

1 Can Innovations in Traditional Pork Products Help thriving EU Untapped Pig Breeds?

2 A Non-Hypothetical Discrete Choice Experiment with hedonic evaluation

3 Kallas Z.^a, Varela E.^a, Čandek-Potokar M.^b, Pugliese C.^c, Cerjak M.^d, Tomažin U.^b,
4 Karolyi D.^d, Aquilani C.^c, Vitale, M.^e & Gil, J.M.^a

5 ^aCREDA-UPC-IRTA, Centre for Agro-food Economy & Development, Castelldefels, Spain.

6 ^bKIS, Agricultural Institute of Slovenia, Ljubljana, Slovenia.

7 ^cUNIFI, Università Degli Studi Di Firenze, Florence, Italy.

8 ^dUNIZG, University of Zagreb, Faculty of Agriculture, Zagreb, Croatia.

9 ^eIRTA, Institute of Agrifood Research and Technology, Product Quality Program, Monells, Spain.

10

11 **Abstract**

12 The EU is supporting measures that stimulate enhanced value-added products in order
13 to conserve local and threatened livestock breeds. Several Traditional Pork Products (TPP)
14 and Innovative Traditional Pork Products (ITPP) with health innovations from four untapped
15 pig breeds in Spain (*Porc Negre Mallorquí*), Croatia (*Turopolje*), Italy (*Cinta Senese*) and
16 Slovenia (*Krškopolje*) were analysed. Consumers' "Non-hypothetical" willingness to pay (WTP)
17 and hedonic evaluation were investigated. An integrated experimental approach using two
18 Non-Hypothetical Discrete Choice Experiment (NH-DCE) was carried out before and after a
19 hedonic evaluation test. Results showed that the health innovative products (ITPP) received
20 similar and even lower WTP than the "control" products (TPP) from the untapped pig breeds.
21 The TPP outperformed products enriched with healthy ingredients or with reduced undesirable
22 compounds. The potential demand for traditional and "unaltered" product from the rustic pig
23 breeds could contribute to their conservation. A market niche exists, where consumers
24 appreciate these high-quality products and where no "add-ons" are required to enhance their
25 uptake.

26

27 **Key words:** Untapped pig breeds, Innovative Traditional Pork products, Non-hypothetical
28 Discrete Choice Experiment, Health perceptions, Hedonic evaluation.

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31 Corresponding author.

32 Zein Kallas

33 CREDA-UPC-IRTA

34 Parc Mediterrani de la Tecnologia

35 Esteve terradas, 8 Edifici ESAB.

36 08860 Castelldefels

37 SPAIN

38 Tf: +34 935 521 213

39 Zein.kallas@upc.edu

40

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44 **1. Introduction**

45 Conservation and enhancement of agro-biodiversity remains one of the top policy
46 challenges addressed by the Common Agricultural Policy (CAP). Different measures have
47 been taken to halt biodiversity loss, to preserve farm genetic resources and to protect the
48 natural capital inherent to the European citizens' health and economy (EC, 2017a). In 2001,
49 the EU adopted the Biodiversity Action Plan for Agriculture (EC, 2017b) which integrated the
50 environmental requirements into market policy. One of the main priorities of this plan is the
51 promotion of actions to conserve local or threatened livestock breeds.

52 The preservation of the untapped animal breeds plays a relevant role in protecting the
53 genetic value related to specific traits that are nearly disappeared from highly selected breeds.
54 It may also contribute to maintain the cultural landscape associated to the animal habitats and
55 their production systems (Tieskens *et al.*, 2017). It furthermore, helps to sustain the cultural
56 and ethnological characteristics of the European rural communities associated to farming and
57 agricultural activities.

58 The EU is supporting measures that stimulate enhanced traditional products with a
59 special quality cues (Balogh *et al.*, 2016). The promotion of the Traditional Food Products
60 (TFP) falls within this approach due to their positive image associated to better quality, positive
61 sensory merits and their strong associations with a particular origin and locality (Guerrero *et al.*,
62 2009; Almli *et al.*, 2011, Verbeke *et al.*, 2016). There is an increasing interest to analyse
63 consumers' purchase intention and WTP towards the TFP and to understand what these
64 products means to consumers and which values bring to societies (Vanhonacker *et al.*, 2010,
65 Balogh *et al.*; 2016; Verbeke *et al.*, 2016). This research fits within these proposed measures
66 that aim to protect the local, autochthonous and untapped pig breeds by creating added-value
67 products that meet consumers' preferences and market demand.

68 The perceived quality traits of the TFP can be improved by several food innovations
69 (Kühne *et al.*, 2010) leading to what we call Innovative Traditional Food products (ITFP). In
70 particular, food innovations that may provide consumers with tangible benefits and perceived
71 consequences for human health are relevant (Magnusson, *et al.* 2003). However, tradition and
72 innovation may appear to be incompatible concepts and even contradictory according to
73 consumers' perceptions (Guerrero *et al.*, 2009). Therefore, it is relevant to verify how health
74 innovations and traditional food products may affect consumers' preferences and how they
75 contribute to the maintaining of threatened animal breeds.

76 Health concerns are becoming a determinant factor for food consumption and purchase
77 decision (Siró, *et al.*, 2008). A relevant part of food innovations is based on producing healthy
78 alternative products by reducing undesirable components (less salt, less saturated fat, less
79 added sugar, without chemical conserving agent...) or by adding healthy substitute ingredients
80 (polyunsaturated fatty acid such as omega-3, natural antioxidant, Stevia leaves, vitamins...).
81 At market level, health claims are increasingly playing an important role as determinant factor
82 for the purchase decision of food (Nayga, 2008; Viana *et al.*, 2014). Several studies showed
83 that health claim label reduces the perception of risk exposure to certain diseases (Kozup *et*
84 *al.*, 2003; Choi & Springston, 2014; Kallas *et al.*, 2014). In consequence, the proliferation of
85 these products has led the European authorities responsible for food policy to continuously
86 regulate the use of these new claims (Regulation 432/2012).

87 The food sector is constantly trying new formulations, innovative ingredients and
88 technologies in food processing. Thus, the market availability of these new and novel products
89 is constantly growing. Their demand has been increasing with respect to what consumers
90 traditionally purchased, making worth the effort to understand consumers' response towards
91 these kind of innovative products, in particular those obtained from autochthonous (local)
92 animal breeds as a policy conservation tool. In this context, it is relevant to update our
93 knowledge regarding the consumers' preference (i.e., their willingness to pay, WTP) and
94 acceptance (i.e. hedonic evaluation) towards these added-value products linked to untapped
95 pig breeds since this may constitute a valuable way to enhance their conservation status.

96 In this context, the main objective of this study was to analyse the consumers' non-
97 hypothetical WTP and hedonic evaluation towards new products obtained from four untapped
98 and local pig breeds in Spain (*Porc Negre Mallorquí*), Croatia (*Turopolje*), Italy (*Cinta Senese*)
99 and Slovenia (*Krškopolje*) in order to asses to what extent promoting either Traditional (TPP)
100 or Innovative (ITPP) added-value pork products may contribute to preserving threatened pig
101 breeds in four EU case studies. For this purpose, we followed a methodological approach that
102 combines the consumers' preference elicitation with the hedonic evaluation. First, the
103 consumers' expected WTP were analysed by a Non-Hypothetical Discrete Choice Experiment
104 (NH-DCE). Afterwards, a hedonic evaluation test in different information environment was
105 carried out. In the last step, the same NH-DCE was repeated allowing to estimate consumers'
106 actual WTP and to understand how the informed sensory experience affected consumers'
107 preferences. In this stage, consumers were allowed to simultaneously review their first choice
108 to control for random change. For the econometric modelling, preferences were estimated by
109 means of the universal logit model (McFadden *et al.*, 1977) using a 'reduced form' indirect
110 utility function of a Random Parameters Logit (RPL).

111 **2. Material and methods**

112 Our methodological approach relied on the expectancy-disconfirmation model (Oliver,
113 1980) and in part on the Total Food Quality Model (Grunert *et al.*, 1996). In an experimental
114 economic environment, we looked for simulating consumers' behaviour in a grocery store
115 when facing a new product for the first time. In this stage, many of the product attributes cannot
116 be experienced before or during the purchase action. Thus, consumers' built expectations
117 (expected WTP) on the basis of the information provided by the product label and on
118 consumers' past experience with other products (cognitive state before consumption).
119 However, after consuming and tasting the food product, other cognitive state appears (actual
120 WTP). The actual hedonic evaluation may have an impact on what consumers expected from
121 the product. A negative disconfirmation occurs when the actual liking experience worsens
122 expectations, leading to consumer dissatisfaction and vice versa. When the expected
123 preferences match the experienced one, the former are confirmed and consumers' satisfaction
124 is reached.

125 **2.1. The experiment performance**

126 Data was collected from open-ended questionnaires completed in a controlled
127 environment from a sample of at least 120 consumers in each country. The individuals selected
128 were consumers over 18 years' old who purchase food and beverages and had purchased
129 and consumed the selected products at least once in the last month. A quota sampling
130 procedure was used in terms of gender and age. The experiment was conducted in Barcelona
131 (Spain), Bologna (Italy), Ljubljana, Maribor and Koper-Capodistria (Slovenia) and Zagreb
132 (Croatia) from February to October 2017. To engage consumers, they were economically
133 compensated for their participation (approximately with twenty Euros value in a voucher/gift by
134 respondent). Each experiment session lasted approximately 1.5 hour. Table 1 represents a
135 summary of the sample description across countries. The experiment was carried out
136 according to the following main steps:

- 137 i. An initial questionnaire regarding pork consumption, purchasing behaviour and opinions
138 towards the traditional pork products was administered. Perceptions regarding the
139 healthiness of the pork products proposed in each case study were also retrieved. The
140 demographic and socioeconomic variables were collected.
- 141 ii. A second step that focused on analysing the expected preference by asking participants
142 to select their preferred product from different choice sets at competing price levels built
143 within a NH-DCE labelled design. Before starting the choice exercise, consumers were
144 unexpectedly rewarded by an extra amount of money and informed that a binding choice
145 set will be drawn and they should exchange money for products based on their decision.

- 146 iii. A hedonic evaluation test was carried out for the products. The hedonic evaluation was
147 carried out with information but without tasting (expected liking) and with both tasting and
148 information (actual liking). After the hedonic test, consumers were asked to carefully
149 review their actual liking scores and to check for the characteristics of each specific
150 product they tasted.
- 151 iv. In the fourth step, consumers turned to answer the same NH-DCE, but this time taking
152 into account their hedonic evaluation.
- 153 v. At the end of the experiment, a non-hypothetical purchase scenario was created to
154 exchange products and money in order to reduce the hypothetical bias and to enforce
155 incentive compatibility. When the “no-purchase option” was selected, no real exchange
156 was realized.

157

158 **2.1.1. The untapped pig breeds used in each case study**

159 The Majorcan Black Pig (*Porc Negre Mallorquí*) is a native, rustic and autochthonous
160 breed from Mallorca (Balearic Islands in Spain) that is managed in extensive and semi-
161 extensive system (between 10 and 25 pigs/ha). This breed is catalogued in list of breeds with
162 danger of extinction since 1997 by the Spanish Ministry of Agriculture, Food and Environmental
163 Affairs (Gonzalez *et al.*, 2013). It is well adapted to the Mediterranean climatic conditions and
164 it is tightly related to the local economy and cultural heritage of the region. The last data
165 available showed that the breed population include 1000 sows and 90 boras in 60 farms
166 (Gonzalez *et al.*, 2013). Currently, there are two available products from the breed: The
167 *Sobrassada de Mallorca de Porc Negre* with a Protected Geographical Indication (PGI) which
168 is a spreadable dry cured sausage and piglets slaughtered at 8 Kg. The development of new
169 products from the breed is fundamental to contribute to its economic sustainability.

170 Slovenia has only one preserved indigenous local pig breed, the Krškopolje pig
171 (*Krškopoljski prašič*). The origin and name of this pig comes from the area where it was mostly
172 populated and preserved (around the town of Krško with the local area named Krško polje).
173 Krškopolje pig has a black coat colour with a white belt across shoulders and forelegs. In the
174 nineties the *in situ* gene bank for Krškopolje pig was established with nucleus of only 30 sows
175 and 3 boars. Presently there are 130 registered farms of Krškopolje pigs with about 300
176 breeding sows and 60 boars, however, the breeders have on average only 2 to 3 sows and
177 pigs are reared in very different conditions; usually farmers combine indoor and outdoor
178 rearing. Feeding is varied, and farmers use various crops and pasture, but also feed mixtures.
179 The increased interest for the breed can be ascribed to the promotion and support for the
180 organic farming along with the subsidies for the use of Krškopolje pig (Kastelic & Čandek-
181 Potokar, 2013).

182 The Turopolje pig breed (*turopoljska svinja*) is one of the oldest pig breeds in Europe. It
183 is a medium-sized, primitive-type and fatty pig breed. Its original habitat, the Turopolje valley,
184 between the Sava and Kupa rivers near Zagreb in the Republic of Croatia did not change for
185 centuries. Even though, this pig had important economic factor in the past, it is nearly extinct
186 in the second half of the 20th century and currently, despite the state support, it is still
187 endangered. Based on official data (HPA, 2018), there were only 14 breeders of Turopolje pig
188 with total of 17 boars and 124 sows under production control in 2017. Pigs are maintained
189 mainly in outdoor system, often in forest with a possibility of free movement (Luković *et al.*,
190 2017). Turopolje pig is poorly exploited local pig breed whose conservation is mainly
191 maintained thanks to a state support to farmers without any marketing strategy (Cerjak *et al.*,
192 2017).

193 *Cinta Senese* is a native Tuscan pig breed. After being nearly extinct in the '80s, it
194 underwent an intense recovery program that, nowadays, has led to about 5000 animals reared
195 in 140 farms. Currently there are 131 boars and 809 sows are currently registered as
196 reproducers. *Cinta Senese* is a medium size pig and tends to an excessive overall carcass
197 fatness. Its name "*Cinta*" derived from the characteristics white band that surrounds the trunk
198 at shoulder level and includes the forelimbs, while the remaining coat is black. *Cinta Senese*
199 is traditionally reared in free-range system and fattened in woods with acorns and chestnut
200 (Pugliese *et al.*, 2013). The combination of its intrinsic meat characteristics, the feeding
201 strategies and its ancient link with the territory has gained the breed a Protected Designation
202 of Origin (PDO) on fresh meat in 2012 which ensure that the products are produced, processed
203 and prepared in a given geographical area, using recognized know-how (Pugliese & Sirtori,
204 2012).

205

206 **2.1.2. The new added-value products and the introduced health innovations**

207 We used several pork products obtained from the above mentioned four untapped pig
208 breeds. The selected products fit within the measures that aim to protect the local and
209 untapped pig breeds by creating added-value products that meet consumers' preferences and
210 market demand. As can be seen in Table 2, different products were identified according to
211 their relevance in each market in terms of consumption and the limited resources to produce
212 the pork products at small scale in enough quantities to be purchased by consumers during
213 the created non-hypothetical purchasing scenarios. The products were patty (Spain), salami
214 (Italy and Slovenia) and dry-cured ham (Croatia). These products were produced using the
215 meat from the untapped breeds as Traditional Pork Products (TPP). For each identified TPP
216 and case study, we included different innovations targeting healthiness improvement by adding

217 a positive component or reducing a negative one. Several Innovative Traditional Pork Products
218 (ITPP) were identified.

219 The ITPP in Spain was obtained by enriching the patties with Porcini (*Boletus edulis*) as
220 a natural source of dietary fibre (*Beta Glucans*, ITPP1) and Blueberries (*Vaccinium*
221 *corymbosum*, ITPP2) as a natural source of antioxidants (Szajdek, & Borowska, 2008; Tsai *et*
222 *al.*, 2007; Sari *et al.*, 2017). In Croatia the ITPP dry-cured ham was produced with reduced
223 salting time and with less smoking (Martuscelli *et al.*, 2009; Hersleth *et al.*, 2011) which were
224 recently identified as the best accepted health-related innovations in TPP by Croatian
225 consumers (Karolyi & Cerjak, 2015). In Italy, the ITPP for salami was produced with natural
226 antioxidant agent. The natural antioxidants employed consisted of grape seed extract,
227 tocopherol and hydroxytyrosol extracted by defatted olive pomace (Shah *et al.*, 2014) and they
228 were obtained from by-products of important Tuscan agricultural productions. Moreover,
229 among the investigated plant extracts, they have shown an interesting potential both for
230 antioxidant activity and microbial inhibition. In Slovenia the ITPP salami was produced without
231 nitrites having important role in typical color formation (stable cured color), characteristic cured
232 aroma, microbiological safety and oxidative stability (Sebranek & Bacus, 2007). However,
233 consumer concerns about health risks associated with consumption of products containing
234 nitrite and nitroso-derivatives (Cassens, 1997) have encouraged meat processors to look for
235 reduced use of nitrites. The main criteria used in the election of each innovation within each
236 case study were: a) the relevance of the innovation in tackling with the most relevant
237 consumers' health concerns. The proposed innovations may contribute to diseases prevention
238 related to salt and nitrites additives consumption. b) The capacity to include the innovations
239 and produce the ITPP at small scale for the experiment performance, c) The ability to afford
240 the production cost due to budget constraints and d) The availability of meat raw material taking
241 into account the limited available number of the untapped breeds according to each case study.

242 The TPPs and the ITPPs produced from the untapped pig breeds were compared with
243 two additional products obtained from commercial pig breeds. The first product was with
244 "conventional quality" (CONV) that met the standards and the minimum requirements of the
245 production process with relatively "normal" or low prices. The second product was with
246 "premium quality" (PREM) that goes beyond the minimum standard and quality requirement
247 with relatively higher prices. Both the CONV and the PREM products were produced in each
248 case study, using different meat quality standards, to ensure homogeneity in the production
249 qualities when compared to the TPP and the ITPP.

250

251 **2.1.3. Hedonic evaluation of the Traditional and Innovative products**

252 The overall acceptability of the products j (TPP, ITPP, CONV and PREM) was assessed
253 using the 9-points hedonic scale that ranges from “I extremely dislike” to “I extremely like”
254 (Peryam and Girardot, 1952). Consumers n received a sheet that contains the description of
255 the j products (the breed type and the innovation description) similar to the description in
256 choice sets used in the NH-DCE and were asked to carefully read the information and to state
257 their “expected liking” scores ($L_{nj}^{Expected_Liking}$). Later, consumers were given the same products
258 j to be evaluated simultaneously with the information sheet that allowed them to identify the
259 products they taste. In this case, consumers were asked to state their “actual liking” scores
260 ($L_{nj}^{Actual_Liking}$). Taking into account the objective of this study, the impact of the hedonic
261 evaluation on the consumers’ non-hypothetical WTP towards the proposed innovations from
262 the untapped pig breeds will be analysed.

263 The products valuation was conducted in individual booths according to ISO 8589 (2007)
264 in several consecutive sessions and days with approximately 15 consumers per session.
265 Consumers were instructed to eat unsalted toasted bread and drank mineral water between
266 samples (Realini *et al.*, 2014). Each product sample was assigned with three digit random
267 numbers and presented to consumers in random order according to a randomized complete-
268 block design in which products were presented to consumer separately. For the salami
269 products (Italy and Slovenia) each consumer received one slice of 4 mm thick for salami
270 following the protocol in Marino *et al.* (2015). For the dry-cured ham product (Croatia) the
271 samples were presented to consumers with a 0.6 mm thick half-slice of ham following Hersleth
272 *et al.* (2015). For the salami and the dry-cured ham, samples were served at room-temperature
273 and sliced immediately before tasting in a room located away from the sample preparation
274 area. For the patty products (Spain) we followed the protocol presented in Martínez *et al.*
275 (2012). Samples were grilled at 165 °C to an internal temperature of 70–75 °C and cut into
276 quarters and kept at 25 °C until tasting. The whole test lasted no more than five days with three
277 or four different panel’s sessions per day depending on each laboratory capacity in each case
278 study.

279

280 **2.1.4. The Non-Hypothetical Discrete choice experiment**

281 Following the description of the experiment performance section, a NH-DCE was applied
282 to analyse consumer preference. The DCE aims to identify the consumers’ trade-offs in their
283 choice decision. In this study the TPP, ITPP, CONV and PREM products j at different price
284 levels were presented to participants n in an array of choice sets. Respondents were asked

285 to select the product they would purchase for sure in a real market situation, thereby revealing
286 their preference for certain characteristics of the products.

287

288 ▪ *Design of the choice sets*

289 In the standard application of the DCE, the first step is to identify the main attributes and
290 level that describe different products. However, Lusk and Schroeder (2004) proposed a holistic
291 design in which the same products were repeated in all scenarios (i.e. choice sets) by only
292 varying the prices of the products across choice sets. Alfnes *et al.* (2006) also used a similar
293 approach but by varying both the prices and the products across choice sets. In this context,
294 each choice set contained the TPP, the ITPP, the CONV and the PREM products that
295 appeared at different price combinations. The NONE option was also included to be consistent
296 with the demand theory and to make the choice task more realistic as this is an available option
297 when shopping. We used an optimal D-efficient experimental design to create labelled
298 alternatives using the Ngene software (ChoiceMetrics, 2016). Accordingly, eight choice sets
299 were needed for estimating Random Parameters Logit models by ensuring price-level balance
300 across the products. Four price levels were identified for the different products in each case
301 study. Price levels and product size and format within choice sets and case study are shown
302 in Table 3.

303 We adopted for a non-hypothetical approach in order to avoid the hypothetical bias
304 related to stated preferences studies, in particular, in relation to small sample sizes. Our aim
305 is to reduce the difference between what a respondent indicates he would purchase in a survey
306 and what he would actually do in real market. According to Loomis (2014), hypothetical bias in
307 surveys reflects the old saying that “there is a difference between saying and doing”. Several
308 *ex-ante* and *ex-post* approaches are available to reduce the hypothetical bias in surveys
309 (Loomis, 2014). One of the *ex-ante* ways is to let the survey to be consequential to respondent.
310 That is, in our research we created a non-hypothetical purchase scenario at the end of the
311 survey. Individuals who agreed to participate were asked to purchase their selected product
312 and to mandatory pay its posted price. To reduce protest answers, before the choice tasks
313 participants were unexpectedly rewarded by an amount of money that covered the highest
314 price level of products presented in the choice sets plus an additional margin ranging from
315 10% to 30% of the highest price depending on the product and the budget constraints.

316 For the description of the TPPs, the product label contained a common text in all case
317 studies: “obtained from an autochthonous and untapped pig breed reared in an extensive (or
318 semi-extensive) production system”. In the case of the health innovations introduced with the
319 ITPP, we provided consumers with a simple and short description about the innovations as
320 appeared in Table 2. An additional description was introduced in the Spanish case study in the

321 porcini mushroom innovation: “enriched with a natural source of dietary fiber that may
 322 contribute to improved natural defence system”. In the case of the blueberries the text read as
 323 follows: “Enriched with a natural source of antioxidant that contribute to prevent cardiovascular
 324 diseases”. An Example of the different choice sets (in local languages) can be seen in Figure
 325 1. The experiments were approved by an ethical committee and have been conducted
 326 according to the principles expressed in the Declaration of Helsinki with a specific care on
 327 protecting personal information according to the European regulations. Before conducting the
 328 experiment, the participants signed a consent form and received an explanation of the
 329 experiment which was read to them aloud and projected using power point before starting in
 330 each case study.

331 Finally, before asking consumers the DCE questions, consumers’ beliefs regarding the
 332 healthiness of the proposed products were elicited in order to better understand the role of
 333 perceptions in defining consumers’ preference (Lusk *et al.*, 2013). Beliefs were elicited using
 334 the consumers’ subjective probabilities with the direct numerical method (Lusk *et al.*, 2013).
 335 Accordingly, consumers were asked for each product the following: “If you were to purchase
 336 the product what is the likelihood that this product would be healthy? For example: a 0%
 337 chance would mean there is no chance the product would actually be healthy; whereas, a
 338 100% chance would mean that the product would be healthy for certain. There is a ___% chance
 339 the product will be healthy.

340
 341 ▪ *The Willingness to Pay estimation*

342 The DCE relies on Lancaster’s Theory of Value (Lancaster, 1966) and on the Random
 343 Utility Theory (RUT) of Thurstone (1927). Subjects (n) choose among alternatives (j)
 344 according to a utility function (U_{jn}) with two main components: a systematic observable (V_{jn})
 345 and a random error term non-observable (ε_{jn}) as follows:

346
$$U_{jn} = V_{jn} + \varepsilon_{jn} \tag{1}$$

347 Assuming linear and additive function, the utility can be expressed as:

348
$$V_{jn} = \beta_j + \alpha_j P_{jn} \tag{2}$$

349 Where j are the TPP, ITPP1, ITPP2, CONV, and PREM products presented previously
 350 in Table 1. P_{jn} is the price of alternative j for consumer n , β_j are the coefficients of the
 351 Alternative Specific constant (ASC) for each product relative to the NONE option, α_j are the
 352 coefficients representing the effect of the j th product price on utility for the j th product.

353 To predict the subjects' preferences for a product, the probability that an individual n
 354 chooses the product i rather than the product j (for any i and j within choice sets, T) can be
 355 obtained by the multinomial logit (MNL) model developed by McFadden (1974) as follows:

$$356 \quad \text{Prob}\{j \text{ is chosen}\} = \frac{e^{\mu V_{jn}}}{\sum_{k=1}^J e^{\mu V_{kn}}} \quad \forall k \in T \quad (3)$$

357 Where μ is a scale parameter that is inversely related to the variance of the error term.

358 However, the MNL assumes homogeneity in preferences and imposes a very strict
 359 structure on cross-price elasticities avoiding the possibility to analyze substitutability between
 360 products (Hensher *et al.*, 2005). Within this approach, the universal or the "mother" logit model
 361 (McFadden *et al.*, 1977) assumes that the utility of a product is specified as a function of the
 362 attributes of the other products. In our research, the utility is a function of an Alternative Specific
 363 Constant (ASC) and the prices of all other products. For example, the utility of the TPP is a
 364 function of the ASC_{TPP} and the prices of TPP, ITPP, CONV and PREM products. In this case,
 365 the utility for product j is specified as follows:

$$366 \quad V_{jn} = \beta_j + \sum_{j=1}^J \alpha_j P_{jn} \quad (4)$$

367 Where $j=$ TPP, ITPP1, ITPP2, CONV, PREM, P_{kn} is the j th product's price for
 368 consumer n , and α_j represents the effect of the j th product's price on the utility for the j th
 369 product. To estimate the universal model, the equation (4) is placed into equation (3). However,
 370 this model still incorporates the violation of the Independence from Irrelevant Alternatives (IIA)
 371 assumption inherent to the MNL model. The Mixed or heterogeneous logit models (MIXL)
 372 known also as Random Parameter Logit models (RPL) are one of the most used alternative to
 373 relax the IIA restriction. The RPL model extends the MNL by allowing for unobserved
 374 heterogeneity through random coefficients on attributes (Ben-Akiva *et al.*, 1997). According to
 375 this model, the coefficient vector for person n is $\beta_j = \bar{\beta} + \sigma \lambda_n$, where $\bar{\beta}$ is the estimated
 376 mean and σ is the standard deviation of the marginal distribution of β and λ_n is a random
 377 term assumed normally distributed with mean zero and unit standard deviation. The term $\sigma \lambda_n$
 378 is the vector of person n specific deviations from the mean value of the β s. The η_n is
 379 described by an underlying continuous distribution for the attributes defined by the researcher.
 380 In most applications the multivariate normal distribution is the most used, MVN (0, Σ). In our
 381 case, we assumed the ASC independently normally distributed in the population following Lusk
 382 and Schroeder (2004). The price coefficients were considered fixed to ensure the estimated
 383 WTP are normally distributed. The WTP of a product j versus the baseline product NONE (i.e.

384 none of them) is calculated as the ratio of the ASC to the price coefficient (Lusk and Schroeder,
385 2004) as follows:

$$386 \quad WTP_{\text{Product } j \text{ Vs. No-option}} = - \left(\frac{\beta_{\text{Product } j}}{\alpha_{\text{price } j}} \right) \quad (5)$$

387 The WTP of the proposed health innovations can be obtained by calculating the marginal
388 WTP of any product j versus any other product by subtracting both WTP values (Lusk and
389 Schroeder, 2004).

390 The Krinsky and Robb parametric bootstrapping method was applied to calculate the
391 confidence intervals of the WTPs with 1,000 random repetitions (Krinsky and Robb, 1986).
392 Finally, coefficients obtained from the estimated RPL models (NLOGIT 6 with 1,000 random
393 draws) before and after the hedonic evaluation cannot be directly compared because of the
394 specific scale parameters that belong to each data sets (Swait and Louviere, 1993). Thus, only
395 the WTPs were compared since the scale parameter is cancelled out. To test the significance
396 of the WTPs differences before and after the hedonic evaluation we used the 1,000 marginal
397 WTP estimates obtained according to the Krinsky and Robb procedure and we performed the
398 combinatorial test suggested by Poe *et al.* (2005).

399

400 3. Results and discussions

401 3.1. The expected and actual Liking of the untapped pig breeds products

402 We first report the results of the expected ($L_{nj}^{\text{Expected_Liking}}$) and the actual liking ($L_{nj}^{\text{Actual_Liking}}$)
403 scores. The main results and the mean comparisons between products and treatments are
404 shown in Table 4. Focusing on the expected liking, non-significant results were found in Spain
405 between the ITPP2 (6.08) and the TPP (6.28), being similar to the expectation for the CONV
406 product (6.62). However, it is relevant to highlight that the ITPP1 received significantly the
407 lowest liking expectation (5.74) and the PREM product the highest one (7.05). In Croatia the
408 innovations ITPP1 and ITPP2 received similar liking expectation to the PREM product (6.48,
409 6.66 and 6.31 respectively), while the TPP received the highest liking expectation (6.97) and
410 the CONV the lowest one (5.09). In Italy, the ITPP and the TPP received similar expected
411 scores (7.46 and 7.44 respectively). Finally, only in Slovenia the ITPP received the highest
412 expected liking (7.38) followed by the TPP (6.89), the PREM (6.17) and the CONV (4.53). In
413 general term, when health innovations were introduced, consumers did not expect any taste
414 improvement when compared to the control product (TPP). Healthy product and related
415 innovations tend to be less tasty and thus it may have played a relevant role in constructing
416 consumer liking expectation for the ITPP (Hieke & Grunert, 2018).

417 For the actual liking scores, results showed that in Spain the ITPP1 and ITPP2
418 significantly received lower score (5.45 and 5.71 respectively) compared to the TPP (7.07)
419 confirming an informed taste reluctance to the proposed health innovation. Similarly, in Croatia
420 the ITPP1 and the ITPP2 received lower actual liking scores (6.55 and 6.53 respectively)
421 compared to the TPP (6.88). In Italy and Slovenia, the actual liking score of the innovations
422 ITPP1 (6.77 and 5.92 respectively) was similar to the TPP (6.92 and 5.95, respectively)
423 confirming non-additional taste improvement from the innovations. Results confirmed that the
424 proposed ITPPs were not able to add a differentiating perceived quality and thus they did not
425 provide a clear added-experience value in comparison to the TPPs.

426 Differences between the expected and the actual liking scores for each product were
427 estimated (Table 4). Results in Spain showed that the actual liking was similar to the expected
428 liking for the CONV, ITPP1 and ITPP2 showing a complete assimilation of what consumers
429 expected from these products. However, the actual liking score was higher than the expected
430 one for the TPP showing an incomplete assimilation with an improved liking scores when
431 consumers tasted the products with information. The Spanish consumers exhibited a better
432 expected liking from the PREM and a worse one from the TPP. In Croatia, consumers taste
433 experience with information matched what they expected from the untapped pig breed
434 products (TPP, ITPP1 and ITPP2). However, the actual liking for the CONV improved what
435 consumer expected from this product while it worsened what consumers expected from the
436 PREM product. Consumers expect more from the PREM product and less from the CONV
437 one. In Italy, the liking expectations of all products from the untapped pig breed were higher
438 than what consumers experienced. Consumer expected more from the products and the
439 innovation proposed from the untapped pig breed. However, the actual liking was higher for
440 the PREM and CONV products. In the same line, in Slovenia the expected liking was higher
441 for all products. It was negatively disconfirmed for the TPP, ITPP1 and the PREM and was
442 positively disconfirmed for the CONV.

443 Compared to the expected liking, the actual liking for the salami innovations (ITPP1) and
444 the basic products (TPP) in Italy and Slovenia decreased significantly. However, for all the
445 proposed innovations (ITPP1 and ITPP2) in Spain (patty) and Croatia (dry-cured ham) the
446 expected and actual liking were equal, confirming what consumers expected. Only the
447 information for the pure product (TPP) from the untapped pig breed in Spain played a relevant
448 role in improving consumers' expectation. It is worth mentioning that three of the four PREM
449 products failed as well to meet consumers' taste expectations and three of the four CONV
450 products outperformed what consumers expected. It is clear that the information and taste
451 experience played a role in determining consumers' final acceptance as it is widely
452 demonstrated that expectations may vary from actual liking (Bredahl *et al.*, 1998, Napolitano

453 *et al.*, 2010). In fact, the eating experience plays an important role in defining the final
454 consumer acceptance (Grunert, 2005; Kallas *et al.* 2014).

455 Results showed that different information conditions provided by the ITPP played a
456 heterogeneous role when influencing consumer acceptance. Consumers in Slovenia and Italy
457 exhibited higher expectation towards the untapped breeds and innovation proposed, indicating
458 a positive influence of the local breed and health information on their purchasing intention.
459 These results corroborate with studies where the inclusion of health information on food label
460 influenced consumers' acceptance (Iaccarino *et al.* 2006; Schouteten *et al.*, 2015) and
461 preference (Kallas *et al.*, 2012; Lange *et al.*, 2002). However, the inclusion of dietary fiber in
462 the patty product in Spain received the lowest expectation. Consumers did not perceive a clear
463 added health value of such innovation. These results are similar to the findings of Laureat *et*
464 *al.* (2016) who found that the inclusion of fiber information had a non-significant impact on
465 consumers' acceptance.

466

467 **3.2. Consumers WTP for the proposed innovations from the untapped pig breeds**

468 We started by estimating a reduced RPL model by case study. Results (Table 5) showed
469 that at 99% confidence level, we can reject the null hypothesis that all coefficients are jointly
470 equal to zero with a Log-Likelihood ratio test highly significant. The goodness of fit was
471 assessed through a highly acceptable McFadden's pseudo-R². The model estimates showed
472 that all coefficients were statistically significant in all countries and treatments. The ASCs
473 represent the utility of the latent attributes different from price that are not included into the
474 utility function, which represent the marginal utility of the product in a holistic way.

475 The utilities associated with the products from the untapped pig breeds were positive
476 and highly significant in all countries before and after the hedonic evaluation. Before the
477 hedonic evaluation, high heterogeneity was found comparing the marginal utility of the health
478 innovative products with the other products in the same treatment. The innovations in Spain
479 received relatively low marginal utility (4.00 for ITPP1 a product enriched with natural source
480 of dietary fiber and 4.64 for ITPP2 with added source of natural antioxidant) compared to the
481 TPP (4.77) and PREM (4.95). Compared to the other products, the ITPP2 (less smoking time)
482 in Croatia clearly exhibited low preference (5.30). However, the ITPP1 (less salting time) was
483 more preferred (12.67). Innovations introduced by the ITPP1 (with natural conserving agent)
484 in Italy and without nitrites in Slovenia were more preferred compared to the other products
485 (8.95 and 11.50 respectively). After the hedonic evaluation, the actual preference models were
486 estimated. Compared to the other products in the same treatment and country, the TPPs in
487 Spain and Italy were the most preferred products (6.40 and 14.34 respectively). In Croatia, the
488 ITPP2 (less smoking time) remained the most preferred alternative (13.89). In Slovenia the
489 PREM product showed the highest relative marginal utility level (12.23).

490 To better understand the preferences, in a further step we estimated and compared the
491 WTP for the different products. Comparisons were done across products in each treatment
492 and between treatments. Results are shown in Table 6. Before the hedonic evaluation the
493 TPPs and the ITPPs received the highest expected WTPs compared to the other products
494 (PREM and CONV) in all countries with the exception of Spain. These results shed light on the
495 positive evaluation of the breeds and the high expected preference that consumers have for
496 their products compared to the commercial one. The proposed products would receive an
497 acceptable market penetration as a starting point that may contribute maintaining the
498 threatened pig breeds. However, results showed that the proposed health innovations did not
499 have a relevant added-value. Non-significant differences were found between the expected
500 WTPs for the TPP and the ITPP in all countries. Innovations would be only relevant if the
501 additional production cost is marginal or if innovations clearly have a positive social impact in
502 decreasing disease related to salt consumption such as the hypertension (Campbell *et al.*,
503 2011), preventing cardiovascular disease related to the consumption of natural antioxidant or
504 reducing health risks related to nitrites (Knekt, *et al.*, 1999) or potentially unhealthy substances
505 from the smoke (Andrés *et al.*, 2007).

506 After the hedonic evaluation treatment, the actual WTP showed that in Spain the TPP
507 remained the most preferred product followed by all the other products in which the preference
508 for the innovative products was similar to the CONV and PREM. In Croatia, relatively similar
509 outcome was obtained, the TPP was the most preferred product followed by the PREM and
510 the ITPP1. The ITPP2 received non-significant WTP similar to the CONV alternative. In Italy,
511 the TPP and the ITPP1 were the most preferred product followed by the PREM and the CONV.
512 In Slovenia the TPP was the most valued product in similar preference position to the PREM
513 followed by the ITPP2 and the CONV.

514 Taking into account the identified significant difference between the expected and actual
515 WTPs, The WTP of the pure products from the untapped pig breed (i.e. the TPP) in all countries
516 gave an encouraging outcome as a policy measure to contribute maintaining the untapped
517 local pig breeds. The innovations “enriched with dietary fiber”, “without nitrites”, “with low
518 salting time”, “with low smoking time” showed lower WTP than the control product (TPP), while
519 the innovations “with natural conserving agent” do not bring a clear added value, in economic
520 term, as it showed similar WTP compared to the control product (TPP).

521 These results showed that consumers have a higher preference for the traditional,
522 natural and unaltered products such as those chosen from the pure untapped local pig breeds.
523 These results agree with the findings of Verbeke *et al.*, (2016) who showed in a large-scale
524 study that European consumers support the development of new meat products guaranteeing
525 the eating quality but without an excessive manipulation. Moving away from a ‘natural’ (i.e.
526 unaltered) meat product tended to be negatively perceived by consumers. In the same context,

527 Siegrist & Sütterlin (2017) demonstrated that mentioning possible health effects using additives
528 in food product decreased the perceived naturalness.

529 To better understand the similar and even lower WTP values of the innovative products
530 (ITPP) compared to the control one (TPP), the consumer's beliefs regarding the healthiness
531 of the products may shed light on these outcomes. Results (Table 7) showed that four of the
532 six health innovations introduced were perceived by consumers as similar to the control
533 product in term of healthiness. Only the innovation "salami without nitrites in Slovenia" and
534 "patty with natural antioxidant in Spain" received statistically higher healthiness perceptions.
535 However, the latter innovation in the patty product was similar to that obtained by PREM, not
536 showing again any clear added health value. In this context, the only innovation that was clearly
537 differentiated by its added health value was "salami without nitrites in Slovenia". These results
538 may explain in part the consumer WTP towards innovation. These results are in accordance
539 to what literature showed on the relevance of consumers' health perceptions in defining their
540 preferences (Lusk *et al.*, 2013, Malone & Lusk 2017 and Lusk, 2018).

541 The NH-DCE using a labelled choice set design is a straightforward alternative to elicit
542 individuals' preference for a product in a holistic way (Lusk and Schroeder, 2014). However,
543 this approach cannot identify preferences for specific attributes not embodied in the choice
544 sets and thus it may ignore other choice motivations (Kamphuis *et al.*, 2015). The use of a
545 non-hypothetical approach in which consumers are presented with a set of products that they
546 can taste and then purchase is not necessarily the best method to minimize hypothetical bias
547 (Loomis, 2014; Meenakshi *et al.*, 2012; Kamphuis *et al.*, 2015). Further research is needed to
548 compare the NH-DCE and taste experience with hypothetical choice designs, testing for
549 external validity (Lusk and Schroeder, 2014). Finally, while other modelling alternatives are
550 available to obtain willingness to pay estimates (Kallas and Gil, 2012), the RPL (known also
551 as mixed logit model) is still the most flexible and preferred modelling option in choice
552 experiment studies (Hess and Train, 2017).

553 The comparability of innovation preferences across countries is limited due to the
554 particular characteristics and the specific quality traits of each local untapped pig breed. The
555 presence of several interfering factors in the product preparation and the inclusion of
556 heterogeneous health innovations makes it difficult to derive an overall conclusion regarding
557 the health innovations. Furthermore, the different socioeconomic features of the samples
558 across countries represents an additional limitation. Nevertheless, our results indicate that
559 preferences clearly depend on the innovation proposed and the product types. It would be
560 worthy classifying the innovations regarding their novelty, i.e. whether they consist in a
561 reduction or an addition of additives and whether they are introduced in fresh or processed
562 products.

563

564 **4. Conclusions**

565 We analysed the consumers non-hypothetical WTP for Traditional (TPP) and Innovative
566 (ITPP) Pork Products obtained from untapped pig breeds in Spain, Croatia, Italy and Slovenia.
567 Compared to conventional (CONV) and premium (PREM) marketed products, results showed
568 high-expected preference in all countries, showing higher expected WTP compared to the
569 majority of the alternative products. However, comparing the informed overall acceptability
570 between the health innovative products and the pure ones, results showed lower average
571 values for the innovation in Spain and Croatia and similar average values in Italy and Slovenia.
572 Consumers did not perceive a clear added quality value from the proposed health innovations
573 in the four local pig breeds.

574 After the informed hedonic evaluation, the WTP for the innovations decreased in all
575 countries with the exception of Italy. The WTP decreased for both innovations in Spain
576 (enriched with dietary fiber and natural oxidant), for both innovations in Croatia (less salt and
577 less smoke) and for the innovation in Slovenia (without nitrites). These results were tightly
578 related to the relatively low average values of the informed overall acceptance compared to
579 the competing products. Furthermore, our research showed that the TPPs and the ITPP were
580 equally perceived as healthy products for the majority of the proposed innovations. Thus, the
581 health added-value of the suggested innovations was marginal. Policy that promotes products
582 from the analysed untapped local pig breeds should focus, in general term, on the “original”
583 and “pure” version of the product without any addition of healthy ingredients or reduction of the
584 undesirable compounds. This may allow consumers to judge the product with a special focus
585 on its origin and therefore highlight the untapped pig breed systems.

586 The European Common Agricultural Policy (CAP) as the main policy driver of agriculture
587 at the EU level is progressively decoupling its subsidies from production, aiming for agriculture
588 and livestock productions that contribute to the conservation and enhancement of rural
589 landscapes. The extensive production systems that characterize these traditional and rustic
590 breeds are fully aligned with this trend, since they are essential in the conservation and
591 enhancement of high natural value farming systems. Despite subsidies to support traditional
592 breeds have been part of the CAP subsidies for a long time, policies aimed to improve the
593 status of these breeds should look for the economic viability of traditional breed farms. Our
594 results show that a market niche exists, where consumers appreciate these high-quality
595 products and where no “add-ons” are required to enhance their uptake by the consumers.
596 Innovations introduced in the way information is conveyed to the consumers on high-quality of
597 the products and its positive externalities may contribute to a higher extent to increase
598 consumer acceptance.

599

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606

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




















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|  | C Salama | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Premium kakovost | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Cel kos – 200 g (vakuusko pakiran) 2,80 € (14,00 €/kg) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|  | D Salama | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Premium kakovost | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Cel kos – 200 g (vakuusko pakiran) 4,00 € (20,00 €/kg) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

Figure 1: choice set example by case study

Table 1: Summary of the socio-economic and demographic variables across countries

| | Country | Spain | Italy | Slovenia | Croatia |
|---|--------------------------|--------------|--------------|-----------------|----------------|
| | Sample size | 121 | 121 | 131 | 121 |
| Gender | Female | 48.76% | 60.33% | 56.49% | 49.59% |
| | Male | 51.24% | 39.67% | 43.51% | 50.41% |
| Age (years) | 18-29 | 12.40% | 38.66% | 19.85% | 17.36% |
| | 30-39 | 21.49% | 26.05% | 22.90% | 23.97% |
| | 40-49 | 26.45% | 16.81% | 22.14% | 28.10% |
| | 50-59 | 22.31% | 10.92% | 20.61% | 14.88% |
| | >60 | 17.36% | 7.56% | 14.50% | 15.70% |
| Family members | Average | 2.92 | 3.23 | 2.79 | 3.65 |
| % with children below 12 years | Yes | 19.83 | 18.18 | 16.79 | 39.50 |
| Household perception of the monthly net income compared to the average | Far below average | 18.18% | 0.83% | 3.05% | 3.31% |
| | Below average | 26.45% | 14.88% | 14.50% | 9.92% |
| | Average | 32.23% | 62.81% | 61.07% | 49.59% |
| | Above average | 18.18% | 16.53% | 17.56% | 32.23% |
| | Far above average | 2.48% | 0.83% | 2.29% | 4.13% |
| | I don't know | 2.48% | 4.13% | 1.53% | 0.83% |
| Household perception of the monthly food expenditure compared to the average | Far below average | 5.00% | 11.57% | 6.11% | 3.31% |
| | Below average | 21.67% | 35.54% | 21.37% | 19.01% |
| | On average | 26.67% | 30.58% | 41.22% | 39.67% |
| | Above average | 38.33% | 16.53% | 26.72% | 28.10% |
| | Far above average | 5.83% | 1.65% | 3.05% | 8.26% |
| I don't know | 2.50% | 4.13% | 1.53% | 1.65% | |
| % who lived in rural area | Yes | 30.58% | 42.02% | 57.25% | 52.50% |

Table 2: The traditional and innovative pork products in each case study

| Country | Pig breed | Product | Commercial product with conventional quality (CONV) | Commercial product with premium quality (PREM) | Traditional Pork Products (TPP) | Innovative Traditional Pork Products (ITPP1) | Innovative Traditional Pork Products (ITPP2) |
|----------|-----------------------------|---------------|---|--|---------------------------------|--|--|
| Spain | <i>Negre Mallorquí (NM)</i> | Patty | Patty Conventional | Patty Premium | Patty (NM) | Patty (NM) & dietary fiber | Patty (NM) & Natural antioxidant |
| Italy | <i>Cinta Senese (CS)</i> | Salami | Salami Conventional | Salami Premium | Salami (CS) | Salami (CS) & Natural conserving agent | - |
| Slovenia | <i>Krškopolje (KRS)</i> | Salami | Salami conventional | Salami Premium | Salami (KRS) | Salami (KRS) without nitrites | - |
| Croatia | <i>Turopolje (TRP)</i> | Dry-cured ham | Dry-cured ham conventional | Dry-cured ham Premium | Dry-cured ham (TRP) | Dry-cured ham (TRP) less salting time | Dry-cured ham (TRP) less smoking time |

Table 3: Price vectors of the products by countries

| Price levels | Spain | Italy | Slovenia | Croatia |
|--------------|------------------------------------|-------------------------------|----------------------------------|--------------------------------------|
| products | Patties 250 g Tray of 2 patties | Salami 100 g Vacuum sliced | Salami 200 g Vacuum one piece | Dry-cured ham 100 g Vacuum sliced |
| TPP | 3.00€, 3.75€ 4.50€, 5.25€ | 1.80€, 2.00€ 2.20€, 2.40€ | 3.60€, 4.00€ 4.40€, 4.80€ | 11.00Kn, 12.00Kn 13.00Kn, 14.00Kn |
| ITPP1 | 3.00€, 3.75€ 4.50€, 5.25€ | 1.80€, 2.00€ 2.20€, 2.40€ | 3.60€, 4.00€ 4.40€, 4.80€ | 11.00Kn, 12.00Kn 13.00Kn, 14.00Kn |
| ITPP2 | 3.00€, 3.75€ 4.50€, 5.25€ | - | - | 11.00Kn, 12.00Kn 13.00Kn, 14.00Kn |
| CONV | 2.00€, 2.50€ 3.00€, 3.50€ | 1.20€, 1.40€ 1.60€, 1.80€ | 2.40€, 2.80€ 3.20€, 3.60€ | 8.00Kn, 9.00Kn 10.00Kn, 11.00Kn |
| PREM | 3.00€, 3.75€ 4.50€, 5.25€ | 1.60€, 1.80€ 2.00€, 2.20€ | 3.20€, 3.60€ 4.00€, 4.40€ | 10.00Kn, 11.00Kn 12.00Kn, 13.00Kn |

Table 4: Actual and expected liking of the products

| | | Spain | | Croatia | | Italy | | Slovenia | |
|-------|-----------------|---------------------------|--------|---------------------------|--------|---------------------------|--------|---------------------------|--------|
| | | Mean | St.d. | Mean | St.d. | Mean | St.d. | Mean | St.d. |
| TPP | Expected liking | 6.28^{b,y} | (1.59) | 6.97^{a,x} | (1.79) | 7.44^{a,x} | (1.08) | 6.89^{a,y} | (1.38) |
| | Actual liking | 7.07^{a,k} | (1.13) | 6.88^{a,k} | (1.62) | 6.92^{b,k} | (1.68) | 5.95^{b,k} | (1.97) |
| ITPP1 | Expected liking | 5.74^{a,z} | (1.65) | 6.48^{a,y} | (1.91) | 7.46^{a,x} | (1.16) | 7.38^{a,x} | (1.37) |
| | Actual liking | 5.45^{a,m} | (2.19) | 6.55^{a,l} | (1.77) | 6.77^{b,k} | (2.06) | 5.92^{b,k} | (2.11) |
| ITPP2 | Expected liking | 6.08^{a,y} | (1.74) | 6.66^{a,y} | (1.81) | | | | |
| | Actual liking | 5.71^{a,m} | (2.26) | 6.53^{a,l} | (1.71) | | | | |
| PREM | Expected liking | 7.05^{a,x} | (1.50) | 6.31^{a,y} | (1.57) | 5.96^{b,y} | (1.37) | 6.17^{a,z} | (1.45) |
| | Actual liking | 6.41^{b,l} | (1.39) | 5.84^{b,m} | (1.93) | 6.29^{a,l} | (1.57) | 5.66^{b,k} | (2.20) |
| CONV | Expected liking | 6.62^{a,y} | (1.56) | 5.09^{b,z} | (1.76) | 5.29^{b,z} | (1.59) | 4.53^{b,w} | (1.84) |
| | Actual liking | 6.44^{a,l} | (1.70) | 6.00^{a,m} | (1.80) | 6.02^{a,l} | (1.66) | 5.81^{a,k} | (2.12) |

^{a,b} refer to the differences between expected and actual liking for each product

^{x,y,z,w} refer to the differences across products for the expected liking scores.

^{k,l,m,n} refer to the differences across products for the actual liking scores.

Table 5: RPL estimates results before and after the hedonic evaluation test

| | <i>Spain</i> | | <i>Croatia</i> | | <i>Italy</i> | | <i>Slovenia</i> | |
|--|--------------|----------|----------------|----------|--------------|----------|-----------------|----------|
| | Expected | Actual | Expected | Actual | Expected | Actual | Expected | Actual |
| Random Alternative Specific Constant β_s | | | | | | | | |
| ASC-TPP β_1 | 4.77*** | 6.40** | 11.86*** | 9.72** | 5.84*** | 14.34*** | 4.96*** | 11.42*** |
| ASC-ITPP1 β_2 | 4.00*** | 3.25*** | 12.67*** | 13.89*** | 8.95*** | 7.78*** | 11.50*** | 11.33*** |
| ASC-ITPP2 β_3 | 4.64*** | 2.06*** | 5.30** | -0.76 | | | | |
| ASC-PREM β_5 | 4.95*** | 2.63*** | 4.85*** | 3.01 | 4.02*** | 10.06*** | 5.30*** | 12.23*** |
| ASC-CONV β_4 | 3.06*** | 3.29*** | 1.23 | 1.89 | -1.72*** | 2.78*** | 0.92 | 4.22*** |
| Non-random price α_s | | | | | | | | |
| Price-TPP α_1 | -1.36*** | -1.77*** | -0.78*** | -0.62*** | -2.19*** | -6.73*** | -1.13*** | -3.13*** |
| Price-ITPP1 α_2 | -1.27*** | -1.25*** | -0.88*** | -1.11*** | -3.74*** | -3.49*** | -2.34*** | -3.73*** |
| Price-ITPP2 α_3 | -1.28*** | -1.19*** | -0.36*** | -0.64*** | | | | |
| Price-PREM α_4 | -1.38*** | -1.01*** | -0.61*** | -0.56*** | -2.88*** | -8.11*** | -2.06*** | -3.32*** |
| Price-CONV α_5 | -1.12*** | -1.22*** | -0.50*** | -0.43*** | -2.33*** | -3.58*** | -1.46*** | -2.42*** |
| S.D. of random estimates | | | | | | | | |
| S.D. ASC-TPP η_1 | 3.31*** | 5.13*** | 2.94*** | 7.29*** | 2.29*** | 4.57*** | 2.40*** | 6.13*** |
| S.D. ASC-ITPP1 η_2 | 2.43*** | 3.48*** | 4.43*** | 6.85*** | 2.71*** | 5.16*** | 2.77*** | 7.33*** |
| S.D. ASC-ITPP2 η_3 | 2.87*** | 5.68*** | 4.06*** | 17.1*** | | | | |
| S.D. ASC-PREM η_4 | 3.52*** | 3.95*** | 3.45*** | 6.51*** | 2.88*** | 8.52*** | 3.26** | 6.41*** |
| S.D. ASC-CONV η_5 | 2.74*** | 5.19*** | 3.92*** | 4.67*** | 4.38*** | 4.67*** | 2.34*** | 3.90*** |
| Log-LL (θ) | -1,157 | -952 | -874.1 | -689.3 | -957.6 | -752.19 | -988.76 | -804.05 |
| Pseudo R ² | 0.33 | 0.45 | 0.50 | 0.60 | 0.38 | 0.52 | 0.41 | 0.52 |

Table 6: Willingness to Pay of the products before and after the hedonic evaluation test

| | | <i>Spain</i> | | <i>Croatia</i> | | <i>Italy</i> | | <i>Slovenia</i> | |
|--------------|---------------------|-----------------------------------|-----------------------------------|-------------------------------------|-------------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|
| | | Expected | Actual | Expected | Actual | Expected | Actual | Expected | Actual |
| TPP | $-\beta_1/\alpha_1$ | 3.48 ^{***a} (2.9-4.1) | 3.60 ^{***a} (2.8-4.3) | 15.17 ^{***a} (13.-16.6) | 15.58 ^{***a} (13.-17.9) | 2.66 ^{***a} (2.2-3.0) | 2.13 ^{***a} (1.9-2.2) | 4.35 ^{***a} (3.8-4.8) | 3.63 ^{***a} (3.2-4.1) |
| | Poe Test | WTPs are equal | | WTPs are equal | | WTPs are different | | WTPs are different | |
| ITPP1 | $-\beta_2/\alpha_2$ | 3.13 ^{***a} (2.5-3.7) | 2.59 ^{***b} (1.6-3.5) | 14.38 ^{***a} (13.-15.7) | 12.44 ^{***b} (11.-13.5) | 2.39 ^{***a} (2.2-2.5) | 2.22 ^{***a} (1.8-2.5) | 4.90 ^{***a} (4.6-5.2) | 3.03 ^{***b} (2.5-3.6) |
| | Poe Test | WTPs are different | | WTPs are different | | WTPs are equal | | WTPs are different | |
| ITPP2 | $-\beta_3/\alpha_3$ | 3.60 ^{***a} (3.0-4.1) | 1.73 ^{**b} (0.4-3.1) | 14.45 ^{***a} (-5.2-9.2) | -1.18 ^d (-11.-9.1) | | | | |
| | Poe Test | WTPs are different | | WTPs are different | | | | | |
| PREM | $-\beta_4/\alpha_4$ | 3.57 ^{***a} (2.9-4.1) | 2.69 ^{***b} (1.3-4.1) | 9.67 ^{***b} (7.3-11.9) | 6.95 ^{***c} (1.8-12.1) | 1.39 ^{***b} (1.0-1.7) | 1.24 ^{***b} (0.8-1.5) | 2.56 ^{***b} (1.9-3.2) | 3.67 ^{***a} (3.2-4.1) |
| | Poe Test | WTPs are different | | WTPs are equal | | WTPs are equal | | WTPs are equal | |
| CONV | $-\beta_5/\alpha_5$ | 2.72 ^{***b} (2.0-3.4) | 2.60 ^{***b} (1.6-3.6) | 2.00 ^c (-5.2-9.2) | 3.36 ^d (-1.6-8.4) | -0.73 ^c (-2.6-1.2) | 0.77 ^{***b} (0.2-1.2) | 0.63 ^c (-1.1-2.4) | 1.74 ^{***c} (1.1-2.3) |
| | Poe Test | WTPs are equal | | WTPs are equal | | WTPs are different | | WTPs are different | |

a, b, c, refers to the difference between the products within each treatment (i.e. by column)

Table 7: Consumers' healthiness perceptions of the products

| consumers' beliefs regarding the healthiness | Spain | | Croatia | | Italy | | Slovenia | |
|--|----------------------|---------|--------------------|---------|--------------------|---------|--------------------|---------|
| | Mean | St.d. | Mean | St.d. | Mean | St.d. | Mean | St.d. |
| TPP | 71.20 ^h | (23.81) | 79.95 ^g | (17.31) | 61.60 ^g | (24.91) | 68.08 ^h | (24.55) |
| ITPP1 | 73.05 ^{g,h} | (23.03) | 81.49 ^g | (17.82) | 61.18 ^g | (25.25) | 75.85 ^g | (22.00) |
| ITPP2 | 74.79 ^g | (21.82) | 78.45 ^g | (19.90) | | | | |
| PREM | 73.74 ^g | (24.09) | 59.40 ^h | (25.23) | 40.73 ^h | (23.31) | 55.52 ⁱ | (26.73) |
| CONV | 64.50 ⁱ | (25.37) | 45.55 ⁱ | (26.12) | 37.42 ⁱ | (23.85) | 33.40 ^j | (23.03) |

^{g,h,i} refer to the differences using the Wilcoxon signed ranks test between health perceptions across products in each case study.