

Working Paper Series

No. 51

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June 2013

Núcleo de Investigação em Microeconomia Aplicada

Universidade do Minho



FCT

Fundação para a Ciência e a Tecnologia
MINISTÉRIO DA EDUCAÇÃO E CIÊNCIA

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(PRELIMINARY DRAFT)



Paper prepared for presentation at the V Workshop on:

Valuation Methods in Agro-food and Environmental Economics:

“Methodological and empirical challenges in Valuation Methods”

Barcelona, 27th - 28th June 2013

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Support from the project “Aplicação de metodologias de economia experimental na avaliação da disposição a pagar dos consumidores por variedades tradicionais de frutas e legumes” (PTDC/EGE-ECO/114091/2009) is greatly appreciated.

CONSUMER PREFERENCES FOR APPLE: COMPARING THE RESULTS OF CONTINGENT VALUATION METHOD AND A REAL PURCHASING SITUATION

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Increased competition in agro-food systems has motivated the appearance of new or more heterogeneous products. In addition consumers are increasingly more demanding about product information and characteristics, associated with a move towards products that differentiate themselves by its environmental characteristics, health effects, quality, origin, etc. Thus consumers' preferences became more complex and diversified.

Consumers are faced with a great variety of competing products and firms are ever more interested in identifying the attributes, or the combination of attributes, that are most valued by consumers. Valuation studies have sought to determine the influence of certain attributes in the willingness to pay (WTP) measures, including the importance of organically produced fruit and vegetables (Zhao et al., 2007; Radman, 2005) or the effect of providing additional information, with respect for example the health benefits, (Ginon et al. 2007; Marette et al., 2010; Bocaletti and Nardella, 2000).

Considering a set of relevant characteristics, this paper investigates the influence of the attribute "National Variety" on rank order preferences and on the willingness to pay measures. The procedure assesses the effect of the origin of apple variety, comparing the values from an open ended question on the willingness to pay for two apple varieties. The elicitation of the value is performed with information on this characteristic and after tasting and rating the varieties. These results are then compared to the value elicited in a real purchasing situation, where the respondent can buy the preferred apple (one kg) if the elicited value on the open ended question is superior to an extracted random price. In sum, the paper demonstrates the applicability of the Contingent Valuation Method to eliciting the effect of information on an attribute on elicited WTP; It tests for hypothetical bias in this elicitation framework. The results show that predicted mean WTP for national varieties is lower than the predicted willingness to pay for foreign varieties. In addition, the results reveal a statistically significant hypothetical bias in the case of the National varieties, but not in the case of the foreign varieties.

Keywords: Experimental Economics, Agro-food economics; Valuation methods

1. Introduction

Increased competition in agro-food systems has motivated the appearance of new and more heterogeneous products. Harker *et al.* (2003) points out that apple industries have evolved with the development of new technologies and products and presently are going through a time of intense competition.

During the last decades the Common Agricultural Policy contributed significantly to the specialization of agricultural production, leading to the disappearance of less productive varieties, with consequent losses in genetic diversity (Dinis *et al.*, 2011). Distinctly, nowadays agricultural policies encourage the reintroduction of traditional varieties, in order to protect the agro-food chain (fruits and vegetables) and to address the needs of a specific segment of demand willing to buy differentiated and higher quality products¹. In the same vein, the Portuguese strategy for sustainable operational programs (MADRP, 2009) includes enhancing policies of quality and differentiation, redirecting the supply to a more informed and increasing demand. The same document indicates the pathway of the differentiation in production of fruits and vegetables, focusing on the remarkable potential of the regional varieties in Portugal. However, these varieties are less productive and are subject to greater production variability, being more costly for farmers. In this regard, farmers should be compensated by the rising cost and risk in the production of traditional varieties. A possible compensation' vehicle should rely on market recognition, in which consumers are willing to pay an extra price or a price premium.

Valuation studies have sought to assess these monetary measures and to determine the impact of certain attributes or characteristics in the willingness to pay (WTP) measures for food products. Despite its extensive application in the valuation of nonmarket goods, the Contingent Valuation Method (CVM) has been recently used to value the food safety and agrofood marketing (Boccaletti and Nardella, 2000; Brugarolas *et al.*, 2009 and the references therein). However, experimental auctions are becoming an important alternative to CVM because overcomes its hypothetical nature, mimics closely the choice process or the market considering a real product and real exchange of money (Brugarolas *et al.*, 2009; Poole *et al.*, 2007; De Groote *et al.*, 2011).

Consumers are increasingly more demanding about product information and characteristics, associated with a move towards products that differentiate themselves by its environmental characteristics, health or nutritional effects, quality, production mode or origin. In addition to brand, product denomination and health claims, the product' origin is one of the extrinsic attributes that influences the valuation of a food product. The intrinsic attributes are related to the sensory characteristics (Ginon *et al.*, 2007).

There is empirical evidence of consumers willing to pay a price premium for organic products (e.g. Boccaletti and Nardella, 2000; Combris *et al.*, 2012), for freshness (e.g. Lund *et al.*, 2006), for health or nutritional effects (e.g. Marette *et al.*, 2010; DeGroote *et al.*, 2011) or due to an appellation of origin (e.g. Combris *et al.*, 2009). Apart from the study of Brugarolas *et al.* (2009) and Dinis *et al.* (2011) there is little evidence on the traditional variety' attribute and its influence on consumers' behavior.

The present paper seeks to extend the knowledge about the impact of the traditional variety' attribute in the specific case of apples. Richards and Patterson (2000) point out that the consumer's experience with apples is often more important to improve sales than the information about the product provided by the industry. Nevertheless, according to Harker *et al.* (2003) the research about the impact of growing process, brand and country of origin on fruit' choice is still ambiguous.

¹ Brugarolas *et al.* (2009) and Dinis *et al.* (2011) provide an excellent overview of the policies and dynamics underlying the sector of fruits and vegetables, considering Spanish tomatoes and Portuguese apples, respectively.

This paper investigates to what extent consumers' willingness to pay for apples depends on the attribute variety's origin (national or foreign). The main goals are: i) to assess consumers' WTP for the attribute product origin (national compared to foreign); ii) to determine the sensitivity of the value elicited to the elicitation method (hypothetical CVM compared to an real auction format). The procedure compares the values from an open ended question on the willingness to pay for two apple varieties. These results are then compared to the value elicited in a real purchasing situation, applying the BDM (Becker *et al* (1964)) procedure. In sum, the paper demonstrates the applicability of the Contingent Valuation Method to eliciting the effect of information on an attribute on elicited WTP, and shows the sensitivity of the values elicited to the elicitation method

2. Literature Review

Valuation studies have sought to determine the influence of certain attributes in the willingness to pay (WTP) measures for food products, including the importance of organically produced fruit and vegetables (Boccaletti and Nardella, 2000; Zhao *et al.*, 2007; Combris *et al.*, 2012), freshness (Lund *et al.*, 2006), the variety origin (Brugarolas *et al.*, 2009) or the appellation of origin (Combris *et al.*, 2009).

Regarding the process of production and storage several authors have elicited consumers' preferences through hypothetical and real purchasing situations. Boccaletti and Nardella (2000) and Combris *et al.* (2012) found significant positive effects on the WTP for fresh fruit and vegetables, and fresh and processed apples, respectively, from a reduction of pesticide use. Through the elicitation of Italian consumers' willingness to pay (WTP) using a payment card method (with five ranges of price premiums in percentage of the regular production' price), Boccaletti and Nardella (2000) found that the majority of participants were willing to pay a price premium for pesticide free fresh fruit and vegetables (only 11% refused to pay more), but the price premium should not be superior to 10% than the regular production' price. Combris *et al.* (2012), combining the BDM auction mechanism with sensorial and visual analysis, found that Portuguese and French consumers are willing to pay for the reduction of pesticides use on apples and apple juice. Comparatively to the conventional apple (whose production only takes into account the national legal requirements for the use of pesticides), the Portuguese are WTP an extra price of 53,6% for the integrated protection apple (reduced use of pesticides) and 96,4% for the organic apple (free pesticides use). In a distinct perspective, Zhao *et al.*, (2007) assessed the impact of the production method on sensory quality, detecting potential differences in taste between organic and conventional vegetables. The results of two consumers' tests, in which consumers were asked to score overall liking, intensity of overall flavor, intensities of bitterness/sweetness, suggested that in overall, organically and conventionally grown vegetables did not show significant differences in consumer liking or consumer-perceived sensory quality. Lund *et al.* (2006) found significant effects of the storage duration (freshness) on the monetary value that consumers attach to Granny Smith apples.

Considering the effects of other attributes not related to the process of production per se, Brugarolas *et al.* (2009) concluded that consumers are willing to pay a surcharge for a traditional tomato variety and Combris *et al.* (2009) found a significant impact of the Burgundy appellation of origin (wine label) on the WTP of French consumers, but not of the German participants. Specifically, implementing the experimental market approach (WTP and WTA), Lund *et al.* (2006) concluded that the consumer perceptions regarding the apples' monetary value was influenced by sensorial aspects (taste) and by the information related to freshness (storage time). Before tasting, 90% of the respondents preferred the new apple (stored for two months) over the older (stored for 8 months) and after tasting this preponderance dropped at 55%. Nevertheless the authors didn't find statistically significant differences between the mean prices to exchange "old" for new apples, before and after tasting. In Brugarolas *et al.* (2009) the results from two procedures, CVM and the second price Vickrey

auction, both suggest that the Spanish consumers are willing to pay a premium price for traditional varieties of tomatoes in comparison to a hybrid with the same characteristics. Nevertheless the mean prices from CVM and the experimental auction were statistically different (at 10% of significance), being lower through the experimental procedure. Combris *et al.* (2009) combines sensory and experimental economics techniques (BDM procedure) to analyze the influence of information and of products' characteristics on consumers' WTP for wines. The experiment involved the evaluation of 4 wines: after blind tasting; after observation of the bottle with no tasting; and after analysis of bottle and tasting. In both samples (France and Germany) prices in the blind tasting are lower than in label and full information cases. The labels have impact on WTP, but the same conclusion does not apply to denomination of origin outside France (the Burgundy appellation does not impact on the WTP of German participants).

Information of product's health, nutritional or risk characteristics (Boccaletti and Nardella, 2000; Ginon *et al.* 2007, Marette *et al.*, 2010; DeGroot *et al.*, 2011) as well as the comparison of the WTP under different information context (e.g. Poole *et al.*, 2007; Combris *et al.*, 2012) has also been subject to analysis.

The effects of providing additional information on the WTP are not unanimous. Distinctly from Ginon *et al.* (2007) and Boccaletti and Nardella (2000) there exist some evidences of a significant impact of providing information (e.g. Marette *et al.*, 2010; and DeGroot *et al.*, 2011). Ginon *et al.*, (2007), using the BDM procedure, assess the impact of nutritional information on consumers' willingness to pay for orange juice, and of a positive health claim about fiber in relation to bread and concluded that the participants were not willing to pay more, after they received detailed information. Additionally, Boccaletti and Nardella (2000) concluded that the information about health risks from pesticides did not affect the WTP. Distinctly, conducting BDM² auctions in three Kenyan regions, DeGroot *et al.* (2011) assessed a premium on WTP of 24% for fortified maize (contained more vitamin A) and a discount of 11% for yellow maize. In the same direction, the results from a lab experiment conducted in Paris (Marette *et al.*, 2010) support a positive effect of providing health information on consumers' WTP for enriched yoghurts (Danacol) with cholesterol-lowering properties. The first stage of the study included tasting and a subsequent hedonic rating between the plain yoghurt and the enriched. The second stage included the elicitation of the WTP using the BDM mechanism and the BMS mechanism³.

Regarding the comparison of the WTP under different information contexts, Poole *et al.* (2007) applied the experimental auction method to assess the impact on WTP for five varieties of soft citrus under three information situations: visual inspection; visual inspection after peeling and after tasting. 40 participants attended a second price Vickrey auction and other 40 attended simultaneously a Vickrey auction and a hedonic test (previous scoring on a scale from 1 to 7). On the basis on visual appearance (1st stage) there were no significant differences between the scores and average bids for all varieties. But differences between varieties were found with information (peeling and tasting). The authors conclude similar evidences from scoring and bidding, serving as validation of the auction procedure. Combris *et al.* (2012) assessed participants' WTP in 4 situations: sensorial analysis; visual analysis; visual analysis and presentation of the information (label); sensorial (tasting) and visual analysis and found a negative impact of providing information on the WTP for regular apples (whose production only takes in account the national legal requirements for the use of pesticides). Nevertheless, at sensory level, the Portuguese consumers evaluate the organic apples 10,8% below the regular.

² Distinctly from the usual randomly generated price, the transaction price was defined by the bid submitted by the participant (if the participant' bid was higher than a number, randomly drawn from a normal distribution, the purchase must occur) (DeGroot *et al.*, 2011).

³ The BDS mechanism (Binswanger, 1980 and Masters and Sanogo, 2002) asked consumers to choose between an enriched yoghurt and a plain yoghurt from the same brand (Marette *et al.*, 2010).

In sum, several applications have demonstrated that consumers' preferences follow Lancaster (1966) specifications in the sense that consumers' WTP vary with the attributes that characterize the product, although there is some variation in the methodologies used, how they are implemented and, as expected, some variation in the results.

3. Methodology

Different methods are used to evaluate the impact of food attributes on consumers' valuation. Despite its extensive application in the valuation of nonmarket goods, the CVM has been recently used to value food safety and design agrofood marketing (Boccaletti and Nardella, 2000; Brugarolas *et al.*, 2009 and the references therein). However, experimental auctions are becoming an important alternative to CVM as they overcome the hypothetical nature of the CVM, mimic closely the choice process and the market in considering a real product and a real exchange of money (Brugarolas *et al.*, 2009; Poole *et al.*, 2007; De Groote *et al.*, 2011).

In realm of experimental economics, two main demand revealing procedures have been applied: the second price sealed bid auction, also called the Vickrey auction (Vickrey, 1961), and the Becker-DeGroot-Marschak (BDM) mechanism (Becker *et al.*, 1964). The second price Vickrey auction asks each respondent to submit a bid (corresponding to its maximum willingness to pay) for a good. The participant who wins the auction can purchase the good at the price stated by the second highest bid among the bidders in the auction. The BDM asks to each respondent to submit a bid that will be compared to a selling price randomly drawn from a distribution of possible prices defined by the researcher. If the submitted bid exceeds (or equals) the selling price, the purchase will occur at the sale price (e.g. Noussair *et al.*, 2004; Lohéac and Issanchou, 2007). Both the experimental approaches incentive truthfully bidding, but in the BDM the behavior of the auction participants' is independent, in the sense that is individual and does not depend on the valuation of other subjects. This reason justified the application of the BDM in the present study. The results are compared with the hypothetical contingent valuation, contributing to the debate in the literature about the reliability of each procedure.

3.1. Implementation procedure

Surveys were administered in person at three supermarkets (grocery stores) located in the Portuguese cities of Coimbra and Porto, between January and May 2012.

A total of 216 participants were recruited among the stores' clients. Each subject took part in one of the two treatments or survey versions: an hypothetical version (HPM) and a real purchasing situation (RM). All the participants tasted the apples (taste panel), were provided information and then their willingness to pay was elicited.

Participants were informed that they would taste two apple varieties (A and B) placed on a table in front of them. In the first stage, participants were allowed to taste Apple A (left side of the table) first and then Apple B (right side). Each participant only tasted one of the 18 possible pairs of apples (Table 1).

Each combination is formed by a Portuguese traditional variety (Malápio da Serra, Pêro Pipo or Bravo-Esmolfe) and a Foreign variety (Golden delicious, Starking or Fuji). To control for the possibility of order effects, for 50% of the combinations (from A to I) apple A corresponds to the Foreign variety and the apple B to the Traditional Portuguese variety and for the other 50% the reverse order (Apple A- traditional Portuguese variety; Apple B- Foreign), as presented on the Table 1.

Table 1 _Tasting combinations

Combination	Panel Position	
	Left (Apple A)	Right (Apple B)

A	Golden Delicious	Malápío da Serra*
B	Golden Delicious	Pêro Pipo*
C	Golden Delicious	Bravo*
D	Starking	Malápío da Serra*
E	Starking	Pêro Pipo*
F	Starking	Bravo*
G	Fuji	Malápío da Serra*
H	Fuji	Pêro Pipo*
I	Fuji	Bravo*
J	Malápío da Serra*	Golden Delicious
L	Malápío da Serra*	Starking
M	Malápío da Serra*	Fuji
N	Pêro Pipo*	Golden Delicious
O	Pêro Pipo*	Starking
P	Pêro Pipo*	Fuji
Q	Bravo*	Golden Delicious
R	Bravo*	Starking
S	Bravo*	Fuji

*Portuguese traditional variety

After tasting, the participants were asked to complete a rating sheet (hedonic classification) for scoring the following apples attributes: appearance, texture, taste and smell (1-5). They were also asked to give an overall score (1-5) for each variety.

The **HPM version** applies the contingent valuation method to assess the willingness to pay for two distinct apples varieties, subjects state their WTP for one kilogram (kg) of each variety before and after tasting the apples. In addition, at a final stage subjects are given the possibility to purchase the apples at the submitted WTP. We also elicit the degree of certainty regarding the expressed WTP values (in a scale ranging from 0-10, where 0 means low certainty, and 10 corresponds to absolute certainty).

The **RM version** is similar to an experimental market, applying the Becker-DeGroot-Marschak (BDM) procedure (Becker et al., 1964). The participants were informed that in case they agreed to participate in the study, they may had to buy 1 kg of apples (one of the two presented varieties). For this purpose, after tasting and rating the two apple varieties, the participants were asked to submit the maximum price they would agree to pay for a kg of each variety. In a second stage, the participants received information about the apples' origin and were asked to resubmit their willingness to pay. For each variety, if the resubmitted WTP exceeds or equals the selling price (drawn at random, ranging from 5 to 400 cents), the participant would take a kg at the random selling price drawn. If the submitted WTP was less than the selling price, the participant paid nothing and could not get the apples.

It was explained to the participants (through several examples⁴) that is of their own interest to bid exactly the amount that the apples were worth to them, that is, to reveal truthfully the value they are actually be willing to pay.

All the questionnaires' versions include a final section to collect purchase behavior data and socio-demographic information. Table 2 presents a summary of the main treatment characteristics.

⁴ For example, if you are willing to pay 1 Euro but you submitted a bid of 50 cents, in case of a selling price of 51 cents, you will not get the apples. If you said the real value you would pay only 51 cents. Also, if you are only willing to pay up to 50 cents and tell us that you will pay 1 euro, in the situation of a selling price of 1 euro, you must buy it for 1 euro when in fact your real value was 50 cents.

Table 2_ Summary of treatments

	Real version (RM)	Hypothetical-Taste (HPM)
1)	Tasting and rating the apples' attributes	Tasting and rating the apples' attributes
2)	WTP elicitation (open ended question)	WTP elicitation (open ended question)
3)	Apple Variety' Information	Apple Variety' Information
4)	New WTP elicitation (open ended question)	New WTP elicitation (open ended question)
5)	BDM procedure	
6)		Elicits degree of certainty regarding the wtp
7)	Gives the possibility of purchasing at the selling price for those who do not win the auction	Gives the possibility of purchasing at the bided wtp

4. Results

The sample is composed of 216 observations, average age is approximately 50 years, most of subjects are female (75% approximately), and have an average income of 1750 Euros per month.

Table 3_ Descriptive statistics

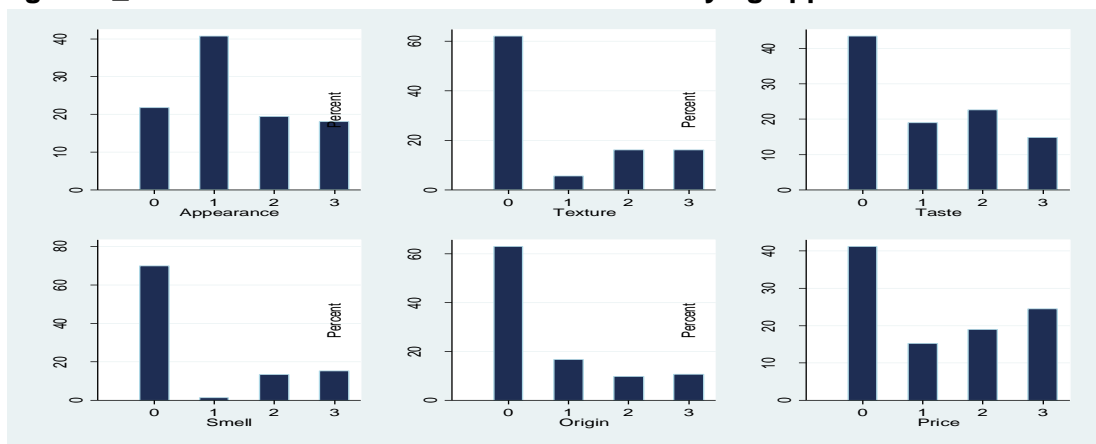
Variables	N. obs	Mean/Median	Std dev.	Min	Max
WTPN	216	1.0149	0.4348	0	3.5
WTPF	216	1.0062	0.4335	0	3
Male	216	0.2454		0	1
Age	216	49.9352	12.5437	24	79
Income	211	1749.308	975.4412	250	5000
KnowTradVar_exp	177	0.3842	0.4878	0	1
Quantity	210	2.3367	1.6445	0	10
Correctly IdentifiesN	116	0.5431		0	1
Correctly IdentifiesF	106	0.4245		0	1
TextureN	216	4		1	5
TextureF	216	4		1	5
TasteN	216	4		1	5
TasteF	216	4		1	5
SmellN	216	4		2	5
SmellF	216	4		1	5
GlobalN	216	4		1	5
GlobalF	216	4		1	5
Appearance	216	0.7824		0	1
Texture	216	0.3796		0	1
Taste	216	0.5648		0	1
Smell	216	0.3009		0	1
Origin	216	0.3704		0	1
Price	216	0.5879		0	1
CertaintyN	106	7		2	10
CertaintyF	106	8		1	10

Notes: Standard deviations in parenthesis; For categorical variables the table displays the median;

Regarding subjects behavior towards apples, 38% identified the national variety by their experience with a rural environment (KnowTradVar_exp) and buys 2.3 kg of apples per week, on average (quantity). It is impressive the ability of subjects to correctly identify the varieties tasted, 54% correctly identified the national variety

(Correctly IdentifiesN), while 43% correctly identified the foreign (Correctly IdentifiesF). Most of the organoleptic characteristics received a classification of 4 (median value), both for national and foreign varieties. However, when asked for the three most important characteristics when buying apples, appearance is the most common (78%), followed by price and taste, 37% refer the origin of the apple as an important characteristic in the buying decision, only Smell is less frequently mentioned. In the HPM treatment, subjects were quite certain of stated WTP, median certainty values are 7 and 8 for the national and foreign varieties, respectively. Finally we observe that overall the mean WTP for the national variety is only slightly higher than the WTP for the foreign variety, however, in order to answer our main research question a multivariable analysis is in order, namely the control for the evaluation of the attributes from the perspective of the consumer. Table 3 presents the descriptive statistics just analyzed.

Figure 1_Rank of most relevant attributes when buying apples



Looking more closely at the attributes considered relevant in the decision to buy apples, Figure 1, depicts the 3 most important attributes considered in the decision of buying apples. Appearance is the number one attribute most frequently mentioned by the respondents, approximately 40% of the respondents classify the Appearance as the number one attribute; next they mention Taste, Price and finally Origin. Recoding these variables as binary variables, we conclude (Table 3) that appearance is in between the first three attributes for 78%, followed by price (58%) and taste (56%), approximately.

Regarding the classification of the organoleptic characteristics of the national varieties tasted (Figure 2), the most appreciated attribute is Taste, followed by texture both with around 30% of the respondents attributing the 5 point classification. The least important attributes are appearance and smell. Overall, the median classification for national varieties is 4 (Table 3).

Figure 2_Rank of Organoleptic characteristics of National Varieties

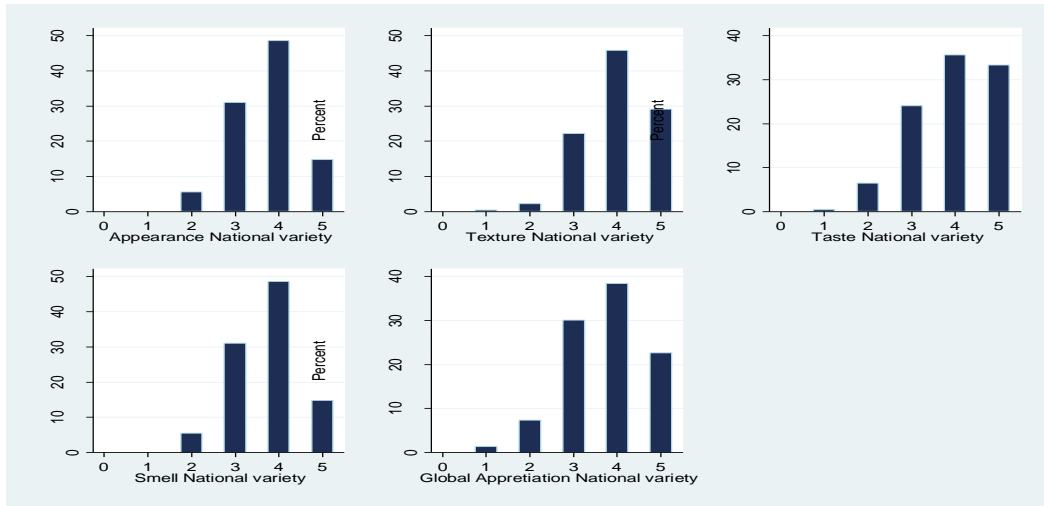


Figure 3_ Rank of Organoleptic characteristics of Foreign Varieties

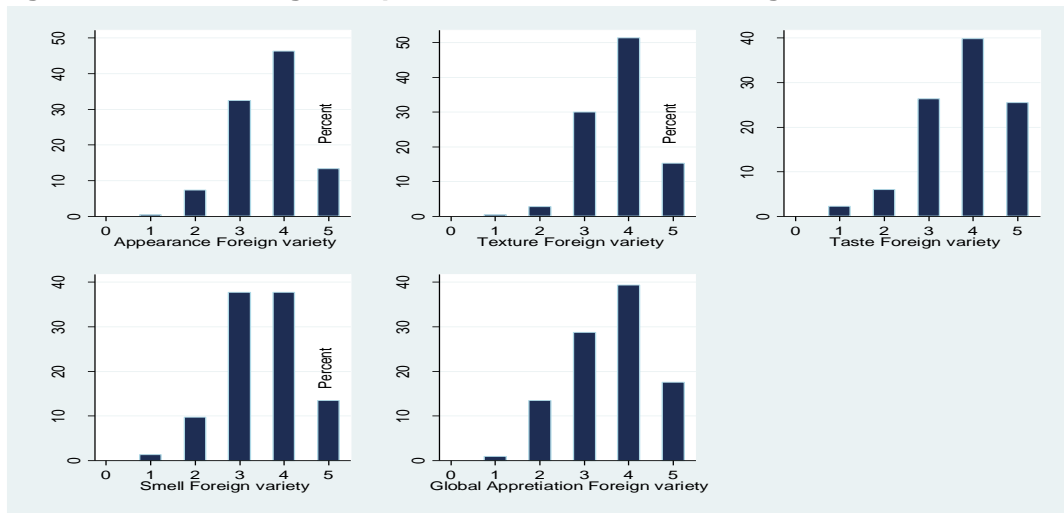
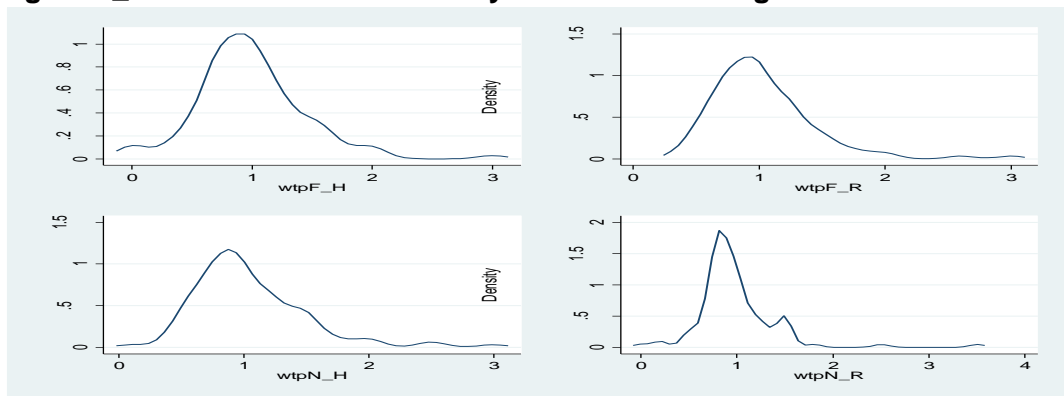


Figure 4_ Distribution of the WTP by treatment and origin



The Foreign varieties most appreciated attribute is also Taste (Figure 2). However, Texture and Appearance also receive very high scores. Overall, the median classification for foreign varieties is also 4 (Table 3).

A graphical representation of the distribution of the WTP by treatment and variety (Figure 4) shows that hypothetical values (wtpN_H and wtpF_H) are only slightly more dispersed than real values (wtpN_R and wtpF_R).

Table 4_ Tobit regressions for Willingness to pay for national and foreign apple varieties in hypothetical (HPM) and real purchasing situations (RM)

	Marginal effects (std dev)			
	WTPN_H	WTPN_R	WTPF_H	WTPF_R
Organoleptic characteristics				
Texture	0.2048* (0.1229)	-0.1266 (0.1232)	0.0259 (0.0709)	-0.1007 (0.0816)
Taste	-0.0379 (0.0812)	0.2146** (0.1059)	0.1844*** (0.0704)	0.1884** (0.0841)
Smell	0.0207 (0.0957)	-0.0627 (0.0408)	0.1327* (0.0813)	0.1223** (0.0619)
Tasting experience				
Correctly Identifies	-0.0621 (0.1398)	-0.2867*** (0.0756)	0.1473 (0.0106)	0.3376*** (0.0797)
KnowTradVar_exp	0.0404 (0.1045)	0.1574** (0.0743)	-0.0418 (0.1257)	0.1000 (0.0883)
Buying experience				
Qapple	-0.0106 (0.0219)	-0.0115 (0.0283)	-0.0067 (0.0252)	-0.0314 (0.0243)
Appearance	0.2274 (0.2183)	0.4322*** (0.1238)	0.2792 (0.2268)	0.2339* (0.1397)
Texture	0.2377 (0.1907)	0.1435** (0.0742)	0.5293*** (0.1503)	-0.0128 (0.1129)
Taste	0.3950** (0.1970)	0.0282 (0.1157)	0.5148*** (0.1970)	0.0627 (0.1189)
Smell	0.2204 (0.3259)	0.3410**** (0.1107)	0.6604** (0.3020)	0.1435 (0.1423)
Origin	0.2619 (0.2266)	0.31136*** (0.0872)	0.7220*** (0.2366)	0.2509*** (0.0909)
Price	0.3077 (0.2682)	<i>Excluded by collinearity</i>	0.7464*** (0.2293)	<i>Excluded by collinearity</i>
Certainty in response				
Certainty	0.0041 (0.0223)		0.0015 (0.0292)	
Sociodemographic characteristics				
Male	-0.0801 (0.1119)	0.1309 (0.1021)	0.1254 (0.1559)	0.0158 (0.1313)
Age	-0.0172* (0.0077)	0.0023 (0.0034)	-0.0119** (0.0062)	0.0062 (0.0044)
Income	0.0006 (0.0001)	-0.0001 (0.0001)	-0.0001 (0.0001)	-0.0000 (0.0001)
Predicted WTP	1.01674	0.92497	0.99288	1.09302
Predict st error	(.0336)	(0.0374)	(0.0625)	(0.0433)
95% CI	[0.9490;1.0844]	[0.8499;1.0000]	[0.8661;1.1197]	[1.0061;1.1799]
N	46	53	37	53
Prob>F	0.0024	0.0005	0.0000	0.0000

Using the data collected we estimate the willingness to pay for national and foreign apple varieties in hypothetical and real purchasing situations. The model used is the tobit regression and accounts for the censored nature of the dependent variable. As explanatory variables we include three groups accounting for organoleptic

characteristics in the view of the respondent (texture, Taste and Smell, measure on a scale of 1 to 5, where 5 is very good); one group including variables regarding the tasting experience(if subject correctly identified the name of the tasted variety, and if the subjects know the variety by experience in growing them themselves or family or friends), we also include a group of variables describing the buying behavior (quantity of apples bough per week, what are the most important attributes when buying apples – appearance, taste, smell, price, origin and texture. Finally, we include socio-demographic characteristics (gender, age and income) and for the hypothetical situation only, we asked respondents how certain they were of the submitted price.

The most consistent organoleptic characteristic is taste whose marginal effect is always positive when significant and quite large in magnitude in three out of the four regressions presented; smell is also significant for the foreign varieties. The correct identification of the national variety, depreciates its price, but increases the price of the foreign variety. Also with a significant positive effect on the WTP for national varieties is knowing the apple by rural experience. The quantity of apples bought per week, on average, is not significant in any regression; the attribute price was excluded due to collinearity in two regressions and is statistically significant only in the regression of WTPF_H, and has the expected positive-sign.

The socio-demographic characteristics are not consistently statistically significant, except for age that in the hypothetical situation has a negative effect on the WTP for national and foreign varieties. Subjects' income is not statistically significant in all regressions and has a very small effect. Although this may seem counterintuitive, the specificities of the situation may explain the result, as subjects are considering buying an item of food, which represents a very small fraction of the monthly income in our data (0.7%). Table 3 also reports the predicted WTP as point and interval estimation. Interestingly the WTP for foreign varieties is higher than for national varieties, in the real purchasing decisions but not in the hypothetical situations. In addition, the hypothetical WTP for national varieties is higher than the real WTP; for foreign varieties, the hypothetical WTP is lower than the real WTP.

Analyzing the statistical significance of these differences, Table 4 reports that there is some evidence of hypothetical bias ($WTP_H > WTP_R$) for national varieties, but not for foreign varieties. The difference between the WTP for foreign and national varieties is not statistically different from zero in the hypothetical treatment, but it is in the real purchasing situation, where the WTP for national variety is lower than the WTP for the foreign variety (p-value of 0.002 for unilateral test)

Table 4_ t-test for hypothetical bias and value of national varieties (p-values)

	WTPF_H (0.9929)	WTPN_R (0.9249)
WTPN_H (1.0167)	(WTPN_H ≠ WTPF_H) 0.7380	(WTPN_R < WTPN_H) 0.0373
WTPF_R (1.093)	(WTPF_R < WTPF_H) 0.9116	(WTPN_R ≠ WTPF_R) 0.0041

(standard errors in parêntesis)

As the order in which the varieties were tasted could have some effect on the WTP we included a dummy variable, which was not statistically significant in any on the four regressions.

Taking the results together we may conclude that the organoleptic characteristics that are most valued in the real purchasing situations are the same for national and foreign varieties. Additionally, organoleptic characteristics are better explanations for the WTP of foreign varieties than for national as they are statistically significant for the hypothetical and real situations, except for Texture. Also, the correct identification of the tasted variety has a positive effect on the WTP for foreign variety but a negative effect on the WTP for national varieties. These results lead as to conclude that in fact

our sample prefers the foreign varieties, pays more for them, and appreciate more effectively its characteristics.

The hypothetical bias, that is present in many applications of the CVM, is not present in the case of the Foreign variety, but it is present in the case of the national variety.

5. Concluding Remarks

The present paper analyzes the effect of the origin of the variety of apples on its valuation using two different methodologies, a hypothetical CV method and a BDM mechanism. Both applications were preceded by tasting and rating the apples with respect to 4 organoleptic characteristics.

We conclude that the elicitation mechanism used matters only in the case of the national varieties, when valuing the foreign variety the predicted mean WTP in the hypothetical (CVM) and real treatment (BDM) are not statistically different. Additionally, in the hypothetical treatment, the predicted mean WTP for the National variety is not distinguishable from the predicted mean WTP for the foreign variety. However, in the real treatment subjects are predicted to be willing to pay statistically higher prices for the foreign variety than for the national variety. Thus, we conclude that the characteristic national variety is not valued by consumers when buying apples, in fact it has a detrimental effect on the valuation. As consumers, about half of them, correctly identify the varieties, and the correct identification has a positive influence on their WTP, we are confident that the lower WTP for the national variety is not due to some confusion on the part of the subjects but is related to the organoleptic characteristics of the specific apples tasted. Additionally, the correct identification of the variety has a positive marginal effect for the foreign variety, but a negative effect in the case of the national variety, giving us further confidence in the consistency of behavior.

It should also be stressed that the organoleptic characteristics that are most valued in the real purchasing situations are the same for national and foreign varieties. Additionally, organoleptic characteristics are better explanations for the WTP of foreign varieties than for national as they are statistically significant for the hypothetical and real situations, except for Texture. Taste is a significant predictor of mean WTP both for national and foreign varieties, but Smell is only significant for the foreign variety. A more detailed analysis by apple variety is left to future work.

In the present application we controlled for the order in which consumers tasted the national and foreign varieties and it made no difference.

In sum, our sample prefers foreign varieties, pays more for them, and appreciates more effectively their characteristics.

REFERENCES

- Becker, G.M., DeGroot, M.H., Marschak, J. (1964). Measuring utility by a single response sequential method. *Behavioural Science* 9, 226–232
- Binswanger, H.P. (1980). Attitudes toward risk: experimental measurement in rural India. *American Journal of Agricultural Economics* 62, 395–407.
- Boccaletti, S., Nardella, M. (2000). Consumer willingness to pay for pesticide-free fresh fruit and vegetables in Italy. *International Food and Agribusiness Management Review*, 3: 297–310.
- Brugarolas M., Martínez-Carrasco L., Martínez-Poveda A., Ruiz J., 2009. A competitive strategy for vegetable products: traditional varieties of tomato in the local market. *Spanish Journal of Agricultural Research* 7(2), 294-304.
- Combris, P., Bazoche P., Giraud-Héraud, E., Issanchou, S. (2009). Food choices: What do we learn from combining sensory and economic experiments? *Food Quality and Preference* 20: 550–557.
- Combris, P., Giraud-Héraud, E., Bazoche, P., Hannus, C., Pinto, A.S., Berjano, M., Maia, R. (2012). Consumers' willingness to pay for reduced pesticide use in the production of fresh and processed apples. *Acta Horticulturae (ISHS)* 940: 425-431
http://www.actahort.org/books/940/940_61.htm
- Dinis, I., Simões, O., Moreira, J. (2011). Using sensory experiments to determine consumers' willingness to pay for traditional apple varieties. *Spanish Journal of Agricultural Research* 9(2), 351-362.
- Ginon, E., Issanchou, S., Lohéac, Y. (2007). Nutritional information and willingness to pay (WTP) Working Paper. Available at
http://www.youennloheac.fr/documents/WP_Ginon_Issanchou_Loheac.pdf
- De Groote H., Kimenju S., Morawetz U. (2011). Estimating consumer willingness to pay for food quality with experimental auctions: the case of yellow versus fortified maize meal in Kenya. *Agricultural Economics* 42, 1–16.
- Harker, F, Gunson, F, Jaeger, S. (2003). The case for fruit quality: an interpretive review of consumer attitudes and preferences for apples. *Postharvest Biology and Technology* 28: 333–347
- Lancaster, K.J. (1966). A new approach to consumer theory. *Journal of Political Economy*, Vol. 74, No. 2.
- Lohéac Y., Issanchou S. (2007). Using auctions to estimate prices and value of food products, *Consumer-led food product development*, ed. H. Macfie, Woodhead Publishing Ltd, 471-491.
- Lund, C., Jaeger, S., Amos, R., Brookfield, P., Harker, R. (2006). Tradeoffs between emotional and sensory perceptions of freshness influence the price consumers will pay for apples: Results from an experimental market. *Postharvest Biology and Technology* 41 (2), 172–180.
- MADRP (2009). *Estratégia nacional para programas operacionais sustentáveis de organizações de produtores de frutas e produtos hortícolas*. Ministério da Agricultura, Desenvolvimento Rural e Pescas, Lisboa.

Marette, S., J. Roosen, S. Blanchemanche, E. Feinblatt-Mélèze (2010). Functional Food, Uncertainty and Consumers' Choices: A Lab Experiment with Enriched Yoghurts for Lowering Cholesterol. *Food Policy* 35(5), 419-428.

Masters, W.A., Sanogo, D. (2002). Welfare gains from quality certification of infant foods: results from a market experiment in Mali. *American Journal of Agricultural Economics* 84 (4), 974–989.

Noussair, C., Robin, S., Ruffieux, B. (2004). [Revealing consumers' willingness-to-pay: A comparison of the BDM mechanism and the Vickrey auction.](#) *Journal of Economic Psychology*, 25(6): 725-741.

Poole, N., Martínez, L., Giménez, F. (2007). Quality perceptions under evolving information conditions: implications for diet, health and consumer satisfaction. *Food Policy*, 32: 175–188.

Radman, M.(2005) Consumer consumption and perception of organic products in Croatia. *British Food Journal*, Vol. 107 Iss: 4, pp.263 – 273

Richards, T., Patterson, P. (2000). New varieties and the returns to commodity promotion: the case of Fuji apples. *Agricultural Research Economic Review*, 29: 10-23.

Vickrey, W. (1961). Counterspeculation, auctions, and competitive sealed tenders. *Journal of Finance*, 16: 8–37.

Zhao, X., Chambers, E., Matta, Z., Loughin, T. M. and Carey, E. E. (2007), Consumer Sensory Analysis of Organically and Conventionally Grown Vegetables. *Journal of Food Science*, 72: S87–S91. doi: 10.1111/j.1750-3841.2007.00277.x