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# Consumer willingness to pay for pesticide-free fresh fruit and vegetables in Italy

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## Abstract

The results and analysis of a survey of Italian consumers' willingness to pay (WTP) for pesticide-free fresh fruit and vegetables are presented. A consumer survey regarding WTP for organic produce was conducted in three large grocery stores in Northern Italy. From the collected data, an ordered logit analysis was constructed to identify the impacts of relevant explanatory variables on the probability of consumers' WTP for different price premiums for the produce. The results indicate that WTP is significantly and positively related to income and risk concern and negatively related to education. © 2001 Elsevier Science Inc. All rights reserved.

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## 1. Introduction

In Italy about 10% of total fresh fruit and vegetables (FFV) sold in supermarket chains belong to two categories: organic products and products obtained from other environmentally friendly methods. Total revenue from these categories is about 1,400 million dollars. However, produce from pure organic farming represents only one-fourth of this amount. This indicates the increasing interest Italian consumers have for environmentally friendly FFV. However, it also indicates the marginal importance that organic products still have on total demand. The relatively high price of organic produce, which is sometimes twice the price of regular produce, compared to the lower prices for fresh produce obtained from other environmentally friendly methods (only 20–30% of regular produce prices), help to explain the differing successes of these two categories.

Factors which may result in a consumer's negative attitude towards organic products

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include: a substantial lack of organic product information and proper organic certification which erodes consumer's trust (Rizzardi, 1997), consumers perceptions that organic products are only baby food or food for sick people (Piraccini, 2000) and the low product availability in supermarkets, where the bulk of consumers shop.

Looking more closely at the 1999 FFV consumption data, organic produce represented only about 5% of the total consumption (Agrisole, 1999a). Present consumer behavior suggests that commercial categories of fresh produce have reached different stages along the product life cycle, with organic products still in the launch phase and other environmentally friendly products in full development. Nevertheless, recent data show a 20% annual growth rate for organic products in Italy (Agrisole, 1999b). However only 65 organic produce wholesalers out of 400 are able to sell their products through multiple retailers; the only way to reach the entire domestic market. 85% of the total revenue of these large producers (about 85 billion lire  $\sim$  40 million dollars) is in the hands of eight leaders.

This high degree of market concentration gives us an idea of the fragmented supply of organic produce in Italy. It turns out, about two-thirds of the firms sell their products directly to final consumers but are able to do so only through local markets. To access the mass market, producers must reach a minimum efficient size. This also contributes to reduced costs, especially marketing costs, characterized by relevant economies of scale, with direct benefits to consumers through lower prices.

Our research is specifically oriented to the customer of large supermarkets/hypermarkets, that is, consumers generally showing a lower WTP for food products compared to those shopping in traditional outlets. The basic idea is to evaluate the potential for organic FFV, in particular if consumers would be willing to pay price premiums to purchase these products and to what extent. Unfortunately, the very few empirical studies addressing this issue are basically descriptive, often with a psychological more than an economic approach. Therefore, the purpose of this article is to measure how much Italian consumers would be willing to pay for safety in the case of pesticide-free FFV and why. We believe that the results can provide important information for the producers and retailers to help them to understand the main factors affecting consumers' decisions and therefore improve their marketing strategies.

## 2. Conceptual framework

Previous discussion supports the idea that in Italy, for most consumers, pesticide-free FFV are basically nonmarket goods. This is true for two main reasons: First, organic produce still has a limited diffusion, mostly through very specific and specialized market channels, therefore, it does not always reach the mass market, which is served through supermarket chains. Second, consumers are not always able to recognize organic produce from regular produce. This is because of a lack of quality signals and inadequate certification procedures and to their limited consumption experience. These two factors make organic FFV quite undifferentiated from regular produce. Under these circumstances, consumers often doubt the existence of "really organic" FFV, perceiving these products as "nonmarket" products. For example, Rizzardi (1997) shows that the scarce demand for these products is attributable

to their limited in store diffusion, to the poor information that consumers have and to the fact that consumers do not trust organic FFV.

Although there are several economic methodologies to value nonmarket goods,<sup>1</sup> researchers usually consider Contingent Valuation (CV) the most appropriate for measuring food safety. The CV method is more flexible and has a relatively low cost compared to other methods that try to replicate real purchasing situations, such as experimental markets.

CV allows a direct estimation of WTP by means of different (direct) elicitation techniques. Consumers simply indicate their WTP without purchasing the (nonmarket) hypothetical product. Direct methods like both CV and experimental markets have raised several concerns about their reliability. A major issue is that consumers may have little information about the risks involved and therefore they may give a wrong monetary evaluation of the benefit from risk avoidance. A possible solution is to inform consumers about the risks involved during the interview or the experiment (Buzby et al., 1995; Fox et al., 1995).

A second problem is in regards to the product dependence of the analysis and the possibility of the extension of WTP results to other foods, that is, the results found for specific risks and food products cannot necessarily be generalized to other risks and products (Caswell, 1998).

Within the specific field of CV analysis, the reliance of this method on consumers' subjective responses makes the results vulnerable to several potential biases. First of all consumers face hypothetical-purchasing situations: they probably take this scenario less seriously than the real one and therefore they may tend to overestimate their true WTP (Blumenshein et al., 1998).

Nevertheless, the selection of appropriate survey and elicitation methods would reduce these biases. Data can be collected through personal face-to-face interviews, mail questionnaires or telephone interviews. Whenever consumers do not have good consumption experience regarding a product, either through direct use or indirectly through the use of similar products, direct contact with a well-trained interviewer would probably help respondents to focus on the risks involved or the risks that could be avoided. The Italian representative consumer is not particularly acquainted with pesticide-free products, and in any case his or her experience is quite limited, because of the rather recent introduction of these items. A direct elicitation with in-person interviews well suits this scenario.

Moreover, WTP elicitation using a payment card method is appropriate for its simplicity and to give to basically uninformed individuals a detailed choice among a range of pre-defined price premiums. This method asks respondents to select the amount they are willing to pay from a checklist of possible payments, either in absolute terms or as a percentage of price. We chose to use a payment card with five classes of price premiums in percentage of regular price.

### **3. Survey design**

Four hundred in-person interviews were conducted in January 1998 in three large supermarkets located in Northern Italy. The main purpose of the survey was to collect data on

individual WTP and on the explanatory variables that, from other similar studies, are believed to affect individual purchasing behavior. Respondents were asked to answer several questions grouped in the three main sections of the questionnaire.

In the first section, we identify the *socio-demographic* individual characteristics of respondents: age, sex, education, income, place of residence, and presence of children.

The second section is dedicated to the evaluation of the respondent's *food-borne risk perception*. Similar to other authors' (Misra et al., 1991) surveys, a pool of eight questions quantify consumer's risk perception about pesticide residues and four other food components: cholesterol, fat, salt, sugar. Specifically, the first five questions asked respondents, for each of these risk sources, to indicate the perceived risk level: no risk, low, moderate, high. In terms of scores, high-risk concern received 3 points, moderate concern 2, low concern 1 and no concern 0. To summarize individual risk types, an overall food risk concern variable (FOOD) was calculated summing the scores for each of the five questions: the maximum value was standardized at 100.

The remaining three questions referred to:

- Consumer's ranking of five food concerns: pesticide residues, cholesterol, fat, salt, sugar; if pesticides were ranked 1st, 2nd, or 3rd the answer received 3, 2, and 1 points, respectively;
- An opinion statement concerning the use of pesticides on FFV: consumer's suggestion to ban pesticides, to ban some pesticides and monitor the use of the others, to increase testing and certification or to do nothing. Points assigned were 3, 2, 1, and 0, respectively;
- An opinion statement about the importance of a label certifying the low level of pesticide residues: "important" received 1 point, "non-important" 0 points.

An overall index variable (PEST) to evaluate risk perception from pesticide residues was calculated adding the points obtained for the above three questions to those obtained from the previous question on the risk level perception about pesticides: the maximum value was standardized at 100.

In the last section, we elicited WTP by asking respondents to indicate how much above regular prices they would be willing to pay, choosing from 5 classes of price premiums: 0%, no more than 5%, 6 to 10%, 11 to 15%, 16 to 20%, or more than 20%.

In this section, we also tried to directly assess the impact that information about health risks from pesticides may have on WTP. First, we asked the respondent if he knew at least one out of three main negative effects of pesticides on human health. From this question a "knowledge" variable (KNOW) was obtained. We also tried to assess the impact of new information on health risks on WTP. After a brief illustration of three main effects, respondents were asked to reformulate their WTP. We found that the new variable was not statistically different from the one obtained from the first elicitation.

We were able to complete 336 questionnaires out of the 400 people interviewed. This was either because the contacted person declined an interview or because the information collected was not complete.

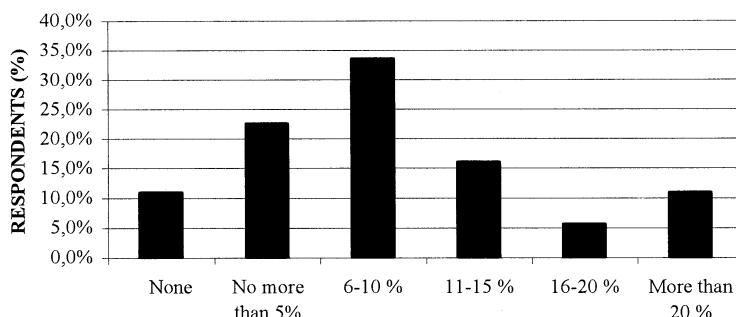


Fig. 1. Respondents' WTP.

#### 4. Survey results

Looking at the WTP sample distribution, the survey clearly suggests that most respondents (72%) were not willing to pay a price premium higher than 15% for pesticide-free FFV. Eleven percent were not willing to pay anything, while the highest percentage, 34%, were willing to pay a premium between 6 and 10% of the regular price (Fig. 1). This preliminary result confirms that Italian consumers do not really trust these products, and therefore perceive them as only a partial solution to their demand for safety (at least in the present situation, with a low evaluation of the positive marginal utility from the consumption of organic FFV). In 1995, Bagnara (1995) found results that, considering the three year lag with respect to our data, are comparable to ours, with 41% of the respondents perceiving the “organic” characteristic as intrinsic to the product but not as added value, therefore, showing no positive WTP for organic products. He also found that 52% of the respondents were willing to pay a positive price premium, but most of them were willing to pay only 20% more than the regular price.

Fig. 2 clearly shows the positive relationship between income and WTP -respondents who were not willing to pay higher prices had an average income of 21.3 million lire, well below the average income of those belonging to the modal WTP class (6–10%), 30 million lire. WTP is also positively related to AGE: the average age of the respondents willing to pay no more than 10% of the regular price was slightly above 40, whereas for those showing a

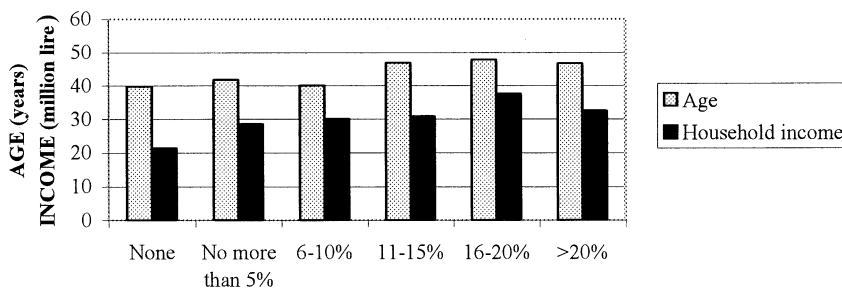


Fig. 2. WTP by age and income.

Table 1  
WTP for pesticide-free FFV and risk concern

WTP	Risk concern (PEST)		
	Low (<50)	Medium (50–80)	High (>80)
None	33%	11%	5%
<5%	23%	23%	23%
6–10	19%	36%	33%
11–15	16%	15%	18%
16–20	7%	6%	5%
>20	3%	9%	16%
Total	100%	100%	100%

higher WTP was about 47. Therefore, the respondents with the highest WTP seem to belong to two main categories defined in the Italian commercial literature (Bove, 1990).

The “traditionalist and careful” category, which includes people between 45 and 55 years of age, with a high education and a medium-high income: they pay particular attention to their food consumption and they usually have a good degree of information.

The “traditionalist-inattentive” category, with the same characteristics of income and age, but with a lower degree of information: they like pesticide-free products because they resemble the “good old ones.”

If WTP reflects the marginal utility attached to the consumption of one unit of pesticide-free FFV, then it should also depend on individual risk attitudes towards pesticides, summarized in the “risk concern variable” PEST. In principle, we would expect a higher WTP for those consumers more averse to risk, that is, with a higher value of the PEST risk concern index. This hypothesis is clearly confirmed in Table 1—16% of the respondents highly concerned about risk from pesticides were willing to pay a price premium greater than 20% of the regular price to buy pesticide-free FFV and only 5% were not willing to pay higher prices. For those showing low risk concern, the percentages were 3% and 33% respectively. In all cases, most of the respondents—74% in the medium and high concern classes and 58% in the low concern class—were willing to pay a premium between 5 and 15% of the regular price. This result reflects the difficulties that consumers faced when they were asked to quantify in monetary terms the benefits from reducing food risks, that is, to translate a qualitative perception into a quantitative measure. The lack of clear certification procedures able to guarantee a credence attribute, such as safety, and scarce product differentiation make the problem worse. Apparently, labeling products to certify organic production is not a guarantee itself. Most Italian consumers do not trust labels because they do not perceive the existence of proper certification procedures (Pirani and Re, 1999).

WTP and independent variables are defined and sample statistics are presented in Table 2. All the explanatory variables are binary, with the exception of the two risk perception indices FOOD and PEST.

In the sample, the average consumer was married (80% of the sample), 42 years old, with an average family income of 39.2 million lire (about 19,000 dollars), obtained at least a high school diploma (72%), lived in an urban area (78%) and knew at least one negative effect of

Table 2  
Variable definition and sample statistics

Variable definition	Variable name	Mean	Standard deviation	Max	Min
Willingness to pay for residue-free produce 0 = none 1 = no more than 5% 2 = 6–10% 3 = 11–15% 4 = 16–20% 5 = more than 20%	WTP	2.1577	1.4233	5	0
Age of respondent 1 = 34 or less, 0 otherwise	AGE 34	0.2976	0.4579	1	0
1 = 35–49, 0 otherwise	AGE 35–49	0.4405	0.4972	1	0
1 = 50–60, 0 otherwise	AGE 50–60	0.1935	0.3956	1	0
1 = more than 60, 0 otherwise	AGE over 60	0.0685	0.2529	1	0
Sex of respondent 1 = male; 0 = female	SEX	0.8185	0.3860	1	0
Education of respondent 1 = high school or university, 0 otherwise	EDUCATION	0.7202	0.4496	1	0
Place of residence 1 = Urban, 0 otherwise	URBAN	0.7768	0.4170	1	0
Household with children (less than 10 years old) 1 = children, 0 otherwise	CHILD	0.2649	0.4419	1	0
Household income 1 = less than 30 million lire, 0 otherwise	INCOME-30	0.3006	0.4592	1	0
1 = 30–60 million lire, 0 otherwise	INCOME 30–60	0.5655	0.4964	1	0
1 = more than 60 million lire, 0 otherwise	INCOME >60	0.1339	0.3411	1	0
Knowledge of pesticide-borne health risks 0 = no information 1 = one or more effects known	KNOW	0.8571	0.3504	1	0
Pesticides concern index	PEST	78.6905	16.6817	100	0
Food-borne risk concern index	FOOD	78.6111	15.9743	100	0

pesticides on human health (86%). The average number of family components was 3.2 with spouse, spouse and one or two children.

The three subsamples, one for each supermarket visited, were not statistically different. We assumed that they were part of the same population and therefore the data were pooled together.

## 5. Procedures and empirical results

The purpose of the estimated model was to measure the impact of the most relevant explanatory factors on the individual WTP with regards to pesticide FFV. Several alternative

Table 3

Regression results of WTP for pesticide residue-free produce (ordered logit analysis)

Variable	Estimated coefficient	t-ratio	Level of significance
Constant	−0.1742	−0.226	0.821
Age 35–49	0.2370	0.949	0.343
Age 50–60	0.3586	1.194	0.233
Age over 60	0.6615	1.479	0.139
Sex	−0.4805*	−1.864	0.061
Education	−0.5373**	−2.142	0.031
Urban	−0.0078	−0.032	0.974
Child	0.0502	0.201	0.841
Income 30–60	0.6435***	2.758	0.006
Income >60	1.4792***	4.019	0.000
Know	0.0935	0.325	0.745
Pest	0.0248***	3.831	0.000
Food	0.0050	0.764	0.445
Summary statistics			
Number of observations: 336			
−2 × Log-likelihood ratio = $\chi^2$ = 46.475			
Percent correctly classified = 33			

Note: \* Significance at the .10 level; \*\* significance at the .05 level; \*\*\* significance at the .01 level.

specifications of the model were estimated, relating WTP to different combinations of individual explanatory variables or interaction variables. The final model, selected to analyze the dependence of WTP on demographic and risk characteristics, was specified as:  $WTP = \alpha + \beta_1 + \beta_2 AGE1 + \beta_3 AGE2 + \beta_4 AGE3 + \beta_5 SEX + \beta_6 EDU + \beta_7 URBAN + \beta_8 CHILD + \beta_9 INCOME30-60 + \beta_{10} INCOME > 60 + \beta_{11} KNOW + \beta_{12} PEST + \beta_{13} FOOD$ .

The discrete structure of WTP implies the adoption of probit/logit like procedures: following Maddala (1983), the logit procedure was preferred over other categorical variable estimating techniques. Moreover, given the ordinal ranking of the WTP variable, the multinomial logit model would fail to account for the ordinal nature of the dependent variable, therefore, the ordered version of logit estimation was applied (Greene, 1990). The LIMDEP econometric software (Greene, 1995) was used for logit estimations. Overall probabilities were calculated at the variables mean values using estimated intercepts and coefficients. Model significance was verified by calculating the  $\chi^2$  statistics resulting from the restricted and unrestricted log-likelihood functions.

Table 3 presents the estimation results from the ordered logit model. The log-likelihood ratio test indicates that the estimated model has satisfactory explanatory power— $\chi^2$  is significant at the 0.01 probability level. Results suggest that the overall ability of the model to yield correct predictions for consumer WTP is 33%.

The negative signs on the SEX and EDUCATION coefficients indicate that male respondents and those with a university degree were less likely to be willing to pay more for pesticide-free produce. Several other authors (Buzby et al., 1995; Malone, 1990) reported an inverse relationship between WTP and education. In particular, in the case of irradiated food, Malone suggested that this may result from the fact that individuals with a higher education

do not perceive a current food safety problem. In his specific application, the inverse relationship could also be reinforced by the perception of a risk attached to irradiation procedures. This latter explanation becomes less convincing for pesticide-free FFV. In our case, the higher degree of general knowledge about the high degree of safety of regular produce may explain the behavior of respondents with advanced education. In other words, these consumers may not perceive pesticide-free FFV as different from regular products, as they would not be perceived as risk reducers. The 1999 test results from the Italian Ministry of Health on 7,802 samples of FFV, as reported on major information sources, also support this hypothesis. 68.4% of the samples were found absolutely free of pesticide residues and 30.3% had residues below the legal standard. The percentage of irregular samples decreased from 5.6% in 1993 to 1.3% in 1999 (Agrisole, 2000).

Regarding SEX, female individuals are probably more “family oriented” and therefore more sensitive to safety problems.

The positive sign on INCOME is common to basically all similar previous studies.

PEST supports the hypothesis that the probability to pay a higher WTP increases with higher concern towards pesticide-borne risks. This last result is in agreement with Misra et al. (1991).

Surprisingly, knowledge of negative pesticide effects (KNOW) is not significant. The initial hypothesis was that information could seriously affect WTP, and that the nonsignificant response could be caused by a not sufficiently detailed question. In the case of organic FFV, a further reason is that without proper certification and differentiation, these products may not be perceived effective in reducing risk. Fu et al. (1999) also found that the relationship between an informational variable (knowledge that pesticides increase cancer risk) and WTP was not significant.

We also expected the presence of children to positively affect WTP and to be significant, as found in a purely qualitative psychological study by Rizzardi (1998).

The food-concern variable (FOOD) does not significantly affect WTP: health risks from other food components (cholesterol, fat, salt, sugar) and their repercussion on human health were probably more familiar to consumers than risks from pesticides, and therefore they did not perceive any clear relationship between the two.

Regarding the weight of the different explanatory variables on WTP we know that, for qualitative choice models, estimated coefficients affect marginal probabilities. Probability derivatives (marginal probabilities) are calculated from the estimated model: they measure the change in the probability of each WTP outcome with respect to a change in each explanatory variable. Unfortunately, for binary variables the probability derivatives do not exist. Therefore, the predicted probabilities for these variables are calculated by holding all other variables at the sample means. Probability derivatives (marginal probabilities) are reported in Table 4. In each row, the sum of marginal probabilities is 0: a higher probability attached to a WTP category means a lower probability for another.

Income seems to be the variable with the strongest impact on the consumer's decision to change his or her behavior from no WTP to a positive WTP and from less than 5% of the price to higher premiums. Individuals within the highest income class showed a strong propensity to pay high price premiums: the probability of paying a premium greater than

Table 4

Marginal effects (*ceteris paribus*) of explanatory variables on WTP probabilities, derived from the ordered logit estimated parameter coefficients

Variable	WTP = 0	WTP = 1	WTP = 2	WTP = 3	WTP = 4	WTP = 5
Constant	0.0150	0.0232	−0.0008	−0.0154	−0.00710	−0.0148
Age 35–49	−0.0204	−0.0315	0.0011	0.0210	0.0096	0.0201
Age 50–60	−0.0309	−0.0477	0.0017	0.0318	0.0146	0.0305
Age over 60	−0.0569	−0.0880	0.0032	0.0587	0.0269	0.0562
Sex	0.0414	0.0639	−0.0023	−0.0426	−0.0195	−0.0408
Education	0.0462	0.0714	−0.0026	−0.0476	−0.0218	−0.0457
Urban	0.0007	0.0010	0.0000	−0.0007	−0.0003	−0.0007
Child	−0.0043	−0.0067	−0.0002	0.0045	0.0020	0.0043
Income 30–60	−0.0554	−0.0856	0.0031	0.0571	0.0261	0.0547
Income >60	−0.1273	−0.1967	0.0071	0.1312	0.0601	0.1257
Know	−0.0081	−0.0124	0.0004	0.0083	0.0038	0.0079
Pest	−0.0021	−0.0033	0.0001	0.0022	0.0010	0.0021
Food	−0.0004	−0.0007	0.0000	0.0004	0.0002	0.0004

15% of the regular price for pesticide-free FFV increases by 0.1257 for individuals in the high income class. This result suggests that high prices for pesticide-free FFV may induce the representative Italian consumer, with an income belonging to the class between 30 and 60 million lire, to purchase regular products.

The effect of the residue concern variable (PEST) is not particularly strong: a unit increase in consumer concern about pesticides increases (decreases) the probability of a positive (zero) WTP by 0.0021. Looking at the different WTP classes, the most consistent (positive) changes in probabilities are in the “11 to 15%” and in the “more than 20%” classes: those individuals who for some reason were particularly worried about health risks from pesticides were willing to pay a consistent price premium to avoid the risk.

Attitude towards risk is generally related with individual characteristics: PEST shows a positive correlation with AGE 35 to 49 and EDUCATION (Table 5). This result may indicate higher risk concerns for individuals within the age class 35 to 49 and with an advanced education. Respondents in this class also showed a higher degree of knowledge about risks from pesticides, which may concur to explain their higher risk aversion. Nevertheless, the fact that AGE 35 to 49 is not significant in the WTP model implies that individuals in this category did not perceive pesticide-free FFV as relevant risk reducers. The reason could be the previously mentioned factors: inadequate certification procedures and the fact that in Italy regular FFV are generally perceived as safe. Other studies on Italian consumers confirm our main results, that is, that lack of knowledge and information/certification on production techniques and scarce product differentiation are all factors which tend to reduce the demand for organic FFV. For example Bagnara (1995) conducted 200 interviews on Italian consumers and found that only 9% of the respondents could effectively distinguish organic produce from regular produce and also that over 40% of the respondents could not find a quality label on the product and received no information regarding production and commercialization.

Table 5  
Matrix of the simple correlation coefficients between explanatory variables

	Age 35–49	Age 50–60	Age over 60	Sex	Income 30–60	Income >60	Education	Urban	Child	Food	Pest	Know
Age 35–49	1.000000											
Age 50–60	–0.434530	1.000000										
Age over 60	–0.240520	–0.132760	1.000000									
Sex	–0.002037	0.015649	–0.055782	1.000000								
Income 30–60	0.112590	–0.072291	–0.095248	0.023271	1.000000							
Income >60	0.003143	–0.037728	0.135640	–0.064165	–0.448600	1.000000						
Education	0.045472	–0.198330	–0.146130	–0.104330	0.082324	0.186680	1.000000					
Urban	–0.100270	0.009209	0.117010	–0.011423	–0.037335	0.021923	0.000284	1.000000				
Child	0.133110	–0.259830	–0.136010	–0.119720	0.009152	0.021395	0.163760	–0.018367	1.000000			
Food	0.024078	0.070863	0.068149	0.088478	–0.055830	–0.094321	–0.106270	0.021562	–0.111070	1.000000		
Pest	0.256910	–0.124340	–0.070673	–0.023121	0.060849	–0.026794	0.142060	–0.042143	0.095781	0.094542	1.000000	
Know	0.122370	0.015380	–0.024058	–0.015760	0.002451	0.135570	0.048722	0.128390	0.052316	–0.011281	0.172150	1.000000

## 6. Final remarks and managerial implications

The purpose of this study was to assess the effects of socio-demographic and risk perception variables on individual WTP for pesticide-free FFV, to indirectly measure the net benefit to consumers from avoiding an important source of health risks.

The results of the present study suggest that Italian consumers were generally concerned about health risks from pesticides, with only 11% of the respondents not willing to pay higher prices for pesticide-free FFV. On the other hand, among those willing to pay higher prices, almost 70% would not pay a premium higher than 10% of the regular price. Our results are in line with those of past studies on consumer perceptions and attitudes with respect to the use of pesticides, which supported the idea that consumers would accept to pay only a small premium above regular retail prices to avoid food borne risks. Nevertheless, we found that 11% of the respondents were willing to pay as much as 20% above regular prices to avoid the pesticide risk, indicating a relevant market niche for these safe products.

We used an ordered logit model to estimate the impact of the main explanatory variables on the probabilities of consumers' WTP. The most relevant increase in the probability of a positive WTP was given by income and individual perception of risk concern about pesticides, while higher education increased the probability of a zero WTP.

Particularly interesting was the fact that point-of-purchase information did not change consumers' attitudes towards these products, that is, their risk perception. This could indicate that consumers need time with the information to be effective, especially for those products/risks consumers are not particularly familiar with. This result, coupled with the fact that organic produce is not well differentiated from regular produce, in addition to the lack of effective guarantees evident to consumers, may explain why even informed consumers may not directly link their information on risks to the benefit they could obtain from safe products. With a long learning process, to include a consumption experience variable in the model would probably improve its explanatory power.

Our findings provide interesting new insights for the definition of marketing strategies. If producers of pesticide-free products intend to sell through mass marketing channels (supermarket chains), then the price premium should not exceed 10 to 15% for individuals with low or medium risk concern, at least following the preliminary indications obtained from our survey, which was aimed only to consumers shopping in supermarkets.

Long-term investment in promotion to inform consumers and educational campaigns on food-borne risks would help to build an individual concern toward the particular risks from pesticide residues, but this concern would translate into a positive WTP only if sustained by an easily recognized certification procedure. This would turn a credence attribute, "pesticide-free," into a search quality signal evident to consumers, so that they would be able to separate regular produce from organic produce.

Even though results indicate that price is a critical factor in determining the level of demand of pesticide-free FFV, a relatively small niche of very concerned consumers may be reached selling through particular marketing channels, such as specialty outlets for organic products, and in this case, prices may include higher premiums, as confirmed by Bagnara (1995). He found that most consumers buying from organic specialty stores were willing to pay more than 20% above regular prices. In the case of these particular outlets, the degree

of information to consumers and the “guarantee” effect of specialized stores contribute to extract a higher WTP from consumers.

Therefore, joint results from our and previous studies indirectly suggest that production costs will be crucial for the success of organic FFV: if these costs exceed by more than 15 to 20% those for standard FFV, than the market for residue free FFV would probably show a slow growth rate, especially in supermarkets, where shoppers generally have a lower WTP compared to those purchasing from specialized outlets. In this case only heavy investments in the marketing strategies discussed above would allow both individual WTP and residue free FFV market share to increase.

## Notes

1. See Caswell (1998) for a discussion of the different methods.

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