CONSEQUENTIALITY IN DICHOTOMOUS CHOICE CONTINGENT VALUATION: EXPERIMENTAL DESIGN EFFECTS

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Contingent valuation with stated preference methods

- Provide estimates of economic <u>value of non-market goods</u> (e.g., clean air)

- Help determine the value of a good to society (e.g., for benefit-cost analyses)

- Wide range of applications: transportation, health, environment, culture, etc.

- Value estimates derived from <u>preferences stated in surveys</u>
  - Typically large survey studies on representative samples of respondents
  - An example (<u>dichotomous choice</u>) contingent valuation question:

    Would you be willing to pay 5 euros annually to reduce marine plastic litter around Svalbard as specified above in the proposed policy?

    Yes/No

Contingent valuation with stated preference methods

- Many advantages:
  - Capture use and passive-use values
  - Go beyond the scope of data on observed behavior

- 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 that a survey is consequential

A necessary condition for truthful preference disclosure:

Consequentiality

- "a survey's results are seen by the agent as <u>potentially influencing</u> an agency's actions and the agent cares about the outcomes of those actions"
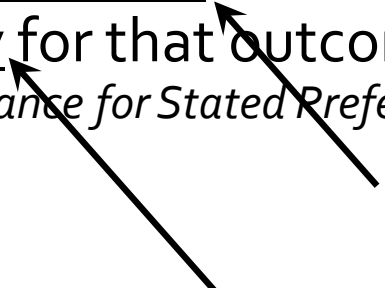 (Carson and Groves 2007)

- "an individual faces or perceives a nonzero probability that their responses will <u>influence decisions</u> related to the outcome in question and they will be <u>required to pay</u> for that outcome"
  (*Contemporary Guidance for Stated Preference Studies*, Johnston et al. 2017)

policy consequentiality

payment consequentiality

Challenges with consequentiality

- **Consequentiality communicated** via survey scripts does not necessarily affect consequentiality perceptions (Czajkowski et al. 2017; Lloyd-Smith et al. 2019)

- 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

  Many studies

  Very few

- 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

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)

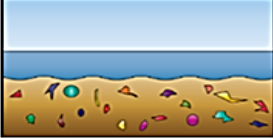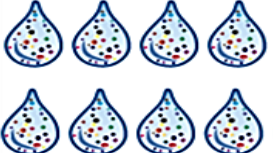- None of these studies considers policy and payment consequentiality separately

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

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 (NOK)
- 10 NOK ≈ 1 EUR

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%
			258	135	18		552	
			47%	24%	3%			

The binary recoding according to the knife-edge result:
A marginally positive probability of consequences is enough

Methodology

- Drivers of consequentiality – **binary and ordered probit** models
  (for a robustness check, shown in the paper only)

- Drivers of consequentiality
  Impact of consequentiality on stated preferences
  Controlling for endogeneity of consequentiality
  Controlling for correlation between payment and
          policy consequentiality

Trivariate probit model
(an instrumental variable approach)

Methodology

Trivariate probit model

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

- y_1^* and y_2^* – unobservable payment and policy consequentiality beliefs

- y_3^* – unobservable willingness-to-pay for the proposed initiative

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

- For each, zero-one coded indicators are observed:
  - y_1, y_2 – recoded consequentiality statements (0 – strongly disagree or disagree, 1 – else)
  - y_3 – a yes-no vote on the initiative (0 – no, 1 – yes)

Payment cons.: $y_1^* = \boldsymbol{\beta}_1' \boldsymbol{x_1} + \boldsymbol{\gamma}_1' \boldsymbol{z} + \epsilon_1$

Voting: $y_3^* = \boldsymbol{\beta}_3' \boldsymbol{x_3} + \delta_1 y_1 + \delta_2 y_2 + \epsilon_3$

Policy cons.: $y_2^* = \boldsymbol{\beta}_2' \boldsymbol{x_2} + \boldsymbol{\gamma}_2' \boldsymbol{z} + \epsilon_2$

- $\boldsymbol{x_1}$, $\boldsymbol{x_2}$ and $\boldsymbol{x_3}$ – vectors of exogenous variables

- Vector $\boldsymbol{z}$ of instruments – uncorrelated with error term ϵ_3 but correlated with y_1 and y_2; affects the yes-no vote only through consequentiality

- Maximum likelihood method

Choice of instrumental variables

- Explain consequentiality but uncorrelated with the error-term for the yes-no vote

- Agreement with the statements (each zero-one coded):
  – **Decisions**: "My decisions and behavior can help reduce marine plastics litter"
  – **Actions**: "My personal actions do NOT play a significant role in the health of the marine environment"

- <u>Correlation with perceived consequentiality</u>: Both variables capture a general sense of a respondent's perceived ability to influence the environmental problem in question

- <u>No direct effect on the yes-no vote</u>:
  – Both statements are very general and refer to any type of behavior or decisions
  – They do not make reference to governmental initiatives
  – It is not obvious whether a person that feels their actions and decision might somehow affect marine plastics pollution will have a lower or higher probability of supporting the proposed initiative

- Two instrumental variables: It is not clear a priori which of them would better explain which consequentiality belief indicator or whether they explain both indicators simultaneously

Explanatory variables

Variable	Explanation	Measurement / Unit	Mean	Std. dev.
Tax (cost)	Randomly assigned tax amount	NOK 1,000	3.22	2.30
Male		1 = male, 0 = female	0.51	0.50
Age		Years / 100	0.45	0.17
Child		1 = yes, 0 = no	0.57	0.50
University	University degree	1 = yes, 0 = no	0.62	0.49
Been	Been to Svalbard	1 = yes, 0 = no	0.13	0.34
Income	Household income	NOK 1,000	790.95	368.83
Missing income	Missing income data	1 = yes, 0 = no	0.24	0.43

Results: Trivariate probit

	Yes-No vote		Payment consequentiality		Policy consequentiality	
Tax (cost)	-0.143***	(0.033)	-0.094***	(0.029)	0.056**	(0.026)
Male	-0.133	(0.117)	-0.128	(0.139)	-0.061	(0.121)
Age	-2.716	(2.283)	-2.825	(2.636)	-4.248*	(2.318)
Age squared	2.639	(2.318)	2.544	(2.662)	4.785**	(2.342)
Child	0.078	(0.141)	0.110	(0.163)	-0.239	(0.145)
University	0.113	(0.118)	0.065	(0.146)	0.127	(0.127)
Been						
Income						
Missing income						
Payment cons.						
Policy cons.						
Decisions (IV)			0.243	(0.182)	0.388***	(0.148)
Actions (IV)			-0.622***	(0.228)	0.036	(0.234)
Constant	-0.962	(0.754)	1.957***	(0.590)	1.247**	(0.509)
Corr. vote and pay.	-0.558*	(0.325)				
Corr. vote and pol.	-0.664**	(0.236)				
Corr. pay. and pol.	0.324***	(0.088)				

- Instrumental variables (IV)
- Zero-one-coded agreement with the statements:
  - Decisions: "My decisions and behavior can help reduce marine plastics litter"
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Been	0.199	(0.167)	0.069	(0.207)	0.001	(0.175)
Income	0.378**	(0.166)	-0.179	(0.188)	-0.245	(0.168)
Missing income	-0.281**	(0.134)	0.202	(0.173)	-0.014	(0.144)
Payment cons.	1.364**	(0.640)				
Policy cons.	1.222***	(0.450)				
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Higher tax amounts lead respondents to perceive the survey as more policy consequential but less payment consequential

Results: Trivariate probit

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Payment cons.	1.364**		Perceiving the survey as payment and policy consequential			
Policy cons.	1.222***		makes it more likely that a respondent votes for the initiative			
Decisions (IV)			0.243	(0.182)	0.388***	(0.148)
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- Consequentiality is endogenous in the voting equation
- Consequentiality and the vote are both related to some unobservable factors
- These factors lower the likelihood of a "Yes" vote and increase the chance of viewing the survey as consequential
- Control of (significant) correlation

Divergent effects of a tax
on payment and policy consequentiality

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

- Interesting extension of earlier work, where consequentiality was assessed in general and preferences were elicited with a single dichotomous choice format too

- 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 consequentiality responses
  - Did the opposite effects balance out?

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- 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

Conclusions

- We contribute to the understanding of consequentiality aspects
  – payment and policy

- Except for consequentiality, we use an incentive compatible setting: single dichotomous choice, tax, no outside options, etc.

- The first investigation of these two aspects for an incentive compatible (single dichotomous choice) format (?)

- (Payment and/or policy) consequential respondents are more likely to vote for the initiative
  – Even when the possible endogeneity is controlled for

- Because of some differences in their roles, it might be recommended to separately assess the consequentiality aspects in field surveys

Conclusions

- We contribute to earlier evidence
  - Consequentiality perceptions might be a function of experimental design features
  - Cost weakens payment consequentiality and strengthens policy consequentiality
  - The finding is robust to the inclusion/exclusion of the instrumental variables

- Evidence of endogeneity of consequentiality perceptions
  - Unobserved factors strengthen consequentiality and decrease the probability of voting for the initiative
  - The finding needs to be treated with caution as it depends on the validity of the instruments (no empirical test of the validity)

- 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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