PAYMENT AND POLICY CONSEQUENTIALITY IN DICHOTOMOUS CHOICE CONTINGENT VALUATION: EXPERIMENTAL DESIGN EFFECTS ON SELF-REPORTED PERCEPTIONS

Tobias Börger
University of Stirling

Tenaw G. Abate
NORCE Norwegian Research Centre AS

Margrethe Aanesen
Arctic University of Norway

Ewa Zawojska
University of Warsaw

ewa.zawojska@uw.edu.pl

HOW TO DISCOVER TRUE VALUE OF NON-MARKET PUBLIC GOODS?

Consequentiality in stated preference

Non-market public goods

- Goods not bought/sold in the market
- Examples:
  - Clean air
  - Hiking trails in a national park
  - Marine biodiversity
- No market price → No indication of the value of the good
- What for may we need the value of such goods?
  - Estimation of benefits from public policy projects
  - Necessary for benefit-cost analyses
  - Evaluation of losses from natural damages for litigation processes (e.g., BP oil spill)
- Many applications: transportation, health, culture, environmental economics, …

How to discover the value of non-market public goods?

Revealed preference methods

→ use information on actual behavior (e.g., visits to a recreational site)

For example:

- In the past 12 months, how many times did you visit lake Ekoln?
- Approximately, how much time does it take you to get there? …

Stated preference methods

→ use surveys specifically designed to elicit information about preferences

For example:

Would you pay 50 EUR annually for the program of maintenance of lake Ekoln?

Yes / No

Stated preference methods

- Advantages:
  - + Capture use and passive-use values (e.g., existence value)
  - + Go beyond the scope of the existing data
  - + Provide relatively clean identification of policy effects
- Disadvantages:
  - – Not based on market behavior
  - – Might be viewed as not related to direct consequences
    - – Financial and policy consequences
    - – Hypothetical scenarios
    - – Lack of economic incentives to disclose preferences truthfully
  - – Incentive properties insufficiently understood
    - – Strategic responding
    - – Behavioral "anomalies" (e.g., attribute non-attendance, protest responses)

Do stated preferences represent true preferences?

How to discover the **true** value of goods?

Make surveys incentive compatible

Incentive compatibility = Revealing true preferences is a respondent's best strategy

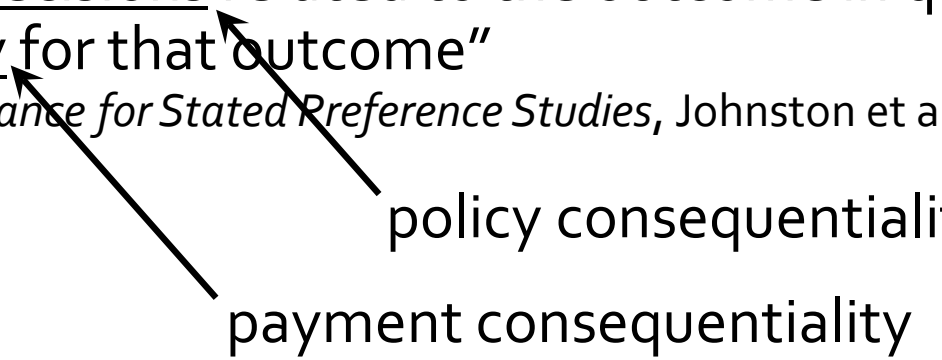
Necessary conditions for incentive compatibility (Carson and Groves 2007):

1. The survey is (perceived as) **consequential**:
   Respondents believe their responses will affect the final decision.
2. The authority can enforce the payment
   (coercive payment; e.g., a tax).
3. The survey involves a yes-no answer on a single project.

Further advancements:
- A sequence of questions (Vossler et al. 2012)
- An open-ended format (Vossler and Holladay 2018)

Consequentiality – definition

- "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)

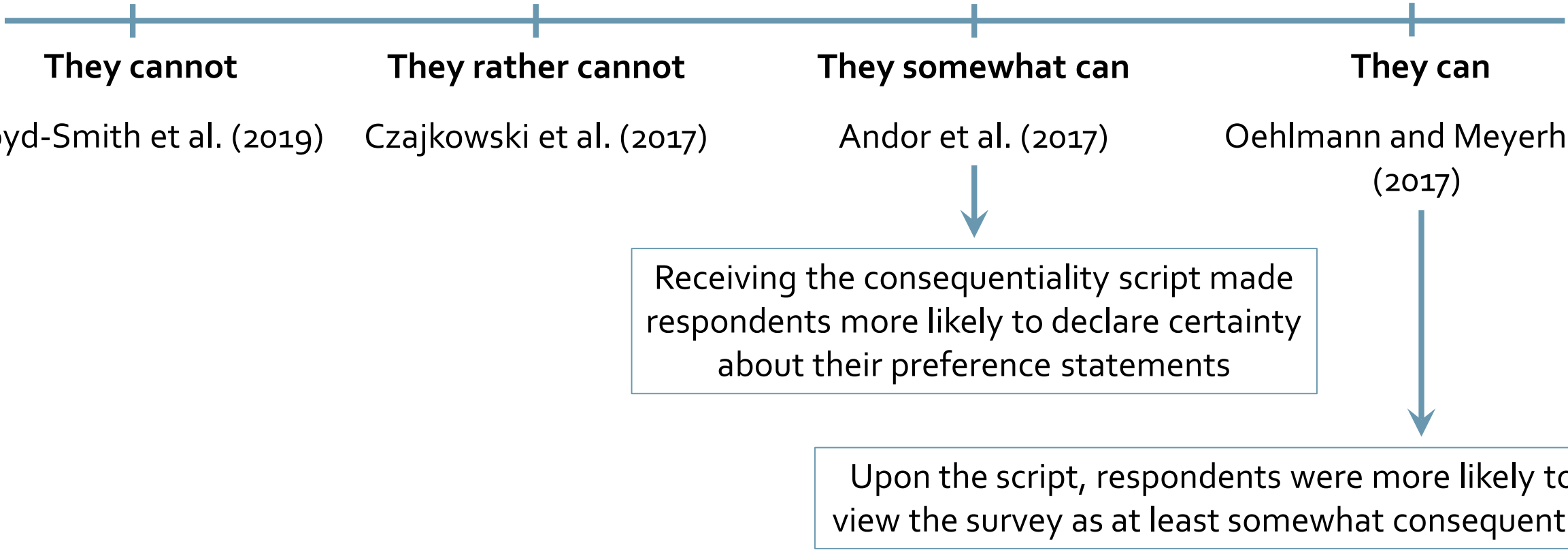


Controlling consequentiality in surveys

- **Communicated consequentiality** – researchers communicate in the script (potential) consequences of the survey outcome
- **Perceived consequentiality** – respondents are directly asked about their belief in the survey consequentiality
- Difficulties in credibly assuring respondents about consequentiality via scripts →
- Keeping consequentiality vague on purpose (e.g., when the presented project is preliminary and policy-makers prefer not to make definite statements)

- Need for elicitation of consequentiality perceptions
  - How to correctly elicit consequentiality perceptions?
  - How to take them into account in preference modelling?

Can consequentiality perceptions be induced with a survey script?



Controlling consequentiality in surveys

- **Communicated consequentiality** – researchers communicate in the script (potential) consequences of the survey outcome
- **Perceived consequentiality** – respondents are directly asked about their belief in the survey consequentiality
- Difficulties in credibly assuring respondents about consequentiality via scripts →
- Keeping consequentiality vague on purpose (e.g., when the presented project is preliminary and policy-makers prefer not to make definite statements)

- Need for elicitation of consequentiality perceptions
  - **How to correctly elicit consequentiality perceptions?**
  - **How to take them into account in preference modelling?**

Very limited guidance in this area

How are consequentiality perceptions elicited?

- A single general question: To what extent do you believe the survey outcome will affect the decision of public authorities?
- Questions differentiating between policy and payment consequentiality:
  - To what degree do you believe the survey outcome will affect whether the project is conducted?
  - If the authorities go forward with the plan, do you think your and other households will have to pay for it?
- Response scale – typically a Likert scale, from two to several levels
- Located after preference elicitation
  (the only exception: Lloyd-Smith et al. 2019)

How are consequentiality perceptions elicited?

- **A single general question**: To what extent do you believe the survey outcome will affect the decision of public authorities?
- **Questions differentiating between policy and payment consequentiality**:
  - To what degree do you believe the survey outcome will affect whether the project is conducted?
  - If the authorities go forward with the plan, do you think your and other households will have to pay for it?
- Response scale – typically a
- Located after preference eli
  (the only exception: Lloyd-S

- Is any of the approaches better?
- Limited evidence
- First field survey study with policy and payment cons.
  - Zawojska et al. (2019)

How are consequentiality perceptions elicited?

- **A single general question**: To what extent do you believe the survey outcome will affect the decision of public authorities?
- **Questions differentiating between policy and payment consequentiality**:
  - To what degree do you believe the survey outcome will affect whether the project is conducted?
  - If the authorities go forward with the plan, do you think your and other households will have
- Response scale – typic
- Located after preferen
(the only exception: Ll

- Distinctive effects of policy and payment consequentiality
- Policy consequentiality lowers sensitivity to the project cost, while payment consequentiality increases it
- Thus, they respectively increase and decrease willingness-to-pay for the project

How to include stated perceptions in preference modelling?

- Endogeneity concerns: Self-reports on consequentiality and stated preferences are likely driven by similar (unobservable) factors
- Limited and mixed empirical evidence on endogeneity
- Studies suggesting endogeneity:
  - Herriges et al. (2010)
  - Groothuis et al. (2017) – unobserved factors strengthen the consequentiality and decrease the likelihood of supporting the program
  - Lloyd-Smith et al. (2019) – without endogeneity control, perceived consequentiality affects stated preferences, but the effect disappears with the 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 separately policy and payment consequentiality

Consequentiality perceptions endogenous to survey design

- Cost:
  - Higher cost amounts weaken perceived consequentiality (Groothuis et al. 2017)
  - No effect of the cost amount on consequentiality (Lloyd-Smith et al. 2019)

- Location of the consequentiality elicitation question:
  - When asked about consequentiality perceptions before preference elicitation, the perceptions are stronger (Lloyd-Smith et al. 2019; Zawojska et al. 2019)

Börger, Abate, Aanesen and Zawojska (forthcoming in *Land Economics*)

"Payment and policy consequentiality in dichotomous choice contingent valuation: Experimental design effects on self-reported perceptions"

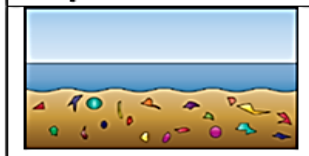
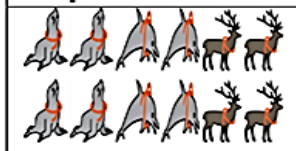
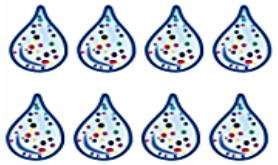
Research questions:

Do self-reports on policy and payment consequentiality depend on the preference elicitation attributes (the project cost)?

Are the self-reports endogenous to stated preferences?

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^* and y_2^* – unobservable payment and policy consequentiality beliefs
- y_3^* – unobservable willingness-to-pay for the proposed initiative
- 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)

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

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

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

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

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

- $\boldsymbol{x_1}$, $\boldsymbol{x_2}$ 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; affect the yes-no vote only through consequentiality
- Maximum likelihood method

Methodology

Trivariate probit model

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

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

- y_1^* and y_2^* – unobservable payment and policy consequentiality beliefs
- y_3^* – unobservable willingness-to-pay for the proposed initiative
- 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.: $y_1^* = \boldsymbol{\beta}_1' \boldsymbol{x_1} + \boldsymbol{\gamma}_1' \boldsymbol{z} + \epsilon_1$

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

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

- $\boldsymbol{x_1}$, $\boldsymbol{x_2}$ and $\boldsymbol{x_3}$ – vectors of exogenous variables
- Vector $\boldsymbol{z}$ of instruments – unco
  affect the yes-no vote only thro
- Maximum likelihood method

Correlation between each pair of error terms is calculated. It helps assess the endogeneity and the correlation between consequentiality indicators.

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"
- Correlation with perceived consequentiality: Both variables capture a general sense of a respondent's perceived ability to influence the environmental problem in question
- No direct effect on the yes-no vote:
  - 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 the 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)	0.137	(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"
  - Actions: "My personal actions do NOT play a significant role in the health of the marine environment"

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)				
Age	-2.716	(2.283)				
Age squared	2.639	(2.318)	2.544	(2.002)	4.765	(2.342)
Child	0.078	(0.141)	0.110	(0.163)	-0.239	(0.145)
University	0.113	(0.118)	0.065	(0.146)	0.137	(0.127)
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)				
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)				

Higher tax amounts lead respondents to perceive the survey as more policy consequential but less payment consequential

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)	0.137	(0.127)
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**					
Policy cons.	1.222***					
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)				

Perceiving the survey as payment and policy consequential makes it more likely that a respondent votes for the initiative

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)	0.137	(0.127)
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)				
Decisions (IV)						
Actions (IV)						
Constant	-0.962	(0.754)				
Corr. vote and pay.	-0.558*	(0.325)				
Corr. vote and pol.	-0.664**	(0.236)				
Corr. pay. and pol.	0.324***	(0.088)				

- 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

- 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

---

- 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 the 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

- 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 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
  - Did the opposite effects balance out?

Conclusions

- We contribute to the understanding of consequentiality aspects – payment and policy
- Except for consequentiality, we 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 (?)
- (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 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

HOW TO DISCOVER THE TRUE VALUE OF NON-MARKET PUBLIC GOODS?

Consequentiality in stated preference

- Although theoretically suggested and needed, consequentiality seems challenging
- Various consequentiality dimensions (e.g., payment, policy) may need to be considered
- Sensitivity to the experimental design: Tax amount – particular care for selecting credible amounts
- Evidence of the endogeneity issue

THANK YOU!

Ewa Zawojska

Faculty of Economic Sciences

University of Warsaw

ewa.zawojska@uw.edu.pl