Valuing the commons: An international study on the recreational benefits of the Baltic Sea

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The Baltic Sea

- 9 nations along its coastline
- 125 million people

- Environmental problems
  - E.g., eutrophication
- International agreements
  - E.g., HELCOM
- Benefits from the sea
  - Recreation
  - Enhanced water quality

The Baltic Sea Region

Country information
- EU member state
- Non EU member state

Economic benefits from improved coastal water quality

– The benefits demonstrated by many studies world-wide

– Broad approaches:

  – Ahtiainen and Vanhatalo (2012) – use meta-analysis to examine the benefits of improved water quality in Europe

  – Ghermandi and Nunes (2013) – derive a global map of coastal recreation values

  – Paracchini et al. (2014) – analyze, assess and discuss outdoor recreation in the EU as an ecosystem service value, including water-related recreation

– Previous valuation studies of the Baltic Sea water quality improvements:

  – Stated preferences (Markowska and Żylicz, 1999; Atkins et al., 2007; Eggert and Olsson, 2009; Kosenius, 2010; Ahtiainen et al., 2014)

  – Revealed preferences (Sandström, 1996; Soutukorva, 2005; Vesterinen et al., 2010)

  – Few internationally comparable estimates of water recreation values

Data and methods

- Travel cost based estimates of the recreational benefits of the BS
  - Identical surveys, data collected simultaneously in all nine littoral countries
  - About 1,000 respondents in each country, 9,127 observations in total
  - The number of <u>recreational</u> trips to the BS in the past 12 months

- Zero Inflated Negative Binomial regression
  - 55% of respondents did not make a trip
  - Some of them would not consider a trip even at a zero price
  - Account for that using a combination of binary probit and count data model
    - Non-participation regression – is an individual in the market for the BS-based recreation?
    - Count data model – how many trips are made
      - Corner solutions possible

Trip characteristics

	Denmark	Estonia	Finland	Germany	Latvia	Lithuania	Poland	Russia (coastal)	Sweden
No. of trips	5.96	1.82	3.95	1.21	2.64	1.66	1.11	0.46	6.42
Distance (km)	93.55	89.77	171.53	565.13	115.21	247.06	461.21	397.00	135.62
Travel time (h)	2.89	2.65	5.71	7.13	2.78	3.38	7.93	5.05	4.80
No. of trips = 0 (share of resp.)	0.37	0.40	0.49	0.75	0.53	0.65	0.69	0.93	0.28
Travel cost (EUR)	37.45	38.34	81.81	203.5	49.70	107.1	201.8	136.2	63.74
Travel cost – vehicle (EUR)	18.66	29.33	39.59	141.72	41.71	98.17	176.61	113.41	28.64
Travel cost – time (EUR)	18.79	9.01	42.21	61.81	7.99	8.95	25.15	22.80	35.09

Visitors' socio-demographics

	Denmark	Estonia	Finland	Germany	Latvia	Lithuania	Poland	Russia (coastal)	Sweden
Age (years)	51.30	44.62	50.84	48.82	44.64	48.04	50.65	39.75	54.28
Education – primary	0.13	0.16	0.17	0.26	0.19	0.26	0.05	0.01	0.24
Education – secondary	0.08	0.04	0.35	0.18	0.23	0.27	0.53	0.24	0.25
Education – vocational	0.22	0.58	0.16	0.47	0.33	0.26	0.04	0.23	0.13
Education – university	0.55	0.20	0.31	0.07	0.22	0.19	0.36	0.50	0.37
Male	0.51	0.43	0.52	0.49	0.52	0.46	0.68	0.49	0.55
Occupation related to the BS	0.06	0.08	0.08	0.04	0.06	0.03	0.06	0.06	0.08
HH size	2.53	2.58	2.47	2.29	2.83	2.52	3.23	3.13	2.31
Number of children	0.68	0.53	0.62	0.49	0.57	0.47	0.54	0.89	0.50
HH income (EUR/month)	2.43	1.24	2.24	2.16	0.73	0.68	1.27	1.25	3.22
Perception of water quality (1-5)	3.39	2.94	2.79	3.62	3.20	2.94	3.18	2.61	3.11

Econometric model results

	Count regression – negative binomial		Non-participation regression – binary probit	
	coefficient	marginal effect	coefficient	marginal effect
Denmark	1.9878***	15.5317***	-2.8536***	-0.1913**
Estonia	0.7751***	3.3723***	-1.6212***	-0.1364***
Finland	1.5547***	10.0336***	-1.7009***	-0.1403***
Germany	1.5764***	11.1152***	-1.8427***	-0.1524***
Latvia	1.7411***	12.9051***	-1.2584***	-0.1113***
Lithuania	2.0602***	19.2002***	-0.5540*	-0.0511*
Poland	1.6054***	11.5342***	-1.5749***	-0.1341***
Russia	1.3829***	8.5203***	2.5233***	0.4506***
Sweden	1.8214***	12.6051***	-3.1023***	-0.2011***
$TC_{Denmark}$	-0.0318***	-0.0948***	–	–
$TC_{Estonia}$	-0.0127***	-0.0380***	–	–
$TC_{Finland}$	-0.0124***	-0.0370***	–	–
$TC_{Germany}$	-0.0129***	-0.0384***	–	–
TC_{Latvia}	-0.0353***	-0.1053***	–	–
$TC_{Lithuania}$	-0.0190***	-0.0567***	–	–
TC_{Poland}	-0.0140***	-0.0417***	–	–
TC_{Russia}	-0.0035***	-0.0104***	–	–
TC_{Sweden}	-0.0102***	-0.0305***	–	–

Econometric model results cont.

	Count regression – negative binomial		Non-participation regression – binary probit	
	coefficient	marginal effect	coefficient	marginal effect
Perception of water quality	0.0726***	0.2171***	-0.0903***	-0.0088**
Male	0.0694**	0.2066**	0.2850***	0.0279**
Household size	0.1805***	0.5396***	–	–
Household size^2	-0.0132**	-0.0395**	–	–
Number of children	–	–	-0.2477***	-0.0242***
Age	–	–	-0.4752***	-0.0433***
Age^2	–	–	0.0947***	0.0095**
Education – secondary	–	–	-0.6938***	-0.0657***
Education – vocational	–	–	-0.7958***	-0.0749***
Education – university	–	–	-1.1835***	-0.1006***
Occupation related to the Baltic Sea	0.3062***	1.0438***	-0.5248***	-0.0470**

Results – model predictions and welfare measures

	Denmark	Estonia	Finland	Germany	Latvia	Lithuania	Poland	Russia (coastal)	Sweden	Total
Predicted prob. of 0 trips	0.43 [0.18]	0.53 [0.10]	0.50 [0.17]	0.71 [0.17]	0.60 [0.22]	0.68 [0.18]	0.75 [0.19]	0.93 [0.05]	0.37 [0.12]	0.69 [0.10]
Reported share of 0 trips	0.38 [0.49]	0.41 [0.49]	0.50 [0.50]	0.76 [0.43]	0.54 [0.50]	0.66 [0.48]	0.70 [0.46]	0.93 [0.25]	0.29 [0.45]	0.69 [0.26]
Predicted avg. no. of trips	5.44 [3.91]	1.86 [0.87]	3.15 [2.15]	1.01 [1.42]	2.39 [2.23]	1.57 [2.18]	0.98 [1.67]	0.42 [0.34]	6.24 [3.35]	1.55 [0.90]
Reported avg. no. of trips	5.96 [15.44]	1.83 [5.63]	3.95 [19.79]	1.22 [10.69]	2.64 [7.17]	1.66 [5.77]	1.12 [8.45]	0.46 [2.44]	6.42 [13.14]	1.75 [6.24]
Consumer surplus per trip (EUR)	32 (30-33)	79 (67-90)	81 (76-86)	78 (75-80)	28 (26-31)	53 (46-59)	72 (67-77)	288 (89-489)	98 (86-110)	85 (75-95)
Adult population (millions)	4.27	1.09	4.21	67.21	1.63	2.35	30.52	6.03	7.38	124.65
Total CS (million EUR)	720 (630-810)	150 (120-180)	1,040 (770-1,210)	5,140 (3,910-5,840)	110 (80-130)	190 (120-260)	2,070 (1,500-2,460)	940 (80-3,170)	4,430 (3,550-5,270)	14,800 (11,300-18,000)

Results of the simulated improvement scenario – welfare measures change (billion EUR)

	Denmark	Estonia	Finland	Germany	Latvia	Lithuania	Poland	Russia (coastal)	Sweden	Total
Total CS (million EUR)	720 (630-810)	150 (120-180)	1,040 (770-1,210)	5,140 (3,910-5,840)	110 (80-130)	190 (120-260)	2,070 (1,500-2,460)	940 (80-3,170)	4,430 (3,550-5,270)	14,800 (11,300-18,000)
Partial effect of perceived water quality	0.40 (0.20-0.60)	0.14 (0.08-0.21)	0.25 (0.13-0.37)	0.08 (0.04-0.11)	0.19 (0.10-0.28)	0.14 (0.08-0.21)	0.08 (0.04-0.12)	0.10 (0.02-0.25)	0.47 (0.24-0.70)	0.12 (0.07-0.18)
Simulated improvement scenario										
Total CS (billion EUR)	780 (670-870)	160 (130-190)	1,130 (840-1,310)	5,550 (4,270-6,350)	120 (90-140)	210 (130-280)	2,230 (1,640-2,680)	1,120 (100-3,650)	4,770 (3,840-5,670)	16,060 (12,290-19,670)
Δ CS	+54	+12	+84	+411	+9	+18	+17	+171	+336	+1,969
	+7.47%	+7.84%	+8.10%	+7.99%	+8.07%	+9.13%	+8.09%	+18.14%	+7.59%	+8.84%

Summary and conclusions

- Calculated CS per trip and reported visitation characteristics
- Annual recreational benefits from the Baltic Sea at 15 billion EUR
  - The distribution of benefits highly heterogeneous
- Improvements of the perceived water quality can lead to significant increases of public welfare
  - The distribution of benefits highly heterogeneous
- Provide some indication for policy
  - How to distribute the costs?

Future work

- Spatially explicit analysis
- Site-specific characteristics
  - Environmental quality indicators
  - Infrastructure and other amenities
- Output
  - Value of access per visit/per ha
  - Annual value of access per site
  - Scenario analysis
  - Mapping for policymaking - cultural ecosystem services