

# **RISK PERCEPTION AND CONSUMER WILLINGNESS TO PAY FOR CERTIFIED BEEF IN SPAIN**

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## ***Abstract***

Food scares have increased consumer food safety concern, particularly for beef. Traceability and food quality labels have been put in place to communicate to consumers the safety characteristics of the specially labelled beef in hopes of recovering confidence and consumption. As a consequence, production costs have increased, and thereby consumer prices as well. In this paper we develop a conceptual model capable of analysing the main factors influencing consumers' willingness to pay for certified beef. A three-equation recursive model is jointly estimated which accounts for the main steps in the consumer decision process. Results indicate that income, level of beef consumption, the average price consumers pay for beef and the perception of beef safety are the main determinants of Spanish consumers' willingness to pay for certified beef.

*Key words:* Certified beef, willingness-to-pay, attitudes, food safety, Spain.

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# **RISK PERCEPTION AND CONSUMER WILLINGNESS TO PAY FOR CERTIFIED BEEF IN SPAIN**

## **1. Introduction**

In recent years, both the supply and the demand for food products have experienced important changes. On the supply side, a new technological revolution is taking place, which has substantially increased the number of food products available to the final consumer. But these technological processes have become increasingly complex, generating new concerns about their long-term effect on the environment and the human health (e.g. GMOs). On the demand side, food markets in developed countries, especially in Europe, are facing some marketing problems mainly related to consumer loss of confidence in the food supply chain.

Recent food scares have increased consumers' concerns for food safety causing significant reductions in the consumption of affected products. As a consequence, the food industry has designed tracing systems and increased vertical coordination to guarantee food safety along the food supply chain. Moreover, policy makers have reinforced controls and strengthened the role of food safety agencies. Partly due to these changes, many authors in recent years have started to analyse consumers' increasing concerns about food safety and its effect on food choices (Wessells et al, 1996; Cowan, 1998; Verbeke and Viaene, 1999, 2001; Porin and Mainsant, 1998; Henson and Northen, 2000, among others).

In Europe, food safety concerns have been particularly important in the beef sector where consumption was reduced due to BSE crisis in 2000. While the short-term impact (during the following two or three months) varied, in all cases consumption fell off substantially: France lost 40%; Germany, 60%; Italy, 42%; and Portugal, 30% (Agra Europe, 2001). For Spain, beef consumption slid downward from 1994 (MAPA, 2004) and then recovered in 1999 and

2000 (Figure 1)<sup>1</sup>. However, this recovery ended with the first case of BSE in Spain in October of 2000. Between 2000 and 2001, beef consumption decreased annually by 12%. However, in the very short run the impact was substantially large (beef consumption decreased from 22 million Kg, in October 2000, to 15.8 million Kg, in December 2000).

(Insert Figure 1)

Spanish producers, manufacturers and policy makers have all participated in the effort to recover beef consumption. Product quality systems and controls have been strengthened to improve beef safety perception. However, food safety is a credence attribute (it is almost impossible for consumers to confirm the safety level of food even after purchasing). Thus, consumers have to rely on intrinsic and extrinsic cues to infer food safety. Among the extrinsic cues, traceability and/or quality labels have been implemented both at European and national levels as a strategy to certify the safety characteristics of the labelled beef. The main objective of these policies has been to transform food safety from a credence attribute to a search attribute.

For Spanish beef, the PDOs (Protected Designation of Origin) have been emphasized in promotional campaigns, highlighting the quality and safety attributes of products from a particular region. Moreover, in 2003, the Spanish government began regulating beef traceability and labelling<sup>2</sup>. After two years of transition, mandatory traceability was introduced in 2005.

Reinforced controls or, at least, a more strict application of already existing regulations, have increased production marginal costs at the producer, wholesale and retail levels. These increases are ultimately transmitted to consumers through higher prices. As shown in Figure 1, consumer beef prices increased slightly between 2000 and 2001, even when the demand

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<sup>1</sup> Note beef consumption away-from-home is not included.

<sup>2</sup> The Spanish legislation is based on the Council Regulation (CE) 1760/2000 and the Commission Regulation (CE) 1825/2000.

was lower due to the BSE crisis mentioned above<sup>3</sup>. Often, major food companies reduce prices or create special offers to maintain sales volume during periods of poor consumer confidence in a product (Yeung and Morris, 2001). Consumers may be willing to take risks at a discounted price, but less so when their health is the risk. It seems more likely that the bulk of consumers who are willing to continue buying beef even during periods of safety concern are those who are willing to pay marginally higher prices in exchange for some kind of quality assurance that reduces their perceived health risk. At any rate, this is the question we are investigating.

The specific objective of this paper is to see if and, then, how much more Spanish consumers are willing to pay for labelled beef as relates to risk perception and confidence in food safety. Moreover, the paper aims to discover the main factors in this consumer decision process.

Several studies have already examined this issue for meat or other food products (Fisher, 1995; Buzby et al., 1998; Caswell, 1998; Latouche et al, 1998; Zanetti, 1998; Sánchez et al, 2001, among others). However, no attempt has been made in the literature to simultaneously consider all the steps in the consumer decision process. Drawing on a review of research literature, we have developed a conceptual model that links consumer: 1) confidence in food safety; 2) perceived risk for beef; and 3) willingness to pay for labelled beef as an extrinsic cue of reduced perceived risk. The three equations are jointly estimated by maximum likelihood, allowing for simultaneity in consumers' decisions, which is the main novelty of our approach, from a methodological point of view. Data used in this study come from a nation-wide telephone survey conducted in the spring of 2003.

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<sup>3</sup> In 2002, prices increased by 10% and consumption recovered even above past levels. However, in this case, beef consumption was mainly favoured by an increase in the perceived risk of lamb meat due to the foot and mouth crisis in the UK sheep sector.

Organisationally, we first review the research literature on the relationship between risk perception and consumer purchasing intentions. This forms the base on which we develop our conceptual model. Second, we outline our data source and the design of the questionnaire, which yields some preliminary and descriptive results. Third, the econometric framework used to estimate the model is described. Fourth, results from the estimated model are presented, followed by our conclusions.

## **2. Risk perception and willingness to pay for improvements in food safety**

Nowadays, consumers figure at least twice in the food supply chain: they are situated at the end of the chain as the end user, and at the start of the chain as inspiration for a consumer-driven or market-oriented chain organisation (Gellynck et al, 2004). Recent studies have explored consumers' preferences for mandatory and voluntary beef labelling programs associated with credence attributes (Alfnes and Rickersten, 2003; Lusk et al., 2001; Roosen, Lusk and Fox, 2003; Enneking, 2004; Loureiro and Umberger, 2004). Most of them explore alternative methodologies to elicit willingness to pay for credence attributes (e.g. contingent valuation, choice experiments, experimental auctions). However, from a policy-making perspective, it is necessary not only to understand whether proposed public policies in the area of traceability may pass a cost-benefit analysis but also to know what the main factors are that explain those preferences.

Food choice is often influenced more by the psychological interpretation of product properties than the physical properties of products themselves (Rozin et al., 1986). Perception of food safety risk is one such psychological interpretation (Yeung and Morris, 2001). Perceived risk theory was initially used by marketing researchers to understand the effect on consumer behaviour of making purchase decisions for cases of imperfect information (Bauer,

1967; Cox, 1967; Cunningham, 1967; Roselius, 1971; Taylor, 1974; Mitchell and Greatorex, 1988; Yavas, 1992; Agrawal, 1995; Mitra et al., 1999; Tse, 1999; among others). However, none of them analysed specific hazards.

In the context of potentially harmful situations, risk is technically defined as “a combination of the probability, or frequency of occurrence of a defined hazard and the magnitude of the consequences of the occurrence” (HMSO, 1995). Total or overall perceived risk for a specific product is a combination of a fixed component, the product category risk (PCR), and a variable component, the product specific risk (PSR) (Dowling and Staelin, 1994). In other words, the perceived risk associated with beef is the result of the overall consumer confidence in food safety and that which is related to beef safety.

In relation to the overall consumer confidence on food safety, since it is prohibited to place unsafe food on the market (The European Parliament and The Council of The European Union, 2002), it is likely that consumers generally expect that food products are safe. Therefore, in the absence of food scares, we can say that food safety in general is taken for granted by consumers. In any case, the literature indicates that, overall, consumer confidence in food safety differs according to: demographic and socio-economic factors such as age, educational level and economic status; consumer trust in regulatory institutions and participants in the food supply chain; the occurrence of food safety incidents and consumer knowledge about food safety issues through labels or media coverage (De Jonge et al., 2004).

Apart from the overall consumer confidence in food safety, the perceived risk associated with beef also depends on specific incidents related to this product. Good examples are the hormone abuse in the meat sector, exemplified by the illegal use of the bovine growth hormone clenbuterol, and the fear that bovine spongiform encephalopathy (BSE) might have significant impacts on human health. However, external incidents have only a variable effect on risk perception and consumer behaviour. Verbeke (2001) reported that after the BSE crisis,

consumers intended to decrease beef consumption in the future. Then, in a follow-up study, after the dioxin scare, the consumer image of poultry and pork was negatively affected, whereas the safety perception of beef improved after it had been initially damaged by the BSE scare. This result indicates that, although it can be assumed that consumers' overall confidence on food safety can affect risk perception of a specific product, we cannot necessarily conclude that safety perceptions related to a particular product category influence general consumer confidence in the safety of food (De Jonge et al., 2004).

Besides general consumer confidence in food safety and external incidents, some other factors may contribute to perceived product risk (safety). Price is one of the most important. The effect of price on perceived quality has been investigated by Jacoby et al. (1971, 1977), Mitchell and Grottel (1989), Malone (1990), Asher (1992), Gotlieb and Sarel (1992) and Narasimhan et al. (1993). Surprisingly, Roselius (1971) and Akaah and Korgaonkar (1988) found that higher price leads to higher perceived risk. Previous consumer experience in buying beef, their image of certain brand names (Richardson et al., 1996) and the image of the store from which the product is bought (Roselius, 1971) are other factors that may influence risk perception.

Many studies have attempted to measure risk perception. Stone and Gronhaug (1993) classified the components of perceived risk as: financial, psychological, social, performance, physical and time-related. Risk components have been measured using a range of scalar quantities corresponding to "low" through "high" risk. Total perceived risk can be obtained using a weighted average which takes into account the relative importance of each component from a consumer perspective. However, with only a few exceptions like Festervand et al. (1986), Henthorne et al. (1990) and Murray and Schlacter (1990), most studies have looked at perceived risk without breaking it down into its constituent components, hereby defining a single scalar quantity to measure the overall perceived risk, as we will be doing in this study.

If consumer perceived risk exceeds a certain threshold or tolerance level, then one or more risk-reduction strategies (risk relievers) will be employed to reduce the amount of perceived risk to a tolerable level (Mitchell, 1998): seeking for information from formal or informal sources, using brand image or price as a quality guide or shopping in a very reputable store (Lee et al., 2000). Roselius (1971) and Derbaix (1983) discuss the most relevant risk relievers indicating that some of them are more effective than others in reducing the perceived risk associated with particular products.

Where food safety is concerned, certification strategies (traceability or quality labels) have been developed to improve consumer perception of food safety, which ultimately generates consumer price increases. Some consumers will be willing to pay higher beef prices to reassure safety but others will trade off price against the safety improvement. Apart from socioeconomic characteristics, it is expected that risk perception associated with beef is one of the main driving forces for the premiums as shown in Loureiro and Umberger (2004).

The preceding review of the literature can be used to construct a conceptual model for consumer purchase decision-making of beef, as it is influenced by food safety (Figure 2). The overall consumer confidence in food safety, together with some external factors related to beef, is the main determinant of the perception of beef safety. Moreover, beef scares also have an indirect influence on the overall confidence on food safety. Empirical evidence during food scares and, to a lesser extent, the literature supports the contention that, other things being equal, there is a negative correlation between risk perception and purchase likelihood (Yeung and Morris, 2001). If perceived risk is high enough, they draw on a risk reducing strategies such as safety assured products which involve paying a marginal higher price. Consumer socioeconomic characteristics, the level of perceived risk, their purchasing behaviour before the incidents and their confidence on certification strategies will, ultimately, determine the



premium they are willing to pay, if any. A similar model could be used for alternative safety and quality assurance policies.

(Insert Figure 2)

### **3. Survey, sampling and questionnaire design**

The data was collected during a nation-wide telephone survey using computer-assisted telephone interview (CATI) technology. Interviewers were constantly monitored throughout the survey period. The interviews were conducted during the spring of 2003. The average interview lasted 16 minutes.

Potential respondents were selected using national random digit dialling across the 6 broad geographical regions considered in the National Food Survey conducted by the Ministry of Agriculture (North West, North East, Madrid and surroundings, East, Centre and South). Population estimates from The National Institute of Statistics (INE) determined the call distribution necessary for proportionate geographic coverage.

Only respondents over 18 years old responsible for household food shopping were selected. The sample was randomly selected although a quota system was established to guarantee that the sample represented Spain's geographic and age distribution. A total of 4238 phone calls resulted in 650 valid responses. The sampling error rate was  $\pm 3.9\%$ .

The sample was 30% male and 70% female. Respondent median age was 45, where 28% of respondents were younger than 35; 28% were between 35 and 49; 23% were between 50 and 65; and 21% were older than 65. The average household size was 3.1, a little bit higher than the INE estimate of 2.9.

Most respondents (74%) had completed primary or high school. About 16% had completed some university degree and the remainder (10%) had not obtained the minimum of

a primary school diploma. A little less than half (46%) said their total monthly household income was between 900 and 1,500 Euros while another 35% earn between 1,500 and 3,000 Euros. About 18% of respondents earn less than 900 Euros and for the remaining 4% the monthly household income was greater than 3,000 Euros.

The questionnaire was structured into four main blocks, following the conceptual model presented in the previous section. As is often the case with questionnaires, the survey includes a balanced mixture covering past behaviour and intention to behave as a proxy for actual behaviour, so, validity cannot be fully guaranteed. Attitudes and perceptions were elicited through a 5-point Likert scale. Multi-scale questions were used to measure attitudes while single-scale questions were used to measure the perceived risk associated to specific food products. Finally, the Chronbach's Alpha was used to check the reliability of the multi-scale responses.

The first block of the questionnaire was an introductory one and addressed consumer concerns about food safety, how information had been received and to what extent food habits had changed. Results from the survey indicate that food scares that have taken place in Europe in the last years, specially the BSE, have substantially increased consumer concerns about food safety in Spain. As Table 1 shows, 63% of the respondents declared to be more concerned about food safety now than five years ago. If only the problem *per se* is considered, this result seems somewhat surprising, at least from a rational point of view, and some other factors have to be found to explain it. Without any doubt, mass media coverage of recent food scares is the biggest influence on consumer behaviour. In a multi-choice question, around 90% of the respondents declared TV as a source of information on food safety issues, 60% through radio and 50% through newspapers, while less than 20% stated that they have received information through doctors, health-specialised magazines or family. Moreover, 52%

of the respondents recognize that mass media exerts a high influence in their shopping and consumption habits while the remainder deny that influence or “do not know”.

To what extent increasing concerns on food safety have modified shopping behaviour is shown at the bottom of Table 1. It seems that, although positively correlated, consumers’ concerns have not been corroborated by changes in food habits of the same magnitude. In any case, almost half of respondents declared to have changed their shopping habits, which is a relatively high percentage. Respondents, then, were asked in what way they had changed. Around 81% of them had given up buying the product, 40% had started to read food labels more carefully, 28.5% had moved to brands which offered them more confidence or guarantees and, finally, 4% had changed the retail outlet where they normally shop.

(Insert Table 1)

In the second block, the questionnaire collected information about overall consumer attitude towards food safety and the safety consumers perceived towards buying various food products, being beef one of them. Table 2 shows consumers’ general attitudes towards food safety, using a five-point scale. Items were taken from Henson and Traill (2000) and the last item was used as a general statement for the purpose of validating construct. As can be observed, Spanish consumers associate food safety with the existence of a clearly indicated expiration date. In general, they perceived that food products are not as safe as they should be and feel that they do not have enough information to assess food safety before buying it. Finally, consumers have serious doubts about food safety in processing plants, food handling in restaurants, and some concerns about the healthiness of certain commonly used additives.

(Insert Table 2)

Results mentioned above indicate that single product food scares also adversely affect consumer confidence in the food supply chain in general. But the largest negative effect of a

food scare is on the specific products involved in the scare. We have tried to further explore this point by asking respondents about their perceived safety of selected groups of products. Results are shown in Table 3 using a five point-scale. Respondents declared a higher than normal loss of confidence in meat products, canned food, preserved food, ready-to-eat meals and imported food. Moreover, the standard deviations associated with these products are higher than other product categories, indicating a heightened variability among consumer perceptions. Finally, note that beef is considered as the most risky food product, and at the same time has the highest standard deviation.

(Insert Table 3)

The third block dealt specifically with traceability and certification. After explaining to consumers what traceability meant<sup>4</sup>, a direct valuation method called contingent valuation or CV, was used to elicit consumer willingness to pay (WTP) a premium for certified beef. We have chosen, as the reference product, the most commonly consumed class of beef (Añojo 1<sup>a</sup>A) (MAPA, 2004). Of the different question formats used to collect information on WTP, a mixed procedure, normally called “closed-ended with follow-up” was selected. The procedure consists of a dichotomous choice (DC) question and a maximum WTP question. In the DC question, consumers were asked whether or not they are willing to pay an extra amount of money for buying the labelled beef, expressed as a percentage over the price they actually are paying (we ask explicitly for that price in the survey). To reduce possible biases, five initial bids or extra amounts were used (+10%, +20%, +30%, +40% and +50%). Consumers were randomly offered one of the five possible bids (130 respondents for each bid). Responses were YES if the individual was willing to pay at least the bid or NO, otherwise. After, they were asked for the exact maximum amount of money they were willing to pay. Taking into

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<sup>4</sup> We have used the definition provided by Smith et al. (2000) who define meat traceability as the ability to identify the origin of animals or meat as far back in the production sequence as necessary to ascertain ownership, identify parentage, assure safety and determine compliance in branded or source-verified beef programs.

account the answers to the two questions, 73% of the respondents were not willing to pay a higher marginal price for labelled beef with a traceability certificate.

The questionnaire ended with some questions related with the demographic and socio-economic characteristics of respondents.

#### **4. Econometric framework**

Taking into account Figure 2, in this paper, a recursive model is estimated to determine the main factors explaining risk perception and consumer willingness to pay for certified beef.

The three equations are:

- a) Overall consumer confidence of food safety
- b) Risk perception for beef
- c) Willingness to pay for certified beef

The first two dependent variables (general attitudes towards food safety and perceived safety for beef) are categorical variables. In the first one, we have considered respondents' valuations, on a five-point scale, to the general item included at the bottom of Table 2<sup>5</sup>. In the second one, an ordered five-point scale measured their perception of beef safety, with 5 indicating a risk perception of "very safe" (see table 3 for average values). In both cases, the original five-point scale was reduced to a three-point one, since only a few respondents chose the two extreme values.

Finally, the willingness-to-pay equation has been specified as a two-step decision process taking into account the results obtained from the two consecutive questions. First, consumers decide if they are willing to pay a premium for certified beef over the price they are actually

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<sup>5</sup> To check for the adequacy of chosen the general item, we have carried out a factor analysis with first 7 items of the construct. Two factors were obtained, which were highly correlated with the general statement (0.91 and 0.74, in absolute values, respectively).

paying. Second, if they are willing to pay, they decide how much more. Premiums are expressed as a percentage price increase over the prices they are normally paying.

Taking these issues into account, four dependent variables have been defined: confidence in food safety ( $FS_i$ ), risk perception for beef ( $BS_i$ ), whether an individual is willing to pay a premium for labelled beef ( $P_i$ ) and, finally, the price premium consumers would pay over the price they are actually paying for beef ( $PP_i$ ). These four variables are modelled as a recursive system such that  $BS_i$  is explained by  $FS_i$ ; and  $P_i$  and  $PP_i$  are explained by  $BS_i$ , as shown in Figure 2. In what follows, vectors of explanatory variables  $x_i^{FS}$ ,  $x_i^{BS}$ ,  $x_i^P$  and  $x_i^{PP}$  are used to explain confidence in food safety, perceived safety for beef, willingness to pay for labelled beef and how much consumers are willing to pay, respectively, with corresponding parameter vectors  $\beta^{FS}$ ,  $\beta^{BS}$ ,  $\beta^P$  and  $\beta^{PP}$  and random errors  $\varepsilon_i^{FS}$ ,  $v_i^{BS}$ ,  $v_i^P$  and  $v_i^{PP}$ .

The overall attitude towards food safety ( $FS_i$ ) is a categorical variable. As mentioned above, the original five-point scale has been transformed to an ordered categorical variable with three categories (low, medium and high). Consequently, this variable has been categorised by an ordered polychotomous response model:

$$FS_i^* = \beta^{FS} x_i^{FS} + \varepsilon_i^{FS} > 0 \quad (1)$$

$$FS_i^* = j \quad \text{if} \quad \mu_{j-1}^{FS} < FS_i^* \leq \mu_j^{FS}, \quad j=1,2,3$$

where  $\varepsilon_i^{FS}$  is distributed as  $N(0,1)$ , and threshold parameters  $\mu_j^{FS}$  are normalized such that  $\mu_0 = -\infty$ ,  $\mu_1 = 0$  and  $\mu_3 = \infty$  for identification. Finally,  $FS_i^*$  is the corresponding latent variable measuring the level of this type of attitude.

Perceived safety for beef ( $BS_i$ ) is a categorical variable, measuring consumer perception of beef safety. Also, three ordered degrees have been considered (low, medium and high) and, hence, it has also been categorised by an ordered polychotomous response model:

$$BS_i^* = \beta^{BS} x_i^{BS} + \alpha^{BS} FS_i^* + v_i^{BS} > 0 \quad (2)$$

$$BS_i^* = j \quad \text{if } \mu_{j-1}^{BS} < BS_i^* \leq \mu_j^{BS}, \quad j=1,2,3$$

where  $\alpha^{BS}$  is a scalar parameter,  $v_i^{BS}$  is distributed as  $N(0,1)$ , and threshold parameters  $\mathbf{m}_j^{BS}$  are normalized such that  $\mu_0 = -\infty$ ,  $\mu_1 = 0$  and  $\mu_3 = \infty$  for identification. Finally,  $BS_i^*$  is the corresponding latent variable measuring the level of this type of attitude.

Willingness to pay is modelled using a sample selection model (Heckman, 1979). The first participation component, whether a consumer is willing to pay or not, is modelled as a probit based on the binary outcome  $P_i \in \{0,1\}$ :

$$P_i = \begin{cases} 1 & \text{if } P_i^* = \beta^P x_i^P + \alpha^P BS_i^* + v_i^P > 0 \\ 0 & \text{otherwise} \end{cases} \quad (3)$$

where  $\alpha^P$  is a scalar parameter, the random error  $v_i^P$  is distributed as  $N(0,1)$ , and  $BS_i^*$  is the corresponding latent variable measuring the perceived level of beef safety. That is, if the  $i$ -th individual is willing to pay extra for labelled beef, then  $P_i = 1$ .

The second component is the premium consumers are willing to pay. It is a censored variable taking the form:

$$PP_i = \begin{cases} PP_i^* = \beta^{PP} x_i^{PP} + \alpha^{PP} BS_i^* + v_i^{PP} > 0 \\ 0 & \text{otherwise} \end{cases} \quad (4)$$

where  $\alpha^{PP}$  is a scalar parameter and  $v_i^{PP} \sim N(0, \sigma_{PP}^2)$ .

The four equations are jointly estimated by maximum likelihood<sup>6</sup>.

## 5. Results

### 5.1. Data and Variable Definitions

Since the estimation procedure described in the Appendix is rather complex, as it is highly nonlinear, we first estimated each equation individually to have an idea which would be the most relevant explanatory variables that should be included in each equation, also taking into account the conceptual model shown in Figure 2 and the literature review presented in Section 2. The complete list of variables included in the model is shown in Table 4<sup>7</sup>.

The first four variables are the endogenous ones. Only 27% of respondents are willing to pay a positive amount for labelled beef to increase its safety level. As a consequence, the average price premium is only 5% over prices consumers are actually paying for beef. Among the explanatory variables, we have considered the socio-economic characteristics of respondents (income, education level and geographical location), which can influence any of the three dependent variables included in the model. The overall confidence in food safety, as mentioned in Section 3, is also determined by the effect that the mass media has on consumer buying behaviour, since this is the traditional source through which Spanish consumers have received information on food safety issues. We have also considered three variables related to actual beef purchasing behaviour: the price consumers are actually paying and two related to experience: the consumption level and the buying frequency).

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<sup>6</sup> See the Appendix for a complete description of the estimation procedure

<sup>7</sup> Table 4 only includes explanatory variables that have resulted significant in at least one of the equations. The complete list of explanatory variables can be obtained from authors upon request, as well as the full questionnaire used.



Finally, since the traceability certificate is included in the product's label, we have included one dichotomous dummy variable related to the attention consumers pay to labels and their confidence in the information included in them. Actually, this variable is the result of jointly considering the responses of two consecutive questions posed to consumers. In the first one, respondents were asked about how often they read food labels (five-point scale). In the second, they were asked about their confidence in them (five-point scale). This variable takes the value 1, if the respondent reads labels often or very often (values of 4 and 5) and is confident or very confident with the information included (values of 4 and 5), and 0, otherwise.

(Insert Table 4)

### *5.2. Estimation results*

In Table 5 estimated parameters for the four-equation model are shown. In general terms, the signs of parameters are quite consistent with expectations. Among socio-economic characteristics of respondents, only education and income levels are influential, and only in some of the equations. More precisely, education is significant in explaining overall consumer confidence in food safety, while income is relevant in the willingness-to-pay equations.

Results from the first equation suggest three main points. First, education is positively correlated with confidence in food safety. Respondents with a higher level of education seem to perceive food safer. Second, there is a negative relationship between product confidence and a high influence of mass media on purchase behaviour. When a food scare occurs, trust in information provided by mass media amplifies the negative perception of food safety. This result is consistent with those found by Loob et al. (2006) for UK consumers. On the positive side of consumer confidence, those consumers who regularly pay attention to food labels and feel confident about the information there, feel more confident about food safety. Finally,

consumers living in the Southern Spain seem to be less satisfied with the existing food safety standards.

The perceived risk for beef is positively and significantly determined by the overall confidence in food safety, as suggested by Dowling and Stalin (1994). The two variables related to beef consumption before beef scares (frequency of purchasing and per capita consumption level) are also positively associated with the perceived safety for beef, as in Gellynck et al. (2006). This result indicates that the more experienced consumers probably have had access to alternative sources of additional information and trust more in the food safety information provided by public authorities. As a result, the impact of beef scares on these consumers has been very limited and their perception about beef safety has even increased. The second interesting result is the relationship between the price consumers are actually paying for beef and consumers' safety perception of this product. This relationship is negative, indicating that higher prices lead to higher perceived risk as in Roselius (1971) and Akaah and Korgaonkar (1988).

Finally, results obtained in the last stage of the procedure are also quite interesting. As mentioned before, this stage consists of estimating two equations. In the first one, the probability of willingness to pay for a premium for label-certified beef is analyzed. Three types of explanatory variables are relevant: First, the consumer perception of beef safety, a variable which will also allow us to corroborate the recursive structure of the estimated model and confirm the results found by Loureiro and Umberger (2004) for US consumers. This variable is negatively related to the probability of paying a premium, indicating that as the beef is perceived safer the need to pay a premium diminishes. The second set of variables is related to the level of consumption. In this case, more experienced consumers before beef incidents are more likely to be willing to pay the premium after those incidents. Finally, as consumer income increases, they are more likely to pay a premium for certified beef.

(Insert Table 5)

In the second equation, for those who have answered positively to the first equation, the main determinants of the exact overprice consumers are willing to pay are considered. As mentioned above, the average premium is relatively low (5%). Explanatory variables are the same as in the first equation although some signs have changed, which is not inconsistent. In this case, once consumers have decided to pay a premium, the amount varies inversely with the consumption level. This is not surprising since household food expenditure is constrained. Income level is also positively associated with price premiums. As mentioned in the previous paragraph, consumers who perceive beef as safe enough to eat are less likely to pay a premium for certified beef. However, among these people, once they have decided to pay, the premium they are willing to pay increases as beef is perceived safer.

## **6. Concluding remarks**

It is no surprise to find that consumer risk perception regarding food has a large impact on food purchasing behaviour. Recent food scares related to beef have increased consumer concern on beef safety, which, ultimately, reduced beef consumption in Spain. Reinforced controls, monitoring and mandatory traceability have been implemented at all stages of the beef supply chain in order to certify consumers that labelled beef is safe. As shown in this paper, beef consumption recovered within two years of the main BSE incident. However, it is difficult to exclusively attribute this recovery to these controls; many other factors, such as other meat incidents seem to play a role. In any case, increasing controls and traceability have increased marginal production costs, which ultimately have been translated into higher retail prices, which consumers may or may not be willing to pay. The aim of this paper has been to investigate the relationship between risk perception and willingness to pay for certified beef

and to discover what the main factors are that affect the different steps in the consumer decision process.

The modelling strategy employed is based on a three level process, which accounts for endogenous relationships across the behavioural determinants (attitudes towards food safety, beef safety perception and willingness to pay) and the role played by different socio-demographic characteristics which improve the performance of the model. A recursive structure has been specified assuming a causal chain along the three equations. Although this modelling approach is more complex than other alternatives, the nature of this kind of structural equation model explicitly allows for non-linear relationships among variables. This is a more adequate strategy since it takes into account the nature of the questions that traditionally are included in consumer surveys.

There are several rather interesting results. First, we have found a significant interaction between confidence in food safety, risk perception for beef and willingness to pay. Consistent with other results found in the literature, confidence in food safety negatively affects the perceived risk associated with beef. Education and trust in information sources seem to be a key variable in explaining confidence in food safety. Education may enhance the positive effect of trust in information provided by public authorities and weaken the negative effect of trust in information provided by mass media, which normally contributes to amplify the negative perception of food safety.

A second interesting result, at least for the meat industry, is that the perceived risk associated with beef is mainly determined by the overall confidence in food safety and by personal experience. Since the consumer confidence in the safety of food is fairly high, and has not changed over time (de Jonge et al., 2004), it seems that food safety is assumed by consumers in the absence of food safety incidents (or, at least, that consumers are aware of).

On the other hand, more experienced consumers seem to be more confident of beef safety as it is more likely that they have explored different information sources.

Although consumers are increasingly concerned about beef safety, it seems consumers place little value on the indication of traceability per se. In fact, only one out of four respondents says they are willing to pay a premium, where risk perception and income are the most important determinants. In other words, traceability alone plays a very small role in consumer choices. As mentioned above, beef safety is considered a given by Spanish consumers and, thus, they do not understand why they have to pay a premium for it. Products labelled with a PDO linked to a particular region with a reputation for food safety or food quality may be able to garner premiums. But, further research is needed to assess the potential benefits (and costs) of alternative extrinsic cues like PDOs that are intended to improve the quality and safety attributes.

Although our modelling strategy has been able to provide new insights into the relationship between risk perception and purchase intentions, there are some limitations to this research that could provide scope for future work. First, we need more theoretical research exploring how to integrate risk perception, trust and intention to purchase. Specifically, it would be very useful to discover how important the particular source of information is as well as the information content on risk perception. Second, it would be useful to generalize our results for food products other than beef and to apply it to other time spans, since interest in the issue of risk perception is evolving very rapidly with continuous improvements from public authorities and the private sector.

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## APPENDIX

Since  $FS_i^*$  and  $BS_i^*$  in (2), (3) and (4) are unobserved, and  $FS_i$  and  $BS_i$ , respectively, are not a good proxies for them, we use  $\widehat{FS}_i^* = \widehat{\beta}^{FS} x_i^{FS}$  and  $\widehat{BS}_i^* = \widehat{\beta}^{BS} x_i^{BS} + \widehat{a}^{BS} \widehat{FS}_i^*$ , instead to explain consumer perception of food and beef safety. Therefore, the model for explaining consumer perception of beef safety becomes:

$$BS_i^* = \beta^{BS} x_i^{BS} + a^{BS} \widehat{FS}_i^* + e_i^{BS} > 0 \quad (A.1)$$

$$BS_i^* = j \quad \text{if} \quad \mu_{j-1}^{BS} < BS_i^* \leq \mu_j^{BS}, \quad j=1,2,3$$

And the sample selection model for willingness to pay for labelled beef becomes:

$$P_i = \begin{cases} 1 & \text{if } P_i^* = \beta^P x_i^P + a^P \widehat{BS}_i^* + e_i^P > 0 \\ 0 & \text{otherwise} \end{cases} \quad (A.2)$$

$$\text{and } PP_i = \begin{cases} PP_i^* = \beta^{PP} x_i^{PP} + a^{PP} \widehat{BS}_i^* + e_i^{PP} > 0 \\ 0 & \text{otherwise} \end{cases} \quad (A.3)$$

The composite errors are given by:

$$\varepsilon_i^{BS} = \nu_i^{BS} + \alpha^{BS} \varepsilon_i^{FS}; \quad \varepsilon_i^P = \nu_i^P + \alpha^P \varepsilon_i^{BS}; \quad \text{and} \quad \varepsilon_i^{PP} = \nu_i^{PP} + \alpha^{PP} \varepsilon_i^{BS} \quad (A.4)$$

where the terms  $\alpha^{BS} \varepsilon_i^{FS}$ ,  $\alpha^P \varepsilon_i^{BS}$  and  $\alpha^{PP} \varepsilon_i^{BS}$ , result from using  $\widehat{FS}_i^*$  and  $\widehat{BS}_i^*$  instead of  $FS_i^*$  and  $BS_i^*$ , respectively.

As error terms in (1) to (4) are normally distributed, the composite error vector  $\{\varepsilon_i^{FS}, \varepsilon_i^{BS}, \varepsilon_i^P, \varepsilon_i^{PP}\}$  is distributed as multivariate normal with zero mean vector and covariance matrix:

$$\Omega = \begin{bmatrix} \Omega_{11} & \Omega_{12} \\ & \Omega_{22} \end{bmatrix} \quad (A.5)$$

where  $\Omega_{11}$  is 3 x 3,  $\Omega_{12}$  is 3 x 1 and  $\Omega_{22}$  is 1 x 1, given by:

$$\Omega_{11} = \begin{bmatrix} 1 & \sigma_{FS,BS} + \alpha^{BS} & \alpha^P (\sigma_{FS,BS} + \alpha^{BS}) \\ 1 + (\alpha^{BS})^2 + 2\alpha^{BS} \sigma_{FS,BS} & \sigma_{BS,P} + \alpha^P (1 + \alpha^{BS} \sigma_{FS,BS}) + \alpha^{BS} \alpha^P (\sigma_{FS,BS} + \alpha^{BS}) \\ (\alpha^P)^2 [(\alpha^{BS})^2 + 1 + 2\alpha^{BS} \sigma_{FS,BS}] + 1 + 2\alpha^P \sigma_{BS,P} & \end{bmatrix}$$

$$\Omega_{12} = \begin{bmatrix} \alpha^{PP} (\sigma_{FS,BS} + \alpha^{BS}) \\ \sigma_{BS,PP} + \alpha^{PP} (1 + \alpha^{BS} \sigma_{FS,BS}) + \alpha^{BS} \alpha^{PP} (\sigma_{FS,BS} + \alpha^{BS}) \\ (\alpha^P) (\alpha^{PP}) [(\alpha^{BS})^2 + 1 + 2\alpha^{BS} \sigma_{FS,BS}] + \alpha^P \sigma_{BS,PP} + \alpha^{PP} \sigma_{BS,P} + \sigma_{P,PP} \end{bmatrix}$$

$$\Omega_{22} = (\alpha^{PP})^2 [(\alpha^{BS})^2 + 1 + 2\alpha^{BS} \sigma_{FS,BS}] + 1 + 2\alpha^{PP} \sigma_{BS,PP}$$

To construct the sample likelihood function, we first introduce the conditional and marginal distributions of the error terms. The conditional distribution of  $\{\varepsilon_i^{FS}, \varepsilon_i^{BS}, \varepsilon_i^P | \varepsilon_i^{PP}\}$  is trivariate normal with mean vector and covariance matrix, respectively:

$$\xi_{1.2} = \Omega_{12} \Omega_{22}^{-1} \varepsilon_i^{PP} \quad \text{where} \quad \varepsilon_i^{PP} = PP_i - \left( \beta^{PP} X_i^{PP} + \alpha^{PP} BS_i^* \right) \quad (A.6)$$

$$\Omega_{11.2} = \Omega_{11} - \Omega_{12} \Omega_{22}^{-1} \Omega_{12}' \quad (A.7)$$

whereas the marginal distribution of  $\{\varepsilon_i^{FS}, \varepsilon_i^{BS}, \varepsilon_i^P\}$  is trivariate normal with zero mean vector and covariance matrix  $\Omega_{11}$  (Kotz et al., 2000).

The conditional probabilities for an individual who is willing to pay a positive amount of money for labelled beef are (for  $j = 1, 2, 3$ ):

$$\Pr(FS_i = j, BS_i = j, P_i = 1 | \varepsilon_i^{PP}) =$$

$$= \Psi \left[ \mu_j^{FS} - \beta^{FS} X_i^{FS} - \xi_{1.2(1)}; \mu_j^{BS} - \beta^{BS} X_i^{BS} - \alpha^{BS} \hat{FS}_i^* - \xi_{1.2(2)}; \beta^P X_i^P + \alpha^P \hat{BS}_i^* + \xi_{1.2(3)}; \Omega_{11.2} \right] \quad (A.8)$$

$$- \Psi \left[ \mu_{j-1}^{FS} - \beta^{FS} X_i^{FS} - \xi_{1.2(1)}; \mu_{j-1}^{BS} - \beta^{BS} X_i^{BS} - \alpha^{BS} \hat{FS}_i^* - \xi_{1.2(2)}; \beta^P X_i^P + \alpha^P \hat{BS}_i^* + \xi_{1.2(3)}; \Omega_{11.2} \right]$$

where  $\xi_{1,2(j)}$  ( $j = 1,2,3$ ) are elements of the conditional mean vector  $\xi_{1,2}$  defined in (A.6) and  $\Psi[\cdot, \cdot, \cdot; \cdot]$  is the trivariate normal cumulative density function (CDF) with the last element being the covariance matrix.

Likewise, using the marginal distribution of  $\{\varepsilon_i^{FS}, \varepsilon_i^{BS}, \varepsilon_i^P\}$ , the probabilities for a consumer that is not willing to pay is the following ( $j = 1,2,3$ ):

$$\begin{aligned} \Pr(\text{FS}_i = j, \text{BS}_i = j, P_i = 0) &= \\ &= \Psi \left[ \mu_j^{FS} - \beta^{FS} X_i^{FS}; \mu_j^{BS} - \beta^{BS} X_i^{BS} - \alpha^{BS} \hat{\text{FS}}_i^*; - \left( \beta^P X_i^P + \alpha^P \hat{\text{BS}}_i^* \right) W_i' \Omega_{11} W_i \right] \\ &- \Psi \left[ \mu_{j-1}^{FS} - \beta^{FS} X_i^{FS}; \mu_{j-1}^{BS} - \beta^{BS} X_i^{BS} - \alpha^{BS} \hat{\text{FS}}_i^*; - \left( \beta^P X_i^P + \alpha^P \hat{\text{BS}}_i^* \right) W_i' \Omega_{11} W_i \right] \end{aligned} \quad (\text{A.9})$$

where  $W_i = \text{diag}\{1, 1, -1\}$ , which accommodates sign changes in the integration limit and covariance matrix while evaluating the trivariate normal probabilities as lower-tailed CDFs.

Finally, using expressions (A.8) and (A.9) and a dichotomous index  $d_{ij}$  defined such that  $d_{ij} = 1$  if  $A_i = j$  and zero otherwise, the sample likelihood function is given by:

$$\begin{aligned} L &= \prod_{\text{FS}_i=1, P_i=1} \prod_{j=1}^3 \left[ \Pr(\text{FS}_i = 1, \text{BS}_i = j, P_i = 1 | \varepsilon_i^{PP}) \phi(\varepsilon_i^{PP}; \sigma_{PP}^2) \right]^{d_{ij}} \\ &\times \prod_{\text{FS}_i=2, P_i=1} \prod_{j=1}^3 \left[ \Pr(\text{FS}_i = 2, \text{BS}_i = j, P_i = 1 | \varepsilon_i^{PP}) \phi(\varepsilon_i^{PP}; \sigma_{PP}^2) \right]^{d_{ij}} \\ &\times \prod_{\text{FS}_i=3, P_i=1} \prod_{j=1}^3 \left[ \Pr(\text{FS}_i = 3, \text{BS}_i = j, P_i = 1 | \varepsilon_i^{PP}) \phi(\varepsilon_i^{PP}; \sigma_{PP}^2) \right]^{d_{ij}} \\ &\times \prod_{\text{FS}_i=1, P_i=0} \prod_{j=1}^3 \left[ \Pr(\text{FS}_i = 1, \text{BS}_i = j, P_i = 0) \right]^{d_{ij}} \\ &\times \prod_{\text{FS}_i=2, P_i=0} \prod_{j=1}^3 \left[ \Pr(\text{FS}_i = 2, \text{BS}_i = j, P_i = 0) \right]^{d_{ij}} \\ &\times \prod_{\text{FS}_i=3, P_i=0} \prod_{j=1}^3 \left[ \Pr(\text{FS}_i = 3, \text{BS}_i = j, P_i = 0) \right]^{d_{ij}} \end{aligned} \quad (\text{A.10})$$

where  $\phi(\varepsilon_i^{PP}; \sigma_{PP}^2)$  is the univariate normal probability density function of  $\varepsilon_i^{PP}$  with mean zero and variance  $\sigma_{PP}^2$ .

Table 1. Consumer concerns about food safety and behavioural changes after food scares in Spain

Consumer concern about food safety	
Lower than five years ago	2%
The same as five years ago	35%
Higher than five years ago	63%
Influence of mass media in shopping behaviour	
Yes	52%
No	47%
No answer	1%
Have you changed your food shopping behaviour after the recent food scares?	
Yes	49%
How? <sup>a</sup>	
Not buying the product affected by the food scare	80,7%
Reading food labels more carefully	39,2%
Changing towards well known and more brands of confidence	28,5%
Changing the retail outlet where I do my shopping	4,1%
No	51%

<sup>a</sup> It was a multiple-choice question (the sum of percentages has not necessarily to be 100).

Table 2. Spanish consumer attitudes towards food safety (average scores from five-point scale, with 5 indicating strong agreement)

Provided a food is within its expiration date it is safe to eat	3.39 (1.26)
I am satisfied that the additives in food today are not harmful to my health	2.63 (1.06)
Standards of hygiene in food processing are higher than they used to be	2.45 (0.88)
I trust the government to ensure that the level of pesticide residues in food is safe	3.04 (1.07)
Restaurants do not care enough when handling food	2.96 (0.91)
Food is not as safe as it used to be	3.65 (0.97)
I am not provided with enough information to judge properly whether food is safe or not	3.48 (0.95)
In general I am satisfied with the safety of food available today	2.92 (0.93)

Note: the Cronbach alpha was 0,76 indicating that the construct was reliable. Values in parentheses are standard deviations.

Table 3. Consumer safety perception of different food products (average values from a five-point scale with 5 indicating very safe)

Food product	Risk perception <sup>a</sup>	Food product	Risk perception <sup>a</sup>
Fresh fruits	4,53 (0,62)	Ready-to-eat meals	2,58 (1,21)
Fresh vegetables	4,52 (0,73)	Preserved food	3,32 (1,23)
Beef	2,61 (1,43)	Canned Food	3,36 (1,27)
Lamb	3,45 (1,13)	Eggs / Mayonnaise	4,10 (0,87)
Pork	3,66 (1,05)	Rice	4,50 (0,70)
Chicken	4,00 (0,96)	Pasta	4,55 (0,61)
Fish	4,53 (0,70)	Wine	4,57 (0,66)
Seafood	4,45 (0,78)	Oil	4,66 (0,57)
Milk products	4,32 (0,79)	Imported food	2,61 (0,62)

<sup>a</sup> A five-point Likert scale has been used with 1 indicating the minimum safety value. Values in parentheses are standard deviations.

Table 4. Definitions of variables and sample statistics

Variable	Definition and measurement	Mean	Standard Deviation
Confidence in food safety (FS)	Respondent's overall satisfaction with food safety (low=1; medium=2; high=3)	1.94	0.78
Perceived safety for beef (BS)	Respondent's overall satisfaction with beef safety (low=1; medium=2; high=3)	1.80	1.43
Willingness to pay ( $P_i$ )	Whether an individual is willing to pay for labelled beef (yes=1; no=0)	0.27	0.45
Increase in price individual is willing to pay ( $PP_i$ )	Premium an individual is willing to pay for labelled beef	0.05	0.10
Average price paid for beef, in euros (PRICE)	Continuous	9.12	1.35
Per capita consumption per week before beef scares ( $Q_i$ )	Continuous	0.25	0.29
Media Influence ( $MI_i$ )	Dummy variable that takes the value 1, if the respondent is highly influenced by mass media in purchase decisions; and 0 otherwise	0.52	0.50
Respondent's attention paid to labels and confidence in the information included on them (INF)	Dummy variable which takes the value 1 if the respondent reads labels often or very often and is confident or very confident with the information included, and 0, otherwise.	0.49	0.50
Medium education level ( $ME_i$ )	Dummy variable which takes the value 1 if the respondent has completed secondary school, and 0, otherwise	0.74	0.44
High education level ( $HE_i$ )	Dummy variable which takes the value 1 if the respondent has a college degree, and 0, otherwise	0.16	0.37
Medium income level (MI)	Dummy variable which takes the value 1 if the household's income lies between 900 and 2100 €/month, and 0, otherwise	0.79	0.41
High income level (HI)	Dummy variable which takes the value 1 if the household's income is higher than 2100 €/month, and 0, otherwise	0.02	0.14
Living in the south (SOUTH)	Dummy variable if the respondent lives in the South, and 0, otherwise	0.21	0.41
Frequency of buying beef before scares (HFB)	Dummy variable which takes the value 1 if the respondent buys beef often or very often (values of 4 and 5 in a five-point scale), and 0, otherwise	0.24	0.43

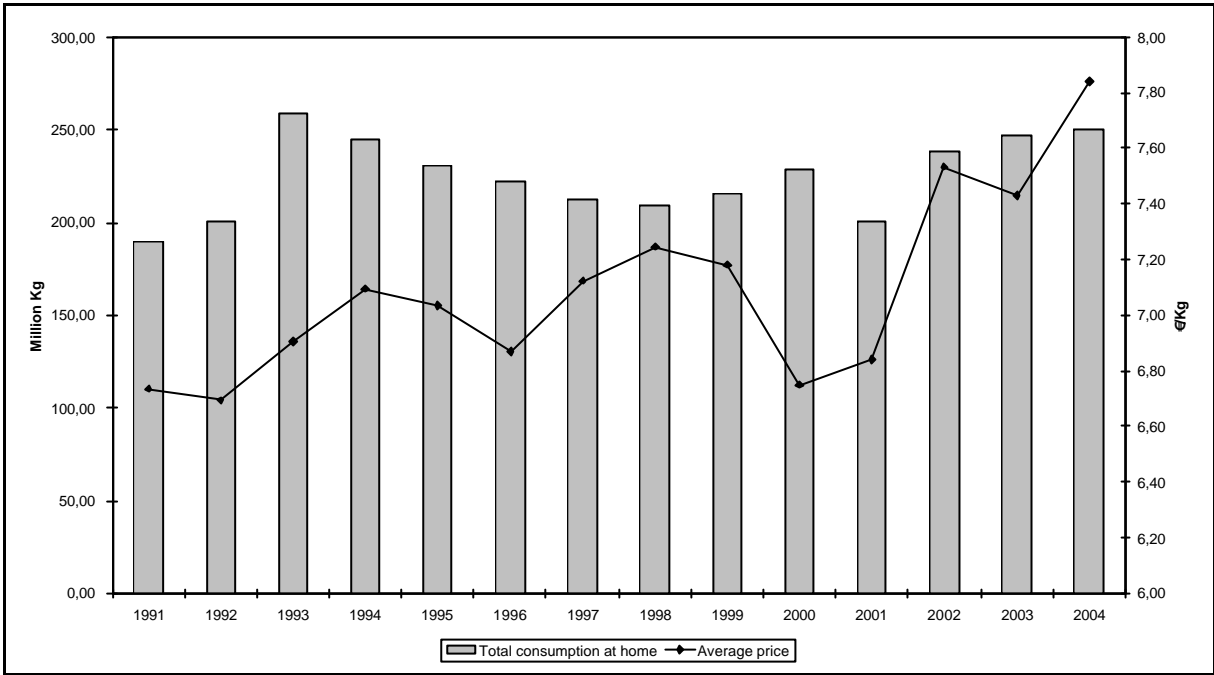


Table 5. Maximum-likelihood joint estimation of the four-equation model <sup>a</sup>

VARIABLE	Confidence in food safety (FS <sub>i</sub> )	Perceived safety for beef (BS <sub>i</sub> )	Willingness to pay (P <sub>i</sub> )	Price premium individual is willing to pay (PP <sub>i</sub> )
Constant	0.42** (2.80)	0.29 (0.80)	-1.78** (-16.99)	0.45** (9.06)
Media Influence (MI <sub>i</sub> )	-0.36** (-3.97)			
Label information (INF <sub>i</sub> )	0.25** (2.73)			
Living in the south (SOUTH <sub>i</sub> )	-0.76** (-6.55)			
Medium education level (ME <sub>i</sub> )	0.29** (1.99)			
High education level (HE <sub>i</sub> )	0.33* (1.83)			
Confidence in food safety (FS <sub>i</sub> )		0.88** (6.56)		
Per capita consumption (Q <sub>i</sub> )		1.27** (6.32)	1.19** (4.88)	-0.20** (-3.61)
High frequency of buying (HFB <sub>i</sub> )		1.54** (11.26)	0.48* (1.91)	-0.13** (-2.54)
Price (PRICE <sub>i</sub> )		-0.13** (-3.44)		
Perceived safety for beef (BS <sub>i</sub> )			-0.51** (-4.34)	0.10** (4.30)
Medium income level (MI <sub>i</sub> )			0.88** (7.20)	-0.06** (-2.29)
High income level (HI <sub>i</sub> )			1.52** (4.12)	0.003 (0.04)
$\mu_2^{FS}$	1.12** (18.73)			
$\mu_2^{BS}$		1.04** (14.18)		
Log-likelihood	-1.94			

<sup>a</sup>Two asterisks (\*\*) denotes significance at the 5% level; one asterisk (\*) denote significance at the 10% level.

Figure 1. Total beef consumption at home (million Kg) and average consumer price (€/Kg)



Source: MAPA (2004)

Figure 2. Conceptual model of consumer willingness to pay for labelled beef relating to food safety and perceived risk

