Dealing with attribute non-attendance behavior in food choice experiments:

making sense of serial, choice-task and inferred methods

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BACKGROUND

CHOICE EXPERIMENTS: WHAT IS IT?

- Choice experiments is a ***stated-preference multi-attribute*** method used to elicit consumer preferences for both public and private goods.

- Applied in many fields of applied economics, recently also popular in ***agri-food industry related studies***.

- Food choice experiments/surveys present respondents with choice tasks designed to elicit trade-offs among alternative foods.

BACKGROUND

AN EXAMPLE OF A FOOD CHOICE TASK

Choice set card 1			
Attributes	**Alternative A**	**Alternative B**	**Alternative C**
Juice	Orange	Apple	None Of Them
Shelf life	20 days	30 days	
Price	$2.00 ☐	$3.00 ☐	☐
Please indicate which option you would choose (Mark your choice)			

BACKGROUND

CHOICE EXPERIMENT: THEORETICAL FRAMEWORK

- It is consistent with the ***Lancaster theory*** and ***Random Utility*** theory:

(1)Good => multiple attributes utility good = Σ utilities attributes;

(2)Selected alternative interpreted as the one with highest utility:

BACKGROUND

CHOICE EXPERIMENT: BEHAVIORAL ASSUMPTIONS

- ***Conventional models imply fully compensatory*** choice behavior (limit):

(1)All attributes are heeded and evaluated: trading off gains and losses across alternatives;

(2)Unconstrained mental efforts in evaluation;

BACKGROUND

ATTRIBUTE NON ATTENDANCE

- A number of choice experiment studies have shown that people employ heuristics such as ***non-attendance*** (ANA).

- ***Respondents ignore*** (or fail to attended to) selected attributes, while making choices.

  ⇒ ***Partially compensatory choice behavior***

BACKGROUND

ATTRIBUTE NON ATTENDANCE (I)

Choice set card 1			
Attributes	**Alternative A**	**Alternative B**	**Alternative C**
Juice	Orange	Apple	None of them
Shelf life	20 days	30 days	
Price	$2.00 ☐	$3.00 ☐	☐
Please indicate which option you would choose (Mark your choice)			

BACKGROUND
ATTRIBUTE NON ATTENDANCE (II)

- ***Corroborating evidence for ANA:***

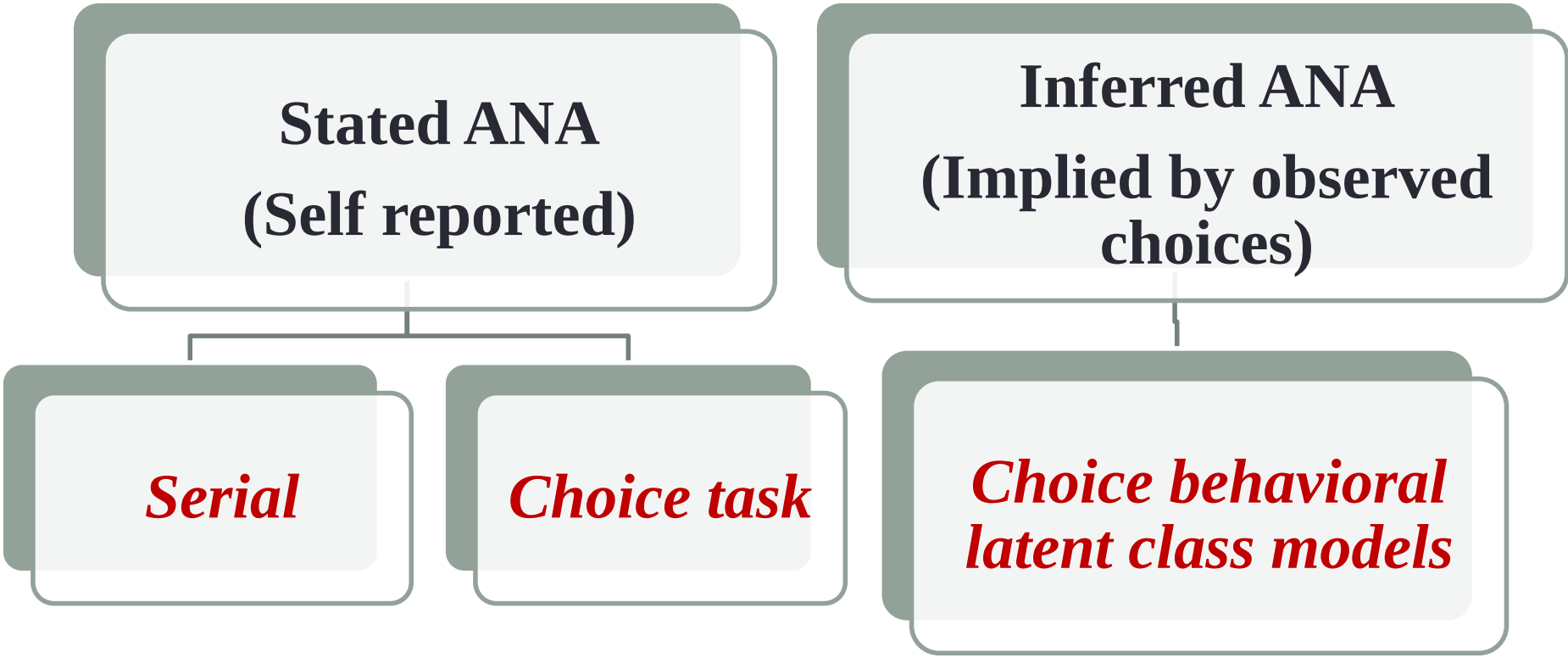
  ⇒ *Fields: transportation, health economics, and environmental valuation;*

  ⇒ *Main substantive findings*: ***bias in market share prediction and welfare measure estimates****;*

  ⇒***Food Economics/food choices****: relatively* ***unexplored… but potentially very important.***

BACKGOUND

METHODS TO ACCOUNT FOR ANA

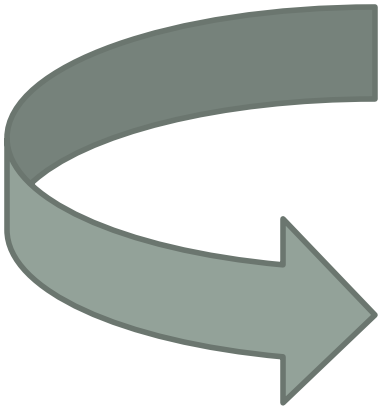


BACKGROUND
METHODS TO MODEL ANA BEHAVIOR

- **Standard modeling approach**:

  ⇒*The attribute self-reported as ignored (or assumed to be ignored)* ***are selectively removed*** *from the utility function.*

$$U_{njtk} = \sum_{k=1}^{K} \beta_{nk} x_{njkt} + \varepsilon_{njt}$$



Ignored attributes

$$U_{njtk} = \sum_{k=1}^{K-S} \beta_{nk} x_{njkt} + \varepsilon_{njt}$$

BACKGROUND
ANA: WHAT ARE THE ISSUES?

- **Serial vs. choice task:**

⇒*Should stated ANA information be collected at the serial level or at the single choice task level?*

⇒*What are the consequences of either for willingness to pay (WTP) estimates and prediction probabilities?*

BACKGROUND
ANA: WHAT ARE THE ISSUES?

- **Serial vs. choice task**

⇒*Which is a better approximation to true ANA behavior? (**measurement errors**);*

⇒ *The need for validation (Hess and Hensher 2010).*

A better understanding could improve the ways we design CE surveys and provide us more reliable and valid valuation estimates used in food system research.

BACKGROUND
ANA: WHAT ARE THE ISSUES? (I)

- **Inferred ANA vs. Stated ANA:**

  ⇒*Lack of concordance between stated and inferred ANA;*

  ⇒*The concordance has never been explored at the choice task level.*

… yet it is crucial to improve the behavioral relevance of CE models and so **design appropriate marketing analytics and strategies.**

OUR RESEARCH

1. We explored whether there is any ***systematic difference*** in terms of ***willingness to pay estimates*** across the ***serial and choice task*** stated ANA;

2. We validated the stated serial and choice task ANA information;

3. We examined if there are differences across the stated ANA information (serial and choice task) and the inferred ANA method.

EXPERIMENTAL PROCEDURES

- **Chicken breast**

Attributes	Levels considered
Organic label (ORG)	Not present Biogarantie label EU Organic label
Animal welfare label (AW)	Not present Present
Types of free-range farming claim (FR)	Not present Free range Traditional free-range Free range-total freedom
Reduced carbon footprint label (CO2 emitted)	Not present 20% reduction: 5.6 kg CO2e vs.7 kg CO2 30% reduction: 4.9 kg CO2e vs.7 kg CO2
Price	€10/kg, €15/kg, €20/kg, €25/kg

EXPERIMENTAL PROCEDURES (I)

- Orthogonal fraction of full factorial design in SPSS: 16 combinations for **alternative A;**
- We then followed Street and Burgess (2007) to generate the set of 16 pairs for **alternative B**;
- Two blocks of 8 questions each per respondent;
- Split sample into two randomly assigned treatments:

  ⇒***Serial*** *follow up questions;*
  ⇒***Choice Task*** *follow up questions.*

DATA

- Data collection: **online survey** (Belgium):

  ⇒*Serial Treatment*: ***344 respondents;***
  ⇒*Choice Task Treatment*: ***257 respondents***.

- ***Majority are women*** (60% and 63%), ***college level educated*** (43% and 44%), and with a ***moderate to well-off financial situation*** (50% and 57%)

- ***No significant differences*** across ***demographics*** across the treatments.

EMPIRICAL ANALYSIS
FIRST OBJECTIVE

➢**STEP1 -** Two ***Random Parameter Logit models***: serial and choice task treatment.

⇒*Behavioral assumption*: ***partially compensatory behavior;***

⇒***Standard approach****: constrain the coefficients of the attribute stated as ignored to zero.*

➢***Utility specification***:

$$U_{njt} = 1_{nk}(I=1)[\beta_1^1 * PRICE_{njt} + \beta_2^1 OrgEU_{njt} + \beta_3^1 OrgBE_{njt} + \beta_4^1 AW_{njt} + \beta_5^1 FR_{njt} + \beta_6^1 FRtrad_{njt} +$$

$$+ \beta_7^1 FRtot_{njt} + \beta_8^1 CO20_{njt} + \beta_9^1 CO30_{njt}] + \alpha_1 * Nobuy + 1_j(\eta_{nt}) + \varepsilon_{njt}$$

EMPIRICAL ANALYSIS
FIRST OBJECTIVE (I)

- **STEP2 –** we compared the individual WTPs for each model;

- We then test the following hypothesis (for both $E[WTP_n]|WTP_n \neq 0$ and $E[WTP_n]|$):

$$H_{01}: (WTP_{nk,serial} - WTP_{nk,choicetask}) = 0,$$

$$H_{11}: (WTP_{nk,serial} - WTP_{nk,choicetask}) \neq 0$$

⇒ *If H_{01} is rejected, we conclude that serial and choice task ANA produce significantly different WTPs.*

EMPIRICAL ANALYSIS
SECOND OBJECTIVE

- Validation Model introduced by Hess and Hensher (2010): serial and choice task:

  ⇒*Behavioral assumption*: ***fully and partially compensatory choice behavior***;

  ⇒*If respondents provide valid self-reports on ANA, then these should be consistent with their choice behavior*

EMPIRICAL ANALYSIS
SECOND OBJECTIVE (I)

➢ ***Utility specification***:

Coefficients estimated for attended attributes.

$$U_{njt} = 1_{nk}(I=1)[\beta_1^1 * PRICE_{njt} + \beta_2^1 OrgEU_{njt} + \beta_3^1 OrgBE_{njt} + \beta_4^1 AW_{njt} + \beta_5^1 FR_{njt} + \beta_6^1 FRtrad_{njt} +$$

$$+ \beta_7^1 FRtot_{njt} + \beta_8^1 CO20_{njt} + \beta_9^1 CO30_{njt}] + 1_{nk}(I=0)[\beta_1^0 * PRICE_{njt} + \beta_2^0 OrgEU_{njt} + \beta_3^0 OrgBE_{njt} +$$

$$+ \beta_4^0 AW_{njt} + \beta_5^0 FR_{njt} + \beta_6^0 FRtrad_{njt} + \beta_7^0 FRtot_{njt} + \beta_8^0 CO20_{njt} + \beta_9^0 CO30_{njt}] + \alpha_1 * Nobuy + 1_j(\eta_{nt}) + \varepsilon_{njt}$$

Coefficients estimated for self reported ignored attributes.

$\Rightarrow \beta_k^0$ *statistically different from zero would indicate that respondents did not fully ignore these attributes.*

EMPIRICAL ANALYSIS
THIRD OBJECTIVE

- ***Equality constrained latent class*** (ECLC) model: 16 classes

- Classes differ between each other for either having:

  (a) ***Different values of taste intensities*** *(β_{kc}) preference classes ; or*

  (b) different ***forms of ANA behavior*** *within each preference class (.*

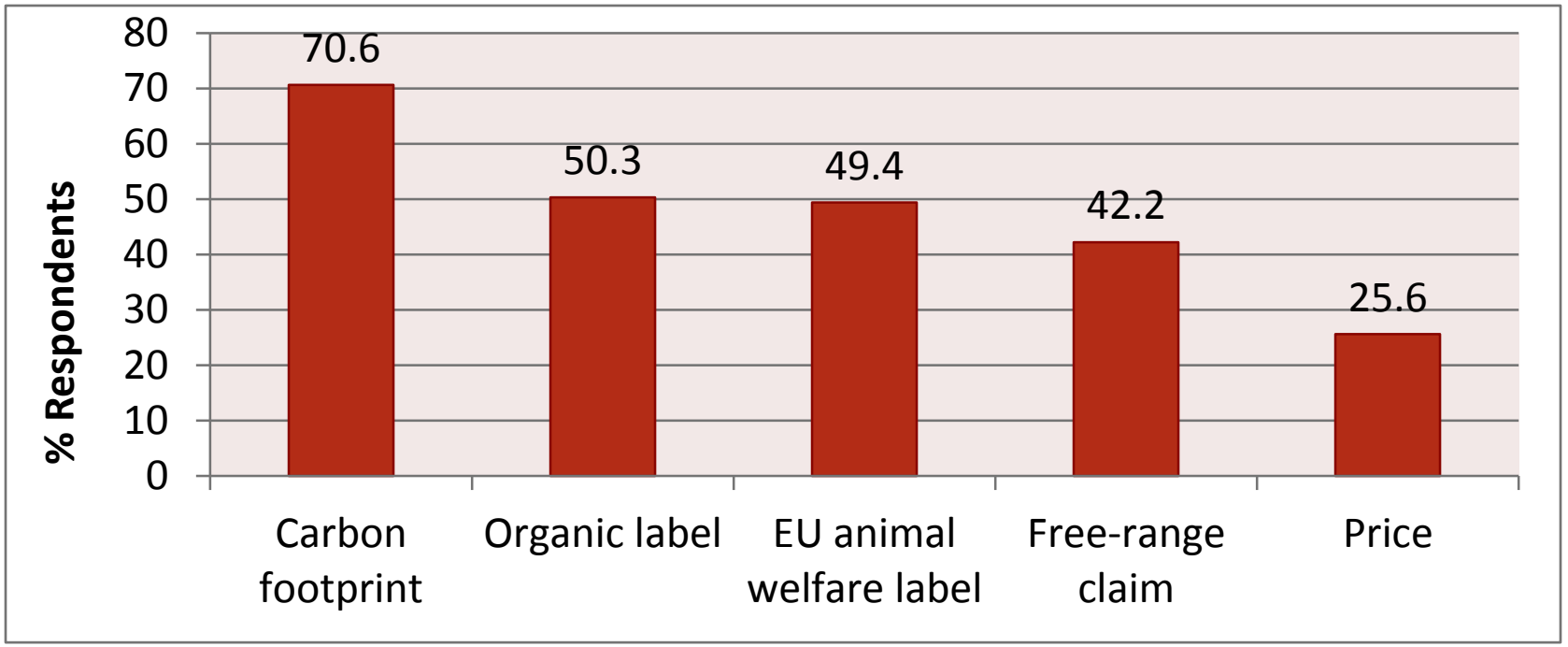
- We then used the ***membership probability estimates*** for each class to ***calculate the frequencies of ANA*** for each attribute.

EMPIRICAL ANALYSIS
LATENT CLASS MODEL (I)

		PRICE	EU	BE	AW	FR	FO	FT	C2	C3	Membership Prob (π_c)
Preference 1	class1	$b_{1\|1}$	$b_{2\|1}$	$b_{3\|1}$	$b_{4\|1}$	$b_{5\|1}$	$b_{6\|1}$	$b_{7\|1}$	$b_{8\|1}$	$b_{9\|1}$	π_1
	class2	$b_{1\|2}$	0	0	0	0	0	0	0	0	π_2
	class3	0	$b_{2\|3}$	$b_{3\|3}$	0	0	0	0	0	0	π_3
	class4	0	0	0	$b_{4\|4}$	0	0	0	0	0	π_4
	class5	0	0	0	0	$b_{5\|5}$	$b_{6\|5}$	$b_{7\|5}$	0	0	π_5
	class6	0	0	0	0	0	0	0	$b_{8\|6}$	$b_{9\|6}$	π_6
	class7	0	0	0	0	0	0	0	0	0	π_7
Preference 2	class8	$b_{11\|8}$	$b_{12\|8}$	$b_{13\|8}$	$b_{14\|8}$	$b_{15\|8}$	$b_{16\|8}$	$b_{17\|8}$	$b_{18\|8}$	$b_{19\|8}$	π_8
	class9	0	$b_{12\|9}$	$b_{13\|9}$	$b_{14\|9}$	$b_{15\|9}$	$b_{16\|9}$	$b_{17\|9}$	$b_{18\|9}$	$b_{19\|9}$	π_9
	class10	$b_{11\|10}$	0	0	$b_{14\|10}$	$b_{15\|10}$	$b_{16\|10}$	$b_{17\|10}$	$b_{18\|10}$	$b_{19\|10}$	π_{10}
	class11	$b_{11\|11}$	$b_{12\|11}$	$b_{13\|11}$	0	$b_{15\|11}$	$b_{16\|11}$	$b_{17\|11}$	$b_{18\|11}$	$b_{19\|11}$	π_{11}
	class12	$b_{11\|12}$	$b_{12\|12}$	$b_{13\|12}$	$b_{14\|12}$	0	0	0	$b_{18\|12}$	$b_{19\|12}$	π_{12}
	class13	$b_{11\|13}$	$b_{12\|13}$	$b_{13\|13}$	$b_{14\|13}$	$b_{15\|13}$	$b_{16\|13}$	$b_{17\|13}$	0	0	π_{13}
Preference 3	class14	$b_{21\|14}$	$b_{22\|14}$	$b_{23\|14}$	$b_{24\|14}$	$b_{25\|14}$	$b_{26\|14}$	$b_{27\|14}$	$b_{28\|14}$	$b_{29\|14}$	π_{14}
	class15	$b_{21\|15}$	$b_{21\|15}$	$b_{21\|15}$	0	0	0	0	$b_{21\|15}$	$b_{21\|15}$	π_{15}
	class16	$b_{21\|16}$	0	0	$b_{21\|16}$	$b_{21\|16}$	$b_{21\|16}$	$b_{21\|16}$	0	0	$1-\sum\pi_c$

RESULTS
ANA - DESCRIPTIVE STATISTICS (II)

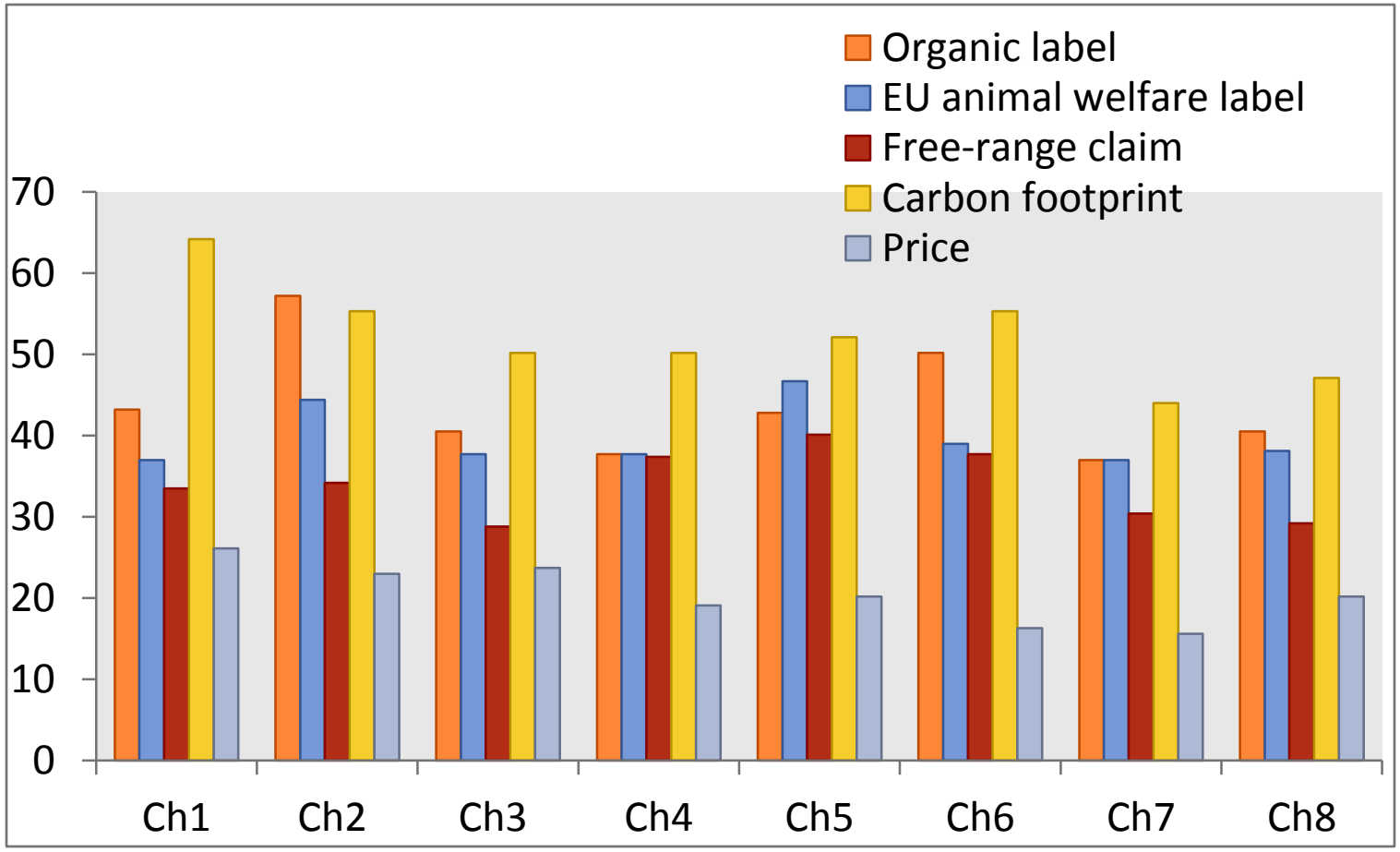
Figure3. Attribute ignored by respondents, serial treatment



Only 17.7% of the respondents did not ignore any of the presented attributes.

RESULTS
ANA - DESCRIPTIVE STATISTICS (IV)

Figure4. Attribute ignored by respondents, choice task treatment



RESULTS
FIRST OBECTIVE: WTP ESTIMATES

Table1. Conditional WTP Estimates , Serial and Choice Task Experiments

	Serial Experiment		Choice Task Experiment		
	Mean	n	Mean	n	T-test(pvalues)
OrgEU	5.25	171	8.67	153	<0.0000
OrgBE	6.07	171	6.89	153	<0.0692
AW	3.86	174	5.82	159	<0.0000
FR	**5.07**	**199**	**4.97**	**182**	<0.6566
FRtrad	**6.06**	**199**	**6.36**	**182**	<0.2549
FRtot	7.14	199	8.71	182	<0.0002
CO20	2.84	101	1.84	136	<0.0120
CO30	**4.47**	**101**	**3.97**	**136**	<0.4015

⇒ **Only 3 out of 8 attributes show no difference in WTPs across treatments: FR, FRtrad, and CO30.**

RESULTS
FIRST OBECTIVE: WTP ESTIMATES (I)

Table 2. Unconditional WTP Estimates , Serial and Choice Task Experiments

	Serial Experiment N=	Choice Task N=	
	Mean	Mean	T-test (p-value)
OrgEU	2.61	5.16	<0.0000
OrgBE	3.02	4.10	<0.0026
AW	1.95	3.60	<0.0000
FR	2.94	3.52	<0.0171
FRtrad	3.51	4.50	<0.0008
FRtot	4.13	6.17	< 0.0000
CO20	**0.83**	**0.98**	**<0.4334**
CO30	1.31	2.10	<0.0057

=> Only for 1 label out of 8 there is a difference across serial and choice task treatment (CO2).

RESULTS

SECOND OBEJACTIVE: VALIDATION MODEL

Table 3. Estimates from the Validation ANA model across Serial and Choice Task Experiments

	Considered		Ignored	
	Serial	Choice task	Serial	Choice task
Price	**-0.26**	**-0.30**	***-0.05***	**-0.08**
OrgEU	**1.09**	**2.43**	*-0.07*	**-0.04**
OrgBE	**1.35**	**1.98**	*-0.09*	**-0.41**
AW	**0.97**	**1.73**	**0.21**	*-0.08*
FR	**1.25**	**1.56**	**0.32**	*0.09*
FRtrad	**1.47**	**1.76**	**0.35**	*0.04*
FRtot	**1.89**	**2.54**	**0.49**	*0.18*
CO20	**0.70**	**0.46**	**0.18**	*0.10*
CO30	**1.20**	**1.13**	**0.42**	*-0.04*

RESULTS
THIRD OBECTIVE: ECLM MODEL

	PRICE	EU	BE	AW	FR	FO	FT	C2	C3	Member. Prob.
class1	$b_{1\|1}$	$b_{2\|1}$	$b_{3\|1}$	$b_{4\|1}$	$b_{5\|1}$	$b_{6\|1}$	$b_{7\|1}$	$b_{8\|1}$	$b_{9\|1}$	23.73
class2	$b_{1\|2}$	0	0	0	0	0	0	0	0	14.93
class3	0	$b_{2\|3}$	$b_{3\|3}$	0	0	0	0	0	0	0.07
class4	0	0	0	$b_{4\|4}$	0	0	0	0	0	3.69
class5	0	0	0	0	$b_{5\|5}$	$b_{6\|5}$	$b_{7\|5}$	0	0	4.16
class6	0	0	0	0	0	0	0	$b_{8\|6}$	$b_{9\|6}$	2.35
class7	0	0	0	0	0	0	0	0	0	5.21
class8	$b_{11\|8}$	$b_{12\|8}$	$b_{13\|8}$	$b_{14\|8}$	$b_{15\|8}$	$b_{16\|8}$	$b_{17\|8}$	$b_{18\|8}$	$b_{19\|8}$	2.34
class9	0	$b_{12\|9}$	$b_{13\|9}$	$b_{14\|9}$	$b_{15\|9}$	$b_{16\|9}$	$b_{17\|9}$	$b_{18\|9}$	$b_{19\|9}$	15.00
class10	$b_{11\|10}$	0	0	$b_{14\|10}$	$b_{15\|10}$	$b_{16\|10}$	$b_{17\|10}$	$b_{18\|10}$	$b_{19\|10}$	0.07
class11	$b_{11\|11}$	$b_{12\|11}$	$b_{13\|11}$	0	$b_{15\|11}$	$b_{16\|11}$	$b_{17\|11}$	$b_{18\|11}$	$b_{19\|11}$	0.10
class12	$b_{11\|12}$	$b_{12\|12}$	$b_{13\|12}$	$b_{14\|12}$	0	0	0	$b_{18\|12}$	$b_{19\|12}$	6.04
class13	$b_{11\|13}$	$b_{12\|13}$	$b_{13\|13}$	$b_{14\|13}$	$b_{15\|13}$	$b_{16\|13}$	$b_{17\|13}$	0	0	0.08
class14	$b_{21\|14}$	$b_{22\|14}$	$b_{23\|14}$	$b_{24\|14}$	$b_{25\|14}$	$b_{26\|14}$	$b_{27\|14}$	$b_{28\|14}$	$b_{29\|14}$	7.34
class15	$b_{21\|15}$	$b_{21\|15}$	$b_{21\|15}$	0	0	0	0	$b_{21\|15}$	$b_{21\|15}$	0.12
class16	$b_{21\|16}$	0	0	$b_{21\|16}$	$b_{21\|16}$	$b_{21\|16}$	$b_{21\|16}$	0	0	14.77

=45.18%

RESULTS
THIRD OBECTIVE: COMPARING SERIAL, CHOICE TASK AND INFERRED ANA

Table 6. Frequencies of stated ANA vs. inferred

Ignorance across attributes	Serial ANA%	Choice Task ANA%	Inferred ANA %	*% serial vs. inferred*	*% C.task Vs. inferred*
Organic labels	50.29	41.83	45.18	11.31	-7.42
Animal welfare	49.42	39.49	26.94	83.44	46.60
Free-range claim	42.15	33.71	32.41	30.06	4.00
Carbon footprint	70.64	44.21	42.91	64.62	3.03
Price	25.58	20.43	30.48	-16.07	-32.98
Complete AA	17.73	34.58	33.41	-46.92	3.51
Complete ANA	7.60	5.60	5.21	45.87	7.49

RESULTS

SUMMARY STATISTICS OF MODEL FIT

Table 7: Summary statistics of model fit

	Serial			Choice task		Inferred
	AA	*Standard ANA*	*Validation ANA*	*Standard ANA*	*Validation ANA*	*ECLC*
N	2752	2752	2752	2056	2056	2752
LL	-1780	-1711	-1714	-1123	-1116	-1665
BIC/N	1.452	1.402	1.404	**1.296**	1.361	1.340
AIC/N	1.334	1.284	1.286	**1.146**	1.158	1.243
N. Par.	55	55	55	55	74	45

SUMMARY OF RESULTS

- ***Serial vs. Choice task***

  1) *marginal willingness to pay estimates differ;*
  2) *serial: low importance for most of the attributes;*
  3) *choice task: for most attributes self-reported ANA statements are consistent with modeling results.*

- ***Inferred vs. Serial*** and choice task

  1) *Choice task ANA statements are more concordant with inferred ANA behavior;*

  2) *Choice task models show better model fit;*

CONCLUSIONS

- Due to importance of product differentiation in the global food industry, CE is now becoming one of the most popular preference elicitation methods used;

- WTP estimates from CE used not just to ***make informed marketing and product adoption decisions*** but also for ***welfare analysis and policy making;***

- Given the effects of ANA behavior in terms of welfare estimates, it is important to examines how people process attribute information and how to capture and model ANA behavior.

CONCLUSIONS (I)

- Contribution to the literatures (research objectives).

- Respondents ignore attribute information. However, they seem not to have homogeneous attribute processing strategies;

- We find no clear support for measurement errors in choice task ANA, which shows more concordance with inferred ANA, and results in better model fit.

- The advantages of accounting for choice task ANA might outweigh its additional cost and effort.

FUTURE RESEARCH

- Explore ANA behavior in both hypothetical and non-hypothetical experimental settings:

  → *Using different ex-ante hypothetical bias mitigation methods;*

  → *Using eye tracking data;*

  → *Explore ANA at the attribute levels.*

- Explore ANA behavior across different design dimensions (e.g. complexity, different range of levels, etc.)

THANK YOU FOR YOUR KIND ATTENTION

Any question, suggestion, etc. is welcome…