Consumers' WTP for quality and safety in clams

Alessandra Castellini[1], Marta Disegna[2], Christine Mauracher[*3], Isabella Procidano[3]

[1] *Alma Mater Studiorum University of Bologna, Italy*
[2] *Free University of Bozen-Bolzano, Bolzano, Italy and Ca' Foscari University, Venice, Italy*
[3] *Ca' Foscari University Venice - Italy*

Abstract

The aim of the research is to estimate the potential demand for certified clams in Italy and to investigate on the determinants of maximum amount that respondents are willing to pay for this product. Quantitative analysis was used based on 1,067 face-to-face interviews collected in three Italian Regions in the Northern bordering the Adriatic Sea (Friuli-Venezia Giulia, Veneto and Emilia-Romagna) carried out during 2008. The consumers' Willingness to Pay is measured using a Contingent Valuation method. In order to estimate separately the determinants of the probability that respondents are willing to pay and the maximum that they are willing to pay, a generalization of Tobit model was adopted. The results indicate that consumers are willing to pay a premium price mainly to purchase better quality products. The research provides some initial insight into consumers' WTP that can be useful for certified fish farming.

Keywords: Certified clams; Willingness to Pay; CV method; Double-hurdle model
Paper type: Regular paper
JEL code: D12 - Consumer Economics: Empirical Analysis

All authors contributed equally to the article.

Address correspondence to Christine Mauracher, Department of Management, Ca' Foscari University, Venice 30121, Italy. E-mail: maurache@unive.it

1. Introduction

In recent years changing life-styles, encouraged by socio-economic trends, have generated new models of food consumption which give particular attention to the health and hygiene characteristics of food products. During the same period consumers have also had to cope with serious food scandals (for example BSE, avian flu and pesticide-residue content), which have heightened their awareness of the importance of food safety and its strict correlation with health, while at the same time reducing their trust in the food industry. Furthermore, globalization and other developments in the food sector have widened the gaps in consumers' knowledge of "farm to fork" processes while the informal guarantee system which once characterized the direct exchange between consumer and producer has collapsed.

Thus, in order to regain the interest of mistrustful consumers bewildered by the wide variety of products on the market, it is vital that all firms develop differentiation strategies to highlight the existence of product/process added value, also by means of the increased use of certification models guaranteed by the appropriate independent Institutions. A firm, by opting for external evaluation of its work, is publicly expressing its willingness to be transparent and at the same time is affirming its full responsibility towards the consumer (Silvestri, 2005).

According to economic theory, a certification label might represent a guarantee of quality for consumers as well as being a sign that the product and the firm can be trusted. The quality label's effectiveness may also depend on its wide dissemination and on the adoption of an appropriate communication strategy in the marketplace: consumers are not willing to pay for better quality if they cannot identify it (Lüth & Spiller, 2007).

The Authors chose to carry out an in depth study of the clam sector, both for economic reasons, because of its commercial relevance in the retail market, and with the aim of protecting consumers from hygiene risks and improving the quality of supply. An important

point to remember is that the clam is a filter-feeding mollusk[1] and by its very nature can be a vehicle for contaminants, thus potentially creating fear and uncertainty in the prospective buyer. Furthermore, the mass media have raised consumers' perception of the risks, alarming them by spreading news about illegal mollusk harvesting in polluted waters.

In this context, the Authors surveyed consumers' Willingness To Pay (WTP) for quality certified clams, with particular reference to a "supply chain control" label. WTP values differed according to the different characteristics of the investigated consumers. In this way it could be possible to evaluate the added value provided by the certification, which could be monetary represented by an estimated Premium Price[2] (PP). The results may offer suggestions for a framework in which firms can promote value-enhancing actions and market strategies in order to develop the market demand, paying anyway attention to the fact that the success of value-added production as certified clams hinges on the existence of niche and not mass markets (Hu et al., 2011).

This study was methodologically based on the Contingent Valuation (CV) method and the analysis of WTP a PP was conducted by using a double-hurdle model. This econometric model permits to distinguish between the decision to purchase and how much money the respondent is actually willing to pay for the new product.

The paper is divided into the following sections: literature review of the CV method; information regarding the questionnaire and the survey sample; methodology section (particularly focused on the method used to get around the problem caused by missing information); the discussion about the outcomes of the model.

2. Conceptual framework: Willingness to Pay and Contingent Valuation Method

[1] A filter-feeding animal eats organic particles and micro-organisms through a water-filtering mechanism. So filter-feeding animals can absorb bacteria, viruses and parasites which cause gastroenteritis, hepatitis and intestinal intoxications if they

[2] A *Premium Price* is a surcharge on the normal price of a product on the market and reflects the consumer's WTP to purchase the goods in question.

Most consumers seek food safety and are willing to pay higher prices for "healthy or nutritive products" because this increases their utility level and, at the same time, reduces health risks. According to a recent survey (ISMEA, 2011) Italian consumers consider fish a light food; healthy, digestible and rich in fundamental nutritional elements. But at the same time they are somewhat afraid of harm caused to the product by sea pollution.

Since they are unable to ascertain food safety and potential health benefits before purchase, a method commonly applied for determining how consumers look for food safety is to estimate their WTP for safer and better quality food (Hu et al., 2001; Goldberg et al., 2005). Rodriguez (2008) defined WTP as the amount of money representing the difference between sale price before and after improving a given food product attribute.

In this study, consumers' WTP for certified food products is measured using a survey-based direct method (i.e. survey by questionnaire) for an evaluation of market and non-market goods (Arrow et al., 1993): the CV method. This method involves creating a hypothetical market situation for a given good or service (Carson et al., 2001). It allows market researchers to quantify the value consumers give to certain products by associating the value with the amount of money they are willing to pay in order to purchase such products (Kawagoe et al., 2001), and is considered the most commonly-employed technique used to estimate consumers' WTP (Hanneman, 1984). The notion of WTP may be defined as the amount of money representing the difference between sale price before and after adding/improving the attributes of a certain food product. Respondents are presented with a hypothetical purchasing situation in which they are invited to associate WTP to a certain premium, expressed either as a sum of money or as a percentage added to the reference prices (Carmona-Torres et al., 2006).

Since 1980 there has been increasing interest in CV, mainly in literature devoted to environmental evaluation (Bishop et al., 1979). Recently, several more references have been

generating more support for the use of the CV method, especially as many of the papers concerned deal with WTP itself in order to explore the demand for healthier and safer food products (see for example Akgüngör et al., 2010; De Francesco & Galvan, 2005; McCluskey et al. 2004; Roosen et al. 1998).

3. Survey methodology

A questionnaire was administered to a sample of 1,067 residents over 20 years old in three Northern Italian Regions bordering the Adriatic Sea: Friuli-Venezia Giulia, Veneto, and Emilia-Romagna. The quota sampling method was used to select the units. The sample was stratified according to the following two variables: the population size of the three regions considered and the age of the local residents. Although the quota sampling method is a non-probabilistic method which was chosen because permits to reproduce the same composition of the population observed in the layers, and the selection procedure was cheaper and faster than other techniques. Of the questionnaires completed, 1,048 were considered usable. On the basis of the stratification variables, 45.99% of questionnaires came from the Veneto region, 41.70% from the Emilia-Romagna region, and the remaining questionnaires (12.31%) from the Friuli-Venezia Giulia region. The survey was carried out in 2008 and face-to-face interviews were conducted near large retail supermarkets, fish shops and markets in the four biggest towns in each province. Anonymity was guaranteed. The questionnaire was created using a funnel structure, starting with general questions related to fish consumption and ending with more specific questions on the object of the survey and on the hypothetic market. To summarize, the questionnaire was divided into four sections (table 1).

As regards WTP, respondents were asked to answer three different questions:

1. Would you purchase certified clams if they were the same price as the conventional product?

2. Would you purchase certified clams if they were a higher price than the conventional

product?

3. How much are you willing to pay (€/Kg) for the certified clams?

Table 1 Structure of the questionnaire

Section	*Object*	*Theme*
A	Fishery products	Purchase and consumption habits.
B	Clams	Purchase and consumption habits, elements affecting the purchase and consumption, product knowledge.
C	Certification hypothesis	Willingness to purchase certified clams and maximum amount of money willing to spend, reasons for purchasing or not.
D	Interviewees profile	Socio-demographic and economic characteristics.

The first and second questions are dichotomous choice questions while the last is an open-ended question adopted in order to give full freedom of response. It is important to remember that interviewees may be willing to pay an adequate monetary value for the certified clams because they are familiar both with the conventional product and with the certification process. To help with the evaluation of the "new" product we only furnished the current sale price of conventional clams on the market (i.e. 8 €/Kg).

4. Data description

In this section respondents' socio-demographic and economic characteristics, and clam consumption habits or preferences are presented. In the following analysis, respondents are classified into three groups: whole sample (WS); respondent, called Potential Buyer (PB, 80.59%), who is willing to purchase certified clams at the same price as the conventional product, or higher; and Non-Potential Buyer (NPB, 19.41%) of certified clams, i.e. respondent who is not willing to purchase certified clams.

The Chi-squared independence test (χ^2) was used to analyze the statistical difference between the two subgroups of respondents (PBs versus NPBs) in terms of the qualitative variables that

describe the sample, while the *t*-test was used to check whether or not the means of the quantitative variables differ significantly across the two subgroups of respondents (tables 2–4). Finally the *t*-test and *F*-test, or ANOVA test, were used to check whether or not the average PP differs significantly across the categories of the qualitative variables that describe the interviewees' characteristics and their consumption habits (tables 5-6).

4.1. Interviewee profile: descriptive statistics

In the three groups analyzed, approximately 60% of interviewees were women; in fact, grocery shopping appears to be mostly a female activity. Table 2 shows that the higher the size of the household the higher the propensity to purchase certified clams, and the average NPB household is significantly smaller than that of the PB one. As regards family composition, the PB group contains a smaller percentage of families with people of 65 and older than the NPB group, indicating that the presence of older people reduces the propensity to buy certified products. The modal income class is in the €1,033 – € 2,066 range. The percentage of families in the low-income class and of families with one or no income earner is higher in the NPB group than in the PB group. This indicates the existence of a positive relationship between the propensity to buy certified products, which generally have a higher price than conventional products, and income.

Respondents are mainly residents of the hinterland and of them 78.18% are PBs (21.82% NPBs). The percentage of PBs increases to 85.01% for respondents living along the coast, indicating the greater propensity amongst residents of these areas to purchase certified products. Furthermore, in Veneto it has been registered the highest percentage of PBs living in a province in the hinterland (82.10%) while the highest percentage of PBs living in coastal areas is recorded in Friuli-Venezia Giulia (86.73%).

Table 2 Socio-demographic and economic characteristics of respondents

	WS	PB	NPB	Significance
Age (mean)	48.91	48.22	51.92	*t*-test = 2.89**
Level of education (%)				$\chi^2 = 10.16^{**}$
High	27.77	28.62	23.04	
Medium	40.94	42.88	36.65	
Low	31.29	28.5	40.31	
Occupation (%)				$\chi^2 = 17.79^{**}$
In Employment	52.95	55.49	42.41	
Housewife	7.83	8.32	5.76	
Pensioner	29.88	26.99	41.88	
Other	9.34	9.21	9.95	
Household size (mean)	2.74	2.83	2.44	*t*-test = 4.22**
Household size (%)				$\chi^2 = 19.11^{**}$
1	11.90	10.10	19.37	
2	35.50	34.85	38.23	
3	26.45	26.64	25.65	
≥ 4	26.15	28.41	16.75	
Presence of Children under 14 (%)				$\chi^2 = 2.98$
No	78.22	76.39	82.20	
Yes	21.78	23.61	17.80	
Presence of elderly persons (65 years old or more) (%)				$\chi^2 = 19.01^{**}$
No	74.79	78.03	62.83	
Yes	25.21	21.97	37.17	
Income Level (%)				$\chi^2 = 27.96^{**}$
≤ €1,033	7.54	5.30	15.18	
€1,033 -| €2,066	37.21	35.31	39.27	
€2.066 -| €3,615	31.49	34.42	27.23	
> €3,615	16.31	18.16	11.51	
Missing value	7.45	6.81	6.81	
Number of income earners in the family (%)				$\chi^2 = 4.18^{*}$
0 or 1 income earners	25.13	23.74	30.89	
> 1 income earners	74.87	76.26	69.11	
Area (%)				$\chi^2 = 6.71^{**}$
Hinterland	64.74	62.80	72.77	
Coast	35.26	37.20	27.23	

No test results are significant unless otherwise indicated. WS = Whole Sample, PB = Potential Buyer, NPB = Non-Potential Buyer. ** Significant at $p \leq 0.01$, * Significant at $p \leq 0.05$.

4.2. Clam consumption habits

Among fish consumers, 76.67% are clam's consumers and fresh clams are the habitual type of clams consumed by the interviewees (table 3). Most of the respondents consume clams at home rather than at restaurants, and the NPB group consumes clams at restaurants more frequently than the PB group. Typically, PBs are habitual clam consumers, i.e. they consume

this product once a month (36.34%) or more (32.12%), while NPBs consume this product only occasionally, i.e. during festive occasions (30.56%) or less than once a month (22.22%).

Table 3 Elements influencing purchase

	WS	PB	NPB	Significance
Type of clam habitually consumed (%)				$\chi^2 = 0.01$
Fresh	87.24	87.21	87.50	
Transformed	12.76	12.79	12.50	
Place where clam is mainly consumed (%)				$\chi^2 = 9.06^{*}$
Home	81.97	83.28	69.44	
Restaurant	19.03	16.72	30.56	
Frequency of clam consumption (%)				$\chi^2 = 13.19^{**}$
Habitually	66.45	68.46	47.22	
Occasionally	33.55	31.54	52.78	
Factors influencing clam purchase (%)				
Price	46.13	45.73	51.11	$\chi^2 = 0.49$
Origin	64.31	65.01	55.56	$\chi^2 = 1.62$
Trade mark	21.36	21.46	20.00	$\chi^2 = 0.05$
Species/Type of clam	44.32	45.37	45.37	$\chi^2 = 3.44$
Processing plant	31.51	32.08	24.44	$\chi^2 = 1.13$
Retailer's advice	56.01	56.05	55.55	$\chi^2 = 0.01$
Main reason for null or low consumption (%)				$\chi^2 = 52.22^{**}$
Too expensive	7.55	6.23	10.26	
High preparation time	19.50	21.18	16.03	
I'm not able to cook it	12.79	12.46	13.46	
I do not like it	19.08	11.21	35.26	
Doubts about safety	24.53	29.28	14.74	
Unknown origin	5.03	6.23	2.56	
Other	11.52	13.41	7.69	

No test results are significant unless otherwise indicated. PB = Potential Buyer, NPB = Non-Potential Buyer. ** Significant at $p \leq 0.01$, * Significant at $p \leq 0.05$.

A five-point Likert-scale (1 = not important at all, 5 = very important) was used to measure the relative importance of the factors influencing clam-purchasing habits. Table 3 shows the percentage of respondents who indicated a high value (4 and 5) for each factor. Generally, the most important factors seem to be the "Origin" of the product and "Retailer's advice". NPBs pay greater attention to the "Price" of the product than PBs perhaps because in the former group the percentage of household with medium-low income is greater than in the latter

group. “Doubts about the safety” of clams seems to be the main reason for low or zero clam consumption in the PB group, whereas for NPBs it is mainly that they do not like the product. Therefore, it seems that consumers, especially PBs, give greater importance to the “Origin” of the product and “Retailer’s advice” so as to obtain more information in order to help them to reduce what they perceive as safety risks.

Finally, it was briefly analyzed the respondents’ knowledge about the product. Amongst the different indicated names[3] for what are in fact the same species of clam, the results clearly indicate that the respondents do not know and cannot distinguish between the different species.

Regarding clam production processes, the interviewees were asked to indicate whether they considered several statements to be correct or not (table 4). More than half of interviewees correctly indicated that “Fresh clams must be alive” and also that “In the three regions in question (Friuli-Venezia Giulia, Veneto, and Emilia-Romagna), clams are both fished and bred”, while only 41% correctly argued that “Some clams must be cleaned before being released for consumption”. Furthermore, table 4 shows that NPBs are less well-informed than PBs.

4.3. PBs and NPBs of certified clams: premium price

There are many interesting inter-relationships among the socio-demographic and economic characteristics of PBs and the average PP declared by them. The PP[4] is the difference between the amount of money that the respondent is willing to pay and the average sale price of the conventional clam on the market (in our case 8 €/kg). The interviewee gives a monetary value to a hypothetical product and this evaluation will necessarily be different

[3] *T. philippinarum* could be Vongole veraci filippine; *T. decussates* could be vongole veraci, caparozzoli, concoli; *C. gallina* as lupine, poverassi or pevarasse, vongole adriatiche, bevarasse, arselle, etc.

[4] The definition of the different PPs may be carried out in accordance with various criteria, such as pilot testing or by means of iterative selection. The adopted reference price (the so- called “starting point”) is the average price of certified clams according to information released by experts in fisheries sector.

from the evaluation that he/she would give to the same product sold in a real market, causing a hypothetical error. In order to correct this hypothetical error, which is inevitably created, we decided to exclude from the following analyses any respondents who gave an anomalous WTP value[5] (the percentage of respondents excluded was 1.22%).

Table 4 Knowledge about clam production processes

	WS	PB	NPB	Significance
Fresh clams must be alive (%)				$\chi^2 = 19.51^{**}$
True (correct answer)	73.04	75.38	63.35	
False	12.00	12.12	11.52	
Do not know	14.96	12.50	25.13	
Some clams must be cleaned before being released for consumption (%)				$\chi^2 = 7.20^{*}$
True (correct answer)	40.86	42.12	35.60	
False	32.72	33.29	30.37	
Do not know	26.42	24.59	34.03	
In the three regions considered, clams are both fished and bred (%)				$\chi^2 = 20.14^{**}$
True (correct answer)	52.24	55.74	37.70	
False	13.62	12.74	17.28	
Do not know	34.14	31.52	45.02	

No test results are significant unless otherwise indicated. PB = Potential Buyer, NPB = Non-Potential Buyer. ** Significant at $p \leq 0.01$, * Significant at $p \leq 0.05$.

The average PP that respondents are willing to pay to buy certified clams, without considering those willing to purchase the product but only at the same price as the conventional one, is 2.22 €/Kg, corresponding to an average WTP value of 10.22 €/Kg.

The guarantees offered by certification result in an increase in confidence towards the product and this is the main motivation that drives PBs to declare a PP which is greater than zero (56.06%). The second and third most important motivations are the increased safety and the quality of the product offered by certification (23.50% and 20.44% respectively).

Table 5 shows that women are willing to pay more than men, and that the higher the age of the PB the smaller the PP that they are willing to pay, with a significant difference only

[5] WTP value higher than $\mu+3\sigma=2.31+3\cdot1.24=6.03$€/Kg ($\mu$ is the average value and σ is the standard deviation) are considered anomalous values.

between the mean PP value stated by PBs younger than 49 and PBs of 49 and over. The average PP for pensioners is lower than the average PP stated by the other occupation categories. Regarding educational level, the average PP is lower for PBs with a low level of education than for PBs with a middle-high level of education.

Table 5 Average Premium Price (€/Kg) in terms of respondents' socio-demographic and economic characteristics.

	PP	Significance		PP	Significance
Gender		*t*-test = 2.71**	*Occupation*		*t*-test = 2.37*
Women	2.30		Pensioner	2.05	
Men	2.08		Other	2.27	
Age		*t*-test = 2.81**	*Educational level*		*t*-test = 2.14*
≤ 49	2.32		Middle-high level	2.27	
> 49	2.09		Low level	2.07	
Size of household		*F*-test = 0.39	*Income Level*		*t*-test = 2.56*
1	2.23		≤ €3,615	2.16	
2	2.19		> €3,615	2.44	
3	2.23		*Region*		*F*-test = 5.23**
≥ 4	2.23		Veneto	2.35	
Presence of Children		*t*-test = 0.62	Friuli-Venezia Giulia	1.97	
No	2.20		Emilia-Romagna	2.16	
Yes	2.26		*Location of the province*		*t*-test = 1.89*
Presence of Elderly persons		*t*-test = 2.01*	Hinterland	2.27	
No	2.26		Coast	2.11	
Yes	2.06				

No test results are significant unless otherwise indicated. PP = Premium price. ** Significant at $p \leq 0.01$, * Significant at $p \leq 0.05$.

As regards the members of the household, there is no difference between the average PP in terms of household size and presence of children younger than 14 years old, while the presence of elderly persons (65 years old and over) seems to significantly reduce the average PP declared. Respondents living in the Veneto region reported an average PP higher than those who live in the other two regions with no significant difference between those who live in the hinterland and those who live near the coast.

PBs who usually buy fresh/thawed fish reported a smaller PP than those who usually buy pre-cooked products, while there is no significant difference between habitual consumers of fish (i.e. once per week or more) and occasional consumers (table 6).

Consumers of conventional clams reported a slightly lower PP than those who do not normally purchase this kind of fish, but the difference between the two means is not significant. Neither the type of clams consumed nor the frequency of clam purchases are significant factors influencing the average PP reported. Respondents who usually consume conventional clam are not interested in purchasing certified clams, primarily because they do not consider the latter product better than the conventional product. On the other hand, respondents who want to purchase the certified clam but only at the same price as the conventional product are mistrustful towards certification and believe that the price is already high.

Table 6 Average Premium Price (€/Kg) in terms of consumption habits

	PP	Significance		PP	Significance
Types of fish consumed		*t*-test = 18.37**	*Consumption of clams*		*t*-test = 0.26
Fresh/thawed	2.23		No	2.24	
Pre-cooked	2.44		Yes	2.21	
Freq. of fish consumption		*t*-test = 0.44	*Type of clams consumed*		*t*-test = 0.94
Habitually	2.22		Fresh	2.23	
Occasionally	2.18		Transformed	2.10	
			Freq. of clam consumption		*t*-test = 0.33
			Habitually	2.20	
			Occasionally	2.23	

No test results are significant unless otherwise indicated. PP = Premium price. ** Significant at $p \leq 0.01$, * Significant at $p \leq 0.05$.

Finally, NPBs are not interested in buying certified clams with a higher price than the conventional product because they think that there are no difference between certified and conventional clams (29.67%), the price is already high (21.98%), certification should already

be mandatory (15.38%), because they have no confidence in certification (16.48%), and they do not think that certification has a cost (13.19%).

5. In-depth analysis

5.1 The econometric model

This survey shows that about one third (32.25%) of respondents declared a PP of €0. These include NPBs, PBs who want to purchase certified clams but at the same price as the conventional product, and PBs who want to purchase certified clams but who do not declare a PP.

To remove all zero responses from the sample may give rise to the sample selection problem (Heckman, 1976) and to a biased estimate of the PP (Carson et al., 1998). Therefore, in order to evaluate the WTP a PP for certified clams the most suitable model is a Tobit model (Tobin, 1958), or one of its generalizations, because this model is applied to a non-negative dependent variable that is essentially continuous over strictly positive values but that takes on zero with positive probability (i.e. a nontrivial fraction of the population takes zero value). For this type of dependent variable, a regression model estimate using the traditional Ordinary Least Square (OLS) method would produce biased and inconsistent estimates (Amemiya, 1984).

In order to study the two natural decision-making steps regarding clam purchase, a two-equation generalization of the Tobit model is adopted, namely the well-known double-hurdle model (Cragg, 1971).

The double-hurdle model allows to take into account the fact that the monetary value declared by the individual is the result of two possible processes (Strazzera et al., 2003): the individual decides whether or not to purchase something according to some choice model (selection stage) and then she/he decides how much money to spend on that purchase

according to another choice model (outcome stage). Therefore, to observe a positive monetary value of clam purchase, two distinct hurdles must be overcome. Through the estimation provided by the double-hurdle model it is possible to obtain two different sets of relevant explicative variables in the two stages, whereas the estimation from the standard Tobit model identifies a single set of variables to measure the effect of the participation decision (selection stage) and level decision (outcome stage). The model used therefore comprises the formulation of two regression models, one for each stage, which are however linked to each other.

Furthermore, in order to use all the observations at each stage, it has been used the estimator proposed by Heien and Wessells (see, for example, Byrne et al., 1996; Manrique et al., 1997) instead of the traditional Heckman two-step estimator that omits zero observations in the second stage.

5.1.1 The double-hurdle model

As regards the first stage, let us assume that $\mathbf{y}_1^*$ is a latent variable, i.e. a variable that cannot be observed directly, defined by equation (1):

$$y_{1i}^* = \mathbf{X}_{1i}\boldsymbol{\alpha}_1 + u_i, \qquad i = 1,...,n \tag{1}$$

where y_{1i}^* is the propensity or willingness of the *i*-th respondent to pay a PP for a particular commodity, $\mathbf{X}_{1i}$ is a vector of 1x(1+*K*) independent variables, $\boldsymbol{\alpha}_1$ is a vector of (1+*K*)x1 parameters, u_i is the error term distributed as $u_i \sim N(0,\sigma_1^2)$.

Since, in practice, y_{1i}^* cannot be observed, but it is known if the *i*-th respondent is willing to pay more than a certain threshold *c* or not, an observable dummy variable ($\mathbf{y}_1$) could be defined according to relation (2):

$$y_{1i} = \begin{cases} 1 & \text{if} \quad y_{1i}^{*} > c \\ 0 & \text{otherwise} \end{cases} \tag{2}$$

In this study, the threshold *c* is the average conventional clam price sold in the real market (8 €/kg), which has been assumed constant for all respondents. Note that the threshold, being constant, can be modified without essentially changing the model, since *c* can be absorbed into the constant term of the regression model (Amemiya, 1984).

Given equation (1), relation (2) and the assumptions made about the error term, the model that better described the selection stage was the Probit model (Maddala, 1983; Breen, 1996).

A positive sign of a coefficient in the estimated Probit model increases the probability to pay an amount greater than *c*, i.e. the PP, while a negative one decreases it.

Through the estimates obtained at the first stage, the predicted inverse Mills Ratio for each observation (MR_i) can be computed, on the basis of the following rule suggested by Heien and Wessells (1990):

$$MR_i = \begin{cases} \phi(z_i) / \left[1 - \Phi(z_i)\right] & \text{if } y_{1i} = 1 \\ \phi(z_i) / \Phi(z_i) & \text{otherwise} \end{cases} \tag{4}$$

where $z_i = (c - \mathbf{X}_{1i}\boldsymbol{\alpha}_1)/\sigma_1$, $\Phi(.)$ is the standard normal distribution, and $\phi(\cdot)$ is the density function of the standard normal variable.

As regards the second stage, given that $\mathbf{y}_2^{*}$ is a latent variable defined by equation (5):

$$y_{2i}^{*} = \mathbf{X}_{2i}\boldsymbol{\alpha}_2 + v_i \tag{5}$$

where y_{2i}^{*} contains the amount of money that the *i*-th respondent is willing to spend, $\mathbf{X}_{2i}$ is a vector of 1x(1+*J*) independent variables which can be different from the independent variables used in the first stage, $\boldsymbol{\alpha}_2$ is a vector of (1+*J*)x1 parameters, v_i is the error term distributed as $v_i \sim N(0, \sigma_2^2)$.

The observed answer to the open-ended evaluation question regarding the amount that the *i*-th respondent is willing to spend for the purchase of the certified clams (y_{2i}) is linked to the *i*-th unobservable value of the latent variable (y_{2i}^{*}) as follows:

$$y_{2i} = \begin{cases} y_{2i}^{*} & \text{if } y_{1i}^{*} > c \\ c & \text{otherwise} \end{cases} \tag{6}$$

In order to identify the variables that influence the PP, once the consumer has decided to pay, it was adopted the following linear regression model, estimated by means of the traditional OLS method, using all the observations in the sample:

$$y_{2i} - c = PP_i = \mathbf{X}_{2i}\boldsymbol{\alpha}_2 - c + \beta MR_i + \varepsilon_i \tag{7}$$

where PP_i is the PP stated by the *i*-th respondent, ε_i is a random component with zero mean and the **MR** variable is added to the matrix of the independent variables ($\mathbf{X}_2$) as an instrument variable. In fact, the **MR** variable enables the two stages to be linked, if they are dependent, and to correct the sample selection problem, if it exists. It is important to note that if the coefficient of **MR**, β, is equal to 0 the decision to pay and the decision of how much to pay are independent and the sample selection problem is unimportant, i.e. the sample selection rule ensures that all potential observations are sampled, so the Tobit model can be used instead of the double-hurdle model.

5.2 Missing income information: propensity score matching

As we have observed in paragraph 4.1, 7.5% of respondents do not state their household income class. In order to overcome this lack, the approach adopted by Sisto (2006) is adopted. This Author suggests that it is possible to obtain the required income information using another survey that studies the same population through the Propensity Score Matching (PSM) method (Rosembaum, 1983).

Through this method, each element of the sample is associated to the most similar statistical unit, in terms of some particular features, of another survey that contain the missing information. In this study, the survey conducted by the Central Bank of Italy on the Italian household income was chosen to complete the database.

There are two conditions that have to be fulfilled in order to implement this matching procedure:

1. the statistical units involved in the surveys must have been generated from two samples randomly drawn from the same population;

2. a series of common variables must be identified in these surveys.

In this study, both such conditions are correctly fulfilled. The variables used in the matching procedure regard socio-demographic and economic features of the household such as: size of household; household members in terms of the number of children less than 7 years old, boys and girls aged between 8 and 14 years old, and elderly persons aged over 64 years old, and the number of income earners. In order to implement the matching procedure an additional dummy variable (t) was worked out, whose value stands at 1 if the single unit derives from this survey, and at 0 if this comes from the Central Bank of Italy's survey. The propensity score is hence the probability that the unit belongs to the survey conditional to **X**, which is the matrix that contains the common explanatory variables. This probability can be evaluated through a Probit regression (p_i, where i=1,…,I is the unit observed in our survey). After having estimated the probability vector for all units descending from both surveys, a measure of distance (usually the Euclidean distance) is also to be introduced in order to evaluate the similarity among the units come from the two surveys. Since the sample size is different in the two surveys, the methodology known as "nearest neighbor matching with replacement" was preferred (Smith and Todd, 2005). Furthermore, the caliper matching procedure (Cochran and Rubin, 1973), i.e. a variation of the above mentioned nearest neighbor

matching, was applied to this study. This procedure consists in imposing a certain threshold, i.e. the propensity range (*r*), which the distance cannot exceed. The value for *r* was decided in such a way that no information from the survey's sample was likely to be excluded, even though the difference in the propensity score was maintained at reasonably low figures. In order to improve the quality of the final results and to avoid the matching of units featuring very heterogeneous socio-cultural characteristics, the matching procedure was actually carried out separately for the three regions analyzed (Friuli-Venezia Giulia, Emilia-Romagna and Veneto). The introduction of the PSM method for estimated income generates an increase in the percentage of the medium-high classes (more than € 2,066 per month), indicating that generally people who do not declare their income actually fall into the high income classes (Table 7).

Table 7 Percentage composition of income classes

Income Level (€)	WS without missing income value (%)	WS with value obtained by PSM method (%)
≤ 1,033	8.15	7.63
1,033 -| 2,066	40.21	37.50
2,066 -| 3,615	34.02	36.35
> 3,615	17.62	18.52
Total	100	100
No. of questionnaires	970	1,048

6. Empirical results and discussion

Both regressions were estimated using a stepwise robust method (the cut-off value $\alpha = 0.05$) in order to correct the possible heteroskedasticity of the error terms. The robust regressions were estimated by using White's robust variance-covariance matrix to generate robust standard errors for the study's statistics (White, 1980).

The missing income values are calculated through the PSM method explained above. Following the Alberini et al. (2005) method, the value of the income variable is the mean of each income class and, in addition, a dummy variable (called "missing income") is created to

represent those who do not state their income (1 indicates that income is not stated, and 0 indicates all other cases). The regression models for the two stages are first estimated considering the entire set of independent variables and the stepwise results (i.e. the significant independent variables for each model) are presented in table 8.

From table 8 it emerges that the MR coefficient is statistically significant and this implies that the decisions to purchase and on how much to spend are dependent on, and are explained by, different sets of variables. Therefore, in this case the use of the double-hurdle model is correct. As regards fish consumption habits, it could be noted that the WTP a PP and the average PP estimated both increase if the respondent mainly consumes fresh fish. The consumption of frozen fish only produces an increase (and preserved fish a decrease) in the WTP a PP. Being a consumer of conventional clams, and in particular a habitual (once per month or more) consumer, increases both WTP a PP and the average PP estimated.

Table 8 Premium Price determinants

Independent variables	First stage*	Second stage**
Buying fresh fish	0.37 (0.16)[a]	0.40 (0.13)
Buying frozen fish	0.25 (0.11)	
Buying preserved fish	-0.33 (0.12)	
Buying clams	1.19 (0.14)	0.58 (0.10)
Buying clams 2-3 times per month	0.59 (0.18)	0.27 (0.10)
Buying clams once per month	0.75 (0.18)	0.21 (0.09)
Emilia-Romagna	-0.61 (0.13)	
Veneto		0.37 (0.08)
Female		0.17 (0.07)
Age 49-|63	0.28 (0.13)	
Older		-0.16 (0.08)
Income	>0.01 (>0.01)	>0.01 (>0.01)
Mills Ratio		-1.10 (0.03)
Constant	-0.59 (0.20)	0.90 (0.14)

Note: [a] Robust Std. Err. in brackets.

* N = 969; McKelvey-Zavoina R^2= 0.421; Wald $chi^2(9)$=194.97; Prob > chi^2=0.

** N = 968; F(9, 958) = 135.18; Prob > F= 0.0000; Adj R^2 = 0.424.

Among the socio-demographic and economic characteristics of the interviewees and their families, the Authors decided to analyze the influence on spending of gender, age, level of

education, occupation, region of residence, location of province (coastal or not), household members and income. The results suggest that level of education, occupation, and location of province are not significant determinants of spending while gender, age, region of residence, household members and income have significant impacts on both stages. With regard to the place of residence, those who come from the Emilia-Romagna region have the lowest propensity to pay a PP while those who live in Veneto region have the highest average PP estimated. The average PP estimated increases if the consumer is a woman rather than a man, while it decreases if elderly people (65 years old and over) are present in the family. Finally, household income level has only a marginal influence both on the willingness to pay a PP and the average PP estimated.

Collating the results it is possible to calculate the average PP estimated for a consumer possessing any given characteristics. The maximum value of the average PP estimated is 2.68 €/Kg and this occurs when: the consumer is a woman, who buys fresh/thawed fish, who purchases clams 2-3 times per month, who lives in the Veneto region and without elderly people in the family. The average PP estimated increases by 0.1 €/kg for every added €1,000 on the average monthly income of the household. The minimum value of the average PP estimated is 0.73 €/Kg and this occurs when the consumer is a man, who does not consume either fish or clams, who lives in the Friuli-Venezia Giulia or Emilia-Romagna regions and/or has elderly people in the family.

7. Conclusions

The analysis shows an interesting potential market for certified claims in terms of both demand and supply. Indeed, this certification can increase consumer satisfaction while at the same time boosting the market performance (and income?) of producers.

The survey indicates that 81% of fish product consumers prefer certified claims.

However to estimate potential demand it is necessary to consider only those consumers who stated that they are willing to pay a higher price than for the conventional product, assuming that the PP is able to offset the higher production costs related to certification.

The survey shows that the number of fish product consumers willing to pay more than 8 €/kg falls to 70%, which still, however, indicates a fair degree of WTP for certification.

It is important to emphasize that the main motivation stated by over half of these respondents is related to trust in certification rather than an expectation of increased health or quality.

This explorative survey indicates therefore that the potential demand for controlled supply chain certification is enough to justify its introduction and that this would be an important response to the illegal clam market. It could also lead to growth in the sector by stimulating qualitative competition.

Of course, the results must be read with caution because the interviewee was asked to evaluate a hypothetical market.

Some considerations can be drawn regarding the most suitable strategies for developing a real demand for certified clams. First of all, the survey revealed a considerable amount of consumer ignorance and misinformation both about the conventional product and its production processes. It will be important to overcome this ignorance and educate the consumer through targeted information about the complexity of the supply chain, thus providing them with the tools to be able to choose with greater awareness.

In order to achieve this goal the relationship between consumers and sales channels, particularly supermarkets, needs to be improved. The staff who sell the fish will need to be adequately trained both in emphasizing issues regarding territorial origin and trademark, and in being able to supply information about the certification process.

Information could also be distributed within stores, concerning both the certification process and the cooking of the certified product, e.g. by providing cookbooks devoted to the preparation of clam dishes.

It is clear that the effectiveness and success of this project will be much stronger if most of the relevant public sector bodies, consortia and associations are involved, thus creating a single network and a coherent image for consumers of the potential benefits to be obtained from product certification.

Finally, sooner rather than later, agreements and relationships among the various operators in the supply chain will have to be improved so that everyone can benefit from the added value which will result from certification.

References

Akgüngör, S., Miran, B. & Abey C. (2010). Consumer Willingness to pay for Organic Food in Urban Turkey. Journal of International Food & Agribusiness marketing, 22: 299-313.

Alberini, A., Rosato, P., Longo, A. and Zanatta, V. (2005). Information and Willingness to Pay in a Contingent Valuation Study: The Value of S. Erasmo in the Lagoon of Venice. Journal of Environmental Planning and Management, Vol. 48 No. 2, pp. 155-175.

Amemiya, T. (1984). Tobit Models: a Survey. Journal of Econometrics, Vol. 24 No. 1, pp. 3-26.

Arrow, K., Solow, R., Portney, P.R., Leamer, E., Radner, R. and Schuman, H. (1993). Report of the NOAA Panel on Contingent Valuation. Federal Register, Vol. 58 No. 10, pp. 4602-4614.

Bishop, R. and Heberlein, T. (1979). Measuring Values of Extramarket Goods: Are Indirect Measures Biased?. American Journal of Agricultural Economics, Vol. 61 No. 5, pp. 926-930.

Breen, R. (1996). Regression Models. Censored, Sample-Selected, or Truncated Data. SAGE Publications, London.

Byrne, P. J., Capps, O. Jr., & Saha A. (1996). Analysis of food-Away-from-Home Expenditure Patterns for U.S. Households, 1982-89. American Journal of Agricultural Economics, 78(3), 614–627.

Carmona-Torres, C. and Calatrava-Requena, J. (2006). Bid Design and its Influence on the Stated Willingness to Pay in a Contingent Valuation Study. Contributed paper prepared for presentation at the *International Association of Agricultural Economists*, Queensland, Australia, August 12-18, 2006, *Annual Meeting*, No. 25367, 18 pp.

Carson, R. T., Hanemann, W. M., Kopp, R. J., Krosnick, J. A., Mitchell, R. C., Presser, S. Ruud, P. A., Smith, V. K., Conaway, M., & Martin, K. (1998). Referendum Design and Contingent Valuation: The NOAA Panel's No-Vote. Recommendation. The Review of Economics and Statistics, 80(2), 335–338.

Cochran, W.G., & Rubin, D.B. (1973). Controlling bias in observational studies: A review. Sankhya. The Indian Journal of Statistics, Series A, 35, 417-446.

Cragg, J. (1971). Some statistical models for limited dependent variables with application to the demand for durable goods. Econometrica, 39, 829–844.

De Francesco E., and Galvan A. (2005). Functional foods: consumers willingness to pay for red chicory 'Radicchio di Chioggia' enhanced with antioxidant compounds. In Defrancesco E., Galletto L., Thiene M. (ed.) Food, Agriculture and the environment. Economic Issues

Goldberg, I. and Roosen, J. (2005). Measuring Consumer Willingness to Pay for a Health Risk Reduction of Salmonellosis and Campylobacteriosis., paper presented at the *11th Congress of the European Association of Agricultural Economist*, Copenhagen, Denmark, 24-27 August, 2005, 15 pp.

Hanneman, W. (1984). Welfare evaluations in contingent valuation experiments with discrete responses. American Journal of Agricultural Economics, Vol. 66, No. 3, pp. 332–41.

Heckman, J.J. (1976). The common structure of statistical models of truncation, sample selection and limited dependent variables and a simple estimator for such models. Annals of Economic and Social Measurement, Vol. 5 No. 4, pp. 475-492.

Heien, D., & Wessels, C. (1990). Demand system estimation with micro data: a censored regression approach. Journal of Business & Economic Statistics, 8(3), 356–371.

Hu, W., Woods, T. & Bastin, S. (2011). Analyzing the Demand for New Value-Added Product: Case of Pure Blueberry Sweetener. Journal of International Food & Agribusiness marketing, 23:56-71.

ISMEA (2011). Il pesce a tavola: percezioni e stili di consumo degli Italiani, Roma.

Kawagoe, K. and Fukunaga, N. (2001). Identifying the value of public services by the contingent valuation method (CVM), Nomura Research Institute, NRI papers No. 39, December 1, 2001, 8 pp.

Lüth M and Spiller A. (2007). Brands as quality signals in the meat market: lessons from the poultry sector. In Quality management and food chains, (edited by Theuvsen L., Spiller A., Peupert M. and Jahn G.), Wageningen Academic Publisher.

Maddala, G.S. (1983). Limited-Dependent and Qualitative Variables in Econometrics. Cambridge University Press, Cambridge.

Manrique, J. and Jensen, H. H. (1997). Spanish Household Demand for Convenience Meat Products. Agribusiness, Vol. 13 No. 6, pp. 579-586.

McCluskey J.J, Grimsrud K.M., Ouchi H., Wahl T.I. (2003). Consumer response to genetically modified food products in Japan. Agricultural and Resource Economics Review, 32, 2: 222-231.

Rodriguez, E., Lacaze, V. and Lupin, B. (2008). Contingent Valuation of Consumers' Willingness-to-Pay for organic Food in Argentina. Paper presented at the *12th International Congress of the European Association of Agricultural Economist EAAE* 2008, Ghent, Belgium, 26-29 August, 2008, 10 pp.

Rosembaum, P., & Rubin, D. B. (1983). The central role of the propensity score in observational studies for casual effects. *Biometrika*, 70, 41–50.

Roosen J., John A.F., David A.H., Schreiber A. (1998). Consumers' Valuation of Insecticide Use Restrictions: An Application to Apples. Journal of Agricultural and Resource Economics, 23, 2: 367-384.

Silvestri S. (2005). *Tapes philippinarum*: la ricerca della qualità come obbligo ed opportunità. In Boatto V., Pellizzato M. (ed.), *La filiera della vongola*, ed. FrancoAngeli, Milano.

Sisto, A. (2006). Propensity Score Matching: un'applicazione per la creazione di un database integrato ISTAT-Banca d'Italia. *Department of Public Policy and Public Choice-POLIS, Working Paper* 63.

Smith, J. A., & Todd, P. E. (2005). Does matching overcome LaLonde's critique of nonexperimental estimators?. Journal of Econometrics, 125, 305–353.

Strazzera E., Genius M., Scarpa R., Hutchinson G. (2003). The effect of protest votes on the estimates of WTP for use values of recreational sites. Environmental and resource economics, Vol. 25, No. 4, pp. 461-476.

Tobin, J.(1958). Estimation of Relationships for Limited Dependent Variables. Econometrica, Vol. 26 No. 1, pp. 24 -36.

White, H. (1980). A Heteroscedasticity-Consistent Covariance Matrix Estimator and a Direct Test for Heteroscedasticity. *Econometrica*, Vol. 48 No. 4, pp. 817-838.