Endogeneity of Self-Reported Consequentiality in Stated Preference Studies

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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

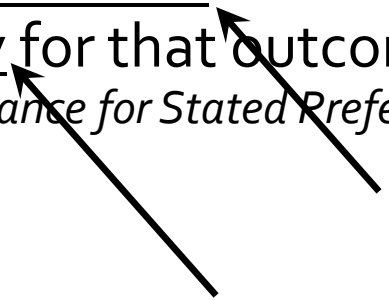
Conditions for truthful preference disclosure
(Carson and Groves 2007; Carson et al. 2014; Vossler et al. 2012)

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)



policy consequentiality

payment consequentiality

Any other dimensions of consequentiality?
E.g., pivotality?

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
  - More indicator (measurement) questions

→ • 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

Our study addresses these questions

Endogeneity of consequentiality perceptions

explored in previous studies

- Herriges et al. (2010) – an exogenous information treatment and a Bayesian treatment-effect model; importance of controlling for endogeneity
- No significant problem of endogeneity especially in studies using socio-demographics as instruments:
  - Vossler et al. (2012) – a generalized method of moments over-identification test
  - Interis and Petrolia (2014) – a two-step instrumental variable probit model
- Groothuis et al. (2017) – a bivariate probit approach; perceived consequentiality found endogenous; unobserved factors strengthen the consequentiality and decrease the likelihood of voting for the program
- Lloyd-Smith et al. (forthcoming) – a special multi-step estimator for a scaled probit model; importance of controlling for endogeneity; with no endogeneity control, perceived consequentiality affects voting behavior, but the effect disappears for the special regressor

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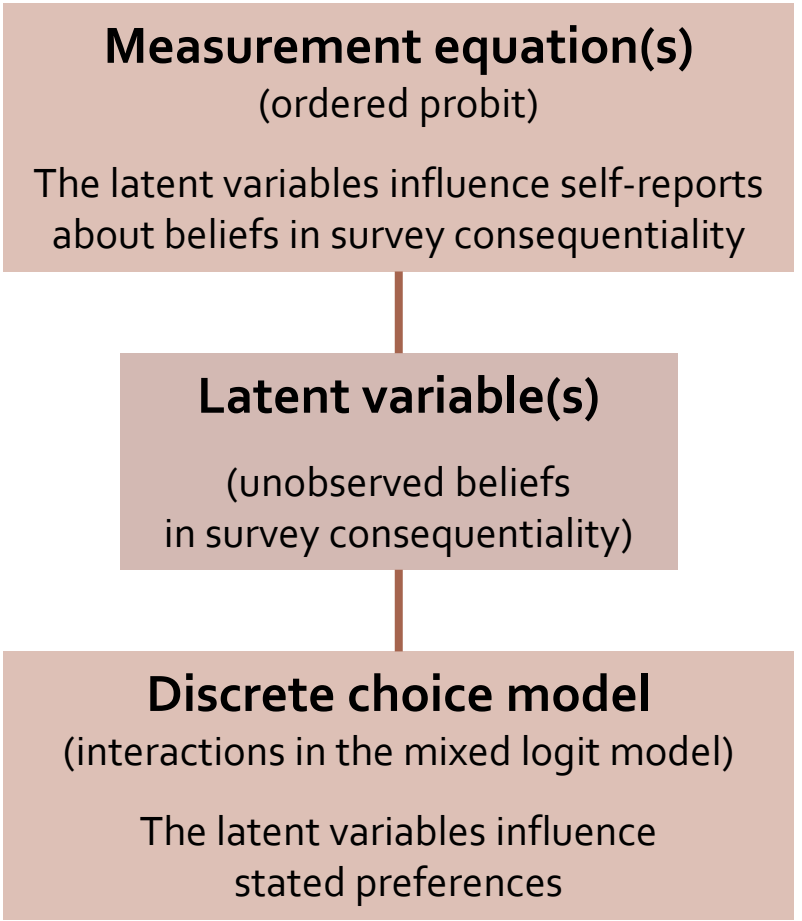
Limitations:

- Little evidence – very few studies
- Mixed evidence
- Mostly for binary choice data (not discrete choice experiments)
- Step-wise procedures
- Single indicator (measurement) questions for consequentiality

Our approach: Hybrid choice model

Budziński and Czajkowski (2018)

- Hybrid choice models incorporate 'soft' (not objectively measureable) variables, such as perceptions and attitudes, into the choice model
- Here, the 'soft' variable: beliefs about survey consequentiality
- Directly including indicator variables (e.g., self-reports about perceived consequentiality) into a choice model may lead to biased estimates due to endogeneity and measurement problems
- All equations are estimated simultaneously



Endogeneity control in hybrid choice models

Budziński and Czajkowski (2018)

Model 1

- Standard hybrid choice models do not resolve endogeneity
- Types of endogeneity:
  1) A latent variable is endogenous
  2) The indicator variable is endogenous, but the latent variable is not

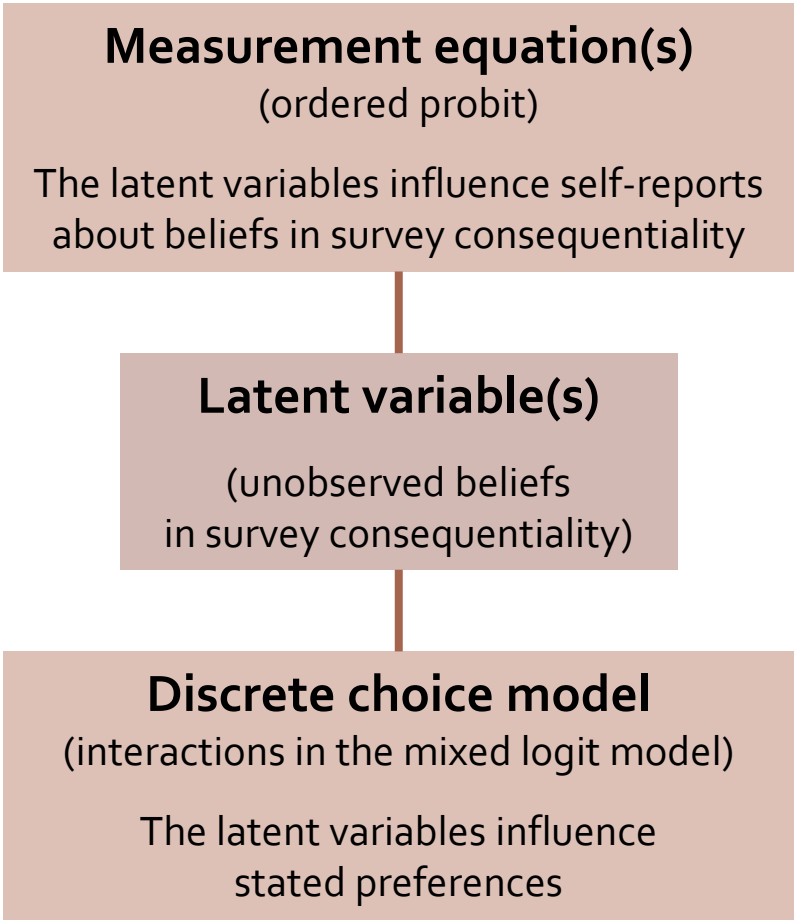
Model 2

- Solutions:
  - Directly modeling the correlation between the latent variable and random parameters – help (1)

Model 3

  - Adding another latent variable to account for correlation between error terms – help (1) and (2)

Here, we present the first application of these approaches



Empirical data

- We use the hybrid choice model to examine the role of consequentiality and of endogeneity control for value estimates
- Data from three large-scale discrete choice experiments
- Samples from 801 to 2,863 respondents
- Various valuation contexts: public theater offer, renewable energy
- Various ways of eliciting consequentiality perceptions: from one to several indicator questions
- This presentation focuses on one application only

Discrete choice experiment

- Public-good scenario: Extension of public theater offer in Poland (a number of shows)
- 4 choice tasks per person; CAWI; a representative sample of 2,863 residents of Poland

	Variant A	Variant B No changes	Attribute levels
 **Entertainment theaters**	+ 25%	no change	+ 25%, + 50%, no change
 **Drama theaters**	+ 50%	no change	
 **Children's theaters**	no change	no change	
 **Experimental theaters**	+ 50%	no change	
Annual cost for you (tax)	50 PLN	0 PLN	5, 10, 20, 50 PLN
Your choice	☐	☐	

Consequentiality elicitation

- 10 statements assessed on a Likert scale with seven levels:
  from 'definitely disagree' to 'definitely agree' + don't know
- All used in the measurement → 10 ordered probit models as measurement equations

I think that …
[1] … by participating in this survey, I will have influence on the future theater offer.
[2] … the results of this survey will determine if to change the theater offer.
[3] … the results of this survey will be used to decide if to change the theater offer.
[4] … if the theater offer is decided to be changed, the results of this survey will be used to decide which type of shows will be played more and less.
[5] … if the theater offer is decided to be changed, the results of this survey will be used to decide if to change the (tax) fees used for funding theaters.
[6] … the increase of the theater offer as described in this survey is possible to be implemented.
[7] … a decision to expand the theater offer will indeed result in more shows and premiers, as described in this survey.
[8] … a decision to expand the theater offer will indeed result in higher (tax) fees, which will increase my household expenditures, as described in this survey.
[9] … I am one of many people participating in this survey, so my responses do not have a chance to affect the survey final results.
[10] … a decision whether to change the theater offer will be taken independently of the survey results.

Results

Measurement equation(s)
(ordered probit)

The latent variables influence self-reports about beliefs in survey consequentiality

Latent variable(s)

(unobserved beliefs in survey consequentiality)

Discrete choice model
(interactions in the mixed logit model)

The latent variables influence stated preferences

- One latent variable (LV): Perceived consequentiality
- Responses to each consequentiality statement are explained with the latent variable
- The latent perceived consequentiality is positively correlated with the statements (except for the last two)

	Model 1	Model 2	Model 3
	Standard	Corr. LV and random parameters	+ 1 LV
LL	-41,858	-41,841	-41,556
AIC/n	7.328	7.326	7.278

→ better → even better

Results

	Model 1	Model 2
	Standard	**Corr. LV and random parameters**
Status quo	0.3837**	0.4652***
Entertainment	0.9375***	1.0439***
Drama	0.6133**	0.5158*
Children's	0.0029	0.0483
Experimental	-0.5546*	-0.5113*
– Cost (10 EUR)	4.1475***	4.0275***
Interactions with LV		
Status quo	-0.3611**	-0.5576**
Entertainment	0.3587	-0.1656
Drama	0.4487*	1.2045***
Children's	0.1170	0.0170
Experimental	1.0192***	0.7649*
– Cost (10 EUR)	-0.5166***	1.0675***

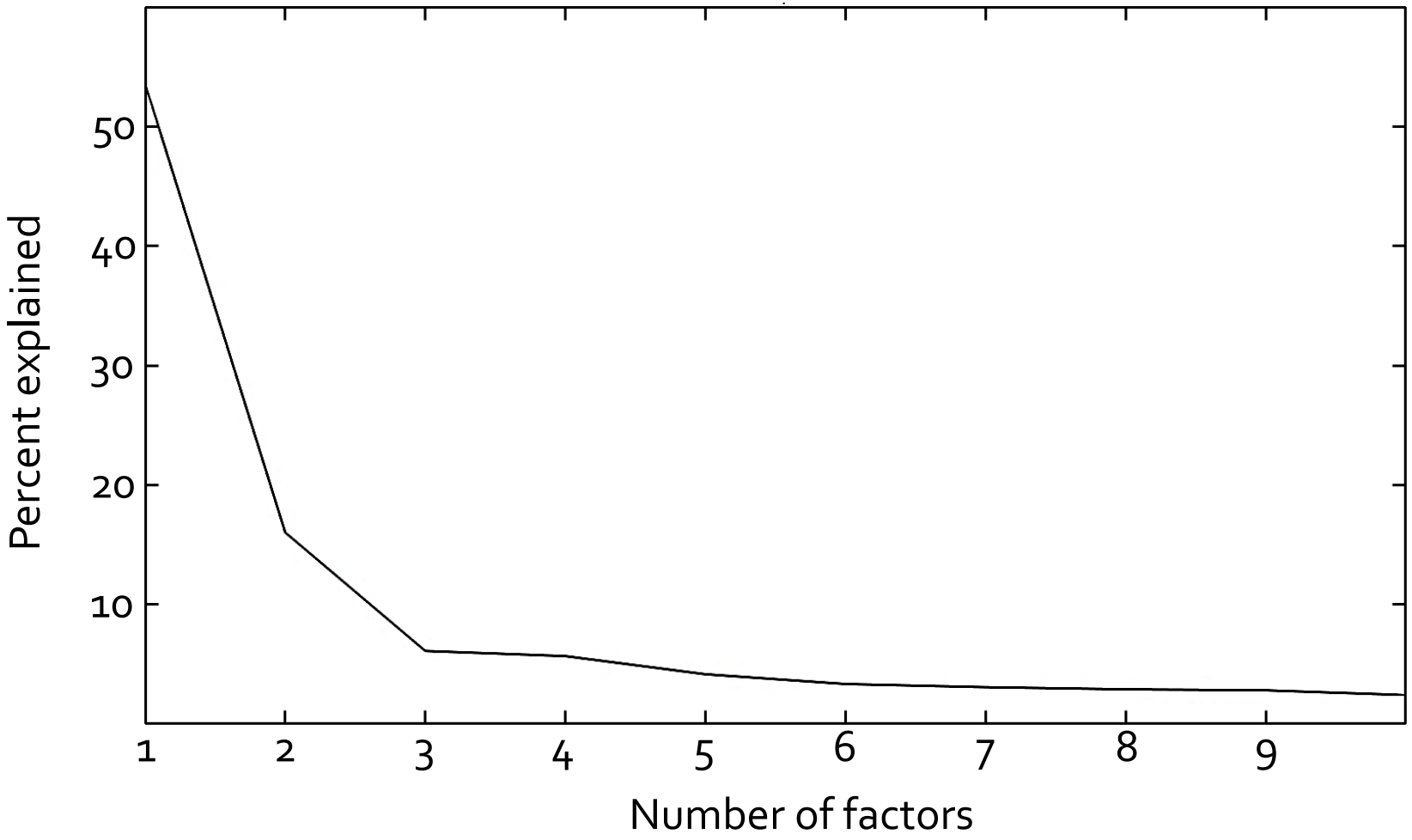
- Preference parameters are random (mixed logit)
- For all, standard deviations are highly significant
- Mean coefficient estimates are reported
- Model 2 accounts for one endogeneity type: endogeneity of the latent variable
- Endogeneity control matters for the cost attribute
- And so it changes willingness-to-pay values

	Model 1	Model 3
	Standard	**+ 1 LV**
Status quo	0.3837**	0.4473***
Entertainment	0.9375***	0.9280***
Drama	0.6133**	0.5096**
Children's	0.0029	-0.0860
Experimental	-0.5546*	-0.2998
– Cost (10 EUR)	4.1475***	3.7717***
Interactions with LV1		
Status quo	-0.3611**	-0.3860**
Entertainment	0.3587	0.5477**
Drama	0.4487*	0.3940
Children's	0.1170	0.1653
Experimental	1.0192***	0.9112***
– Cost (10 EUR)	-0.5166***	-0.3611**
Interactions with LV2		
Status quo		-0.0595
Entertainment		0.0259
Drama		0.0281
Children's		0.2930
Experimental		0.0877
– Cost (10 EUR)		-0.2668*

Results

- LV2 explains significantly all indicator questions in the measurement equations – positive correlation
- In Model 3, LV1 is correlated negatively with the last two statements and positively with all others
- LV2 can be another dimension of consequentiality / yea-saying
- Or a negligible role of endogeneity
- How many dimensions of consequentiality do we have?

How many dimensions of consequentiality do we have?



Closing thoughts

- More research:
  - Model specifications with more latent variables to control for more dimensions of consequentiality (or for other aspects captured by the ten statement responses)
  - Other datasets with several indicators of consequentiality
  - The need to (theoretically) identify dimensions of perceived consequentiality and to design ways (indicator questions) of eliciting the perceptions
- For now:
  - Some evidence of endogeneity issues – particularly important for the cost attribute
  - Accounting for consequentiality (or other) dimensions appears to be more important for the model fit than controlling for endogeneity
  - Similar findings from other datasets we have considered
- **The first application of a hybrid choice model in theory correcting for endogeneity**

THANK YOU!

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