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## Estimation of consumers' willingness to pay to reduce pesticides, based on experimental markets

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# Deliverable Factsheet

**Date: December 2009**

<b>Deliverable</b>	4.2 : Estimation of consumers' willingness to pay to reduce pesticides, based on experimental markets
<b>Working Package</b>	WP4 : Indirect Pesticides Costs on Consumers Willingness to Pay
<b>Partner responsible</b>	INRA
<b>Other partners participating</b>	INRB
<b>Nature</b>	R
<b>Dissemination level</b>	PU
<b>Delivery date according to DoW</b>	October 2009
<b>Actual delivery date</b>	December 2009
<b>Finalization date</b>	November 2010
<b>Relevant Task(s):</b>	4.2, 4.3 and 4.4

## **Brief description of the deliverable:**

This deliverable presented an experimental market focused on consumers' willingness to pay for produce grown with different pesticides rates. .). Experimental markets are carried out in Portugal, France (for the period May 2008 to October 2009) and then in Greece and Holland (2010).

## **Followed methodology / framework applied:**

Economic experimental method: Becker-DeGroot-Marschak procedure and choices between different size lots of the preferred apple and any other apples.

## **Target group(s):**

Experimental economics research units

## **Key findings / results:**

There is a consumer willingness to pay higher for produces grown with less pesticides and the preferred certification is the zero synthesis pesticides (i.e. organic produce). We show the following results. i) In Portugal, the premium against a regular product is 53.6 % for Integrated Pest Management (IPM) and 96.4% for organic products. ii) In France the premium is 43.6% for IPM and 72.5% for organic products. However, in both two countries, premium increase is lower for a processed product.

## **Interactions with other WPs deliverables / joint outputs**

WP no.	Relevant tasks	Partner(s) involved	Context of interaction
5	5.2	WU and LEI	Product choice (apple) and experimental auction for Netherlands (in 2010)



Project no. **212120**

Project acronym: **TEAMPEST**

Project title:

**Theoretical Developments and Empirical Measurement of the  
External Costs of Pesticides**

Collaborative Project

SEVENTH FRAMEWORK PROGRAMME  
THEME 2  
Food, Agriculture and Fisheries, and Biotechnology

### **Deliverable 4.2**

Bazoche, P., Berjano, M., Combris, P., Giraud-Héraud, E., Hannus, C.,  
Maia, R., Seabra Pinto, A.

Estimation of consumers' willingness to pay to reduce pesticides,  
based on experimental markets

December, 15<sup>th</sup>, 2009

## **Extended summary**

Much work has been done in economics to appraise consumers' environmental characteristics valuations. Economists have employed several methods to determine how consumers value the environmental characteristics of foodstuffs.

In this study, we used an experimental market to determine consumer's willingness to pay (WTP) for produce grown with different pesticide levels. We worked on apples grown with different production types: conventional apples, Integrated Pest Management (IPM) apples and organic apples. Experimental markets are carried out in Portugal, France (for the period May 2008 to October 2009) and then in Greece and Holland (2010).

The pesticides use complies with legal norm in the conventional apple. The pesticide quantity use is lower in the IPM apples and there is no synthesis pesticide in the organic apple.

In this experimental market, we evaluated the consumers' WTP under different information conditions.

There is a consumer willingness to pay higher for produces grown with less pesticides and the preferred certification is the zero synthesis pesticides (i.e. organic produce). We show the following results. i) In Portugal, the premium against a regular product is 53.6 % for Integrated Pest Management (IPM) and 96.4% for organic products. ii) In France the premium is 43.6% for IPM and 72.5% for organic products. However, in both two countries, premium increase is lower for a processed product.

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## 1. Introduction

### **Survey of the literature about experimental economic methods and consumer's willingness to pay (WTP) for pesticides reduction**

The first works regarding consumer's WTP for pesticide reduction have used stated preferences methods. Their goal was to estimate the consumers' perception of risk associated with pesticides use.

Hammitt (1990) focused on organic products by comparing them with the conventional ones. Consumer's choices show that they were willing to pay significant premium to obtain the organic product (a median 50% above the cost of conventional produce).

Misra *et al.* (1991) used a survey sent to 580 households in the Georgia in order to determine consumers' perceptions of food safety and their attitudes toward pesticides use. At the question 'Are you willing to pay a higher price for certified residue free produce?', 46% of the participants answered 'yes', 26% answered 'no' and 29% are not sure. Among those who were willing to pay a premium, 87% were willing to pay a maximum of only 10% more for certified residue free produce.

Eom's study (1994) also used a survey to estimate consumers' preferences toward health risks posed by pesticide residues. The author collected 567 questionnaires from interviewers at grocery entrance in North Carolina. In the survey, the author compared produces commercially grown with pesticides and produces screened for pesticide residues. He found that consumers were willing to pay substantially high price premiums for safer produce: 65% of respondents were willing to pay on average  $\$0.35 \pm 0.57$  per pound more for the produces screened for pesticide residues.

Baker (1999) used a conjoint analysis to evaluate consumer responses to hypothetical apple products in a nationwide survey sent to households in the US. The author worked on 510 surveys. One of the aims of the study was to try to understand consumers' valuation of food safety attributes. Product characteristics included price, quality, pesticides use levels and the corresponding cancer risk and type of government inspection. Consumers expressed a broad preference for reduced pesticides use.

With their study, Mourato *et al.* (2000) estimated the economic impacts of pesticide use on human health and on the environment. For that, they estimated consumers' WTP thanks to a contingent ranking approach, which is a survey based technique. Questions have been asked to 504 UK participants. It was a survey with questions concerning the environmental impacts

of pesticides use on wheat production. The results suggested that consumers would be willing to pay substantial price markups for environmentally friendly bread loaves: an average of 0.7 pence per loaf of bread to avoid case of human illness.

Using a double-bounded logit model, Loureiro *et al.* (2002) wanted to assess the mean WTP for eco-labelled apples. They concluded that female respondents with children and strong environmental and food safety concerns were more likely to pay a premium for eco-labelled apples. However the estimated premium was small (about 5 cents per pound over an initial price of 99 cents), reflecting the overall difficulty with garnering a premium based on “environmentally sound” practices.

Cranfield *et al.* (2003) undertook a contingent valuation survey to determine if Canadian consumers would pay a premium Pesticide Free Production. Pesticide Free Production is a production system that falls between organic and IPM agricultural production. Authors worked on 295 surveys from participants from Calgary, Toronto and Winnipeg. They found that 67% of respondents would be willing to pay a modest (i.e. 1 to 10%) premium for Pesticide Free Production relative to a conventional produce and that about 5% would pay a 20% premium.

Chalak *et al.* (2008) presented results from two choices experiments designed to take account of the different negative externalities associated with pesticide use in agricultural: reduction of environmental quality or problem on consumer’s health. The results showed that there is preference heterogeneity in addition to a reasonably high WTP estimates for a reduction in the pesticides use for both environmental quality and consumer health.

Mainly, the studies presented in the former section have concluded that there is a premium for the environmental characteristics of food. But all these studies have recorded behavioural intentions which may not completely correspond to actual behaviour in market transactions. Loureiro *et al.* (2003) showed that consumers who stated that they are willing to pay a premium, which is equal to or greater than a positive lower bound, had a higher likelihood of actually buying the product in question. This implies that consumers' actions in the economic experiment validate their survey responses.

Thus, it is necessary to use methodologies that are not only based on consumers’ statements but that analyse their real buying behaviour: the experimental economic approach. Experimental economics methods put people in an active market environment dealing with

real money and real products. This valuation provides, in a direct form, a set of heterogeneous WTP that in theory represent the real value for the products.

In the experimental economic approach, individuals are in a laboratory environment with a simplified economical situation reproduced. Smith (1980) and List (2006) showed that laboratory behaviour is a good indicator of field behaviour.

Roosen *et al.* (1998) were the first to analyse WTP for pesticide-free produce in experimental economics. They recruited 54 American participants and used the Vickrey's auction method to determine the consumers' WTP. Their analysis showed that WTP for produce free from neuroactive pesticides is significantly higher than for conventional produce and that the inferior appearance of the apples has a significant (negative: -63%) effect on WTP. The authors measured also consumers' WTP for a partial reduction of pesticides use in apples. They found a 50% increase of WTP between the partial pesticides reduction and the complete pesticides lack.

Bougherara (2003) evaluated consumers' WTP for 3 different kinds of orange juices: standard, organically-farmed and environmentally-friendly. The participants were divided into two groups. In the first group, participants had to reveal their WTP by the BDM procedure before and after receiving information about the meaning of organically-farmed and environmentally-friendly. In the second group, participants had to reveal their WTP just once after reading information. With this study, Bougherara showed that revealing information about healthy risks did not affect the valuation of the labelled product but did cause a loss of value for the conventional product.

This result about negative impact of information on non-labelled product was also shown by Combris *et al.* (2010) with an experiment on pears. They used the BDM procedure on 74 participants who had to give their WTP under different information conditions of 3 kinds of pear: conventional, retailer quality, Protected Denomination of Origin. These pears were presented with different signals. The results showed an important decrease of WTP for pear without signal.

Another study shows the same results: Rozan *et al.* (2004) worked with 120 consumers aged from 20 to 65 and with 3 types of products (apples, potatoes and bread) available as certified or non-certified. The two procedures used were BDM mechanism and the second price auction mechanism. They observed that buying prices for non certified food products decrease



when healthy information (controlled heavy metal content label) is provided. However the buying prices for certified products did not significantly increase.

## 1.1 Experimental markets

The experimental markets design, described below, was defined.

The aim of this experiment was to measure the consumers' willingness to pay (WTP) for apples and for a processed product (apple juice) produced with less pesticide.

In this study we also wanted to compare two different methods to obtain the WTP: one direct method (direct sales with different prices with the Becker-DeGroot-Marschak (BDM) procedure<sup>1</sup> and an indirect method (choices between different size's lots of the preferred apple and any other apples). Another aim was to see if the potential diversity in consumer behaviour was depending on geographical location.

The markets included both fresh products (apples from the two varieties *Royal Gala* and *Granny Smith* for Portugal's experience and Golden for the France's experience) and processed ones (apple juice).

In order to see the impact of different information about pesticides use, we used different apple types which are product with different level of pesticides:

- Regular apples,
- Integrated Pest Management (IPM) apples,
- Organic apples.

The regular apples correspond simply to the respect of the national legislation for the pesticides' use. The IPM apples correspond to a controlled reduction of these pesticides as compared to the existing legislation; this is a well known concept which leads to reduce pesticides on farms. However, this concept is quite complex and does not clearly define a list of banned pesticides or even a maximum use level for pesticide. The organic apples correspond to a total lack of the synthesis pesticides in the context of organic farming.

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<sup>1</sup> Becker, G., DeGroot, M., Marschak, J. (1964). "Measuring Utility by a Single-Response Sequential Method". *Behavioural Science*, 9: 226-232.

We also wanted to know the impact of pesticides reduction on a processed product: the apple juice. We used the same level of reduction for the apple juice:

- Regular juice = juice obtained from regular apples,
- IPM juice = juice obtained from IPM apples,
- Organic juice = juice obtained from organic apples.

Apples were presented to the consumer with their labels (or without in the case of the regular apples which did not have any label).

We used different apples types in Portugal and in France. In the case of the Portuguese experience, we were careful to take into account the heterogeneity of tastes that can be observed in this market. For that, we asked to the consumers to make an advance tasting of two varieties: type "tart" with the Granny Smith variety and type "sweet" with the Royal Gala variety. These precautions made it possible, not only to limit the number of systematic refusals to purchase during the experiment, but also to prevent having consumers that proposed a purchase price equal to zero in whatever the selling situation. In France, we proceed a bit differently. Thanks to the Portugal's results, we knew that around half of the participants would take the "tart" type apples (Granny Smith) and that the other half would take the other type: Royal Gala and particularly, we knew that no consumer was really against one type. So we decided to use only one variety but a quite common variety. We decided to work with the Golden variety, which is the most consumed type in France. Furthermore, to avoid any problem, we asked to all the participants which type of apple they usually consume and recruited only the one who answered at least the Golden type. The other difference is the size of the apple. In Portugal, all the apples had the same calibre although in France, calibres were a bit different: the organic apple was a bit smaller than the other. So we had to add one small apple in order to not have just one small apple in the French experiments.

In both countries, the experiment included three stages:

### ***Stage 1. Sales of apples***

The objective of this stage was to measure consumers' WTP for pesticide reduction and to show how the results depended, or not, on a modification both of the intrinsic characteristics of the products (variety of apple, organoleptic quality, size, etc) and also of the extrinsic aspects (brand and origin of products). Thus, we showed how an eventual increasing of the WTP, due to pesticide reduction, was conditioned by the stability of the organoleptic

properties. This is an important result when it comes to discuss how much the producers should reduce the pesticide level regarding the potential gain that can be obtained through a reinforcement of taste.

In Portugal, a lot of technical specifications regarding the characteristics of products were also measured in order to know their relevant characteristics ("Brix", acidity) and to estimate the correlation between WTP and these characteristics. With these measurements, we saw that the WTP is perfectly correlated to the hedonic note. We also saw that for the Royal Gala (variety with more sugar than the Granny Smith the WTP is positively correlated to the "Brix" and the WTP is negatively correlated to the pH and that this is the opposite for the Granny Smith. So, because we had already these answers, we didn't do all the physicochemical measures in Dijon.

### ***Stage 2. Sales of apple juice***

The aim was to measure how the consumer response might be different according to the reduction of pesticides in the processed material. The changes verified in the WTP were then compared with those obtained previously with apples sales on stage 1.

Note that for stage 1 and stage 2, the value elicitation mechanism used was the Becker-DeGroot-Marschak mechanism.

### ***Stage 3. Choice of apple lots***

This stage assessed the robustness of the results obtained in comparing them to a situation of exchange (valuation of the Willingness to Exchange, WTE). The principle was the following. Based on the results obtained in stage 1 of the experiment, it was possible to identify the preferred alternative of each consumer. Each participant was then informed that this new stage consisted in making choices between different quantities (in Portugal) or weight (in France, because of the size differences) of apples of their preferred apple and the other apples.

The results obtained under these hypothetical trades allowed us to reconstitute the WTP of each consumer for the various certifications proposed. Thus, it was possible to measure the robustness of the WTP obtained in stage 1 of the experimentation.

## **1.3. Principal results**

The results show that there is a premium for a pesticide use reduction: consumers agreed to pay more for product safer for them but they prefer a total lack than a partial reduction because they are ready to pay more for organic produce after they received the information on

the zero synthesis pesticide use than for the IPM produce. We show the following results. i) In Portugal, the premium against a regular product is 53.6 % for Integrated Pest Management (IPM) and 96.4% for organic products. ii) In France the premium is 43.6% for IPM and 72.5% for organic products. However, in both two countries, premium increase is lower for a processed product. We also underlined the importance of the taste in consumers' choices because they decrease their WTP after tasting the product they didn't like in the blind tasting.

## **2. Protocols presentation**

The aim of these experiments was the same in the two countries. After the first experiment in Lisbon, we changed a little bit the protocol for Dijon in order to improve this protocol according to Lisbon's results. That's why there are few differences between the two protocols.

### **2.1 Participants and session**

The experimental protocol design was first applied in Portugal, in Lisbon, to 102 consumers and then in France, in Dijon, to 107 consumers.

In Lisbon, the experiments took place in the Agronomic University building. In Dijon, we worked in the INRA's sensory analysis room; INRA is the National Institute of Agronomic Research.

We did 11 sessions in Lisbon and 10 in Dijon (because the room was bigger in Dijon: we were able to receive 10 people maximum in Lisbon and 16 people maximum in Dijon). The session lasted around 1h30; it was at 2.30pm, 6pm and 8.30pm in Lisbon and at 3pm and 6pm in Dijon.

### **2.2 The recruitment**

Participants were randomly recruited from the general population, according to a set of criteria, specific to this type of experience. For the recruitment, the same questions have been asked to the participants in Lisbon and in Dijon in order to have the same information about the consumers. The questions asked were about: i) apples consumption frequency; ii) participant's role in the food shopping in the family; knowledge about apples prices.

We have especially assured that the participants were regular buyers of apples (at least once a week). If the answers met the criteria, i.e. the frequency consumption was at least once a week, participant was doing the shopping sometimes (at least once every two months) and the

answer to the price they think for 1kg of apple was less than 5€, we asked for all the socio-demographic data.

All the consumers recruited received a letter with explanation about the experiments but there were nothing said about pesticides. In this letter, it was explain that the subject of the study was the valuation of apples coming from different types of production.

### **2.3 Experimental procedure**

As we said above, we used different certifications: the regular apple, the IPM apple and the organic apple. The IPM certification can be guaranteed by the producers, by the retailer or by producers from a specific area. To see if there is an impact of the guarantee's origin we used different apples from each certification. The different apples were distinguished by their labels. The producers' IPM apples were defined as 'Protecção Integrada' in Portugal and as 'Production Fruitière Intégrée' in France.

As we said above, there were 3 stages in the protocol: apples sales, apple juices sales and choices between sets of different types of apple.

At the end, there were the drawing lots. This part has been done to involve the participants properly in the experience; this is a proper part of the BDM mechanism. Because they are liable to buy one product, the participants are supposed to be more precise in their answers.

#### ***A. Stage 1 (sales of apples)***

In this first stage, there were four steps and in all steps, consumers had to answer to the same question: "What is the maximum price you are ready to pay to buy 1kg of this apple?" but with different information.

- 1<sup>st</sup> step = intrinsic characteristics

At this step, the consumers did not have any information about the apples. This was a 'blind tasting'. The only information was the name of the variety because the participants can know it just by looking at the product. After the evaluation, the participants gave the maximum price they were ready to pay for 1kg of each apple they had tasted.

There was a difference between Portugal's and French's experiments for this step. In Lisbon, the participants had to taste six apples from two different varieties: three Granny Smith and three Royal Gala. In the two varieties, there was: one regular apple, one IPM apple and one organic apple.

In Dijon, the participants had to taste six apples from the same variety (the Golden variety). Apples were evaluated three by three, it means variety by variety in Lisbon and all the six simultaneously in Dijon.

In this step and only for Portugal, the participants had to answer to a sensory analysis questionnaire: colour, texture, flavour and global taste.

At the end of this step, each consumer has given a maximum purchase price for six different apples.

In France, the whole experiment was carried on using only the Golden variety. In Portugal, it was different. For each Portuguese participant, the prices' mean for the three apples for each variety has been calculated in order to find the preferred variety. If there were two equal means, the variety with the apple with the higher price was chosen. And in case of equality between the two first prices, the variety with the third higher price was chosen and so on. Only the preferred variety (Granny Smith or Royal Gala) was then used for the next steps.

- 2<sup>nd</sup> step = extrinsic characteristics without information

Then, in Lisbon, participant had to taste different apples from their preferred variety: regular apple, IPM apple and organic apple. They had to taste different Golden in France: the same one and one small regular apple.

Apples were presented simultaneously to the participants with their labels. No information was given to the participant and they were not allowed to taste the products. They were asked to evaluate the apple in looking at, in touching at, in smelling at but without eating it and to answer to the question: "What is the maximum price you are ready to pay to buy 1kg of this apple?"

Note that at the end of this step, in Dijon, participants had to answer to few questions about their knowledge on labels used in the experiment. The question was: "For all the apples you had evaluated, which guarantee do you think you have: a taste guarantee, an area origin guarantee, a pesticide reduction use guarantee?"

- 3<sup>rd</sup> step = extrinsic characteristics with information

At this step, each participant received an information sheet with the information about the label they were seeing on the apples. The participants had to read the information sheet and then answer to the same question as before: "What is the maximum price you are ready to pay to buy 1kg of this apple?" At this step they were still evaluating apples without tasting them.

The information given to the participants were a bit different in Lisbon and in Dijon. For the regular apples, the information given was that the pesticides quantities used were following the legal instructions. In the case of IPM apples, we had simplified the information given to consumers, stating that it was a halving of the number and amounts of pesticides used in relation to the benchmark of the regular apple in Portugal and that it was a diminution (without any precision of the diminution's proportion) in France. We specified to the consumers that the reduction was certified by the producers. For the retailer quality apples, we said to the consumers that there was a reduction of the pesticides use and that this reduction was certified by the retailer. In the case of organic apples, consumers were informed of the synthesis pesticides use lack.

- 4<sup>th</sup> step = intrinsic and extrinsic characteristics with all information

Participants still had the five (Portugal) or six (France) apples in front of them. Now they had to taste the apples before giving their purchase prices in answering to the same question: "What is the maximum price you are ready to pay to buy 1kg of this apple?"

After this 4<sup>th</sup> step, the highest price was spotted to define the preferred certification for each participant. This preferred certification was the reference for the choices in stage 3. In case of equality the preferred certification was chosen by drawing lots.

*B. Stage 2 (sales of apple juices)*

The principle was exactly the same than the method which was used in the apple sales: BDM mechanism. The difference was that the participants did not have the product in front of them to make the valuation but only the labels of the products. They had to answer to the following question: "What is the maximum price you are ready to pay to buy 1 Litre of this apple juice?" in looking at the 3 labels they had in their hands.

The different juices were issued of different apples: one regular apple juice coming from regular apples, one IPM apple juice coming from IPM apples and one organic apple juice coming from organic apples.

### **Stage 3 (choices)**

For this stage, we used the preferred certification defined at the end of the 4<sup>th</sup> step of the apples sales. The participants had all the information, they had the apples still on their table and they were allowed to taste the fruits again. In this part, each participant had to make choices:

- between 1 fixed set (6 units in Lisbon and 1kg in Dijon) of his preferred certification and increasing sets of all the other certifications,
- and then between decreasing sets of his preferred certification and 1 fixed set (6 units in Lisbon and 1kg in Dijon) of all the other certifications.

The difference between Lisbon and Dijon was due to the difference of apples size in Dijon. It was not possible to propose unit set in Dijon because, for instance, 6 regular apples are not similar in term of quantities to 6 organic apples. That is why we used quantities set in Lisbon and weight set in Dijon.

Each participant had to complete 8 choice boards in Lisbon (because of the 5 different certifications) and 10 choice boards in Dijon (because of the 6 different certifications):

Boards are like the one below:

- 4 like the one below in Portugal:

<b>Quantity of apple of the preferred certification</b>	<b>Quantity of apple of other certification</b>
6	6
6	7
6	8
6	9
6	10
6	11

- 4 like the one below in Portugal:

<b>Quantity of apple of the preferred certification</b>	<b>Quantity of apple of other certification</b>
6	6
5	6
4	6
3	6
2	6
1	6



- 5 like the one below in France:

<b>Quantity of apple of the preferred certification</b>	<b>Quantity of apple of other certification</b>
1 kg	1 kg
1 kg	1.150 kg
1 kg	1.300 kg
1 kg	1.450 kg
1 kg	1.600 kg
1 kg	1.750 kg

- 5 others like the one below in France :

<b>Quantity of apple of the preferred certification</b>	<b>Quantity of apple of other certification</b>
1 kg	1 kg
0.850 kg	1 kg
0.700 kg	1 kg
0.550 kg	1 kg
0.400 kg	1 kg
0.250 kg	1 kg

Finally, each participant drew lots for a sales or a choices situation. This drawing lot at the end was explained to the participants at the beginning to involve them. They knew that they were a possibility for them to buy a product at the end of the session.

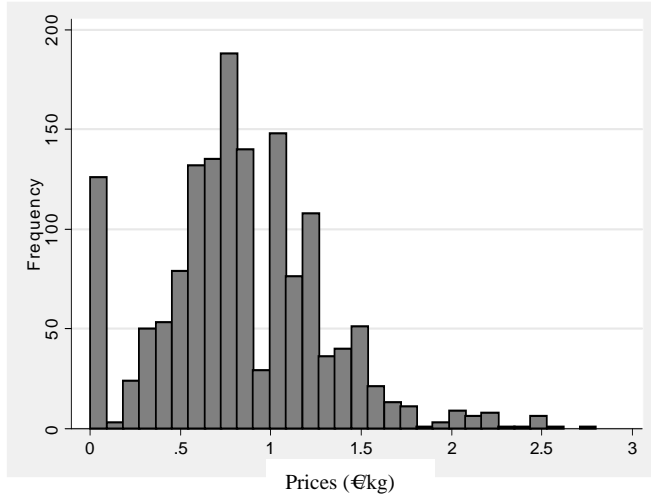
At this stage, there were two possibilities:

- One sales situation was drawn lots: then the participant was drawing lots for a sale price. If this price was lower than the one he gave during the experience, the participant bought the product at the sale price (i.e. the less expensive). At the opposite, if the sale price was higher than the one given during the experience, the participant didn't buy the product.
- One choice situation was drawn lots: the participant had to draw lots for one of the 48 lines in Lisbon and for one of the 60 lines in Dijon of the boards and received the apple set he had chosen on this line.

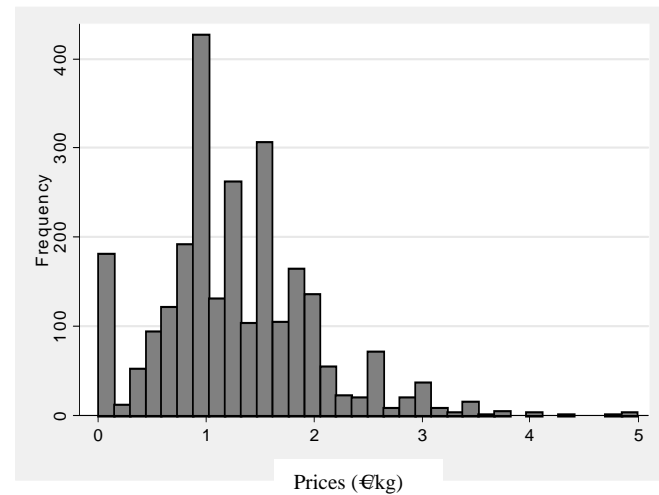
### 3. Results

#### 3.1 WTPs' Distribution

Lisbon:



Dijon:



The Willingness to Pay's distributions are in accord with a classic price distribution. The zero's answers proportions are not too high and are similar in Portugal and in France: 8% in Portugal and 7% in France.

#### 3.2 Sensory data

The WTP is a good indicator to the consumers' preferences: there is a positive correlation really significant between the WTP and the hedonic score for the apples ( $p < 0.001$  for the two varieties Royal Gala and Granny).

We notice that consumers are sensitive to the sugar contained in the apple: there is a positive correlation between the sugar contains and the WTP but this correlation is more significant for the Royal Gala variety ( $p < 0.05$ ) than for the Granny variety ( $p < 0.1$ ).

There is also a bound between the acidity rate and the WTP for the Granny variety ( $p < 0.05$ ) but there is nothing between these two data in the Royal Gala variety. This can be explained by the fact that the acidity is expected for the Granny apples but not for the Royal Gala apples.

### 3.3 Consumer's WTP for pesticides reduction

With this experimental market, we noticed that consumers are willing to pay more for produce grown with fewer pesticides. Indeed, there is a significant difference between regular apples, IPM apples and organic apples after we gave information about pesticides reductions. Consumers are ready to pay 0.56€ in mean for regular apples, 0.86€ in mean for IMP apples and 1.10€ in mean for organic apples in Portugal. In France, in the same order, means are: 1.01€, 1.45€ and 1.57€. If we speak in terms of premium, i.e. each WTP minus regular apples' WTP, the premium for a total lack of pesticides' use is more important than the one for a 50% pesticides reduction:

Table 1 – Reduction in pesticides' mean premium (apple fruit)

	50% pesticides reduction	Ban of synthesis pesticides
Portugal	+53.6%	+96.4%
France	+43.6%	+72.5%

This result is also found with the processed produce: the apple juice. Even if the differences are less important, the premium increases with the percentage of pesticide reduction:

Table 2 - Reduction in pesticides' mean premium (apple juice)

	50% pesticides reduction	Ban of synthesis pesticides
Portugal	+21.8%	+46.1%
France	+28.2%	+41.9%

At this stage, it is important to note that this premium is dependent of the sensory attributes. We noticed that because of the differences in consumers' answers before and after tasting. Indeed, there is a decrease after tasting for the organic apple (before tasting the premium is 96.4% and after tasting this 52.5% in Lisbon and 72.5% before, 59.1% after tasting in Dijon); this apple was not really good noted at the first tasting (blind tasting) so its score decreases at the end. At the opposite, the IPM apple which was appreciated during the blind tasting in France has an increase of its WTP after tasting at the end (43.6% and then 87.7%).

So even if there is a positive message to the consumers like a pesticides use reduction, produce have to be tasty to be purchased at a higher price.

#### **4. Policy recommendations**

We showed in this deliverable that there is a consumer willingness to pay higher for produces grown with less pesticides and the preferred certification is the zero synthesis pesticides (i.e. organic produce). We showed that the premium against a regular product is more than 40 % for Integrated Pest Management (IPM) in the different countries and 70% for organic products. Even if premium increase is lower for a processed product, it seems, the results that we have obtained, with the experimental market confirm that it is possible to assess the alternatives for having consumers contribute to the improvement of environmental practices.

By using different methods of evaluating the behaviour of consumers, we have shown that the standard evaluation of WTP was a good way to measure consumer demand for pesticide reduction. Nevertheless, this WTP is actually enhanced if the information is passed on to consumers. Hence we showed the need to use the logos of IPM certifications (public certifications or private certifications) and organic production.

## 5. References

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