# Assessing Consumers' Willingness to Pay for Different Units of Organic Milk: Evidence from Multi-Unit Auctions

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**Abstract:**

Experimental auctions are normally conducted using single-unit auctions. In this paper, we explore the use of multi-unit auctions to investigate the determinants of consumers' willingness to pay (WTP) for a food product (i.e., organic milk) in a multi-unit shopping scenario. We also analyze the effect of positive and negative information about organic farming on WTP. Our results suggest that although consumers are willing to pay for organic milk, their WTP decreases with the number of purchased units. We also found that the magnitude and the statistical significance of the determinants of WTP change from one unit to another. The most important factors affecting WTP are the number of units subjects are willing to buy, health concerns, and perceived animal welfare benefits of organic production. The type of information provided also plays a relevant role. Specifically, we find that positive information on organic farming increases WTP, negative information decreases WTP, and provision of both positive and negative information does not affect WTP.

**Keywords**: Organic milk, Multi-unit Vickrey auction, information

## 1. Introduction

The interest in organic foods has grown considerably in the last decade in response to the increasing concerns regarding the negative externalities associated with the effects of intensive farming systems on both human health and the environment (e.g., the contamination of food, land and ground water by pesticide residues, etc.). This increase in interest has also been stimulated by the increasing consumer anxiety about numerous food scares such as the mad cow disease, the avian influenza, the Belgian dioxin scare, etc. (Miles and Frewer, 2001). From the production side, the subsidies that governments of developed countries provide to organic producers have promoted a certain degree of substitution between conventional and organic farming (Soler et al, 2002).

Organic farming arose in the countries of northern Europe in the beginning of the 20$^{th}$ century. Since then, its development has been influenced by several philosophical movements and the culture and socio-economic situation of various countries as well as by producer and consumer organizations. Until the 1970s, organic farming in Europe remained a purely symbolic activity occupying an area less than 10,000 hectares. However, due to the integration of environmental considerations in the design of the Common Agricultural Policy reforms and the cumulative effects of the above mentioned food scares, organic farming in Europe has experienced the strongest growth since 1990. In fact, while organic farming occupied about 100,000 hectares in 1985, it covered 6,920,462 hectares in 2007 (Willer and Youssefi, 2007; Willer et al, 2008).

Several studies have been carried out in several countries to examine consumers' willingness to pay (WTP) for specific organic foods. Table 1 summarizes the results of several studies carried out in different countries. In general, three stated preference methods have been used: hedonic prices, contingent valuation, and conjoint analysis/choice experiments. In spite of the useful information these methods provide, their main limitation is that they allow subjects to deviate from their true values since they do not provide respondents an incentive to spend cognitive effort in evaluating the product as they do in real market situations. Moreover, when subjects believe that their value will be used to formulate business strategies or public policies, they may behave strategically in an attempt to influence the outcome of the study. As a result,

researchers have turned to the use of experimental auctions that use real products and exchange of real money (McAfee and McMillan, 1987). In these experimental auctions, a participant can incur real costs if he or she deviates from the equilibrium strategy, which then provides him/her an incentive to bid his/her real values. Several studies such as by Fox et al. (2002); Dickinson and Baily (2002); Soler et al. (2002); Lusk et al. (2004b); Kassardjian et al. (2005); Rousu et al. (2005); Shaw et al. (2006); and Alfnes (2009), among many others, have used experimental auctions to determine consumers' WTP for food products, in general, and organic food, in particular.

While the use of single-unit auctions is useful in assessing consumers' valuation of a single unit of an organic product, consumers can be interested as well in purchasing not just one but multiple units of this type of product. Also, due to increasing time constraints, many consumers are becoming increasingly concerned about optimizing shopping efficiency by purchasing multiple units of products to save several trips to the store. While extensively studied in the literature, the WTP values obtained from single-unit auctions, however, are only applicable for the first unit a consumer is willing to buy. Therefore, single-unit auctions are useful if one assumes that people are interested in purchasing one unit during the auction but these auctions cannot provide information on consumer's WTP for subsequent units of the product beyond the first unit. Hence, the use of single-unit auction in deriving a consumer's demand curve and surplus is limited[1]. Also, it is a common practice in studies using single-unit experimental auctions to estimate the effects of various factors determining consumers' WTP for the product of interest. But again, these estimates should be applicable only in the case of one-unit purchases since consumer behavior or preferences can be different for subsequent quantities of the purchased product. For example, some of the factors that are statistically significant in determining WTP for a single unit may become statistically insignificant for multiple units of purchase. Therefore, the use of single-unit auction to assess consumer behavior in multi-unit shopping scenario is limited and can lead to biased conclusions if the analyst assumes that results obtained for a single unit are also applicable to any additional unit beyond the first unit.

[1] However, an approximation of the demand curve for the market (i.e., not for a single consumer) can be obtained using single-unit auction if we consider a large number of consumers.

In this paper, due to the limitations of single-unit experimental auction in assessing consumer behavior in multi-unit setting, we propose the use of a *multi-unit auction* to measure consumers' WTP for multiple units of organic food (i.e. organic milk) and estimate the factors affecting consumers' WTP for each additional unit beyond the first unit. Also, the use of multi-unit auction allows us to derive the demand curve for the product being auctioned for each individual and the market. Hence, demand elasticities and consumer surplus measures can be derived, which can then be used, among others, in evaluating consumer demand and welfare implications of policy interventions (e.g., product taxes, price ceilings, price floors). We currently are not aware of any published study that has used a multi-unit auction mechanism to elicit consumers' WTP for a food product in general and organic food in particular.

In our experiment we used an incentive compatible multi-unit auction mechanism, the so called multi-unit Vickrey auction. Multi-unit Vickrey auction is a generalization of the second price auction. Each participant is asked to bid on multiple units of the same product and the winner pays an amount corresponding to the sum of the bids (excluding his or her own bids) that are displaced by his or her successful bids (Krishna, 2010). For a better understanding of the auction mechanism, consider two bidders and two identical units of the same product to be auctioned. Each bidder reports a bid of two values (i.e. one value for each unit). Let's say that bidder 1's bid is (10, 7) and the bid of bidder 2 is (9, 8). Ranking the four values we obtain (10, 9, 8, 7). The pricing rule dictates that the owner(s) of the two highest bids is declared the winner(s) and pays an amount corresponding to the sum of the highest rejected bids (excluding his or her own bids). In this particular example, bidder 1 is declared the winner with the value 10 and bidder 2 is also a winner with the value 9. Each of them pays a price equal to the highest rejected bid excluding his or her bids. Hence, bidder 1 pays 8 but bidder 2 pays 7 (not 8 since 8 is his or her value for the second unit). Now suppose that bidder 1 provided a bid equal to (11, 10) so the ranking of values is now (11, 10, 9, 8). Bidder 1 then wins the two units and pays 9 for the first unit and 8 for the second unit (please see Annex1 for additional numerical examples). Since the price that the winner(s) has to pay is not based on the winner's bid but on the bids of the other participants,

bidding truthfully is a dominant strategy in the Vickrey auction (Engelbrecht-Wiggans & Kahn, 1998).

The price that consumers are willing to pay for an organic product can depend on the type of information that is provided to them. For example, several empirical studies have observed the sensitiveness of consumers' WTP for organic food to different types of information on labeling, reference prices, organic foods' intrinsic characteristics, etc. Specifically, results from previous empirical studies (see Table 1) on consumers' acceptability of organic food showed that the majority of subjects think of organic products as healthier, more nutritious and better for the environment than conventional products. However, in the last few years, some unfavorable information about organic farming has been published claiming the non-existence of these differences between organic products and their conventional counterparts in terms of nutritional content or safety[2]. The internet has also made it easy for a large number of consumers to access these types of information, which could potentially influence their WTP for organic foods. Hence, another objective of our paper is to test, in a multi-unit auction setting, the sensitivity of consumers' WTP to three types of information about organic farming: 1) positive information (information in favor of organic foods); 2) negative information (information against organic foods); and 3) both types of information[3]. Hence, we test the following hypotheses:

I. Consumers' WTP increases in presence of positive information.

II. Consumers' WTP decreases in presence of negative information.

III. Consumers' WTP does not change in presence of both types of information.

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[2] For example: "There is no evidence that organically produced foods are nutritionally superior to conventionally produced foodstuffs" (Dangour et al, 2009); "there is no evidence to support the argument that organic food is better than food grown with the use of pesticides and chemical" (Society of Chemical Industry, 2008); "Organically grown wheat may have different labeling and a higher price in stores, but it contains essentially the same profile of amino acids, sugars and other metabolic substances as wheat grown with conventional farming" (Zorb et al, 2006); "USDA makes no claims that organically produced food is safer or more nutritious than conventionally produced food. Organic food differs from conventionally produced food in the way it is grown, handled, and processed." (The United States Department of Agriculture (USDA), 2007 (in PopCon.org)); "Research shows that nutritionally there is no evidence that organic produce is better or safer than conventionally grown produce. Organic food differs from conventional foods in the way in which they are grown and processed" (The American Dietetic Association (ADA), 2007 (in PopCon.org)).

[3] The information provided came from scientific papers and from papers published in public bodies' web sites such as the USDA web site.

Our paper is structured into four sections. In the next section, we describe our experimental design. In the third section, results from both the survey and the experimental auction are presented. We then draw some concluding remarks in section 4.

## 2. Experimental design

In contrast to previous studies, we designed an experiment: (1) to analyze the main determinants of consumers' WTP for organic milk using multi-unit Vickrey auction and (2) to investigate the sensitivity of WTP values to different types of information about organic farming (i.e., positive, negative, and both). To recruit participants, we contracted a company with experience in carrying out market studies and sensory analysis. This company randomly selected the participants from a list of people who were responsible for food shopping in their household, using a quota system to guarantee that the sample represented the appropriate population age distribution. In total, 80 subjects participated in the experiment without having prior information on the objective of the study, the product studied and the conditions of our study. Table 2 shows the socio-demographic and economic characteristics of participants in the experiment. Participants were randomly distributed among four treatments, as shown in Table 3. We conducted a total of 8 sessions with 10 participants per session.

The auctioned product was "six-pack" (i.e. six identical items in the same package) of organic milk. Each unit contains one liter of organic milk. "Six-pack" is the packaging form popularly used in Spain for products such as soda, juice, water, beer, and milk, which are products that consumers are used to buying in multiple units in the same shopping trip. While a "six-pack" consists of 6 identical units of the same product together in a bundle, consumers in retail stores are not forced to buy the entire bundle – that is they can purchase less than 6 units by just opening the package and take the number of units they want to buy. This handling flexibility makes the product available to all consumer types (regular and occasional buyers)[4]. Since the fat content of milk can affect consumer's preference, we used semi-skimmed organic milk which is more likely to

[4] Otherwise, only consumers who need to buy the entire bundle will be able to purchase the product and, as a result, sellers can incur losses by ignoring buyers of few units.

be accepted by either whole or skimmed milk consumers[5]. In our sample, 62%, 45% and 24% of the participants declared being consumer of semi-skimmed milk, whole milk and skimmed milk, respectively. Finally, it is important to note that Spanish milk is Ultra Pasteurized (using UHT method) which extends its shelf life and allows the milk to be stored unrefrigerated because of the longer lasting sterilization effect. The experiment was performed in a room equipped with ten computers. We used the z-tree software (Fischbacher, 2007) to collect bids and to determine the winner and the clearing price. The participants also had to complete a questionnaire on various aspects related to organic products, in general, and organic milk, in particular.

We carried out the experiment in four steps. In step 1, each subject sat in a table separated from the rest to minimize any possible interactions and allow anonymous bidding. After taking a seat, each participant received an envelope which contained 15€ as compensation for their participation, his or her identification number (to be held in secret during the process) and a questionnaire. Also we endowed participants with six items of exactly the same conventional counterpart milk (same brand and same fat content)[6]. To avoid brand effects, we covered all the milk items with white paper. We then asked participants to complete the questionnaire.

In step 2, once the questionnaire was completed, the actual experiment began. One of the main determinants of success in experimental auctions is a good understanding by the participants of the operating procedures used in the auction mechanism. To achieve this goal, we gave each participant a printed material that included an explanation of how the specific auction works and some examples to illustrate the auction. After reading and discussing the instructions, participants were given the opportunity to ask questions to dissipate any doubts about the process. Given the importance of this step, we informed participants that it is very important that they fully understand the auction mechanism. We also demonstrated to them how they can lose money if they deviate from their true valuations. Finally, to permit a better understanding of the auction mechanism and a

[5] In each session and before starting the auction, we informed participants of the fat content of the milk and we asked them if anyone has any objections in bidding for semi-skimmed milk. None of the participants showed any objections. They were, however, instructed that they can bid zero if they do not want semi-skimmed milk.

[6] Lusk and Shogren (2007: 65–68) argue that if there are perfect field substitutes to products offered in the full bidding approach, then the bids for each of the products will be censored at the market price of the products and the differences in optimal bids might differ from the measure of real interest, the differences in value. As a result, they recommended the use of the endow-upgrade approach, since bids cannot be affected by such bias.

good familiarity with the software, we carried out a training session, auctioning six identical items of organic milk and informed participants that no actual economic exchange would take place at the end of the training session. In this session, we asked participants to bid the amount they are willing to pay to exchange each item of their conventional milk with a unit of organic milk. Therefore, for each unit won the winner gets a unit of organic milk to be exchanged with one of the endowed unit of conventional milk plus the amount of the clearing price. We informed the participants that the only difference between the milk they already have and the product to be auctioned was the organic attribute. Once all participants reported their bids through the computer, the computer software identify the winner(s) and the price to be paid (i.e. clearing price). To avoid the problem of bid affiliation and to carry out a clean assessment of the information effect, we did not post the clearing price after each round.

In step 3, once the participants became familiar with the procedure, we announced the start of the real auction of organic milk. Each participant had to submit, again through the computer, how much he or she was willing-to-pay more to exchange each unit of conventional milk with a unit of organic milk. The same process was repeated for three additional rounds. In step 4, we provided participants with different types of information. Depending on the treatment (i.e. four treatments and 20 subjects participated in each treatment), we provided participants with only positive information; only negative information and both types of information about organic food (see Annex 2 and 3). In the treatment that was given both the positive and negative information, these two types of information were printed using both sides of a paper and were randomly presented to the subjects. To serve as the control group, one-fourth of the participants were not given additional information. For this control group, the experiment was conducted as laid out in step 3, with a total of six rounds. In the other three cases, the additional information was provided after the 4$^{th}$ round. Hence, two more rounds were carried out after the provision of the additional information. At the end of the six rounds, one round was chosen randomly to determine the binding round. The winner(s) in the binding round was (were) appointed as the winner(s) of the auction. Once the results were announced, the experiment ended by handing the product to the winner(s) who had to pay the corresponding market-clearing price and the corresponding number of units of the

endowed milk (e.g. if the winner wins two units of organic milk, he has to give the experimenter two units of conventional milk and pay the corresponding clearing price).

## 3. Results

This section is organized into four subsections. In the first subsection, we outline some background information about our sample purchasing habits and attitudes towards organic food, in general, and organic milk, in particular. In the second subsection, we analyze consumers' WTP for multiple units of organic milk. In the third subsection, we discuss the factors affecting the WTP for each unit of organic milk. Finally, in the fourth subsection, we assess the effect of the provision of different types of information about organic foods on consumers' WTP for organic milk.

### *3.1. Sample's Purchasing Habits and Attitudes towards Organic Milk*

About 77% of our participants purchase milk once per week. 62% of participants buy semi skimmed milk and 43% of them buy milk in package of six units. In relation to organic foods, 56% of participants considered themselves to be regular or occasional buyers of organic products. Vegetables, fruits, eggs and honey are the organic foods that are purchased the most. Specialized food stores are the shopping places most frequented by organic food buyers. Only 31% of participants have purchased organic milk in the past. The main reasons provided for not buying organic milk are high price, unavailability, and lack of information on characteristics of organic milk. Finally, 66% of subjects revealed having a favorable attitude towards organic milk and 55% declared that they need more time and more information about organic milk before they could switch from purchasing conventional to organic milk.

### *3.2. Consumers' WTP for organic milk*

One of the advantages of using multi-unit Vickrey auction is that we can obtain consumers' WTP for multiple units of the good, which then allows us to construct the demand curve of the product. Figure 1 exhibits the demand curve of organic milk. As predicted by theory, we found that the average price premium consumers are willing to pay for organic milk is decreasing as the

number of units being auctioned increases. For example, our results show that consumers on average are willing to pay 62% more for the first unit, 55% more for the second unit, 50% more for the third unit, 46% more for the fourth unit, 42% more for the fifth unit and 39% more for the sixth unit[7]. This finding implies that to increase sales, food marketers could adopt price discount strategies as the number of units purchased increases. Also our results show that only 5% of participants revealed not willing to pay a price premium for any unit of organic milk. However, 9%, 13%, 8%, 4%, 6% and 55% of participants reported willing to pay a price premium for the quantities of 1 unit, 2 units, 3 units, 4 units, 5 units and 6 units of organic milk, respectively.

The analysis of the consumer surplus is also a useful tool for studying consumer behavior in a multi-unit setting. In Figure 2, the level of consumer surplus is shown by the area under the demand curve and above the market price premium. Concerning the determination of the market price premium, there was an attempt by a retailer of high quality foods in Barcelona to introduce its own brand of organic milk with a market price of 1.04€/unit. Also the manufacturer who provided the organic milk used in our experiment had the intention to sell his product at a price of 1.28€/unit. Since the auctioned units of organic milk used in our experiment were covered (therefore consumer cannot determine if the product is a retailer or private brand), we estimated the market price premium by subtracting the average price of conventional milk (0.90€) from the average of the prices of the two mentioned brands (i.e. 0.26 = ((1.04+1.28)/2 – 0.90). We can see that in average participants can benefit from purchasing a bundle of six units of the auctioned organic milk during the same shopping trip since their consumer surplus from buying these units is positive. Also, this result suggests that organic milk manufacturers could be introduced into the market in package sizes up to six units since we found that 27% of participants are willing to buy a bundle of six units of organic milk at a price premium of 0.26€/unit. In addition, basing on results from the calculation of the individual consumer surplus, other package sizes can also be considered. In fact, we found that 76%, 64%, 47%, 38% and 33% of participants are willing to buy a package of 1 unit, 2 units, 3 units, 4 units, and 5 units of organic milk, respectively (i.e., their consumer surplus is positive for these bundles).

[7] These percentages were calculated with respect to an estimated average of the prices of the different brands of conventional milk available in the market which is equal to 0.90€.

### *3.3. Factors affecting consumers' WTP for organic milk*

As mentioned in the introduction, we are also interested in analyzing the factors affecting consumers' WTP for multiple units of organic milk using multi-unit Vickrey auction. Since subjects' bids are censored at zero, we estimated six random effects Tobit models to take into account the panel nature of our data[8].

Formally, the random effect Tobit model is expressed as follows:

$$y_{irj} = \begin{cases} y^*_{irj} & si \quad y^*_{irj} > 0 \\ 0 & si \quad y^*_{irj} \leq 0 \end{cases}$$

$$y^*_{irj} = x_{irj}\beta_j + u_{ij} + \varepsilon_{irj} \qquad \forall i = 1,...N;\ r = 1,...,4;\ and\ j = 1,...,6$$

where: *j* indexes the six units auctioned in the experiment (that is, this equation is estimated six separate times, once for each of the unit of organic milk under analysis); *i* indexes cross-section units such that *i* = 1, 2, . . . , N (N is the number of participants); and *r* indexes the number of rounds (time series units) such that *r* = 1, 2, 3, 4. The matrix $X_{irj}$ is of dimension (4N x K) and contains data on the observable explanatory variables of the model for the six auctioned units *j*. $Y_{irj}$ is the price premium consumer *i* is willing to pay to exchange a unit of conventional milk with a unit *j* of organic milk. $\beta_j = \left(\beta_{j,1}...\beta_{j,k_j}\right)' \in R^{k_j}$ are vectors of parameters to estimate; The effects of relevant unobservable variables and time-invariant factors are captured by the vector $u_{ij}$. The stochastic disturbances of the model for the six auctioned units are captured by the vector $\varepsilon_{irj}$.

The dependent variables are $BID_j$, where j = 1 to 6 indexes the price premium for the jth auctioned unit. Taking into account the information obtained from the survey, the explanatory variables can be grouped into three main categories. The first category includes variables that capture purchasing and consumption habits related to organic foods, in general, and organic milk, in particular, such as frequency of purchasing and consuming organic foods, purchased quantity of milk and weekly expenditure of organic foods. We included these variables in the analysis not only to assess their effect on consumers' WTP but also to help control for some unobservable factors

[8] We used bids of the first four rounds.

such as inventory effect. The second category of explanatory variables reflects information regarding the attitudes that participants have towards various aspects related to organic milk. Several empirical studies (see Table 1) showed strong relationship between consumers' WTP for organic foods and variables such as environmental issues, health concerns, availability, trust on information sources, etc. The third category includes variables that represent the socio-demographic and economic characteristics of participants (gender, age, marital status, employment, income etc.) and their lifestyles (health, eating habits, sports etc.). The table in Annex 4 exhibits the description of the variables considered in the estimation.

In order to keep the estimated model as simple and manageable as possible, we reduced, using factor analysis (see Annex 5), the information on participants' attitudes toward organic foods (that were measured using a 17-item Likert scale shown in the first column of the Table in Annex 5) into 9 factors. These 9 factors explain 85.21% of the total information provided by the original 17 variables. The Cronbach's Alpha, a measure of the internal consistency or the average correlation of the items used in the analysis, is equal to 0.80. Each column in Annex 5 represents each of the 9 factors. Numbers in each column represent the correlation between factors and each of the original variables. Bold numbers indicate that correlations were higher than 0.6. These numbers have been used to name the few factor. For instance, from the two items: 1) organic foods are healthier for kids; and 2) organic foods are adequate for a safe diet, we constructed the second factor named HEALTHY.

Results from the estimation of the six random effect Tobit models using STATA are shown in Table 4. In general, the determinants of consumers' WTP differ from one unit to another and in cases where the effect is significant for more than one unit, the magnitude of the effects differ between units. In this section, we start by discussing the factors that positively affect consumers' WTP. We then focus on those factors that negatively affect consumers' WTP for organic milk. In both sections, we will first discuss the factors that significantly affect WTP for all units and then focus our attention on the factors that influence the WTP for specific number of units.

Our analysis differs from previous studies that used single unit experimental auctions to elicit WTP for food products since we are able to show a strong relationship between consumers'

WTP for organic milk and the number of units they want to purchase. In general, we found that the participants who declared that they were willing to buy ***n*** units were also the subjects who were willing to pay more for the $(n-i)^{th}$ unit ($i = 1,\ldots, n-1$). For example, we found that subjects who revealed their willingness to pay a premium for three, four, five or six units were willing to pay more for the second auctioned unit. However, and as expected, we did not find a significant relationship between the price premium for the $(n-i)^{th}$ unit (e.g. fourth unit) and the number of units participants were willing to pay if this number was less or equal to ***n-I*** (e.g. 2UNITS, 3UNITS and 4UNITS). In fact, our results show that, for example, subjects who were only willing to pay a price premium for the first unit and the second unit did not influence the average price premium for the second, third, fourth, fifth or the six auctioned unit of organic milk due to their lack of interest in these units[9]. In summary, our results showed that the number of units that a subject is willing to buy is a key determinant of consumer behavior in a multi-unit shopping scenario of organic milk. Hence, the higher is the number of units that a subject is willing to buy, the higher is his/her willingness to pay for the previous units.

Similar to results found in previous studies on consumers' WTP for organic food (see Table 1), we found that health issue (i.e., the variable HEALTHY) was a key factor that positively influenced consumers' WTP for organic milk. In fact, subjects who considered organic milk as healthier and more nutritious were willing to pay a higher price premium. However, this positive influence of the factor health is only significant for the last four units. Also, our results show that the interest for the animal welfare is an important determinant of consumers' WTP for organic milk. Specifically, we found that subjects who supported the idea that the production of organic milk improves the level of animal welfare were willing to pay a significant higher price premium for all the unit of organic milk except the first one. Interestingly, we also found that those who were not buyers of milk (but are consumers of milk) and those who revealed being not informed or little informed on the characteristics of organic food were also willing to pay a higher price premium for organic milk. This finding is of great interest for producers and retailers of organic food in general

[9] For this reason in model six, for example, we do not report the effect of the explanatory variables: 2UNITS…6UNITS because they are statistically insignificant and they also decreased the degree of fit of the model.

and organic milk in particular, since a successful attraction of these consumers can significantly increase the potential market of organic products. According to our results, improving the availability of organic foods in habitual shopping centers and promoting the prominence of organic food with respect to their conventional counterparts, are key actions in attracting consumers to the market of organic food. In fact, our result show that subjects who revealed being not buyers of milk and those who are little informed or not informed about organic foods' characteristics highly agreed with the following statements: 1) "organic food are not available in habitual shopping places", 2) "looking for organic food need much time", 3) "there is a lack information on organic food benefits", and 4) "there is a lack information on organic food certifications".

Our results also point out other factors that positively affect consumers' WTP for organic milk. However, their effect is only significant for some units. As can be observed in Table 4, participants who frequently buy milk (WEEKLY) were only willing to pay more for the first two units. We also found that the higher is the quantity of conventional milk (QUANTITY) that a subject is used to purchasing, the higher is his/her WTP for organic milk but this effect was only significant for the last three units. Additionally, our results indicate that participants who declared having a good health state (HEALTH) showed a higher willingness to pay. However, this variable seems to be a minor determinant of WTP for organic milk since it significantly affects the WTP for only the first, the third and the fourth unit. Interestingly, we found that the variables PRICE, ENVIRONMENT and AGE_ELDER significantly affect the willingness to pay a price premium for the first unit. In fact our results show that the higher is the price that a subject is used to paying for conventional milk, the higher is his/her willingness to pay a price premium for the first unit of organic milk. Consistent with previous studies (see Table 1), we found that participants who agreed with the statement that "the production of organic milk improves the sustainability of the environment and reduces the contamination of water and soil" reported higher price premium for the first unit of organic milk. Also our results show that elder subjects were willing to pay higher price premium for the first unit of organic milk. Unexpectedly, subjects who revealed feeling indifferent between conventional and organic foods (INDIFFERENT) reported significant higher price premium for the first three units of organic milk, perhaps, because they wanted to try the new product.

As expected, our results also suggest that subjects who claimed having lack of information on organic food benefits and certifications reported a lower WTP for organic milk. Hence, more effort by producers and retailers in promoting organic food benefits is required to increase the market potential of organic products. Interestingly, those who think that organic products have an intense taste are less willing to pay a premium for organic milk. Our results also suggest that subjects who thought of organic foods as expensive products reported a lower WTP for organic milk but the effect is only significant for the sixth unit. Finally we found that male participants were willing to pay lower price premium for the first two units of organic milk in comparison with female participants. We conclude this section by pointing out that generalizing the results for only a single unit of organic food to assess consumer behavior in multi-unit shopping scenario of organic foods can lead to incomplete and even biased conclusions. For example, if we only consider the results corresponding to the first unit, we would mistakenly conclude that the environmental issue and the price of conventional milk are the only key determinants of consumers' WTP for organic milk and that health and animal welfare issues are irrelevant factors. However, our results showed that health and animal welfare issues are key factors that influence WTP for various units of organic milk and that the price of conventional milk and the environmental factor are the key determinants of the WTP for the first unit only.

### *3.4. Sensitivity of consumers' WTP to controversial information on organic farming*

We have seen in the last section that health is one of the most important factors that positively influence consumers' WTP for organic milk. The majority of the participants in our experiment considered organic milk to be healthier and more nutritious. However, during the last few years, a number of scientific papers (e.g. Zorb et al, 2006; Dangour et al, 2009) have been published showing that there are no significant differences between organic food and their conventional counterpart in terms of safety or nutritional content. They also claim that if some differences were found, they were related to the place and the conditions of the setting in which the experiments had taken place and, therefore, conclusions could not be generalized. Since the positive attitudes that the majority of consumers have towards organic food are mainly based on

subjective perceptions (Tarkiainen and Sundqvist, 2005: and Lobb et al, 2007), we also aim in this study to analyze the effect of "non positive" information about organic food on consumers' WTP for organic milk. To tackle this issue, as mentioned above, we provided participants in our experiment with three types of information about organic farming and we analyzed the effect of this information on consumers' WTP.

In this context, we carried out two types of analysis: within subjects and between subjects. In the within-subjects analysis, since participants received the corresponding information on organic farming after the 4th round, we compared the average WTP before (first four rounds) and after (last two rounds) the provision of information. Results exhibited in Figure 3 show that while the introduction of positive information increases consumers' WTP in both mechanisms, the introduction of negative information has the opposite effect. The provision of both types of information does not seem to have an effect on the average WTP. These effects, however, are statistically weakly significant, although economically the difference can be important since the positive information on average increases the WTP by 49% while the negative information on average decreases the WTP by 18%.

To carry out the analysis between subjects, we analyzed the change in bids of subjects who received information in comparison with subjects who did not receive information (i.e., the control group). We calculated the difference between the mean of the price premium in the first four rounds and the mean of the price premium in the last two rounds for all subjects. Then using dummy variables for the different groups, we assessed the effect of providing controversial information. To carry out this analysis, we estimated six Tobit models (i.e., a Tobit model for each auctioned unit of organic milk). We specified the six Tobit models as follows (Amemiya, 1984):

$$y_{ij} = \begin{cases} y_{ij}^* & si \quad y_{ij}^* > 0 \\ 0 & si \quad y_{ij}^* \leq 0 \end{cases}$$

$$y_{ij}^* = x_{ij}\beta_j + \varepsilon_{ij} \qquad \forall i = 1,...N \ and \ j = 1,...,6$$

where: *j* indexes the jth auctioned unit in the experiment (that is, this equation is estimated six separate times, once for each of the unit of organic milk under analysis) and *i* indexes cross-

section units such that $i$ = 1, 2, ..., N (N is the number of participants). The matrix $X_{ij}$ is of dimension (N x K) and contains data on the observable explanatory variables of the model for the six auctioned units. $Y_{ij}$ is the difference between the mean of the price premium in the first four rounds and the mean of the price premium in the two last rounds. $\beta_j = \left(\beta_{j,1} \ldots \beta_{j,k_j}\right)' \in R^{k_j}$ are vectors of parameters to estimate. $\varepsilon_{ij}$ capture the stochastic disturbances of the model for the six auctioned units. Results are shown in Table 5.

As expected, we found that provision of positive information increases the price premium participants are willing to pay to exchange the conventional milk with the organic milk. Conversely, provision of negative information decreases participants' WTP for organic milk. Finally, consistent with the results we found in the within-subjects analysis, the WTP of participants who received both types of information and the WTP of participants who did not receive any type of information are not significantly different from each other.

## 4. Conclusions

Food consumption habits and lifestyles of consumers around the world are changing. Their interest in and knowledge about health and nutrition is growing and this is reflected by the increasing demand for food quality. At the same time, with increasing opportunity cost of time, people are busier which increases the incentive to optimize food shopping or limit the number of trips to food stores by purchasing multiple units of products. In this paper, we analyzed consumers' WTP for organic milk. Unlike previous studies, however, we examined consumers' WTP for organic milk using multi-unit auction instead of the commonly used single-unit auction. With multi-unit auction, we were then able to estimate the demand curve, the consumer surplus, the potential market and the determinants of consumers' WTP for various units of organic milk. In addition, in this paper, we also examined the effect of different types of information (positive, negative, both) on WTP for organic milk.

Our results suggest that consumers are willing to pay a premium for organic milk. However, their WTP can differ with the number of units purchased. The factors that significantly influence WTP can also differ with the number of units purchased. In fact, our results, using multi-

unit auction, showed that parameters such as consumers' WTP and the magnitude of the effects of the factors that influence WTP can differ depending on the quantity purchased. Specifically, our results indicate that 97%, 87%, 76%, 64%, 59% and 58% of subjects are willing to pay a premium for the first, the second, the third, the fourth, the fifth and the sixth unit of organic milk, respectively. Results also suggest that health issues, animal welfare, taste and lack of information on organic food benefits are key factors that influence WTP for organic milk. Another interesting finding of our research is the sensitivity of consumers' WTP to the nature of information they received. We found that subjects' WTP responds positively to positive information about organic farming and responds negatively to negative information. Interestingly, WTP does not seem to be affected when both types of information are provided. Hence, these results imply that propagation of negative information can dramatically affect consumer preferences toward organic products and can slow down the growth of the organic product market. However, our results also suggest that negative information can be neutralized by positive information about organic farming.

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**Table 1:** Factors affecting WTP for organic food in previous studies

| Authors | Country | Purchase motivations of organic food | Purchase disincentives of organic food |
|---|---|---|---|
| Magnusson et al (2001) | Sweden | Better taste<br>Better for the health<br>Better aspect<br>Freshness<br>Better aspect | Price (expensive)<br>Unavailability of organic food in habitual shopping area |
| Soler et al (2002) | Spain | Better for the environment<br>More healthy<br>More nutritious<br>High reference prices of conventional food | Price (expensive) |
| Fotopoulos and Krystallis (2002) | Greece | More healthy<br>Better quality<br>High education<br>High income<br>Place of residence (near from the production area) | Low availability<br>Expensive |
| O'Donovan and McCarthy (2002) | Ireland | Better for the environment<br>More healthy<br>Better quality<br>High socio-economic level | High price of organic food<br>Low availability |
| Makatouni (2002) | UK | Organic food are healthier<br>Better for the environment<br>High level of animal welfare | |
| Chen (2007) | Taiwan | Environment protection<br>Animal welfare<br>Health<br>Political values<br>Natural content<br>Family and friends (if they prefer organic food) | Convenience |
| Roitner-Schbesberger et al (2007) | Thailand | Health concerns<br>Environmental concerns<br>High income<br>High educational level | Lack of knowledge/information<br>Confusion with other safe product label<br>Competitiveness with other safe product<br>Expensive<br>Luck of trust in the label<br>Luck of availability |
| Onyango et al (2007) | USA | Food naturalness<br>Vegetarian-vegan identity<br>Preference for US production<br>Female<br>Young<br>Moderately religious<br>High level of education | Food familiarity (consumer prefers familiar brand) |

**Table 2:** Sample socio-demographic and economic characteristics

| Variables | Categories | Percentage Sample |
|---|---|---|
| Gender | Female | 61 |
| | Male | 39 |
| Age | 18 – 34 years old | 24 |
| | 35 – 49 years old | 46 |
| | 50 – 66 years old | 30 |
| Marital status | Single | 61 |
| | Married or has children | 39 |
| Education | High education | 12 |
| | Medium education | 56 |
| | Low education | 32 |
| Family income | < 1500€ | 21 |
| | 1501€ – 2500€ | 45 |
| | 2501€ – 4000€ | 26 |
| | > 4000€ | 08 |

**Table 3:** Experimental design

| Treatments | Number of sessions | Participants by session | Total number of participants |
|---|---|---|---|
| Positive information | 2 | 10 | 20 |
| Negative information | 2 | 10 | 20 |
| Both types of information | 2 | 10 | 20 |
| Without information | 2 | 10 | 20 |

**Table 4**: Results from random effect Tobit model for panel data

| VARIABLES | UNIT1 | UNIT2 | UNIT3 | UNIT4 | UNIT5 | UNIT6 |
|---|---|---|---|---|---|---|
| CONSTANT | -0.747** | -0.550 | -1.180*** | -1.049*** | -0.858*** | -0.674 |
| ROUND2 | 0.005 | 0.010 | 0.008 | -0.006 | 0.006 | -0.021 |
| ROUND3 | 0.027 | 0.029 | 0.020 | 0.031 | 0.029 | -0.008 |
| ROUND4 | 0.051** | 0.065*** | 0.054** | 0.046** | 0.058*** | 0.024 |
| 2UNITS | 0.203*** | - | - | - | - | - |
| 3UNITS | 0.383*** | 0.324*** | - | - | - | - |
| 4UNITS | 0.311*** | 0.250*** | 0.239*** | - | - | - |
| 5UNITS | 0.333*** | 0.273*** | 0.310*** | 0.270*** | - | - |
| 6UNITS | 0.272*** | 0.286*** | 0.384*** | 0.383*** | 0.370*** | - |
| WEEKLY | 0.350*** | 0.559*** | 0.152 | 0.033 | -0.026 | -0.138 |
| NOBUY | 1.278*** | 1.563*** | 1.194*** | 1.028*** | 0.931*** | 1.046*** |
| QUANTITY | 0.004 | 0.005 | 0.005 | 0.008** | 0.008*** | 0.008* |
| PRICE | 0.360*** | -0.018 | -0.062 | 0.039 | 0.025 | -0.100 |
| EXPENDITURE | -0.001** | -0.001 | 0.000 | 0.000 | 0.000 | 0.002 |
| LITTLE_INFORMED | 0.119 | 0.253*** | 0.144 | 0.272*** | 0.250*** | 0.117 |
| NOT_INFORMED | 0.227 | 0.431*** | 0.466*** | 0.479*** | 0.536*** | 0.407* |
| NEVER | -0.076 | -0.142 | 0.442** | 0.264 | 0.187 | 0.360 |
| OCCASIONALLY | -0.155 | -0.148 | 0.335* | 0.065 | 0.074 | 0.159 |
| M_LITTLEINFORMED | 0.145 | 0.003 | 0.196** | 0.092 | 0.084 | 0.024 |
| INDIFFERENT | 0.283*** | 0.226** | 0.211** | 0.102 | 0.124 | 0.075 |
| GENDER | -0.167** | -0.195** | 0.005 | -0.043 | 0.020 | 0.003 |
| AGE_ELDER | 0.203** | -0.025 | 0.077 | 0.148 | 0.101 | 0.208 |
| HOUSEHOLD | 0.074 | 0.067 | -0.091 | -0.140 | -0.187** | -0.105 |
| HEALTH | 0.335*** | 0.099 | 0.266** | 0.242** | 0.153 | 0.090 |
| HIGH_EDU | 0.059 | 0.162 | 0.223*** | 0.083 | 0.053 | 0.171 |
| MED_INC | 0.022 | 0.074 | -0.053 | -0.067 | -0.152 | -0.187 |
| HIGH_INC | -0.399*** | -0.404*** | -0.097 | -0.059 | -0.061 | -0.281 |
| ENVIRONMENT | 0.085* | 0.005 | -0.057 | -0.038 | -0.025 | -0.069 |
| HEALTHY | 0.049 | 0.048 | 0.133*** | 0.186*** | 0.173*** | 0.237*** |
| NO_INFORMATION | -0.139*** | -0.191*** | -0.122*** | -0.107*** | -0.098** | -0.124** |
| UNAVAILABLE | -0.086** | -0.093** | -0.018 | 0.016 | 0.028 | -0.020 |
| EXPENSIVE | 0.001 | -0.036 | 0.004 | -0.035 | -0.030 | -0.110** |
| CERTIFICATION | 0.024 | 0.082** | 0.058 | 0.004 | 0.000 | 0.079* |
| CONFUSION | 0.037 | 0.047 | -0.016 | 0.006 | -0.012 | -0.043 |
| WELFARE | 0.025 | 0.082** | 0.104*** | 0.112*** | 0.119*** | 0.114** |
| TASTE | -0.119*** | -0.147*** | -0.154*** | -0.164*** | -0.136*** | -0.163*** |
| Loglik | 47.25 | 78.23 | 39.73 | 55.44 | 52.30 | 16.95 |
| Wald Chi2 | 122.16 | 131.83 | 172.50 | 206.17 | 185.50 | 83.61 |
| Prob > Chi2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

*** (**) (*) Statistically significant at 1% (5%) (10%) level

**Table 5:** Results from the estimation of Tobit models (information effect)

| VARIABLES | UNIT1 | UNIT2 | UNIT3 | UNIT4 | UNIT5 | UNIT6 |
|---|---|---|---|---|---|---|
| **Constant** | .104 | .128 | .569* | .543 | .152 | .279 |
| **Quantity** | .006* | .007 | .001 | -.001 | -.000 | -.003 |
| **Price** | -.275 | -.399* | -.693** | -.795** | -.437 | -.483 |
| **Income** | .240** | .319** | .380** | .384* | .312 | .284 |
| **Positive information** | **.176**** | **.531***** | **.402***** | **.365***** | **.267*** | .212 |
| **Negative information** | **-.211**** | **-.250*** | **-.385**** | **-.369**** | **-.469**** | **-.497**** |
| **Pos_Neg information** | -.116 | .085 | -.069 | -.032 | .044 | -.070 |
| **Pseudo R2** | .31 | .41 | .32 | .23 | .18 | .17 |

*** (**) (*) Statistically significant at 1% (5%) (10%) level

**Figure 1:** Price premium for multiple units of organic milk

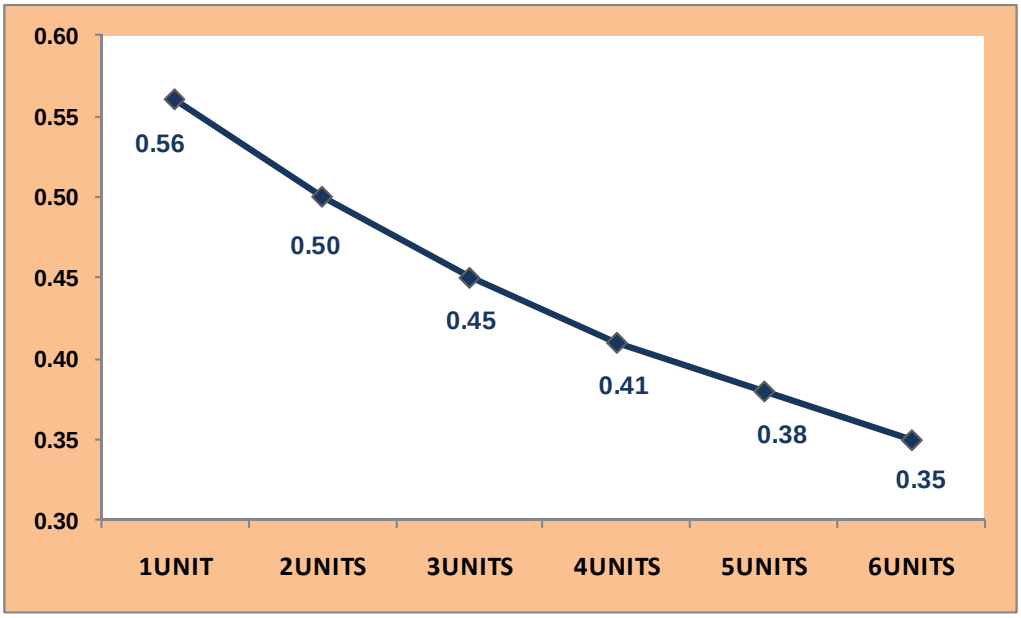


**Figure 2:** Consumer surplus

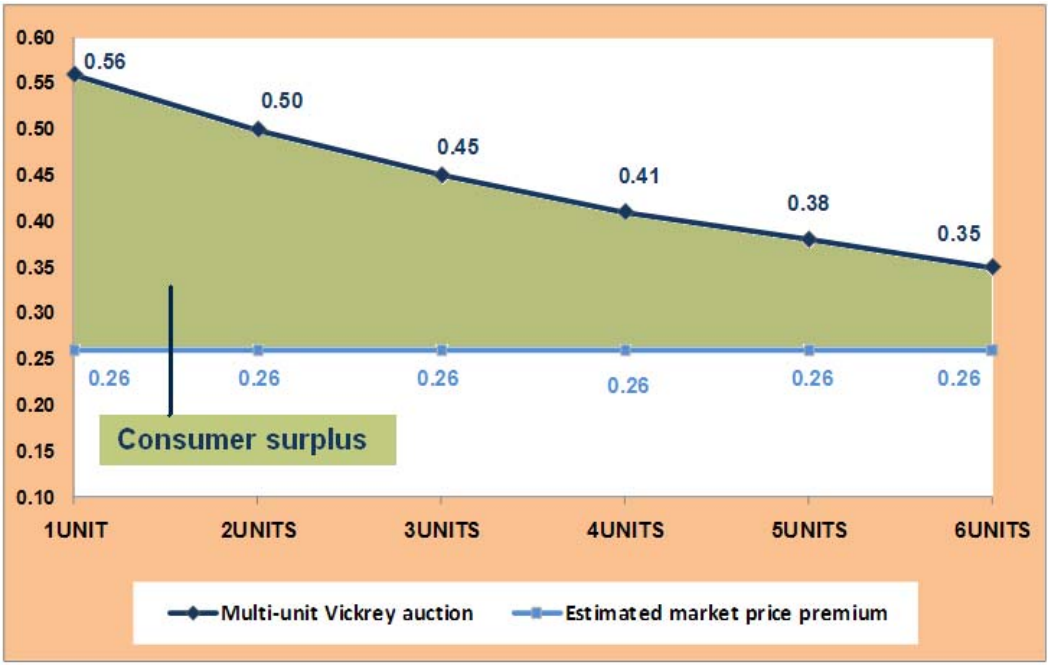
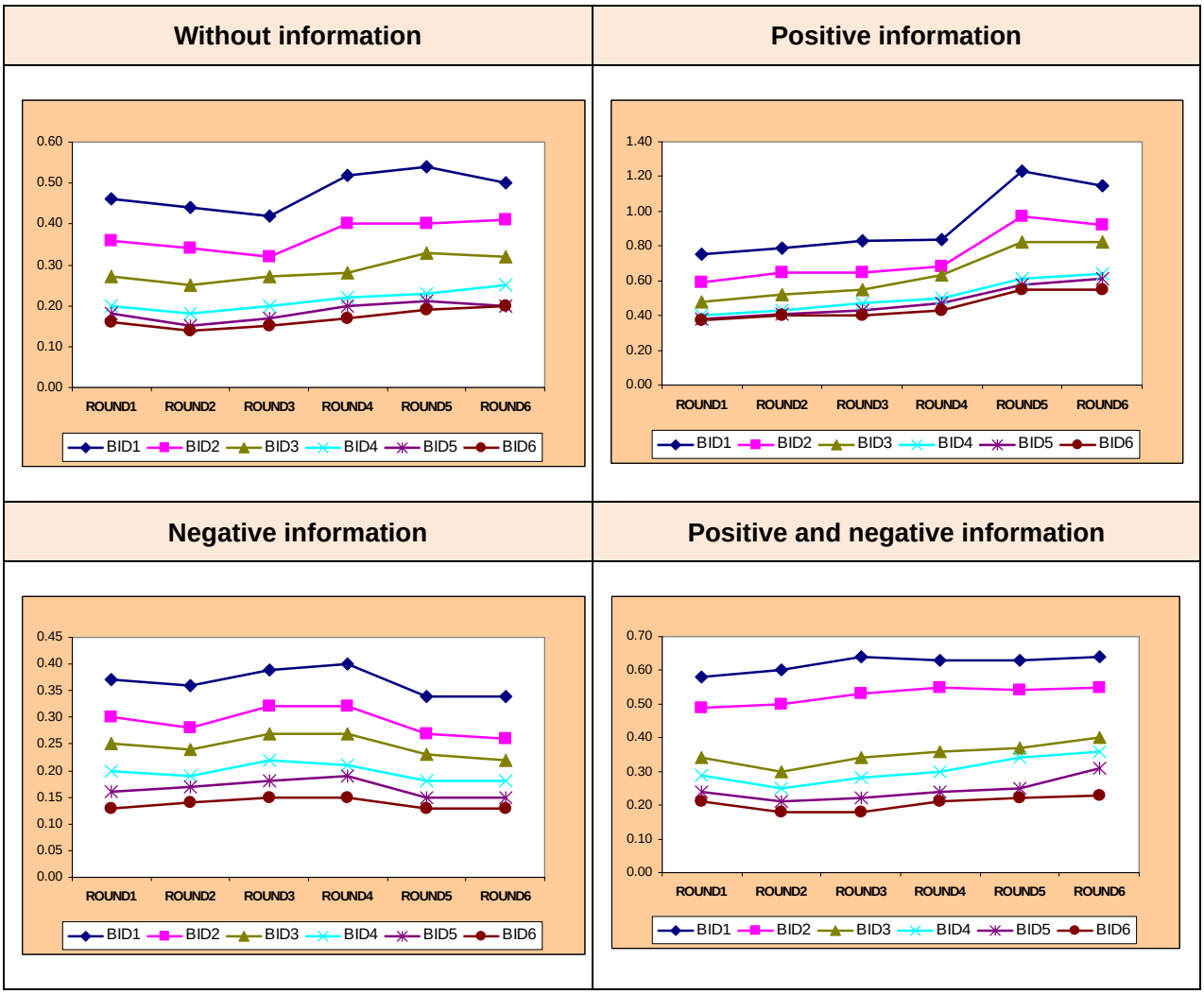


**Figure 3:** The effect of providing information on the price premium consumer is willing to pay



## **Annex 1:** Pricing rule of the multi-unit Vickrey auction

As an example, if we ask a group of 10 participants to report their WTP for each one of six auctioned units of the same product, we can collect 60 bids which will be ranked and the six highest bidders are the winners. The winner pays an amount corresponding to the sum of the bids (excluding his or her own bids) that are displaced by his or her successful bids.

**Example 1:** if the bids are ranked from highest to lowest as follows:

1 A1€ (first bid from bidder A)
2 B1€ (first bid from bidder B)
3 B2€ (second bid from bidder B)
4 C1€ (first bid from bidder C)
5 J1€ (first bid from bidder J)
6 D1€ (first bid from bidder D)
7 H1€ (first bid from bidder H)
8 F1€ (first bid from bidder F)
.
.
59 E4€ (fourth bid from bidder E)
60 G4€ (fourth bid from bidder G)

- Bidder A wins one unit and pays ***H1€***. Bidder B wins two units and pays ***H1€*** for the first unit won and ***F1€*** for the second unit won. Bidders C, J and D each one wins one unit and pays a price equal to ***H1€***.

**Example 2:** if the bids are ranked from highest to lowest as follows:

1 C1€ (first bid from bidder C)
2 F1€ (first bid from bidder F)
3 C2€ (second bid from bidder C)
4 C3€ (third bid from bidder C)
5 F2€ (second bid from bidder F)
6 G1€ (first bid from bidder G)
7 C4€ (fourth bid from bidder C)
8 B1€ (first bid from bidder B)
9 E1€ (first bid from bidder E)
10 I1€ (first bid from bidder I)
.
.
59 B3€ (third bid from bidder B)
60 D4€ (fourth bid from bidder D)

- Bidder C wins three units and pays B1€ for the first unit, E1€ for the second unit and I1€ for the third unit. Bidder F wins two units and pays ***C4€*** for the first unit and ***B1€*** for the second unit. Bidder G wins one unit and pays a price equal to ***C4€***

**Annex 2:** Positive information on organic food provided to subjects

- "Organic farming can be defined easily as a compendium of agricultural techniques that would normally exclude the use in agriculture of synthetic chemicals such as fertilizers, pesticides and antibiotics, in order to preserve the environment, maintain or increase soil fertility and provide foods with all its natural properties."

Spanish Ministry of Environment and Agriculture, 2009

- "Organic milk comes from cows, sheep and goats living in a welfare-oriented animal husbandry: outdoors in summer with access to pasture and indoors in winter when the climate is rough, with organic forage and regular exercise".

European Commission: Agriculture and Rural Development, 2009

- Organic milk contains 60% more of omega-3s (which help to fight serious heart and arthritis problems) and 30% more beta carotene (which reduces the chance of heart attacks and increases the efficiency of the immune system).

Butler et al (2008) – Journal of the science of food and agriculture

- The review of 29 scientific studies shows that organic foods are superior in terms of food security and nutritional content than conventional foods.

Heaton, 2001 – Soil Association - UK

**Annex 3:** negative information on organic food provided to subjects

- *"USDA makes no claims that organically produced food is safer or more nutritious than conventionally produced food. Organic food differs from conventionally produced food in the way it is grown, handled, and processed."*

United States Department of Agriculture (USDA), 2007 (in ProCon.org)

- Because of its low productivity level, organic products are incapable of feeding the world population in general and the populations of poor countries, in particular, as presented as alternative to conventional products.

Carlisle, 2000 - National Center for Public Policy Research- USA

- "Under the new regulation of the European commission of agriculture and rural development, organic foods can contain up to 0.9% genetically modified material"

European Commission of Agriculture and Rural Development, 2007

- Organic farming practices are inadequate to control soil erosion because organic farmers cannot use modern conservation tillage techniques that have been extraordinarily successful in reducing soil erosion.

Trimble, 1999 - University of California

**Annex 4:** The independent variables used in the estimation

| Label of independent Variables | Name | Description |
|---|---|---|
| First round | **ROUND1** | Dummy variable that takes the value 1 if the round is the first one; and 0 otherwise |
| Second round | **ROUND2** | Dummy variable that takes the value 1 if the round is the second one; and 0 otherwise |
| Third round | **ROUND3** | Dummy variable that takes the value 1 if the round is the third one; and 0 otherwise |
| Fourth round | **ROUND4** | Dummy variable that takes the value 1 if the round is the fourth one; and 0 otherwise |
| Buyer of 2 units | **2UNITS** | Dummy variable that takes the value 1 if participant gave positive price premium only for two units; and 0 otherwise |
| Buyers of 3 units | **3UNITS** | Dummy variable that takes the value 1 if participant gave positive price premium only for three units; and 0 otherwise |
| Buyers of 4 units | **4UNITS** | Dummy variable that takes the value 1 if participant gave positive price premium only for four units; and 0 otherwise |
| Buyers of 5 units | **5UNITS** | Dummy variable that takes the value 1 if participant gave positive price premium only for five units; and 0 otherwise |
| Buyers of 6 units | **6UNITS** | Dummy variable that takes the value 1 if participant gave positive price premium for all the six units; and 0 otherwise |
| Purchase frequency of conventional milk | **WEEKLY** | Dummy variable that takes the value 1 if the participant purchases milk weekly; and 0 otherwise |
| Purchase frequency of conventional milk | **NOBUY** | Dummy variable that takes the value 1 if the participant has never purchased milk; and 0 otherwise |
| Quantity of conventional milk purchased /month | **QUANTITY** | Continuous variable: quantity of milk purchased by month |
| Price of conventional milk | **PRICE** | Continuous variable: the price at which participant used to buying one liter of conventional milk |
| Expenditure in foods | **EXPENDITURE** | Continuous variable: the household expenditure in buying food products by week |
| Information level on organic foods | **LITTLE_INFORMED** | Dummy variable that takes the value 1 if the participant is little informed on organic foods; and 0 otherwise |
| Information level on organic foods | **NOT_INFORMED** | Dummy variable that takes the value 1 if the participant is not informed on organic foods; and 0 otherwise |
| Purchase frequency of organic foods | **NEVER** | Dummy variable that takes the value 1 if the participant is not a buyer of organic foods; and 0 otherwise |
| Purchase frequency of organic Foods | **OCCASIONALLY** | Dummy variable that takes the value 1 if the participant is occasional buyer of organic foods; and 0 otherwise |
| Information level on organic milk | **M_LITTLEINFORMED** | Dummy variable that takes the value 1 if the participant is little informed on organic milk; and 0 otherwise |
| Attitudes toward organic foods | **INDIFFERENT** | Dummy variable that takes the value 1 if the participant is indifferent between conventional and organic food; and 0 otherwise |
| Gender | **GENDER** | Dummy variable that takes the value 1 if the participant is male; and 0 otherwise |
| Age | **AGE_ELDER** | Dummy variable that takes the value 1 if the age of participant is greater than or equal to 50 years; and 0 otherwise |
| Large family | **HOUSEHOLD** | Dummy variable that takes the value 1 if the participant lives in a family of more than four members; and 0 otherwise. |
| Subjects' health | **HEALTH** | Dummy variable that takes the value 1 if the participant declares having a good health; and 0 otherwise. |

**Annex 4 (continue):** The independent variables used in the estimation (continued)

| Label of independent Variables | Name | Description |
|---|---|---|
| Education level | **HIGH_EDU** | Dummy variable that takes the value 1 if the participant has a high education level; and 0 otherwise. |
| medium income | **MED_INC** | Dummy variable that takes the value 1 if the household's income is between 1501 and 2500€/month; and 0 otherwise |
| High income | **HIGH_INC** | Dummy variable that takes the value 1 if the household's income is more than 4000€/month; and 0 otherwise |
| Organic farming conserves the environment | **ENVIRONMENT** | Continuous variable. Factor analysis carried out on a 17-item Likert scale to measure participants' attitudes to organic food |
| Organic foods are healthy | **HEALTHY** | Continuous variable. Factor analysis carried out on a 17-item Likert scale to measure participants' attitudes to organic food |
| Lack of information on organic food | **NO_INFORMATION** | Continuous variable. Factor analysis carried out on a 17-item Likert scale to measure participants' attitudes to organic food |
| Unavailability of organic foods | **UNAVAILABLE** | Continuous variable. Factor analysis carried out on a 17-item Likert scale to measure participants' attitudes to organic food |
| Organic foods are expensive | **EXPENSIVE** | Continuous variable. Factor analysis carried out on a 17-item Likert scale to measure participants' attitudes to organic food |
| Certified organic foods are trustworthy | **CERTIFICATION** | Continuous variable. Factor analysis carried out on a 17-item Likert scale to measure participants' attitudes to organic food |
| Confusion between organic and conventional foods' labels | **CONFUSION** | Continuous variable. Factor analysis carried out on a 17-item Likert scale to measure participants' attitudes to organic food |
| Producing organic milk improves the animal welfare | **WELFARE** | Continuous variable. Factor analysis carried out on a 17-item Likert scale to measure participants' attitudes to organic food |
| Organic milk has an intense taste | **TASTE** | Continuous variable. Factor analysis carried out on a 17-item Likert scale to measure participants' attitudes to organic food |

**Annex 5:** Results from factor analysis on consumers' attitudes towards organic foods

| ITEMS | ENVIRONMENT | HEALTHY | NO_INFORMATION | UNAVAILABLE | EXPENSIVE | CERTIFICATION | CONFUSION | WELFARE | TASTE | Communalities |
|---|---|---|---|---|---|---|---|---|---|---|
| OF (Organic Foods) are healthier for kids | .149 | **.873** | .082 | .080 | .087 | .191 | .067 | .227 | -.093 | .906 |
| OF are adequate for a safe diet | .267 | **.853** | .039 | -.011 | .167 | .158 | .025 | .036 | -.084 | .862 |
| OF reduce the contamination of water and soil | **.930** | .121 | -.082 | .065 | .016 | .182 | .080 | -.048 | .019 | .932 |
| OF improve the sustainability of the environment | **.927** | .235 | -.053 | .065 | -.006 | .140 | .021 | .036 | -.051 | .946 |
| Organic milk production requires a high level of animal welfare | .100 | .130 | .036 | .071 | .093 | .357 | -.069 | **.586** | -.549 | .819 |
| Organic milk production prohibits the used synthetic hormones | -.039 | .157 | .036 | -.076 | -.023 | -.020 | -.042 | **.920** | .080 | .889 |
| I trust in organic milk because It has an organic food certification | .066 | .400 | -.058 | .046 | .142 | **.814** | -.064 | -.017 | .022 | .856 |
| I trust in organic milk because It is certified by public organisms | .377 | .034 | -.145 | .055 | .060 | **.795** | .048 | .094 | .040 | .816 |
| OF are expensive | .049 | .129 | .046 | .200 | **.873** | .123 | -.058 | .005 | .001 | .842 |
| The difference between conventional and organic foods in terms of price is exaggerated | -.011 | -.055 | .018 | .035 | **.925** | .030 | .132 | -.043 | -.041 | .882 |
| OF are not available in habitual shopping places | .097 | .140 | -.033 | **.826** | .239 | .148 | .110 | .007 | .296 | .892 |
| Looking for OF need much time | .059 | -.025 | .063 | **.887** | .208 | -.030 | .183 | -.071 | .000 | .877 |
| I confuse different label of organic milk | .060 | .024 | .100 | .045 | .106 | .065 | **.845** | .044 | .253 | .811 |
| I confuse organic and functional milk | .045 | .086 | .132 | .250 | -.025 | -.067 | **.792** | -.115 | -.011 | .735 |
| There is a lack of information on organic food benefits | -.052 | .106 | **.961** | .003 | .001 | -.029 | .022 | -.012 | .017 | .940 |
| There is a lack of information on organic food certifications | -.088 | -.006 | **.902** | .050 | .116 | -.136 | .212 | .072 | .092 | .914 |
| The taste of organic milk is intense | -.004 | -.131 | .131 | .288 | .080 | .121 | .231 | .075 | **.779** | .805 |
| Eigen value | 2.007 | 2.113 | 1.848 | 1.877 | 2.545 | 1.640 | 1.677 | 1.300 | 1.183 | |
| Variance (%) | 10.564 | 11.121 | 9.726 | 9.878 | 13.393 | 8.632 | 8.827 | 6.844 | 6.226 | |
| Cumulative variance (%) | 10.564 | 21.69 | 31.41 | 41.29 | 54.68 | 63.31 | 72.14 | 78.98 | **85.21** | |
| Cronbach's Alpha | **.80** | | | | | | | | | |
| Kaiser-Meyer-Oklin | **.65** | | | | | | | | | |
| Bartlett's test (significance) | **.00** | | | | | | | | | |