CONSEQUENTIALITY IN STATED PREFERENCE: EXAMINING ENDOGENEITY

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Stated preference methods

- Widely used to measure the value of non-market goods, especially public goods
- In transportation, marketing, health, culture, environmental economics, …
- Based on surveys
- Many advantages:
  - Capture use and passive-use values
  - Go beyond the scope of the existing data
- But also important disadvantages:
  - Not based on market behavior
  - Might be viewed as not related to direct consequences
  - Incentive properties insufficiently understood

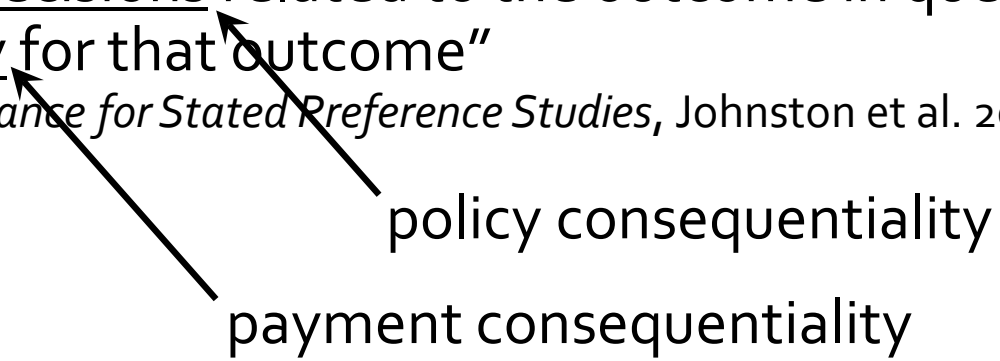
Conditions for truthful preference disclosure
(Carson and Groves 2007; Carson et al. 2014; Vossler et al. 2012)

One of the conditions requires the survey consequentiality

A necessary condition for truthful preference disclosure:

Consequentiality

- "a survey's results are seen by the agent as potentially influencing an agency's actions and the agent cares about the outcomes of those actions" (Carson and Groves 2007)
- "an individual faces or perceives a nonzero probability that their responses will influence decisions related to the outcome in question and they will be required to pay for that outcome" (*Contemporary Guidance for Stated Preference Studies*, Johnston et al. 2017)



Challenges with consequentiality

- **Consequentiality communicated** via survey scripts does not necessarily affect consequentiality perceptions (Czajkowski et al. 2017; Lloyd-Smith et al. forthcoming)
- How to **elicit consequentiality perceptions**?
  - A single general question: To what extent do you believe that the survey outcome will affect the decision of public authorities?
  - Questions differentiating between policy and payment consequentiality
- How to include data on consequentiality perceptions in **preference modelling**?
  - Endogeneity concerns: Self-reports on perceived consequentiality are likely driven by similar (unobservable) factors as stated preferences

Many studies

Very few

Very limited guidance in this area

Our study refers to both of these questions

Endogeneity of consequentiality perceptions

as explored in previous studies

- Limited and mixed empirical evidence on endogeneity
- Studies suggesting endogeneity:
  - Herriges et al. (2010)
  - Groothuis et al. (2017) – unobserved factors strengthen consequentiality and decrease the likelihood of voting for the program; higher tax amounts in the preference elicitation question reduce both consequentiality and willingness to pay
  - Lloyd-Smith et al. (2019) – without endogeneity control, perceived consequentiality affects stated preferences, but the effect disappears with endogeneity control
- No significant problem of endogeneity: Vossler et al. (2012), Interis and Petrolia (2014) (both use socio-demographics as instruments)
- None of these studies considers policy and payment consequentiality separately

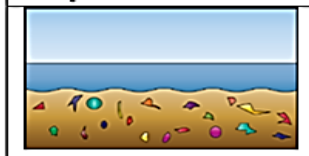
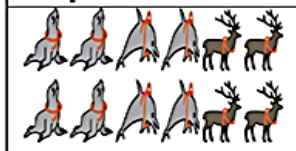
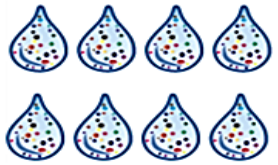
Our research questions:

Are self-reports on policy and payment consequentiality endogenous to stated preferences?

Do the self-reports depend on the preference question attributes (the project cost)?

Data

- A contingent valuation survey
- An initiative to reduce the impacts of marine plastic litter around Svalbard
- Norwegian households
- Online, June 2018
- 552 usable questionnaires

Impacts of marine plastic litter around Svalbard	Current situation	With the initiative
Impact on beaches		
	**100** grams of plastics per meter square of beach	**10** grams of plastics per meter square of beach
Impact on mammals		
	**60** seals, reindeer, or porpoises get entangled in nets and ropes	**10** seals, reindeer, or porpoises get entangled in nets and ropes
Impact on birds		
	**90%** of seabirds have pieces of plastic in the stomachs	**10%** of seabirds have pieces of plastic in the stomachs
Impact on microplastics		
	**90%** of water samples contain microplastics	**10%** of water samples contain microplastics

Data

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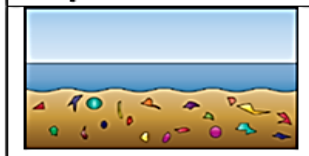	**100** grams of plastics per meter square of beach	**10** grams of plastics per meter square of beach
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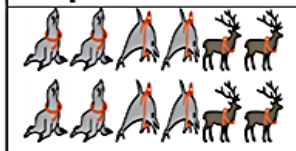	**60** seals, reindeer, or porpoises get entangled in nets and ropes	**10** seals, reindeer, or porpoises get entangled in nets and ropes
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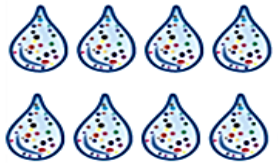	**90%** of water samples contain microplastics	**10%** of water samples contain microplastics

Data

Considering the anticipated results of the initiative outlined above, would you vote for this initiative if the initiative would cost your household an annual tax of NOK ____ for the next ten years?

- ❑ Yes, I would vote for the initiative if it costs my household NOK ___ per year.
- ❑ No, I would not vote for the initiative if it costs my household NOK ___ per year.

- Randomly assigned tax: 500; 1,500; 2,700; 4,400; 7,000 Norwegian Kroner

Data

- Consequentiality measures – two Likert-scale statements
- Five-point scale – from Strongly Disagree (SD) to Strongly Agree (SA)
- Policy consequentiality – "My responses to this survey will have an influence on whether this initiative is implemented"
- Payment consequentiality – "If the government carries out this initiative, I believe that I will be charged the tax of NOK ___"
- Spearman's rank order correlation of 0.214

		Policy cons.						
		1 (SD)	2 (D)	3 (N)	4 (A)	5 (SA)	Total	
Payment cons.	1 (SD)	4	4	3	2	0	13	2%
	2 (D)	11	17	25	14	3	70	13%
	3 (N)	18	44	150	41	5	258	47%
	4 (A)	7	24	67	66	4	168	30%
	5 (SA)	5	7	13	12	6	43	8%
	Total	45	96	258	135	18	552	
		8%	17%	47%	24%	3%		

Methodology

- Separate analysis for policy consequentiality and for payment consequentiality
- Drivers of consequentiality – binary and ordered probit models
  (for robustness check, shown in the paper only)
- Endogeneity of consequentiality – bivariate probit models
  (a two-stage instrumental variable approach)

Methodology

Bivariate probit models

- y_1^* – unobservable consequentiality beliefs (e.g., policy cons.)
- y_2^* – unobservable willingness-to-pay for the proposed initiative
- For each, zero-one coded indicators, y_1 and y_2, are observed:
  - y_2 – a yes-no vote on the initiative (0 – no, 1 – yes)
  - y_1 – a recoded consequentiality statement (0 – strongly disagree or disagree, 1 – else)

$$y_1 = \begin{cases} 1 & if\ y_1^* > 0 \\ 0 & otherwise \end{cases}$$

$$y_2 = \begin{cases} 1 & if\ y_2^* > 0 \\ 0 & otherwise \end{cases}$$

First stage: $y_1^* = \beta_1' \boldsymbol{x_1} + \gamma z + \epsilon_1$

Second stage: $y_2^* = \beta_2' \boldsymbol{x_2} + \delta y_1 + \epsilon_2$

- $\boldsymbol{x_1}$ and $\boldsymbol{x_2}$ – vectors of exogenous variables
- Instrument z – uncorrelated with y_2 (preference) but correlated with y_1 (consequentiality)
- Maximum likelihood method

Methodology

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Correlation between the error terms, $\rho = Cor(\epsilon_1, \epsilon_2)$
If $\rho = 0$, no endogeneity and parameters can be estimated consistently in separate models

Explanatory variables

Variable	Explanation	Measurement / Unit	Mean	Std. dev.
Tax (cost)	Randomly assigned tax amount	NOK 1,000	3.21	2.30
Male	Sex	1 = male, 0 = female	0.51	0.50
Age	Age	Years	44	17.21
University	University degree	1 = yes, 0 = no	0.62	0.49
Visited	Visited or lived in Svalbard	1 = yes, 0 = no	0.13	0.34
Informed	How informed a respondent feels about "marine plastic litter"	From 1 = not at all to 5 = extremely	2.88	0.85
Dirtiness	Respondent's perception of dirtiness of Svalbard shores	From 1 = very clean to 5 = very dirty	3.86	0.78

Results: Bivariate probit for payment cons.

	First stage: Payment cons.		Second stage: Yes-No vote	
	Coeff.	St. Err.	Coeff.	St. Err.
Tax (cost)	-0.088***	(0.028)	-0.138***	(0.037)
Male	-0.246*	(0.140)	-0.142	(0.130)
Age				
University				
Visited				
Informed				
Dirtiness				
Payment cons.			1.579**	(0.619)
Ineffective (IV)	-0.739***	(0.247)		
Constant	1.743***	(0.466)	-2.327***	(0.648)
$\rho = Cor(\epsilon_1, \epsilon_2)$			-0.490	(0.384)
Log-likelihood			-519	
BIC			1,158	

- Instrument – uncorrelated with preferences but correlated with consequentiality
- Agreement with the statement: "I do not think measures in Norway alone will do much about marine plastic in Svalbard"
- Zero-one coded

Results: Bivariate probit for payment cons.

	First stage: Payment cons.		Second stage: Yes-No vote	
	Coeff.	St. Err.	Coeff.	St. Err.
Tax (cost)	-0.088***	(0.028)	-0.138***	(0.037)
Male	-0.246*	(0.140)	-0.143	(0.129)
Age	-0.001	(0.004)	0.001	(0.003)
University	0.044	(0.144)	0.114	(0.123)
Visited	0.055	(0.214)	0.242	(0.177)
Informed	0.124	(0.084)	0.310***	(0.079)
Dirtiness	0.007	(0.087)	0.229***	(0.079)
Payment cons.			1.579**	(0.619)
Ineffective (IV)	-0.739***	(0.247)		
Constant	1.743***	(0.466)	-2.327***	(0.648)
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Log-likelihood			-519	
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No endogeneity

Results: Bivariate probit for policy cons.

	First stage: Policy cons.		Second stage: Yes-No vote	
	Coeff.	St. Err.	Coeff.	St. Err.
Tax (cost)	0.058**	(0.026)	-0.181***	(0.026)
Male	-0.026		-0.193*	(0.117)
Age	0.003	(0.004)	-0.001	(0.003)
University	0.060	(0.125)	0.100	(0.117)
Visited	-0.034	(0.175)	0.208	(0.171)
Informed	0.053	(0.071)	0.292***	(0.077)
Dirtiness	0.202***	(0.076)	0.117	(0.084)
Policy cons.			1.386***	(0.365)
Ineffective (IV)	-0.626***	(0.178)		
Constant	-0.040	(0.403)	-1.338***	(0.383)
$\rho = Cor(\epsilon_1, \epsilon_2)$			-0.677***	(0.230)
Log-likelihood			-609	
BIC			1,338	

Main difference

Endogeneity

Divergent effects of a tax

on payment and policy consequentiality

- For higher tax amounts:
  - Stronger policy consequentiality – more likely that responses will affect the decision whether to implement the initiative
  - Weaker payment consequentiality – less likely that the tax will be imposed

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- Groothuis et al. (2017) suggest a negative relationship:
  - higher tax amounts make respondents perceive the vote threshold less likely to be met, and so the chances to influence policy are reduced
- Possible explanations of the positive effect:
  - The tax amount seen as a 'lever' to affect the implementation: The higher the tax, the more weight of the referendum outcome
  - Strong public focus on marine plastic pollution in Norway. The society may know that the initiative is very costly. So if asked to contribute little, respondents might not find it credible that it will be effectively implemented

Divergent effects of a tax

on payment and policy consequentiality

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  - Stronger policy consequentiality – more likely that responses will affect the decision whether to implement the initiative
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- Interesting extension of earlier work, where consequentiality was assessed in general and preferences were elicited with a single binary choice format
- Groothuis et al. (2017):
  - Higher tax amounts weaken perceived consequentiality
  - Did their respondents interpret the consequentiality more like payment consequentiality?
- Lloyd-Smith et al. (2019):
  - No effect of a tax on preference responses
  - Do the opposing effects balance out?

Conclusions

- We contribute to the understanding of consequentiality aspects – payment and policy
- Except for consequentiality, we basically use an incentive compatible setting: single binary choice, tax, no outside options, etc.
- The first investigation of these two aspects for an incentive compatible (single binary choice) format (?)
- Because of some differences in their roles, it might be recommended to separately assess the consequentiality aspects in field surveys

Conclusions

- (Payment and/or policy) consequential respondents are more likely to vote for the initiative
- Some evidence of endogeneity of consequentiality perceptions
  - Unobserved factors strengthen consequentiality and decrease the probability of voting for the initiative
  - The same result in Groothuis et al. (2017), who do not distinguish between consequentiality aspects
  - Inconsistent results for the two consequentiality aspects – true difference or the sample too small?
- We contribute to earlier evidence
  - Socio-demographic variables do not typically affect consequentiality perceptions
  - Consequentiality perceptions might be a function of experimental design features: here, a tax decreases payment consequentiality and increases policy consequentiality
- Growing evidence that the experimental design does have an effect on stated consequentiality
  - Groothuis et al. (2017) – a cost amount
  - Lloyd-Smith et al. (2019) – a position of a consequentiality elicitation question
- Possible context dependence – e.g., a contribution amount and how likely it is for implementation, media coverage, public awareness of the policy costs

THANK YOU!

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