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# **A comparison of generalized multinomial logit, random parameters logit, wtp-space and latent class models to studying consumers' preferences for animal welfare**

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## 1. INTRODUCTION: Background

- ❑ **ANIMAL WELFARE** is becoming a relevant **FACTOR** affecting **CONSUMER PREFERENCES**.
- ❑ Consumers are **DEMANDING** animals being reared **AS CLOSELY AS POSSIBLE** as they would be in their **NATURAL CONDITIONS**.
- ❑ Is becoming a prominent **POLITICALLY SENSITIVE** issue in EU
- ❑ Resulting in **CONTINUOUS CHANGES** in **REGULATIONS**.
- ❑ EU regulations **BAN** a number of **INTENSIVE** farming methods.

## 1. INTRODUCTION: Background

- ❑ **PIG WELFARE** is receiving **SPECIAL ATTENTION**.
- ❑ **BANNED** the use of **SOW STALLS** by **January 2012**.



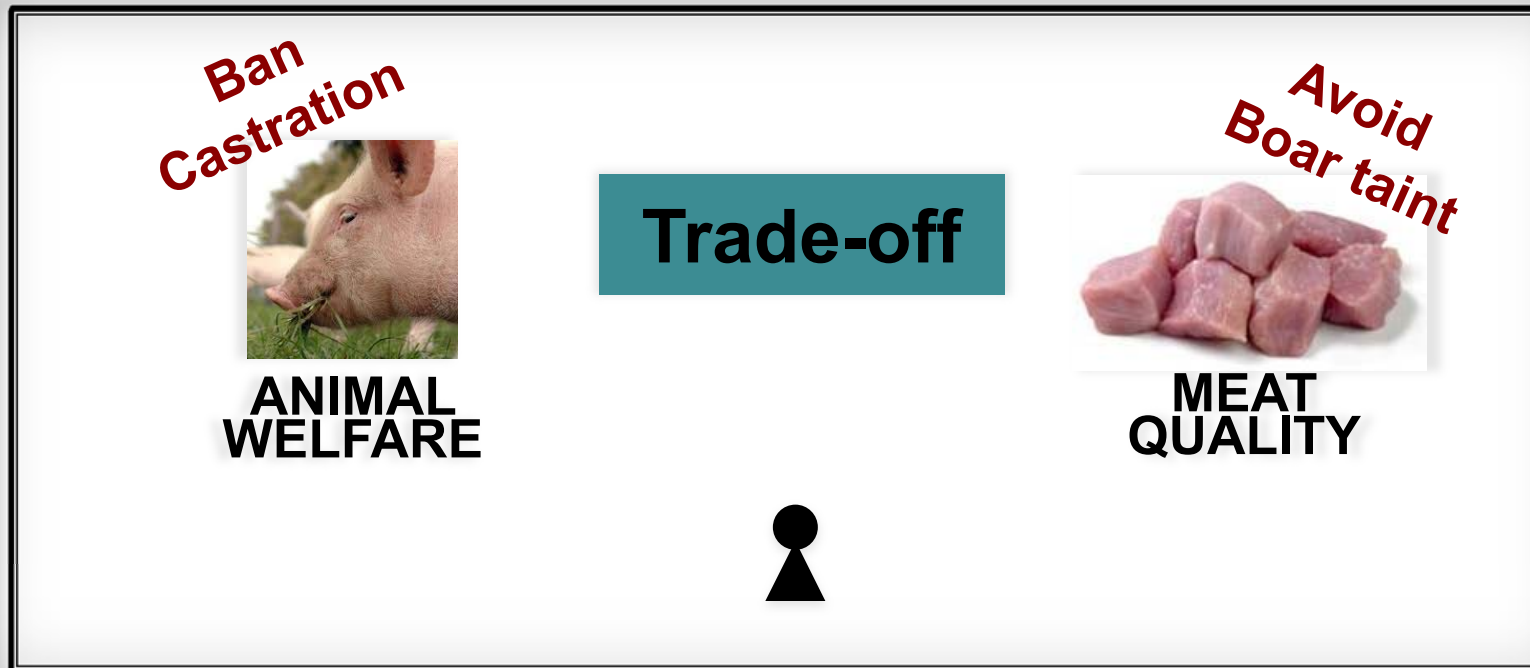
## 1. INTRODUCTION: Background

- ❑ **BAN PIG CASTRATION** (2018), which may affect **CONSUMER PREFERENCES** as an **ANIMAL WELFARE** measure.
- ❑ However **CASTRATION**:
  - To **AVOID** the **RISK** of obtaining meat with **BOAR TAIN**
    - **OFF-ODOUR** and **FLAVOUR** in meat
    - Can **NEGATIVELY** affect **CONSUMERS' ACCEPTABILITY**
    - **NOT ALL** consumers are **SENSITIVE** to boar taint



There is an associated **MEAT (sensory) QUALITY** problem

# 1. INTRODUCTION: Background



## 1. INTRODUCTION: Background

- ❑  $\approx 40\%$  of total EU pigs are **CASTRATED WITHOUT ANESTHESIA**
- ❑ **LEGALLY** performed during the first **SEVEN** days after birth
- ❑ After that should only be performed under **ANESTHESIA** and must include a prolonged **ANALGESIA** by a **VETERINARIAN**



## 1. INTRODUCTION: Background

### □ Alternatives to **CASTRATION**:

- Genetic **SELECTION** for 'low-taint' breeds
- Different **MANAGEMENT** strategies
- Slaughter at a **YOUNGER** age and **LOWER** weight

- **MASKING** boar taint with different **STRATEGIES** such as spices, marinades or heat treatment.

- We developed a **MASKING STRATEGY (herbs + spices + smoking)**

- **FRANKFURTER SAUSAGES**



## 1. INTRODUCTION: Objectives

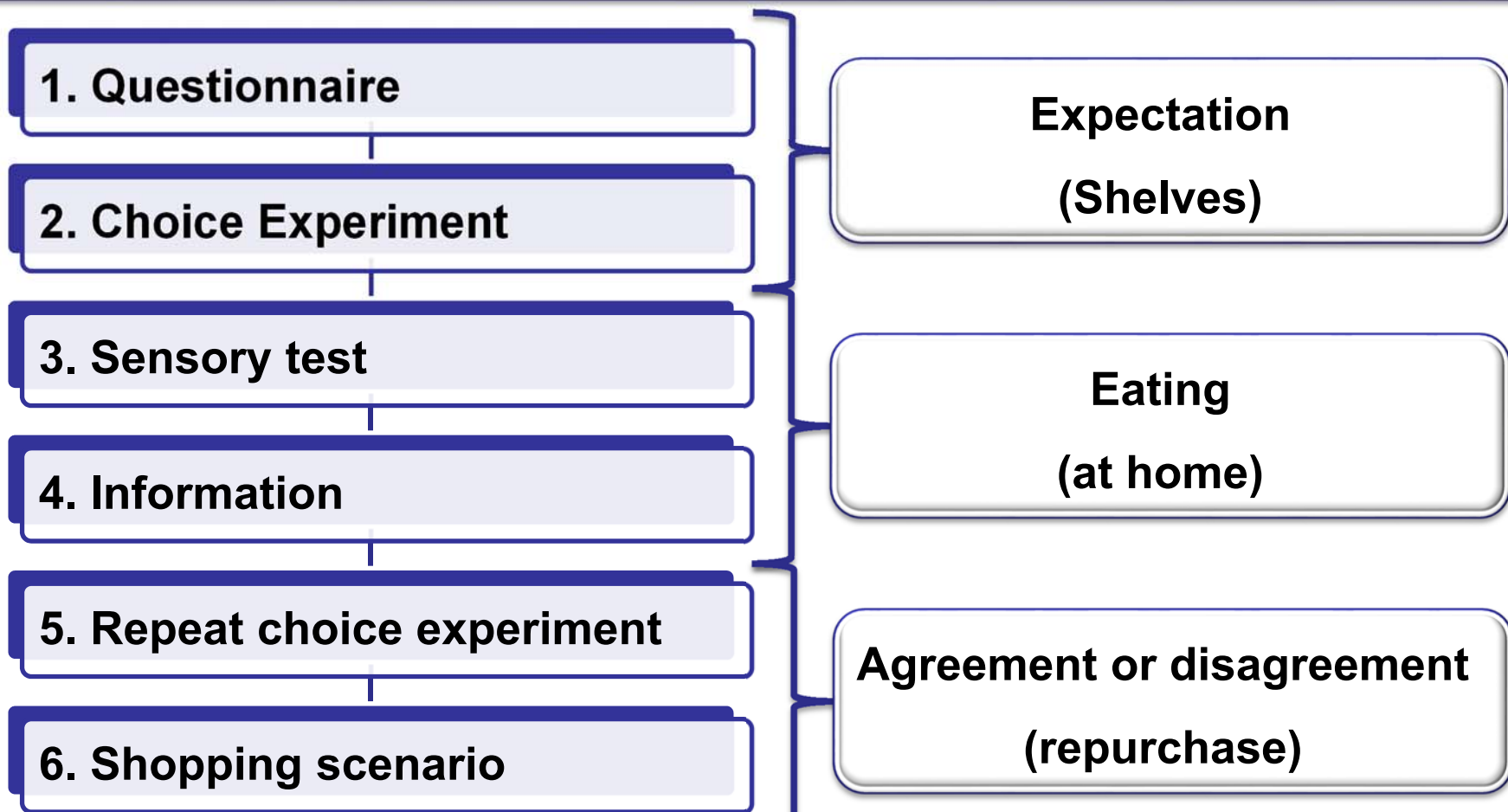
1. **CONSUMERS' EXPECTED PREFERENCE** → Masking strategy.
2. **CONSUMERS ACCEPTANCE** → Eating test (Sensory evaluation)
3. How **EXPECTATIONS** are **AFFECTED** are affected.
4. To **COMPARE** results between different **MODELLING** approaches (RPL, GMNL, WTP-Space & LC).



## 2. METHODOLOGICAL FRAMEWORK

- TWO NON-HYPOTHETICAL DISCRETE CHOICE EXPERIMENTS.**
- REAL SHOPPING SCENARIO**
- Consumers **REWARDED** by €15 to participate.**

We attempted to **MIMIC CONSUMER REACTION** when facing a **NEW PRODUCT** in a purchase point



## 2. METHODOLOGICAL FRAMEWORK: Steps

### 1. First, **SHORT QUESTIONNAIRE**

- **ATTITUDES**
- **OPINIONS**
- **CONSUMPTION**
- **SOCIOECONOMIC**
- **LIFE-STYLE**

## 2. METHODOLOGICAL FRAMEWORK: Steps

2. Second, the first DCE exercise was applied
  - Participants **UNEXPECTEDLY REWARDED** by an extra €5
  - Select **THEIR PREFERRED** products from different choice sets.
  - **REAL MARKET** is created at the **END** of the experiment to **EXCHANGE REAL MONEY** and **REAL PRODUCTS**.
  - Consumers who agreed to participate were asked to **PURCHASE** one **RANDOMLY** selected product and to **PAY** its posted price

# 1. EXPECTATIONS ARE OBTAINED

## 2. METHODOLOGICAL FRAMEWORK: Steps

3. Third, a **HEDONIC EVALUATION** test : Nine-point scale (1 ‘dislike extremely’; 2 ‘dislike very much’; 3 ‘dislike moderately’; 4 ‘dislike slightly’; 5 ‘neither like nor dislike’; 6 ‘like slightly’; 7 ‘like moderately’; 8 ‘like very much’; and 9 ‘like extremely’).

- **CREATE EATING EXPERIENCE**
- **4 FRANKFURTER SAUSAGES**
  - i. **CASTRATED + ORIGINAL FLAVOUR**
  - ii. **CASTRATED + MASKING FLAVOUR**
  - iii. **NON-CASTRATED + ORIGINAL FLAVOUR**
  - iv. **NON-CASTRATED + MASKING FLAVOUR**

## 2. METHODOLOGICAL FRAMEWORK: Steps

4. Fourth, participants were **INFORMED** what they **TASTED**
  - Given 5 minutes to check their **LIKING SCORES**
  - **Asked** to **ASSOCIATE** their sensory **EXPERIENCE** with the **SPECIFIC** products and characteristics.

## **2. INFORMED EATING EXPERIENCE IS OBTAINED**



## 2. METHODOLOGICAL FRAMEWORK: Steps

4. Fifth, the **SAME CHOICE EXPERIMENT** was **REPEATED**
  - Participants turned to **RESELECT** their **PREFERRED PRODUCTS** from the same choice sets.
  - **REVIEW** the **FIRST DCE** → to **CONTROL** for **RANDOM CHANGES**.
  - Take into **CONSIDERATION** their **SENSORY EXPERIENCE** and considering the product the **LIKE** the **MOST** and the product the **LIKE** the **LEAST** and the products **BETWEEN**.

## 2. METHODOLOGICAL FRAMEWORK: Steps

5. **SIXTH**, a **REAL SHOPPING SCENARIO** was created to exchange real product and money.
- **RANDOMLY** selected Choice set and product
  - Consumers who accepted to participate **SHOULD PURCHASE** their **CHOSEN** product.
  - **PAY** its posted price
  - **TAKE** a real product
  - If the “**NO-PURCHASE**” was selected, then **NO REAL** exchange was realized

## **3. AGREEMENT OR DESAGREEMENT WITH EXPECTATIONS IS OBTAINED**

## 2. METHODOLOGICAL FRAMEWORK: Sample

- ❑ **150 consumers selected from Madrid**
- ❑ **RECRUITMENT** criteria
  - Regularly **PURCHASE** food
  - Having **PURCHASED AND CONSUMED FRANKFURTER** sausage at least **ONE TIME** in the last **MONTH**
  - **Stratified** by gender, age and postal code

### 3. EMPIRICAL APPLICATION: The DCE: Attributes and levels

#### Literature and discussion groups

- **FLAVOUR**: original, masking strategy
- **CASTRATION**: meat from castrated or non-castrated
- **BRAND TYPE**: manufacturer and private brands.
- **PRICE**: €1.79, €1.39, €0.99, €0.59

One relevant **LIMITATION** in **NON-HYPOTHETICAL** Choice experiment is to avoid “consumers’ **DECEPTION**”

### 3. EMPIRICAL APPLICATION: The DCE: Attributes and levels

“Deception is defined as an act or statement **INTENDED** to make **PEOPLE BELIEVE** something that is **NOT TRUE**”.

Were **FORCED** to **DELIVER** consumers the “**EXACT**” product presented in the **CHOICE SETS**.

Select only the **ATTRIBUTES** that we were able to “**CONTROL**” and “**PRODUCE**”.

**BEHAVIORAL ECONOMIC** is in general **STRICT** about using **DECEPTION** in economic experiments, while other disciplines (e.g. psychology) **ALLOW IT**.

### 3. EMPIRICAL APPLICATION: The DCE: Design

- ❑ Orthogonal fractional factorial design with only **8 CHOICE SETS**.  
D-efficient 100%.
- ❑ Participants were also asked to perform:
  - ❑ **WARMING-UP** choice set
  - ❑ Final additional task: **HOLD-OUT TASK**.

### 3. EMPIRICAL APPLICATION: The DCE: Design

#### CHOICE SET 4

			
<p>10 20683/A CEE</p> <p><b>Salchichas Frankfurt</b></p> <p>Carne procedente de cerdo NO castrado Marca del fabricante Sabor a las finas hierbas con ahumado natural Referencia/Lote: T8A1 Conservar entre 0°C y 4°C Producido en España Fecha de caducidad 30-06-2014 Peso neto 200 g</p> <p><b>Total €: 1,79 €</b></p>	<p>10 20683/A CEE</p> <p><b>Salchichas Frankfurt</b></p> <p>Carne procedente de cerdo castrado Marca del distribuidor Sabor original Referencia/Lote: T8A2 Conservar entre 0°C y 4°C Producido en España Fecha de caducidad 30-06-2014 Peso neto 200 g</p> <p><b>Total €: 0,99 €</b></p>	<p>10 20683/A CEE</p> <p><b>Salchichas Frankfurt</b></p> <p>Carne procedente de cerdo castrado Marca del fabricante Sabor a las finas hierbas con ahumado natural Referencia/Lote: T8A3 Conservar entre 0°C y 4°C Producido en España Fecha de caducidad 30-06-2014 Peso neto 200 g</p> <p><b>Total €: 0,59 €</b></p>	<p>10 20683/A CEE</p> <p><b>Salchichas Frankfurt</b></p> <p>Carne procedente de cerdo NO castrado Marca del distribuidor Sabor original Referencia/Lote: T8A4 Conservar entre 0°C y 4°C Producido en España Fecha de caducidad 30-06-2014 Peso neto 200 g</p> <p><b>Total €: 1,39 €</b></p>
<p>Meat of boar</p> <p>Flavoured with spices and naturally smoked</p> <p>Manufacturer brand</p> <p>1,79 €</p>	<p>Meat of castrated pig</p> <p>Original flavour</p> <p>Private brand</p> <p>0,99 €</p>	<p>Meat of castrated pig</p> <p>Flavoured with spices and naturally smoked</p> <p>Manufacturer brand</p> <p>0,59 €</p>	<p>Meat of boar</p> <p>Original flavour</p> <p>Private brand</p> <p>1,39 €</p>

Which product would you prefer if there were only these 4 products in their usual place of purchase?

A

B

C

D

Would you buy the product you have chosen above?

Yes

NO



### 3. EMPIRICAL APPLICATION: The DCE: Design

#### Special choice set – The hold out task

 <p>10 20683/A CEE</p> <p><b>Salchichas Frankfurt</b></p> <p>Carne procedente de cerdo castrado Marca del fabricante Sabor a las finas hierbas con ahumado natural Referencia/Lote: T1A1 Conservar entre 0°C y 4°C Producido en España Fecha de caducidad 30-06-2014 Peso neto 200 g Total €: 0,99 €</p> <p><b>A</b></p>	 <p>10 20683/A CEE</p> <p><b>Salchichas Frankfurt</b></p> <p>Carne procedente de cerdo castrado Marca del fabricante Sabor original Referencia/Lote: T5A2 Conservar entre 0°C y 4°C Producido en España Fecha de caducidad 30-06-2014 Peso neto 200 g Total €: 1,39 €</p> <p><b>B</b></p>	 <p>10 20683/A CEE</p> <p><b>Salchichas Frankfurt</b></p> <p>Carne procedente de cerdo NO castrado Marca del fabricante Sabor original Referencia/Lote: T3A3 Conservar entre 0°C y 4°C Producido en España Fecha de caducidad 30-06-2014 Peso neto 200 g Total €: 0,99 €</p> <p><b>C</b></p>	 <p>10 20683/A CEE</p> <p><b>Salchichas Frankfurt</b></p> <p>Carne procedente de cerdo castrado Marca del distribuidor Sabor a las finas hierbas con ahumado natural Referencia/Lote: T3A4 Conservar entre 0°C y 4°C Producido en España Fecha de caducidad 30-06-2014 Peso neto 200 g Total €: 1,79 €</p> <p><b>D</b></p>
 <p>10 20683/A CEE</p> <p><b>Salchichas Frankfurt</b></p> <p>Carne procedente de cerdo NO castrado Marca del fabricante Sabor a las finas hierbas con ahumado natural Referencia/Lote: T8A1 Conservar entre 0°C y 4°C Producido en España Fecha de caducidad 30-06-2014 Peso neto 200 g Total €: 1,79 €</p> <p><b>E</b></p>	 <p>10 20683/A CEE</p> <p><b>Salchichas Frankfurt</b></p> <p>Carne procedente de cerdo NO castrado Marca del fabricante Sabor original Referencia/Lote: T6A2 Conservar entre 0°C y 4°C Producido en España Fecha de caducidad 30-06-2014 Peso neto 200 g Total €: 0,59 €</p> <p><b>F</b></p>	 <p>10 20683/A CEE</p> <p><b>Salchichas Frankfurt</b></p> <p>Carne procedente de cerdo castrado Marca del fabricante Sabor a las finas hierbas con ahumado natural Referencia/Lote: T7A4 Conservar entre 0°C y 4°C Producido en España Fecha de caducidad 30-06-2014 Peso neto 200 g Total €: 1,39 €</p> <p><b>G</b></p>	 <p>10 20683/A CEE</p> <p><b>Salchichas Frankfurt</b></p> <p>Carne procedente de cerdo NO castrado Marca del distribuidor Sabor original Referencia/Lote: T7A3 Conservar entre 0°C y 4°C Producido en España Fecha de caducidad 30-06-2014 Peso neto 200 g Total €: 0,59 €</p> <p><b>H</b></p>

Which product would you prefer if there were only these 8 products in their usual place of purchase?

Pa

Would you buy the product you have chosen above?

Yes

No

and

### 3. EMPIRICAL APPLICATION: The DCE: Real market



Paper prepared for presentation at the 157<sup>th</sup> EAAE Seminar 'VI Workshop on Valuation Methods in Agro-food and Environmental Economics', Castelldefels, Spain, June 30<sup>th</sup>– July 1<sup>st</sup>, 2016

## 3. EMPIRICAL APPLICATION: The DCE: Real market

### FOLLOW-UP questions

CERTAINTY

COMPLEXITY

NON-ATTENDANCEES (yes/no)

RELATIVE IMPORTANCE of attributes (0-10)

0

1

2

3

4

5

6

7

8

9

10

### 3. EMPIRICAL APPLICATION: The DCE: Econometric model

#### The Mixed Logit Model (MIXL)

$$U_{njt} = \beta_n x_{njt} + \varepsilon_{njt} / \sigma_n \quad n = 1, \dots, N \quad j = 1, \dots, J \quad t = 1, \dots, T$$

- Extend the MNL introducing for unobserved heterogeneity
- Recent studies argued that much of the **PREFERENCE HETEROGENEITY** captured by random parameters in MIXL can be better captured by the scale term (**SCALE HETEROGENEITY**).
- The MIXL turns to be likely a **POOR APPROXIMATION** if scale heterogeneity is not accounted for

### 3. EMPIRICAL APPLICATION: The DCE: Econometric model

#### The Generalized Multinomial Logit Model (GMNL)

$$U_{njt} = [\sigma_n \beta + \gamma \eta_n + (1 - \gamma) \sigma_n \eta_n] X_{njt} + \varepsilon_{njt}$$

- $\sigma_n$  is a **SCALING FACTOR** that proportionately scales the  $\beta$  **UP** or **DOWN**.
- $\delta$  is a **MIXING PARAMETER** that determines the level of **MIXING** between the **SCALE** heterogeneity and the **PARAMETER** heterogeneity.

### 3. EMPIRICAL APPLICATION: The DCE: Econometric model

#### The GMNL-WTP space specification

$$U_{njt} = \sigma_n \beta_{p,n} \left( -p + \left( \frac{\beta'_n}{\beta_{p,n}} \right) X_{njt} \right) + [\gamma \eta_n + (1 - \gamma) \sigma_n \eta_n] X_{njt} + \varepsilon_{njt}$$

- GMNL model can be **REPARAMETRIZED** .
- Directly **GIVES** the individual-specific **WTP ESTIMATES**.
- BYPASSES** the **NECESSITY** of specifying the distribution of the **RATIO** of two **RANDOM** parameters.

### 3. EMPIRICAL APPLICATION: The DCE: Econometric model

#### Latent Class model (LC)

- The LC **DETERMINE** the **PROBABILITY** of an individual to belong to the **CLASSES** and the class **PROBABILITIES** of **CHOOSING** one alternative **CONDITIONAL** on the preferences within each **CLASS**.

$$\Pr(y_{i,j,t} = 1 | i \in C) = \frac{\exp(\beta'_c \cdot X_{i,j,t})}{\sum_{j=1}^J \exp(\beta'_c \cdot X_{i,j,t})}$$

### 3. EMPIRICAL APPLICATION: The DCE: Econometric model

#### Willingness to pay (price continuous coding)

$$IP_{\text{Product\_attribute}} = - \left( \frac{\beta_{\text{Product\_attribute}}}{\beta_{\text{monetary\_attribute}}} \right)$$

#### The relative importance (Price as effect coding)

$$I_k = \frac{(\max \beta_k - \min \beta_k)}{\sum_{k=1}^K (\max \beta_k - \min \beta_k)} \Rightarrow$$

- To compare with the relative importance of attributes obtained from linear scale from 0 to 10.



### 3. EMPIRICAL APPLICATION: The DCE: Econometric model

- ❑ **HALTON Sequence estimation in Nlogit 5**
  - **Authors differ in the appropriate value.**
  - **Train recommends SEVERAL HUNDRED**
  - **Bhat suggests 1,000 as an appropriate value**
  - **We used 500 DRAWS**
- ❑ **NORMAL DISTRIBUTION**

## 4. RESULTS: Sensory results

### Creating the **Sensory Experience**

Type of pork meat	Overall liking
Original sausage from non-castrated	5.46 <sup>c</sup> (1.61)
Sausage from non- castrated <b>WITH MASKING STRATEGY</b>	6.42 <sup>a</sup> (1.18)
Original sausage from castrated pig	5.91 <sup>b</sup> (1.30)
Sausage from castrated pig <b>WITH MASKING STRATEGY</b>	6.62 <sup>a</sup> (1.29)

The **APPLIED MASKING STRATEGY** had a **POSITIVE EFFECT** on frankfurter sausage **ACCEPTANCE**.

No difference between **CASTRATED** or **NON-CASTRATED**

$\beta_s$	GMNL		WTP-space		RPL		LC		$\beta_s$
	Pre <sup>a</sup>	Post <sup>b</sup>	Pre	Post	Pre	Post	Pre	Post	
	Random $\beta_s$		Random $\beta_s$		Random $\beta_s$		Latent class 1 Class probability 0.25***		Probability
<div style="border: 1px solid black; border-radius: 15px; padding: 10px; margin: 10px auto; width: 80%;"> <p><b>GOODNESS OF FIT</b></p> <ul style="list-style-type: none"> <li>▪ Psuedo R<sup>2</sup></li> <li>▪ AIC information criteria</li> <li>▪ Log_likelihood improvement</li> </ul> <p>Th <b>GMNL-WTP</b> space showed the highest <b>GOODNESS OF FIT</b>.</p> </div>									
	-	-	-	-	-	-	0.25	-0.93***	$\beta_{4,Price}$
	-	-	-	-	-	-	-0.53***	-2.28***	$\beta_{5,No\ option}$
N= 6,000 observations (150 consumers x5 alternatives 8 choice sets)									
Log-Likelihood ( $\theta$ )	-1,529.5	-1,418.3	-1449.7	-1,306.2	-1,539.4	-1,433.5	-1,572.7	-1,528.6	
Log-Likelihood (0)	-1,931.3	-1,931.3	-1,931.3	-1,931.3	-1,931.3	-1,931.3	-1,931.3	-1,931.3	
LL ratio test	803.55 (0.000)	1,025.8 (0.000)	963.05 (0.000)	1250.20 (0.000)	783.82 (0.000)	995.61 (0.000)	717.15 (0.000)	805.30 (0.000)	
Pseudo R <sup>2</sup>	0.208	0.265	0.249	0.323	0.202	0.257	0.185	0.208	
AIC/N	2.57	2.39	2.44	2.204	2.58	2.40	2.65	2.57	

$\beta_s$	GMNL		WTP-space		RPL		LC		$\beta_s$
	Pre <sup>a</sup>	Post <sup>b</sup>	Pre	Post	Pre	Post	Pre	Post	
	Random $\beta_s$		Random $\beta_s$		Random $\beta_s$		Latent class 1		
							Class probability		
							0.35***	0.35***	Probability
Boar animal, $\beta_1$	0.28**	-0.01	0.11*	-0.09**	0.12**	-0.06	1.00***	-1.30***	$\beta_{1-Boar}$
Private brand, $\beta_2$	-0.21***	-0.26***	-0.07	-0.19***	-0.19***	-0.32***	-0.16*	-0.32***	$\beta_{2-Private}$
Masking strategy, $\beta_3$	-0.47	0.50*	-0.21***	0.42***	-0.33***	0.61***	-1.09***	1.09***	$\beta_{3-Masking}$
Price, $\beta_4$ (random)	-	-	1.0 (Fxd.)	1.0 (Fxd.)	-	-	-1.40***	-0.98***	$\beta_{4-Price}$
	Non-random $\beta_s$		Non-random $\beta_s$		Non-random $\beta_s$		0.42	1.27***	$\beta_{5-No\ option}$
Price, $\beta_4$ (non-random)	-1.69***	-1.51***	-	-	-1.65***	-1.49***	Latent class 2		
Opt-out, $\beta_5$	-0.40***	0.02	-0.63***	0.33***	-0.37***	0.07	Class probability		
	Scale parameters		Scale parameters		-		0.24***	0.31***	Probability
Tau ( $\tau$ )	1.10***	0.01	0.42*	0.49	-	-	0.27***	0.12*	$\beta_{1-Boar}$
							-0.11	-0.07	$\beta_{2-Private}$
							0.59***	-0.43***	$\beta_{3-Masking}$
							-1.71***	-0.82***	$\beta_{4-Price}$
							-2.29***	-0.60***	$\beta_{5-No\ option}$
							Latent class 3		
							Class probability		
							0.28***	0.33***	Probability
							-0.75***	0.75***	$\beta_{1-Boar}$
							-0.11	-0.35***	$\beta_{2-Private}$
							-0.50***	1.31***	$\beta_{3-Masking}$
							0.25	-0.93***	$\beta_{4-Price}$
							-0.53***	-2.28***	$\beta_{5-No\ option}$
							-1,572.7	-1,528.6	
							-1,931.3	-1,931.3	
							717.15	805.30	
							(0.000)	(0.000)	
							0.185	0.208	
							2.65	2.57	
AIC/N	2.57	2.39	2.44	2.204	2.58	2.40			

BEFORE THE EATING EXPERIENCE, consumers exhibit a preference for meat obtained from PIGS REARED IN NATURAL CONDITION (i.e. non-castrated) as a potential preference for a positive pig welfare.

Class 3 (Non-preference).

$\beta_s$	GMNL		WTP-space		RPL		LC		$\beta_s$
	Pre <sup>a</sup>	Post <sup>b</sup>	Pre	Post	Pre	Post	Pre	Post	
	Random $\beta_s$		Random $\beta_s$		Random $\beta_s$		Latent class 1		
							Class probability		
							0.35***	0.35***	Probability
Boar animal, $\beta_1$	0.28**	-0.01	0.11*	-0.09**	0.12**	-0.06	1.00***	-1.30***	$\beta_{1-Boar}$
Private brand, $\beta_2$	-0.21***	-0.26***	-0.07***	-0.19***	-0.19***	-0.32***	-0.16*	-0.32***	$\beta_{2-Private}$
Masking strategy, $\beta_3$	-0.47***	0.50**	-0.21***	0.42***	-0.33***	0.61***	-1.09***	1.09***	$\beta_{3-Masking}$
Price, $\beta_4$ (random)	-	-	1.0 (Fxd.)	1.0 (Fxd.)	-	-	-1.40***	-0.98***	$\beta_{4-Price}$
	Non-random $\beta_s$		Non-random $\beta_s$		Non-random $\beta_s$		0.42	1.27***	$\beta_{5-No option}$
Price, $\beta_4$ (non-random)	-1.69***	-1.51***	-	-	-1.65***	-1.49***	Latent class 2		
Opt-out, $\beta_5$	-0.40***	0.02	-0.63***	-0.33***	-0.37***	0.07	Class probability		
	Scale parameters		Scale parameters		-	-	0.34***	0.31***	Probability
Tau ( $\tau$ )	1.10***	0.01	0.42*	0.49	-	-	0.27***	0.12*	$\beta_{1-Boar}$
Gamma ( $\gamma$ )	0.41***	0.72***	0.0 (Fxd.)	0.0 (Fxd.)	-	-	-0.11	-0.07	$\beta_{2-Private}$
	S.D. of random $\beta_s$		S.D. of random $\beta_s$		S.D. of random $\beta_s$		0.59***	-0.43***	$\beta_{3-Masking}$
S.D. price	-	-	0.0 (Fxd.)	0.0 (Fxd.)	-	-	-1.71***	-0.82***	$\beta_{4-Price}$
S.D. boar animal	1.20***	1.04***	0.62**	0.80***	1.06**	1.41***	-2.29***	-0.60***	$\beta_{5-No option}$
S.D. private brand	0.10	0.47***	0.03	0.13***	0.05	0.22**	Latent class 3		
S.D. masking strategy	1.19***	1.25***	0.63***	0.92***	1.10***	1.37***	Class probability		
	-	-	-	-	-	-	0.29***	0.33***	Probability
	-	-	-	-	-	-	-0.75**	0.75***	$\beta_{1-Boar}$
	-	-	-	-	-	-	-0.11	-0.35***	$\beta_{2-Private}$
	-	-	-	-	-	-	-0.50***	1.31***	$\beta_{3-Masking}$
	-	-	-	-	-	-	0.25	-0.93***	$\beta_{4-Price}$

□ However, **AFTER TASTING** The utility of **CASTRATION** decrease → **ANIMAL WELFARE** turns to be **NON-RELEVANT**.

$\beta_s$	GMNL		WTP-space		RPL		LC		$\beta_s$
	Pre <sup>a</sup>	Post <sup>b</sup>	Pre	Post	Pre	Post	Pre	Post	
	Random $\beta_s$		Random $\beta_s$		Random $\beta_s$		Latent class 1		
							Class probability		
							0.35 <sup>***</sup>	0.35 <sup>***</sup>	Probability
Boar animal, $\beta_1$	0.28 <sup>**</sup>	-0.01	0.11 <sup>*</sup>	-0.09 <sup>**</sup>	0.12 <sup>**</sup>	-0.06	1.00 <sup>***</sup>	-1.30 <sup>***</sup>	$\beta_{1-Boar}$
Private brand, $\beta_2$	-0.21 <sup>**</sup>	-0.26 <sup>***</sup>	-0.07 <sup>***</sup>	0.19 <sup>***</sup>	-0.19 <sup>***</sup>	-0.32 <sup>***</sup>	-0.16 <sup>*</sup>	-0.32 <sup>***</sup>	$\beta_{2-Private}$
Masking strategy, $\beta_3$	-0.47 <sup>**</sup>	0.50 <sup>**</sup>	-0.21 <sup>***</sup>	0.42 <sup>**</sup>	-0.33 <sup>***</sup>	0.61 <sup>**</sup>	-1.09 <sup>**</sup>	1.09 <sup>**</sup>	$\beta_{3-Masking}$
Price, $\beta_4$ (random)	-	-	1.0 (Fxd.)	1.0 (Fxd.)	-	-	-1.40 <sup>***</sup>	-0.98 <sup>***</sup>	$\beta_{4-Price}$
	Non-random $\beta_s$		Non-random $\beta_s$		Non-random $\beta_s$		0.42	1.27 <sup>***</sup>	$\beta_{5-No\ option}$
Price, $\beta_4$ (non-random)	-1.69 <sup>***</sup>	-1.51 <sup>***</sup>	-	-	-1.65 <sup>***</sup>	-1.49 <sup>***</sup>	Latent class 2		
Opt-out, $\beta_5$	-0.40 <sup>***</sup>	0.02	-0.63 <sup>***</sup>	-0.33 <sup>***</sup>	-0.37 <sup>***</sup>	0.07	Class probability		
	Scale parameters		Scale parameters		-	-	0.34 <sup>***</sup>	0.31 <sup>***</sup>	Probability
Tau ( $\tau$ )	1.10 <sup>***</sup>	0.01	0.42 <sup>*</sup>	0.49	-	-	0.27 <sup>***</sup>	0.12 <sup>*</sup>	$\beta_{1-Boar}$
Gamma ( $\gamma$ )	0.41 <sup>***</sup>	0.72 <sup>**</sup>	0.0 (Fxd.)	0.0 (Fxd.)	-	-	-0.11	-0.07	$\beta_{2-Private}$
	S.D. of random $\beta_s$		S.D. of random $\beta_s$		S.D. of random $\beta_s$		0.59 <sup>***</sup>	-0.43	$\beta_{3-Masking}$
S.D. price	-	-	0.0 (Fxd.)	0.0 (Fxd.)	-	-	-1.71 <sup>***</sup>	-0.82 <sup>***</sup>	$\beta_{4-Price}$
S.D. boar animal	1.20 <sup>***</sup>	1.04 <sup>***</sup>	0.62 <sup>***</sup>	0.80 <sup>***</sup>	1.06 <sup>**</sup>	1.41 <sup>***</sup>	-2.29 <sup>**</sup>	-0.60 <sup>***</sup>	$\beta_{5-No\ option}$
S.D. private brand	0.10	0.47 <sup>***</sup>	0.03	0.13 <sup>***</sup>	0.05	0.22 <sup>**</sup>	Latent class 3		
S.D. masking strategy	1.19 <sup>***</sup>	1.25 <sup>***</sup>	0.63 <sup>***</sup>	0.92 <sup>***</sup>	1.10 <sup>**</sup>	1.37 <sup>***</sup>	Class probability		
	-	-	-	-	-	-	0.29 <sup>***</sup>	0.33 <sup>***</sup>	Probability
	-	-	-	-	-	-	-0.75 <sup>***</sup>	0.75 <sup>***</sup>	$\beta_{1-Boar}$
	-	-	-	-	-	-	-0.11	-0.35 <sup>***</sup>	$\beta_{2-Private}$
	-	-	-	-	-	-	-0.50 <sup>***</sup>	1.31 <sup>**</sup>	$\beta_{3-Masking}$
	-	-	-	-	-	-	0.25	-0.93 <sup>***</sup>	$\beta_{4-Price}$

- ❑ For the **BRAND**, consumers do not prefer **PRIVATE** brands.
- ❑ **NON-SIGNIFICANT DIFFERENCES BEFORE** and **AFTER** eating.

$\beta_s$	GMNL		WTP-space		RPL		LC		$\beta_s$
	Pre <sup>a</sup>	Post <sup>b</sup>	Pre	Post	Pre	Post	Pre	Post	
	Random $\beta_s$		Random $\beta_s$		Random $\beta_s$		Latent class 1		
							Class probability		
							0.35 <sup>***</sup>	0.35 <sup>***</sup>	Probability
Boar animal, $\beta_1$	0.28 <sup>**</sup>	-0.01	0.11 <sup>*</sup>	-0.09 <sup>**</sup>	0.12 <sup>**</sup>	-0.06	1.00 <sup>***</sup>	-1.30 <sup>***</sup>	$\beta_{1-Boar}$
Private brand, $\beta_2$	-0.21 <sup>***</sup>	-0.26 <sup>***</sup>	-0.07 <sup>***</sup>	-0.19 <sup>***</sup>	-0.19 <sup>***</sup>	-0.32 <sup>***</sup>	-0.16 <sup>**</sup>	-0.32 <sup>***</sup>	$\beta_{2-Private}$
Masking strategy, $\beta_3$	-0.47 <sup>***</sup>	0.50 <sup>**</sup>	-0.21 <sup>***</sup>	0.42 <sup>***</sup>	-0.33 <sup>***</sup>	0.61 <sup>***</sup>	-1.09 <sup>***</sup>	1.09 <sup>***</sup>	$\beta_{3-Masking}$
Price, $\beta_4$ (random)	-	-	1.0 (Fxd.)	1.0 (Fxd.)	-	-	-1.40 <sup>***</sup>	-0.98 <sup>***</sup>	$\beta_{4-Price}$
	Non-random $\beta_s$		Non-random $\beta_s$		Non-random $\beta_s$		0.42	1.27 <sup>***</sup>	$\beta_{5-No option}$
Price, $\beta_4$ (non-random)	-1.69 <sup>***</sup>	-1.51 <sup>***</sup>	-	-	-1.65 <sup>***</sup>	-1.49 <sup>***</sup>	Latent class 2		
Opt-out, $\beta_5$	-0.40 <sup>***</sup>	0.02	-0.63 <sup>***</sup>	-0.33 <sup>***</sup>	-0.37 <sup>***</sup>	0.07	Class probability		
							0.34 <sup>***</sup>	0.31 <sup>***</sup>	Probability
	Scale parameters		Scale parameters		-	-	0.27 <sup>***</sup>	0.12 <sup>*</sup>	$\beta_{1-Boar}$
Tau ( $\tau$ )	1.10 <sup>***</sup>	0.01	0.42 <sup>*</sup>	0.49	-	-	-0.11	-0.07	$\beta_{2-Private}$
Gamma ( $\gamma$ )	0.41 <sup>***</sup>	0.72 <sup>***</sup>	0.0 (Fxd.)	0.0 (Fxd.)	-	-	0.59 <sup>***</sup>	-0.43 <sup>***</sup>	$\beta_{3-Masking}$
	S.D. of random $\beta_s$		S.D. of random $\beta_s$		S.D. of random $\beta_s$		-1.71 <sup>***</sup>	-0.62 <sup>***</sup>	$\beta_{4-Price}$
S.D. price	-	-	0.0 (Fxd.)	0.0 (Fxd.)	-	-	-2.29 <sup>***</sup>	-0.60 <sup>***</sup>	$\beta_{5-No option}$
S.D. boar animal	1.20 <sup>***</sup>	1.04 <sup>***</sup>	0.62 <sup>***</sup>	0.80 <sup>***</sup>	1.06 <sup>***</sup>	1.41 <sup>***</sup>	Latent class 3		
S.D. private brand	0.10	0.47 <sup>***</sup>	0.03	0.13 <sup>***</sup>	0.05	0.22 <sup>**</sup>	Class probability		
S.D. masking strategy	1.19 <sup>***</sup>	1.25 <sup>***</sup>	0.63 <sup>***</sup>	0.92 <sup>***</sup>	1.10 <sup>***</sup>	1.37 <sup>***</sup>	0.29 <sup>***</sup>	0.33 <sup>***</sup>	Probability
	-	-	-	-	-	-	-0.75 <sup>***</sup>	0.75 <sup>***</sup>	$\beta_{1-Boar}$
	-	-	-	-	-	-	0.11	-0.35 <sup>***</sup>	$\beta_{2-Private}$
	-	-	-	-	-	-	-0.50 <sup>***</sup>	1.31 <sup>***</sup>	$\beta_{3-Masking}$
	-	-	-	-	-	-	0.25	-0.93 <sup>***</sup>	$\beta_{4-Price}$

❑ FLAVOUR, BEFORE eating → NEGATIVE EXPECTED PREFERENCE.

❑ However, AFTER eating their utility become POSITIVE

$\beta_s$	GMNL		WTP-space		RPL		LC		$\beta_s$
	Pre <sup>a</sup>	Post <sup>b</sup>	Pre	Post	Pre	Post	Pre	Post	
	Random $\beta_s$		Random $\beta_s$		Random $\beta_s$		Latent class 1		
							Class probability		
							0.35***	0.35***	Probability
Boar animal, $\beta_1$	0.28**	-0.01	0.11*	-0.09**	0.12**	-0.06	1.00***	-1.30***	$\beta_{1-Boar}$
Private brand, $\beta_2$	-0.21***	-0.26***	-0.07***	-0.19***	-0.19***	-0.32***	-0.16*	-0.32***	$\beta_{2-Private}$
Masking strategy, $\beta_3$	-0.47**	0.50**	-0.21***	0.42**	-0.33***	0.61**	-1.09***	1.09***	$\beta_{3-Masking}$
Price, $\beta^*_4$ (random)	-	-	1.0 (Fxd.)	1.0 (Fxd.)	-	-	-1.40***	-0.98***	$\beta_{4-Price}$
	Non-random $\beta_s$		Non-random $\beta_s$		Non-random $\beta_s$		0.42	1.27***	$\beta_{5-No\ option}$
Price, $\beta_4$ (non-random)	-1.69***	-1.51***	-	-	-1.65***	-1.49***	Latent class 2		
Opt-out, $\beta_5$	-0.40***	0.02	-0.63***	-0.33***	-0.37***	0.07	Class probability		
	Scale parameters		Scale parameters		-	-	0.34***	0.31***	Probability
Tau ( $\tau$ )	1.10**	0.01	0.42*	0.49	-	-	0.27***	0.12*	$\beta_{1-Boar}$
Gamma ( $\gamma$ )	0.41***	0.72	0.0 (Fxd.)	0.0 (Fxd.)	-	-	-0.11	-0.07	$\beta_{2-Private}$
	S.D. of random $\beta_s$		S.D. of random $\beta_s$		S.D. of random $\beta_s$		0.59***	-0.43***	$\beta_{3-Masking}$

□ **TAU PARAMETER** that captures the **SCALE HETEROGENEITY**

- High and significant scale before tasting
- Non-significant scale after tasting

□ After the sensory experience the **VARIATION OF THE DEGREE** of **UNCERTAINTY DECREASED** significantly.



$\beta_s$	<i>GMNL</i>		<i>WTP-space</i>		<i>RPL</i>		<i>LC</i>		$\beta_s$
	Pre <sup>a</sup>	Post <sup>b</sup>	Pre	Post	Pre	Post	Pre	Post	
	Random $\beta_s$		Random $\beta_s$		Random $\beta_s$		Latent class 1 Class probability 0.35 <sup>***</sup> 0.35 <sup>***</sup>		Probability

## □ NEXT STEPS

- **WTP** comparisons
- **RELATIVE IMPORTANCE** comparisons with the Likert Scale
- Include **NON-ATTENDANCE**
- **HOLD-OUT** task

	-	-	-	-	-	-	-0.50 <sup>***</sup>	1.31 <sup>***</sup>	$\beta_3$ -Masking
	-	-	-	-	-	-	0.25	-0.93 <sup>***</sup>	$\beta_4$ -Price
	-	-	-	-	-	-	-0.53 <sup>***</sup>	-2.28 <sup>***</sup>	$\beta_5$ -No option

N= 6,000 observations (150 consumers \*5 alternatives 8 choice sets)

<b>Log-Likelihood (θ)</b>	-1,529.5	-1,418.3	-1449.7	-1,306.2	-1,539.4	-1,433.5	-1,572.7	-1,528.6
<b>Log-Likelihood (0)</b>	-1,931.3	-1,931.3	-1,931.3	-1,931.3	-1,931.3	-1,931.3	-1,931.3	-1,931.3
<b>LL ratio test</b>	803.55 (0.000)	1,025.8 (0.000)	963.05 (0.000)	1250.20 (0.000)	783.82 (0.000)	995.61 (0.000)	717.15 (0.000)	805.30 (0.000)
<b>Pseudo R<sup>2</sup></b>	0.208	0.265	0.249	0.323	0.202	0.257	0.185	0.208
<b>AIC/N</b>	2.57	2.39	2.44	2.204	2.58	2.40	2.65	2.57

## 5. CONCLUSIONS

❑ The **SENSORY EXPERIENCE** may had impact on:

### 1. PREFERENCE

- Consumers would prefer **MEAT QUALITY** than **ANIMAL WELFARE**.

### 2. SCALE PARAMETER.

- The **SENSORY EXPERIENCE DECREASED** the degree of **UNCERTAINTY**.

❑ **WTP-SPACE** model seems to best fit the data.

## 5. CONCLUSIONS

- These results **HIGHLIGHT** the **IMPORTANCE** of the **DIRECT PROMOTION** and the *in situ* **MARKETING TECHNIQUES** of these types of product in the retail point by **GIVING POTENTIAL CONSUMERS THE OPPORTUNITY** to test the product.

**Thank you for your  
attention**