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Using eye tracking as an aid to pre-test choice experiments: an application to an online DCE on small ruminants' meat

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Abstract. The decrease in small ruminant's meat consumption in Europe during the last decades has been accentuated by consumers perception of small ruminant's meat as a traditional product, difficult to cook and with high prices. Additionally, the wide range of products and labels in the market, has forced consumer to rely on larger set of products' characteristics. However, given the limited capacity of the brain, not all this information can be processed. Our main objective is to understand which attributes consumers are interested in when selecting lamb/sheep meat. Through a Discrete Choice Experiment (DCE) using eye-tracking, we compared the stated preferences of the respondents in the DCE, the self-reported statements on non-attendance and their visual attention to each attribute and levels. We estimated a multinomial logit model (MNL) in R, that was used to design a final DCE. The data was collected in seven European countries (Finland, France, Greece, Italy, Spain, Turkey and United Kingdom) and analysed through MNL. Results show differences between the preferred attributes in each country. Only the price attribute was significant for all countries. We also found differences between the respondents self-reported statements and their visual attention.

Keywords. DCE – Eye tracking – Small ruminants' meat – MNL – Labels.

Utilisation de l'oculométrie comme outil d'essai préliminaire d'une enquête de choice experiment: application à une enquête en ligne sur la viande de petits ruminants

Résumé. La diminution de la consommation de viande de petit ruminant en Europe au cours des dernières décennies a été accentuée par la perception par les consommateurs de la viande de petit ruminant en tant que produit traditionnel, difficile à cuisiner et à prix élevé. En outre, la vaste gamme de produits et d'étiquettes sur le marché a obligé les consommateurs à s'appuyer sur un ensemble plus large de caractéristiques. Cependant, compte tenu de la capacité limitée du cerveau, toutes ces informations ne peuvent pas être traitées. Notre objectif principal est de comprendre les attributs qui intéressent les consommateurs lors de la sélection de la viande d'agneau/de brebis. Dans le cadre d'une expérience de choix discret (DCE) utilisant l'oculométrie (eye-tracking), nous avons comparé les préférences déclarées des répondants dans DCE, les déclarations auto-déclarées sur la non-participation et leur attention visuelle à chaque attribut et niveau. Nous avons estimé un modèle logit multinomial (MNL) en R, utilisé pour concevoir un DCE final. Les données ont été collectées dans sept pays européens (Finlande, France, Grèce, Italie, Espagne, Turquie et Royaume-Uni) et analysées via une MNL. Les résultats montrent des différences entre les attributs préférés dans chaque pays. Seul l'attribut de prix était significatif pour tous les pays. Nous avons également constaté des différences entre les préférences exprimées par les répondants et leur attention visuelle.

Mots-clés. DCE – Eye tracking – Viande de petits ruminants – MNL – Etiquettes.

I – Introduction

In the last decades, small ruminant's meat consumption in Europe has stagnated (European Commission, 2018). The perception of a traditional product with high prices, difficult to cook and with specific taste, has driven consumers away. Especially young consumers, as the meat often is sold in family-sized portions; but, when new products were introduced for them, the sales increased (Pol-

icy Department: Structural and Cohesion Policies – European Parliament, 2008), which shows the potential of a market that has been underdeveloped.

Consumers need to rely on a large set of products' characteristics and not all this information can be processed, given the limited time and capacity of the brain (Ares *et al.*, 2014). Previous studies suggest that to simplify complex decisions, respondents may follow some decision rules or "heuristics", which result in non-attendance to certain attributes (Orquin and Mueller Loose, 2013). This has become a problem in discrete choice experiments (DCE), as if respondents do not attend to all the attributes, this could lead to biased results (Caputo *et al.*, 2016).

Our main objective is to understand which attributes consumers are interested in when selecting lamb/sheep meat. Through a DCE using eye-tracking, we compared the stated preferences of the respondents in the DCE, the self-reported statements on non-attendance (Scarpa *et al.*, 2013) and their visual attention to each attribute and levels (Erdem *et al.*, 2015). We used the results to create a DCE in wider scale, which included only the key attributes for the consumers

II – Materials and methods

1. Pilot study design

We designed a labelled DCE. Each choice task contained a non-choice alternative and four types of meat in specific cuts: lamb leg, lamb chops, goat chops, T-bone steak. Based on the results from previous studies and focus groups, we selected eleven credence attributes for the design of a pilot choice experiment: price, halal label, origin, Protected Geographical Indication label – PGI, animal feeding, carbon footprint label, organic label, fat content, protein content, cholesterol content label and preparation (normal or ready to cook). Attributes varied between two and three levels. Prices were set fix and adjusted in +/-30% by each type of meat and cut.

We developed a hypothetical DCE, as some of the labels and attributes are not currently present in all the target markets included in the study. Each respondent was presented with six choice tasks. We designed the DCE using a D-efficient approach in the Ngene software. All choice sets and alternatives were randomly presented to avoid bias. For the pilot study, we collected a total of 138 choices. The panel data was analysed using multinomial logit code in R and used for the development of a final DCE that included only the key attributes.

We collected the data for the pilot study in Ancona (Italy), in October 2018. All participants were meat consumers and ate lamb at least once in the last year. While the respondents were answering the choice experiment, their visual attention was recorded using a contact-free eye-tracking device. As in previous works (Balcombe *et al.*, 2015), participants viewed each choice set as long as they need it and then selected one of the alternatives of the choice. We analysed the eye-tracking data by defining areas of interest (AOIs) on the products and heat maps. After performing a qualitative analysis on the results, some attributes were dropped for the final DCE.

2. Final DCE design and data collection

Based on the pilot study results, we designed a label and hypothetical DCE, using an efficient design. Each choice task included a non-choice alternative and the same four types of meat used in the pilot. We develop 24 choice tasks in 2 blocks. The product attributes were adapted according to the results from the pilot study. Between mid-March to mid-May 2019, we collected more than 400 responses from each of the following countries: Finland, France, Greece, Italy, Spain, Turkey and UK, equivalent to 34,392 choices. We analysed the data using MNL in R.

III – Results and discussion

1. Pilot study results

The MNL estimation based on the DCE and the eye-tracking data resulted in substantially similar results. Results show that price is an important attribute for consumers and, as expected, has a significantly negative coefficient. The organic label gets also significant attention from consumers and had a significant positive effect on the choices of consumers. These results match with previous literature (Apostolidis and McLeay, 2016; Zanoli *et al.*, 2013) and can be observed in the heat maps on Fig 1.

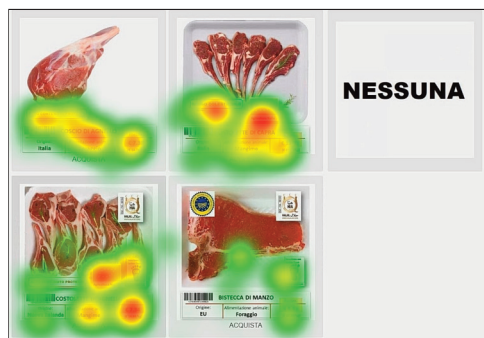


Fig. 1. Heat map from an eye-tracking respondent.

However, we found some differences among DCE, eye-tracking results and the consumers' self-reports on non-attendance. The protein label gained many consumers' visual attention (Fig.1); in the DCE model estimates the corresponding coefficient was significant but negative. Nevertheless, most respondents declared not considering it when making their choice. The same happened to the preparation format, which was also reported as non-attended, but it was found significant albeit negative in the DCE estimates.

The national origin and the PGI label had a significant positive effect on the choices of consumers and got some visual attention during the selection process. However, respondents declared to not pay attention to the origin of the meat when selecting their choice. Given the pilot study results, the attributes animal feeding and cholesterol content were removed from the final DCE model.

2. International DCE results

Results vary between countries, as it can be seen in Table 1.

Beef is usually preferred over lamb cuts, except for lamb chops in ES and TR. Price is significant and has a negative coefficient in all countries. National origin and organic label have positive coefficients and are the most important attributes in FI, FR, GR and IT. National origin is also important in ES and TR. In FI, FR, IT and ES, EU origin has also a positive coefficient, although always smaller than the national one. Only in TR halal is perceived as an important attribute with a positive coefficient. For UK consumers, organic was the most important attribute with a positive coefficient. IGP label and Carbon footprint have a positive coefficient for GR, ES and TR; while the high protein content label has a negative coefficient and is significant only in FI and UK. The ready to eat preparation is significant in FI, GR and SP. In FI, the ready to eat preparation is appreciated by consumers, while in GR and ES it has a negative coefficient. Lower fat content is only significant in IT and has a small coefficient.

Table 1. MNL estimation results for the final DCE for Finland, France, Greece, Italy, Spain, Turkey and UK

	Finland		France		Greece		Italy		Spain		Turkey		UK	
Final LL	-7308.62		-7523.24		-7469.13		-7450.41		-7612.75		-7158.37		-7514.05	
Adjust Rho sqr	0.082		0.057		0.031		0.073		0.053		0.050		0.059	
Estimates	Coeff.	Std.error	Coeff.	Std.error	Coeff.	Std.error	Coeff.	Std.error	Coeff.	Std.error	Coeff.	Std.error	Coeff.	Std.error
Lamb leg cte.	-0.568	0.044	-0.374	0.066	-0.703	0.064	-0.640	0.046	-0.192	0.043	-0.509	0.052	-0.335	0.068
Lamb chops cte.	-0.214	0.045	-0.108	0.046	-0.388	0.053	-0.044*	0.039	0.519	0.045	0.131	0.041	-0.117*	0.064
Goat chops cte.	-0.729	0.057	-1.048	0.065	-0.670	0.058	-0.786	0.054	-0.054*	0.067	-0.726	0.067	-1.292	0.083
Beef T-bone cte.	0.000	NA	0.000	NA	0.000	NA	0.000	NA	0.000	NA	0.000	NA	0.000	NA
None cte.	-1.427	0.091	-0.738	0.110	-0.651	0.111	-1.552	0.094	-1.048	0.085	-0.955	0.107	-1.496	0.123
Price	-0.168	0.007	-0.092	0.006	-0.134	0.013	-0.166	0.008	-0.114	0.007	-0.020	0.002	-0.165	0.010
Halal label	-0.097	0.034	-0.165	0.033	0.044*	0.033	-0.058*	0.031	-0.168	0.032	0.363	0.032	-0.096	0.033
National origin	0.552	0.051	0.511	0.053	0.584	0.052	0.592	0.050	0.418	0.051	0.412	0.046	0.096*	0.050
EU origin	0.159	0.059	0.212	0.054	0.070*	0.056	0.114	0.052	0.185	0.051	0.074*	0.058	-0.017*	0.051
IGP label	0.062*	0.059	0.111	0.038	0.234	0.037	0.177	0.037	0.100	0.037	0.229	0.056	0.092	0.039
Carbon footprint	0.090	0.034	0.062*	0.033	0.118	0.033	0.037*	0.031	0.080	0.032	0.140	0.032	0.025*	0.033
Organic label	0.224	0.038	0.327	0.038	0.267	0.036	0.231	0.035	0.066*	0.035	0.201	0.036	0.177	0.037
Lower fat content	0.057*	0.038	0.070*	0.036	0.043*	0.037	0.076	0.034	0.035*	0.035	0.016*	0.036	0.034*	0.036
High protein	-0.071	0.036	-0.017*	0.035	-0.030*	0.034	-0.012*	0.033	0.005*	0.033	-0.063*	0.033	-0.085	0.034
Ready to eat	0.089	0.034	-0.048*	0.034	-0.138	0.033	-0.017*	0.031	-0.150	0.032	0.003*	0.032	-0.012*	0.034

*The coefficient is not significant at significant level of 0.05

IV – Conclusions

Our results present an alternative way for the selection/reduction of attributes and their levels in the development of future DCE. Accordingly, organic labels, price and origin continue being the way in which products signal their quality and are a must for the development of DCE in lamb meat. Other attributes as PGI, halal label and carbon footprint might vary between countries and should be taken into consideration depending on the market under study.

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