Does taste beat food safety?

Evidence from the "Pêra Rocha" case in Portugal

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Summary

Until recently, fresh fruits such as pears were provided to markets as generic products. However, these products are now differentiated by cultivars, origins and appearances, as well as by companies' production and processing methods. Therefore, we observe a lot of denominations of origin, retailers' and private labels in order to signal the differentiation to the consumers, who are often willing to pay large price premiums for products with specific attributes.

Indeed the value consumers put on fruits depends on the degree of product-information that are available to them and this information derives mainly from tasting and from the label of the products. In this paper, we used an experimental auction to investigate how quality attributes information affects consumers' willingness to pay for different types of pears, particularly choosing the Portuguese "Rocha" pear variety. The BDM auction mechanism was combined with sensory analyses in order to develop an integrated approach to evaluate product attributes.

The main results show that information on the products' characteristics related to food safety instantly influences consumers' willingness to pay. However, it appears that sensory intrinsic attributes related to taste finally beats the guarantee of food safety in driving the buying behaviour.

KEYWORDS: Experimental auction, Willingness to pay, Quality signals, Food safety, Fruits.

1. Introduction

The European fruit and vegetable sector has experienced important changes during the last years. Producers have had to meet the challenges of global competition within the European market and of the strong concentration process in retailing. Consequently, these products are now differentiated by cultivars, origins and appearances, as well as by companies' production and processing methods. Therefore, we observe a lot of denominations of origin, retailer labels or private brands in order to signal the differentiation to the consumers who are often willing to pay large price premiums for products with specific attributes.

In this paper, we use a protocol based on an experimental auction in order to improve the understanding of how different attributes of fruits can interact and affect consumers' willingness-to-pay (WTP). Taking the example of the pear industry in Portugal, we apply this protocol to both non-certified and certified products. For this last category of products, our aim is to show the role of two kinds of "labels" in order to transmit the information on attributes to consumers: (*i)* a collective label with a denomination of origin (namely the "Rocha do Oeste" pear) and (*ii)* a premium retail label (namely the well known "Fileira Qualidade Carrefour", Carrefour's Quality Lines). The main result we obtain is that "food safety" is an important issue for these certifications, but it cannot outperform sensory attributes, because consumers are not ready to compromise on taste.

The purpose of our experiment is to improve the assessment of the relative influences of different attributes on the consumers' WTP for a product. Following the typology of Nelson (1970), and Darby and Karny (1973), our aim is to compare the relative influences of search attributes (which are directly observable, like "appearance" of pears for example), experience attributes ("taste" for example, which is usually unknown before consumption) and credence attributes (for example "food safety", which cannot be evaluated directly by consumers).

Following Caswell *et al.* (2002), the three main attributes of "appearance", "taste", and "food safety" that we consider in our experiment are "intrinsic" attributes, related to the physical characteristics of the product. However, in the food area, there are a lot of extrinsic cues which are searchable and closely related to the marketing and differentiation strategies of the producers. According to Caswell *et al.* (1992) and Grunert (2005) information in the form of labels could contribute to the comprehensiveness and accuracy of consumers' evaluation of search, experience and credence attributes.

In the case of credence attributes, extrinsic cues have an important role to inform the consumers who can "believe" or "give credence" to the signals without being able directly to test or verify the credence quality itself. Then, consumers have a tendency to rely on simple indicators such as brand name, retailer reputation, and labelling in their evaluations. For example, an eco-label is a credible label that identifies environmentally preferable products based on an environmental impact assessment of the product compared to other products in the same category. Consumers are generally unable to measure quality attributes such as the impact of production practices on environment but they may make inferences about these attributes from extrinsic quality indicators and cues as brand names.

In this context, research on country-of-origin effects has established that consumers may use origin information as a quality cue (Stefani *et al*., 2006). Certification of origin can also carry information on health and safety issues, namely if they certify the so-called "Integrated Pest Management". In this way, certification of origin can act as a private brand in order to differentiate products by enlarging product attractiveness, assuring the consumer simultaneously on more than one attribute. This is the reason why we compare the effectiveness of a certification of origin to a retailer's label in their respective abilities to carry information on a selection of attributes in the pear sector. We show however that both labels neglect a very important certification which is rarely used in the fruit sector, namely a ripeness certification ("fully ripe" for example) which could provide a taste guarantee to consumers.

The paper is organized as follows. The next section presents the reasons for using the WTP approach to measure consumer preferences. Then we describes the experimental design and present empirical findings, specifically the results in terms of WTP. The concluding section discusses implications of the empirical findings.

2. Background on WTP for quality attributes

Recent studies find that consumers are willing to pay for different quality attributes and for information about them. The WTP approach is, therefore, concerned with measuring *ex ante* valuations, that is, valuations at the moment choices are made. Researchers measure WTP also from actual market transactions, and from a variety of stated and revealed preferences methods.

A common feature in WTP studies is the use of various types of contingent valuation methodologies to elicit WTP, including surveys, choice experiments (conjoint analysis), and experimental markets.

Stated preferences studies like stated choice surveys use new or non-existent product attributes and asked consumers to make choices in a sequence of choices scenarios. The values of different attributes are estimated by varying the product attributes between the choice scenarios.

Studies that measure consumer preferences in terms of their WTP for different attributes and that are based on real choices and costs are denominated revealed preference methods.
Experimental markets (EM) are well-known category of revealed preference methods that are characterised by the use of real economic incentives. Methods with this feature are called incentive-compatible methods for eliciting willingness to pay (Alfnes *et al*, 2006).
EM give the opportunity to control the type and timing of information provided to participants and observe changes in bidding behaviour (Shogren *et al*, 1999). A lot of research studies have used EM to assess consumers' WTP for different quality attributes. Examples of EM studies that evaluate search quality attributes are the research of Melton *et al.* (1996) that analysed WTP for fresh pork shops and concluded that attributes like appearance affect WTP. Also, the study of Lange *et al.* (2002) that used EM to reveal the WTP for Champagnes presented with different external information. Recently, Lund *et al.* (2006) analysed the monetary value consumers put on freshness of apples and they used EM. Others researchers have measured monetary values of experience quality attributes. Lusk *et al.* (2001) used an experimental auction to investigate how variance in beef tenderness affects consumers' valuations. As well, Umberger, *et al.* (2004) used an experimental auction to determine consumer WTP for beef flavour.
Experimental markets have become an increasingly popular tool for evaluating consumer preferences for credence attributes since the nineties (Fox *et al*, 1995; Hayes *et al*, 1995; Rozan *et al*, 2004; Hobbs *et al*, 2006). Credence quality attributes, like food safety have been valuated using the revealed preference approach. Food safety can be treated as a dimension of quality (Hooker *et al.*, 1995) where safety attributes are categorised as a subset of quality attributes that including foodborne pathogens, heavy metals, pesticide residues, food additives and veterinary residues. Measuring WTP for safety attributes has been an important issue in agricultural economics and the different food safety attributes have led to an important range of WTP analysis.
In early empirical studies on food safety, WTP was frequently valuated by means of contingent valuation (CV) surveys. Some of them have focused on risk reductions from pesticides in food (Buzby *et al*., 1998), others on risk reduction from pathogen like *Salmonella* (Henson, 1996). However, Shogren (1993) argued that survey methods like CV are not a real market discipline because they don't create an environment conducting to accurate and reliable responses. Also, a few authors considered that CV of food safety overcomes the information problem by providing objective assessments of health risk.
Others researchers employed choice experiment to calculate WTP for several food safety attributes. Enneking (2004) used this method to analyse the impact of food safety label applied to brand products. He concluded that WTP estimates vary considerably across food labels and quality labelling influences consumer choice behaviour. Also, Alfnes *et al.* (2003) used a choice experiment to analyse Norwegian consumers' preferences for domestic, imported and hormone-treated beef.
Due to the concern over the "hypothetical nature" of the stated preferences approaches, research conducted more recently has used experimental economics procedures to elicit WTP for food safety attributes. This technique has been applied to a number of different food safety attributes including reductions in pesticides risk (Roosen *et al*., 1998; Rozan *et al*., 2004), pathogen risk (Hayes *et al*., 1995), and in the use of food irradiation (Shogren *et al.* 1999).
Advantages and limitations of EM in valuing food safety attributes have been discussed in the literature. Buzby *et al.* (1998) used three different techniques to evaluate the costs of foodborne illness and the benefits to society of a safer food supply. They presented a case study for each technique: CV surveys on pesticide residues, EM for a chicken sandwich with risk of contamination and one expenditure-based technique such as the cost-of-illness approach. They argued that valuation with controlled environment offers advantages like consider consumers' budget constraints, revelation of truthful values by the use of a reveal-mechanism and minimization of selection bias by recruiting for a "generic consumer

study". Enneking (2004) criticised experimental auctions and CV studies, because he considered that these approaches pick out the food safety attributes as a central survey theme. He argued that consumers' attention is concentrated on this product feature, resulting in an over-representation compared with real market behaviour, where food safety is only one of several attributes.
In this paper, we argue that consumers can and do make tradeoffs between different quality attributes. Following, Grunert (2005), we consider that the importance of different attributes to consumers could change over time. According to him, sooner or later it is possible that credence attributes could lose out to experience attributes. He points out that taste and healthiness have the same importance before consumption, but it may change after consumption. Consumer could give a different importance to taste because it has now been experienced, while healthiness is still intangible and information-based.
Research in experimental markets as the work of Melton *et al.* (1996) suggested that measure consumer preferences for any fresh food based on appearance without tasting is unrealistic. With the same point of view, Hobbs *et al.* (2006) used an experimental auction to evaluate WTP for two different kinds of meat with different quality assurances. The results show that consumers make tradeoffs between taste and production methods attributes, and they suggest that consumers are unlikely to compromise eating experience.

3. Objectives

We used an experimental auction to investigate how quality attributes information affects consumers' willingness to pay for different types of pears, particularly choosing the Portuguese "Rocha" pear cultivar. As in Melton *et al.* (1996), Roosen *et al.* (1998), Umberger *et al.* (2004) and Hoobs *et al.* (2006), our experiment features simultaneous valuation of multiple attributes of quality (taste, appearance, food safety and labels), where quality is defined as a multi-dimensional vector of these attributes. Participants faced the problem of evaluating four different modalities of "Rocha" pear.

4. Data and methodology

In our experiment, the elicitation method used was the BDM mechanism (Becker-DeGroot-Marschak, 1964), also known as lottery mechanism. The BDM mechanism has been used in different research beginning with the analysis of the preference reversal phenomenon and risk preferences. Recently, it was used to evaluate quality differentiated products (Lusk *et al*., 2001) and to elicit willingness to pay for GMO-free products (Noussair *et al*., 2004). The BDM mechanism is theoretically equivalent to a second-price sealed-bid auction (Vickrey auction). In both cases, the dominant strategy is to bid one's private value because bids are separated from market price. Like Vickrey auction, the BDM mechanism provides incentives to participants to truthfully reveal their preferences.
The BDM mechanism was combined with sensory evaluation in order to develop an integrated approached able to evaluate extrinsic as well as intrinsic product attributes, and possible interactions between them. Sensory techniques were also used to make sure that pears were very similar within each alternative.

4.1 Experimental Subjects

The experiment took place in the district of Oeiras, near Lisbon, in Portugal. Oeiras has a population of about 170,000 and is located in a predominantly urban area.
Seventy-four participants were recruited from the general population of these location and three groups were selected. One group was recruited using the specific protocol describe by Lange *et al.* (2002), that consists of random choices of phone numbers in the district where the study was performed (Oeiras). This group was a representative random panel of the Oeiras population. The two other groups were selected using a random sample from the

different professional's categories of employees of the National Agrarian Station (research institute) and the city council of Oeiras. The participants of the first group didn't have agrarian knowledge and the participants of the other group had information about agronomic science.
For the three groups, individuals contacted by phone were selected if they ate at least 3 pears per week, regularly participated in their food purchasing, and if they ate "Rocha" pears. Consumers' information obtained by a questionnaire answered by phone also gave us details about socio-economic characteristics of the participants, pears characteristics selection at the moment of purchase and places of purchase. Table 1 presents summary statistics for the socio-demographic variables describing the three groups.
Participants took part in one of eight sessions, and the number of participants in each session varied from five to fourteen people. No compensation was offered for participation, but subjects were given 2 euros before they start bidding and were told they could keep the money if they did not spend it.
Note that recruitment without compensation is likely to increase selection bias, but, since, opportunity costs vary across individuals, it is possible that uniform compensation may differentially impact subjects' revealed values. Buzby *et al.* (1998) reported a significant positive effect on revealed values for reduction in *Salmonella* risk when a $3 participation payment was made to student subjects whose opportunity costs were likely near zero.

[Insert Table 1]

4.2 Products

The "Rocha" pear is produced exclusively in Portugal, the greater part of the fruit grows in the Central West Coast (accounting for 90% of the national production), although its production extends towards the central interior. This fruit is very familiar to Portuguese people and widely consumed on a weekly or daily basis. The "Pêra Rocha do Oeste" is a Protected Designation of Origin (PDO) since 1993. Among the 14 Portuguese PDO/PGI fresh fruits, the PDO "Pêra Rocha do Oeste" is the most important and the exportation markets are its principal destination (Fragata *et al*., 2007). The largest importer of "Rocha" pear is the United Kingdom (41%), followed by France (17%), Brazil (14%), Ireland (9%), the Netherlands (7%) and the Russian Federation (4%). This pear has developed a good reception from the big chain retailers, as its shelf life and resistance to handling are superior to "Williams", the main competing pear cultivar during the summer (Silva *et al*., 2005).
Four modalities/types of "Rocha" pear were chosen for this experiment, selected for their differences in intrinsic attributes and extrinsic quality cues. One generic "Rocha" pear without signal of quality (P1), a pear with a premium retailer label (P2) and two pears with the Protected Designation of Origin (P3 and P4) with two levels of maturities, controlled by a sugar contents measurement (ºBrix). The means °Brix of the four modalities were: 14° for P1; 13° for P2 and P3; 11° for P4 (see Table 2). The selection of homogenous subsets of pears within each category was done with assistance from post-harvest scientists at INIAP with training in sensory analysis and product characterization (sugar contents, texture and assessed colour of the pears).

4.3 Experimental procedure

Sessions were run in a classroom located in the formation center of INIAP. Participants sat in individual tables organised in four rows of four tables. All sessions were held in the week of 6 to 12 November 2006. At this time several categories of "Rocha" are available on the market.
Prior to conducting the experiment for the "Rocha" pear, care was taken to make sure all participants were familiar with the experimental procedure and understood it. In addition to describing each part of the experience and the respective steps, participants were given

examples of how the BDM mechanism works. The preference revelation property was emphasized by explaining why it was in a participant's best interest to bid his true valuation in the BDM mechanism. Participants then gained first-hand experience with the BDM mechanism by participating in a non-hypothetical market with small pears (a pear size not evaluated in our experimental market). Once this familiarisation had taken place, the experiment with the "Rocha" pear was conducted.

The experiment consisted in an evaluation phase followed by a selling phase. During the evaluation phase, participants had to evaluate different alternatives of "Rocha" pear in four different information conditions. In each information situation, participants could evaluated the four modalities simultaneously and had to complete a small questionnaire indicating, for each alternative pear, whether they want to buy 1 kilo of this pear and if "yes" at what maximum price. Questionnaires were collected at the end of each information step in order to prevent subjects from reconsidering their evaluations from one information situation to the other.

The evaluation stage of the experiment consisted of four steps: (i) blind tasting of the four modalities pears, ii) visual and tactile examination, iii) additional information, iv) tasting with all the information.

At the beginning of the first step, situation 1 (S1), participants received a sample of each of the four alternative pears for tasting. Each modality was identified with a letter and besides the fact that they were "Rocha" pears, no other indication was given. Clear plastic cups containing pear slices were given to participants – each cup containing three slices of one modality. For each alternative, participants had to indicate their buying intention and maximum price as explained previously.

- In situation 2 (S2), one fruit of each of the four modalities was given to each participant. Three modalities were identified with a personalized retailer/producer label: P2 with a label "Fileira Qualidade Carrefour" (FQC), and P3 and P4 with a label "Rocha do Oeste" (RO). The participants could only make a visual and tactile inspection of the products and examine the labels, but were not allowed to taste the pears. They had enough time to evaluate each of the alternative pear carefully before completing the questionnaire.
- In situation 3 (S3), some it information was given about quality assurance, origin and food safety for each fruit. Before the information was issued individually to participants, they were asked to answer a few questions to check their prior beliefs about those quality attributes: (1) Do you know if this type of pear has quality assurance? (2) Do you know if this label assures specific origin? (3) Do you know if this pear has food safety assurance? The experimenter provided oral comments about the interpretation of the questions and additional information about agricultural integrated production practices were given. Responses were collected by means of a matrix questionnaire in table form. Participants had three alternatives answers: "yes", "no" and "don't know". After they answered, they were given another table form with the same questions and the right answers. After considering the information provided, participants had to evaluate the same four alternative pears.

Finally, in situation 4 (S4), participants were given a knife and asked to taste the pears before given a new evaluation accounting for all the information about each of the four alternative pears.

During the last phase of the experiment, each participant selected one situation at random (by choosing one card among sixteen), and then drew one token from a box containing 30 tokens with price ranging from €0,20 to €2,00. If the bid the participant submitted in one situation was higher than the price on the token he drew, the participant had to buy 1 kilo of "Rocha" pear at the price appearing on the token. If his bid was less he had no opportunity to buy. At the end of the session participants could ask to check the bag containing the tokens.

5. Results

5.1 Results for each information situation

From the seventy-four participants who evaluated 4 alternative pears in 4 information situations, we collected a total of 1184 prices. Figure 1 shows the distribution of these prices. Refusals to buy result in 177 zero prices (14.9% of the total). Given that no participant systematically refused to buy (out of 16 evaluations, the maximum number of refusals to buy is 8, and the median is 2), we can interpret these refusals as zero WTP for specific characteristics. Strictly positive WTP are distributed almost normally, around a mean of €0.88 and a median of €0.9. Compared to market prices, the WTP distribution seems to be slightly shifted to the left, but nevertheless a majority of positive WTP are within the range of market prices (from €0.68 to €1.5).
Figure 2 splits the distribution of prices according to pears (rows) and information situations (columns). From this figure, we can see that the distributions of prices for pear P4 (last row) are characterized by a lot of zero WTP in all the information situations, and in particular in situation S1 when tasting was the only way to evaluate the pears.

[Insert Figure 1,2]

Looking at mean WTP by pear and information situation makes interpretation easier. Figure 3 displays the mean WTP for each pear (including refusal to buy, counted as zero) with the corresponding 95% confidence interval.
Under blind tasting condition (situation S1), the generic "Rocha" pear P1 obtains a mean WTP of €0.91, significantly higher than those of all other pears, which actually have a lower sugar rate (controlled by a sugar contents measurement, see Table 2). The mean of prices proposed for pear P1 is greater than the mean prices for pears P2, P3 (+ €0.14 and + €0.13, respectively, with $P < 0.005$ in both cases) and P4 (+ €0.46, $P < 0.0001$). Moreover, after blind tasting, participants are also willing to pay significantly more for pears P2 and P3 than for pear P4 (+ €0.32 and + €0.33 respectively, $P < 0.0001$). As prices proposed for pears P2 and P3 (with identical sugar rate) do not differ significantly, the hierarchy of prices appears to be the same as the hierarchy of sugar rates. So we can conclude that participants are sensitive to variations in sensory characteristics, and adjust their WTP accordingly.
In situation S2, participants could evaluate the pears by visual inspection and examination of the stickers on pears P2, P3 and P4. Mean WTP differences show no impact of quality labels. Mean WTP are not different for pears P1, P2 and P3 though P1 has no label, and P2 has a different label from P3. Moreover, WTP for P4 is significantly lower than WTP for P3 (- €0.29, $P < 0.0001$) though they both have the same label. The main visible difference between P4 and the other pears is colour, P4 being greener than the other three. This difference in colour is taken as an evidence of unripeness by participants. It should be noted that there was no direct correspondence between situation S1 and S2: pears were identified by different codes, were not presented necessarily in the same order, and participants received only peeled slices in situation S1 and the entire fruit in situation S2. Once again, this result points out the importance of fruits' maturity in the consumer choices.
The sequel of the experiment shows that the limited knowledge of consumers on integrated pest management is largely responsible for their relative lack of responsiveness to fruit labelling. To control for a priori beliefs of participants at this stage of the experiment, we asked them to complete a short questionnaire. For each pear, they had to answer three questions: about guarantee of quality, guarantee of origin, and food safety guarantee (associated with integrated pest management). Table 3 shows the distribution of responses for each pear and each guarantee. Right answers are written in bold characters, and percentages showing that only a minority of consumers are well informed about one of the

guarantees given by the labels are underscored. Data from Table 3 highlight the fact that participants are strongly under informed on the guarantee of higher food safety standards given by labels. Indeed, from the column "Guarantee of Food Safety" of Table 3, we can see that a minority (less than 50%) consider that these labels take into account integrated pest management. Moreover, only 8.2% of participants know that generic “Rocha” pear doesn’t have a specific guarantee of food safety (i.e. a higher standard compared to the public regulations).

After having completed the questionnaire, participants were given the right answers and asked to perform another evaluation of the four pears. As a result of this new evaluation, pear P1 obtains a much lower WTP than pears P2 and P3 (- €0.36, $P < 0.0001$). The control of participants’ knowledge before this evaluation allowed a good estimation of the effect of an information about the food safety guarantee brought by the labels. It highlights the increase in labels’ reputation that more communication could bring. Nevertheless, the fact that in this situation, informed participants did not value pear P4 very much compared to P2 and P3 (- €0.30, $P < 0.0001$), raises the question of the trade-off between food safety guarantee and sensory quality.

Situation S4 brings some answer to this question. When fully informed on labels and after tasting of all the pears, participants finally value the pears according to their sensory characteristics rather than their labels. WTP for pear P4 remains significant lower than WTP for P1, P2 and P3, (- €0.25, - €0.27, - €0.35 respectively, $P = 0.0001$ or less). Moreover, WTP for pears P1, P2 and P3 are not significantly different. This could mean that the better taste of pear P1 compensates for the absence of specific guarantee on sanitary risks.

[Insert Table 2 and Figure 3]

5.2 Effects of information on WTP

The results obtained for each information situation show a complex pattern of relationships between taste and food safety in consumers’ evaluation. Note that the greatest WTP obtained across all situations (€0.91) are for pear P1 in situation S1 and for pears P2 and P3 in situation S3.

In the first case, consumers revealed their WTP after blind tasting without any information regarding origin or production practices. As could have been expected, participants enjoy the sweetest pear. More surprising is the fact that a WTP of €0.91 is significantly higher than those obtained in situations closer to actual purchase conditions, that is when participants could only see the fruits and their quality labels. This lead to the idea that pear producers could certainly increase the market price of ripe fruits if they were able to certify a “Fully Ripe” characteristic to consumers.

In the second case, participants revealed their WTP without tasting the pears, but after having been informed of production practices and the associated guarantees. Again, this situation is far from a natural buying situation (taking into account the lack of knowledge of consumers on the real significance of the labels). Because the guarantee of food safety is insufficiently conveyed by the labels in situation 2, we can estimate the difference in WTP between a safe pear and an unsafe one. The absence of sanitary guarantees explains the decrease of the WTP for pear P1, since the WTP for pear P1 is €0.30 less in situation 3 than situation 2 ($P < 0.0001$). Note that information on integrated pest management increases the WTP for pear P2 (+ €0.10, $P = 0.0003$) and pear P3 (+ €0.07, $P = 0.05$). Moreover, it appears that the guarantee of origin (or the absence of guarantee of origin in the case of the retail label) has no specific effects compared to the food safety guarantees.

In order to evaluate the respective weights of taste and food safety attributes, we need to better understand the evolution of the WTP for each pear during the experiment. Figure 4 shows the mean WTP trends for each pear and each information situation. The WTP for

pear P1 starts from €0.91 in situation S1 and decreases to €0.86 in situation S2. When consumers are informed on the absence of safety guarantee, in situation S3, the mean WTP for P1 decreases dramatically to €0.56. The trend is reversed when participants can taste again the pears in situation S4, and the WTP then grows from €0.55 to €0.78 ($P < 0.0001$). Participants valuate the pear taste strongly, despite the absence of food safety guarantees.
The WTP for the others pears show similar trends according to the information provided to participants. It seems that the reference to a label ("Rocha do Oeste" or "Fileira Qualidade Carrefour") improves the WTP after the blind tasting. However, this result is significant only for pear P4, which WTP increases of €0.11 from situation 1 to situation 2 ($P = 0.02$). When participants have all the information about safety guarantees attached to the labels, they increase their WTP in a much clearer way. Indeed, comparing situations S1 and S3, we observe that the WTP increases by €0.15 ($P = 0.0004$) for pear P2, €0.13 ($P = 0.008$) for P3 and €0.17 ($P = 0.001$) for P4. Contrary to pear P1, the average WTP for P2, P3 and P4 decrease in situation S4. These results support the idea that participants put more weight on "taste" than on "food safety".

[Insert Figure 4]

6. Final remarks

This research is a first contribution towards reducing the information gap in the pear market. The experiment's results reveal that consumers are willing to pay significantly more for fully ripe pears, and for better quality assurances related to on-farm production methods, such as the absence of pesticides. These results have important implications for firms strategies regarding production, commercialization and signaling of product quality to consumers.
However, our results reveal no statistically significant difference between the WTP for Denomination of Origin and the WTP for retailers' high premium labels, suggesting that the guarantee of origin is not very crucial for consumers. It seems that, in addition to marketing and promotion efforts, these labels should improve the signaling of credence attributes to consumers. They should do so, not because the WTP is higher for goods produced with less pesticides, insecticides, etc., but because the absence of these guarantees could lead to an important decrease of the WTP. Indeed, our results support the idea of a negative effect of the absence of information (i.e, non safe production) previously highlighted by Fox et al. (2002). In this sense, a signaling like the one given by "organic products" could be a good assurance for the future of producers' income.
However, the results of this study suggest that "taste beats food safety", because even when consumers are well informed about safer products, they finally prefer to choose and enjoy the tasty alternative. This result is of great practical importance, because a large number of standards, labels and quality signals establish no link between the different attributes of the products and their methods of production. For example, in France, the logo "Label Rouge" signals sensory quality, but does not guarantee the origin of the product or the way it has been produced (organic or environmental friendly production for example). Unlike the "Label Rouge", the "Appellation d'Origine Contrôlée" guarantees the origin and is very well known, but this label does not give any guarantees regarding sensory quality or environmental aspects. In the same way, the label "Agriculture Biologique", signaling organic products, accounts for the environment and gives some guarantees about food safety, but does not guarantee a high level of sensory quality. Therefore in France, contrary to Portugal where, for example, the "Rocha do Oeste" is a multipurpose label, none of the well known signals of quality take into account the necessity of a simultaneous certification of attributes which is asked for by consumers. This is the reason why the premium retail labels (like the one of "Carrefour" we studied in this paper) are expanding (see Bazoche et al., 2005).

The next step of this research should be to apply our methodology across a wider cross section of the European population, both geographically and socially. Hence, future research should explore the diversity of possible tradeoffs between food safety and sensory pleasure. This point is of particular importance in the fruit sector given that most of economic problems of this sector arise from the difficulty to offer a ripeness guarantee to consumers.

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Tables

Table 1. Profile of participants (N=74)

Group	Characteristic	Option	Percentage
City Council n=24	Gender	Female	79.2
		Male	20.8
	Age (years)	16-34	45.8
		35-59	54.2
		60-76	0.0
Oeiras n=21	Gender	Female	47.8
		Male	52.2
	Age (years)	16-34	8.7
		35-59	34.8
		60-76	56.5
EAN n=29	Gender	Female	66.7
		Male	33.3
	Age (years)	16-34	11.1
		35-59	85.2
		60-76	3.7

Table 2. Characteristics of the tested pears

Code	Designation	Quality signal	Appearance (colour)	Sugar rate (°Brix [2])	IPM[3]	Market price[4] (€)
P1	Pêra Rocha generic	no	yellow	14	no	[0.68; 0.89]
P2	Pêra Rocha "Carrefour's Quality Line"	Premium label	yellow	13	yes	[1.02;1.23]
P3	Pêra Rocha do Oeste	PDO[1]	yellow	13	yes	[1.10,1.50]
P4	Pêra Rocha do Oeste	PDO[1]	green	11	yes	[1.10,1.50]

[1] PDO: Protected Denomination of Origin
[2] Brix degrees are roughly equivalent to the percentage of sugar present in the pear
[3] IPM: Integrated Pest Management
[4] Source for price: http://www.gppaa.min-agricultura.pt/cot/2006/iVeg.html, Week 6-12/11/2006; Pêra*Rocha*SE*65-70mm; (I): DOP and (II): Generic (price*36%)

Table 3. A priori knowledge on guarantees on pears

	Guarantee of quality			Guarantee of origin			Guarantee of safety		
	Yes	No	Don't know	Yes	No	Don't know	Yes	No	Don't know
P1 Pêra Rocha Generic	41.9%	**16.2%**	41.9%	**58.9%**	1.4%	39.7%	20.5%	**8.2%**	71.2%
P2 Pêra Rocha "Carrefour's Quality Line"	**51.4%**	21.6%	27.0%	41.1%	**15.1%**	43.8%	**49.3%**	2.7%	47.9%
P3 Pêra Rocha do Oeste	**74.0%**	6.8%	19.2%	**89.2%**	0.0%	10.8%	**47.9%**	2.7%	49.3%
P4 Pêra Rocha do Oeste ("green")	**57.5%**	17.8%	24.7%	**86.5%**	2.7%	10.8%	**43.8%**	4.1%	52.1%

Graphs and Diagrams

Figure 1. Distribution of WTP for all pears and information situations

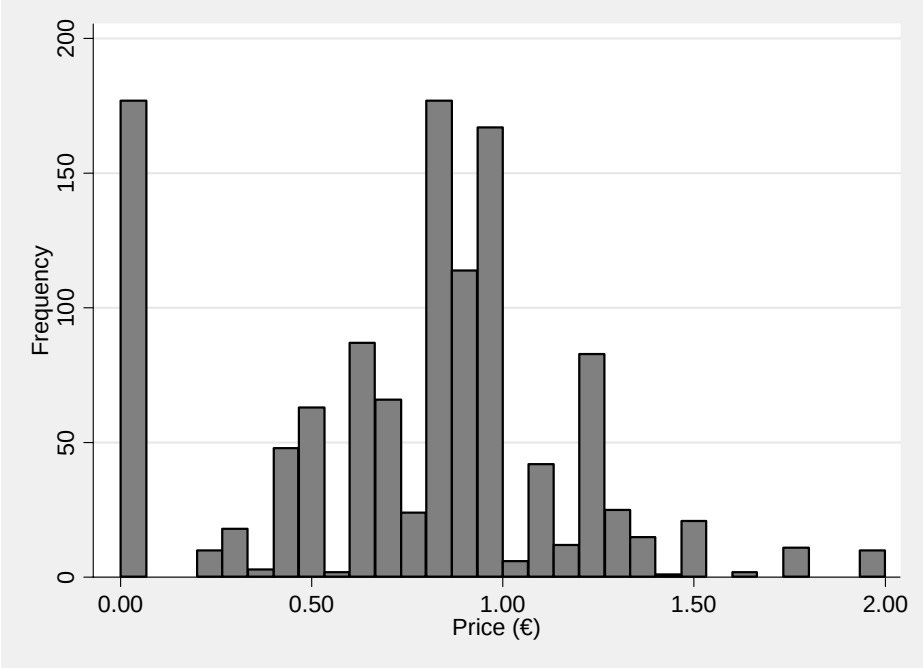


Figure 2. Distribution of WTP for each pear in each information situation

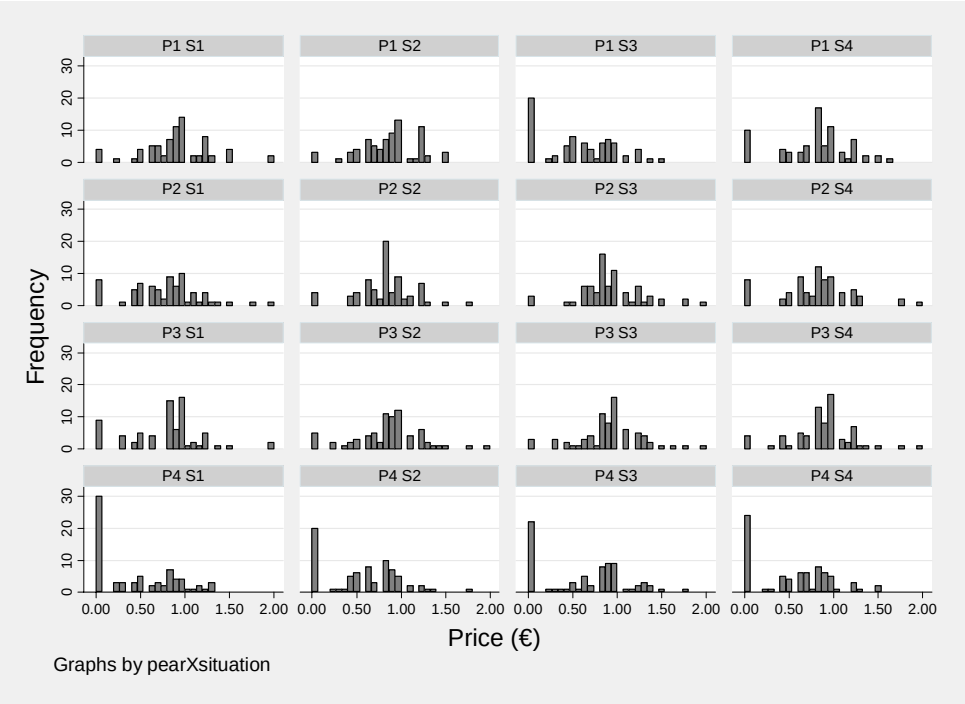


Figure 3. Confidence intervals (95%) of mean WTP for each pear

in each information situation

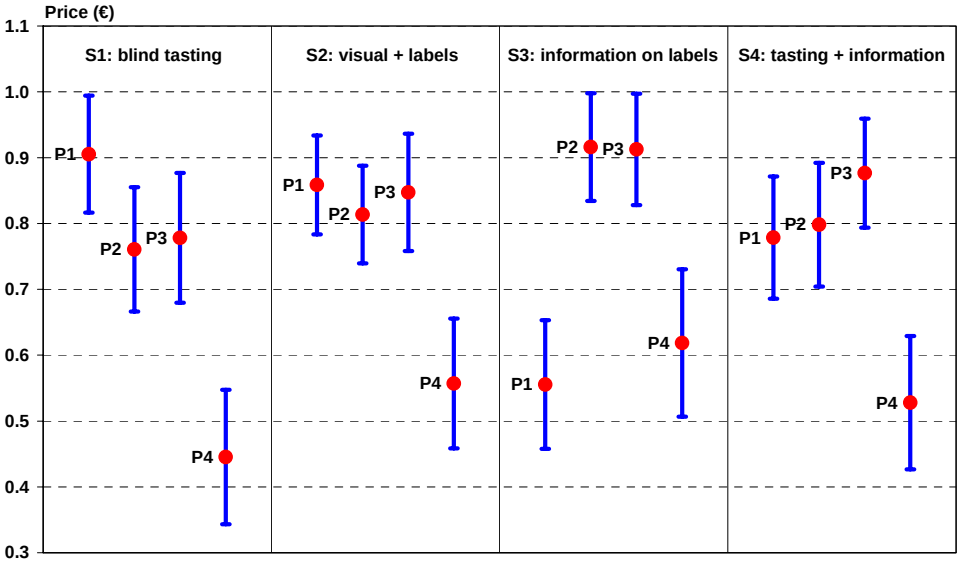
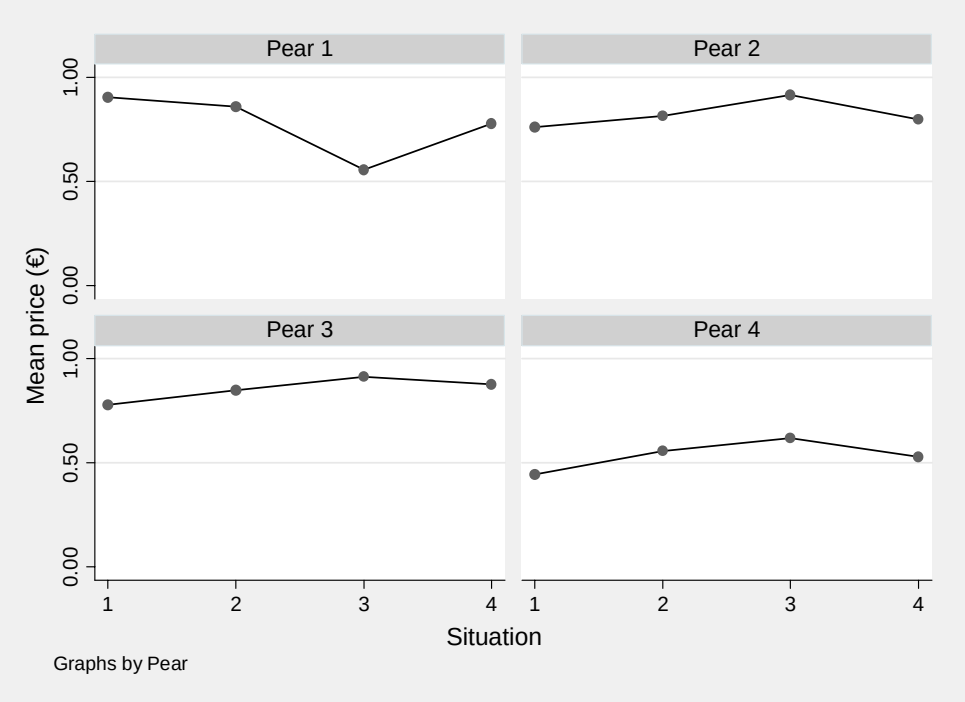


Figure 4. Trends in mean WTP according to the information situation for each pear



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