Coastal recreation valuation – discrete choice model

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Travel cost method

- Reference model
  - Czajkowski, M., Ahtiainen, H., Artell, J., Budziński, W., Hasler, B., Hasselström, L., Meyerhoff, J., Nõmmann, T., Semeniene, D., Söderqvist, T., Tuhkanen, H., Lankia, T., Vanags, A., Zandersen, M., Żylicz, T., and Hanley, N., 2015. Valuing the commons: An international study on the recreational benefits of the Baltic Sea. *Journal of Environmental Management*, 156:209-217
  - The Baltic Sea treated as a single site that is visited at a (travel) cost
  - If someone chooses to visit the Baltic Sea *n* times, it reveals information that: utility of visiting the site is higher than utility of the money spent on the travel (up until the *n*+1'th trip)
  - We use the travel cost method approach to estimate demand function
    - A count data model – the number of trips as a function of travel cost
    - E.g., fit zero-inflated negative binomial distribution to the data about the number of trips and their costs
  - Knowing demand function allows for calculating consumer surplus (welfare change associated with making the trip)

	DE	DK	EE	FI	LT	LV	PL	SE	Total
Consumer surplus per trip (EUR@PPP)	78	31	79	81	53	28	72	98	
Total recreational benefits per year (M EUR@PPP)	5 142	722	149	1 043	191	108	2 066	4 433	14 799

Discrete choice method

- Spatially-explicit approach
  - An individual chooses a site to visit (or chooses not to make the trip)
  - This reveals information about utility levels associated with alternatives (sites)
  - Alternatives are described using attributes
    - Travel cost
    - Characteristics of the sites
    - Site specific constants
  - Utility levels influence choice probabilities (higher utility = higher probability of visiting)
  - We can use the actual choices to model how each alternative's (each site's) attributes influence choice probabilities (and hence utility levels)
  - One of the attributes is monetary (travel cost) so its coefficient can be used as an estimate of the marginal utility of money
- Application
  - Models are country-specific
  - A choice set consists of all the observed destinations in a country
  - Ignore the number of trips (focus on the last trip only)

Discrete choice method

- Single constant models

	DE	DK	EE	FI	LT	LV	PL	SE
Opt-out (constant)	11.56***	1.14***	0.38***	4.31***	3.84***	0.47***	5.53***	0.35***
Travel cost (100 EUR PPP)	-0.33***	-2.23***	-2.33***	-0.59***	-0.45***	-1.95***	-0.49***	-1.95***
LL at convergence	-1 183.06	-2 941.75	-280.70	-2 165.00	-1 234.92	-1 712.82	-1 751.19	-2 703.47

- Models with environmental characteristics of the sites

	DE	DK	EE	FI	LT	LV	PL	SE
Opt-out (constant)	9.08***	1.27***	1.11***	9.38***	12.58***	0.28	7.62***	0.24***
Population density	-0.45***	0.01***	0.24***	0.28***	0.83***	0.15***	0.11***	0.03**
Compliant with guide values (vs. mandatory)	0.29	-0.02	-	-1.65***	3.78***	-1.12***	0.17	-0.16***
Non-compliant (vs. mandatory)	-	0.27	-	0.34	0	1.30***	0.71*	-1.65***
Compliant with Blue Flag guidelines	-1.48**	0.15***	-	-	-	1.07***	1.86***	-0.39**
Intestinal coli conc. (100 cfu/100 ml)	-7.77***	-0.03	-0.53*	6.35***	137.76***	-3.61***	-0.43	-0.25***
Escheria coli conc. (100 cfu/100 ml)	1.36***	-0.04	-1.02***	-0.51**	-31.74***	-0.01	0.59***	0.13***
Travel Cost (100 EUR PPP)	-0.35***	-2.22***	-2.06***	-0.43***	-0.46***	-1.76***	-0.49***	-1.92***
LL at convergence	-1 157.57	-2 890.04	-261.44	-1 705.00	-1 017.13	-1 467.68	-1 669.89	-2 677.47

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Site characteristics

- EEA bathing water quality directives

	Excellent	Good	Sufficient
Intestinal coli concentration (cfu/100 ml)	100	200	185
Escheria coli concentration (cfu/100 ml)	250	500	500

- Variation observed within the sites (number of sites in parentheses)

	DE (39)			DK (135)			EE (5)			FI (42)			LT (7)			LV (17)			PL (49)			SE (94)		
	10%	50%	90%	10%	50%	90%	10%	50%	90%	10%	50%	90%	10%	50%	90%	10%	50%	90%	10%	50%	90%	10%	50%	90%
Intestinal coli (cfu/100 ml)	10.0	17.7	54.0	5.0	17.3	66.9	8.0	26.8	133.2	2.4	6.5	37.8	0.6	4.1	33.0	0.0	9.3	51.9	6.2	18.8	64.4	9.2	40.8	60.6
Escheria coli (cfu/100 ml)	16.8	49.6	186.2	14.0	38.1	191.2	4.7	35.4	189.5	5.0	18.9	121.2	1.6	11.6	115.9	13.8	36.0	711.2	18.0	55.0	306.6	10.0	50.0	101.7

  - Dark green – 90% of sites meets ‘Excellent’ quality requirements
  - Light green – 90% of sites meets ‘Good’ quality requirements
- Use better environmental quality indicators?
- Control for other site-specific characteristics?
  - We tried: population density, season, month, reason for the trip (swim, beach, cruise etc.)

Recreational value of the sites

- Models with alternative (site) specific constants
  - Not possible to include any other attributes that do not differ between choice observations
- Knowledge of the utility function allows for predicting choice probabilities
  - What would the welfare change be if one of the sites was not available?
  - What if all sites were closed?

	DE	DK	EE	FI	LT	LV	PL	SE
Number of sites	39	135	5	42	7	17	49	94
Consumer surplus – TCM (EUR@PPP per trip)	78	31	79	81	53	28	72	98
Welfare change resulting from closing all sites – DCE1 (EUR@PPP per individual)	73	43	9	115	91	36	82	74
Welfare change resulting from closing all sites – DCE 2	70	42	10	158	89	40	82	75
Welfare change resulting from closing all sites – DCE 3	78	41	13	159	88	41	85	78