

AUTHENTICITY AND FOOD SAFETY IN READY TO HEAT LASAGNE: AN EVALUATION AFTER THE ‘HORSE MEAT SCANDAL’

Abstract (250 words)

The recent ‘horse meat scandal’ in Europe has sparked huge concerns among consumers, as horse meat was found in beef lasagne ready to be consumed. Within STARTEC, a European funded project, this study investigates consumers’ preferences, attitudes and willingness to pay (WTP) towards characteristics of ready to heat (RTH) fresh lasagne, including origin of the meat, tested for meat authenticity, safety of the lasagne, and nutritional value, using Discrete Choice Experiments in six countries - Republic of Ireland, France, Italy, Spain, Germany and Norway. Our representative sample of 4,598 European consumers makes this the largest cross country study of this kind. The questionnaire was administered online in January 2014. Results from models in WTP-space show that, on average, consumers are willing to pay considerable amount (about €4-9) for food authenticity; on this Irish and Italian are the least concerned while Spanish are the most concerned. As expected from discussing with stakeholders, food safety claims and nutritional value of the RTH lasagne are relatively less important. Consumers also value knowing the origin of ingredients preferring locally sourced meat. Primarily, the results of this study present strong evidence that consumers in Europe are highly concerned about authenticity of the meat in ready meals and strongly prefer to know that the meat is national. This evidence suggests that there is great value in providing information on these attributes, both from a consumer perspective and where this leads to an increased consumer confidence has benefits for the food industry.

Keywords (up to 10): Random Utility Maximisation; food safety; ready meals; horse meat scandal; consumer preferences.

Introduction

In the late 2012, European food industry has been affected by a crisis driven by the finding of horsemeat in pre-prepared foods, without any declaration on the package, food label or ingredients list (European Commission, 2014). This is commonly referred to as the 'horse meat scandal'. The scandal is largely contained within Europe and first came to light when the Food Safety Authority of Ireland published results that beef burger products had tested positive for equine DNA (Food Safety Authority of Ireland, 2013). This led to further incidences being revealed in the UK and across Europe. This has affected consumer confidence in the integrity of the market of pre-prepared food containing meat. In light of this, the analysis of consumer preferences and willingness to pay for enhanced features becomes necessary. The main contribution of this manuscript to the literature is indeed to ascertain, employing the Discrete Choice Experiment (DCE) method, the additional value current and potential consumers are willing to pay for improved safety, information and quality features of ready to heat (RTH) fresh lasagne. Furthermore, this is the first study which explores this issue across different countries in Europe.

This paper is structured as follows: Section 2 highlights the background literature, Section 3 describes the methodology and introduces the case study, Section 4 presents the results, and Section 5 concludes the paper.

Background literature

Since the '90s, studies in the fields of economic, psychology and marketing have been increasingly focused on consumer preferences and impacts of crisis and risk perception. This theme became of pivotal importance in marketing science when consumer confidence in the food safety regulation diminished due to several significant food safety incidents (Cope et al., 2010). The consumer's perception of risk influences choice about products, brands and retailers, and modifies the consumer decision-making process and intentions (Frewer and van Trijp, 2007; Verbeke, 2001). The literature about consumer risk perception analyses lifestyle hazards, such as inappropriate dietary choices (Steptoe et al., 2004) or microbiological risks caused by wrong consumer behaviour (Fischer et al., 2005), the influence of cultures (Palmer, 2003), media and ethic and other concern (Dreesenz et al., 2005) on risk perception, trust towards food product considering public responses to regulate food safety (Berg et al., 2005), and the role of affect in guiding risk and benefit judgments (Finuncane et al., 2000).

Another important stream is focused on the role of risk perceptions and the reactions to food scandals. Bánáti (2011) highlight that, despite the fact that food has never been safer than nowadays, consumers are considerably uncertain, anxious and increasingly critical about food safety. Concerning this topic, Berg (2004) analyses the impact of dioxins in food in Belgium and the detection of mad cow disease in Britain on consumer trust, identifying four groups of consumers, namely the sensible, the sceptical, the naïve and the denying. Lakner et al., (2005) analyse consumers' reactions to the Hungarian paprika scandal of 2004. Van Kleef et al. (2009) surveyed consumers from four countries affected by specific food scandals, namely German consumers and Bovine Spongiform Encephalopathy (BSE) scandal and nematode worms in fish; Greek consumers and mould in Greek yogurt and avian influenza; Norwegian consumers and E. coli in meat and contaminants in Norwegian salmon; British consumers and BSE and contaminants in Scottish salmon, highlighting the crucial best practice in risk management in consumers eyes. Zhou and Wang (2011), analyse attitudes of Chinese consumers towards the safety of milk powder after the melamine scandal, highlighting their concerns about the products.

Literature analysis highlight that whilst consumer preferences for food quality and safety features are well known, there is little evidence of those preferences when fraudulent labelling has occurred as with the horse meat scandal. This research aims to understand consumer concerns about food safety and to highlight which issues cause the major concerns. To reach this main objective, consumer preferences and willingness to pay for label information attesting improved features of the product in terms of food safety will be analysed. The study also aims to point out similarities and differences of consumers' preferences across Europe.

Methodology

These objectives will be achieved through the analysis of consumers' preferences for RTH fresh lasagne. A survey was administered online in January 2014 to a sample of households representative of the population, across six European countries; namely Republic of Ireland, France, Italy, Spain, Germany and Norway. We selected an online administration as it was the best method to reach so many respondents in different countries across Europe. The collected data are from 4,598 consumers.

The survey instrument was developed as follows: firstly the respondents faced a presentation of the survey and were asked consent to participate in the study, after having received all relevant information about data protection and privacy. Then, after a few socio-demographic

questions used by the survey company to screen respondents to obtain a sample as representative as possible of the population, they were presented with a general ('warm-up') questions aimed at making the respondent comfortable with participating in the survey and answering questions (Bateman et al., 2002). A screening question was used to ascertain if consumers currently bought RTH meals or would consider buying them in the future.

Following the socio-demographic questions, the five attributes used in the DCE were described to respondents. A question is asked after each attribute description to help keep the respondent actively engaged and focused on the DCE attributes and levels before the DCE is shown to them. The final part of the survey presents eight DCE questions. Attributes were selected based on focus groups, consultation with SMEs producers of RTH lasagne, and relevant literature. Five major attributes were selected: risk of food poisoning, origin of the meat, test of meat authenticity, retention of nutritional values. Attributes and levels used in the DCE are reported in Table 1. The price used in each country has been converted in Purchasing Power Parity (PPP) for the analysis, using the tool available on Methodex Currency Converter as follows: Germany 2010 was used as the baseline, a coefficient of 0.917 has been multiplied to the price for France, a coefficient of 0.890 for the Republic of Ireland, 0.955 for Italy, 0.086 for Norway and 1.084 for Spain.

Attributes	Levels
1. Risk of food poisoning	Enhanced Safety Current Safety
2. Origin of the meat	Unknown Imported National
3. Test of meat authenticity	Tested Not tested
4. Retention of nutritional values	Twice the current level Current level
5. Price	6 levels from € 2.80 to €5.50 (in Norway we used prices between kr 35 and kr 60) In analysis, price has been converted in PPP.

Table 1 Attributes and Levels – RTH lasagne

We designed the questionnaire adopting the D_b -efficiency under uninformative prior criteria for the indirect utility coefficients (Ferrini and Scarpa, 2007). Twenty-four different choice sets were produced and then divided into three blocks. Respondents faced 8 choice tasks in which they were asked to state their preferred RTH lasagne among two experimentally designed alternatives and a current situation. They also had the option to not buy any lasagne. Figure 1 shows an example of choice task.

Attribute	Lasagne 1	Lasagne 2	Lasagne with Current standards
Risk of food poisoning	Enhanced safety	Enhanced safety	Current safety
Origin of the meat	National	Imported	Unknown
Test of Meat Authenticity	Tested	Not Tested	Not Tested
Retention of nutritional values	Twice the current level	Current level	Current level
Price	€4	€3.5	€2.5

I would buy:

- Option 1
- Option 2
- Lasagne with current standards
- I would not buy any of the proposed Lasagne

Figure 1 Example of choice task

Econometric approach

DCE is an application of the theory of value (Lancaster, 1966) combined with the Random Utility Maximization Theory (Thurstone, 1927; Manski, 1977). Under this setting, the core assumption of DCE is that choices are driven by the maximisation of respondents' utility. The utility that each alternative brings to the respondents can be represented by the function:

$$U_{nit} = V_{nit}(\beta, X_{nit}) + \varepsilon_{nit}, \quad (1)$$

where n indicates the respondent, i the chosen alternative, t the choice occasion, x is a vector of attributes, β is a vector of parameters to be estimated and ε is a random error term (unobserved by the researcher, often referred to as disturbance) assumed to be iid Gumbel distributed. Given the utility function of Equation 1, the probability for individual n of choosing alternative i over any other alternative j in choice set represented by a multinomial logit (MNL) model (McFadden, 1974) is:

$$Pr_{nit} = \frac{e^{\mu V_{nit}}}{\sum_{j=1}^J e^{\mu V_{njt}}}, \quad (2),$$

where

$$V_{nit} = \beta' x_{nit} \quad (3)$$

In order to compare results of different countries, the model was estimated in willingness to pay (WTP) space (Scarpa and Willis, 2010, Train and Weeks, 2005):

$$U_{nit} = -\alpha p_{nit} + (\alpha w)' X_{nit} + \varepsilon_{nit} , \quad (4)$$

where w is the vector of WTP for each attribute computed as the ratio of the attribute's coefficient to the price coefficient: $w = \beta / \alpha$. Note that equation (4) is equivalent to equation (1) when none of the parameters is random. An important feature of the WTP-space specification, in addition to allowing researchers to directly interpret attributes estimates in “money terms”, is the possibility to test the spread of the WTP distribution directly using Log-likelihood tests (Thiene and Scarpa, 2009). Furthermore, in a Mixed Logit (MXL) framework (Train, 2009), the specification in WTP-space allows the analyst to directly specify a convenient distribution for WTP estimates (Train and Weeks, 2005).

The presence of such heterogeneity is not detected by the standard MNL. MXL – or Random Parameter Logit (RPL) – models have been introduced to investigate such heterogeneity. In this context the utility function includes parameters described by an underlying continuous distribution $\phi(\cdot)$. The unconditional probability of a sequence of T choices can be derived by integrating the distribution density over the parameter values:

$$\Pr(nit) = \int \prod_{t=1}^T \frac{e^{V_{nit}}}{\sum_{j=1}^J e^{V_{n,jt}}} f(\alpha, \beta) d\alpha, d\beta. \quad (5)$$

In Equation 5, in order to take into account the fact that we observe a panel composed by T choices for each respondent, we integrate the product of the T logit probabilities. Given the particular composition of the choice set we decided to include an error component to the model (Walker, Ben-Akiva, and Bolduc, 2007, 1107–1109 and 1112 for panel data).

As the adopted utility specification in WTP-space (Equation 4) is non-linear in the parameters (Scarpa et al., 2008), our models were estimated in BIOGEME 2.2 (Bierlaire, 2003), that allows for nonlinearities in the utility function, with the CFSQP algorithm (Lawrence et al., 1997) to avoid the problem of local maxima in simulated maximum Log-likelihood. The integrals were approximated numerically by means of simulation methods (Train, 2009) based on 1,000 Modified Hypercube Sampling draws (Hess et al., 2006).

Results

Our first order of business is to look now at the descriptive statistics of the samples across the six countries. The sample size varies (between 700 and 813 respondents), but keeps a fairly good male female ratio, age, education, employment and civil status across the six countries in which we administered the survey. In Republic of Ireland we did not manage to sample in the youngest segment of the population, but this was possible and done in the other countries.

	Republic of Ireland	Norway	France	Germany	Italy	Spain
Sample Size	700	700	790	798	813	797
Gender						
Male	44%	49%	47%	48%	48%	51%
Female	56%	51%	53%	52%	52%	49%
Age						
18-24	0%	15%	12%	11%	11%	10%
25-34	5%	18%	18%	18%	22%	26%
35-44	17%	18%	19%	20%	21%	24%
45-54	27%	17%	18%	21%	20%	16%
55-64	27%	17%	18%	16%	14%	13%
65+	24%	15%	15%	14%	12%	11%
Education						
School up to 14 years of age	1%	1%	10%	3%	3%	1%
School 14-16 years of age	7%	6%	13%	10%	5%	5%
School 16-18 years of age	24%	43%	23%	33%	27%	18%
Post-school diploma	37%	22%	19%	31%	31%	22%
University degree	22%	27%	16%	22%	34%	46%
Post-graduate University degree	9%	1%	19%	1%	0%	0%
Employment						
Working full time	36%	41%	49%	48%	43%	48%
Working part time	20%	10%	8%	13%	15%	10%
Unemployed	13%	7%	7%	5%	10%	16%
Student	5%	12%	5%	8%	9%	9%
Retired	10%	14%	25%	19%	12%	10%
Looking after the house	14%	5%	5%	6%	10%	5%
Unable to work for health reasons	3%	11%	2%	2%	0%	1%
Marital status						
Single/never married	18%	29%	22%	26%	29%	30%
Married	54%	33%	44%	42%	49%	46%
Living with a partner, not married	16%	22%	19%	19%	15%	17%
Other	12%	16%	15%	13%	7%	7%

Table 2 Demographic characteristics of respondents across the 6 countries

The samples targeted in each country were highly educated and most respondents were either employed or retired at the time of the interview. About half the sample in each country but Norway was married. The highest prevalence of married was in Republic of Ireland and Italy.

Table 3 shows results from the RPL model estimations in WTP-space in each country. In our analysis we considered all features as dummy variables, with a baseline in the current level of safety, information about the origin of the meat in the sauce, DNA test and retention of

nutritional values. Before we explain the results it is important to notice that a RPL model is characterised by the estimation of two parameters for each attribute described by a continuous distribution: the mean (μ) and the spread of the distribution (σ). In our particular case, all attributes in the model are modelled as continuously distributed variables and therefore are presented in the table with these two values.

When reviewing the results, it is firstly interesting to notice that the sign of all WTPs confirm prior expectations, with positive WTPs when risk reduction is fostered, when consumers are provided with information about the product origin, and particularly when it is nationally produced, when meat authenticity is tested and when nutrition values are retained. WTP estimates are statistically significant in almost all cases, with wide heterogeneity within and between countries as shown by the spread of the estimated distributions and the differences in certain attributes such as Enhanced Safety and test for meat authenticity.

Analysing firstly results from the samples within each country, it is possible to notice that respondents from the Republic of Ireland place the highest monetary value on the RTH lasagne being tested for meat authenticity (€3.47 on average) and nationally produced (€3.18 on average). They are willing to pay less to reduce the risk of poisoning (€0.5 on average) and to improve the retention of nutritional values (0.65 on average). The same order of preferences, but with higher absolute values associated with each feature, is highlighted for Norwegian, German and Spanish consumers. Preferences are slightly different in France and Italy, where the national origin of the RTH lasagne is rated as the most important product's feature: indeed, this information is associated with the highest price premium for consumers in these countries. The Test of authenticity on meat is rated second, showing less sensitiveness to the horse meat scandal than participants from the other nationalities.

Since results from the RPL model in WTP-space as presented in Table 3 are not easily interpretable, we generated kernel distributions for the WTP associated with each attribute in each country as described in the model and presented the outcome in Figure 2.

	Republic of Ireland		Norway		Italy		France		Germany		Spain	
	WTP	t-ratio	WTP	t-ratio	WTP	t-ratio	WTP	t-ratio	WTP	t-ratio	WTP	t-ratio
Risk of food poisoning												
Current Safety (ref. level)												
μ Enhanced Safety	0.54	7.72	0.99	3.97	1.02	5.73	0.83	4.04	1.93	3.57	2.19	10.77
σ Enhanced Safety	0.43	2.55	1.25	2.62	1.13	4.13	1.86	3.12	1.80	3.11	2.89	8.41
Origin of the meat												
Unknown (ref. level)												
μ Imported	1.10	9.39	2.34	3.4	1.73	5.3	2.37	3.87	1.26	3.63	3.69	9.1
σ Imported	0.30	1.67	2.35	2.93	1.09	3.34	1.98	2.93	2.04	2.67	1.15	6.79
μ National	3.18	12.96	4.94	3.49	4.19	5.02	7.48	3.55	6.19	3.37	8.42	9.12
σ National	1.70	8.84	4.41	3.25	1.65	4.21	4.19	3.35	5.23	3.25	5.75	8.81
Test of meat authenticity												
Not tested (ref. level)												
μ Tested	3.47	13.63	6.16	3.63	3.63	5.73	5.24	3.67	7.42	3.41	9.38	9.37
σ Tested	1.67	9.31	4.36	3.19	2.15	4.52	4.39	3.33	5.56	3.15	7.51	8.46
Retention of nutritional val.												
Current level (ref. level)												
μ Twice the current level	0.66	7.84	0.89	4.33	0.39	3.44	0.30	1.75	0.16	0.68	0.51	4.69
σ Twice the current level	0.57	4.30	1.34	2.72	1.47	4.27	1.16	2.44	1.98	2.93	2.30	8.74
Error component A - B	4.39	10.09	13.00	3.24	6.05	4.49	9.53	3.3	8.93	3.06	17.50	8.5
Option A	0.41	1.52	-0.18	0.16	1.54	3.68	-4.81	2.12	-4.26	1.75	-0.03	0.09
Option B	0.29	1.11	-0.63	0.51	0.85	1.69	-4.50	2.1	-4.41	1.83	0.70	2.29
Current situation	-3.60	5.12	-8.68	2.35	-4.40	2.79	-9.69	2.6	-8.02	2.41	1.85	7.29
Log-Likelihood	-4,390.744		-4,518.679		-5,752.351		-5,110.501		-5,316.198		-6,403.621	
sample size	700		700		813		790		798		797	
number of parameters	16		16		16		16		16		16	

Table 3 WTP for each enhanced attribute (in € Germany PPP 2010)

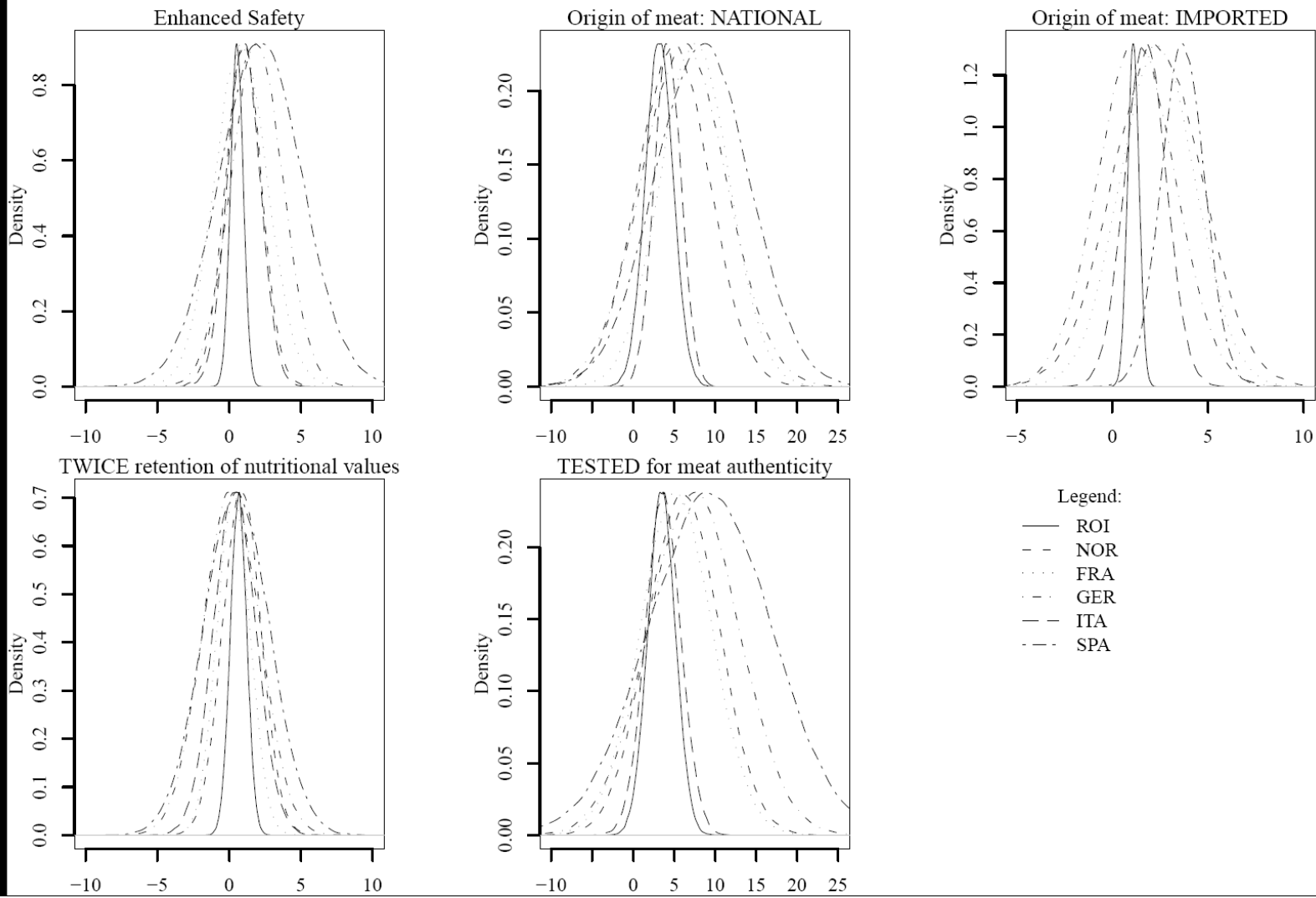


Figure 2 Kernel distribution of WTP for each attribute across the six countries

The distributions presented in Figure 2 highlight how the mean WTP for enhanced nutritional value in RTH lasagne is very close to zero with little variation across and within countries, while for enhanced safety, even if WTP are close to zero, there is more variation across countries and little variation within Republic of Ireland but higher variation within the sample in Germany (which has the highest value together with Spain).

The willingness to pay for knowing the origin of the meat and for the test of authenticity is more controversial, presenting overall higher WTP but much more heterogeneous within each sample (with the sample from Republic of Ireland with a smaller variation and average WTP very close to zero). In particular, knowing that the meat is imported or national is most valued by respondents from Spain and least valued by respondents from the Republic of Ireland (with very little variation within both samples). Respondents from other countries show more heterogeneity.

Discussion and conclusions

This study investigates consumers' preferences, attitudes and willingness to pay towards RTH lasagne including origin of the meat, whether the meat is tested as what is stated in the ingredients, safety of the lasagne, and nutritional value. We use a Discrete Choice Experiments administered in six countries – Republic of Ireland, France, Italy, Spain, Germany and Norway – to a total sample of 4,598 consumers. Results are coherent with priors and expectation and, analysing descriptive statistics and attitudinal questions it appears evident that the survey instrument worked well in all subsamples.

We add to the recent literature focused on consumer preferences and impacts of crisis and risk perception, by studying preferences for origin of the meat, whether the meat is tested as what is stated in the ingredients, safety of the lasagne, and nutritional value in fresh RTH lasagne. We use marketing to study how consumer confidence in the food safety regulation diminished due to a significant food safety incidents such as the “horse meat scandal”. As Cope et al. (2010), we found significant impacts. This paper is not focussed on consumer risk perception and trust towards food product. From our results we could argue that, in marketing a RTH product such as fresh lasagne, meat authenticity and origin is more important than food safety and, as expected, nutritional value. This study contribute to the literature by firstly exploring preferences when fraudulent labelling has occurred as with the horse meat scandal, aiming at understanding consumer concerns about food safety and to highlight which issues cause the major concerns.

Our analysis indicates that consumers would welcome the enhancement of quality and safety in ready to heat lasagne, but that they do not feel they should pay for enhancing those two features. This is probably due to the fact that products are already considered safe once reheated in the microwave and that when consuming RTH lasagne a person does not usually consider its nutritional value and vitamin retention. While we find many similarities across the six regions, we also observe some differences. The results show that all consumers have strong preferences for meat produced in their nation and for meat tested.

This can be the impact of the recent 'horse meat scandal' in Europe, as in that recent event, horse meat was found in RTH lasagne which stated that beef was the ingredient of the sauce. The results from RPL models in WTP-space, which account for heterogeneity within each sample, show that on average consumers are willing to pay about €4 to €9 to know that the meat they eat is authentic, with Italian and Irish least concerned and Spanish most concerned from a monetary point of view. Food safety is relatively less important as consumers are willing to pay €0.6 to reduce risk of food poisoning. Consumers also consider it important to support locally sourced meat with an average willingness to pay of €4 to consume lasagne produced with national meat. Primarily the results of this study present strong evidence that consumers in Europe are highly concerned about the authenticity of the meat declared on ready meals and strongly prefer to know that the meat is national. This evidence suggests that there is great value in providing information on these attributes, both from a consumer and, where this leads to an increased consumer confidence, from the food industry perspective, suggesting that there is great value in providing information on these attributes. In the highly competitive market for food, this suggests that local producers have scope to differentiate and add value to their products through enhancing the safety and quality of RTH meals by enhancing certain attributes such as food safety and origin labelling. A further important finding from this study is that strong regional differences in price premiums exist for these enhanced features. This suggests that food producers should consider tailoring their products for different markets.

The limitations of this paper are mainly related to the fact that the data were collected after the horse meat scandal and that no data from before the scandal is available. Furthermore, the attitudinal part of the questionnaire should be explored and interacted with the preferences' analysis in order to better explain heterogeneity.

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