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Analytical Hierarchy Process Versus The Choice Experiments: A Stated Preference Analysis

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Outline

1. INTRODUCTION
2. OBJECTIVE
3. METHODOLOGY
4. EMPIRICAL APLICATION
5. RESULTS
6. CONCLUSIONS

1. INTRODUCTION

- ***Within the range of methods that analyze individuals' preference for "complex goods and services", several alternative are available.***
- ***Choice Experiment (CE) is one of the most recently used in exploration of consumers' preferences*** (Carlsson *et al*., 2007; Alfens, 2004; Burton and Pearse, 2002 and Burton *et al*., 2001)***.***
- ***The CE has demonstrated its capacity to simulate the "purchasing" stated preferences, since consumers are asked in an hypothetical market; which product they would "buy" among competing products at different prices.***

1. INTRODUCTION

- ***The Analytical Hierarchy Process (AHP) has also been used as a suitable method to asses individuals' preferences for "complex goods and services"*** (Sedef *et al*., 2007; Scholz and Decker, 2007; Parra *et al*., 2005; Scholl *et al*., 2005 and Ramanathan and Ganesh, 1994).

- ***The AHP allow for seeking the "theoretical" stated preferences, since consumers are asked to state their preferred attributes and levels of the analyzed products in a pair-wise comparison following a structured hierarchy.***

1. INTRODUCTION

- ***A key question is to know if asking consumers "what they prefer" using AHP or what "they would they buy" using CE could lead to different results.***
- **Several studies have compared individuals' preferences using the AHP and the Conjoint Analysis (Malvinas, *et al*. 2005; Scholz *et al*., 2005 and Meißner, *et al*. 2007) and the Case-Based ranking method (Perini, 2009). However, up to date there are no works that try to compare empirical results of the AHP and the CE.**

2. OBJETIVE

- ***To assess the differences between the "purchasing" and "theoretical" stated preferences using the CE and the AHP respectively.***

- ***To know if asking consumers "what they prefer" using AHP or what "they would they buy" using CE could lead to different preferences results.***

3. METHODOLOGY:
3.1. The Choice Experiment

- The CE is based on the characterization of the analyzed product through a series of attributes (which one is a monetary attributes).
- The combination of attributes' levels allow to create hypothetical scenarios or product that will be evaluated by subjects.
- Scenarios are presented following "orthogonal designs" in order to form a "choice sets".
- Respondent are asked to chose between the hypothetical products in each Choice Set.

3. METHODOLOGY:
3.1. The Choice Experiment

- The conceptual foundations of CE rely on two main theories:
  a) Lancaster's Theory of Value (Lancaster, 1966), which proposes that utilities for goods can be decomposed into separable utilities for their characteristics or attributes, and
  b) Random Utility Theory (Thurstone, 1927), which explains the dominance judgments made between pairs of offerings.

- Based on this theoretical framework, subjects choose among alternatives according to a utility function.

3. METHODOLOGY:
3.1. The Choice Experiment

Utility of the hypothetical scenarios

$$U_{in} = V_{in}\,(Z_i \,.\, S_n) + \varepsilon_{in}$$

- U_{in}: utility provided by alternative *i to subject n.*
- V_{in} is the systematic component of the utility.
- Z_i is a vectors of attributes of alternative i.
- S_n socio-economic characteristics of respondent n. ε_{in}: random term.

- Probability that an individual n choose the scenario i (P_{in}):
- Conditional Logit Model (McFadden . 1974):

$$P_{in} = \frac{e^{\mu V_{in}}}{\sum_{j=1}^{J} e^{\mu V_{jn}}}$$

3. METHODOLOGY:
3.1. The Choice Experiment

$$V_{in} = ASC + \sum_{k} \beta_k X_{ki}$$

ASC =Alternative Specific Constant, representing the utility of the fixed comparator

***i* = 1…I, representing the selected alternative *i* within the choice sets**

***k* = 1…K, representing the attributes;**

β = model parameter of attribute *k*;

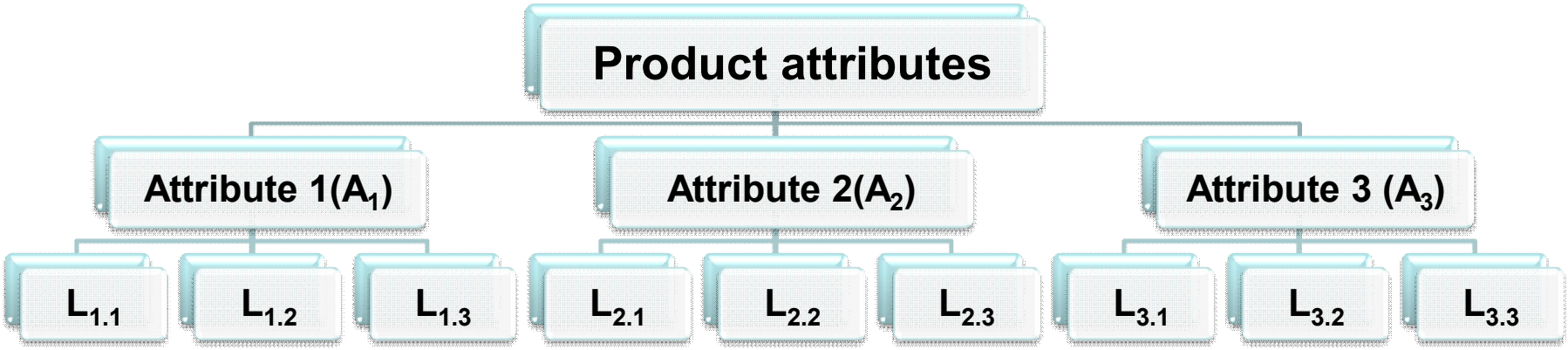
X_{ki}= value of attribute *k* in alternative *I*;

IMPLICIT PRICE OF ATTRIBUTE

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

3. METHODOLOGY:
3.2. The Analytical Hierarchy Process

- **Hierarchical structure used to value product attributes and levels:**



- **The relative importance or weights (*w*) of attributes (A_n) and levels ($L_{n.p}$), where; *n* (*1, ... , N*) is the number of attributes and *p* (*=1, ... , P*) is the number of levels, are obtained from a pair-wise comparisons.**

3. METHODOLOGY:
3.2. The Analytical Hierarchy Process

- Hierarchical structure used to value product attributes and levels:

$$A_k = \begin{bmatrix} a_{11k} & a_{12k} & \dots & a_{1nk} \\ a_{21k} & a_{22k} & \dots & a_{2nk} \\ \dots & \dots & a_{ijk} & \dots \\ a_{n1k} & a_{n2k} & \dots & a_{nnk} \end{bmatrix}$$

- **Weights assigned by subject to each attribute and levels are obtained using the following expression.**

$$w_{ik} = \sqrt[N,P]{\prod_{i=1}^{i=N,P} a_{ijk}}$$

3. METHODOLOGY:
3.2. The Analytical Hierarchy Process

- For aggregating individual weights (w_{ik}) in a social collective decision-making context is that of the geometric mean:

$$w_i = \sqrt[K]{\prod_{k=1}^{k=K} w_{ik}}$$

- To obtain weights' order for levels we calculate a global weight obtained by multiplying aggregated levels' weights (w_i for each levels $L_{n.p}$) with its corresponding weight (w_i) of attribute (A_n) as mentioned by Malvinas *et al*. (2005).

$$w_{G\_Ln.p} = w_{An} \times w_{Ln.p}$$

4. EMPIRICAL APPLICATION

- *Analyze the stated preferences of restaurateurs for including rabbit meat in their menus.*
- **Realize an EXPLORATORY STUDY of preferences comparison.**
- **Face to face questionnaires realized in December 2008 for 50 restaurateurs.**

4. EMPIRICAL APPLICATION:
Attributes and levels

- We relied on prior research performed on rabbit meat preference (Hoffman, *et al.*, 2004).
- Subsequently discussed in a focus groups.
- A pilot questionnaire was applied.

Format	**(A_2)**	**Pieced**	**$L_{2.2*}$**
		Boneless	**$L_{2.3}$**
Brand	**(A_3)**	**Quality brand**	**$L_{3.1*}$**
		Commercial brand	**$L_{3.2}$**
		Unbranded	**$L_{3.3}$**
Price	**(A_4)**	**5.50 €**	**$L_{4.1*}$**
		6.00 €	**$L_{4.2}$**
		6.50 €	**$L_{4.3}$**

4. EMPIRICAL APPLICATION:

4.1. Experimental Design, CE

- From a full factorial design we obtain ($3^4 \times 3^4$)= 6,561 possible combinations.
- Following a main effect Orthogonal fractional factorial design: 9 choice set.

CHOICE SET # 1	Product "A"	Product "B"	Opt_out
Origin (A_1) 	Catalonia	Spain	Neither
Format (A_2) 	Boneless	Entire	
Brand (A_3) 	Unbranded	Quality brand	
Price (A_4) 	6.50 €	5.50 €	
Supposing these options are the only ones available, which would you buy?	☐	☐	☐

4. EMPIRICAL APPLICATION:
4.2. AHP application

- The same attributes were used.
- An example of the application the AHP questionnaire.

Origin	9	8	7	6	5	4	3	2	**1**	2	3	4	5	6	7	8	9	Brand
Unbranded	9	8	7	6	5	4	3	2	**1**	2	3	4	5	6	7	8	9	Quality brand
Boneless	9	8	7	6	5	4	3	2	**1**	2	3	4	5	6	7	8	9	Entire
Catalonia	9	8	7	6	5	4	3	2	**1**	2	3	4	5	6	7	8	9	Spain

- Coefficients magnitude imply relative importance of levels.

Variables	Coefficients.	Standard error	p-value
ASC_Opt out	-7.1591	1.0677	0.0000
Spain	-0.0714	0.0980	0.4662
Catalonia	0.7964	0.1006	0.0000
Commercial brand	-0.0992	0.1037	0.3388
Price	-1.1405	0.1730	0.0000

- Overall, the model is highly significant and shows a good fit when comparing the log likelihood at zero and at convergence

Summary statistics

No. of observations	450		
Log-Likelihood (0)	-481.0647	Log-Likelihood (1)	-410.8064
Log-Likelihood ratio	140.516 (0.000)	ρ^2 (pseudo R^2)	0.15

- Almost all implicit prices are statistically different from zero.
- As the coefficient, they gives us the attributes ranking.

	Attributes	IP (€/kg)	95% C.I.
Origin (A_1)	$IP_{L1.1}$: Catalonia	0.698	(0.506 ;1.008)
	$IP_{L1.2}$: Spain	-0.063	(-0.213 ; 0.083)
	$IP_{L1.3}$: Foreign	-0.636	(-0.958 ; -0.404)
Format (A_2)	$IP_{L2.1}$: Entire	0.243	(0.097 ; 0.419)
	$IP_{L2.2}$: Pieced	0.110	(-0.036 ; 0.273)
	$IP_{L2.3}$: Boneless	-0.352	(-0.624 ; -0.134)
Brand (A_3)	$IP_{L3.1}$: Quality brand	0.086	(-0.053 ; 0.239)
	$IP_{L3.2}$: Commercial brand	-0.087	(-0.244 ; 0.056)
	$IP_{L3.3}$: Unbranded	0.001	(-0.194 ; 0.223)

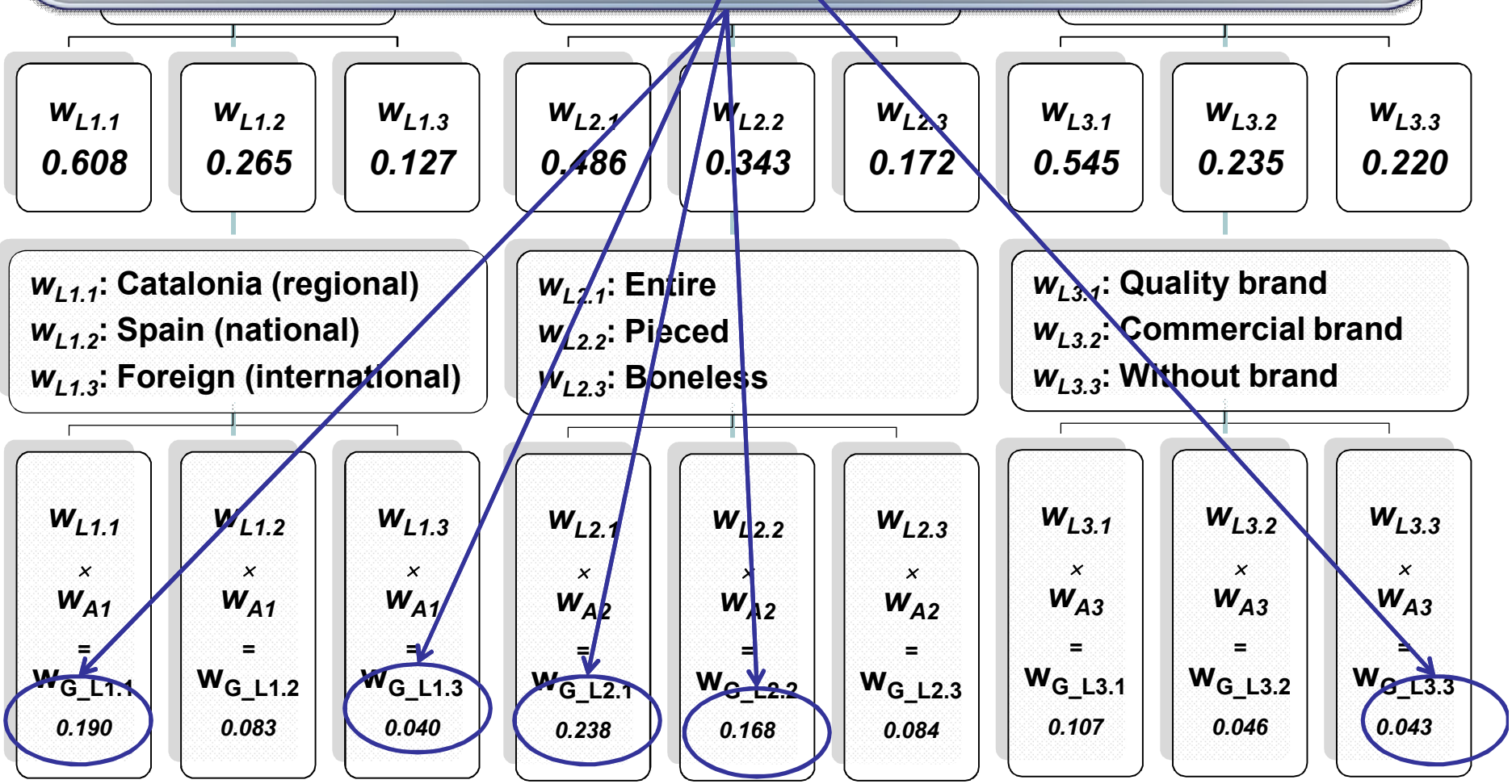
5. RESULTS
5.3. Results of AHP

	Origin	Format	Brand
Aggregated weight (Geometric mean)	*0.312*	*0.491*	*0.197*
Arithmetic mean	0.323	0.485	0.192
Trimmed mean*	0.392	0.418	0.190
Variance	0.054	0.057	0.017

- These results suggest that the "Format" attributes is the most important with an aggregate weight of 49.1%. Origin attribute occupies the second positions with aggregate weights of 31.2%. In the last position we found the brand" attribute with an aggregate weight of 19.7%.

- The lowest weight is for the “foreign” origin (4.0%) followed by “unbranded” product (4.3%).

(16.8%).



- For the remaining levels, there is a small difference in the ranking between the "entire" and "Catalonian" levels preferences, there is a 55.6 % of coincidence in the ranking of levels.

AHP results (Theoretical stated preference)			CE results (Purchasing stated preference)	
Levels	$w_{G\_Ln.p}$	Relative importance	Levels	IP
$w_{G\_L2.1}$: Entire	0.2384	1	$IP_{L1.1}$: Catalonia	0.6983
$w_{G\_L1.1}$: Catalonia	0.1899	2	$IP_{L2.1}$: Entire	0.2428
$w_{G\_L2.2}$: Pieced	0.1682	3	$IP_{L2.2}$: Pieced	0.1094
$w_{G\_L3.1}$: Quality brand	0.1072	4	$IP_{L3.1}$: Quality brand	0.0865
$w_{G\_L2.3}$: Boneless	0.0844	5	$IP_{L3.3}$: Unlabeled	0.0005
$w_{G\_L1.2}$: Spain	0.0827	6	$IP_{L1.2}$: Spain	-0.0626
$w_{G\_L3.2}$: Commercial brand	0.0462	7	$IP_{L3.2}$: Commercial brand	-0.0870
$w_{G\_L3.3}$: Unbranded	0.0433	8	$IP_{L2.3}$: Boneless	-0.3521
$w_{G\_L1.3}$: Foreign	0.0397	9	$IP_{L1.3}$: Foreign	-0.6357

6. CONCLUSIONS

- Results demonstrate that there is a 55.6 % of coincidence in the ranking of attributes and levels between the AHP and CE results.
- While the AHP allow for preference scores at individual level, the CE does not.
- The task of a pair wise comparison of attributes and levels seem to be easier than comparing two or more complex goods as is the case of the CE.
- More efforts are needed to investigate with more details the source of difference in results, taking into consideration the exploratory characteristics of our study.