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MEASURING QUANTITY-CONSTRAINED AND MAXIMUM PRICES CONSUMERS ARE WILLING TO PAY FOR QUALITY IMPROVEMENTS: THE CASE OF ORGANIC BEEF MEAT

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MEASURING QUANTITY-CONSTRAINED AND MAXIMUM PRICES CONSUMERS ARE WILLING TO PAY FOR QUALITY IMPROVEMENTS: THE CASE OF ORGANIC BEEF MEAT*

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Abstract
In this paper, models for estimating the maximum price consumers are willing to pay (MPWTP) for organic beef meat, and the maximum quantity-constrained price (i.e., when buying the same quantity they bought of regular meat) consumers are willing to pay (MQCP), are presented. To this purpose, the relevant theoretical and econometric approaches are presented, based on the RUM model and on a Contingent Valuation technique.

Key-words:
Organic meat, willingness-to-pay, double-bounded probit

1. Introduction

Organic products are usually considered to represent a quality improvements for food, since they are considered safer and more environment-friendly. Of course, prospective producers are concerned about their profitability, since they usually entail higher production costs. When an organic product is not currently available on the market, contingent valuation (CV) techniques are an attractive tool for assessing consumers' attitudes towards the new product. This is the case for organic beef meat in Italy: until the 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. Nevertheless, until now production is still sporadic, so that for most consumers organic meat is not actually available.

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Several papers have dealt with the attitudes of consumers towards organic products and safe food in a broader sense (Thompson (1998) provides a more detailed review of U.S. studies on consumer demand for organic produce): Huang (1996); Henson, S. (1996); Thompson and Kidwell (1998); Fu TsuTan et al. (1999); Van Ravenswaay and Blend (1999); Blend and van Ravenswaay (1999); Weaver et al. (1992); Ott (1990); Govindasamy and Italia (1999); Underhill and Figueroa (1996); Loureiro et al. (2001); Boland et al. (1999); Gil et al. (1999) among others. Many papers dealing with the willingness-to-pay for quality improvements use a setting similar to the one used for valuing environmental goods. In that setting, the trade-off is between a lump sum payment and a change in quality/quantity of the environmental good. We argue that this setting is not always appropriate when concerning goods that do not completely substitute for the previously available good, and that can be consumed along with it. The goal of this paper is then to examine this issue, to present the theoretical framework for the “traditional” approach and for a new approach aiming at estimating the maximum price consumers are willing to pay (MPWTP) for quality improvements, and to use these frameworks for an empirical exercise concerning organic beef meat.

2. Theoretical and econometric model

Since organic meat is not yet currently available, contingent valuation techniques, usually utilised for estimating non-market goods, are also a natural approach for estimating consumers’ willingness to pay for organic meat. In contingent valuation, consumers are asked to state their willingness to pay for a given change in the quantity or quality change of the relevant good. It should nevertheless be stressed that when asking this question, respondents are usually placed in a take-or-leave situation: either the old, or the new quantity or quality of the relevant good is possible. By contrast, when organic meat becomes available, the consumer can still buy regular meat. In this sense, availability of organic meat is equivalent to the enlargement of the choice set the consumer is facing: he/she can choose to buy only organic meat (in the same or in a different quantity as he/she did the regular one), both qualities, or only the regular one. This point is often disregarded in the literature: a “traditional” approach is asking to consumers what is the price they would be willing to pay for the new quality (or, equivalently, what would be the price increase they would pay for the better quality). But, implicitly, this approach assumes that the same quantity as the regular product is purchased; in a sense, this is equivalent to constraining the consumer to totally substituting the old for the new product and to buy the same quantity.

Our approach allows to estimate the *maximum* price consumers are willing to pay for organic meat, or the choke price for organic quality. In the same time, we are able to estimate the price consumers would be willing to pay for organic meat, were they constrained to totally substitute regular for organic meat, and to buy the same quantity as before organic quality is made available.

To put this situation in a theoretical framework, assume the only available meat is the regular one (quality q^0) and the consumer has solved his/her maximisation problem and chosen the optimal quantity x^0 of regular meat at a price p^0, achieving utility v^0. The minimum expenditure necessary to achieve level of utility v^0 is indicated by the expenditure function:

$$e_0(P, p^0, v^0) = e_0(P, p^0, v(P, p^0, s, M)) = e_0(P, p^0, s, M) \quad (1)$$

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

Now assume that quality q^1 is made available in perfectly elastic supply to the consumer at a higher price p^1; to attain the same utility level v^0 the minimum expenditure will be:

$$e_1(P, p^0, p^1, v^0) = e_1(P, p^0, p^1, v(P, p^0, p^1, s, M)) = e_1(P, p^0, p^1, s, M) \quad (2)$$

The consumer will buy a positive quantity of organic meat if:

$$e_1(P, p^0, p^1, s, M) < e_0(P, p^0, s, M) \quad (3)$$

For an empirical analysis of the problem, following the random utility model (RUM), 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 e_0 and e_1 the random components of the expenditure functions, the above condition is therefore:

$$e_1(P, p^0, p^1, s, M) + e_1 < e_0(P, p^0, s, M) + e_0 \quad (4)$$

or:

$$f(P, p^0, p^1, s, M) > m \quad (5)$$

where $f(\cdot) = e(P, p^0, s, M) - e(P, p^0, p^1, s, M)$ and $m = e_1 – e_0$.

Assuming a probability distribution for m, it is 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 m, G_m; the probability that a consumer will respond “yes” to an offered p^{bid} is the probability that $f(\cdot)$ is greater than m:

$$P(\text{consumption}) = P[m < f(P, p^0, p^{bid}, s, M)] = G_m[f(P, p^0, p^{bid}, s, M)] \quad (6)$$

and: P(no consumption) = 1- $G_m[\cdot]$ (7)

Maximum likelihood techniques can be employed to estimate the parameters in $f(\cdot)$, the difference-in expenditure (DE) equation. 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.

Since the maximum level of p^1 for which the consumer is willing to buy organic meat is the one for which the expenditure with and without organic meat are equal, i.e. the level of p^1 for which $f(\cdot)$ is equal to zero, the maximum price the consumer is willing to pay for organic meat can be recovered from the estimated equation by setting $f(\cdot)$ to zero and solving for p^1, thus finding a maximum-price-consumers-are-willing-to-pay equation (MPWTP). Using the MPWTP equation, it is then possible to calculate the maximum price each consumer is willing to pay for organic meat[1], and to compute its mean value and other descriptive statistics for the sample[2].

For our empirical exercise, the density function of m is assumed to be normal, with mean 0 and variance σ[3]. In other words, the parameters in the DE equation are only identifiable up to a scale parameter, as usual in probit and logit analysis. Nevertheless, the parameters of the MPWTP equation are perfectly identified, since they are found by dividing the parameters of the difference-in expenditure equation other than the p^{bid} by the parameter of the p^{bid}.

In the "traditional" approach, it is implicitly assumed that the consumer can buy either regular *or* organic meat (qualities q_0 and q_1, respectively) in the same quantity for prices p^0 and p^1, respectively. This situation can be depicted using the restricted expenditure functions (Freeman, 1993):

$$e_{r0} = e_{r0}(P, p^0, q_0, u_0, s) \quad (8)$$

$$e_{r1} = e_{r1}(P, p^1, q_1, u_0, s) \quad (9)$$

The restricted expenditure function e_{r0} is obviously the same as expenditure function e_0 in (1), while e_{r1} is different from e_1 in (2), since the quantity is constrained, and the only available quality

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[1] This can be considered a sort of choke price for organic quality of beef: for higher prices, the consumer will consume no organic beef; for lower prices, consumption will be positive.

[2] Careful readers will notice a similarity of our approach with Cameron's treatment of referendum contingent valuation questions (Cameron, 1991). 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* (to the researcher) quantity of the new good at a given price, *allowing for a change in the quantity of the regular one*. It is therefore not possible to compute from this equation a welfare change measure; the DE equation is only functional for estimating the MPWTP equation.

[3] In principle, since the difference in expenditures cannot be negative, the random component should be accordingly bounded; this point is here disregarded and left to future elaboration.

is q_1. The valuation function, or willingness-to-pay function, indicating the sum a consumer is willing to pay to have the quality increase from q_0 to q_1, in this case, is:

$$WTP(P, p_m, q_{0,} q_1, u_0, s) = e_{r0}(P, p^0, q_{0,} u_0, s) - e_{r1}(P, p^1, q_{1,} u_0, s) \quad (10)$$

Using again the RUM approach, and attaching a random component n to the equation, the probability of a “yes” response from a consumer asked whether he/she would buy the same quantity at a given bid price is:

$$P(consumption) = P[n < WTP(P, p^0, p^{bid}, s, M)] = G_n[WTP(P, p^0, p^{bid}, s, M)] \quad (11)$$

Notice that in this approach, a response “I would buy some organic meat, but less than I did of regular meat” should be interpreted as a “no” response. As before, the WTP equation can be estimated by maximum likelihood methods. When the WTP is equal to zero, the consumer is indifferent between buying and not buying organic meat. Hence, by setting the WTP equation to zero and solving for p^{bid}, one can recover an equation indicating the maximum price consumers are willing to pay for buying the same quantity as before, but of organic quality (maximum quantity-constrained price consumers are willing to pay or MQCP).

To increase the efficiency of the estimates of the difference-in-expenditure equation, a double bounded approach is appropriate (Carson et al., 1986; Hanemann et al., 1991): consumers are asked if they are willing to buy organic meat at a given price (first bid, B); if they are, they are asked if they are equally willing to buy at a higher price (higher bid, HB); if, by contrast, they answer no to the first bid, the question is asked again with a lower price (lower bid, LB). There are four possible responses for the two questions: “yes-yes”, “no-no”, “no-yes”, “yes-no”, each of them defining a portion of the cumulative density function. Precisely, defining for brevity G($\cdot$) the value of $G_m[f(P, p^0, p^{bid}, s, M)]$ for p^{bid}=B, HB, LB, and recalling that by the symmetry of the normal distribution $1-G_m[\cdot] = G_m[-(\cdot)]$, we have:

$$P(yes\text{-}yes) = G(HB) \quad (12)$$

$$P(yes\text{-}no) = G(B) - G(HB) \quad (13)$$

$$P(no\text{-}no) = G(-LB) \quad (14)$$

$$P(no\text{-}yes) = G(LB) - G(B) \quad (15)$$

If the consumer is asked whether he/she would buy organic meat at a given bid price, and is given the possibility to answer “yes, I would buy the same quantity of organic as I did of regular meat” (YS), “yes, I would buy some organic meat, but less than I did of regular meat” (YL), and “no, I wouldn’t buy any organic meat” (NO), then both the MPWTP and the MQCP can be estimated. Assume the consumer is offered a higher bid price if he/she responds YS, and a lower bid price both in case of a YL or of a NO response. Table 1 shows the portions of the cumulative density function corresponding to each combination of responses in our and in the “traditional” approach.

Since some consumers had stopped to consume meat, due to the BSE, and others did not know the price they paid for regular meat, p^0 does not enter in their DE and WTP equations; therefore, the equations were estimated separately for them and for consumers who usually bought regular meat and knew its price.

It should also be noted that, since DE and WTP are differences between two expenditure functions, it is quite possible that income and personal characteristics effects vanish if their parameters are equal in both. Nevertheless, we preferred to keep them, in order to take into account possible interaction effects with quality. Different specifications were tested for the equations; our preferred version was a very simple linear specification, including among the explanatory variables prices, income classes, and personal characteristics.

One important issue is the accuracy of the mean MPWTP and MQCP estimates. Since the parameters in the MPWTP and MQCP function are non-linear functions of the parameters of the DE and WTP equations, the variation in mean MPWTP and MQCP also depends on the variability of the DE and WTP equations parameters. For this reason, confidence intervals for the mean MPWTP and MQCP have been calculated using Krinsky and Robb’s (1986) Monte Carlo simulation approach. Multiple random drawings from a multivariate normal distribution with mean β (the vector of the estimates of the DE and WTP equations) and variance-covariance matrix V (the estimated variance-covariance matrices) have been made, resulting in random β vectors; from each of them, a new vector of the MPWTP and MQCP equation parameters has been calculated, and the mean MPWTP and MQCP for the sample have been computed. The final result are empirical distributions of mean MPWTP and MQCP. $(1-\alpha)$ confidence intervals have been obtained by sorting the distributions and dropping $\alpha/2$ values from both tails of the sorted distributions.

3. Data and procedure

Data were collected through a random telephone survey in Piedmont Region (Italy). The questionnaire was designed with three specific goals: a) to analyse consumers’ behaviour changes after BSE events and consumers' knowledge and purchase habits of organic products; b) to evaluate consumers' willingness to pay for organic beef; c) to determine consumers' preferences about organic beef selling outlets, packaging and label.

In the central part of the interview, a closed-ended[4] contingent valuation (CV) question was asked: respondents were asked whether they would pay a specific price (bid price) to buy organic beef. As mentioned above, to increase the elicitation process efficiency, the take-it-or-leave-it format was set with a follow-up question: if the answer to the first question was 'yes' another WTP question was asked using an higher price; if the answer was 'no' the interviewer proposed a lower price.

To evaluate meat cuts characterised by different prices and cooking processes, respondents were asked about their WTP for roast and minute steak, two cuts of beef largely popular among Italian consumers.

Respondents were previously informed about the prospective availability, the characteristics, and the certification process of organic beef meat. The wording of the elicitation question for those persons presently consuming regular meat was as follows: "Assume you can find on the market certified organic beef meat; if roast cost X ITL/kg, would you buy it?". Three answers were provided: "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". These respondents were also asked about the price they presently paid for regular meat.

Respondents who had answered to a previous question that they had given up eating beef after the 'mad cow' events were asked about the possibility to go back and consume it; the wording of the elicitation question in this case was: "Assume you can find on the market certified organic beef meat; if roast cost X ITL/kg, would you buy it again?". In this case, the answer could only be "yes" or "no". For these respondents the question about prices currently paid was obviously omitted.

The same questions were asked for minute steak.

To avoid a question order bias, six different versions of the questionnaire were randomly submitted to the respondents, each different for the ordering of the questions and/or of the provided answers.

The bid vector of the X prices was set based on a preliminary inspection of regular beef prices. Organic beef is supposed to be, at present, more expensive than regular meat, due to higher production costs and to specialised distribution. Bid prices were therefore set higher than, or equal to, first-rate quality meat currently on sale. Bids were randomly submitted to the respondents. When the respondent stated to be willing to pay the first bid price, he/she was asked a second bid price, 5,000 ITL/kg (2.58 €/kg) higher. If the respondent was unwilling to pay the first price, then he/she was asked a second one, reduced by the same amount.

The questionnaire was pre-tested with a small pilot sample in order to assess the adequacy of the bid design and the clearness of the questionnaire.

The target population was those residents in Piedmont Region who were usually in charge of buying food for themselves and their family. A sample of families living in Piedmont region were randomly drawn from the electronic telephone directory[5]. A total of 879 families living in the region were contacted in June and July 2001[6]; interviewers explicitly asked to speak to the household member who was usually responsible for food shopping. The response rate was 51.4%, which is reasonably fair for a telephone survey. Part of the interviews (4,9%) were stopped by the interviewer when respondents were found to be permanently out of the beef market (vegetarians, people consuming only other meat for health reasons, farmers self-consuming their products). Finally, 0.8% of the questionnaires were not usable because incomplete (respondents were unable to state their WTP). In conclusion, a final sample of 402 questionnaires was successfully completed. Part of the respondents who completed the questionnaire did not consume specifically roast or minute steak; so, the usable number of questionnaires employed to estimate MPWTP for organic meat was 376 for roast and 397 for minute steak.

Table 2 reports the descriptive statistics of the explanatory variables. They include respondents' socio-demographic characteristics[7] (gender, age, education, household size, household income classes), their residence (divided in small –less than 50,000 inhabitants- and big towns), and a dummy variable indicating their answer to the question whether they knew organic products, which supposedly could influence their preference for organic meat. A comparison of the sample with the population is difficult because the reference population are the persons in charge of purchasing food, not the entire population. Nevertheless, the sample characteristics, whenever possible, were compared to Census data: in our sample, the share of women is obviously much higher, as expected, because they more frequently take care of buying food (82 vs. 52%); the younger age group (20-39) is slightly underrepresented (31 vs. 36%); the same applies to people with lower education (no respondent without any school diploma is included in the sample, while they are 6.4% in the Region; the relevant shares for elementary school are 19 vs. 38%). Inference of the results to the general population should be therefore done with some caution, because of a possible bias.

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[4] The closed-ended format simulates the real-life situation, in which consumers have to decide whether or not to buy goods at given prices; it therefore simplifies respondents' valuation process.

[5] Bias due to unlisted telephone numbers has been assumed to be marginal, since the share of households not having a telephone is very low.

[6] "Contacted families" do not include those who were not found at home.

[7] Since 15.2% of the interviewed people refused to reveal their family income, missing income values were imputed, regressing socio-economic variables on income for the complete questionnaires, using the estimated parameters to predict missing values, and attributing the observations to the relevant income classes.

4. Results

Tables 3 and 4 present the estimates of the difference-in-expenditure and MPWTP and MQCP equations for roast and minute steak. As already mentioned, they are estimated separately for those consumers who know the price of regular meat (Group A) and those who either do not consume regular meat or consume it, but do not know its price (Group B).

The DE equations show how the explanatory variables influence the probability of a positive response: in the first case, the probability concerns the consumption of any amount of organic meat, in the second, the consumption of the same amount as the regular meat. Starting with *roast*, in the parameters of the bid price and of the regular meat price are negative (as expected) and positive, respectively, and are highly significant. The price parameter in the first MPWTP equation suggests that a thousand ITL/kg increase in the price the consumer pays for regular meat implies an increase of 966 ITL/kg (€ 0.50) in the maximum price he/she would pay for organic meat; the relevant parameter in the MQPC equation suggests that a consumer would be willing pay 976 ITL/kg (€ 0.50) more for organic meat for every thousand ITL/kg increase in the price of regular meat, were he/she given as the only choice to buy organic meat in the same quantity as the regular one. Most parameters of consumers' characteristics are not significantly different from zero, thus indicating that the effect of these variables are equal for the expenditure functions for regular and for organic meat, and that there are few interaction effects with quality. Only the parameter of city size is weakly significant among group A; by contrast, among these consumers, the knowledge of organic products is not significant at the usual levels. The opposite is nevertheless true for the other group of consumers, possibly because some of them are those who stopped buying regular meat after the BSE crisis, and therefore are more concerned of food safety; so, they are probably more interested in organic meat when they already know other organic products. Income has a significant, positive and increasing effect among Group A, at least among the first classes. By contrast, it is not significant among Group B, which seems consistent with the fact that persons who do not remember the price they paid are included in it, along with people concerned with BSE, which may make them much interested in organic meat regardless of their income.

Also in the case of *minute steak* the parameters of the bid price and of the regular meat price are highly significant and have the same negative and positive signs. For this cut, however, the effect of the price of regular meat on the MPWTP for organic meat is weaker. Among the other variables, the parameter of the knowledge of organic products is significant and positive, both for group A and for group B. Again, income classes parameters are to a large extent significant and exhibit the predicted signs and values among Group A, unlike Group B.

Using the MPWTP and MQCP equations, the MPWTP and MQCP for the surveyed consumers have been estimated, and, using a Monte Carlo simulation, their mean, median and 95 percent confidence intervals have been computed for the sample. They are presented in Table 5.

The average MPWTP for consumers presently buying regular roast and remembering its price is lower than the corresponding MPWTP for minute steak, and much lower than the MPWTP of Group B. By contrast, MPWTP for minute steak is about the same for Group A and B. The variation in both MPWTP and MQCP is reasonably narrow, when considering the large variation in prices consumers are paying for regular meat; only in the case of Group B for roast the 95% confidence interval is quite large.

The average price currently paid is 25,892 lire (€ 13. 37) for regular roast meat, and 29,547 lire (€ 15.26) for minute steak. Therefore, the average choke price for organic roast is 75% higher than the average current price for regular roast, and the corresponding value for minute steak is 53%. If the average MQCPs are compared to the current average prices, they are 25% and 20% higher for roast and minute steak, respectively. This suggests that organic beef meat can have a certain market share also at quite higher prices than current prices of regular beef meat.

5. Summary and conclusions

In this paper, theoretical and econometric approaches for evaluating the maximum price consumers are willing to pay for a new quality, as well as the price they would pay if they were to totally substitute the new for the old quality, have been presented, and implemented for the case of organic beef meat.

The results show that consumers' MPWTP and MQCP are quite high, thus suggesting that organic beef meat might gain an appreciable market share. This is an encouraging signal for prospective producers of organic meat, who might compensate the likely increase in production costs with a substantial premium for the new good.

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Table 1: Combination of responses and corresponding cdf

Response to 1st bid (B)	2nd bid	Response to 2nd bid	Cdf for MPWTP estimation	Cdf for MQCP estimation
YS	HB	YS	G(HB)	G(HB)
YS	HB	YL	G(HB)	G(B) – G(HB)
YS	HB	NO	G(B) – G(HB)	G(B) – G(HB)
YL	LB	YS	G(B)	G(LB) – G(B)
YL	LB	YL	G(B)	G(-LB)
YL	LB	NO	inconsistent	G(-LB)
NO	LB	YS	G(LB) – G(B)	G(LB) – G(B)
NO	LB	YL	G(LB) – G(B)	G(-LB)
NO	LB	NO	G(-LB)	G(-LB)

Table 2: Descriptive statistics of the explanatory variables

	Mean	Standard deviation
Price of regular roast *(thousand ITL/kg)* (*)	25.892	4.790
Price of regular minute steak *(thousand ITL/kg)* (*)	29.547	5.591
Big town (*=1 if living in towns with more than 50,000 inhabitants*)	0.311	0.463
Sex (*female = 1*)	0.818	0.386
Age (*years*)	50.108	15.612
Education (*years of study*)	10.313	3.852
Household size (*number of family members*)	3.189	1.052
Family income classes (**)		
0-15 million ITL/year (0-7,747 €)	0.080	0.271
15-30 million ITL/year (7,747-15,494 €)	0.308	0.462
30-45 million ITL/year (15,494-23,241 €)	0.338	0.474
45-60 million ITL/year (23,241-30,987 €)	0.194	0.396
Over 60 million ITL/year (over 30,987 €)	0.080	0.271
Knows organic (*=1 if knowing organic products*)	0.639	0.481
N. observations = 402		

(*) Calculated for consumers of the specific meat cut who could remember the price

(**) Values missing because of respondents' refusal to declare their income were replaced by fitted values (see footnote 6)

Table 3: Difference-in-expenditure, MPWTP AND MQCP equations for roast

	Coeff.	t-ratio	P-value	MPWTP equation	Coeff.	t-ratio	P-value	MQCP equation
Group A								
Constant	-0.3873	-0.295	0.768	-2.433	0.842	0.919	0.358	3.599
pbid	-0.1592	-4.851	0.000		-0.234	-11.194	0.000	
p	0.1538	4.471	0.000	0.966	0.228	10.194	0.000	0.976
Age	0.0161	1.436	0.151	0.101	-0.007	-0.938	0.348	-0.028
Education (years)	0.0266	0.513	0.608	0.167	-0.054	-1.522	0.128	-0.229
Household size	-0.0323	-0.229	0.819	-0.203	-0.067	-0.518	0.604	-0.284
Big town (1 = > 50000 inh.)	0.5679	1.675	0.094	3.567	0.097	0.465	0.642	0.413
Knows organic	0.4315	1.510	0.131	2.710	0.281	1.299	0.194	1.200
Sex (Female = 1)	0.4840	1.332	0.183	3.040	0.224	0.784	0.433	0.959
Income class 2	1.1923	2.654	0.008	7.489	1.152	3.185	0.001	4.921
Income class 3	1.3836	2.666	0.008	8.690	1.650	4.058	0.000	7.050
Income class 4	0.8443	1.576	0.115	5.303	1.424	2.959	0.003	6.085
Income class 5	0.7376	0.984	0.325	4.633	1.422	2.547	0.011	6.076
N	199				199			
Log-likelihood	-85.590				-172.589			
Group B								
Constant	1.1420	0.931	0.352	19.005	3.629	3.504	0.000	26.857
pbid	-0.0601	-4.427	0.000		-0.135	-9.697	0.000	
Age	0.0147	1.266	0.206	0.245	0.007	0.842	0.400	0.055
Education (years)	0.0482	0.918	0.358	0.803	-0.013	-0.381	0.703	-0.096
Household size	-0.1492	-1.136	0.256	-2.483	-0.103	-0.884	0.377	-0.762
Big town (1 = > 50000 inh.)	-0.0794	-0.276	0.783	-1.322	0.872	3.655	0.000	6.453
Knows organic	0.5267	2.181	0.029	8.765	0.361	1.581	0.114	2.674
Sex (Female = 1)	0.2698	0.952	0.341	4.490	-0.052	-0.239	0.811	-0.388
Income class 2	0.5747	1.133	0.257	9.565	0.249	0.389	0.697	1.846
Income class 3	0.7733	1.228	0.220	12.869	0.813	1.217	0.224	6.014
Income class 4	0.1097	0.185	0.854	1.826	0.634	0.922	0.357	4.691
Income class 5	0.8582	1.101	0.271	14.283	1.123	1.494	0.135	8.309
N	177				177			
Log-likelihood	-105.917				-182.1677			

Table 4: Difference-in-expenditure, MPWTP AND MQCP equations for minute steak

	Coeff.	t-ratio	P-value	MPWTP equation	Coeff.	t-ratio	P-value	MQCP equation
Group A								
Constant	2.139	1.962	0.050	16.289	2.265	2.795	0.005	10.433
pbid	-0.131	-6.891	0.000		-0.217	-15.565	0.000	
p	0.058	2.659	0.008	0.440	0.138	9.045	0.000	0.636
Age	0.013	1.591	0.112	0.100	0.011	1.475	0.140	0.050
Education (years)	-0.011	-0.284	0.776	-0.082	0.006	0.215	0.829	0.029
Household size	-0.014	-0.145	0.884	-0.105	-0.103	-1.259	0.208	-0.476
Big town (1 = > 50000 inh.)	0.173	0.662	0.508	1.316	0.142	0.720	0.471	0.655
Knows organic	0.730	3.068	0.002	5.558	0.398	1.984	0.047	1.832
Sex (Female = 1)	0.305	1.030	0.303	2.326	-0.090	-0.433	0.665	-0.412
Income class 2	0.656	1.745	0.081	4.996	0.636	1.895	0.058	2.927
Income class 3	0.897	2.114	0.035	6.830	0.930	2.457	0.014	4.282
Income class 4	0.838	1.843	0.065	6.381	0.856	2.085	0.037	3.944
Income class 5	0.692	1.248	0.212	5.268	0.918	1.879	0.060	4.227
N	226				226			
Log-likelihood	-136.070				-224.084			
Group B					Coeff.	t-ratio	P-value	MQCP equation
Constant	2.2154	2.213	0.027	26.111	4.253	4.162	0.000	31.999
pbid	-0.0848	-6.008	0.000		-0.133	-8.117	0.000	
Age	0.0066	0.767	0.443	0.078	0.001	0.077	0.939	0.004
Education (years)	0.0747	1.631	0.103	0.880	-0.036	-1.007	0.314	-0.272
Household size	-0.1247	-1.031	0.302	-1.470	-0.117	-0.983	0.326	-0.882
Big town (1 = > 50000 inh.)	-0.3543	-1.447	0.148	-4.176	0.749	3.064	0.002	5.639
Knows organic	0.4891	2.234	0.025	5.765	0.318	1.512	0.131	2.389
Sex (Female = 1)	0.2699	0.942	0.346	3.181	0.051	0.196	0.845	0.384
Income class 2	0.6099	1.588	0.112	7.189	0.497	1.157	0.247	3.736
Income class 3	0.6484	1.465	0.143	7.643	0.980	2.160	0.031	7.370
Income class 4	-0.0052	-0.011	0.991	-0.061	0.767	1.482	0.138	5.771
Income class 5	1.1671	1.653	0.098	13.755	1.266	2.222	0.026	9.525
N	171				171			
Log-likelihood	-133.545				-169.890			

Table 5: Results of the simulations: maximum, and quantity-constrained, prices consumers are willing to pay for organic beef

	MPWTP				MQCP			
	Mean	Median	95% confidence interval		Mean	Median	95% confidence interval	
			Lower bound	Upper bound			Lower bound	Upper bound
	Thousand ITL							
	Roast							
Group A	40.842	40.565	38.271	45.073	31.199	31.192	30.421	32.012
Group B	49.681	48.713	43.122	61.445	33.462	33.443	31.975	35.086
Total	*45.261*	*43.929*	*38.580*	*58.499*	*32.330*	*31.999*	*30.534*	*34.785*
	Minute steak							
Group A	45.116	44.980	42.924	48.211	35.186	35.182	34.416	35.975
Group B	45.013	44.751	41.831	49.631	35.460	35.477	33.895	36.963
Total	*45.064*	*44.885*	*42.211*	*49.013*	*35.323*	*35.284*	*34.133*	*36.716*
	Euro							
	Roast							
Group A	21.09	20.95	19.77	23.28	16.11	16.11	15.71	16.53
Group B	25.66	25.16	22.27	31.73	17.28	17.27	16.51	18.12
Total	*23.38*	*22.69*	*19.93*	*30.21*	*16.70*	*16.53*	*15.77*	*17.96*
	Minute steak							
Group A	23.30	23.23	22.17	24.90	18.17	18.17	17.77	18.58
Group B	23.25	23.11	21.60	25.63	18.31	18.32	17.51	19.09
Total	*23.27*	*23.18*	*21.80*	*25.31*	*18.24*	*18.22*	*17.63*	*18.96*