Exploring farmers' preferences for implementing agri-environmental schemes – a cross country comparison of schemes as incentives for nutrient abatement in Baltic Sea catchments

Berit Hasler, Mikołaj Czajkowski, Katarina Elofsson, Line Hansen, Janne Helin, Tobias Häggmark, Maria Konrad, Helle. Nielsen, Olli Niiskanen, Tea Noman, Andeers B. Pedersen, Kaja Petersen, Katarzyna Zagórska

Go4 Baltic

BONUS
SCIENCE FOR A BETTER FUTURE OF THE BALTIC SEA REGION

The outset

- Ambitious targets to reduce nutrient loadings to the Baltic Sea
- Not possible to reach these targets without nutrient loads reductions from agriculture
  - Agriculture contributing over 60-70% of the diffuse nutrient loads
  - Agriculture also being an important source of GHG emissions
    - Estimated 10-12% of the global GHG-emissions
    - A main share of the non-CO_2 GHG emissions (N_2O, CH_4)
- Agricultural sector politically and socially *sensitive*
  - How to induce changes?

Voluntary contracts for nutrient abatement and climate change mitigation

- Voluntary contracts have been around for a long time
  - The EU Common Agricultural Policy includes subsidy schemes for agri-environmental schemes (AES) and measures (part of the Rural Development Program)
- Agri-environmental schemes
  - Aim to encourage farmers to apply agricultural production methods that protect the environment
  - Constitute a significant financial cost for the EU
    - 8 billion EUR in the program period 2007-2013
  - Result in significant changes in farmers implementation of sustainable practices
  - Currently, AES not differentiated enough to capture heterogeneity in farm characteristics and local conditions
- How to design the AES to ensure participation and effectiveness?
  - Incentives = the payment levels, but also other contract characteristics: the contract type, length, required area to enroll, flexibility to terminate, availability of support etc.

Evaluation of the AES effectiveness

- Ex post evaluations
  - Limited data on uptake, no insights into farmers' motives for entry or non-entry into AES
- Experimental and stated preference methods
  - Rural development (Villanueva et al., 2017)
  - Conservation (Kanna and Ando, 2009; Adams et al., 2014)
  - Pesticide management (Pedersen et al., 2012; Christensen et al. 2012)
  - Land diversification requirements ("greening"; Schultz et al., 2013)
  - Carbon sequestration and climate mitigation (Aslam et al., 2017)
  - Water protection (Beharry-Borg et al., 2012)
  - Scheme design and characteristics (Ruto and Garrod, 2009; Kuhfuss et al., 2016; Mettepenningen et al., 2013)

Discrete choice experiment study of farmers' preferences

- Stated preference study – a discrete choice experiment
  - Observe farmer's choices in hypothetical situations of contract selection
  - Farmer's choices reveal their underlying preferences
    - Willingness-to-accept (WTA) payments for implementing particular schemes
    - How are WTA influenced by specific contract characteristics
    - Farmers' heterogeneity linked to their preferences
- Representative sample of farmers from:
  - Estonia – 294
  - Denmark – 462
  - Poland – 540
  - Sweden – 598
  - Finland – 525
  - **Total: 2,419 farmers**

Hypothetical setting

"The EU rural development program and subsidy schemes for farmers are regularly reformed. **Imagine that from 2018, all farmers in <*country*> will be presented with a new system of subsidies.** Farmers would be offered to enter into contracts and be compensated for implementing specific agro-environmental measures. **All current contracts and subsidies for set aside, catch crops or fertilizer utilization would be** cancelled and could be replaced with the choice you make here.

We now ask you to consider which contracts you would prefer, given a list of possible contract specifications. These contracts and payments are designed in a way that promote agricultural practices with the aim to improve water quality and climate. In the choice questions that follow, we would like to know how attractive these contracts are to you. We ask that you **rank the possible contracts, including the option not to participate in the new system**.

Before you are presented with the choices of contracts we will present the contracts and their requirements."

Experimental design – choice alternatives

Set aside In this contract you would be required to set aside part of your arable land. The land which would be set aside cannot be plowed or cultivated for the entire period of contract duration. The area shall have grass cover and either be grazed or cut.	
Improved utilization of fertilizers In this contract you would be required to improve the utilization of the fertilizers used on your farm, and you may use the contract for two different technologies: precision farming technologies, which means technologies that improves and target the placement of the fertilizers on the field, or injectors for the spreading of the manure. The technology will be used on the farm's area inside rotation, where applicable (mentioned as 100% of the area in the contract).	
Catch crops and winter cover Catch crops are grass and legumes, crucifers and chicory, sown together with the main crop or before/after harvest of the main crop, but not later than August 20'th. Catch crops are to be followed by a spring crop. The area with catch crops under this contract should be in addition to the catch crop area already required as greening or in other environmental regulation.	
None of these contracts This option is also given to the respondents meaning that they will not enter into a contract with set aside, improved utilization of fertilizer or catch crops.	

Experimental design – choice attributes

- Area enrolled
  - 1-25% of arable land
  - Improved fertilization contracts – always 100%
  - Subsidy paid only for the area enrolled in the contract
- Contract length
  - 1-20 years
- Possible to terminate
  - No
  - Yes – with a refund
  - Yes – without a refund
- Advisory support
  - Paid
  - Free
- Subsidy
  - EUR per ha of land enrolled

Example of a choice task

	 Set aside	 Catch crops	 Fertilizer technology	None of these
Area enrolled in the contract (% of your farmed in rotation)	10%	15%	100%	
Length of the contract (years)	1 year	10 years	5 years	
Flexibility to terminate the contract	Possible with refund	Possible without refund	Not possible	
Advisory assistance	Charged	Free	Free	
Subsidy (EUR per ha enrolled)	378 EUR / ha	82 EUR / ha	304 EUR / ha	
Your ranking of the contracts the most (1) to the least (4) preferred	[ ]	[ ]	[ ]	[ ]

Results – country-specific estimates of the distributions of WTA (EUR / ha)

	Denmark		Estonia		Finland		Poland		Sweden	
	Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.	Mean	St. Dev.
Set aside	-360***	573***	-300***	608***	-212***	294***	-384***	530***	-172***	432***
Area enrolled (%) – set aside	-4***	15***	-6***	7***	0	2***	-6***	21***	-1	4***
Contract length (years) – set aside	-20***	13***	2***	22***	-8***	6***	-21***	16***	-8***	16***
Catch crops	-226***	507***	-210***	559***	-176***	281***	-251***	512***	-232***	402***
Area enrolled (%) – catch crops	-1	8***	-10***	5***	-4***	0	2**	1	-6***	3***
Contract length (years) – catch crops	-23***	21***	0	19***	-9***	9***	-10***	16***	-15***	10***
Fertilization	-664***	698***	-523***	763***	-349***	380***	-271***	515***	-493***	508***
Contract length (years) – fertilization	-10***	15***	-11***	2***	-8***	4***	-7***	5***	-3*	3**
Possible to terminate – with refund	73***	145***	-122***	52***	-5	50***	47***	108***	-27**	1
Possible to terminate – without refund	143***	17**	8	83***	53***	72***	93***	111***	19*	65***
Advisory	28***	71***	131***	214***	-3	65***	18*	67***	33***	74***

Results – farm-specific explanatory variables of the distributions of WTA (EUR / ha)

	Main effects		Interactions								
	Mean	St. Dev.	Total farmland (100 ha)	Leased farmland (100 ha)	Income (100,000 EUR/y)	Income missing	Livestock	No livestock	Pig farm	Cow farm	Organic
Set aside	-261***	466***	44***	-113***	-37**	-146***	67***	-3	-99***	-130***	-64***
Area enrolled (%) – set aside	5***	15***	-1***	2	-6***	-6***	-4***	-4**	-4***	-4**	3***
Contract length (years) – set aside	-17***	19***	-1**	3*	0	6***	-3***	1	5***	-2**	0
Catch crops	-191***	556***	23***	-29*	37***	-223***	-31***	-3	118***	-77***	11
Area enrolled (%) – catch crops	1	5***	-1	-2*	-1**	-4***	0	2*	2***	4***	-4***
Contract length (years) – catch crops	-17***	18***	-2***	6***	4***	12***	-2***	1	5***	5***	1
Fertilization	-373***	608***	42***	-30**	-20**	-11	51***	94***	142***	73***	-338***
Contract length (years) – fertilization	-20***	12***	-1	-2	2***	-1	2***	13***	13***	4***	1
Possible to terminate – with refund	4	91***	-35***	-2	53***	49***	-47***	33***	-22***	73***	-30***
Possible to terminate – without refund	76***	120***	-42***	56***	13*	-14*	-34***	15*	-47***	56***	-18**
Advisory	9	57***	8***	3	15**	16***	-28***	-11	-3	13**	-12*

Conclusions

- Offer insights into farmers' willingness to pay for implementing AES
- Substantial within- and between-country heterogeneity
  - To some extent explained by differences in farm characteristics
- Current AES do not allow for the differentiation of subsidies
  - We find much of farmers' WTA heterogeneity is driven by differences in local conditions and farm types
  - No differentiation of payments leads to over- and undercompensation
- Policy relevance:
  - Offer guidance on the design of future contracts to assure required acceptance rates
  - Inputs into the analysis of the ecological and economic efficiency of different contracts
  - Addressing preference heterogeneity and linking it to farm characteristics allows for more precise predictions and designing AES that target specific groups

Thank you

- Contact me
  - mc@uw.edu.pl
  - czaj.org

- Acknowledgements
  - The work presented is part of the BONUS GO4BALTIC project: http://projects.au.dk/go4baltic/
  - The BONUS GO4BALTIC project is supported by BONUS (Art 185), funded jointly by the EU and national funding institutions in Denmark (the Innovation Fund), Estonia (Estonian Research Council ETAG), Finland (Academy of Finland), Poland (NCBR) and Sweden (FORMAS)