Consumers' short- and long-term response to "mad cow": beef consumption and willingness-to-pay for organic beef in Italy

Alessandro Corsi
University of Turin, Italy

Dept. of Economics, Via Po, 53 10124 Torino (Italy)
alessandro.corsi@unito.it

Paper prepared for presentation at the XIth EAAE Congress
(European Association of Agricultural Economists),
'The Future of Rural Europe in the Global Agri-Food System',
Copenhagen, Denmark, August 24-27, 2005

Alessandro Corsi

CONSUMERS' SHORT- AND LONG-TERM RESPONSE TO "MAD COW": BEEF CONSUMPTION AND WILLINGNESS-TO-PAY FOR ORGANIC BEEF IN ITALY

Abstract

This paper aims at assessing: 1) consumers' habits concerning beef consumption and their responses to the BSE both immediately and at a longer term; 2) consumers' attitudes and willingness to pay for organic beef, an obvious alternative to regular beef in terms of safety. It is based on two random telephone surveys, the first one conducted in 2001 (few months after the BSE crisis) and the second one in 2003. The analysis shows that though the effect of the BSE crisis has weakened along with time distance, it left some permanent signs in consumers' behaviour. The analysis of the effect of the time distance from the BSE crisis on consumers' attitudes towards organic beef leads to the main conclusion that the demand for organic beef reduced, but that in the meantime it became more inelastic.

Keywords: BSE, organic beef, willingness to pay

J.E.L. classification: Q13, Q21

1. Introduction

The BSE crisis has been one of the most severe food scares in the European food sector. While the first wave mainly affected the UK, the second wave, in 2001, had deep impacts also in other European countries. Several studies analysed the impact of BSE on price and demand (e.g., Burton and Young, 1997; Lloyd et al., 2001; Mangen and Burrell, 2001). It is well known that the overall reaction of consumers was a reduction in beef consumption and that since then consumption has to a certain extent recovered. But little information is available on consumers' individual immediate reactions (one exception is Smith et al., 1999) and on later individual behaviour. This paper is based on two surveys, the first one conducted in June and July 2001 (few months after the BSE crisis) and the second one in April and June 2003, and aims at assessing: 1) consumers' habits concerning beef consumption and their responses to the BSE both immediately and at a longer term; 2) consumers' attitudes and willingness to pay for organic beef, an obvious alternative to regular beef in terms of safety.

In the following paragraph a short description of data used is presented. Paragraph 3 analyses consumers' stated reactions to the BSE crisis in terms of beef consumption. In paragraph 4 their willingness to pay for organic beef is estimated, and the comparison between 2001 and 2003 results allows for an assessment of the long-term impact of BSE on organic beef. Some conclusions follow.

2. Data

Data for both surveys were collected through random telephone surveys in Piedmont (Italy). The target population was those residents in Piedmont Region usually in charge of buying food for themselves and their family. The interviewers therefore explicitly asked to talk with the household member usually in charge of buying food. The response rates were 51.4 and 57.7 percent, respectively, which is reasonably fair for a telephone survey. The interviewers stopped some interviews when respondents were found to be permanently out of the beef market (vegetarians, people consuming only other beef for health reasons, farmers self-consuming their products). Finally, after eliminating questionnaires that were not usable because they were incomplete, the 2001 survey consisted of 402 valid questionnaires, and the 2003 survey of 330. The first survey was designed with the goals of analyzing consumers' familiarity with, and purchase habits of, organic products, of evaluating

consumers' willingness to pay for organic beef, and of determining consumers' preferences about organic beef selling outlets, packaging and label; also their reactions to the BSE crisis were investigated. The second survey skipped questions about preferences for organic outlets and packaging, but in addition investigated whether consumers had changed their first reactions to the BSE or the BSE had induced long-term changes in consumption behaviour.

3. Reactions to the BSE crisis

Respondents were asked whether they presently consumed beef. Excluding those who did not consume beef because they did not like it or because they were vegetarian (and whose interviews were stopped), the share of "no" responses represents those who stopped eating beef because of the BSE. The shares were 9.7 and 2.1 in 2001 and 2003, respectively, a statistically significant difference. The difference (7.6 percent) can therefore be considered as the transitory "radical" change in beef consumption, and the remaining 2.1 percent the long-term one.

Nevertheless, changes in habits do not confine themselves in stopping beef consumption. Both in the first and in the second survey respondents were asked if they had changed their consumption habits as a reaction to the BSE scare and, if so, in which ways. In 2001 39.3 percent declared they had changed their habits, and in 2003 the corresponding figure was 35.8 percent (the difference is not statistically significant). A probit analysis of the determinants of consumption change (Table 1) suggests that almost no socio-economic characteristics influenced the choice: the model is hardly significant for 2001, and not significant for 2003. Though some variable is significant either in 2001 or in 2003, the conclusion seems to be that the panic hit the overall population regardless of income and other socio-economic characteristics and mainly depending on their personal psychological impact.

Nevertheless, there are important differences in the stated modalities of change. In both years (Table 2), the highest share of responses was "I consume/d less of beef and more of other kinds of meat (chicken, pork) or fish", but more so in 2001 than in 2003 (68.4 vs. 50 percent). The share of those declaring they had given up eating beef is also declining (24.7 and 20.3 percent). By contrast, in 2003 the shares of those stating they had simply reduced beef consumption (11.9 percent, as compared to 3.8 percent in 2001) and of those declaring they had stopped consuming certain cuts such as e.g. t-bone steaks (17.8 percent, as compared to 3.2 percent in 2001) are much higher. This difference between the two surveys (which a chi-squared test indicates as significant) is hardly explainable, but in a way it seems that consumers had ex post rationalised their choices, in particular when they now state they choose the most "rational" response (avoiding "dangerous" cuts).

An interesting information concerns how consumers in 2003 stated their long-term reaction to the mad cow crisis (Table 3). Of those who had changed their beef consumption habits after the BSE crisis, 55.9 percent had gone back to consuming the same quantity of beef as before the crisis. By contrast, about 29 percent of respondents stated they had maintained the changes, and 15 percent had increased their consumption as compared to the immediate period after the crisis, but still consumed less beef than before the crisis. This supports the view that the BSE crisis, though recovered to a large extent, left some permanent sign on consumers' behaviour.

There seems to be no particular socio-economic determinant of the decision to maintain the changes taken on in 2001. A probit model analysing the choice to keep to the changes adopted in 2001 is overall significant only at the 10 percent level, and the only individual significant coefficient is education (Table 4). Again, reactions to the BSE, the long-term ones in this case, seem to be rather random.

4. BSE crisis and willingness-to-pay for organic beef

The second main goal of the surveys was assessing consumers' attitudes and willingness to pay for organic beef. Until now production of organic beef is still sporadic in Italy. Till European Council Regulation (EC) 1804/1999 was issued, no animal product in Europe had the right to be labelled as "organic", but since a national regulation was further needed, in Italy it was not before 2000 that

organic animal products could be legally marketed, so that for most Italian consumers organic beef was not actually available at the time of the first survey. Actually, due to technical production problems connected with the regulations and to market uncertainties, the production of organic beef in Italy is still very rare nowadays, and so it was at the time of the second survey. The first research was promoted by a regional organic farmers' association (Agri.Bio Piemonte), that was interested in market prospects of organic beef; the second one was based on own University funds. In the interview, after an explanation about the prospective availability, the characteristics, and the certification process of organic beef meat, respondents were asked whether they would pay a specific price (bid price) to buy organic beef. To increase the elicitation process efficiency, a follow-up question was used (Carson et al., 1986; Hanemann et al., 1991): those respondents who had answered 'yes' to the first question were asked again if they were willing to pay a second higher price; if the answer to the first question was 'no' the interviewer proposed a lower price. Three initial bids were chosen, the same for both surveys[1]. Bid prices were set at levels considered a priori higher than, or equal to, first-rate quality beef currently on sale, though regular beef prices showed a much larger variation than expected. WTP for two meat cuts largely popular among Italian consumers, roast and minute steak, was evaluated; the former cut is cheaper but more time-consuming for cooking. Those respondents who did not like the specific cut were therefore excluded from the specific estimation. Three answers were prompted for those persons presently consuming regular meat: "Yes, I would buy it in the same quantity I'm currently consuming"; "Yes, but I would buy less than what I'm currently consuming"; "No". Respondents who had given up eating beef after the 'mad cow' events were asked about the possibility to go back and consume it; in this case, the answer could only be "yes" or "no".

4.1. Shares of "yes" responses at the different bids

A first and simple way to assess consumers' willingness to pay for organic beef is looking at the share of positive responses for each bid. Table 5 presents the results, referred to the initial bid for beef consumers[2]. In both years, the share of "no" responses increases with increasing prices, with the exception of the highest bid price for roast. The shares of "yes, same quantity" and of "yes, but less" responses respectively decrease and increase with price but for the highest minute steak price in 2003. When comparing the surveys, the shares of "no" and of "yes, but less" responses are higher in 2003 than in 2001 for respondents asked the lower initial bids; the opposite holds in general for respondents asked the highest initial bid. Chi-squared tests on the distribution for each initial bid price reject the hypothesis of no effect of the year for all initial bids but for the highest one for roast. Though the consumption patterns are not very clear from these raw data, it might be argued that the time distance from the BSE crisis decreased the willingness to pay for organic beef among those consumers who were willing to buy it, but paying low prices, while it increases among the high price segment.

4.2. Parametric estimates of reservation prices

An alternative and more formal way of assessing consumers' willingness to pay for organic beef is estimating the maximum price consumers are willing to pay for it through a parametric approach (Corsi and Novelli, 2003). The theoretical and econometrical background is as follows. If a consumer makes his/her choice when organic beef is not available, the expenditure function indicates the minimum expenditure needed to achieve his/her utility.

$$e_0(P, p_0, v_0) = e_0(P, p_0, v(P, p_0, s, M)) = e_0(P, p_0, s, M) \quad (1)$$

where P is the vector of other prices, s are preference shifters such as attributes of the individual, and M is income.

[1] Since between the first and the second survey Euro was introduced, in the second survey bid prices were given in Euro, but also the corresponding value in Italian Lira was proposed. For all the following elaboration, the Lira values are converted to Euro.

[2] Respondents not consuming beef at the time of the second survey were very few, which makes the comparison with the first one problematic.

When organic beef becomes available at price p_1, to attain the same utility level v_0 the minimum expenditure will be:

$$e_1(P, p_0, p_1, v_0) = e_1(P, p_0, p_1, v_0(P, p_0, p_1, s, M)) = e_1(P, p_0, p_1, s, M) \quad (2)$$

where price p_0 is included in the expenditure function because regular meat is still available.

When organic beef becomes available, if the expenditure now needed for reaching the same utility is less, then the consumer will purchase some organic beef, while if the opposite holds, he/she will consume no organic beef:

$$e_1(P, p_0, p_1, s, M) < e_0(P, p_0, s, M) \quad (3)$$

or:

$$d(P, p_0, p_1, s, M) > 0 \quad (4)$$

where $d(\cdot) = e_0(P, p_0, s, M) - e_1(P, p_0, p_1, s, M)$ is the difference-in-expenditure (DE) function.

If the DE is expressed as a function of explanatory variables and of a random term, then assuming an appropriate distribution for the random term allows estimation of the DE function with maximum likelihood methods. For an empirical analysis of the problem, following the random utility model, it is assumed that, while consumers know their preferences with certainty, there are some components unknown to the researcher that are treated as random. Calling ε_0 and ε_1 the random components, and e'_0 and e'_1 the systematic components of expenditure functions (1) and (2), respectively, the condition for the consumer to buy a positive quantity of organic meat is:

$$e'_1(P, p_0, p_1, s, M) + \varepsilon_1 < e'_0(P, p_0, s, M) + \varepsilon_0 \quad (5)$$

or:

$$d'(P, p^0, p_1, s, M) > \mu \quad (6)$$

where $d'(\cdot) = e'_0(P, p_0, s, M) - e'_1(P, p_0, p_1, s, M)$; $\mu = \varepsilon_1 - \varepsilon_0$; and $d(\cdot) = d'(\cdot) - \mu$.

To estimate the equation, a density function has to be assumed for μ. Since $d(.) \geq 0$, then $\mu < d'(p_1^*)$ when the consumer chooses some organic meat, and $\mu = d'(p_1^*)$ otherwise. Hence, the density function of μ must have a mass density at $d'(p_1^*)$. Therefore, in our exercise μ is assumed to have a normal probability distribution, censored at $d(p_1^*)$. It is then possible to express the probability of a positive consumption of organic meat for a particular p_1 offered (p_{bid}) in terms of the cumulative density function of μ, G_μ, provided that $p_{bid} < p_1^*$[3]; the probability that a consumer will respond "yes" to an offered p_{bid} is the probability that μ is smaller than $d'(\cdot)$ or:

$$P(\text{consumption}) = P[\mu < d'(P, p_0, p_{bid}, s, M)] = G_\mu[d'(P, p_0, p_{bid}, s, M)] \quad (7)$$

and:

$$P(\text{no consumption}) = 1 - G_\mu[\cdot] \quad (8)$$

Maximum likelihood techniques can be employed to estimate the parameters in $d'(\cdot)$. It is important to note that with this approach, if the consumer is willing to buy some organic meat, even a lower quantity than the quantity of regular meat he/she bought before organic meat was made available, this should be considered as a "yes" response[4].

---

[3] The condition that $p_{bid} < p_1^*$ has to be checked after the estimation. This is because the probability of a "yes" response for any $p_{bid} > p_1^*$ is $G_\mu(p_1^*)$ and not $G_\mu(p_{bid})$, and because p_1^* is unknown before the estimation. In practice for estimation one has to use the regular normal cdf, that gives the exact probability of a "yes" response for any $p_{bid} < p_1^*$. If $p_{bid} > p_1^*$, the relevant probability is underestimated.

[4] Our approach is similar to Cameron's (1988) treatment of referendum contingent valuation questions in that it uses the difference in expenditure (see also Hanemann and Kanninen, 1999). Nevertheless, in Cameron's approach the difference in expenditure measures the willingness to pay for a *given* change in the quantity/quality of the relevant good; put in the same terms, in our approach it measures the willingness to pay for an *unknown*

Explanatory variables comprise the prices of regular and organic beef, income, and taste shifters such as socio-economic characteristics. The DE function is decreasing in p_1, since e_1 is increasing in p_1 and p_1 is not an argument in e_0. For a given price p_1^* the DE reduces to zero and, for any $p_1 > p_1^*$, the difference in expenditure remains zero: the consumer would simply buy the same quantity of regular meat, and no organic meat. Hence, p_1^*, the reservation price, is the maximum price consumers are willing to pay for organic meat. Since p_1^* is the price for which the expenditure functions with and without organic meat are equal, i.e. the level of p_1 for which the difference in expenditure is equal to zero, p_1^* can be recovered by setting $d(\cdot)$ to zero and solving for p_1, which yields a reservation price (RP) equation, i.e., an equation giving the maximum price consumers are willing to pay as a function of the explanatory variables. The reservation price for each consumer in the sample can then be calculated multiplying the individual covariates by the vector of the coefficients of the RP equation, and the sample mean and other descriptive statistics for the sample can be used to estimate the relevant parameters in the population. Confidence intervals for the estimates can also be estimated by simulation methods (Krinsky and Robb, 1986). Multiple random drawings from a multivariate normal distribution with mean β (the vector of the estimates of the DE equation) and variance-covariance matrix V (the estimated variance-covariance matrix) result in random β vectors; from each of them, a new vector of the RP equation coefficients can be calculated, and the reservation prices for the sample can be computed. The final results are empirical distributions of the average reservation prices. From these, $(1-\alpha)$ confidence intervals are obtained by sorting the distributions and dropping $\alpha/2$ values from both tails of the sorted distributions.

With this approach, also observations from persons who did not consume regular meat at the time of the surveys due to the BSE can be used. The only difference with the above approach is that, since they already excluded consumption of regular meat, its price does not enter in their DE equation, so that their DE equation has to be estimated separately. We pooled with these respondents those who consumed beef, but could not remember the price they paid (Group B, as opposed to Group A, including those beef consumers who remembered the price).

Tables 6 and 7 present the estimated DE equations and the relevant RP equations for both surveys and for the pooled sample. The DE equations show how the explanatory variables influence the probability of a positive response, i.e., the probability of consumption of any amount of organic beef. The parameters of the RP equations, i.e., the equations giving the unconstrained and constrained reservation prices as functions of the explanatory variables, are simply the coefficients of the DE equations divided by (-) the coefficient of the bid price, since we chose a linear specification for the DE equations. Just as examples of how to interpret the RP equations, the price coefficient in the RP equation for Group A in 2001 suggests that one Euro increase in the price the consumer pays for regular roast beef implies an increase of 0.966 €/kg in the maximum price he/she would pay for organic roast beef.

Unlike the raw data, there is scarce evidence for an effect of the year. We tested with log-likelihood ratio tests the restriction of equal parameters in both years for the DE equations and were unable to reject the restriction but for minute steak in Group B. Also using an alternative way of testing the year effect, namely inserting a year dummy in the equations estimated on the pooled sample, we found that the relevant parameters were never significant.

Nevertheless, while the overall models are not significantly different, the parameters of the bid prices are consistently larger in 2001 than in 2003, and their difference is significant, since their 95 percent confidence intervals never overlap. In other words, in 2003 the probability of a positive difference in expenditure and hence, the willingness to buy organic beef, decreases more rapidly along with price than it did in 2001. No oher estimated parameter shows the same pattern.

This is also reflected in the average reservation prices, shown in Table 8. Reservation prices are consistently higher in 2003 than in 2001. Confidence intervals in 2001 never include the 2003 average, for both Groups A and B for roast and minute steak. Confidence intervals in 2003 are much larger than

---

(to the researcher) quantity of the new good at a given price, *allowing for a change in the quantity of the regular one*.

in 2001, partly due to the smaller sample size, but also possibly to a larger dispersion in behaviour. Nevertheless, they almost never include the 2001 average, with the exception of Group A for roast. These results suggest that reservation prices did increase from 2001 to 2003.

This seems at odds with the previous results that the shares of yes responses are lower at the proposed bid prices. Nevertheless, it is quite possible that the demand at those prices is lower in 2003 than in 2001 and that the reservation prices are higher in 2003, if the demand curve shifts to the left but becomes steeper. To check this hypothesis, the percentage of consumers that, at the different bid price levels, were likely to purchase organic meat was estimated. The DE equations were used to compute the difference in expenditure for each particular consumer in the sample at a particular bid price, multiplying the individual covariates by the vector of the coefficients of the DE equation. Then their probability to buy some organic meat was calculated[5]. Estimates of the proportion of likely buyers in the total population were then obtained by averaging the estimated probabilities of individuals in the sample, and the results were taken as an estimate of the probability in the total population. Again, the Krinsky and Robb's (1986) simulation approach was used to provide empirical confidence intervals.

The results of this exercise are shown in Table 9, that also exhibits the actual response shares at the bid prices ("yes" responses in this table include both "yes, same quantity" and "yes, but less" responses). When comparing actual and simulated shares, it can be seen that the simulated mean values are sensibly similar to the actual ones, and that confidence intervals are in almost all cases overlapping. When comparing 2001 to 2003 values, the former are always higher for the lower bid prices, while in most cases they are lower for the highest bid price. This result supports the view of a steeper demand curve in 2003 than in 2001.

5. Conclusions

This paper had two goals: 1) analysing the short- and long-term reactions of consumers to the BSE crisis and 2) analysing if, and how much, the time distance from the BSE crisis had affected consumers' willingness to buy organic beef.

Though the effect of the BSE crisis has weakened along with time distance, it left some permanent signs in consumers' behaviour. The share of those stopping eating beef, though significantly reduced from 2001 to 2003, is still positive. Probably more importantly, a sizeable part of those who had changed their beef consumption habits after the BSE crisis maintained, completely or partially, their changes. Both the choice of changing consumption habits just after the BSE crisis, and the choice of maintaining the change, appear to a large extent independent of socio-economic characteristics and hence seem to depend mostly on individual psychological characteristics.

The analysis of the effect of the time distance from the BSE crisis on consumers' attitudes towards organic beef leads to recognize that, at low prices, consumers are less willing to buy organic beef in 2003 than they were in 2001. Nevertheless, the share of those willing to buy it at high price increased. The main conclusion is therefore that the demand for organic beef reduced, but that in the meantime it became more inelastic. For prospective producers, these results suggest that organic beef is less likely to become a large consumption good now than it was in 2001, but that there are better prospects as a niche, high price product.

References

Burton, M., and T. Young (1997). Measuring Meat Consumers' Response to the Perceived Risk of BSE in Great Britain. *Risk Decision and Policy* **2**: 9-18.

[5] Of course, this relies on the same assumption on the density distribution of the error as the one used in estimating the DE equation.

Cameron T.A. (1988), A new paradigm for valuing non-market goods using referendum data: maximum likelihood estimation by censored logistic regression, *Journal of Environmental Economics and Management,* **15**, 335-379

Carson R.T., Hanemann W.M. and Mitchell R.C. (1986). *Determining the demand for public goods by simulating referendum at different tax prices*. Manuscript, University of California, San Diego

Caskie P., Davis J., and Moss J.E. (1999) The economic impact of the BSE: a regional perspective, *Applied Economics*, **31**: 1623-1630

Corsi A., Novelli S. (2003), *Measuring Quantity-Constrained and Maximum Prices Consumers are Willing to Pay for Quality Improvements: the Case of Organic Beef Meat*, paper presented at the 25th International Conference of Agricultural Economists, August 16-22, 2003, Durban, South Africa

Hanemann W.M. and Kanninen B.J. (1999). Statistical Considerations in CVM, in *Valuing Environmental Preferences - Theory and Practice of the Contingent Valuation in the US, EU and Developing Countries* (I.J. Bateman, K.G. Willis Eds.), Oxford University Press, Oxford

Hanemann W.M., Loomis J.B. and Kanninen B.J. (1991). Statistical efficiency of double-bounded dichotomous choice contingent valuation, *American Journal of Agricultural Economics*, **73**, 1255-63

Henson S., Mazzocchi M. (2002). Impact of Bovine Spongiform Encephalopathy on Agribusiness in the United Kingdom: Results of an Event Study of Equity Prices, *American Journal of Agricultural Economics*, **84**(2): 370-386

Krinsky I., Robb A.L. (1986). On approximating the statistical properties of elasticities*, Review of Economics and Statistics*, **68**: 715-719

Lloyd, T., S. McCorriston, C.W. Morgan, and A.J. Rayner (2001). The Impact of Food Scares on Price Adjustment in the UK Beef Market. *Agricultural Economics* **25**: 347-357

Mangen, M.-J.J., and A.M. Burrell, A.M (2001). Decomposing Preference Shifts for Meat and Fish in the Netherlands. *Journal of Agricultural Economics* **52**: 16-28.

Pico Ciamarra, U. (2003). Reazioni emotive del consumatore: la "mucca pazza" in un "sistema quasi ideale di domanda, *Rivista di Economia Agraria*, **58**: 365-389

Smith A.P., Young J.A. Gibson J. (1999). How now, mad-cow? Consumer confidence and source credibility during the 1996 BSE scare, *European Journal of Marketing*, **33**(11): 1107-1122

Table 1: Probit analysis of the determinants of beef consumption change following BSE

	2001		2003	
	Coeff.	t-ratio	Coeff.	t-ratio
Constant	-0.964	-1.737	-2.119	-3.415
Age	0.001	0.290	0.010	1.671
Education (*years of study*)	-0.001	-0.049	0.016	0.695
Household size	0.165	2.423	0.080	1.042
Big city *(=1 if living in towns with more than 50,000 inhabitants)*	0.286	1.955	0.008	0.053
Familiar with organic products (*1= yes*)	-0.224	-1.576	0.378	2.125
Sex *(female = 1)*	0.065	0.370	0.402	2.039
Income class 2	0.197	0.747	0.227	0.827
Income class 3	0.064	0.228	0.261	0.860
Income class 4	0.209	0.686	0.128	0.358
Income class 5	-0.345	-0.914	0.309	1.075
N	400		326	
LL	-259		-204.82	
Chi-squared (10)	17.89		14.80	
Significance level	0.057		0.140	
% correct predictions	64.0		63.5	

Note: Income classes are as follows: 1= 0-7,747 €/year; 2 = 7,747-15,494 €/year; 3 = 15,494-23,241 €/year;
4 = 23,241-30,987 €/year; 5= over 30,987 €/year

Table 2: Stated beef consumption changes following BSE

	2001	2003	2001	2003	2001	2003
	N.	N.	% over changed	% over changed	% over total	% over total
Gave up beef	39	24	24.7	20.3	9.7	7.3
Less beef	6	14	3.8	11.9	1.5	4.2
Less beef, more of other meat/fish	108	59	68.4	50.0	26.9	17.9
Gave up some beef cuts	5	21	3.2	17.8	1.2	6.4
Total changed consumption habits	158	118	100.0	100.0	39.3	35.8
Total questionnaires	402	330			100.0	100.0

Table 3. Stated behaviour in 2003 for those who changed their beef consumption

	N.	%
No change as compared to 2001	34	28.8
More beef than in 2001, but less than before BSE	18	15.3
Same beef consumption as before BSE	66	55.9
	118	100.0

Table 4: Probit analysis of the determinants of maintaining beef consumption change following BSE

	Coeff.	t-ratio	P-value
Constant	-2.183	-1.732	0.083
Age	0.019	1.672	0.094
Education (*years of study*)	0.144	3.145	0.002
Household size	-0.142	-0.909	0.363
Big city *(=1 if living in towns with more than 50,000 inhabitants)*	0.200	0.697	0.486
Familiar with organic products (*1= yes*)	-0.446	-1.261	0.207
Sex *(female = 1)*	0.435	1.027	0.304
Income class 2	-0.215	-0.419	0.675
Income class 3	-0.680	-1.140	0.254
Income class 4	-0.526	-0.752	0.452
Income class 5	-0.831	-1.518	0.129
N	116		
LL	-62.078		
Chi-squared (10)	16.18		
Significance level	0.095		
% correct predictions	73.3		

Tab. 5: Shares of responses to the WTP question

	2001			**2003**		
			Roast			
Bid Price	*13.00*	*15.50*	*18.00*	*13.00*	*15.50*	*18.00*
Yes, same quantity	74.6	63.4	42.7	57.1	41.2	37.8
Yes, but less	19.5	27.7	36.4	27.6	38.2	44.9
No	5.9	8.9	20.9	15.2	20.6	17.3
Total	100.0	100.0	100.0	100.0	100.0	100.0
N.	*118*	*112*	*110*	*105*	*102*	*98*
			Minute steak			
Bid Price	*15.50*	*18.00*	*20.60*	*15.50*	*18.00*	*20.60*
Yes, same quantity	72.1	62.8	20.8	49.1	34.3	35.9
Yes, but less	23.0	26.5	45.6	36.8	45.4	38.8
No	4.9	10.6	33.6	14.2	20.4	25.2
Total	100.0	100.0	100.0	100.0	100.0	100.0
N.	*122*	*113*	*125*	*106*	*108*	*103*

Table 6: Difference-in-expenditure and reservation price equations for roast

	2001				2003				Pooled sample			
	DE eqns			RP eqns	DE eqns			RP eqns	DE eqns			RP eqns
	Coeff.	t-ratio	P-value		Coeff.	t-ratio	P-value		Coeff.	t-ratio	P-value	
Group A												
Constant	-0.3873	-0.295	0.768	-1.256	0.6679	0.325	0.746	3.893	0.0284	0.028	0.978	0.131
pbid	-0.3083	-4.851	0.000		-0.1716	-3.293	0.001		-0.2171	-6.788	0.000	
p	0.2978	4.471	0.000	0.966	0.1535	1.869	0.062	0.895	0.1965	4.709	0.000	0.905
Age	0.0161	1.436	0.151	0.052	0.0030	0.161	0.872	0.018	0.0097	1.038	0.299	0.044
Education *(years)*	0.0266	0.513	0.608	0.086	0.0912	1.164	0.244	0.532	0.0614	1.789	0.074	0.283
Household size	-0.0323	-0.229	0.819	-0.105	-0.1299	-0.598	0.550	-0.757	-0.0861	-0.799	0.424	-0.397
Big town *(1 = > 50000 inh.)*	0.5679	1.675	0.094	1.842	0.1667	0.427	0.670	0.972	0.2895	1.366	0.172	1.334
Familiar with organic products	0.4315	1.510	0.131	1.400	-0.0150	-0.038	0.970	-0.088	0.2879	1.384	0.166	1.327
Sex *(Female = 1)*	0.4840	1.332	0.183	1.570	0.5605	1.487	0.137	3.267	0.5404	2.576	0.010	2.490
Income class 2	1.1923	2.654	0.008	3.867	-0.0361	-0.058	0.953	-0.211	0.5869	1.794	0.073	2.704
Income class 3	1.3836	2.666	0.008	4.488	0.4753	0.677	0.498	2.771	0.9022	2.377	0.017	4.156
Income class 4	0.8443	1.576	0.115	2.739	-0.0967	-0.097	0.923	-0.564	0.4544	1.062	0.288	2.094
Income class 5	0.7376	0.984	0.325	2.392	0.0096	0.016	0.988	0.056	0.3273	0.882	0.378	1.508
N	199				109				308			
Log-likelihood	-85.590				-68.362				-160.455			
Group B												
Constant	1.1420	0.931	0.352	9.815	0.0304	0.035	0.972	0.504	0.5248	0.815	0.415	6.549
pbid	-0.1163	-4.427	0.000		-0.0603	-3.315	0.001		-0.0801	-5.719	0.000	
Age	0.0147	1.266	0.206	0.126	0.0103	1.187	0.235	0.172	0.0109	1.631	0.103	0.136
Education *(years)*	0.0482	0.918	0.358	0.415	0.0339	0.806	0.420	0.563	0.0358	1.215	0.224	0.447
Household size	-0.1492	-1.136	0.256	-1.283	-0.1182	-1.069	0.285	-1.961	-0.0973	-1.255	0.209	-1.214
Big town *(1 = > 50000 inh.)*	-0.0794	-0.276	0.783	-0.683	0.6464	1.875	0.061	10.727	0.2676	1.318	0.188	3.340
Familiar with organic products	0.5267	2.181	0.029	4.527	0.3265	1.343	0.179	5.419	0.4147	2.637	0.008	5.176
Sex *(Female = 1)*	0.2698	0.952	0.341	2.319	0.3058	1.025	0.305	5.075	0.2276	1.234	0.217	2.840
Income class 2	0.5747	1.133	0.257	4.940	0.7505	1.984	0.047	12.455	0.6701	2.329	0.020	8.363
Income class 3	0.7733	1.228	0.220	6.647	0.8718	1.779	0.075	14.468	0.7524	2.210	0.027	9.390
Income class 4	0.1097	0.185	0.854	0.943	1.3016	2.473	0.013	21.601	0.5619	1.584	0.113	7.013
Income class 5	0.8582	1.101	0.271	7.376	0.5864	1.427	0.153	9.731	0.4963	1.507	0.132	6.194
N	177				197				374			
Log-likelihood	-113.297				-122.482				-243.960			

Table 7: Difference-in-expenditure and reservation price equations for minute steak

	2001				2003				Pooled sample			
	DE eqns			RP eqns	DE eqns			RP eqns	DE eqns			RP eqns
	Coeff.	t-ratio	P-value		Coeff.	t-ratio	P-value		Coeff.	t-ratio	P-value	
Group A												
Constant	2.1394	1.962	0.050	8.413	-1.1920	-0.765	0.445	-10.625	0.7963	1.032	0.302	4.509
pbid	-0.2543	-6.891	0.000		-0.1122	-3.102	0.002		-0.1766	-7.580	0.000	
p	0.1118	2.659	0.008	0.440	0.1429	2.199	0.028	1.274	0.1144	3.642	0.000	0.648
Age	0.0132	1.591	0.112	0.052	0.0153	1.011	0.312	0.136	0.0117	1.711	0.087	0.066
Education *(years)*	-0.0108	-0.284	0.776	-0.042	0.0741	1.144	0.253	0.660	0.0173	0.630	0.529	0.098
Household size	-0.0139	-0.145	0.884	-0.054	0.0637	0.342	0.733	0.568	-0.0039	-0.050	0.960	-0.022
Big town *(1 = > 50000 inh.)*	0.1728	0.662	0.508	0.680	0.5770	1.601	0.109	5.143	0.3334	1.831	0.067	1.888
Familiar with organic products	0.7300	3.068	0.002	2.871	0.2231	0.646	0.518	1.988	0.5232	2.859	0.004	2.963
Sex *(Female = 1)*	0.3055	1.030	0.303	1.201	0.5282	1.544	0.123	4.708	0.3959	2.111	0.035	2.242
Income class 2	0.6561	1.745	0.081	2.580	-0.4016	-0.787	0.431	-3.580	0.1591	0.541	0.589	0.901
Income class 3	0.8970	2.114	0.035	3.527	-0.1583	-0.281	0.778	-1.411	0.3112	0.957	0.338	1.762
Income class 4	0.8381	1.843	0.065	3.296	-0.0193	-0.021	0.983	-0.172	0.4474	1.178	0.239	2.533
Income class 5	0.6918	1.248	0.212	2.721	-0.2013	-0.373	0.709	-1.794	0.1723	0.509	0.611	0.976
N	226				127				353			
Log-likelihood	-136.070				-81.286				-227.829			
Group B												
Constant	2.2154	2.213	0.027	13.485	0.8394	0.810	0.418	14.183	1.6581	2.471	0.013	15.917
pbid	-0.1643	-6.008	0.000		-0.0592	-3.306	0.001		-0.1042	-6.819	0.000	
Age	0.0066	0.767	0.443	0.040	0.0026	0.260	0.795	0.043	0.0027	0.427	0.669	0.026
Education *(years)*	0.0747	1.631	0.103	0.454	0.0535	1.199	0.231	0.904	0.0509	1.851	0.064	0.489
Household size	-0.1247	-1.031	0.302	-0.759	-0.1014	-0.871	0.384	-1.713	-0.1056	-1.360	0.174	-1.013
Big town *(1 = > 50000 inh.)*	-0.3543	-1.447	0.148	-2.157	0.2789	0.902	0.367	4.713	-0.0825	-0.469	0.639	-0.792
Familiar with organic products	0.4891	2.234	0.025	2.977	0.1334	0.525	0.599	2.254	0.3997	2.691	0.007	3.837
Sex *(Female = 1)*	0.2699	0.942	0.346	1.643	0.2266	0.741	0.459	3.829	0.1855	1.007	0.314	1.780
Income class 2	0.6099	1.588	0.112	3.713	0.4792	1.333	0.182	8.097	0.4224	1.654	0.098	4.055
Income class 3	0.6484	1.465	0.143	3.947	0.8374	1.997	0.046	14.150	0.5578	1.862	0.063	5.354
Income class 4	-0.0052	-0.011	0.991	-0.032	0.7091	1.437	0.151	11.983	0.1510	0.481	0.631	1.449
Income class 5	1.1671	1.653	0.098	7.104	0.3200	0.843	0.399	5.408	0.4009	1.379	0.168	3.848
N	171				192				363			
Log-likelihood	-133.545				-115.652				-260.952			

Table 8: Estimated reservation prices (Euro)[a]

	2001				2003				Pooled sample			
	Mean	Median	95% confidence interval		Mean	Median	95% confidence interval		Mean	Median	95% confidence interval	
			Lower bound	Upper bound			Lower bound	Upper bound			Lower bound	Upper bound
	Roast											
Group A	21.11	20.96	19.75	23.40	23.45	22.38	19.29	32.28	21.97	21.87	20.52	24.04
Group B	25.55	25.18	22.28	31.49	34.47	32.35	25.93	53.27	28.63	28.24	24.98	34.29
Total	23.33	22.74	19.92	30.13	28.96	27.39	19.68	47.95	25.30	24.54	20.71	33.04
	Minute steak											
Group A	23.31	23.23	22.15	24.96	28.51	27.32	23.66	40.28	24.52	24.44	23.15	26.41
Group B	23.25	23.13	21.61	25.54	36.69	34.41	27.82	56.44	26.59	26.42	24.32	29.77
Total	23.28	23.19	21.81	25.25	32.60	30.71	24.06	51.64	25.56	25.28	23.32	29.10

[a] Results from 10,000 Monte Carlo random draws

Table 9: Estimated probabilities of purchase of organic beef at selected prices [a] and actual proportions of "yes" responses in the sample

Price (Euro)	Actual % of "yes" responses in the sample				Estimated average probabilities			
	Mean	*95% C.I.*	*Mean*	*95% C.I.*	*Mean*	*95% C.I.*	*Mean*	*95% C.I.*
Roast	***2001***		***2003***		***2001***		***2003***	
Group 1								
13.00	0.944	0.890-0.997	0.842	0.726-0.958	0.940	0.903-0.967	0.875	0.792-0.938
15.50	0.910	0.842-0.979	0.842	0.726-0.958	0.864	0.824-0.898	0.794	0.720-0.857
18.00	0.770	0.665-0.876	0.667	0.506-0.828	0.733	0.674-0.790	0.691	0.588-0.780
Group 2								
13.00	0.919	0.852-0.987	0.843	0.758-0.928	0.891	0.837-0.935	0.837	0.782-0.884
15.50	0.895	0.815-0.974	0.750	0.644-0.856	0.837	0.783-0.883	0.804	0.751-0.851
18.00	0.724	0.609-0.839	0.921	0.854-0.987	0.765	0.702-0.822	0.767	0.708-0.819
Minute steak								
Group 1								
15.50	0.933	0.901-0.966	0.854	0.754-0.954	0.944	0.909-0.970	0.833	0.753-0.897
18.00	0.917	0.881-0.953	0.725	0.587-0.863	0.861	0.818-0.897	0.775	0.705-0.835
20.60	0.658	0.596-0.720	0.744	0.607-0.881	0.71	0.647-0.769	0.703	0.624-0.775
Group 2								
15.50	0.917	0.875-0.958	0.862	0.773-0.951	0.858	0.798-0.909	0.838	0.783-0.885
18.00	0.839	0.784-0.894	0.817	0.727-0.907	0.762	0.703-0.817	0.804	0.751-0.853
20.60	0.582	0.508-0.656	0.730	0.621-0.840	0.635	0.562-0.705	0.764	0.701-0.821

[a] Results from 10,000 Monte Carlo random draws