

External validity of experiments in environmental economics: framing and subject pool effects among students and professionals

Workshop – Economic experiments for EU agricultural policy evaluation: Methodological challenges, Angers - 2017

Marie Ferré, Prof. Dr. Stefanie Engel, Dr. Elisabeth Gsottbauer

Institute for Environmental Decisions – ETH, Zurich; Alexander von Humboldt
Professorship - University of Osnabrück; University of Innsbruck

Motivations and previous research

- Increasing use of laboratory experiments to study environmental policy issues (Harrison & List, 2004; Exadaktylos et al., 2013)
- Standard to use university students & Context-free or neutrally framed designs
- External validity of the results?

Motivations and previous research (cont.)

- Subject-pool effect:

- More studies use samples of representative populations & professionals. Mixed results (Fehr & List, 2004; Belot et al., 2010)
- Gap: Comparison of the behavior of professionals with students in a contextualized experiment

- Framing effect:

- A shift in the subject's decisions/preferences induced by an alternative way of describing a particular situation/problem
- E.g.: varying the formulation of an incentive scheme, the -/+ connotation of the frame, giving a connotation that affects individuals' social preferences
- Effect of framing on subjects' behavior (Tversky & Kahneman, 1981; Hossain & List, 2012; Gächter et al., 2009; Elliott et al., 1998)

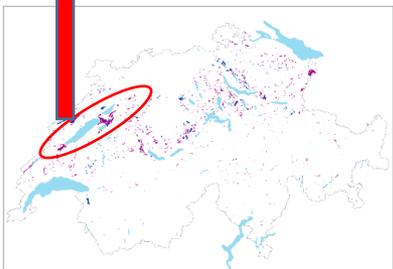
Research questions

1. Do the behavior of university students and «professionals» differ in an experiment that is fully contextualized by a specific agricultural problem?
2. How does such experimental framing affect individuals' behavior?
3. How do players' characteristics affect players' decisions?

Our study



Drained former peatlands; intensive vegetable farming



Organic soils in Switzerland
Image adapted from Wüst-Galley et al. 2015



Illustration of the loss of the top soil layer (peat) from drainage (S. Paul)



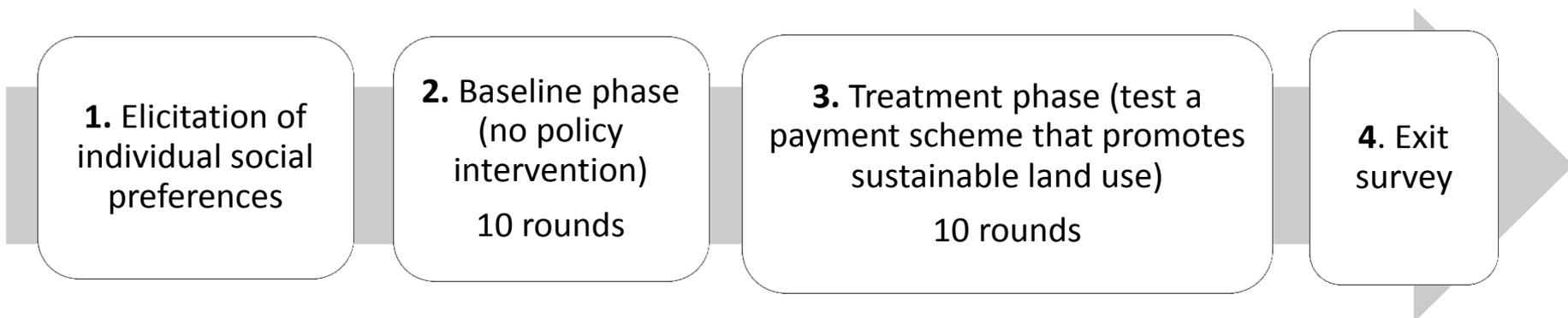
Profile of an organic soil:
peat layer on top and
underlying mineral layer

Experimental design 1

- A computerized framed interactive experiment to simulate farmers' decision situations under alternative conservation payment schemes
- The experiment captures the key aspects of the management problem:
 1. High opportunity cost of sustainable use
 2. farmers need to cooperate to raise the water table
 3. Farmers are heterogeneous in opportunity costs of adopting sustainable use
- Two experimental settings:
 - Static setting: high simplification of the farmers' decision situation
 - Dynamic setting: it captures the complexity of the dynamics of soil degradation

Experimental Design 2

- Between-subject design
- Groups of 2 players: H and L farmers (high vs. low opportunity costs)



Treatments :

- **DA:** Differentiated agglomeration payment: based on opportunity costs of players
- **UA:** Uniform agglomeration payment: it pays an equal amount to players
- **UI:** Uniform individual payment

Experimental Design 3

Every round, the player decides between intensive and sustainable land use:

1. Binding side-payment offers within group

To negotiate decisions (players differ in their incentives to adopt sustainable use), to reduce payoff inequalities

2. Vote on rewetting the soils or not (unanimous decision)

Payoff matrixes

1.

		Player H	
		Intensive land use	
Player L	Intensive land use	π^L	π^H

Payoff matrix 1: Stage 2 payoffs if soils are not rewetted ('Status quo')

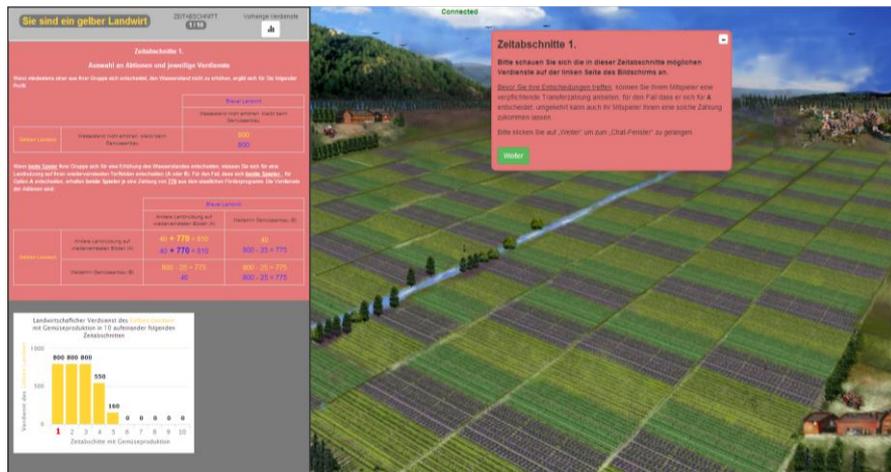
2.

		Player H	
		Sustainable land use	Intensive land use
Player L	Sustainable land use	$R + P^L - S^L + S^H$ $\mathbf{R} + \mathbf{P}^H + \mathbf{S}^L - \mathbf{S}^H$	$R + S^H$ $\pi^H - C - S^H$
	Intensive land use	$\pi^L - C - S^L$ $\mathbf{R} + \mathbf{S}^L$	$\pi^L - C$ $\pi^H - C$

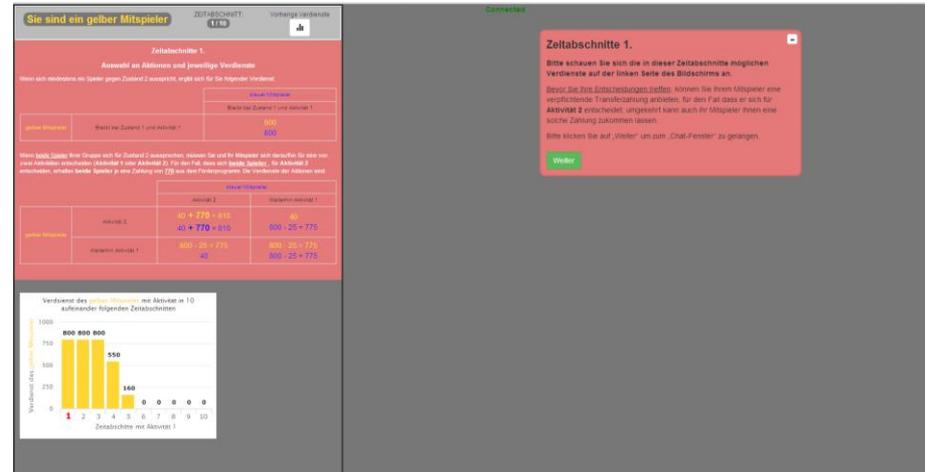
Payoff matrix 2: Stage 2 payoffs if soils are rewetted; presence of an agglomeration payment P_i ; R = profit under sustainable land use, C = cost of reverting to intensive land use

Experimental design 4

- Two subject pools: university students and farm apprentices
- Framed and unframed design



Screen shot; dynamic setting; Framed design



Screen shot; dynamic setting; Unframed design

	Framed experiment		Unframed experiment	
	<i>Apprentices</i>	<i>Students</i>	<i>Students</i>	
<i>Dynamic setting</i>	Baseline (78)	Baseline (80)	Baseline (76)	
	UA (88)	UA (80)	UA (76)	
	Baseline (58)	Baseline (222)	Baseline (78)	
<i>Static setting</i>	UI (30)	UI (74)	-	
	DA (28)	DA (74)	-	
	-	UA (74)	UA (78)	

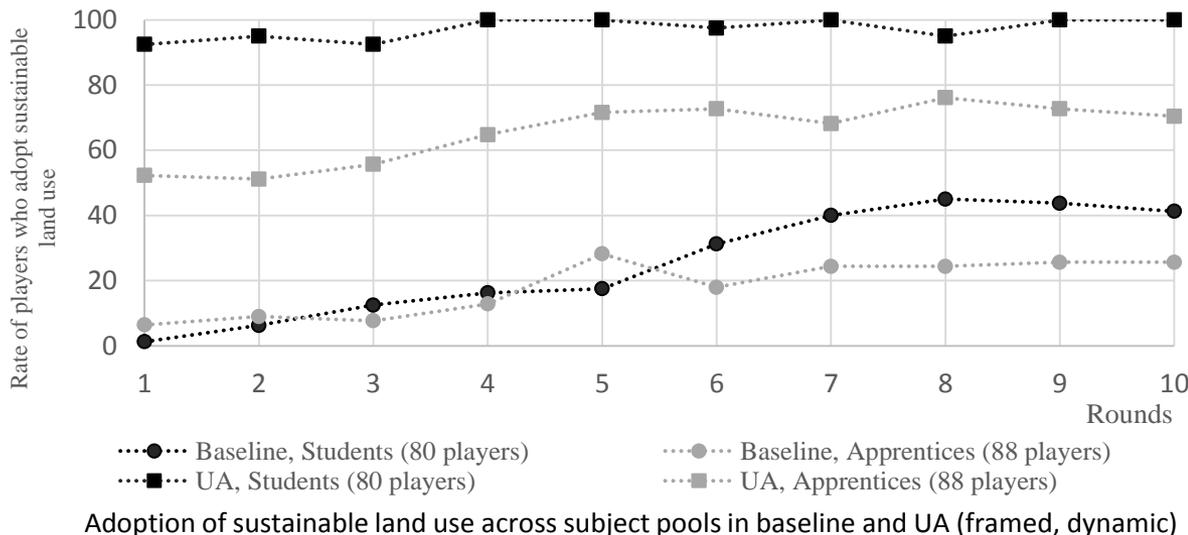
Results

- 1) How is the performance of treatments affected by subject pool and by the experimental framing?

Analysis of absolute performance and relative performance (the ranking of the payment designs)

- 2) How do the individual characteristics of players affect their decisions depending on subject pool and across framings?

Results – Impacts of subject pool



Effect of subject pool	Environmental effectiveness	Use of side payments	Cost effectiveness	Income inequality
Dynamic setting	<u>Baseline & UA</u> : Yes, students adopt sustainable use earlier on and focus more strongly on payoff maximization	<u>Baseline</u> : No; <u>UA</u> : Yes, in the use of bargaining power: 47.5% vs. 10.2% of apprentice and student groups make a side payment offer. Higher proportion of apprentices H condition their cooperation on a side payment	<u>Baseline</u> : No; <u>UA</u> : payment schemes more cost-effective among students than among apprentices	<u>UA</u> : Yes, because of higher payoffs redistribution among students than among apprentices
Static setting	<u>Baseline</u> : weak effect; <u>UI & DA</u> : No	No	No + no effect on the ranking of payment scheme.	No + no effect on the ranking of payment schemes

Results – Impact of framing

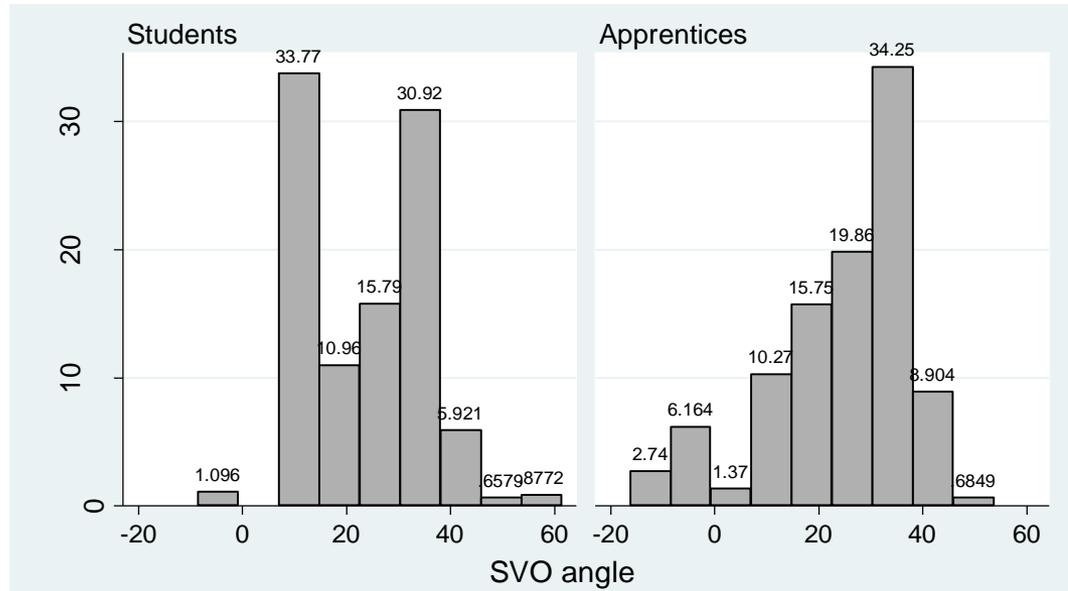
On environmental effectiveness:

- No significant difference in decisions of university students with the type of framing (in either setting)

On the use of side payments and cost effectiveness:

- No significant effect of framing

Results – Social preferences across subject pools



Distribution of the SVO angle among students (456) and apprentices (146)

- SVO angle \equiv level of prosociality. Average angle not different between farm apprentices and students: 24.8 vs. 24.2
- But: distribution varies: apprentices exhibit higher SVO angles than students; 45.7% of students are individualistic against 34.3% among apprentices
- This partly explains the higher rate of successful coordination among students

Panel random effect regression analysis on land use choice

Subject-pool effect:

- Effect of reputation opposite for students and apprentices. Hyp.: due to difference in cultural background
- Effects of environmental consideration, willingness to take risks, and social preferences stronger for students than for apprentices. Hyp.: due to familiarity with the farming context

Framing effect:

- Effects of willingness to take risks and environmental consideration: stronger predictors in framed than in unframed design. Hyp.: farming context induces non-economic considerations; player may account for the impact of decision on payoffs and on the environment → various types of risk considerations

Conclusion

- No significant effect of the introduction of a specific experimental framing on behavior with a sample of university students
- Significant impact of the type of subject on the performance level of the payment treatments
- For the treatments tested, subject pool does not affect the ranking of policy options in their performance
- Importance of some players' characteristics on coordination and the adoption of sustainable land use. These characteristics vary across framings and subject pools

THANK YOU!

For discussion: Conclusions on generalizability of results from this study 1

- **Potential factors affecting generalizability:**
 - **Type of subject.** In this study: impact of subject pool on experimental outcomes, in the magnitude of the results.
 - Probably context/game/study-dependent:
 - Impact of subject pool more pronounced in the dynamic setting of the experiment that closely captures the resource management problem
 - Every scenario tested had an equilibrium that maximized players' payoffs. A different game structure may reveal other impacts.
 - **The experimental framing:** can affect internalized norms of participants and can trigger signals that do (not) matter to the decision-making process of a particular subject.
 - Distribution of players' characteristics and social preferences across subject pools. Some of those influence players' decision significantly, and their effect vary across framings and subject pools.

For discussion: Conclusions on generalizability of results from this study 2

- Potential aspects improving the generalizability of economic experiments:
 - To conduct the experiment with the population that is most concerned by the issue: unique insights.
 - To include the important components of the management issue. Trade-off between capturing the essence of the problem (no oversimplification of the game structure) and being able to disentangle the effects.
 - To control for individuals' characteristics among participants and among the ideal population.

Appendix 1: Previous Research - Subject-pool effect

- Growing number of experiments that involve samples of representative populations, professionals, specialists. Mixed results with regard to behavioral differences between those and students.
 - Potential reasons to behavioral differences: distribution of social preferences (Carpenter & Seki, 2011), familiarity of the subject with the experiment (Fréchette, 2009), self-selection issue.
 - Professionals tend to behave more prosocial than students (e.g., Fehr & List, 2004; Bellemare & Kröger, 2007; Belot et al., 2010).
- No study compares professionals with students in a contextualized experiment.
 - Involving professionals can provide unique insights.
 - The experimental context can trigger signals that do (not) matter to the decision-making process of a particular subject

Appendix 2: Previous Research - Framing effects

- Framing effect = a shift in the subject's decisions or preferences induced by an alternative way of describing a particular situation/problem.
- Framing approaches: varying the formulation of an incentive scheme, playing on the -/+ connotation of the framing tool, on a connotation that affects individuals' social preferences.
 - Acknowledged effect of framing on subjects' behavior (Tversky & Kahneman, 1981; Hossain & List, 2012; Gächter et al., 2009; Elliott et al., 1998).
- More studies that work on the effect of frame on how subjects view their decision and on the creation of norms (e.g., Pillutla and Chen, 1999).