Ecological Economics 127 (2016) 121–128

Contents lists available at ScienceDirect

Ecological Economics

journal homepage: www.elsevier.com/locate/ecolecon

Analysis

Estimating the demand curve for sustainable use of pesticides from contingent-valuation data

Cristina Amaro da Costa [a,*], José Lima Santos [b]

[a] Escola Superior Agrária de Viseu, Quinta da Alagoa, Estrada de Nelas, 3500-606 Viseu, Portugal
[b] Centro de Estudos Florestais (CEF), Instituto Superior de Agronomia, Universidade de Lisboa, Tapada da Ajuda, 1349-017, Lisboa, Portugal

ARTICLE INFO

Article history:
Received 21 May 2015
Received in revised form 27 December 2015
Accepted 3 April 2016
Available online 26 April 2016

Keywords:
Contingent valuation
Pesticides
Integrated pest management
Differentiated markets
Policy options

ABSTRACT

Stated-preference valuation techniques are often used to assess consumers' willingness-to-pay for food items produced in farming systems that adopt a sustainable use of pesticides (SUP). We propose an innovative valuation methodology in which dichotomous-choice contingent valuation is used to estimate the demand curve (price-quantity relationship) for such food items where price means price premium for the SUP output, quantity is the probability of choosing SUP and the conventional food product is kept available in the market at the current market price. This methodology can be used to evaluate market differentiation as a policy option to promote the SUP.

The methodology is tested with data from a sample of urban consumers of fruits and vegetables in Portugal. The estimated demand curve is used to define the price level maximizing the total premium revenue for the SUP sector as a whole. This optimal level of the price premium is €77.55 (or 163% of the value of the monthly basket of fruits and vegetables at current prices). Adopting the optimal price premium will decrease the number of consumers of SUP food by 54%. The reduction is even higher for low income consumers (80%) leaving them more exposed to the risks of pesticide use.

© 2016 Elsevier B.V. All rights reserved.

1. Introduction

The negative effects of pesticide use are a major concern for food, environmental and agricultural policies. Therefore, the European Union has established rules for the sustainable use of pesticides (SUP), through integrated pest management (promotion of low pesticide-input management including non-chemical methods), to reduce pesticide impacts on human health and the environment (COM (2002) 349 final, 01.07.2002). Different policy tools can be used to promote a generalised adoption of SUP practices: regulation, economic incentives, either positive (agri-environment schemes) or negative (pesticide taxes), and market differentiation where higher-cost SUP food commands a price premium.

All these policy tools may have an impact on food prices. However, options for consumers are different: while with regulation (pesticide withdrawal) consumers have no choice but to buy safer and more expensive food, with other policy tools (for example market differentiation) consumers will have a choice between cheaper, but less safe food, and more expensive, but safer, food. Other tools (as agri-environment schemes) may deliver safer but not necessarily more expensive food with costs being incurred by general taxpayers.

Defining a strategy to promote the SUP requires that policy makers are able to assess consumers' response to price premiums or price raises for safer and environmentally friendlier food that would result from different policy options. As regards market differentiation, there is a need to estimate the demand curve for SUP food when conventional food is also available.

Many stated-preference[1] valuation studies have been carried out to assess consumers' preferences related to SUP food. Most of these studies pursue one of two well defined goals: (1) selecting an optimal level of health or environmental benefits; or (2) estimating the average consumer's willingness-to-pay (WTP) for a discrete improvement in health and environmental benefits to develop an aggregated benefit estimate for the overall consumer population. We first discuss the achievements and limitations of both approaches, and then propose a third new valuation approach to estimate the demand curve for SUP food when conventional food is also available to consumers. This is the valuation methodology used and tested in this article, with the

[1] The methods used in environmental valuation can be divided into revealed preference and stated-preference approaches. The revealed preference methods assume that observed behaviour is relevant for welfare analysis and is the basis for standard market and non-market valuation approaches such as the hedonic price and travel cost methods. In contrast, stated-preference elicits individual valuations that are assumed to be contingent upon the alternative goods that are offered in a 'hypothetical market' (Pearce, 2002). Stated preference methods include contingent valuation, choice experiments, contingent ranking, contingent rating, and conjoint analysis.

* Corresponding author.
E-mail addresses: amarocosta@esav.ipv.pt (C.A. Costa), jlsantos@isa.utl.pt (J.L. Santos).

http://dx.doi.org/10.1016/j.ecolecon.2016.04.019
0921-8009/© 2016 Elsevier B.V. All rights reserved.

demand curve being then used to estimate the impact of different price policies within the differentiated market approach for the promotion of SUP, namely the impact of higher prices for SUP food on the purchase of safer food by low-income consumers. This focus on low-income consumers is justified by a concern that potentially higher health risks might be faced by this group when market differentiation is used to promote the SUP, which is related to lower information levels about pesticide risks and lower affordability of differentiated food for these consumers (Laisney, 2013; Toma, 2014).

1.1. Uses of Stated-Preference Techniques to Assess Consumers' Preferences Related to SUP Food

A large number of stated-preference valuation studies have estimated WTP for food safety and health and environmental outcomes of SUP along the last three decades (Adams and Salois, 2010; Baskaran et al., 2010; Batte et al., 2007; Buzby et al., 1995; Combris et al., 2009; Cranfield and Magnusson, 2003; Hamilton et al., 2003; Kiruthika and Selvaraj, 2013; Mourato et al., 2000; Schou et al., 2006).

Among those studies, only a few tried to estimate WTP for marginal levels of pesticide risk reductions in order to select an optimal level of health or environmental benefits (Baskaran et al., 2010; Mourato et al., 2000; Mullen et al., 1997; Schou et al., 2006). The results of these studies indicate that it is difficult for survey respondents to process scenarios related to small, marginal changes in pesticide use and risks, and its complex effects, and thus to make rational choices in this context.

There are different reasons that explain such difficulty: the scientific uncertainty that surrounds the physical effects of particular changes, how these effects affect human well-being, how to translate these changes into terms and sentences that might be understood by respondents or how to achieve a correct description of small changes without amplifying them (Pearce et al., 2006; Wätzold et al., 2008).

Another strong limit to these approaches is that respondents usually lack the cognitive skills required to understand and value risk in a continuous scale or to make choices between different levels of the attribute. In addition, because peoples' preferences might be formed during the valuation process, based on the information provided, apparently inconsequential changes in the formulation of choice problems may cause significant preference shifts. This might lead to distorted estimates of environmental values (Johansson et al., 2012; Loewenstein et al., 2001; Pearce et al., 2006; Spash, 2002; Tversky and Kahneman, 1981; Wätzold et al., 2008). For example, if people are uninformed about the issues and have no previous preferences, the fact that there is a survey employing resources to value them gives a value sign leading to preference formation: “If they think that it's important, so should I” (Fischhoff, 2005, p. 950). Two examples from the valuation literature are Mourato et al. (2000) and Schou et al. (2006). Both valued the effects of different agricultural practices, including pesticide use, on biodiversity, specified as species richness, and on health, specified as cases of illness, and concluded that, when different levels of pesticides were included in the choice set, they led to higher WTP values. In these studies, the authors concluded that marginal risks of pesticide use were so low that respondents had difficulty in realizing the risk changes that were actually at stake.

Even if the valuation of marginal changes would be informative for selecting optimal risk levels, the empirical limitations of stated-preference valuation techniques suggest looking for alternative sounder ways for setting risk reduction targets.

Other stated-preference valuation studies were used to value the aggregated benefits of SUP, assuming discrete (as opposed to marginal) risk changes (Baskaran et al., 2010; Buzby et al., 1995; Takatsuka et al., 2005; Wätzold et al., 2008). Based on these studies, and if the payment vehicle is a tax, annual household donation or payment, it is possible to estimate the average WTP (per consumer or Kg) for that discrete change and to calculate the aggregated benefits of SUP adoption by multiplying the average WTP by the number of consumers or by the total consumption of a product (in Kg). Several studies have used this method to estimate a ceiling for the amount of financial resources that should be allocated to SUP promotion (Baskaran et al., 2010; Takatsuka et al., 2005).

However, if the payment vehicle is a price premium (additional payment above the base price of a product, or stated as a percentage of a monthly grocery bill or the value of a food basket), then multiplying it by the consumption of a product (in Kg or percentage of grocery bill) might raise validity issues because it assumes constant consumption irrespective of price (and quality) change. When the supply-side price increases with quality (because of cost consideration), the demand of the product (or the number of consumers choosing the product) will in general change, except for those consumers for whom the price increase is exactly equal to their marginal WTP for quality.

Buzby et al. (1995) and Mullen et al. (1997) used price premium as a payment vehicle to assess the WTP for SUP in different food products. Both studies obtained the aggregate benefit, multiplying the average WTP by the total produce (kg) or by the number of households, assuming that consumption is fixed even when prices rise due to the proposed premium. These authors pointed out that the WTP estimates should be interpreted with caution, as the aggregated WTP was estimated based on a single purchase/payment which is far from a realistic hypothetical scenario (for example if WTP was elicited based on a years' supply, it would likely have been lower).

To overcome these limitations, we develop and test in this article a methodology that deals, in an explicit way, with the price-quantity demand relationship. In the proposed approach, discrete-choice contingent-valuation data are analysed in an unconventional way that is: not to estimate consumers' WTP for a discrete gain in quality/safety (as usual), but to estimate the price-quantity relationship, where price means price premium for the SUP output, quantity is the probability of choosing the SUP output and the conventional food product is kept available in the market at the current price. This scenario simulates the case when market differentiation, and not regulation or agri-environment schemes, is the policy choice to promote the SUP. This model also enables us to estimate the impacts of alternative price premium levels within this policy approach.

For this purpose, we assume a discrete quality change, namely the health and environmental safety increase yielded by a shift from conventional to SUP standards, which, as was revealed by the literature review, is easier for respondents to understand and value than marginal risk changes.

This innovative methodology is used to define an optimal price policy for SUP food, that is: the price premium level maximizing the total premium revenue for the SUP sector as a whole. Given the low share of SUP food in the overall food expenditure, we assume that 100% of the food currently purchased is conventional. The impacts of that optimal price policy on low-income consumers are then assessed, to identify possible limitations of the market differentiation approach to promote the SUP.

The proposed analytical approach is developed and tested based on a specific contingent-valuation survey of a sample Portuguese urban consumers, which was aimed at modelling their choices for SUP as opposed to conventional output. In this case, fruits and vegetables from integrated pest management at different price-premium levels and conventional output at current market prices were the options proposed to consumer. Including a significant segment of low-income consumers in the sample allowed us to estimate the impact of different price policies on these consumers' choices.

2. Methodology

2.1. A Contingent Valuation Survey to Value the SUP — The Questionnaire

Economic valuation aims at eliciting public preferences for changes in the state of the environment and health benefits in monetary terms.

Among valuation methods, the Contingent Valuation (CV) method can be applied in a wide range of contexts. The CV method relies on a 'constructed market' — that is a hypothetical market that is presented to respondents, asking them to directly state their WTP or purchasing intentions for a change in environmental quality, based on a well specified hypothetical scenario (Hanley et al., 2001; Pearce et al., 2006). The hypothetical market where the change in environmental quality in question would be traded is described by means of an appropriately designed questionnaire which elicits people's intended future behaviour in that hypothetical market. Estimated values are thus contingent on the specific aspects of the hypothetical market.

To specify the hypothetical market, it is essential that the good/service, the context in which it would be provided and the payment vehicle are presented in a clear format, using e.g. detailed pictures (Madureira, 2001). A random and representative sample of people is then directly asked to express or reveal their maximum WTP (or intended purchasing behaviour) for a hypothetical change in the level of provision of the good/service which is assumed to be a prediction of their actual behaviour in a real market with the same characteristics.

A popular technique to ask respondents to express or reveal their WTP is the single-bounded dichotomous-choice.[2] The dichotomous-choice format has become popular in CV studies because it simplifies the cognitive task presented to the respondents — they only have to make a judgement about a given price in the same way they decide to buy or not a good at a given price (Akter et al., 2009; Calia and Strazzera, 2000). This procedure minimises non-responses and outliers, and is easier for respondents than other methods requiring longer adjustment processes.

In our study, a consumer questionnaire was developed to elicit preferences for a SUP monthly basket of food (SUP basket) as an alternative to the conventional food basket using the dichotomous-choice method. The questionnaire was developed based on several works reported in the literature related to food safety (Cranfield and Magnusson, 2003; De Jonge et al., 2007; Madureira, 2001; Roitner-Schobesberger, 2006).

We pre-tested the questionnaire, in Lisbon and Viseu (146 respondents), before implementing a first phase of the survey (214 respondents; pilot survey). The questionnaire was then debriefed in an interviewer group discussion to evaluate and establish final data collection procedures. The pre-tests and group discussion allowed us to select the payment vehicle for the WTP experiment, to refine the initial draft questionnaire and to adjust the price-premium levels to be used in the final survey.

The questionnaire consisted of four sections. The first includes questions about the respondent and the household's habits regarding food consumption. Consumer awareness and perceptions of pesticide and fertiliser use risks were assessed in the second section. The contingent valuation exercise constitutes the third part. The questionnaire gathered additional information in order to obtain a clear image of the respondents' profile and socio-economic conditions. Some control questions closed the survey, in order to explore whether the respondents had a reasonably good understanding of the questionnaire and how credible they found the scenarios to be.

[2] A wide variety of elicitation techniques have been proposed in CV: closed-ended or dichotomous choice, open-ended, payment card (Carson and Groves, 2007; Cooper et al., 2002). In the closed-ended or dichotomous choice, a scenario that describes a certain change in the provision of a good or service is presented to the respondent, as well as how the respondent would pay for this provision. Then respondents are asked whether or not they would be willing to pay some specified price. This technique indirectly measures WTP and does not provide much information. In the open-ended, respondents are asked how much they would be willing to pay for the item. In this case, the question is presented in a cognitively complex way that leads to lots of "protest zeros". In the payment card technique, respondents are faced with a card/table with an array of payment values and are asked to choose from them.

2.2. The Hypothetical Market for SUP Food

2.2.1. The Basket

Special attention was given to the determination of the monthly basket of the respondent's household. A card was presented with several options for the average weekly consumption of fruits and vegetables, based on the weekly consumption for a household with one to eight persons as it seemed easier to assess than monthly consumption.

The value of the weekly basket was then converted on a monthly basis. That value (monthly basket of fruit and vegetables) was then presented to the respondent to confirm it. If the respondent thought that his monthly expense with fruits and vegetables was different from the presented one, he was asked to look at the card with the options for the average weekly basket and to choose another one that better fitted his household consumption. The process was then repeated until the respondent agreed with the presented monthly expenditure on fruits and vegetables or, instead, he could present the value he estimated for that monthly expenditure.

2.2.2. Scenario Setting

Respondents were then informed about the existence of farming systems where the SUP was ensuring that the food produced was healthier and with less harmful effects on the environment when compared with conventional farming. They were then faced with a scenario where an agricultural policy would be implemented to promote SUP which would impose extra costs for farmers and thus higher prices for consumers.

Respondents were reminded of the value of the monthly basket they had previously confirmed and confronted with the precise cost increase that would result from SUP adoption. The valuation question was then presented in the dichotomous-choice format: respondents were asked if they would accept such a policy knowing that the SUP would increase their monthly expenditure in fruits and vegetables by a specified cost increase (price premium).

The question wording was: "Consider your average monthly expenditure in fruits and vegetables, which, as seen in a previous question, is €_____ (A). The implementation of this policy would increase your average monthly expenditure in fruits and vegetables from €____ (A) to €____ (B = A × price premium percentage). Would you be in favour of this policy?".

The price premium varied across individuals and was set as a percentage of the value of the monthly basket at current prices; the used set of percentages was based on successive adjustments of the responses to the pre-tests and the pilot survey.

After each WTP question, respondents that stated they would support the adoption of the SUP were asked to confirm their answer by stating which expenditures (tobacco/wine, travelling, transports, clothes, non-essential food, books/magazines, others) they would reduce in order to allow them to pay the price premium. A further WTP question was then asked using the same (percent) price premium, but framed as the purchase of a kg of apples, and they were allowed to change their previous answer if they felt it appropriate. This question was used to correct for yea-saying behaviour by allowing respondents to revise their positive answer in a less abstract setting. Only the answer to the second question was used in the analysis.

If respondents were against the policy, in one of the three phases (main question, consideration of expenditures that they would reduce, and apple question), they were asked the main reason for refusing it, to identify protest answers. People might have given a no response, because they ignore the value of the good; they are not concerned about the environmental issues at stake; or (even if they do) they are protesting about being asked the question in that precise way; they discredit the hypothetical market; they feel no amount is enough to pay for environmental quality (Hanley et al., 2001). As usual in contingent valuation studies (Aldanondo-Ochoa and Almansa-Sáez, 2009; Baskaran et al., 2010; Verbič and Slabe-Erker, 2009; Wätzold et al., 2008), protest

bidders were excluded from the data (including only 'genuine nos' and positive bidders before model estimation).

The questionnaire was administered by a trained team of interviewers to a representative sample of the Portuguese urban population (household as the survey unit), in 2008. Respondents were selected by stratified random sampling (proportional to the population of the Lisbon metropolitan district) based on the parameters of the household characteristics (sex, age, education, income, family size) derived from national census statistics. This proportional stratification helped to reduce the potential sampling error (sampling error of 3.1% with 95% of confidence level) and increased the likelihood of generating a representative sample of the Portuguese urban population.

The questionnaires were applied face-to-face, at the respondents' homes, using cards that summarise the information and reduce the time consumed in the interview. Respondents were the main responsible person for purchasing food within their household, with more than 18 years old.

2.3. Analysing Respondents Intended Choices on SUP Versus Conventional Food

The responses to the questionnaire were then analysed to yield the effects of variables such as the price premium, income or knowledge about SUP production systems on the probability of a yes response, using a conditional logit regression approach.

The probability of choosing the SUP output, p, was used as the dependent variable in a binary logit model (Hair et al., 2009; Stock and Watson, 2007), which predicts the log of the ratio (odds ratio) between the probability of choosing SUP, p, and choosing conventional, $1-p$:

$$\ln \frac{p}{1-p} = \beta_0 + \beta_1 x_1 + \ldots\ldots + \beta_n x_n \quad (1)$$

where β_i are the logit function parameters, $i=\{0,\ldots,n\}$, and x_i ($i=\{1,\ldots,n\}$) are the corresponding independent variables that are expected to determine the respondent's choice.

With a simple mathematical transformation, it is then possible to obtain the probability of accepting the price premium for a SUP basket (one of the independent variables) everything (the other independent variables) being equal, or in the present case the probability of choosing the SUP basket when the conventional basket is kept available in the market:

$$p = \frac{1}{1 + e^{-(\beta_0+\beta_1 x_1+\ldots.+\beta_n x_n)}}. \quad (2)$$

After testing the effects of different possible independent variables, we selected only those that produce a best multivariate model in terms of both statistical significance and conceptual validity of the effects (Table 1).

The monthly or annual expenditure in the good/service was considered in several CV studies, usually with a significant influence on the WTP (Santagata and Signorello, 2000; Griffith and Nesheim, 2008; Urban et al., 2012). In our study, we considered the monthly expenditure on fruits and vegetables of the household (BASKET).

Household income is expected to positively influence the consumers' likelihood of choosing SUP food, as a healthier and environmentally sounder food, instead of the conventional one. Pearce et al. (2006) refer that the WTP and thus the probability of paying for health or environmental benefits should increase with income. Several authors found that the household income (Batte et al., 2007; Cranfield and Magnusson, 2003; Gracia et al., 2010; Rimal et al., 2005; Wätzold et al., 2008) influence the probability that a consumer will be willing to pay for pesticide-free, integrated pest management or organic food. We will analyse the effect of the per-capita household income (INCOME), by checking the sign of the variable's effect, which provides a very general validity test in preference based techniques (Pearce et al., 2006).

Across many studies, it was found that knowledge has a positive influence in the purchasing of SUP (Boccaletti and Nardella, 2000; Briz and Ward, 2009; Magistris and Gracia, 2008; Rimal et al., 2005). Including knowledge about SUP production systems as a variable in our model allowed us to explore how the increase in knowledge or awareness about SUP production systems will affect the number of consumers opting for the SUP output, thus indicating how consumers' knowledge can contribute to increase the sales revenue of the SUP sector.

The variable KNOWSUP represents the level of knowledge and understanding of environmentally friendly farming systems, such as integrated pest management (IPM) or organic farming (OF). First, we asked respondents if they were aware of the concept of SUP food, such as IPM, OF or other quality certification systems, and then we asked them to explain what the meaning of those systems was. The number of correct characteristics related with SUP production systems (pesticide use, use of sustainable farming practices, environmental and health risks) that were self-reported by the respondents was registered from '0' to '4', where '0' indicated that the respondent know nothing about SUP production systems and '4' indicated the highest level of knowledge.

Table 1
List of explanatory variables.

Variable	
PRICE	Price premium for the monthly basket of fruits and vegetables (€)
BASKET	Monthly expenditure in fruits and vegetables (€)
INCOME	Income per household (€)
KNOWSUP	Knowledge about SUP production systems

2.4. Estimating of the SUP Sector's Gross Revenue Using CV Data

The total premium revenue of the SUP sector is defined as the total income from the sales of SUP output net of the income that would be obtained from the sales of identical amounts of conventional food (in the monthly basket) at the current market prices. The total premium revenue (TR) is obtained by multiplying the number of urban households (N) by the probability of choosing the SUP output, p, at a pre-specified level of the price premium ($PRICE$) by that price premium:

$$TR = N \times p \times PRICE. \quad (3)$$

The total premium revenue is net of the market value of the food basket if it had been produced conventionally. It thus represents the incentive for farmers and other agents in the food supply chain to engage in any required extra costs to produce SUP instead of conventional output. We used the estimated model of probability of purchase to predict different probabilities of purchase under different levels of the price premium (price policies for the SUP output) to select the level of the price premium (optimal price policy) that yields the maximum total premium revenue for the SUP sector. If the marginal cost of producing according to SUP standards is constant with the amount produced (and sold), this would be the optimal monopoly price for the sector of SUP as a whole.[3] (The marginal cost may decline with the level of price premium because consumption of SUP output is expected to decline with that level, which might lead to an optimal price premium level beyond the maximum gross revenue of the SUP sector).

[3] In order to establish the policy price that best suits the SUP sector, we will consider, by convenience, that there are no concurrence to the SUP products — market monopoly. Actually, some quality products exist and might substitute for the SUP products, but it is also true that usually such products are produced based on strict technical rules that will ensure health safety and environmental quality, and thus might be considered similar to the SUP products.

2.5. Estimating the Actual Price Premium for the SUP Basket

Prices for conventional and SUP (OF and IPM) fruits and vegetables were collected, in Lisbon in 2008, among the most popular supermarkets, local markets, specialised stores and from door to door baskets. Based on the different options for the average weekly consumption of fruits and vegetables estimated for a household (assuming households with one to eight persons), we computed a weighted average value for both the conventional and SUP baskets by multiplying each quantity of the food product included in the basket by the corresponding average price collected for each production system.

The estimated actual SUP price premium was then compared with the optimal price premium (that yields the maximum gross revenue for the SUP sector) in order to understand if the actual price premium implicit in the value of the SUP basket is higher or lower than the optimal value, and thus should be decreased or increased to maximise the SUP sector gross revenue.

We also analysed the effect of the optimal price premium on the demand of SUP food by low income consumers (10% of consumers with the lowest income), and then compared this effect with the average effect on all consumers.

All statistical analyses were carried out using IBM SPSS Statistics for Windows, Version 22.0 (Armonk, NY: IBM Corp.).

3. Results and Discussion

3.1. Basic Sample Statistics

Table 2 presents a summary of the basic statistics characterizing the sample. Our sample of the main survey included 725 respondents, a majority of whom were females (62%), as expected because the survey was directed to respondents who are usually responsible for shopping in their household. The average age of the respondent was 40 years old with an age distribution identical to that of the national population (INE, 2011). The education level is on average ISCED[4] 4.5, meaning that a significant number of respondents (41%) have at least completed secondary school. The average household size is 2.7, with an average monthly household income of €1280, and an average BASKET of 47.35 €. Comparing our sample averages with national census data, the average household profile – age, family size and family income – is almost identical to its national counterpart (INE, 2011).

The level of knowledge and understanding of environmentally friendly farming systems (KNOWSUP) is very low (0.34). A significant part of the respondents (80%) know nothing about SUP production systems and only 17% were able to refer more than one correct characteristic related with SUP production systems (pesticide use, use of sustainable farming practices, environmental or health risks). Less than 1% really described SUP production systems accurately.

Other studies, such as Briz and Ward (2009), found a higher proportion of consumers that clearly understood the meaning of SUP production systems, such as organic production. This level of knowledge is far ahead from the Portuguese reality, and thus it reinforces the need for raising the average consumer's level of knowledge or awareness about SUP food/production systems. This need is even more relevant if the influence of such knowledge as a driver of the probability of choosing SUP food is considered.

Based on the responses to the valuation questions and to the follow up control questions, we believe that respondents had a reasonably good understanding of the survey material and valuation tasks. A relatively low proportion of respondents (less than 10%) had difficulties in understanding the questionnaire or doubted the credibility of the scenario, a figure that is similar to those reported by other studies (Boccaletti and Nardella, 2000; Travisi and Nijkamp, 2008; Turpie, 2003).

Table 2
Sample characteristics (n = 725).

Characteristic	Mean or percentage
Female	62%
Age	40.3 ± 16.3
Education (ISCED 0–6)	4.49 ± 1.44
Household size	2.7 ± 1.3
INCOME	€568.92 ± €307.97
BASKET	€47.57 ± €25.78
KNOWSUP	0.34 ± 0.76

3.2. The Demand for SUP Food

The estimated logit model is presented in Table 3. It has an overall percentage of correct predictions of 72.7%, which is acceptable when compared with other studies related to environment or food quality and safety (Boccaletti and Nardella, 2000; Hamilton et al., 2003; Tranter et al., 2009). The null hypothesis that the model's independent variables don't add explanatory power to the simpler model of the overall percentage of those choosing the SUP food is rejected with a very high level of significance. All variables are highly statistically significant and have the expected sign: the sign of PRICE is negative and the signs of the variables related with income (INCOME) and food expenditure (BASKET) are positive — meaning that respondents with higher incomes and with larger monthly baskets of fruits and vegetables are more willing to shift to the SUP. Our results are in agreement with similar CV studies (Batte et al., 2007; Griffith and Nesheim, 2008; Urban et al., 2012).

The variable KNOWSUP is also positive, meaning that well informed respondents are more ready to shift from the conventional food basket to the SUP basket. The positive relation between knowledge about SUP systems and the intention of paying more for them was also found either in studies about IPM, OF or other quality food products (Cranfield and Magnusson, 2003; Gifford and Bernard, 2004), or for environmental quality and health benefits (Martin-Lopez et al., 2007; Turpie, 2003).

The logit model, or log of the odds ratio for the probability of choosing SUP food is thus:

$$\ln\frac{p}{1-p} = -1.323 - 0.018 \times PRICE + 0.001 \times INCOME + 0.024 \times BASKET + 0.454 \times KNOWSPU. \quad (4)$$

Based on the mathematical transformation (Eq. (2)), the probability of choosing to pay the price premium for a SUP basket (or of shifting from conventional to the SUP basket) is:

$$p = \frac{1}{1 + e^{1.323 + 0.018 \times PRICE - 0.001 \times INCOME - 0.024 \times BASKET - 0.454 \times KNOWSUP}}. \quad (5)$$

Given our sampling frame, the probability of shifting from the conventional to the SUP basket, p, given by this function, reflects the relative number (fraction) of Portuguese urban households with a specified INCOME, BASKET and KNOWSUP who are willing to choose the SUP basket at a specified price premium level, when the option of buying conventional at the current price is still available. Replacing INCOME, BASKET and KNOWSUP, in Eq. (5), by their corresponding average sample levels (Table 2) yields the demand curve for SUP (in relative or fraction terms) presented in Fig. 1.

As summary for the price-quantity relationship depicted in the demand function in Fig. 1, the price elasticity of demand for the SUP basket

[4] The International Standard Classification of Education (ISCED) was developed by UNESCO and adopted since 1997 to facilitate comparisons of education statistics and indicators across countries on the basis of uniform and internationally agreed definitions (UNESCO, 2012). Until 2011, ISCED had 7 levels of education, from early childhood education (ISCED 0), primary education (ISCED 1), secondary education (ISCED 2–3), post-secondary non tertiary education (ISCED 4) to tertiary education levels (ISCED 5–6).

Table 3
Estimated coefficients of the binary logistic regression (linear logit function).

	Model (2)	p<	Effect on probability of choosing SUP[a]
Constant	−1.232**	0.0009	
PRICE	−0.018***	0.0000	
INCOME	0.001*	0.0160	0.17
BASKET	0.024***	0.0000	0.34
KNOWS	0.454***	0.0009	0.19
N	399		
−2 Log-likelihood	429.883		
Overall percentage	0.727		
Chi square	66.236	0.0000	

* p < .05.
** p < .01.
*** p < 0.001.
[a] Effect of shifting values of each variable from decils 1 to 9 on the probability of purchasing the SUP basket when PRICE = 0.

is −0.4 for a price premium of €45/basket, −1.2 for €95/basket and −2.2 for €145/basket.

3.3. The SUP Sector's Gross Revenue Function and the Optimal Pricing Policy for SUP

Based on Eq. (3), and using the sample averages for the variables INCOME, BASKET and KNOWSUP we can now calculate the SUP revenue per household (TR_h) function:

$$TR_h = \frac{PRICE}{1 + e^{0.018299 \times PRICE - 0.54958}}. \quad (6)$$

This TR_h function yields the gross revenue for any level of the price premium (Fig. 1). Taking the first derivative of TR_h (Eq. (6)) and making it equal to zero (Eq. (7)), we obtain the price premium level that maximises the total premium revenue for the SUP sector, which is also presented in Fig. 1.

$$\frac{dTR_h}{dPRICE} = 0 \Rightarrow \frac{e^{0.018299 \times PRICE}(1.73253 - 0.03170 \times PRICE) + 3.00164}{(1.73253 + e^{0.018299 \times PRICE})^2} = 0 \quad (7)$$

$PRICE = 77.55$ with a probability of choosing to pay the price premium for a SUP basket of p = 0.295.

We can conclude that the optimal level of the price premium is €77.55 (or 163% of the average monthly expenditure of €47.57 (Table 2) at current prices for conventional food). At this price level, the number of consumers choosing SUP declines by more than half, from the slightly more than 60% of households choosing SUP at zero price premium to about 30% of households at this optimal price level. Thus, adopting the optimal price premium for the SUP output will significantly decrease the number of consumers choosing SUP by almost 54%, with the corresponding increase in health and environmental risks, as in this case the SUP production will decrease and conventional farming will increase (when compared to the situation with a zero price premium).

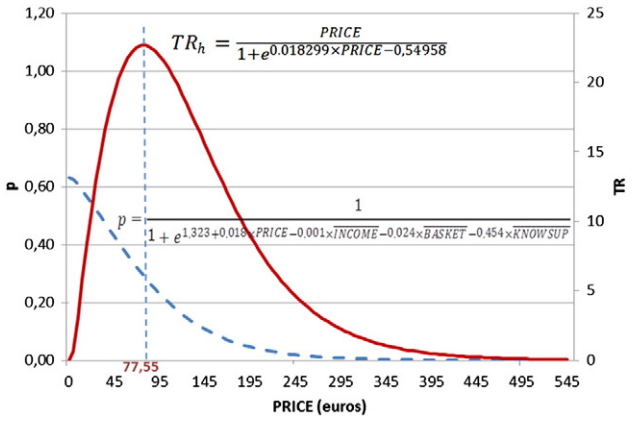

Fig. 1. Demand for SUP food (p) and per-household total premium revenue (TR_h) for the SUP sector as a whole for any level of the price premium. (The optimal price, which maximises the TR_h, is €77.55 or 163% of the value of the average basket at current prices for conventional food).

Even assuming that the SUP sector does not actually act as a perfect monopolist, which is reasonable, it is possible to conclude that opting to promote the SUP through market differentiation will have a significant cost in terms of the number of consumers that will buy SUP outputs (limiting positive health impacts) and thus in terms of the relative share of SUP within the total output of fruits and vegetables (limiting positive impacts). Support for SUP production systems through agri-environmental programmes will allow smaller price premium levels, but with a cost for general taxpayers.

Multiplying the number of urban Portuguese families (2.8 million families in 2011)[5] by the optimal price premium level (€77.55), yields the maximum Portuguese SUP market dimension: €766.5 M/year. This value represents the maximum gross revenue that the SUP sector could achieve, above the revenue obtained if the output was sold at the current prices for conventional products. It represents the revenue increase that the agricultural sector could obtain considering only those limits related to demand and its relation to the premium price level. Note that, at this optimal price premium level, the value of the SUP basket is 163% of the average price of the same basket valued at current prices for conventional output.

The estimated *current price premium* level for SUP food can now be compared to the estimated *optimal price premium* level, in order to understand if the current pricing policy of the SUP sets the price premium at a level that is higher (or lower) than that corresponding to the optimum, and thus should be decreased (or increased) to raise the SUP sector's gross revenue.

We have calculated the basket of SUP output at current prices, which is about €164.24 with a price premium of €96.19 above the basket of conventional output at current prices.[6] This price premium of the basket of SUP output at current prices is thus 171% above the basket of conventional output at current prices and above the optimal price premium level for the SUP sector.

According to the results from the model, the probability of choosing the food basket of SUP output at current prices will be 23%, which costs the SUP sector about 7% of consumers, and a loss of the gross revenue of about €5 M/month.

One major obstacle to implement a price policy that will differentiate SUP food from conventional food will probably be the budget constraints that low-income individuals face in accessing SUP food (Dibsdall et al., 2003; Laisney, 2013; Toma, 2014).

If we estimate the probability of changing from conventional to SUP for the low income group, the reduction in the number of consumers is even higher. For the consumers in the first decile of INCOME[7] (€250 on average), the number of consumers that will choose SUP food will decrease 80% when the price premium increases from zero to the optimal

[5] In 2011, there were 4 millions of families in Portugal and, according to the European concept for the definition of rural and urban areas, in Portugal, 13.5% of the families lived in rural areas, while 69.8% lived in urban areas and 16.7% in intermediate areas, respectively 540,000, 2,792,000 and 668,000 families (INE, 2012).

[6] The average value of the SUP basket, obtained from the most frequented supermarkets, local markets, specialised stores and from door to door baskets and based on the different options for the average monthly basket, was €164.24, while for the conventional basket was €68.05. The differential between the SUP and the conventional basket was then €96.19.

[7] We took the first decile figure from our sample. However, we compared our figures with national census data (INE, 2012), which only reports the quintiles for the per-capita monthly income. Census figures are similar to ours: first quintile €331.13 (our figure: €290.92); second quintile €499.88 (€441.33); third quintile €562.58 (€600.00); and fourth quintile €766.50 (€749.50).

price premium for the SUP sector (with this reduction, only 13% of the low income consumers will choose SUP basket). The low income consumers will then be more exposed to the health risks of pesticide use.

In other words, a price policy for the SUP sector that will promote the price premium to the optimal level will exclude more than 50% of the consumers and that effect is even higher in low income groups (80% of them will be excluded).

Finally, we have analysed the effect of knowledge on the SUP demand, since it may constitute one of the factors that can be improved in order to promote the SUP production systems. If we are able to improve consumers' knowledge and understanding of environmentally friendly farming systems (KNOWSUP), in order for them to identify at least two correct characteristics of SUP production systems (pesticide use, use of sustainable farming practices, environmental or health risks), we could change the percentage of consumers that would be willing to change from the conventional basket to the SUP basket from 29.2% to 41.1%, representing an increase in SUP demand of almost 30%.

4. Conclusions

In the present study, we propose an innovative way to analyse the type of data usually collected in stated-preference surveys related to demand for differentiated food products, namely those resulting from the SUP. We propose a method that estimates the probability of purchasing the differentiated product (SUP output) as a function of the price premium level, household income, level of consumption of the food item at stake, and knowledge about environmentally friendlier and healthier production systems. This method is a more straightforward use of discrete-choice contingent valuation data than when WTP is the variable to be predicted instead of the purchase decision.

Our paper focuses on developing and testing a CV application to measure the potential market demand (market size) for SUP output under different price policies (price premium levels) for the differentiated output, when conventional output is still available for consumers. The proposed application is aimed at providing a reliable method to assess alternative price policies for the SUP sector. Quantifying the market demand function for the SUP output will allow the analyst to determine the price policy yielding the highest gross return for the differentiated SUP sector.

Possibly an interesting use can be to assess the appropriate trade-off between the incentive for farmers of a higher price premium and the effect of this higher price premium on shrinking demand.

The method developed in this study can also be used to compare market differentiation with alternative policy options to promote the SUP. An alternative option can be to promote the adoption of the SUP through a subsidy approach (agri-environmental scheme), where farmers will be compensated for adopting SUP standards and still sell their products at the conventional price. The zero price premium policy will allow a higher number of consumers to have access to SUP food, regardless of their income, monthly expenditure or level of knowledge. Such policy also allows the market share for SUP outputs to double (60% instead of 30% if we compare this policy with the differentiated market approach analysed in this paper), with the attendant health and environmental benefits, but with an extra cost for taxpayers who will pay the subsidy. Here, the maximum gross revenue for the SUP sector, as is estimated, can be used to set a ceiling on the amount of public funds spent with an agri-environmental programme, in that it represents the maximum amount consumers are willing to pay if a differentiated market approach is adopted for the promotion of SUP.

The impact of the optimal price policy on the low-income groups (when compared to a zero price premium policy) was also analysed. A price policy for the SUP sector that is consistent with the maximization of the gross revenue of the SUP sector will exclude about 80% of the consumers with low income, who will buy SUP at zero price premium, with a substantial increase of their vulnerability to pesticide use risks.

The effect of consumers' knowledge on demand for SUP food also revealed to be very significant. Improving consumers' knowledge and understanding of environmentally friendly farming systems and of the SUP will significantly increase the ability of consumers to make wiser judgments about healthier and safer food.

Furthermore, estimating the market demand curve for the differentiated SUP output under different price-premium levels will make less unrealistic assumptions about respondents' cognitive skills, but surprisingly it has also seldom (if ever) been tried in the past; most CV and choice-experiment surveys have focused on consumers' WTP, and not on estimating potential market size under different levels of price premium for SUP output.

The definition of appropriate policies that aim to promote the adoption of SUP may also be supported by the knowledge of the market demand curve for the differentiated SUP output under different price-premium levels. Based on this model, it was possible to compare the optimal price premium with a (rough) estimation of the price premium currently practised. The currently used price premium for SUP food is higher than the optimal price premium that maximises the SUP sector gross revenue.

Future developments of this research should be to apply the methodology across a wider cross section of the European population, both geographically and socially. Future research should also explore a cost–benefit evaluation, including the cost structure of the SUP production systems, to define the net revenue to the SUP sector.

Acknowledgements

The present work was financed by the AGRO (Action 8.1) n.545/2004 project "The environmental indicators to assess the IPM, integrated production, organic farming and sustainable use of pesticides".

References

Adams, D.C., Salois, M., 2010. Local versus organic: a turn in consumer preferences and willingness-to-pay. Renew. Agr. Food Syst. 25 (4), 331–341. http://dx.doi.org/10.1017/S1742170510000219.

Akter, S., Brouwer, R., Brander, L., van Beukering, P., 2009. Respondent uncertainty in a contingent market of carbon offsets. Ecol. Econ. 68 (6), 1858–1863. http://dx.doi.org/10.1016/j.ecolecon.2008.12.013.

Aldanondo-Ochoa, A.M., Almansa-Sáez, C., 2009. The private provision of public environment: consumer preferences for organic production systems. Land Use Policy 26 (3), 669–682. http://dx.doi.org/10.1016/j.landusepol.2008.09.006.

Baskaran, R., Cullen, R., Colombo, S., 2010. Testing different types of benefit transfer in valuation of ecosystem services: New Zealand winegrowing case studies. Ecol. Econ. 69, 1010–1022. http://dx.doi.org/10.1016/j.ecolecon.2010.01.008.

Batte, M.T., Hooker, N.H., Haab, T.C., Beaverson, J., 2007. Putting their money where their mouths are: consumer willingness to pay for multi-ingredient, processed organic food products. Food Policy 32, 145–159. http://dx.doi.org/10.1016/j.foodpol.2006.05.003.

Boccaletti, S., Nardella, M., 2000. Consumer willingness to pay for pesticide-free fresh fruit and vegetables in Italy. Int. Food Agribusiness Manag. Rev. 3 (3), 297–310 (http://www.ifama.org/files/297-310.pdf).

Briz, T., Ward, R.W., 2009. Consumer awareness of organic products in Spain: an application of multinominal logit models. Food Policy 34 (3), 295–304. http://dx.doi.org/10.1016/j.foodpol.2008.11.004.

Buzby, J.C., Ready, R.C., Skees, J.R., 1995. Contingent valuation in food policy analysis: a case study of a pesticide-residue risk reduction. J. Agric. Appl. Econ. 27 (2), 613–625 (http://ageconsearch.umn.edu/bitstream/15278/1/27020613.pdf).

Calia, P., Strazzera, E., 2000. Bias and efficiency of single vs. double bound models for contingent valuation studies: a Monte Carlo analysis. Appl. Econ. 32 (10), 1329–1336. http://dx.doi.org/10.1080/000368400404489.

Carson, R.T., Groves, T., 2007. Incentive and informational properties of preference questions. Environ. Resour. Econ. 37 (1), 181–210. http://dx.doi.org/10.1007/s10640-007-9124-5.

Combris, P., Pinto, A.S., Fragata, A., Giraud-Héraud, E., 2009. Does taste beat food safety? Evidence from the "Pêra Rocha" case in Portugal. J. Food Prod. Mark. 16 (1), 60–78. http://dx.doi.org/10.1080/10454440903415667.

Cooper, J.C., Hanemann, M., Signorello, G., 2002. One-and-one-half-bound dichotomous choice contingent valuation. Rev. Econ. Stat. 84 (4), 742–750. http://dx.doi.org/10.1162/003465302760556549.

Cranfield, J.A., Magnusson, E., 2003. Canadian consumer's willingness-to-pay for pesticide free food products: an ordered probit analysist. Int. Food Agribus. Man. 6 (4), 13–30 (http://www.ifama.org/files/Cranfield.pdf).

De Jonge, J., Van Trijp, H., Renes, R.J., Frewer, L., 2007. Understanding consumer confidence in the safety of food: its two dimensional structure and determinants. Risk Anal. 27 (3), 729–740. http://dx.doi.org/10.1111/j.1539-6924.2007.00917.x.
Dibsdall, L.A., Lambert, N., Bobbin, R.F., Frewer, L.J., 2003. Low-income consumers' attitudes and behaviour towards access, availability and motivation to eat fruit and vegetables. Public Health Nutr. 6 (2), 159–168. http://dx.doi.org/10.1079/PHN2002412.
Fischhoff, B., 2005. Cognitive processes in stated preference methods. In: Mäler, K.G., Vincent, J.R. (Eds.), first ed. Handbook of Environmental Economics 2(2). Elsevier, pp. 937–968. http://dx.doi.org/10.1016/S1574-0099(05)02018–8.
Gifford, K., Bernard, J., 2004. The impact of message framing on organic food purchase likelihood. J. Food Distrib. Res. 35 (3), 19–28 (http://ageconsearch.umn.edu/bitstream/27552/1/35030019.pdf).
Gracia, A., Magistris, T., Barreiro-Hurlé, J., 2010. Why do we buy organic? Integrating knowledge, attitudes and concerns in a simultaneous equation model for Spanish consumers. 119th EAAE Seminar, Capri, June 30. (15p. http://citarea.cita-aragon.es/citarea/bitstream/10532/1603/1/2010_105.pdf).
Griffith, R., Nesheim, L., 2008. Household willingness to pay for organic products. Inst. Fiscal Studies, WP CWP18/08. (55p. http://dx.medra.org/10.1920/wp.cem.2008.1808).
Hair Jr., J.F., Black, W.C., Babin, B.J., Anderson, R.E., 2009. Multivariate Data Analysis. seventh ed. Prentice Hall, Madrid, pp. 413–425.
Hamilton, S.F., Sunding, D.L., Zilberman, D., 2003. Public goods and the value of product quality regulations: the case of food safety. J. Public Econ. 87 (3–4), 799–817. http://dx.doi.org/10.1016/S0047-2727(01)00103–7.
Hanley, H., Shogren, J., White, B., 2001. Introduction to Environmental Economics. Oxford Univ. press, pp. 47–53.
INE, 2011. Censos 2011. Instituto Nacional Estatística, Lisboa.
INE, 2012. Inquérito às Despesas das Famílias 2010/2011. Instituto Nacional Estatística, Lisboa (99p).
Johansson, P., Hall, L., Chater, N., 2012. Preference change through choice. In: Dolan, R.J., Sharot, T. (Eds.), Neuroscience of Preference and Choice. Cognitive and Neural Mechanisms. Elsevier Academic Press, Amsterdam, pp. 121–141.
Kiruthika, N., Selvaraj, K.N., 2013. An economic analysis of consumer preference towards pest management (IPM) produce. J. Environ. Res. Dev. 7 (4 A), 1684–1692 (http://www.jerad.org/ppapers/dnload.php?vl=7&is=4A&st=1684).
Laisney, C., 2013. Les différences sociales en matière d'alimentation. Centre d'études et de prospective, Analyse 64 (4p. http://agreste.agriculture.gouv.fr/IMG/pdf/analyse641310.pdf).
Loewenstein, G.F., Weber, E.U., Hsee, C.K., Welch, N., 2001. Risk as feelings. Psychol. Bull. 127 (2), 267–286 (http://psycnet.apa.org/doi/10.1037/0033-2909.127.2.267).
Madureira, L., 2001. Valoração económica de atributos ambientais e paisagísticos através de escolhas contigentes — O amendoal tradicional do Douro Superior PhD Thesis UTAD, Vila Real, pp. 4–6.
Magistris, T., Gracia, A., 2008. The decision to buy organic food products products in Southern Italy. Brit. Food J. 110 (9), 929–947. http://dx.doi.org/10.1108/00070700810900620.
Martin-Lopez, B., Montes, C., Benayas, J., 2007. The non-economic motives behind the willingness to pay for biodiversity conservation. Biol. Conserv. 139 (1–2), 67–82. http://dx.doi.org/10.1016/j.biocon.2007.06.005.
Mourato, S., Ozdemiroglu, E., Foster, V., 2000. Evaluating health and environmental impacts of pesticide use: implications for the design of ecolabels and pesticide taxes. Environ. Sci. Technol. 34 (8), 1456–1461. http://dx.doi.org/10.1021/es990732v.
Mullen, J.D., Norton, G.W., Reaves, D.W., 1997. Economic analysis of environmental benefits of integrated pest management. J. Agric. Appl. Econ. 29 (2), 243–253. http://dx.doi.org/10.1017/S1074070800007756.
Pearce, D., 2002. An intellectual history of environmental economics. Annu. Rev. Energy Environ. 27, 57–81. http://dx.doi.org/10.1146/annurev.energy.27.122001.083429.
Pearce, D., Atkinson, G., Mourato, S., 2006. Cost-benefit analysis and the environment. Recent Developments. OECD, Paris.
Rimal, A.P., Moon, W., Balasubramaniam, S., 2005. Agro-biotechnology and organic food products purchase in the United Kingdom. Brit. Food J. 107 (2), 84–97. http://dx.doi.org/10.1108/00070700510579162.
Roitner-Schobesberger, B., 2006. Consumers' perception of organic foods in Bangkok, Thailand. MSc Thesis University of Natural Resources and Applied Life Sciences, Vienna, pp. 51–54. http://www.wiso.boku.ac.at/2561.html.
Santagata, W., Signorello, G., 2000. Contingent valuation of a cultural public good and policy design: the case of "Napoli Musei Aperti". J. Cult. Econ. 24, 181–204. http://dx.doi.org/10.1023/A:1007642231963.
Schou, J.S., Hasler, B., Nahrstedt, B., 2006. Valuation of biodiversity effects from reduced pesticide use. Integrated environ. Assess. Manag. 2 (2), 174–181. http://dx.doi.org/10.1002/ieam.5630020214.
Spash, C.L., 2002. Informing and forming preferences in environmental valuation: coral reef biodiversity. J. Econ. Psychol. 23 (5), 665–687. http://dx.doi.org/10.1016/S0167-4870(02)00123-X.
Stock, J.H., Watson, M.K., 2007. Introduction to Econometrics. second ed. Pearson Int., Boston, pp. 394–407.
Takatsuka, Y., Cullen, R., Wilson, M., Wratten, S., 2005. Values of ecosystem services on arable land and the role of organic farming. 2005 NZARES Conference, New Zealand, August 26–27 (22p. http://purl.umn.edu/98523).
Toma, H., 2014. Food purchase behaviors for low, medium and high income families. Int. J. Acad. Res. Environ. Geogr. 1 (2), 33–39. http://dx.doi.org/10.6007/IJAREG/v1-i2/1450.
Tranter, R., Bennett, R., Costa, L., Cowan, C., Holt, G., Jones, P., Miele, M., Sottomayor, M., Vestergaard, J., 2009. Consumers' willingness-to-pay for organic conversion-grade food: evidence from five EU countries. Food Policy 34 (3), 287–294. http://dx.doi.org/10.1016/j.foodpol.2009.03.001.
Travisi, C.M., Nijkamp, P., 2008. Valuing environmental and health risk in agriculture: a choice experiment approach to pesticides in Italy. Ecol. Econ. 67 (4), 598–607. http://dx.doi.org/10.1016/j.ecolecon.2008.01.011.
Turpie, J.K., 2003. The existence value of biodiversity in South Africa: how interest, experience, knowledge, income and perceived level of threat influence local willingness to pay. Ecol. Econ. 46 (2), 199–216. http://dx.doi.org/10.1016/S0921-8009(03)00122–8.
Tversky, A., Kahneman, D., 1981. The framing of decisions and the psychology of choice. Science 211 (4481), 453–458. http://dx.doi.org/10.1126/science.7455683.
UNESCO, 2012. The International Standard Classification of Education 2011. UNESCO Institute for Statistics, Montreal (84p).
Urban, J., Zvěřinová, I., Ščasný, M., 2012. What motivates Czech consumers to buy organic food? Sociol. Cas. 48 (3), 509–536 (http://sreview.soc.cas.cz/uploads/836e9ea2e152e317fb65c6928fa66dc4da65e5fb_709-736.pdf).
Verbič, M., Slabe-Erker, R., 2009. An econometric analysis of willingness-to-pay for sustainable development: a case study of the Volčji Potok landscape area. Ecol. Econ. 68 (5), 1316–1328. http://dx.doi.org/10.1016/j.ecolecon.2008.09.002.
Wätzold, F., Lienhoop, N., Drechsler, M., Settele, J., 2008. Estimating optimal conservation in the context of agri-environmental schemes. Ecol. Econ. 68 (1–2), 295–305. http://dx.doi.org/10.1016/j.ecolecon.2008.03.007.