NATIONAL SCIENCE CENTRE
POLAND

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

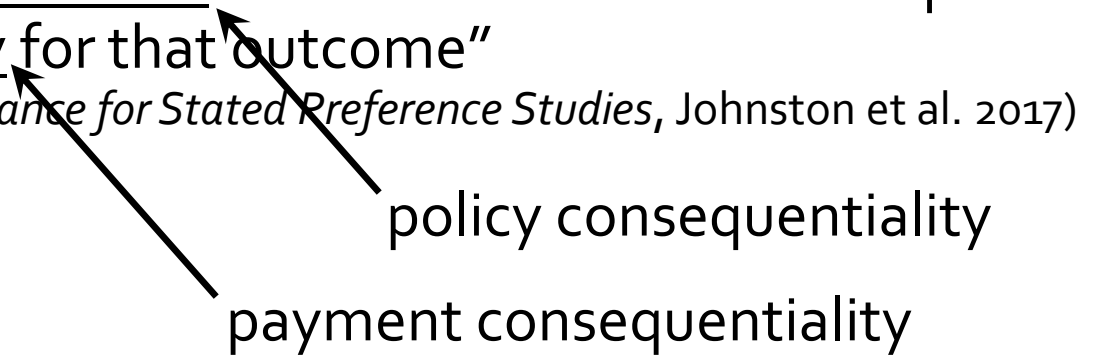
Conditions for truthful preference disclosure
(Carson and Groves 2007; Carson et al. 2014; Vossler et al. 2012)

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)



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. 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
  - 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 to be endogenous; unobserved factors strengthen the consequentiality and decrease the likelihood of voting for the program
- Lloyd-Smith et al. (2019) – 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 with the special regressor

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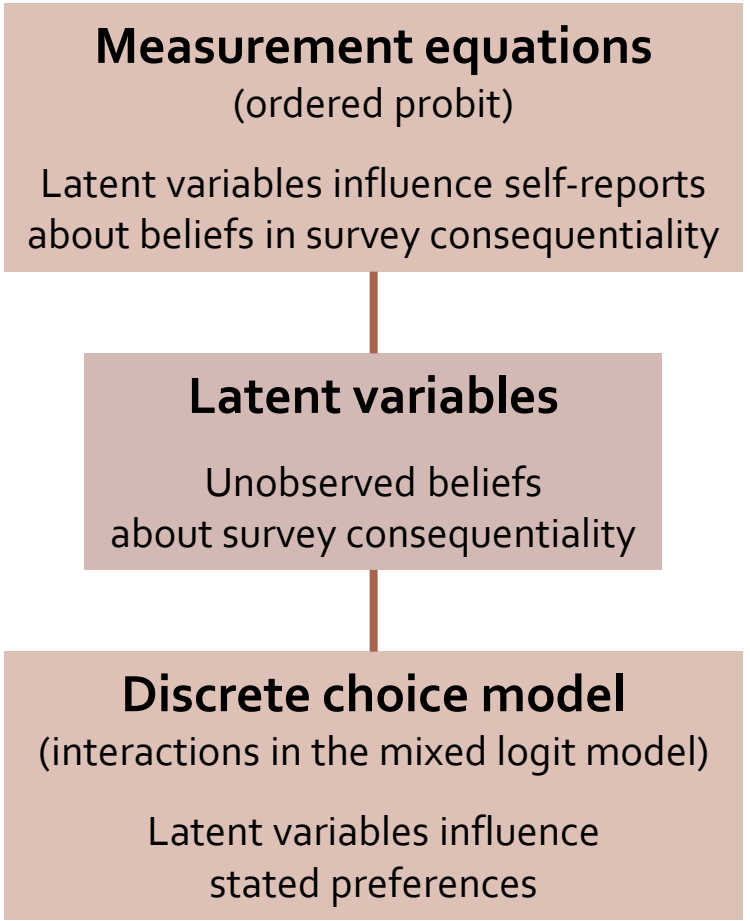
Limitations:

- 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

- Hybrid choice models incorporate 'soft' (not objectively measureable) variables, such as perceptions and attitudes, into the choice model
- Here, the 'soft' variables: 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

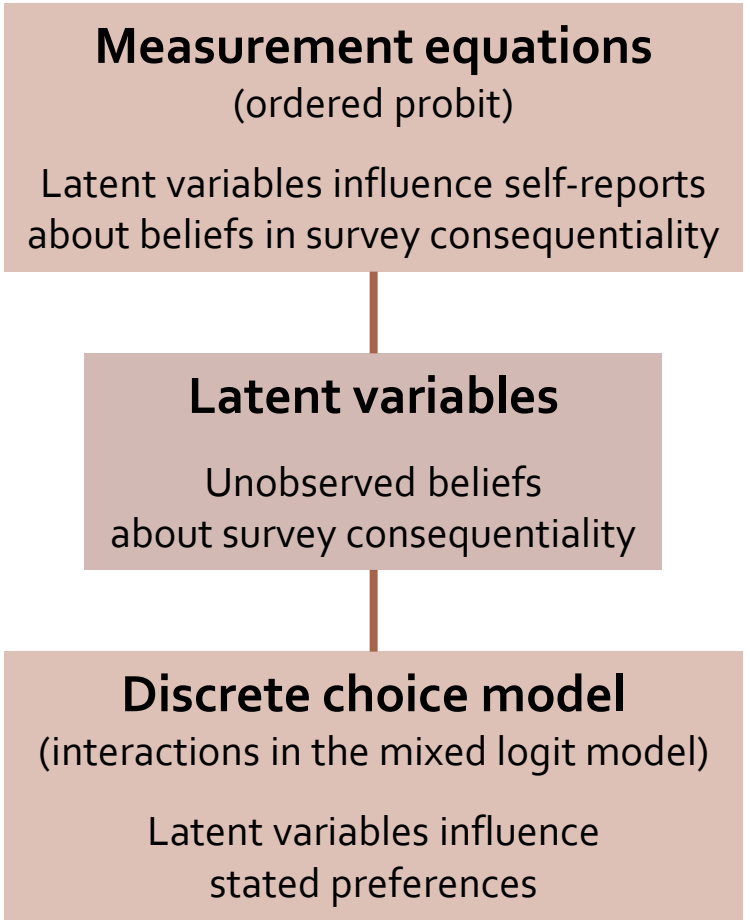
Budziński and Czajkowski (2018)

Model 1

- Standard hybrid choice models do not resolve endogeneity of indicator variables
- Two types of endogeneity:
  1) Latent variables are endogenous
  2) Indicator variables are endogenous, but latent variables are not
- Solutions:
  - Directly modeling the correlation between latent variables and random parameters – help (1)
  - Adding a latent variable to capture the correlatio caused by missing covariates – help (1) and (2)

Model 2

Model 3



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

- Randomized statements assessed on a Likert scale with seven levels: from 'definitely disagree' to 'definitely agree' + don't know
- Used in the measurement → 9 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] … the increase of the theater offer as described in this survey is possible to be implemented.
[6] … a decision to expand the theater offer will indeed result in more shows and premiers, as described in this survey.
[7] … 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.
[8] … I am one of many people participating in this survey, so my responses do not have a chance to affect the survey final results.
[9] … a decision whether to change the theater offer will be taken independently of the survey results.

Results

Measurement equations
(ordered probit)

Latent variables influence self-reports about beliefs in survey consequentiality

Latent variables

Unobserved beliefs about survey consequentiality

Discrete choice model
(interactions in the mixed logit model)

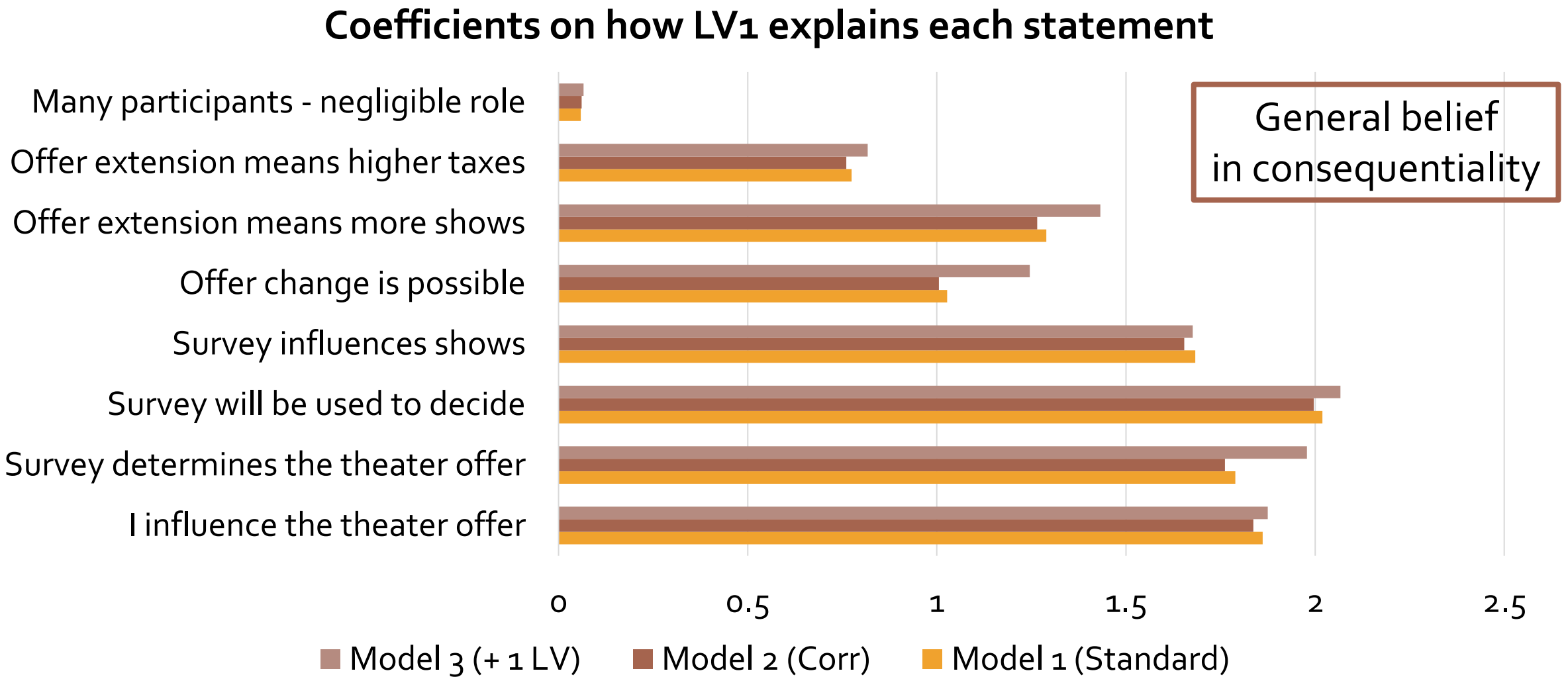
Latent variables influence stated preferences

	Model 1	Model 2	Model 3
	Standard	**Corr. LVs and random parameters**	**+ 1 LV**
LL	-38,620.1	-38,564.6	-38,465.4
AIC/n	6.764	6.756	6.739

- Responses to consequentiality statements are explained with latent variables
- Two latent variables (LVs) expressing perceived consequentiality:
  - General belief in consequentiality
  - Lack of belief in pivotality

Results: Measurement equations

Ordered probits



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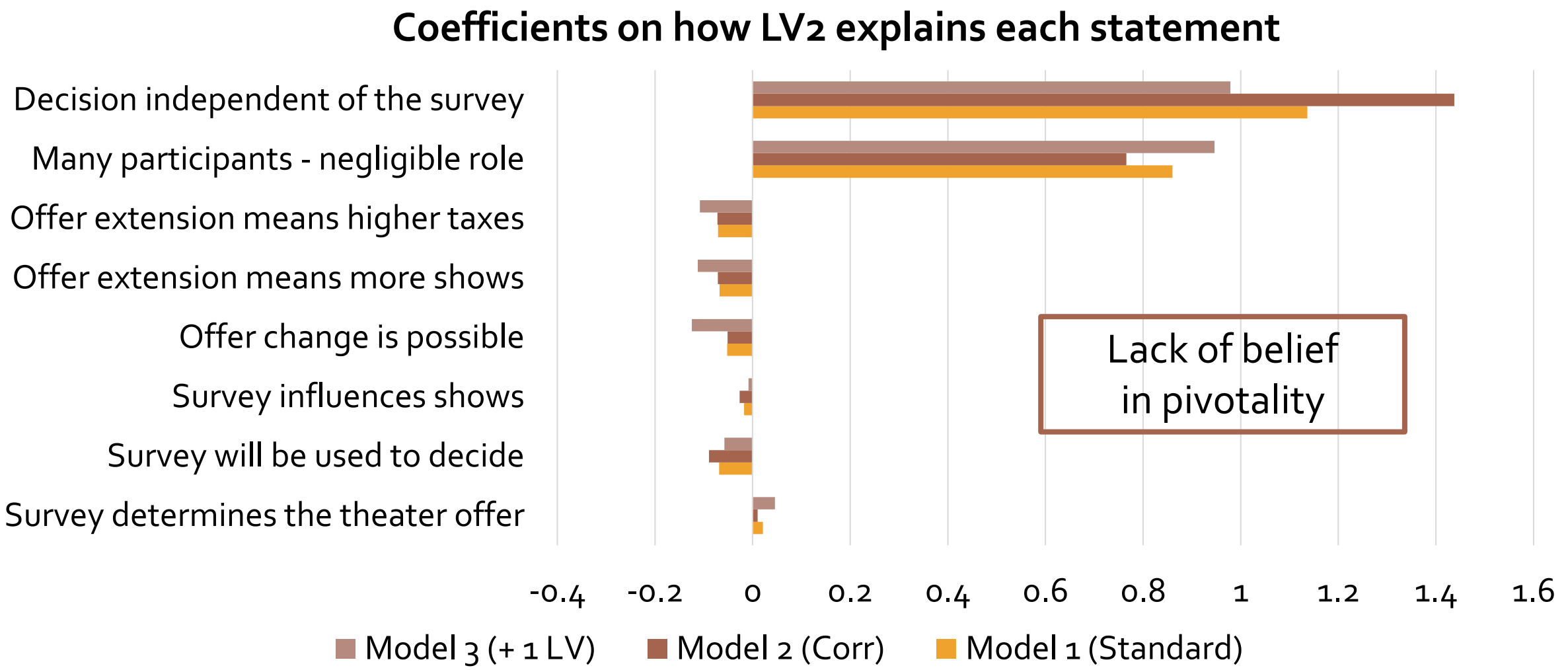
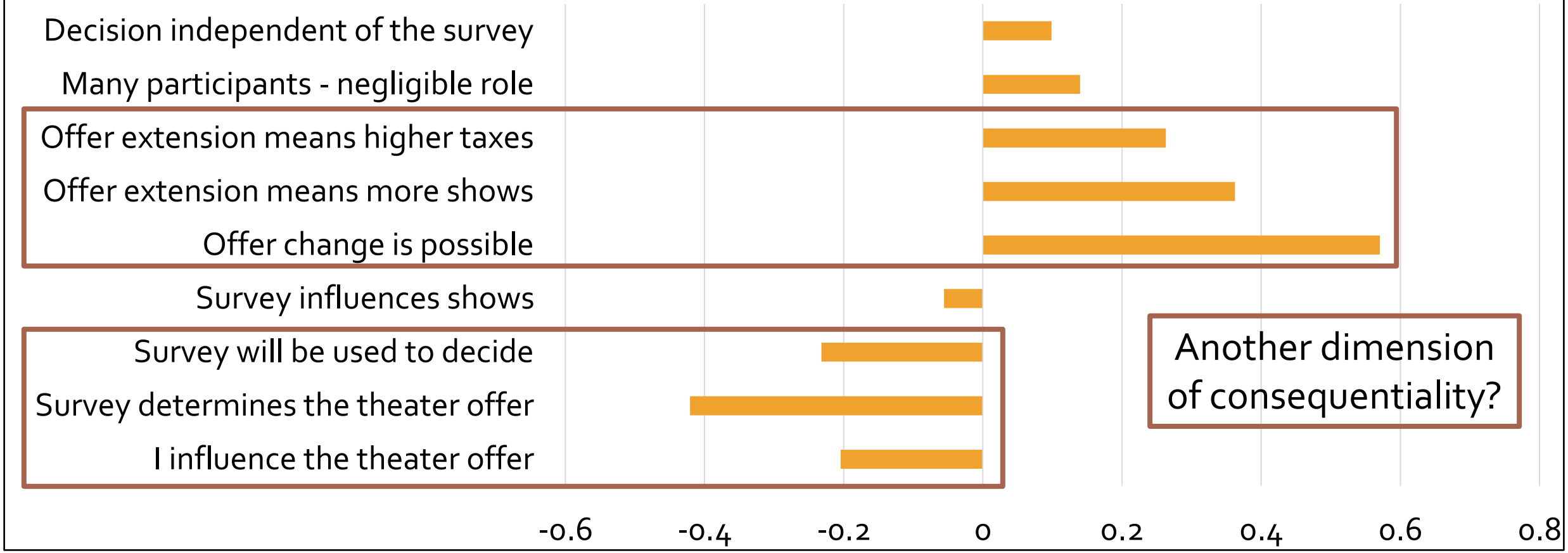


Results: Measurement equations

Ordered probits

Additional latent variable in Model 3 (+ 1 LV) to control endogeneity

Coefficients on how LV3 explains each statement



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Latent variables influence stated preferences

	Model 1	Model 2	Model 3
	Standard	**Corr. LVs and random parameters**	**+ 1 LV**
LL	-38,620.1	-38,564.6	-38,465.4
BIC/n	6.834	6.835	6.819

→ better → even better

- Two latent variables (LVs) expressing perceived consequentiality:
  - General belief in consequentiality
  - Lack of belief in pivotality

Results: Discrete choice component

Mixed logits with means interacted with LVs

Mean coefficient estimates

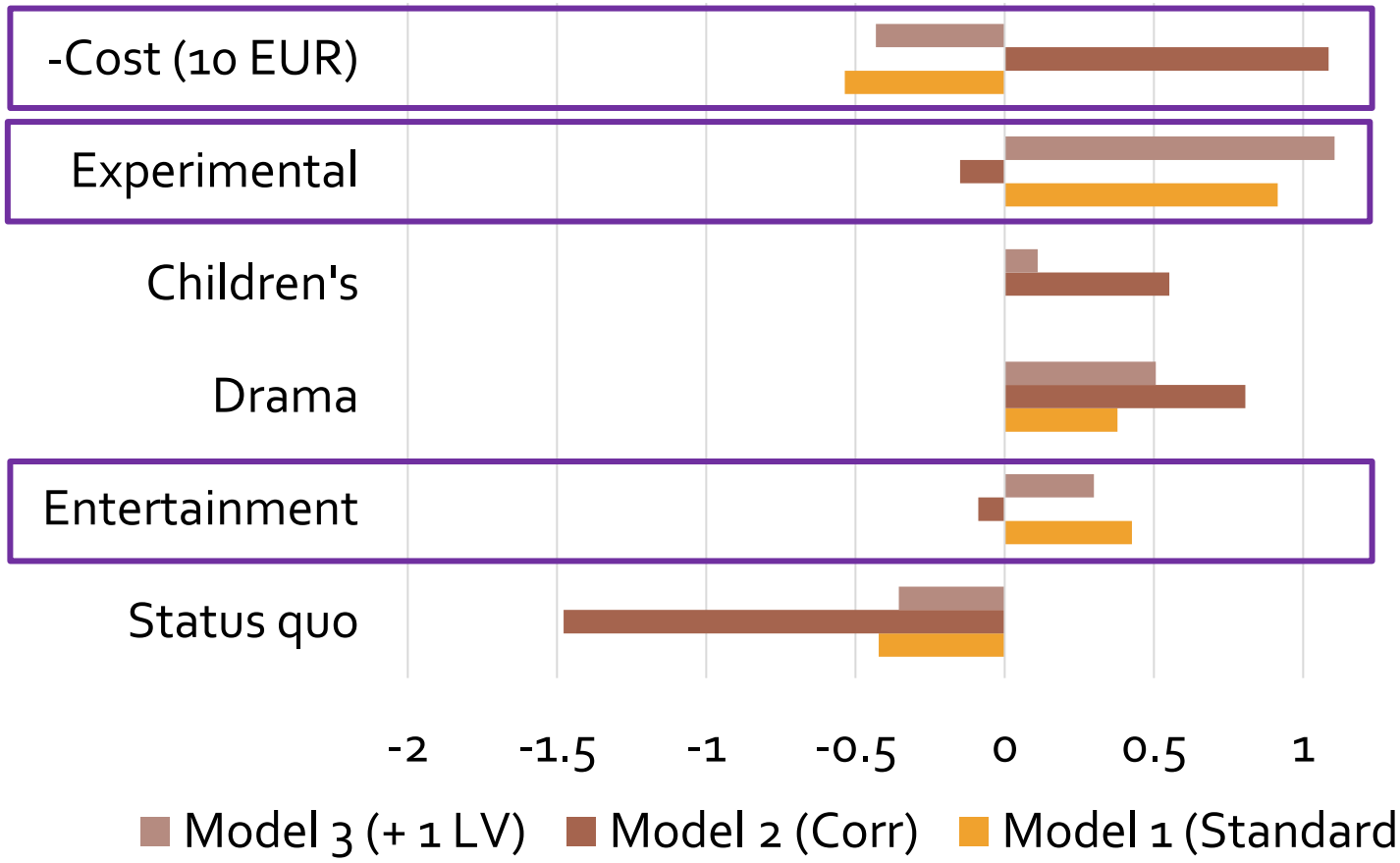
	Model 1	Model 2	Model 3
	Standard	**Corr. LVs and random parameters**	**+ 1 LV**
Status quo	0.4719***	0.4459***	0.4711***
Entertainment	0.8926***	0.999***	0.9151***
Drama	0.5769**	0.464*	0.4259
Children's	0.1364	0.1099	0.0443
Experimental	-0.4336	-0.502*	-0.409
– Cost (10 EUR)	3.7752***	3.8161***	3.6282***

- Preference parameters are random
- For all, standard deviations are (highly) significant
- Mean coefficient estimates are similar across models

Results: Discrete choice component

Mixed logits with means interacted with LVs

Coefficients of interactions of means with LV1 (general consequentiality)

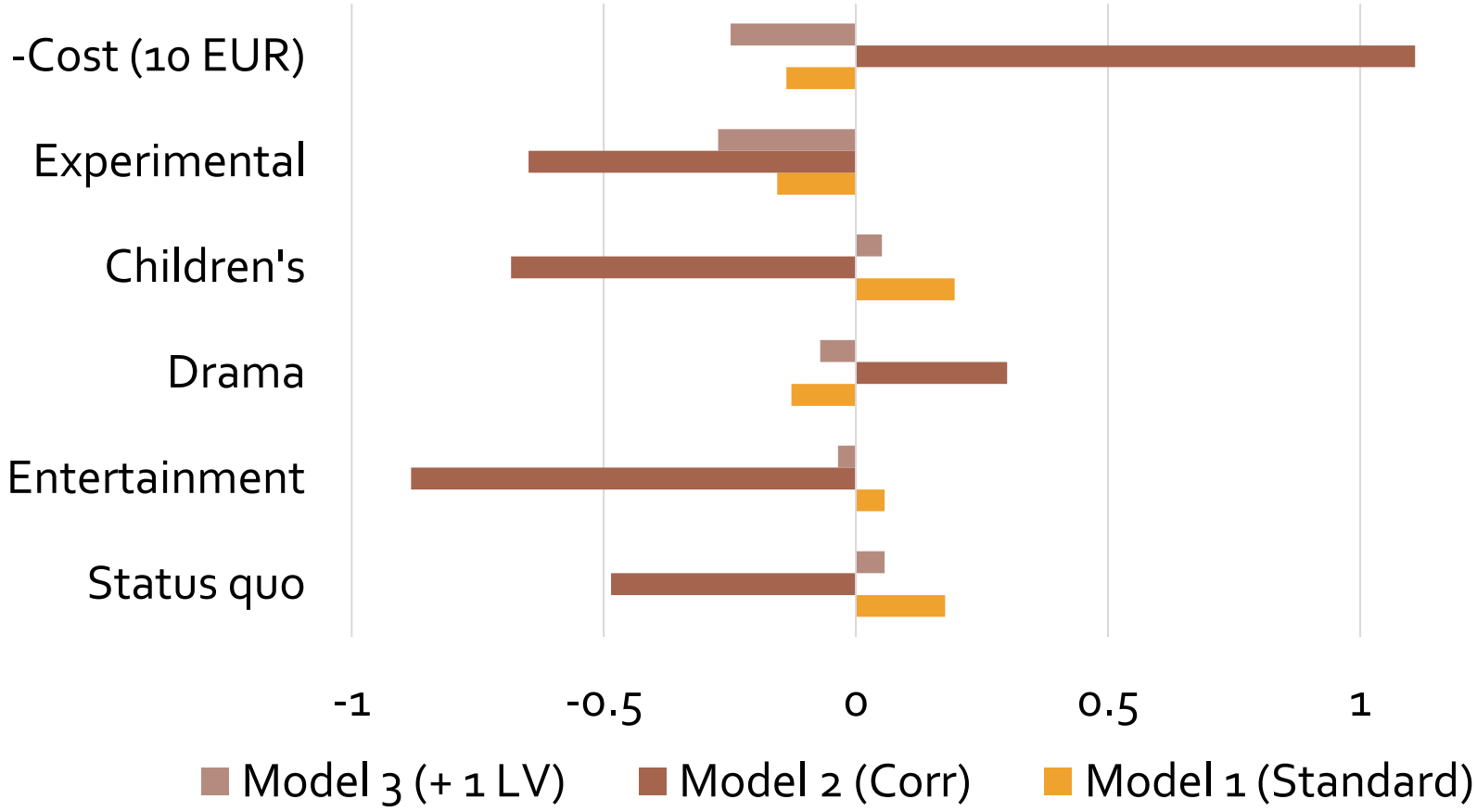


- Model 2 (Corr) accounts for one endogeneity type: endogeneity of the latent variable
- Endogeneity control matters largely for cost
- And so it changes willingness-to-pay values
- In Model 3 (+1 LV), maybe another consequentiality dimension?

Results: Discrete choice component

Mixed logits with means interacted with LVs

Coefficients of interactions of means with LV2 (pivotality)



- Similar findings
- Endogeneity control in Model 2 matters for many attributes
- In Model 3, maybe another dimension of consequentiality, rather than endogeneity control?

Closing thoughts

- More research:
  - Model specifications with more latent variables to control for more dimensions of consequentiality (or for other aspects captured by the nine Likert-scale 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 these perceptions
- For now:
  - Some evidence of endogeneity issues
  - Accounting for endogeneity of perceived consequentiality appears to matter for value estimates
  - 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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