USING INFERRED VALUATION TO DISENTANGLE RESPONSE BIASES IN STATED PREFERENCE DISCRETE CHOICE EXPERIMENTS

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Stated preference discrete choice experiments

- Many 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, values of separate attributes of the goods
- But also disadvantages:
  - Not based on market behavior = subject to various **survey response biases**
  - May be viewed as not related to direct consequences – **hypothetical bias**
  - May encourage respondents to answer in a manner to appear better and be positively viewed by others – **social desirability bias / warm glow**
  - May encourage **strategic responses** to affect the actual outcome
  - …

Inferred (indirect) valuation

Lusk and Norwood (2009)

- Instead of directly asking: Which good do you prefer the most?
  The inferred valuation asks indirectly: Which good does the population prefer the most?
- Alleviate hypothetical bias, particularly, resulting from social desirability bias?
- Some evidence from the growing literature in psychology and an indirect questioning approach developed and tested by Fisher (1993)

Inferred (indirect) valuation

Lusk and Norwood (2009)

- Theoretical model in brief
- A utility function involves two components:
  1. standard indirect utility V, which depends on wealth and provision of a good, and
  2. morality M , which depends on honesty and fulfilling social norms
- A respondent may gain utility from the value of a good (captured in V)
  but also from the act of saying they will pay for the good (captured in M)
- For inferred valuation (expected preferences of others), M=0
  (no extra utility from declaring noble intentions)

How does inferred valuation perform for various preference elicitation formats?

- Lusk and Norwood (2009): "One of the key advantages of inferred valuation is that the theory underpinning the methodology **does not depend on a particular elicitation format** or type of good. Inferred valuation [...] **can be applied with any elicitation format** and for public and private goods."
- Various studies have applied the inferred valuation but, to our knowledge, none of them has examined the method across varying elicitation formats

1. We study the inferred valuation in a discrete choice experiment, upon varying the number of choice alternatives: 2, 3 and 4
2. For each number of choice alternatives, we compare the inferred values with the values elicited in a traditional (direct) way

6 split-sample preference elicitations

What response biases/effects can affect value estimates in our study?

	2 choice alternatives	3 and 4 choice alternatives
Inferred valuation	True value	True value + number-of-alternatives related effects (e.g., complexity, preference matching)
Direct valuation	True value + social desirability bias	True value + social desirability bias + number-of-alternatives related effects (e.g., complexity, preference matching) + strategic responding

As everyone faced a sequence of choice tasks, we assume that anchoring and sequencing effects do not differ across the elicitation formats.

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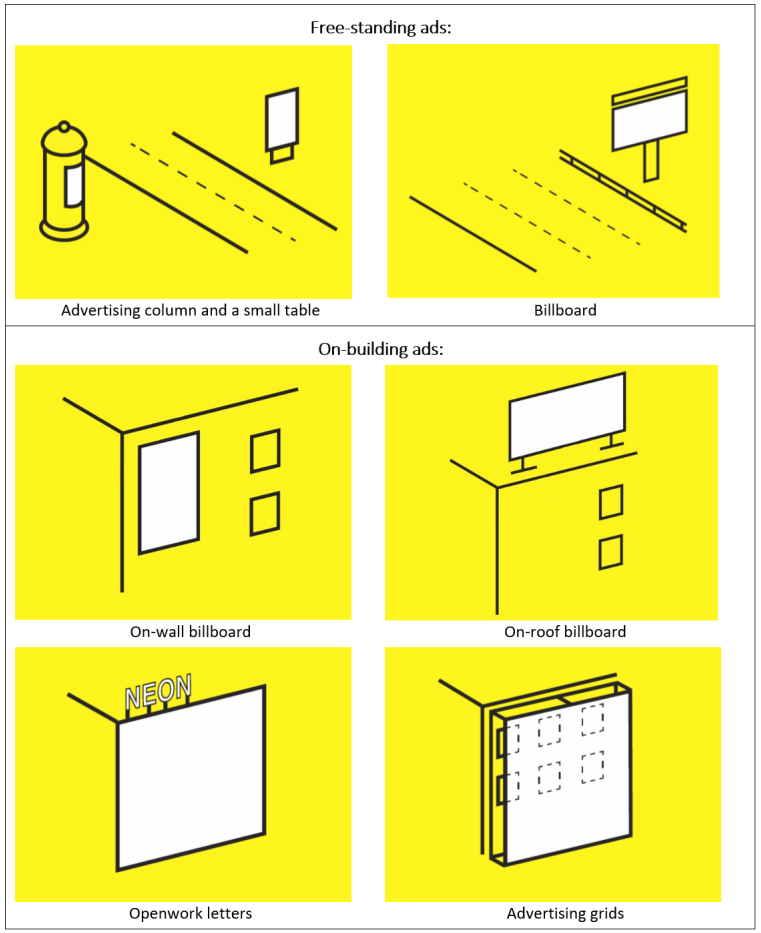
We aim to contribute to understanding how these response effects affect discrete choice value estimates

Empirical data

Czajkowski et al. (forthcoming). Valuing externalities of outdoor advertising in an urban setting - the case of Warsaw. Journal of Urban Economics.



- Discrete choice experiment (DCE) to elicit residents' preferences towards reducing outdoor advertisement in Warsaw, Poland
- Motivated by the "Landscape Bill" in Poland, which granted local governments a law to impose local regulations on outdoor advertising

Attributes	Attribute levels
Free-standing advertising	100% (no change) 75% (small reduction) 50% (medium reduction) 25% (large reduction) 0% (ban)
On-buildings advertising	100% (no change) 75% (small reduction) 50% (medium reduction) 25% (large reduction) 0% (ban)
Annual cost for respondent's household	0 (no change), 10, 25, 50, 75, 100, 200 PLN

Administration of the study and example of a choice card

- 12 choice tasks per respondent, 2,3 or 4 alternatives per choice task
- CAWI-based, December 2017 to January 2018
- Representative sample of 1250 adult inhabitants of Warsaw
- Response rate 48.7%

Choice situation 1	Alternative A (Status quo)	Alternative B	Alternative C
Free-standing advertising	100% (no change)	50% (medium reduction)	75% (small reduction)
On-buildings advertising	100% (no change)	0% (ban)	25% (large reduction)
Annual cost for your household	0 PLN (no change)	25 PLN	50 PLN
Your choice:	□	□	□

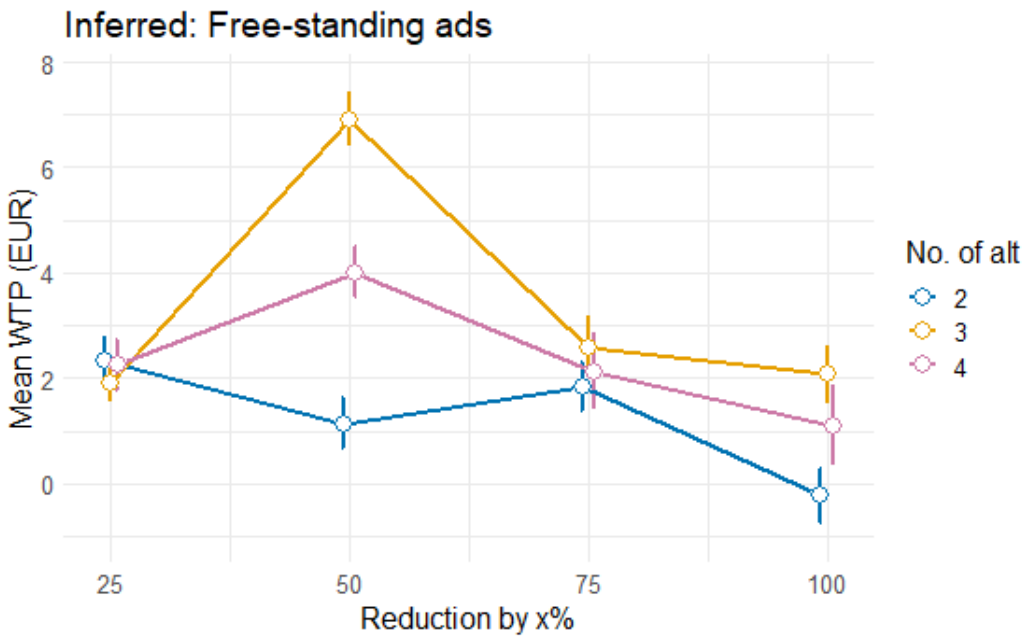
Empirical data – treatments

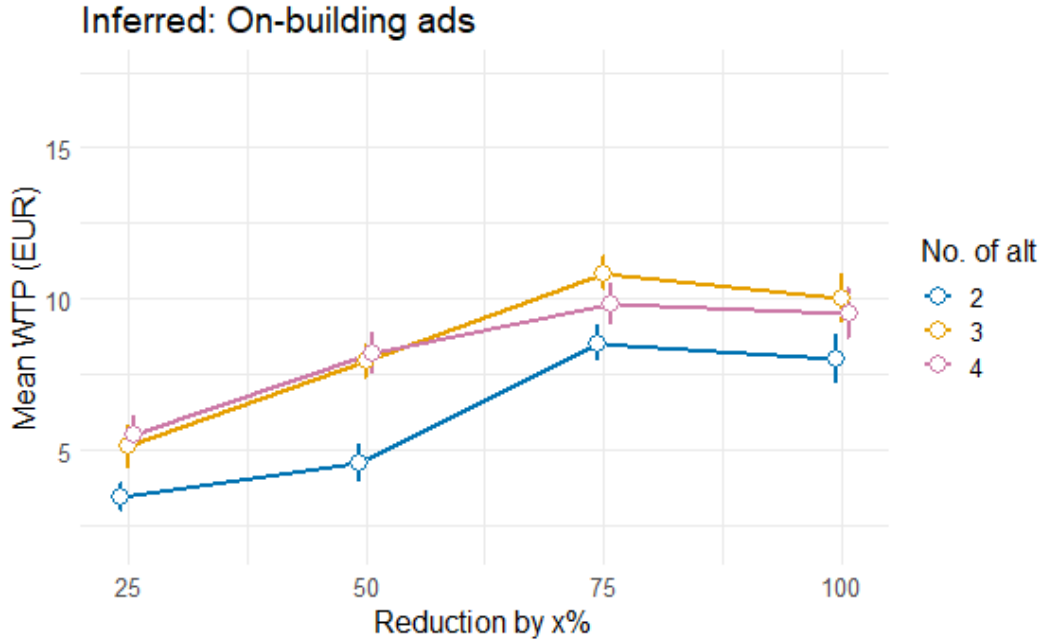
- Two series of choice tasks in the DCE:
  - Direct valuation: Choose the best alternative for your household (a series of 12 tasks)
  - Inferred valuation: Choose the alternative that you think is most preferred by Warsaw residents (a series of 6 tasks)
- We rotated the order of the two series
  Here, we use data only from the series displayed first
- Three treatments varying the number of choice alternatives: 2, 3 and 4
- In brief: 2 x 3 split-sample design

Econometric approach

- Two separate mixed (random-parameter) logit models: one for inferred valuation and one for direct valuation
- Heterogeneous preferences described by continuous distributions of the parameters on choice attributes – all normal, except for the log-normal cost
- All preference parameters interacted with 3- and 4-alternative elicitations
- Willingness-to-pay (WTP) space – parameters represent WTP in EUR per year
- Maximum likelihood method; 4,000 scrambled Sobol draws

Results: Inferred values across various elicitation formats





Compared to the 2-alternative elicitation, in 3- and 4-alternative elicitations:

- WTP is statistically higher, except for two levels of free-standing ads
- WTP for avoiding status quo is significantly higher
- WTP values are more similar (not statistically different for all but one cases)

Results: Inferred values across various elicitation formats

- These results signal some significant effects tied to the number of choice alternatives e.g., increased complexity, improved preference matching upon more alternatives
- These differences are NOT related to strategic responses – no incentive for a strategic response when asked about others' preferences

- Inferred valuation does not generate the same value estimates for different numbers of choice alternatives, evidencing that the method is not free from some behavioral effects

Compared to the 2-alternative elicitation, in 3- and 4-alternative elicitations:

- WTP is statistically higher, except for two levels of free-standing ads
- WTP for avoiding status quo is significantly higher
- WTP values are more similar (not statistically different for all but one cases)

Results: Inferred versus direct values

		2 alt. inferred	2 alt. direct	3 alt. inferred	3 alt. direct	4 alt. inferred	4 alt. direct
WTP estimates	Status quo	-3.3	-6.5	-5.3	-6.1	-6.0	-8.0
	Free-standing -25%	2.3	1.9	1.9	2.4	2.2	2.9
	Free-standing -50%	1.1	1.6	6.9	2.7	4.0	5.2
	Free-standing -75%	1.8	3.7	2.6	2.6	2.1	5.7
	Free-standing -100%	-0.2	3.5	2.1	1.0	1.1	2.5
	On-building -25%	3.4	4.3	5.1	5.4	5.5	8.1
	On-building -50%	4.6	5.2	7.9	9.7	8.2	13.7
	On-building -75%	8.5	5.8	10.9	8.6	9.8	14.3
	On-building -100%	8.0	7.4	10.0	9.6	9.5	15.0

Results: Inferred versus direct values

	2 alt.	3 and 4 alt.
Inferred	True value	True value + number-of-alternatives related effects (e.g., complexity, preference matching)
Direct	True value + social desirability bias	True value + social desirability bias + number-of-alternatives related effects (e.g., complexity, preference matching) + strategic responding

		2 alt. inferred	2 alt. direct	3 alt. Inferred	3 alt. direct	4 alt. inferred	4 alt. direct
WTP estimates	Status quo	-3.3	-6.5	-5.3	-6.1	-6.0	-8.0
	Free-standing -25%	2.3	1.9	1.9	2.4	2.2	2.9
	Free-standing -50%	1.1	1.6	6.9	2.7	4.0	5.2
	Free-standing -75%	1.8	3.7	2.6	2.6	2.1	5.7
	Free-standing -100%	-0.2	3.5	2.1	1.0	1.1	2.5
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	On-building -75%	8.5	5.8	10.9	8.6	9.8	14.3
	On-building -100%	8.0	7.4	10.0	9.6	9.5	15.0
WTP inferred – WTP direct	Status quo	3.1	**	0.7		2.0	**
	Free-standing -25%	0.5		-0.5		-0.7	
	Free-standing -50%	-0.5		4.2	**	-1.2	
	Free-standing -75%	-1.8		0.0		-3.5	**
	Free-standing -100%	-3.7	**	1.1		-1.4	
	On-building -25%	-0.9		-0.3		-2.6	**
	On-building -50%	-0.6		-1.8	**	-5.5	**
	On-building -75%	2.8	**	2.3	**	-4.5	**
	On-building -100%	0.6		0.4		-5.5	**

Results: Inferred versus direct values

2 alternatives:

- Direct WTP is statistically higher for avoiding status quo and banning free-standing advertisement, suggesting positive social desirability bias in direct valuation
- The effect is less clear for 75% reduction in on-building advertisement

3 and 4 alternatives:

- The estimates may include both effects: social desirability and strategic responding
- The estimates in 4 alternatives are in line with predictions based on social desirability bias
- The results in 3 alternatives are much less straightforward – perhaps affected by strategic response considerations

		2 alt. inferred	2 alt. direct	3 alt. inferred	3 alt. direct	4 alt. inferred	4 alt. direct
WTP estimates	Status quo	-3.3	-6.5	-5.3	-6.1	-6.0	-8.0
	Free-standing -25%	2.3	1.9	1.9	2.4	2.2	2.9
	Free-standing -50%	1.1	1.6	6.9	2.7	4.0	5.2
	Free-standing -75%	1.8	3.7	2.6	2.6	2.1	5.7
	Free-standing -100%	-0.2	3.5	2.1	1.0	1.1	2.5
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WTP inferred – WTP direct	Status quo	3.1	**	0.7		2.0	**
	Free-standing -25%	0.5		-0.5		-0.7	
	Free-standing -50%	-0.5		4.2	**	-1.2	
	Free-standing -75%	-1.8		0.0		-3.5	**
	Free-standing -100%	-3.7	**	1.1		-1.4	
	On-building -25%	-0.9		-0.3		-2.6	**
	On-building -50%	-0.6		-1.8	**	-5.5	**
	On-building -75%	2.8	**	2.3	**	-4.5	**
	On-building -100%	0.6		0.4		-5.5	**

Results: Inferred versus direct values

		2 alt. inferred	2 alt. direct	3 alt. inferred	3 alt. direct	4 alt. inferred	4 alt. direct
WTP	Small reduction program	90.9	126.2	123.5	139.0	137.7	190.2
	Large reduction program	137.2	159.0	187.8	172.8	179.5	279.6
	Total ban program	111.0	173.6	174.1	167.0	166.1	255.6
WTP direct / WTP inferred	Small reduction program	1.39		1.12		1.38	
	Large reduction program	1.16		0.92		1.56	
	Total ban program	1.56		0.96		1.54	

Social desirability bias in a range of 16-56%

Substantially different results – strategic responses?

Social desirability bias in a range similar to 2-alternative version: 38-56%

Concluding thoughts

- Inferred valuation does not generate the same value estimates for elicitation formats varying in the number of choice alternatives
- The approach appears to be susceptible to behavioral effects (e.g., choice task complexity, preference matching)
- Studies examining social desirability bias by comparing direct and inferred values from choice experiments with more than 2 choice alternatives may confound the bias examination with strategic response bias
- Our estimates of social desirability bias are lower than in some other empirical studies, which may be related to stronger consequentiality beliefs in our study