTP_t + WTP_{af})	1,251175					
WTP_d - WTP_f	2,270666					
Simulated model parameters						
LV-shifted SQ		-4,5328	-1,87262	-2,36319	-0,87518	-1,21838
LV-shifted total extension (100 sq.km)		4,453691	2,050771	3,521841	0,057594	-0,15761
LV-shifted foreign extension (100 sq.km)		**-2,6823**	**-2,27067**	**-1,9465**	**-1,68315**	**1,027448**
LV-shifted total WTP for foreign extension (WTP_f=WTP_t + WTP_{af})		1,771392	-0,2199	1,575342	-1,62556	0,869836
LV-shifted WTP_d - LV-shifted WTP_f		2,6823	2,270666	1,946499	1,683151	-1,02745

Simulation outcomes: Sweden

LV3, LV4, LV5 shift preferences towards IPG-state, however

- LV4 sets $WTP_f = WTP_{NO} < 0$
- LV5 sets WTPt = WTPd = $WTP_{SE} < 0$, Note: $WTP_{NO} > WTP_{SE}$ (!!!)

the less support to 'patriotism' → the greater $WTP_{NO} - WTP_{SE}$

- LV3 is an unambiguous IPG-driver.

the less are doubts in NO credibility → the smaller $WTP_{SE} - WTP_{NO}$

(however, at the same time preferences towards SQ more profound)

LV2 is not IPG-relevant

LV1 shifts preferences out from IPG-state:

The stronger desire to visit the both parts → the higher WTP_{SE}, lower WTP_{NO} (Why?) and less profound preferences for the SQ.

Conclusions

- Scandinavian case is closer to the IPG-state as compared with the Białowieża case, due to co-operative preferences of Scandinian respondents, being dominant with them; however they appeared not sufficient for ensuring the true IPG-state, which was achieved in none of the cases.
- IPG-drivers are rather scarce amongst the LVs under consideration (and thus, amongst the appropriate attitudes and perceptions of the respondents) as compared to those, causing the shift in reverse direction.
- Some of the links identified between the respondents' attitudes and their preferences can be rationally explained, whilst the others seem to lack the immediate rational interpretation.
- The majority of LVs shift WTP for the total extension and additional WTP for the foreign side extension into opposite directions: while one of them is increased, another one is reduced. As a result, WTP in some cases of LVs being IPG-drivers switches the sign from positive to negative.
- Therefere, in order to be an effective IPG-driver, the factor should ideally push upwards the WTP for the both attributes.

Thank you for your attention!

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