

Travisi, Chiara M.; Nijkamp, Peter

Working Paper

Willingness to Pay for Agricultural Environmental Safety: Evidence from a Survey of Milan, Italy, Residents

Nota di Lavoro, No. 100.2004

Provided in Cooperation with:

Fondazione Eni Enrico Mattei (FEEM)

Suggested Citation: Travisi, Chiara M.; Nijkamp, Peter (2004) : Willingness to Pay for Agricultural Environmental Safety: Evidence from a Survey of Milan, Italy, Residents, Nota di Lavoro, No. 100.2004, Fondazione Eni Enrico Mattei (FEEM), Milano

This Version is available at:

<http://hdl.handle.net/10419/117981>

Standard-Nutzungsbedingungen:

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

Terms of use:

Documents in EconStor may be saved and copied for your personal and scholarly purposes.

You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.

If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.

**Willingness to Pay for Agricultural
Environmental Safety:
Evidence from a Survey of Milan,
Italy, Residents**

Chiara M. Travisi and Peter Nijkamp

NOTA DI LAVORO 100.2004

JULY 2004

SIEV – Sustainability Indicators and Environmental Valuation

Chiara M. Travisi, *Department of Management Economics and Industrial Engineering,
Polytechnic of Milan and Fondazione Eni Enrico Mattei*
Peter Nijkamp, *Department of Spatial Economics, Free University and Tinbergen Institute*

This paper can be downloaded without charge at:

The Fondazione Eni Enrico Mattei Note di Lavoro Series Index:
<http://www.feem.it/Feem/Pub/Publications/WPapers/default.htm>

Social Science Research Network Electronic Paper Collection:
<http://ssrn.com/abstract=562722>

The opinions expressed in this paper do not necessarily reflect the position of
Fondazione Eni Enrico Mattei

Willingness to Pay for Agricultural Environmental Safety: Evidence from a Survey of Milan, Italy, Residents

Summary

The widespread use of pesticides in agriculture provides a particularly complex pattern of multidimensional negative side-effects, ranging from food safety related effects to the deterioration of farmland ecosystems. The assessment of the economic implications of such negative processes is fraught with many uncertainties. This paper presents results of an empirical study recently conducted in the North of Italy aimed at estimating the value of reducing the multiple impacts of pesticide use. A statistical technique known as *conjoint choice experiment* is used here in combination with *contingent valuation* techniques. The experimental design of choice modelling provides a natural tool to attach a monetary value to negative environmental effects associated with agrochemicals use. In particular, the paper addresses the reduction of farmland biodiversity, groundwater contamination and human intoxication. The resulting estimates show that, on average, respondents are prone to accept substantial willingness to pay premia for agricultural goods (in particular, foodstuff) produced in environmentally benign ways.

Keywords: Pesticide risks, Food safety, Willingness-to-pay, Choice modeling, Contingent valuation

JEL Classification: C42, H23, I12, Q24

The author wish to thank the research group on ecotoxicology of the University of Milano-Bicocca for providing scientific support during the survey design. A special word of thanks goes to Anna Alberini and Arianne de Blaeij for helpful comments and suggestions on an earlier draft, and to Guido Sali and Paulo Nunes for valuable advice.

Address for correspondence:

Chiara M. Travisi
Fondazione Eni Enrico Mattei
Corso Magenta 63
20123 Milan
Italy
Phone: +39 02 52036951
Fax: +39 02 52036946
E-mail: chiara.travisi@feem.it

1. Introduction

Conventional agriculture produces non-negligible negative side-effects that have been broadly scientifically documented in the scientific literature (Pimentel et al., 1992; Pimentel and Greiner, 1997). The order of magnitude of these externalities justifies the theoretical and political significance of the literature on agro-environmental regulations, pesticide and fertiliser reduction, and the assessment of the associated economic costs. In the European Union, the increasing awareness of governments and consumers for pesticide-related food safety and the changing social preferences towards improving the environmental sustainability of agriculture have culminated in a number of valuable studies on the estimation of consumers' willingness to pay (WTP) for reducing the potential impact of pesticide use on human health and the environment (Swanson, 1998; Mourato et al., 2000; Foster and Mourato, 2000; Schou et al., 2002). Monetary estimates of individual WTP for pesticide risk reduction is a key input to design and implement appropriate pesticide policy measures (such as pesticide taxation, design of eco-labelling) or to plan national incentive programmes for the dissemination of more environmental benign agricultural practices. In this context, the Italian agricultural policy aims to decrease the risks attached to the use of pesticides by providing economic incentives for organic farming and Integrated Pest Management (IPM) [1].

The design of eco-labelling for fresh food produced with more benign agricultural practices is a major concern in the Italian agricultural sector. Economic theory suggests that an efficient incentive should be set equal to the marginal damage associated with pesticide usage. Similarly, estimates of individual WTP for pesticide risk reduction would provide key information to introduce price differentials in products, according to the type and severity of pesticide risks related to their production processes. In this perspective, a proper incentive programme for Italian farmers, or the design of eco-labelling, would require a estimating of the Italians' WTP for pesticide risk reduction. This paper presents an original study recently conducted in Italy with the aim of providing estimates of the WTP of Italian consumers to gain improvements in the environmental and health safety of agriculture.

Our study has combined two *stated preference* methods, Conjoint Choice Experiment (CCE) and Contingent Valuation (CV) techniques, to estimate the value of reducing the multiple impacts of pesticide use. Examples of previous studies using CV methods for pesticide risk valuation can be found in Higley and Wintersteen (1992); Bubzy et al. (1995); Mullen et al. (1997); Fu et al., (1999); Brethour and Weersink (2001); Cuyno et al. (2001); Wilson (2002). Recently, Foster and Mourato

(2000) and Schou et al. (2002) have applied Contingent Ranking techniques to value multiple pesticide impacts, while several examples of Conjoint Analysis -applied to the valuation of various pesticide risks for consumers- can be found in Baker and Crosbie (1993), Eom (1994) and Baker (1999).

The CCE application was designed to estimate the value of some important pesticide-related environmental attributes, using a 'green shopping' payment vehicle. Respondents were asked to view the various environmental impacts of pesticide use in the agricultural production as foodstuff attributes to be taken into account in the purchase decision. The environmental attributes taken into considerations here were the reduction in farmlands' biodiversity, the contamination of soil and groundwater in the agricultural land, and the health effects of pesticides on the general public. The monetary attribute used was the monthly food expenditure through which it is possible to estimate the marginal value of the other non-market characteristics. The CV experiment then asked the respondents to report a maximum WTP for eliminating all the negative environmental impacts under consideration.

The remainder of the present paper is organised as follows. Section 2 presents the survey design. Section 3 discusses the econometric model used for the analysis. Section 4 presents and discusses our main results.

2. Preferences for Agricultural Safety: A Survey of Milan Residents

This study assesses people's preferences for alternative scenarios of agricultural production based on lower pesticides input (e.g., low pesticide input, integrated pest management, organic), focusing on the environmental and economic effects they generate. Elicitation of the public's preferences for, and economic valuation of, alternative agricultural scenarios, however, is complicated by two factors. First, the environmental negative side effects of pesticide use –such as pollution of soil, surface and ground water, higher mortality of sensitive animal and insect species, effects on human health, etc- are not bought and sold in regular markets. This implies that we need to apply non-market valuation techniques.

Second, low-input agricultural practices have only recently been applied in Italy and have not been monitored in their environmental and economic effects, so we resort to *stated preference* non-market valuation techniques, relying on what people say they would do under hypothetical circumstances rather than actual behaviours. We deploy a combination of two stated preference methods, Conjoint Choice Experiment (CCE) and Contingent Valuation (CV) techniques.

In a typical conjoint choice experiment study, respondents are asked to choose between two or more goods (or policy scenarios) each of which is described by a set of few attributes, one of which

is usually its cost to the respondent. Attributes are varied across scenarios, and the scenarios are usually matched in such a way that the respondents have to trade off attributes. For the purpose of statistically modelling the respondent's choice in a conjoint choice experiment it is assumed that the respondent chooses the alternative that gives the highest utility. Utility is a function of the alternative's attributes and of residual income (income net of the cost of the alternative under consideration), plus a random term.

Depending on the assumption about the distribution of the error term, the resulting statistical model is either a conditional logit, a multinomial probit or a related choice model (Green, 2002). The implicit marginal prices of each attribute and the welfare changes associated with changes in the level of the attributes are easily derived. In a typical contingent valuation study, respondents are asked to choose between two scenarios, each of which is described by two attributes, an economic and a non-economic one.

2.1 SELECTION OF THE ATTRIBUTES

Since the range of the environmental impacts associated with pesticide use is potentially very wide, the selection of the relevant environmental attributes to be included in the questionnaire is a particularly delicate step. In choosing relevant attributes, we were guided by a group of Italian ecotoxicologists, which helped us identify main environmental effects of pesticides and select indicator variables describing each environmental effect. Environmental indicators are selected to describe, as accurately as possible, the main areas of well-documented environmental damage in Italy. Specifically, we focus on biodiversity, soil and groundwater (groundwater contamination is here considered intimately linked to soil contamination) and human health. By contrast, Foster and Mourato (2000) only considered human health and biodiversity. The impact on biodiversity is here quantified in terms of the number of endangered farmland bird species, while the impact on soil and groundwater is measured using the percentage of farmland areas contaminated by pesticides. The impact on human health is measured in terms of cases per year of acute intoxication, both as a result of work and domestic exposure. For each attribute we consider three different levels [5], as shown in Table 1.

When choosing the human health attribute we first reasoned that, since lay people –when asked about pesticides- are most frightened by potential risks related to pesticide residues in foodstuff (STOA, 1998), it would have been important to capture people WTP for improving food safety on such concern. Unfortunately, no epidemiological studies have been conducted in Italy to document pesticide residues risks. We felt, therefore, that valuing consumers WTP for a reduction of pesticide residues risk exposure would have required an appropriate analysis of risk perception concerning this, which was not our main research question. This is the reason why, rather than concentrating on

pesticide residues effects, we preferred to focus on risks due to domestic or work pesticide exposure, which is the best documented pesticide impact for Italy.

Selecting the most appropriate economic attribute required us to analyse the literature and the results from focus groups discussions. In the pesticide risk valuation literature, simulated markets for green produce are sometimes used in hopes of minimizing the problem of hypothetical bias (Ravenswaay and Hoehn, 1991). However, the results of our pre-test showed that respondents were disturbed by a “single-green produce” perspective, and felt more comfortable with choices related to the whole shopping basket for groceries. Therefore, a “green shopping” payment vehicle was preferred and respondents were presented with several agricultural foodstuff market scenarios.

Table 1 – Attributes and levels.

<i>ATTRIBUTE</i>	<i>LEVEL-1 STATUS QUO</i>	<i>LEVEL-2</i>	<i>LEVEL-3</i>	<i>LEVEL-4</i>
<i>Food expenditure</i> [€/household month]	current (*)	+50	+100	+200
<i>Human health</i> [N° cases intoxication/year]	250	150	100	50
<i>Soil and groundwater</i> [% contaminated agricultural land]	65%	45%	25%	15%
<i>Biodiversity</i> [N° endangered farmland bird species]	15	9	6	3

(*)The current level of food expense is indicated by respondents before starting the CM exercise.

2.2 QUESTIONNAIRE AND SURVEY ADMINISTRATION

The questionnaire used in our experiment is comprised of three sections. The first part introduces the subject of the environmental side-effects of pesticides use in modern agriculture, *via* a costs-benefit perspective, which emphasized existing trade-offs between positive and negative externalities associated with agricultural production based on the use of synthetic inputs. The second section contains a Conjoint Choice Experiment/Contingent Valuation (CCE/CV) exercise, while the third one asks questions about the respondent socio-economic and attitudinal characteristics. The design of the CCE survey was inspired by recent literature on pesticide risk valuation, which extends the estimation of the social costs of pesticide applications in agriculture to both environmental and human well-being, modelled as different attributes of a common phenomenon (Mourato et al., 2000; Foster and Mourato, 2000; Schou et al., 2002).

Respondents are asked to view the various side-effects of pesticide usage due to conventional agricultural practices as food attributes to be taken into account in daily purchase decisions.

Alternatives are differentiated in terms of food expenditure and environmental sustainability, which describes the range of environmental externalities attached to the underlying production process.

Each respondent is presented with 4 or 5 choice sets developed using cyclic experimental design technique (Bunch et al., 1993) [6]. Each choice set requires respondents to make a choice among three alternative agricultural scenarios: the *status quo* scenario and two alternative ones (see Figure 1). The *status quo* scenario is represented by the conventional scenario of agricultural practices, priced at the household monthly food expense level (reported by respondents), for which each of the aforementioned environmental attributes is set at their current position (i.e., respectively, 250 cases of acute intoxication per year, 15 endangered bird species and 65% of farmland areas contaminated).

Characteristics	Option A Current Situation	Option B Alternative agricultural practices	Option C Alternative agricultural practices
Food expenditure €/household month	current	+ 50 €	+ 100 €
Biodiversity: N° of endangered bird species	15	10	5
Soil and groundwater: % of contaminated farm land	65%	30%	40%
Human Health: cases of intoxication per year	250	160	90

- I would choose option A, obtained with conventional agricultural practices
- I would choose option B, obtained with more environmental benign agricultural practices
- I would choose option C, obtained with more environmental benign agricultural practices

Figure 1: Example of choice set.

A CV question follows each CCE exercise. A dichotomous choice format is used to elicit information about the respondents' maximum WTP for eliminating all of the described negative effects of pesticide use on the environment and human health.

The questionnaire was developed by using the results from one focus group and one pre-test [2]. The focus group and the pre-test were necessary to test the appropriateness of the attributes included in the questionnaire, to select a proper payment vehicle of the WTP experiment, and to refine the initial draft questionnaire. On the basis of the results provided by the pilot study some minor modifications in the draft questionnaire were included [3]. The final survey was carried out in Milan between May and June 2003. The survey questionnaire was self-administered by respondents intercepted at three shopping malls in Milan by three interviewers. The enumerators were instructed

to stop potential respondents and ask them to pick up the questionnaire, compile it and then drop it off after shopping. Overall, 484 questionnaires were distributed by three interviewers, 302 of which were returned in a completed form. The return rate was about 62 percent. Table 2 shows the survey statistics and the socio-demographics of the sample.

Table 2- Survey statistics and socio-demographics of the sample.

Variable	Sample average or percentage	Milan average (b)
<i>Individual characteristics</i>		
Age	33.9	44
Monthly Household Income in Euro (€/household)	2,098.1	2,791.3
Female	61.6	53.2
Household size	3.5	2.5
Household with one or more persons under 15	15.1	NA
Year of schooling	13.04	NA
<i>Attitudinal characteristics</i>		
Respondent with strong environmental attitude (a)	26.1	
Respondent very well informed on pesticide risks (a)	12.2	
<i>Respondents debriefs</i>		
Found some question hard to understand	8.5	
Did not find information provided enough	4.4	

Note:

(a) Based on a five point Likert scale

(b) Authors' calculation based on the Milan Municipality Abstract of Statistics, 2002

3. Modelling Consumers Preferences: the Econometric Model

3.1 THE CONJOINT CHOICE EXPERIMENT

Our analysis of the responses to the conjoint choice questions uses the random utility model (McFadden, 1986). Let W represent a set of alternative agricultural practices, and T the set of vectors of measured attributes. The choice for a consumer can be defined as a draw from a multinomial distribution with a probability:

$$\Pr(x|t, A) \quad \forall x \in A \quad \text{with } A \subseteq W \quad (1)$$

where $\Pr(x|t, A)$ is the probability of selecting agricultural practice x , given the vector of observed attributes t and the set of agricultural practices A , for each alternative contained in the choice set A .

The behavioural basis of stated choice data emerges from Random Utility Model (RUM). Let U_{iq} be the utility of the i th agricultural scenario for the q th consumer. Under the RUM framework, U_{iq} is assumed to be partitioned into two components: a systematic component V_{iq} that depends on the attributes, and a random component, ε_{iq} (see (2)), that is individual-specific (Ben-Akiva and Lerman, 1997).

$$U_{iq} = V_{iq} + \varepsilon_{iq} \quad (2)$$

The utility function V_{iq} , which represents the utility of the different options in the multinomial logit model, can have different functional forms. The simplest form assumes that V_{iq} has an additive structure and is homogeneous across the population in terms of the relative importance of the attribute (x_k). The additive structure only includes the k attributes from the choice set i , as follows:

$$V_{iq} = \sum_{k=1}^K \beta_{k iq} x_k \quad (3)$$

The utility V_{iq} of the i th alternative for the q th respondent consists of the sum of the values of the different attributes k . In addition, utility maximisation theory assumes that consumers will choose the agricultural scenario that yields the highest utility. Then, the individual consumer q will choose the i th agricultural scenario if and only if:

$$U_{iq} > U_{jq} \quad \forall i, j \in A \text{ with } i \neq j \quad (4)$$

where U_{jq} is the utility level of all non-selected alternatives, and A is the set of possible choice alternatives.

Under the assumption that the error terms are independently and identically distributed and follow the Gumbel distribution, a multinomial logit model results.

Combining (3) and (4), we know that an agricultural scenario i is chosen if and only if:

$$(V_{iq} + \varepsilon_{iq}) > (V_{jq} + \varepsilon_{jq}) \text{ or } (V_{iq} - V_{jq}) > (\varepsilon_{jq} - \varepsilon_{iq}) \quad (5)$$

Since $(\varepsilon_{jq} - \varepsilon_{iq})$ cannot be observed, it is not possible to assess exactly whether $(V_{iq} - V_{jq}) > (\varepsilon_{jq} - \varepsilon_{iq})$. Therefore, the aim of this choice model is to calculate the probability that $V_{iq} - V_{jq}$ will be larger than $(\varepsilon_{jq} - \varepsilon_{iq})$, i.e.,

$$\Pr(x_{iq} | t_q, A) = \Pr_{iq} = \Pr\{\varepsilon_{jq} - \varepsilon_{iq} < [V_{iq} - V_{jq}]\} \quad \forall i, j \text{ with } i \neq j$$

This means that the probability that a consumer will choose the agricultural scenario x_i equals the probability that the difference between the random components of the utility function is smaller than the systematic component of the utility function across the two alternative agricultural practices under consideration. The purpose of the choice model is to estimate the value and statistical significance of the determinants of the utility function. The basic model assumes a linear, additive form of the attributes as specified in (2).

In our questionnaire, the CCE exercise implies a choice between three alternative agricultural scenarios, including the *status quo*. The agricultural scenarios differ with respect to food cost, effects on farmland birds' biodiversity, contamination of soil and aquifers in farmland areas and threats to human health. The utility of alternative i for respondent q is assumed to depend on:

the food cost of the q th respondent related to the i th agricultural scenario (x_{fiq});

the effects of the i th agricultural scenario on birds' biodiversity for the q th respondent (x_{biq});

the contamination of soil and groundwater related to the i th agricultural scenario for the q th respondent (x_{siq});

the effects of the i th agricultural scenario on the health of the general public for the q th respondent (x_{hiq}). This leads to the following utility expression:

$$V_{iq} = \beta_{fq} x_{fiq} + \beta_{bq} x_{biq} + \beta_{sq} x_{siq} + \beta_{hq} x_{hiq} \quad (6)$$

We assume that the error terms of the resulting utility function are independently and identically distributed and follow the Gumbel distribution. A non-trivial consequence of using this error assumption is the property of independence of irrelevant alternatives (IIA). This property requires that the probability of choosing one alternative over a second one depends only on the utility of the respective alternatives [7]. In other words, the probability ratio of two options should be unaffected by including or omitting other alternatives.

Under this assumption, a conditional logit model results, which predicts the probability of selecting alternative i to be:

$$P_{iq} = \frac{\exp(V_{iq})}{\sum_{j=1}^J \exp(V_{jq})} \quad (7)$$

and:

$$V_{iq} = \sum_{k=1}^K \beta_{ikq} x_{ikq} \quad (8)$$

This model is estimated by the method of maximum likelihood.

After estimating the model, we can infer the marginal rate of substitution between any of the attributes in our choice set. The marginal rate of substitution between the food expense coefficient and the biodiversity coefficient gives the implicit WTP to protect farmland bird biodiversity:

$$WTP_b = -(\beta_b / \beta_f) \quad (9)$$

Similarly, the marginal rate of substitution between the food expense coefficient and the soil contamination one gives the implicit WTP to reduce soil contamination:

$$WTP_s = -(\beta_s / \beta_f) \quad (10)$$

Finally, the marginal rate of substitution between the food expense coefficient and the human health one gives the implicit WTP to prevent cases of human illness:

$$WTP_h = -(\beta_f / \beta_h) \quad 11$$

Nevertheless, it is likely that respondents to express their preferences for alternatives by considering reasons beyond the attributes specified.

An alternative-specific constant term, C , can be added to the model to capture the effect of some systematic but unobserved factors on the respondents' choices. In other words, while the x variables show the effect of deterministic variables in explaining choices (i.e., attributes in the choice sets), the constant C captures the unobserved factors that explain choices (see equation 12). Technically, they reflect the mean of the differences in the error terms (Ben-Akiva and Lerman, 1985). In a multinomial logit model it is possible to have $(a-1)$ alternative specific constants, where a is the number of options. This is because the constants are based on differences between the alternative options and the current situation.

In the present context, though we do not use labelled options, it may be that consumers attach a value to the *status quo* or to one of the two safer agricultural options as such. To test whether this is indeed the case, one can add an alternative specific constant to the utility function:

$$V_{iq} = \delta_{iq} C_{iq} + \sum_{k=1}^K \beta_{kiq} x_k \quad 12$$

More complex specifications are possible which include socioeconomic and attitudinal variables [8].

3.2 THE CONTINGENT VALUATION EXERCISE

In CV surveys, one of the most widely used approaches to elicit information about the respondent's WTP is the so-called dichotomous-choice format (Hanemann 1985, Carson 1985). In the follow-up of our CCE part, we use this type of elicitation question for the respondents' WTP for eliminating all risks, both to human health and the environment, associated with pesticide applications in agriculture. The dichotomous-choice format mimics behaviour in regular markets, where people usually buy, or decline to buy, a certain good at the proposed retail price. Besides, similarly to the CCE technique, this CV format is consistent with the incentive comparability property and is also credited with reducing the cognitive burden placed on the respondent, except that its incentive comparability property might be affected by the previous conjoint questions.

The dichotomous-choice "double-bounded" payment question asked the respondent if he/she would be willing to pay B_1 percent extra on household monthly food expense to gain the proposed improvement in agricultural safety. In a follow-up question respondents who answered "yes" to the first bid value were asked if they would pay B_2^+ percent extra on household monthly food expense, with $B_2^+ > B_1$, while respondents who answered "no" were faced with a B_2^- amount, with $B_2^- < B_1$. The bid value B_1 varied randomly across respondents and the amount of the second bid B_2 depends on the amount of the first one [9].

Four response sequences were possible in our exercise: both answers are positive (yes/yes); both answers are negative (no/no); refuse the first bid but accept the second (no/yes); or accept the first but refuse the second (yes/no). Therefore, for any given underlying WTP distribution $F(B_i; \theta)$, the probability of response is given by:

$$\Pr\{yes / yes\} \equiv P^{yy} = 1 - F(B_2^+; \theta) \quad (13)$$

$$\Pr\{no / no\} \equiv P^{nn} = 1 - F(B_2^-; \theta) \quad (14)$$

$$\Pr\{yes / no\} \equiv P^{yn} = F(B_2^+; \theta) - F(B_1; \theta) \quad (15)$$

$$\Pr\{no / yes\} \equiv P^{ny} = F(B_1; \theta) - F(B_2^-; \theta) \quad (16)$$

Given these expressions, the log-likelihood function for the double-bounded model can be written as:

$$\log L = \sum_{i=1}^n [I_{yy} \log P_i^{yy} + I_{yn} \log P_i^{yn} + I_{ny} \log P_i^{ny} + I_{nn} \log P_i^{nn}] \quad (17)$$

Since the follow-up bid amount is greater (lower) than the first for those who answer “yes” (“no”) to the initial payment question, the four pairs above identify intervals in which the respondents’ WTP amount is assume to fall. Specifically, the respondent’s WTP is greater than B_2 for (yes/yes) sequences; WTP falls between B_2 and B_1 for (no/yes) pairs; it falls between B_1 and B_2 for (yes/no); and it is lower than B_2 for (no/no). This yields the following log-likelihood function:

$$\log L = \sum_{i=1}^n \log[F(WTP^H; \theta) - F(WTP^L; \theta)] \quad (18)$$

where WTP^H and WTP^L are the higher and the lower bound of the interval around WTP as explained above [10]. Our results are based on the assumption that WTP follows a Weibull distribution.

4. Survey valuation results

4.1 DESCRIPTION OF THE DATA

Table 1 reports descriptive statistics for our sample and compares them with those for the population of Milan, showing that the socio-demographic of our sample are for some part different to those of the population of Milan. The average respondent is 34 years old, has a household income of roughly € 25,000 a year, and has completed high school. The sample is slightly unbalanced toward females, and overrepresents households that large relative to the Milan average. Fifteen percent of the sample has at least one person in the household who is younger than 15.

The main differences between the socio-demographics of our sample and those of the population of Milan concern age and income level. The average age of our sample is rather low -34 rather than 44 years old- and the household income is the 25 percent higher than the Milan average. This suggests that we should control for these individual characteristics in our statistical model of the choice responses. Moreover, twenty-six percent of the respondents have a strong environmental attitude and the 12.2 percent is very well concerned about pesticide risks.

Based on the responses to the choice question and to control questions, we believe that respondent had a reasonably good comprehension of survey material and choice tasks, as only 4.4 percent complained about insufficient information, and 8.5 percent reported that they had found some of the question difficult to understand.

4.2 RESULTS OF THE CONJOINT CHOICE EXPERIMENT

In this paper, we report the results of conditional logit models estimated from the data collected during the Milan survey. As shown in Table 3 we first estimate a basic model and, subsequently, we use interactions between the choice attributes and socio-demographic variables to control for individual characteristics.

All of our models include alternative-B and C-specific intercepts and are weighted with population weights to balance the sample age distribution according to distribution of age in Milan. The attribute FOODEXP is the cost of the alternatives to the respondent and is expressed as Euros per household per month. BIODIV takes on the values 15, 9, 6 and 3, representing the number of endangered bird species in the alternative scenario. The attribute GRWATER is the percentage of contaminated farmland and can assume values 65, 45, 25, 15. HEALTH takes on the value of 250, 150, 100 and 50, representing the number of cases of acute human intoxication per year due to pesticides.

To capture variation in the marginal utility of the attributes across individuals, one would like to control for the respondent's socio-demographic characteristics. Regarding the preferences for the environmental attributes (biodiversity, soil and ground water protection, human health) one would expect them to vary across respondents' profiles, depending on individual environmental attitude and socio-demographic characteristics. We attempt to control for socio-demographic by creating interactions of the environmental attributes with various socio-demographic characteristics, such as gender, age, education level and whether there are persons under 15 in the respondent's household. A similar logic was applied to respondents' environmental attitude, for which we tried several interactions with attitudinal individual specific variables. Results presented in Table 3 include models with simple interaction with a dummy on respondent's pesticide risk concern.

An important prediction of economic theory is that WTP is an increasing function in the individuals' income level. To capture preferences variation regarding respondents' income level we try an interaction of the FOODEXP variable with the respondents' income level variable.

We begin with a model that include interactions between choice attributes and selected respondents' features, focusing in particular on the effect of respondents' gender, education level, concern on pesticide risks, whether there are person under 15 in the household and income level, on their preferences for reduction of pesticide risks. Results for these conditional logit models are reported in Table 3. All attributes coefficients have the expected *a priori* sign and are highly statistically significant, with the exception of BIODIV. The explanatory power of the models is relatively high for a discrete choice model, with an R-square higher than 0.2 [11].

The coefficient for GRWATER is negative and is strongly statistically significant with a coefficient of -0.017, implying that, all else the same, reducing ground water contamination by 50%, raises the probability of selecting the agricultural scenario by about 2%. The level of impact on human health has a highly statistically significant coefficient equal to -0.0034, while the intensity of impact on bird biodiversity is significant at the 10 percent level with coefficient equal to

-0.0319. These results indicate respondents are willing to accept higher food prices to obtain improvements in the agricultural production safety.

Results of the conditional logit model based on our full set of regressors (interactions with attributes) are reported in column (B) and (C). The likelihood ratio (LR) statistics for significant of all coefficients on the interactions between attributes and individual characteristics, which are equal to 9.51, 15.51 and 15.57, respectively, confirm that the choices do depend on certain individual characteristics. The probability of selecting one scenario out of the three alternative options, therefore, depends on the attribute of the agricultural scenarios and respondents' profile in predictable ways.

Column (A) shows that running the model with interactions between attributes and respondents' socio-demographic produces an insignificant and lower coefficient for the BIODIV attribute, and a slightly higher coefficient -though always strongly significant- for the FOODEXP variable (from 0.0008 to 0.0014). Consistently with what predicted by the economic theory, interaction between FOODEXP and income level produces a positive and statistically significant coefficient, even though rather low (0.19^{-04}). The interaction between BIODIV and education level and HEALTH and gender are statistically significant at the 10% level, while the interaction between BIODIV and concern level and GRWATER and the dummy for household with persons under 15 are insignificant. The interaction between GRWATER and the dummy for household with persons under 15 has, in contrast with our expectations, a negative (though insignificant) coefficient.

In column (B), we include an interaction between GRWATER and age, BIODIV and gender, as well as an interaction between HEALTH and pesticide risk concern level. These specifications do not change the coefficient of the choice attributes, which remain stable, but produces a significant (10% level) and positive coefficient for the interaction between GRWATER and the dummy for household with persons under 15. The coefficients on the other regressors are also consistent with our a priori pattern of expectations, though not always statistically significant. Finally, column (C) shows that adding an interaction between HEALTH and the dummy for household with persons under 15 does not change previous results and shows a positive but not significant coefficient, as expected.

Table 3 shows that Milan's respondents are on average willing to pay 24 Euros per household per month to avoid the loss of one species of farmland bird biodiversity, 15 Euros per household per month to avoid the contamination of one percent of farmland soil and aquifer, and 3 Euros per household per month to prevent one case per year of human ill-health. Willingness to pay is, therefore, substantially larger for environmental dimensions than for human health. Nevertheless, it is not possible to make direct comparisons across different pesticide risks and the related WTPs,

since the unit of measurement used to quantify risks in the experimental design varies. A more rigorous way of making direct comparisons is to observe unit trade-offs across choice attributes (see Table 4). From this simple exercise we can see that, on average, respondents are only willing to tolerate about 9 cases of human illness to save an entire species of farmland birds, and 5 cases of human intoxication to reduce soil and ground water contamination with 1 percent. Trade-offs between biodiversity protection and ground water quality show that the respondents were willing to accept only about 2 percent of soil and aquifer contamination to save an entire farmland bird's species. This indicates the importance that the sample attached to both the preservation of human health and the protection of farmland soil and ground water resources. Clearly, the issue of farmland biodiversity decrease is still weakly perceived by Italian households.

Table 3: Conditional logit model results. *T* statistics in parentheses. *N* = 4074.

<i>Variable</i>	<i>(A)</i> <i>Full model</i> <i>weighted</i>	<i>(B)</i> <i>Full model</i> <i>weighted</i>	<i>(C)</i> <i>Full model</i> <i>weighted</i>
Intercept option B ^(c,d)	1.9220 (16.320)	1.9352 (16.227)	1.9356 (16.200)
Intercept option C ^(c,d)	1.551 (13.201)	1.5653 (13.124)	1.5676 (13.098)
FOODEXP ^(c,d)	-0.0014 (-5.308)	-0.0014 (-5.413)	-0.0014 (-5.412)
BIODIV ^(c,d)	-0.0319 (-1.066)	-0.0341 (-1.114)	-0.0344 (-1.123)
GRWATER ^(c,d)	-0.0170 (-5.831)	-0.0227 (-5.174)	-0.0227 (-5.181)
HEALTH ^(c,d)	-0.0034 (-3.385)	-0.0043 (-2.483)	-0.0044 (-2.480)
FOODEXP x income	0.1884(10 ⁻⁶) (2.592)	0.1992(10 ⁻⁶) (2.712)	0.2002(10 ⁻⁶) (2.721)
BIODIV x female	--	-0.0035 (-1.979)	-0.0032 (-1.552)
BIODIV x education level	-0.0085 (-1.060)	-0.0071 (-0.867)	-0.0070 (-0.859)
BIODIV x pesticide risk concern	0.00022 (0.531)	0.2245(10 ⁻⁴) (0.032)	0.0012(10 ⁻⁵) (0.006)
GRWATER x household with person under 15 dummy	-0.00066 (-0.982)	0.0017 (1.192)	0.0012 (0.507)
GRWATER x age	--	0.0001 (1.561)	0.0011 (1.582)
HEALTH x female	0.00071 (1.120)	0.0015 (1.823)	0.0014 (1.775)
HEALTH x dummy for household with person under 15	--	--	0.0023 (0.249)
HEALTH x pesticide risk concern	--	0.0001 (0.289)	0.0001 (0.319)
Log-likelihood	-2036.134	-2033.130	-2033.099
N° of observations	4074	4074	4074

<i>Variable</i>	<i>(A)</i> <i>Full model</i> <i>weighted</i>	<i>(B)</i> <i>Full model</i> <i>weighted</i>	<i>(C)</i> <i>Full model</i> <i>weighted</i>
Pseudo-R ^{2(e)}	0.2150	0.2156	0.2160
LR test of significance of all coefficient	9.51 (p < 0.01)	15.51 (p < 0.01)	15.57 (p < 0.005)
WTP to protect birds' biodiversity ^(f)	23.01	24.36	24.57
WTP to reduce soil and aquifer contamination ^(f)	12.28	16.21	16.21
WTP to protect human health ^(f)	2.50	3.07	3.14

Table 4: Unit trade-offs across choice attributes.

	<i>Human health</i>	<i>Soil and groundwater</i>	<i>Birds biodiversity</i>
<i>Human health</i>	1	0.2	0.1
<i>Soil and groundwater</i>	5	1	0.5
<i>Birds biodiversity</i>	9.4	1.8	1

4.3 RESULTS OF THE CONTINGENT VALUATION EXPERIMENT

After having responded to the series of choice modelling questions, respondents were exposed to a CV question with a dichotomous choice double-bounded format (see above). Respondents were asked to indicate whether they would have been willing to accept an increase in their household food expense to eliminate all risks related to pesticide use in agricultural production, i.e. related to both human health and the environment. This exercise allows us to calculate an “overall” WTP estimate for reducing all pesticides negative side-effects, compared to a “target specific” WTP to be inferred by means of the CM questions. What we estimate, using a dichotomous choice format, is the mean WTP for an overall increase in agricultural safety. The density functions of the WTP with a Weibull distribution are plotted in Figure 2. The mean and median WTP estimates appeared to be, respectively, a 19.78 and 15.01 percent increase in the household food expense (see Table 5).

Table 5- Contingent Valuation WTP estimate

<i>WTP^(a)</i>	
Mean	19.797
Median	15.009
Lower bound	14.544
Upper bound	15.475

Notes:

(a) WTP are measured as percentage of increase in the household food expense

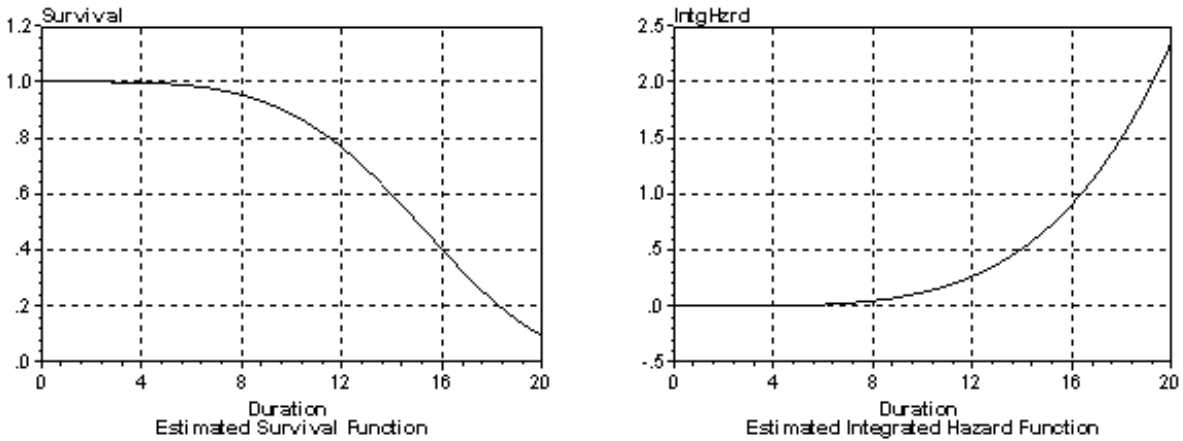


Figure 2 - Density and hazard function of WTP inferred from the CV question

5. Discussion and Conclusions

This study presents the results of a stated choice approach combining choice experiment and contingent valuation techniques to isolate the willingness to pay for improvements in agricultural safety for human health and environmental concerns, namely farmland biodiversity, soil and ground water. A rather more interesting part appears to be the choice experiment in which we use a “green” food expense payment package to elicit the respondents’ preferences for alternative agri-environmental scenarios, proposing them a series of four or five choice sets made up of three possible options of agricultural practices, including the *status quo*. The biggest advantage of this methodology in respect to contingent valuation is that respondents were forced to make trade-offs - not only between environmental issues and money- but also among different aspects of environmental safety. These are important and typical features of environmental decision-making and, therefore, it is easy to appreciate the merits of these kinds of results.

From a statistical point of view, the results of the choice modelling experiment perform well in terms of theoretical validity. Our *a priori* expectation on the effect of differences in the respondents’ socio-economic profile on attribute coefficients is confirmed by the statistical analysis, with the exception of the effect of gender and education level. This suggests that some degree of

bias, probably related to the sampling process might be present to be investigated in a following experiment.

Our conditional logit models of the choice responses indicate that the choice between agricultural scenarios *does* depend in predictable ways on the attributes. For example, respondents consider the food shopping less attractive if the groundwater pollution generated from the food production process is increased. As well, respondents are against cheaper shopping that, on the other hand, have heavier effects on biodiversity and human health. A first result is, therefore, that respondents are capable of assessing agricultural scenarios defined by multiple attributes. Second, respondents do assess agricultural scenarios described in terms of environmental and monetary attributes as we expected, showing a positive willingness-to-pay for a gain in agricultural environmental safety.

We examine also the effects of respondents' attitudinal and socio-demographic characteristic on their preferences, via interactions between choice attributes and explanatory variables, with a special focus on: gender, age, education level, income level, pesticide risk concern and whether in the household there are persons under 15.

Our a priori pattern of expectations is satisfied with the exception of the interaction between BIODIV and gender and BIODIV and the respondent's education level, which show negative coefficients (Table 3, column (C) and (D) (see also Hammitt, 1990). Women are less prone to pay for bird's biodiversity than men, while they are more prone to pay for human health than men are. While previous studies on individual preferences for pesticide related issues (Govindasamy *et al.*, 1998a, 1998b, Foster and Mourato, 2000) show that women usually exhibit a more altruistic attitude than men, our results seem to indicate that actually women are more willing to pay for enhancing agricultural safety for themselves and the general public, while are less willing to pay for protecting biodiversity than men. To some extent our study shows that female respondents do assign a higher priority to Italians' safety than men do.

Using a five-point Likert scale, respondents were asked to declare their level of concern on the topic proposed in the questionnaire choosing between a *not at all informed* and a *very well informed* position. The interactions between both BIODIV and HEALTH with the pesticide risk concern variable have a positive coefficient in all our models. This means that the higher the respondent's concern on the topic of our questionnaire, the higher the WTP for human health and for birds' biodiversity.

Importantly, consistently with what predicted by the economic theory, interaction between FOODEXP and income level produces a positive and statistically significant coefficient in all our models, even though the elasticity is rather low (0.19^{-04}).

In addition, the survey shows that Milan's respondents are on average willing to pay 24 Euros per household per month to avoid the loss of one species of farmland bird biodiversity, 15 Euros per household per month to avoid the contamination of one percent of farmland soil and aquifer, and 3 Euros per household per month to prevent one case per year of human ill-health. Though one might be surprised by the fact that biodiversity and groundwater got a higher value compared to human health, a comparison of unit trade-offs reveals that Milan's respondents perceive strongly the possible risks for human health related to pesticides use, while there is much less concern about the rather vague concept of biodiversity.

6. References

- Adamowicz, W., Louviere, J.J., Williams, M. (1994). "Combining Revealed and Stated Preference Methods for Valuing Environmental Amenities", *Journal of Environmental Economics and Management*, 26:271-292.
- Adamowicz, W., Swait, J., Boxall, P., Louviere, J.J., Williams, M. (1996). "Perceptions versus Objective Measurement of Environmental Valuation", *Journal of Environmental Economics and Management*, 32: 65-84.
- Armstrong P., Garrido, R., Ortúzar (2001). Confidence intervals to bound the value of time. *Transportation Research, Part E* 37(2-3): 143-161.
- Baker, G. (1999). "Consumer preferences for food safety attributes in fresh apples: market segments, consumer characteristics and marketing opportunities." *Journal of Agricultural and Resource Economics*, 24(1): 80-97.
- Baker, G.A.C., Crosbie, P.J. (1993). "Measuring food safety preferences: identifying consumers segments." *Journal of Agricultural and Resource Economics*, 18: 277-287.
- Ben-Akiva, M., Lerman, S.R. (1986). *Discrete Choice Analysis: Theory and Application to Travel Demand*, The MIT Press, Cambridge.
- Blamey, R.K., Common, M.S., Quiggin, J. (1995). "Respondents to Contingent Valuation Surveys: Consumers or Citizens?", *Australian Journal of Agricultural Economics*, 39(3):263-288.
- Brethour, C. A., Weersink, A. (2001). "An Economic evaluation of the environmental benefits from pesticide reduction." *Agricultural Economics*, 25: 219-226.
- Bunch, D.S., Louviere, J.J., Anderson, D. (1993). A Comparison of Experimental Design Strategies for Multinomial Logit Models: The Case of Generic Attributes. Working Paper.
- 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", *Journal of Agricultural and Applied Economics*, 27(2): 613-625.
- Cuyno, L. C. M., Norton, G. W., Rola A. (2001). "Economic analysis of environmental benefits of integrated pest management: a Philippine case study." *Agricultural Economics*, 25: 227-233.
- Diamond, P.A., Hausman, J.A. (1994). "Contingent Valuation: Is Some Number Better than Non Number?", *Journal of Economics Perspectives*, 8(4): 45-64.
- Eom, Y. S. (1994). "Pesticide Residue Risk and food Safety Valuation: A Random Utility Approach." *American Journal of Agricultural Economics*, 76: 760-771.
- Foster V., Mourato, S. (2000). "Valuing the Multiple Impacts of Pesticides Use in the UK: A Contingent Ranking Approach." *Journal of Agricultural Economics*, 51: 1-21.
- Fu T-T, Liu J-T, Hammitt, J.K. (1999). "Consumer willingness to pay for low-pesticide fresh produce in Taiwan", *Journal of Agricultural Economics*, 50(2): 220-233.

- Govindasamy, R., Italia, J., Rabin, J. (1998b). Predicting Consumer Risk Aversion to Synthetic Pesticide Residues: A Logistic Analysis. New Brunswick, Department of Agricultural Economics, The State University of New Jersey, Rutgers.
- Govindasamy, R., Italia, J., Rabin, J. (1998a). Consumer response and perceptions of integrated pest management produce. New Brunswick, Department of Agricultural Economics, The State University of New Jersey, Rutgers.
- Green, W.H. (2002). *Econometric Analysis*, 4th edition. Prentice Hall, Upper Saddle River, NY.
- Hammit, J. K. (1990). "Risk Perceptions and Food Choice: An Exploratory Analysis of Organic-Versus Conventional - Produce Buyers", *Risk Analysis*, 10: 367-374.
- Hensher, D. A., Johnson, L. W. (1981). *Applied Discrete Choice Modelling*. John Wiley and Sons, New York.
- Higley, L. G., Wintersteen, W.K. (1992). "A novel approach to environmental risk assessment of pesticides as a basis for incorporating environmental costs into economic injury level." *American Entomologist*, 38: 34-39.
- Lancaster, K. (1966). "A new approach to consumer theory", *Journal of Political Economy*, 74: 132-157.
- Lazari, A.G., Anderson, D.A. (1994). "Design of Discrete Choice Set Experiments for Estimating Both Attribute and Availability Cross Effects", *Journal of Marketing Research*, 31: 375-383.
- Louvier, J.J., Hensher, D.A. (1982). "On the Design and Analysis of Simulated Choice or Allocation Experiments in Travel Choice Modelling", *Transportation Research Record*, 890:11-17.
- Louvier, J.J., Woodworth, G. (1983). "Design and Analysis of Simulated Choice or Allocation Experiments: An Approach Based on Aggregate Data", *Journal of Marketing Research*, 20: 350-367.
- Louviere J. J., Hensher, D.A., Swait, J.D. (2000). *Stated choice methods; analysis and applications*, Cambridge University Press, Cambridge.
- Maler, K.G. (1974). *Environmental Economics: A Theoretical Inquiry*, The Johns Hopkins University Press, Baltimore.
- McFadden, D. (1986). "The Choice Theory Approach to Market Research", *Marketing Science*, 5: 275-297.
- McFadden, D. (1994). "Contingent Valuation and Social Choice", *American Journal of Agricultural Economics*, 76: 689-708.
- McFadden, D. Train, K., Tye, W.B. (1977). "An Application of Diagnostic Tests for the Independence from Irrelevant Alternatives Property of the Multinomial Logit Model", *Transportation Research Record*, 637: 39-45.
- Misra, S.K., Huang, C.L., Ott, S.L. (1991). "Consumer Willingness to Pay for Pesticide-Free Fresh Produce", *Western Journal of Agricultural Economics*, 16: 218-227.
- Mitchell, R. and Carson, R. (1989). *Using Surveys to Value Public Goods: The Contingent Valuation Method*, Resources for the Future, John Hopkins Press, Baltimore.
- Morrison, M.D., Bennett, J.W. (1997). *Water Use Trade-offs in the Macquarie and Gwydir Valleys*. Choice Modelling Research Report No.2, School of Economics and Management, University College, The University of New South Wales.
- Mourato, S., Ozdemiroglu, E., Foster, V. (2000). "Evaluating health and environmental impacts of pesticide use: implications for the design of ecolabels and taxes", *Environmental Science & Technology*, 34(8), 1456-1461.
- Mullen J.D., Norton G.W., Reaves, D.W. (1997). "Economic Analysis of Environmental benefits of Integrated Pest Management", *Journal of Agricultural and Applied Economics*, 29(2): 243-253.
- Opaluch, J.J., Swallow, S.K., Weaver, T., Wessells, W. Wichelns, D. (1993). "Evaluating Impacts from Noxious Facilities: Including Public Preferences in Current Siting Mechanisms", *Journal of Environmental Economics and Management*, 24: 41-59.
- Pimentel, D., Acquay, H., Biltonen, M., Rice, P., Silve, M., Nelson, J., Lipner, V., Giordano, S., Horowitz, A., D'Amore, M. (1992). Environmental and human costs of pesticide use. *Bioscience* 42: 750-760.
- Pimentel, D., Greiner, A. (1997). Environmental and socio-economic costs of pesticide use. In Pimentel, D. (eds), *Techniques for reducing pesticide use: economics and environmental benefits*. Chichester: John Wiley and Sons, 51-78.
- Press J., S., Söderqvist, T. (1998). On estimating the benefits of groundwater protection: a contingent valuation study in Milan. In Swanson T., Vighi M. (Eds), *Regulating Chemical Accumulation in the Environment*, Cambridge University Press, Cambridge.

- Ravenswaay van , E.O., Hoehn, J.P. (1991). Contingent Valuation and Food Safety: the case of pesticides residues. Dept. of Agricultural Economics, Staff Paper N. 91-13. East Lansing, MI: Michigan State University.
- Rizzi, L. I., Ortúzar, J. D. (2003). Stated preferences in the valuation of interurban road safety. *Accident Analysis and Prevention* 25(1): 9-22.
- Schou, J. S., Hasler, B., Kaltoft, P. (2002). “Valuing biodiversity effects of pesticide use. What does perception of uncertainty mean for survey design?”, Conference Proceedings. Risk and Uncertainty in Environmental and Resource Economics, Wageningen, The Netherlands.
- Stevens, T. H., Echevarria, J., Glass, R. J., Hager, T. and More, T. A. (1991). Measuring the Existence Value of Wildlife: What Do CVM Estimates Really Show?, *Land Economics*, 67(4), 390-400.
- Vestein, K., Hoen, H., Navriud, S. and Strand, S. (1993). Valuing Biodiversity in Norwegian Forests: A Contingent Valuation Study with Multiple Bias Testing. Memorandum No. /, Department of Economics, University of Oslo.
- STOA (1998). http://www.europarl.eu.int/stoa/publi/98-11-01/chap1_en.htm

8. NOTES

1. Italy has the third highest level of pesticide consumption with the 13 percent of total purchases, and a rate of consumption of about 7.7 kg of pesticide per hectare of agricultural land treated (OECD, 1991).
2. A pre-test on 40 respondents was undertaken in April 2003 in Milan.
3. A draft version of the questionnaire asked respondents to choose among a conventional package of spaghetti and spaghetti produced with wheat from more environmentally benign agricultural practices. The pilot survey showed that respondents were disturbed by a “single-green produce” perspective, being more comfortable with choices related to the whole shopping basket for foodstuff (a “green food expense” payment portfolio).
4. University campuses and shopping centers were considered to be privileged locations to maximize the visibility of our questionnaire and the sampling size, curbing the generally high costs of surveys. In university campuses interviewers asked people to pick up the questionnaire, bring it home and make it compiled by the member of the family responsible for the daily food shopping. In shopping centers, people were asked to pick up the questionnaire before shopping, compile it and drop it off to the interviewer after shopping.
5. The attribute levels used in the choice sets were: monthly food expense (actual; +50€; +100€; +200€); number of endangered bird species (15, 9, 3); % of farmland contaminated (65, 45, 15); cases of acute pesticide intoxication per year (250; 100; 50).
6. The design of the 9 choice sets is consistent with modern principles of experimental design (Bunch et al., 1993; Lazari and Anderson, 1994). In particular, we used a shifted or cyclic design, which generally has a superior efficiency compared to other strategies for generating main effects designs (Bunch et al., 1993). These shifted designs use an orthogonal fractional factorial to provide the basic alternatives for each choice set. Subsequently, the alternatives within a choice set are cyclically generated. The attribute levels of the new alternatives add one to the general level of the previous alternative, until it is at its maximum. At this point, the assignment returns to the lowest level. We started, therefore, from a set of 81 possible permutations of the hypothetical agricultural scenario (3 levels⁴ attributes). Then, we generated the ‘fractional factorial’ using a simple routine in the software package SPSS®. Subsequently, we used a cyclic design to generate 9 choice sets. These choice sets satisfy the principle of orthogonality, level balance, and minimal overlap (see Huber and Zwerina, 1996).
7. Violation of the IIA assumption may occur for various reasons, such as the inclusion of close substitutes in choice sets or the existence of random taste variations, i.e. heterogeneous preferences. Various tests have been proposed for detecting violations of the assumption of identically and independently distributed error terms, including the estimation of a mother logit (McFadden et al., 1977; McFadden, 1986). If an IIA violation is found, it may be possible to modify the existing MNL model to remove the violation, for instance by including individual characteristics in the model, or by estimating more complex models that relax part or all of the IIA assumption.
8. It is not possible to include socioeconomic and attitudinal variables directly into utility functions, as these are invariant across the alternatives in a choice set. Hence, their coefficient cannot be estimated. Instead, they have to be estimated interactively, either with the alternative-specific constant (C), or with one of the attributes from a choice set (X) (see Swallow et al. 1994):

$$V_i = C + \sum_h CS_h + \sum_k \beta_k X_k + \sum_{h,k} \beta_k S_h X_k$$

where $i=1, \dots, N$; $k=1, \dots, K$; $h=1, \dots, H$; C is an alternative-specific constant, β is a coefficient, X is a variable representing an attribute from a choice set, and S represents socioeconomic or attitudinal variables.

9. Three different initial bid values B , randomly distributed among respondents, were used in our survey: plus 10 percent; plus 15 percent, plus 20 percent of the monthly household food expense. Those respondents who accepted the first bid were then faced with increments of, respectively, 20 percent, 30 percent and 40 percent; while respondents answering “no” were faced with increments of, respectively, 5 percent, 10 percent and 10 percent.
10. One should bear in mind that for respondents who give two positive responses, the upper bound of WTP might be infinity, $+\infty$ (or the respondent’s income); while for those who give two negative answers, the lower bound is either zero (if the distribution of WTP admits only positive values) or negative infinity, $-\infty$, if the WTP distribution is a normal or a logistic one.
11. Hensher and Johnson (1981) comment that “the value of R -square between 0.2 and 0.4 are considered extremely good fits, so that the analysis should not be looking for values in excess of 0.9, as it is often the case for when using R^2 in ordinary regression”.
12. Coefficients across all segments of the population are implicitly restricted to be equal to \log_{LR} , while coefficients of

sub-models are allowed to vary ($\Sigma \log_{LM}$). The test statistics is $2[(\Sigma \log_{LM}) - \log_{LR}]$ and is distributed as a chi-squared variable with degrees of freedom equal to $(\text{dof}_{LR} - \text{dof}_{LM})$.

13. The critical value for a chi-squared distribution with one degree of freedom (3.841) is considered for sub-models based on: sex, motherhood, education, attitude and concern. For sub-models based on income level we consider the critical value for a chi-squared distribution with three degrees of freedom (7.815).
14. Respondents can show a lexicographic behaviour even when unlabelled options are used. Rizzi and Ortùzar (2003) identify three main reasons for lexicographic response patterns. One is related to a weak experimental design in which the differences in the attribute levels are simply not large enough to enable respondents to trade-off the choice attributes. A second reason could be simplification. If the cognitive effort required to answer is excessive for the respondent, he or she might choose the option that is the best in terms of just one attribute. Finally, lexicographic answers might come from respondents with random response patterns.

NOTE DI LAVORO DELLA FONDAZIONE ENI ENRICO MATTEI

Fondazione Eni Enrico Mattei Working Paper Series

Our Note di Lavoro are available on the Internet at the following addresses:

<http://www.feem.it/Feem/Pub/Publications/WPapers/default.html>

<http://www.ssrn.com/link/feem.html>

NOTE DI LAVORO PUBLISHED IN 2003

PRIV	1.2003	<i>Gabriella CHIESA and Giovanna NICODANO</i> : <u>Privatization and Financial Market Development: Theoretical Issues</u>
PRIV	2.2003	<i>Ibolya SCHINDELE</i> : <u>Theory of Privatization in Eastern Europe: Literature Review</u>
PRIV	3.2003	<i>Wietze LISE, Claudia KEMFERT and Richard S.J. TOL</i> : <u>Strategic Action in the Liberalised German Electricity Market</u>
CLIM	4.2003	<i>Laura MARSILIANI and Thomas I. RENSTRÖM</i> : <u>Environmental Policy and Capital Movements: The Role of Government Commitment</u>
KNOW	5.2003	<i>Reyer GERLAGH</i> : <u>Induced Technological Change under Technological Competition</u>
ETA	6.2003	<i>Efrem CASTELNUOVO</i> : <u>Squeezing the Interest Rate Smoothing Weight with a Hybrid Expectations Model</u>
SIEV	7.2003	<i>Anna ALBERINI, Alberto LONGO, Stefania TONIN, Francesco TROMBETTA and Margherita TURVANI</i> : <u>The Role of Liability, Regulation and Economic Incentives in Brownfield Remediation and Redevelopment: Evidence from Surveys of Developers</u>
NRM	8.2003	<i>Elissaios POPYRAKIS and Reyner GERLAGH</i> : <u>Natural Resources: A Blessing or a Curse?</u>
CLIM	9.2003	<i>A. CAPARRÓS, J.-C. PEREAU and T. TAZDAÏT</i> : <u>North-South Climate Change Negotiations: a Sequential Game with Asymmetric Information</u>
KNOW	10.2003	<i>Giorgio BRUNELLO and Daniele CHECCHI</i> : <u>School Quality and Family Background in Italy</u>
CLIM	11.2003	<i>Efrem CASTELNUOVO and Marzio GALEOTTI</i> : <u>Learning By Doing vs Learning By Researching in a Model of Climate Change Policy Analysis</u>
KNOW	12.2003	<i>Carole MAIGNAN, Gianmarco OTTAVIANO and Dino PINELLI (eds.)</i> : <u>Economic Growth, Innovation, Cultural Diversity: What are we all talking about? A critical survey of the state-of-the-art</u>
KNOW	13.2003	<i>Carole MAIGNAN, Gianmarco OTTAVIANO, Dino PINELLI and Francesco RULLANI (lix)</i> : <u>Bio-Ecological Diversity vs. Socio-Economic Diversity. A Comparison of Existing Measures</u>
KNOW	14.2003	<i>Maddy JANSSENS and Chris STEYAERT (lix)</i> : <u>Theories of Diversity within Organisation Studies: Debates and Future Trajectories</u>
KNOW	15.2003	<i>Tuzin BAYCAN LEVENT, Enno MASUREL and Peter NIJKAMP (lix)</i> : <u>Diversity in Entrepreneurship: Ethnic and Female Roles in Urban Economic Life</u>
KNOW	16.2003	<i>Alexandra BITUSIKOVA (lix)</i> : <u>Post-Communist City on its Way from Grey to Colourful: The Case Study from Slovakia</u>
KNOW	17.2003	<i>Billy E. VAUGHN and Katarina MLEKOV (lix)</i> : <u>A Stage Model of Developing an Inclusive Community</u>
KNOW	18.2003	<i>Selma van LONDEN and Arie de RUIJTER (lix)</i> : <u>Managing Diversity in a Globalizing World</u>
Coalition		
Theory	19.2003	<i>Sergio CURRARINI</i> : <u>On the Stability of Hierarchies in Games with Externalities</u>
Network		
PRIV	20.2003	<i>Giacomo CALZOLARI and Alessandro PAVAN (lx)</i> : <u>Monopoly with Resale</u>
PRIV	21.2003	<i>Claudio MEZZETTI (lx)</i> : <u>Auction Design with Interdependent Valuations: The Generalized Revelation Principle, Efficiency, Full Surplus Extraction and Information Acquisition</u>
PRIV	22.2003	<i>Marco LiCalzi and Alessandro PAVAN (lx)</i> : <u>Tilting the Supply Schedule to Enhance Competition in Uniform-Price Auctions</u>
PRIV	23.2003	<i>David ETTINGER (lx)</i> : <u>Bidding among Friends and Enemies</u>
PRIV	24.2003	<i>Hannu VARTIAINEN (lx)</i> : <u>Auction Design without Commitment</u>
PRIV	25.2003	<i>Matti KELOHARJU, Kjell G. NYBORG and Kristian RYDQVIST (lx)</i> : <u>Strategic Behavior and Underpricing in Uniform Price Auctions: Evidence from Finnish Treasury Auctions</u>
PRIV	26.2003	<i>Christine A. PARLOUR and Uday RAJAN (lx)</i> : <u>Rationing in IPOs</u>
PRIV	27.2003	<i>Kjell G. NYBORG and Ilya A. STREBULAIEV (lx)</i> : <u>Multiple Unit Auctions and Short Squeezes</u>
PRIV	28.2003	<i>Anders LUNANDER and Jan-Eric NILSSON (lx)</i> : <u>Taking the Lab to the Field: Experimental Tests of Alternative Mechanisms to Procure Multiple Contracts</u>
PRIV	29.2003	<i>TangaMcDANIEL and Karsten NEUHOFF (lx)</i> : <u>Use of Long-term Auctions for Network Investment</u>
PRIV	30.2003	<i>Emiel MAASLAND and Sander ONDERSTAL (lx)</i> : <u>Auctions with Financial Externalities</u>
ETA	31.2003	<i>Michael FINUS and Bianca RUNDSHAGEN</i> : <u>A Non-cooperative Foundation of Core-Stability in Positive Externality NTU-Coalition Games</u>
KNOW	32.2003	<i>Michele MORETTO</i> : <u>Competition and Irreversible Investments under Uncertainty</u>
PRIV	33.2003	<i>Philippe QUIRION</i> : <u>Relative Quotas: Correct Answer to Uncertainty or Case of Regulatory Capture?</u>
KNOW	34.2003	<i>Giuseppe MEDA, Claudio PIGA and Donald SIEGEL</i> : <u>On the Relationship between R&D and Productivity: A Treatment Effect Analysis</u>
ETA	35.2003	<i>Alessandra DEL BOCA, Marzio GALEOTTI and Paola ROTA</i> : <u>Non-convexities in the Adjustment of Different Capital Inputs: A Firm-level Investigation</u>

GG	36.2003	<i>Matthieu GLACHANT</i> : <u>Voluntary Agreements under Endogenous Legislative Threats</u>
PRIV	37.2003	<i>Narjess BOUBAKRI, Jean-Claude COSSET and Omrane GUEDHAMI</i> : <u>Postprivatization Corporate Governance: the Role of Ownership Structure and Investor Protection</u>
CLIM	38.2003	<i>Rolf GOLOMBEK and Michael HOEL</i> : <u>Climate Policy under Technology Spillovers</u>
KNOW	39.2003	<i>Slim BEN YOUSSEF</i> : <u>Transboundary Pollution, R&D Spillovers and International Trade</u>
CTN	40.2003	<i>Carlo CARRARO and Carmen MARCHIORI</i> : <u>Endogenous Strategic Issue Linkage in International Negotiations</u>
KNOW	41.2003	<i>Sonia OREFFICE</i> : <u>Abortion and Female Power in the Household: Evidence from Labor Supply</u>
KNOW	42.2003	<i>Timo GOESCHL and Timothy SWANSON</i> : <u>On Biology and Technology: The Economics of Managing Biotechnologies</u>
ETA	43.2003	<i>Giorgio Busetti and Matteo MANERA</i> : <u>STAR-GARCH Models for Stock Market Interactions in the Pacific Basin Region, Japan and US</u>
CLIM	44.2003	<i>Katrin MILLOCK and Céline NAUGES</i> : <u>The French Tax on Air Pollution: Some Preliminary Results on its Effectiveness</u>
PRIV	45.2003	<i>Bernardo BORTOLOTTI and Paolo PINOTTI</i> : <u>The Political Economy of Privatization</u>
SIEV	46.2003	<i>Elbert DIJKGRAAF and Herman R.J. VOLLEBERGH</i> : <u>Burn or Bury? A Social Cost Comparison of Final Waste Disposal Methods</u>
ETA	47.2003	<i>Jens HORBACH</i> : <u>Employment and Innovations in the Environmental Sector: Determinants and Econometrical Results for Germany</u>
CLIM	48.2003	<i>Lori SNYDER, Nolan MILLER and Robert STAVINS</i> : <u>The Effects of Environmental Regulation on Technology Diffusion: The Case of Chlorine Manufacturing</u>
CLIM	49.2003	<i>Lori SNYDER, Robert STAVINS and Alexander F. WAGNER</i> : <u>Private Options to Use Public Goods. Exploiting Revealed Preferences to Estimate Environmental Benefits</u>
CTN	50.2003	<i>László Á. KÓCZY and Luc LAUWERS</i> (Ixi): <u>The Minimal Dominant Set is a Non-Empty Core-Extension</u>
CTN	51.2003	<i>Matthew O. JACKSON</i> (Ixi): <u>Allocation Rules for Network Games</u>
CTN	52.2003	<i>Ana MAULEON and Vincent VANNETELBOSCH</i> (Ixi): <u>Farsightedness and Cautiousness in Coalition Formation</u>
CTN	53.2003	<i>Fernando VEGA-REDONDO</i> (Ixi): <u>Building Up Social Capital in a Changing World: a network approach</u>
CTN	54.2003	<i>Matthew HAAG and Roger LAGUNOFF</i> (Ixi): <u>On the Size and Structure of Group Cooperation</u>
CTN	55.2003	<i>Tajji FURUSAWA and Hideo KONISHI</i> (Ixi): <u>Free Trade Networks</u>
CTN	56.2003	<i>Halis Murat YILDIZ</i> (Ixi): <u>National Versus International Mergers and Trade Liberalization</u>
CTN	57.2003	<i>Santiago RUBIO and Alistair ULPH</i> (Ixi): <u>An Infinite-Horizon Model of Dynamic Membership of International Environmental Agreements</u>
KNOW	58.2003	<i>Carole MAIGNAN, Dino PINELLI and Gianmarco I.P. OTTAVIANO</i> : <u>ICT, Clusters and Regional Cohesion: A Summary of Theoretical and Empirical Research</u>
KNOW	59.2003	<i>Giorgio BELLETTINI and Gianmarco I.P. OTTAVIANO</i> : <u>Special Interests and Technological Change</u>
ETA	60.2003	<i>Ronnie SCHÖB</i> : <u>The Double Dividend Hypothesis of Environmental Taxes: A Survey</u>
CLIM	61.2003	<i>Michael FINUS, Ekko van IERLAND and Robert DELLINK</i> : <u>Stability of Climate Coalitions in a Cartel Formation Game</u>
GG	62.2003	<i>Michael FINUS and Bianca RUNDSHAGEN</i> : <u>How the Rules of Coalition Formation Affect Stability of International Environmental Agreements</u>
SIEV	63.2003	<i>Alberto PETRUCCI</i> : <u>Taxing Land Rent in an Open Economy</u>
CLIM	64.2003	<i>Joseph E. ALDY, Scott BARRETT and Robert N. STAVINS</i> : <u>Thirteen Plus One: A Comparison of Global Climate Policy Architectures</u>
SIEV	65.2003	<i>Edi DEFRANCESCO</i> : <u>The Beginning of Organic Fish Farming in Italy</u>
SIEV	66.2003	<i>Klaus CONRAD</i> : <u>Price Competition and Product Differentiation when Consumers Care for the Environment</u>
SIEV	67.2003	<i>Paulo A.L.D. NUNES, Luca ROSSETTO, Arianne DE BLAEIJ</i> : <u>Monetary Value Assessment of Clam Fishing Management Practices in the Venice Lagoon: Results from a Stated Choice Exercise</u>
CLIM	68.2003	<i>ZhongXiang ZHANG</i> : <u>Open Trade with the U.S. Without Compromising Canada's Ability to Comply with its Kyoto Target</u>
KNOW	69.2003	<i>David FRANTZ</i> (Iix): <u>Lorenzo Market between Diversity and Mutation</u>
KNOW	70.2003	<i>Ercole SORI</i> (Iix): <u>Mapping Diversity in Social History</u>
KNOW	71.2003	<i>Ljiljana DERU SIMIC</i> (Ixi): <u>What is Specific about Art/Cultural Projects?</u>
KNOW	72.2003	<i>Natalya V. TARANOVA</i> (Ixi): <u>The Role of the City in Fostering Intergroup Communication in a Multicultural Environment: Saint-Petersburg's Case</u>
KNOW	73.2003	<i>Kristine CRANE</i> (Ixi): <u>The City as an Arena for the Expression of Multiple Identities in the Age of Globalisation and Migration</u>
KNOW	74.2003	<i>Kazuma MATOBA</i> (Ixi): <u>Glocal Dialogue- Transformation through Transcultural Communication</u>
KNOW	75.2003	<i>Catarina REIS OLIVEIRA</i> (Ixi): <u>Immigrants' Entrepreneurial Opportunities: The Case of the Chinese in Portugal</u>
KNOW	76.2003	<i>Sandra WALLMAN</i> (Ixi): <u>The Diversity of Diversity - towards a typology of urban systems</u>
KNOW	77.2003	<i>Richard PEARCE</i> (Ixi): <u>A Biologist's View of Individual Cultural Identity for the Study of Cities</u>
KNOW	78.2003	<i>Vincent MERK</i> (Ixi): <u>Communication Across Cultures: from Cultural Awareness to Reconciliation of the Dilemmas</u>
KNOW	79.2003	<i>Giorgio BELLETTINI, Carlotta BERTI CERONI and Gianmarco I.P. OTTAVIANO</i> : <u>Child Labor and Resistance to Change</u>
ETA	80.2003	<i>Michele MORETTO, Paolo M. PANTEGHINI and Carlo SCARPA</i> : <u>Investment Size and Firm's Value under Profit Sharing Regulation</u>

IEM	81.2003	<i>Alessandro LANZA, Matteo MANERA and Massimo GIOVANNINI: <u>Oil and Product Dynamics in International Petroleum Markets</u></i>
CLIM	82.2003	<i>Y. Hossein FARZIN and Jinhua ZHAO: <u>Pollution Abatement Investment When Firms Lobby Against Environmental Regulation</u></i>
CLIM	83.2003	<i>Giuseppe DI VITA: <u>Is the Discount Rate Relevant in Explaining the Environmental Kuznets Curve?</u></i>
CLIM	84.2003	<i>Reyer GERLAGH and Wietze LISE: <u>Induced Technological Change Under Carbon Taxes</u></i>
NRM	85.2003	<i>Rinaldo BRAU, Alessandro LANZA and Francesco PIGLIARU: <u>How Fast are the Tourism Countries Growing? The cross-country evidence</u></i>
KNOW	86.2003	<i>Elena BELLINI, Gianmarco I.P. OTTAVIANO and Dino PINELLI: <u>The ICT Revolution: opportunities and risks for the Mezzogiorno</u></i>
SIEV	87.2003	<i>Lucas BRETSCGHER and Sjak SMULDERS: <u>Sustainability and Substitution of Exhaustible Natural Resources. How resource prices affect long-term R&D investments</u></i>
CLIM	88.2003	<i>Johan EYCKMANS and Michael FINUS: <u>New Roads to International Environmental Agreements: The Case of Global Warming</u></i>
CLIM	89.2003	<i>Marzio GALEOTTI: <u>Economic Development and Environmental Protection</u></i>
CLIM	90.2003	<i>Marzio GALEOTTI: <u>Environment and Economic Growth: Is Technical Change the Key to Decoupling?</u></i>
CLIM	91.2003	<i>Marzio GALEOTTI and Barbara BUCHNER: <u>Climate Policy and Economic Growth in Developing Countries</u></i>
IEM	92.2003	<i>A. MARKANDYA, A. GOLUB and E. STRUKOVA: <u>The Influence of Climate Change Considerations on Energy Policy: The Case of Russia</u></i>
ETA	93.2003	<i>Andrea BELTRATTI: <u>Socially Responsible Investment in General Equilibrium</u></i>
CTN	94.2003	<i>Parkash CHANDER: <u>The γ-Core and Coalition Formation</u></i>
IEM	95.2003	<i>Matteo MANERA and Angelo MARZULLO: <u>Modelling the Load Curve of Aggregate Electricity Consumption Using Principal Components</u></i>
IEM	96.2003	<i>Alessandro LANZA, Matteo MANERA, Margherita GRASSO and Massimo GIOVANNINI: <u>Long-run Models of Oil Stock Prices</u></i>
CTN	97.2003	<i>Steven J. BRAMS, Michael A. JONES, and D. Marc KILGOUR: <u>Forming Stable Coalitions: The Process Matters</u></i>
KNOW	98.2003	<i>John CROWLEY, Marie-Cecile NAVES (Ixxiii): <u>Anti-Racist Policies in France. From Ideological and Historical Schemes to Socio-Political Realities</u></i>
KNOW	99.2003	<i>Richard THOMPSON FORD (Ixxiii): <u>Cultural Rights and Civic Virtue</u></i>
KNOW	100.2003	<i>Alaknanda PATEL (Ixxiii): <u>Cultural Diversity and Conflict in Multicultural Cities</u></i>
KNOW	101.2003	<i>David MAY (Ixxiii): <u>The Struggle of Becoming Established in a Deprived Inner-City Neighbourhood</u></i>
KNOW	102.2003	<i>Sébastien ARCAND, Danielle JUTEAU, Sirma BILGE, and Francine LEMIRE (Ixxiii) : <u>Municipal Reform on the Island of Montreal: Tensions Between Two Majority Groups in a Multicultural City</u></i>
CLIM	103.2003	<i>Barbara BUCHNER and Carlo CARRARO: <u>China and the Evolution of the Present Climate Regime</u></i>
CLIM	104.2003	<i>Barbara BUCHNER and Carlo CARRARO: <u>Emissions Trading Regimes and Incentives to Participate in International Climate Agreements</u></i>
CLIM	105.2003	<i>Anil MARKANDYA and Dirk T.G. RÜBBELKE: <u>Ancillary Benefits of Climate Policy</u></i>
NRM	106.2003	<i>Anne Sophie CRÉPIN (Ixiv): <u>Management Challenges for Multiple-Species Boreal Forests</u></i>
NRM	107.2003	<i>Anne Sophie CRÉPIN (Ixiv): <u>Threshold Effects in Coral Reef Fisheries</u></i>
SIEV	108.2003	<i>Sara ANIYAR (Ixiv): <u>Estimating the Value of Oil Capital in a Small Open Economy: The Venezuela's Example</u></i>
SIEV	109.2003	<i>Kenneth ARROW, Partha DASGUPTA and Karl-Göran MÄLER(Ixiv): <u>Evaluating Projects and Assessing Sustainable Development in Imperfect Economies</u></i>
NRM	110.2003	<i>Anastasios XEPAPADEAS and Catarina ROSETA-PALMA(Ixiv): <u>Instabilities and Robust Control in Fisheries</u></i>
NRM	111.2003	<i>Charles PERRINGS and Brian WALKER (Ixiv): <u>Conservation and Optimal Use of Rangelands</u></i>
ETA	112.2003	<i>Jack GOODY (Ixiv): <u>Globalisation, Population and Ecology</u></i>
CTN	113.2003	<i>Carlo CARRARO, Carmen MARCHIORI and Sonia OREFFICE: <u>Endogenous Minimum Participation in International Environmental Treaties</u></i>
CTN	114.2003	<i>Guillaume HAERINGER and Myrna WOODERS: <u>Decentralized Job Matching</u></i>
CTN	115.2003	<i>Hideo KONISHI and M. Utku UNVER: <u>Credible Group Stability in Multi-Partner Matching Problems</u></i>
CTN	116.2003	<i>Somdeb LAHIRI: <u>Stable Matchings for the Room-Mates Problem</u></i>
CTN	117.2003	<i>Somdeb LAHIRI: <u>Stable Matchings for a Generalized Marriage Problem</u></i>
CTN	118.2003	<i>Marita LAUKKANEN: <u>Transboundary Fisheries Management under Implementation Uncertainty</u></i>
CTN	119.2003	<i>Edward CARTWRIGHT and Myrna WOODERS: <u>Social Conformity and Bounded Rationality in Arbitrary Games with Incomplete Information: Some First Results</u></i>
CTN	120.2003	<i>Gianluigi VERNASCA: <u>Dynamic Price Competition with Price Adjustment Costs and Product Differentiation</u></i>
CTN	121.2003	<i>Myrna WOODERS, Edward CARTWRIGHT and Reinhard SELTEN: <u>Social Conformity in Games with Many Players</u></i>
CTN	122.2003	<i>Edward CARTWRIGHT and Myrna WOODERS: <u>On Equilibrium in Pure Strategies in Games with Many Players</u></i>
CTN	123.2003	<i>Edward CARTWRIGHT and Myrna WOODERS: <u>Conformity and Bounded Rationality in Games with Many Players</u></i>
	1000	Carlo CARRARO, Alessandro LANZA and Valeria PAPPONETTI: <u>One Thousand Working Papers</u>

NOTE DI LAVORO PUBLISHED IN 2004

IEM	1.2004	<i>Anil MARKANDYA, Suzette PEDROSO and Alexander GOLUB: <u>Empirical Analysis of National Income and So2 Emissions in Selected European Countries</u></i>
ETA	2.2004	<i>Masahisa FUJITA and Shlomo WEBER: <u>Strategic Immigration Policies and Welfare in Heterogeneous Countries</u></i>
PRA	3.2004	<i>Adolfo DI CARLUCCIO, Giovanni FERRI, Cecilia FRALE and Ottavio RICCHI: <u>Do Privatizations Boost Household Shareholding? Evidence from Italy</u></i>
ETA	4.2004	<i>Victor GINSBURGH and Shlomo WEBER: <u>Languages Disenfranchisement in the European Union</u></i>
ETA	5.2004	<i>Romano PIRAS: <u>Growth, Congestion of Public Goods, and Second-Best Optimal Policy</u></i>
CCMP	6.2004	<i>Herman R.J. VOLLEBERGH: <u>Lessons from the Polder: Is Dutch CO2-Taxation Optimal</u></i>
PRA	7.2004	<i>Sandro BRUSCO, Giuseppe LOPOMO and S. VISWANATHAN (lxv): <u>Merger Mechanisms</u></i>
PRA	8.2004	<i>Wolfgang AUSSENEGG, Pegaret PICHLER and Alex STOMPER (lxv): <u>IPO Pricing with Bookbuilding, and a When-Issued Market</u></i>
PRA	9.2004	<i>Pegaret PICHLER and Alex STOMPER (lxv): <u>Primary Market Design: Direct Mechanisms and Markets</u></i>
PRA	10.2004	<i>Florian ENGLMAIER, Pablo GUILLEN, Loreto LLORENTE, Sander ONDERSTAL and Rupert SAUSGRUBER (lxv): <u>The Chopstick Auction: A Study of the Exposure Problem in Multi-Unit Auctions</u></i>
PRA	11.2004	<i>Bjarne BRENDSTRUP and Harry J. PAARSCH (lxv): <u>Nonparametric Identification and Estimation of Multi-Unit, Sequential, Oral, Ascending-Price Auctions With Asymmetric Bidders</u></i>
PRA	12.2004	<i>Ohad KADAN (lxv): <u>Equilibrium in the Two Player, k-Double Auction with Affiliated Private Values</u></i>
PRA	13.2004	<i>Maarten C.W. JANSSEN (lxv): <u>Auctions as Coordination Devices</u></i>
PRA	14.2004	<i>Gadi FIBICH, Arieh GAVIOUS and Aner SELA (lxv): <u>All-Pay Auctions with Weakly Risk-Averse Buyers</u></i>
PRA	15.2004	<i>Orly SADE, Charles SCHNITZLEIN and Jaime F. ZENDER (lxv): <u>Competition and Cooperation in Divisible Good Auctions: An Experimental Examination</u></i>
PRA	16.2004	<i>Marta STRYSZOWSKA (lxv): <u>Late and Multiple Bidding in Competing Second Price Internet Auctions</u></i>
CCMP	17.2004	<i>Slim Ben YOUSSEF: <u>R&D in Cleaner Technology and International Trade</u></i>
NRM	18.2004	<i>Angelo ANTOCI, Simone BORGHESI and Paolo RUSSU (lxvi): <u>Biodiversity and Economic Growth: Stabilization Versus Preservation of the Ecological Dynamics</u></i>
SIEV	19.2004	<i>Anna ALBERINI, Paolo ROSATO, Alberto LONGO and Valentina ZANATTA: <u>Information and Willingness to Pay in a Contingent Valuation Study: The Value of S. Erasmo in the Lagoon of Venice</u></i>
NRM	20.2004	<i>Guido CANDELA and Roberto CELLINI (lxvii): <u>Investment in Tourism Market: A Dynamic Model of Differentiated Oligopoly</u></i>
NRM	21.2004	<i>Jacqueline M. HAMILTON (lxvii): <u>Climate and the Destination Choice of German Tourists</u></i>
NRM	22.2004	<i>Javier Rey-MAQUIEIRA PALMER, Javier LOZANO IBÁÑEZ and Carlos Mario GÓMEZ GÓMEZ (lxvii): <u>Land, Environmental Externalities and Tourism Development</u></i>
NRM	23.2004	<i>Pius ODUNGA and Henk FOLMER (lxvii): <u>Profiling Tourists for Balanced Utilization of Tourism-Based Resources in Kenya</u></i>
NRM	24.2004	<i>Jean-Jacques NOWAK, Mondher SAHLI and Pasquale M. SGRO (lxvii): <u>Tourism, Trade and Domestic Welfare</u></i>
NRM	25.2004	<i>Riaz SHAREEF (lxvii): <u>Country Risk Ratings of Small Island Tourism Economies</u></i>
NRM	26.2004	<i>Juan Luis EUGENIO-MARTÍN, Noelia MARTÍN MORALES and Riccardo SCARPA (lxvii): <u>Tourism and Economic Growth in Latin American Countries: A Panel Data Approach</u></i>
NRM	27.2004	<i>Raúl Hernández MARTÍN (lxvii): <u>Impact of Tourism Consumption on GDP. The Role of Imports</u></i>
CSRM	28.2004	<i>Nicoletta FERRO: <u>Cross-Country Ethical Dilemmas in Business: A Descriptive Framework</u></i>
NRM	29.2004	<i>Marian WEBER (lxvi): <u>Assessing the Effectiveness of Tradable Landuse Rights for Biodiversity Conservation: an Application to Canada's Boreal Mixedwood Forest</u></i>
NRM	30.2004	<i>Trond BJORN DAL, Phoebe KOUNDOURI and Sean PASCOE (lxvi): <u>Output Substitution in Multi-Species Trawl Fisheries: Implications for Quota Setting</u></i>
CCMP	31.2004	<i>Marzio GALEOTTI, Alessandra GORIA, Paolo MOMBRINI and Evi SPANTIDAKI: <u>Weather Impacts on Natural, Social and Economic Systems (WISE) Part I: Sectoral Analysis of Climate Impacts in Italy</u></i>
CCMP	32.2004	<i>Marzio GALEOTTI, Alessandra GORIA, Paolo MOMBRINI and Evi SPANTIDAKI: <u>Weather Impacts on Natural, Social and Economic Systems (WISE) Part II: Individual Perception of Climate Extremes in Italy</u></i>
CTN	33.2004	<i>Wilson PEREZ: <u>Divide and Conquer: Noisy Communication in Networks, Power, and Wealth Distribution</u></i>
KTHC	34.2004	<i>Gianmarco I.P. OTTAVIANO and Giovanni PERI (lxviii): <u>The Economic Value of Cultural Diversity: Evidence from US Cities</u></i>
KTHC	35.2004	<i>Linda CHAIB (lxviii): <u>Immigration and Local Urban Participatory Democracy: A Boston-Paris Comparison</u></i>
KTHC	36.2004	<i>Franca ECKERT COEN and Claudio ROSSI (lxviii): <u>Foreigners, Immigrants, Host Cities: The Policies of Multi-Ethnicity in Rome. Reading Governance in a Local Context</u></i>
KTHC	37.2004	<i>Kristine CRANE (lxviii): <u>Governing Migration: Immigrant Groups' Strategies in Three Italian Cities – Rome, Naples and Bari</u></i>
KTHC	38.2004	<i>Kiflemariam HAMDE (lxviii): <u>Mind in Africa, Body in Europe: The Struggle for Maintaining and Transforming Cultural Identity - A Note from the Experience of Eritrean Immigrants in Stockholm</u></i>
ETA	39.2004	<i>Alberto CAVALIERE: <u>Price Competition with Information Disparities in a Vertically Differentiated Duopoly</u></i>
PRA	40.2004	<i>Andrea BIGANO and Stef PROOST: <u>The Opening of the European Electricity Market and Environmental Policy: Does the Degree of Competition Matter?</u></i>
CCMP	41.2004	<i>Micheal FINUS (lxix): <u>International Cooperation to Resolve International Pollution Problems</u></i>

KTHC	42.2004	<i>Francesco CRESPI</i> : <u>Notes on the Determinants of Innovation: A Multi-Perspective Analysis</u>
CTN	43.2004	<i>Sergio CURRARINI and Marco MARINI</i> : <u>Coalition Formation in Games without Synergies</u>
CTN	44.2004	<i>Marc ESCRHUELA-VILLAR</i> : <u>Cartel Sustainability and Cartel Stability</u>
NRM	45.2004	<i>Sebastian BERVOETS and Nicolas GRAVEL</i> (lxvi): <u>Appraising Diversity with an Ordinal Notion of Similarity: An Axiomatic Approach</u>
NRM	46.2004	<i>Signe ANTHON and Bo JELLESMARK THORSEN</i> (lxvi): <u>Optimal Afforestation Contracts with Asymmetric Information on Private Environmental Benefits</u>
NRM	47.2004	<i>John MBURU</i> (lxvi): <u>Wildlife Conservation and Management in Kenya: Towards a Co-management Approach</u>
NRM	48.2004	<i>Ekin BIROL, Ágnes GYOVAI and Melinda SMALE</i> (lxvi): <u>Using a Choice Experiment to Value Agricultural Biodiversity on Hungarian Small Farms: Agri-Environmental Policies in a Transitional Economy</u>
CCMP	49.2004	<i>Gernot KLEPPER and Sonja PETERSON</i> : <u>The EU Emissions Trading Scheme. Allowance Prices, Trade Flows, Competitiveness Effects</u>
GG	50.2004	<i>Scott BARRETT and Michael HOEL</i> : <u>Optimal Disease Eradication</u>
CTN	51.2004	<i>Dinko DIMITROV, Peter BORM, Ruud HENDRICKX and Shao CHIN SUNG</i> : <u>Simple Priorities and Core Stability in Hedonic Games</u>
SIEV	52.2004	<i>Francesco RICCI</i> : <u>Channels of Transmission of Environmental Policy to Economic Growth: A Survey of the Theory</u>
SIEV	53.2004	<i>Anna ALBERINI, Maureen CROPPER, Alan KRUPNICK and Nathalie B. SIMON</i> : <u>Willingness to Pay for Mortality Risk Reductions: Does Latency Matter?</u>
NRM	54.2004	<i>Ingo BRÄUER and Rainer MARGGRAF</i> (lxvi): <u>Valuation of Ecosystem Services Provided by Biodiversity Conservation: An Integrated Hydrological and Economic Model to Value the Enhanced Nitrogen Retention in Renaturated Streams</u>
NRM	55.2004	<i>Timo GOESCHL and Tun LIN</i> (lxvi): <u>Biodiversity Conservation on Private Lands: Information Problems and Regulatory Choices</u>
NRM	56.2004	<i>Tom DEDEURWAERDERE</i> (lxvi): <u>Bioprospection: From the Economics of Contracts to Reflexive Governance</u>
CCMP	57.2004	<i>Katrin REHDANZ and David MADDISON</i> : <u>The Amenity Value of Climate to German Households</u>
CCMP	58.2004	<i>Koen SMEKENS and Bob VAN DER ZWAAN</i> : <u>Environmental Externalities of Geological Carbon Sequestration Effects on Energy Scenarios</u>
NRM	59.2004	<i>Valentina BOSETTI, Mariaester CASSINELLI and Alessandro LANZA</i> (lxvii): <u>Using Data Envelopment Analysis to Evaluate Environmentally Conscious Tourism Management</u>
NRM	60.2004	<i>Timo GOESCHL and Danilo CAMARGO IGLIORI</i> (lxvi): <u>Property Rights Conservation and Development: An Analysis of Extractive Reserves in the Brazilian Amazon</u>
CCMP	61.2004	<i>Barbara BUCHNER and Carlo CARRARO</i> : <u>Economic and Environmental Effectiveness of a Technology-based Climate Protocol</u>
NRM	62.2004	<i>Elissaios POPYRAKIS and Reyer GERLAGH</i> : <u>Resource-Abundance and Economic Growth in the U.S.</u>
NRM	63.2004	<i>Györgyi BELA, Györgyi PATAKI, Melinda SMALE and Mariann HAJDÚ</i> (lxvi): <u>Conserving Crop Genetic Resources on Smallholder Farms in Hungary: Institutional Analysis</u>
NRM	64.2004	<i>E.C.M. RUIJGROK and E.E.M. NILLESEN</i> (lxvi): <u>The Socio-Economic Value of Natural Riverbanks in the Netherlands</u>
NRM	65.2004	<i>E.C.M. RUIJGROK</i> (lxvi): <u>Reducing Acidification: The Benefits of Increased Nature Quality. Investigating the Possibilities of the Contingent Valuation Method</u>
ETA	66.2004	<i>Giannis VARDAS and Anastasios XEPAPADEAS</i> : <u>Uncertainty Aversion, Robust Control and Asset Holdings</u>
GG	67.2004	<i>Anastasios XEPAPADEAS and Constadina PASSA</i> : <u>Participation in and Compliance with Public Voluntary Environmental Programs: An Evolutionary Approach</u>
GG	68.2004	<i>Michael FINUS</i> : <u>Modesty Pays: Sometimes!</u>
NRM	69.2004	<i>Trond BJØRNDAL and Ana BRASÃO</i> : <u>The Northern Atlantic Bluefin Tuna Fisheries: Management and Policy Implications</u>
CTN	70.2004	<i>Alejandro CAPARRÓS, Abdelhakim HAMMOUDI and Tarik TAZDAÏT</i> : <u>On Coalition Formation with Heterogeneous Agents</u>
IEM	71.2004	<i>Massimo GIOVANNINI, Margherita GRASSO, Alessandro LANZA and Matteo MANERA</i> : <u>Conditional Correlations in the Returns on Oil Companies Stock Prices and Their Determinants</u>
IEM	72.2004	<i>Alessandro LANZA, Matteo MANERA and Michael MCALEER</i> : <u>Modelling Dynamic Conditional Correlations in WTI Oil Forward and Futures Returns</u>
SIEV	73.2004	<i>Margarita GENIUS and Elisabetta STRAZZERA</i> : <u>The Copula Approach to Sample Selection Modelling: An Application to the Recreational Value of Forests</u>
CCMP	74.2004	<i>Rob DELLINK and Ekko van IERLAND</i> : <u>Pollution Abatement in the Netherlands: A Dynamic Applied General Equilibrium Assessment</u>
ETA	75.2004	<i>Rosella LEVAGGI and Michele MORETTO</i> : <u>Investment in Hospital Care Technology under Different Purchasing Rules: A Real Option Approach</u>
CTN	76.2004	<i>Salvador BARBERA and Matthew O. JACKSON</i> (lxx): <u>On the Weights of Nations: Assigning Voting Weights in a Heterogeneous Union</u>
CTN	77.2004	<i>Álex ARENAS, Antonio CABRALES, Albert DÍAZ-GUILERA, Roger GUIMERA and Fernando VEGA-REDONDO</i> (lxx): <u>Optimal Information Transmission in Organizations: Search and Congestion</u>
CTN	78.2004	<i>Francis BLOCH and Armando GOMES</i> (lxx): <u>Contracting with Externalities and Outside Options</u>

CTN	79.2004	<i>Rabah AMIR, Effrosyni DIAMANTOUDI and Licun XUE</i> (lxx): <u>Merger Performance under Uncertain Efficiency Gains</u>
CTN	80.2004	<i>Francis BLOCH and Matthew O. JACKSON</i> (lxx): <u>The Formation of Networks with Transfers among Players</u>
CTN	81.2004	<i>Daniel DIERMEIER, Hülya ERASLAN and Antonio MERLO</i> (lxx): <u>Bicameralism and Government Formation</u>
CTN	82.2004	<i>Rod GARRATT, James E. PARCO, Cheng-ZHONG QIN and Amnon RAPOPORT</i> (lxx): <u>Potential Maximization and Coalition Government Formation</u>
CTN	83.2004	<i>Kfir ELIAZ, Debraj RAY and Ronny RAZIN</i> (lxx): <u>Group Decision-Making in the Shadow of Disagreement</u>
CTN	84.2004	<i>Sanjeev GOYAL, Marco van der LEIJ and José Luis MORAGA-GONZÁLEZ</i> (lxx): <u>Economics: An Emerging Small World?</u>
CTN	85.2004	<i>Edward CARTWRIGHT</i> (lxx): <u>Learning to Play Approximate Nash Equilibria in Games with Many Players</u>
IEM	86.2004	<i>Finn R. FØRSUND and Michael HOEL</i> : <u>Properties of a Non-Competitive Electricity Market Dominated by Hydroelectric Power</u>
KTHC	87.2004	<i>Elissaios POPYRAKIS and Reyer GERLAGH</i> : <u>Natural Resources, Investment and Long-Term Income</u>
CCMP	88.2004	<i>Marzio GALEOTTI and Claudia KEMFERT</i> : <u>Interactions between Climate and Trade Policies: A Survey</u>
IEM	89.2004	<i>A. MARKANDYA, S. PEDROSO and D. STREIMIKIENE</i> : <u>Energy Efficiency in Transition Economies: Is There Convergence Towards the EU Average?</u>
GG	90.2004	<i>Rolf GOLOMBEK and Michael HOEL</i> : <u>Climate Agreements and Technology Policy</u>
PRA	91.2004	<i>Sergei IZMALKOV</i> (lxx): <u>Multi-Unit Open Ascending Price Efficient Auction</u>
KTHC	92.2004	<i>Gianmarco I.P. OTTAVIANO and Giovanni PERI</i> : <u>Cities and Cultures</u>
KTHC	93.2004	<i>Massimo DEL GATTO</i> : <u>Agglomeration, Integration, and Territorial Authority Scale in a System of Trading Cities. Centralisation versus devolution</u>
CCMP	94.2004	<i>Pierre-André JOUVET, Philippe MICHEL and Gilles ROTILLON</i> : <u>Equilibrium with a Market of Permits</u>
CCMP	95.2004	<i>Bob van der ZWAAN and Reyer GERLAGH</i> : <u>Climate Uncertainty and the Necessity to Transform Global Energy Supply</u>
CCMP	96.2004	<i>Francesco BOSELLO, Marco LAZZARIN, Roberto ROSON and Richard S.J. TOL</i> : <u>Economy-Wide Estimates of the Implications of Climate Change: Sea Level Rise</u>
CTN	97.2004	<i>Gustavo BERGANTIÑOS and Juan J. VIDAL-PUGA</i> : <u>Defining Rules in Cost Spanning Tree Problems Through the Canonical Form</u>
CTN	98.2004	<i>Siddhartha BANDYOPADHYAY and Mandar OAK</i> : <u>Party Formation and Coalitional Bargaining in a Model of Proportional Representation</u>
GG	99.2004	<i>Hans-Peter WEIKARD, Michael FINUS and Juan-Carlos ALTAMIRANO-CABRERA</i> : <u>The Impact of Surplus Sharing on the Stability of International Climate Agreements</u>
SIEV	100.2004	<i>Chiara M. TRAVISI and Peter NIJKAMP</i> : <u>Willingness to Pay for Agricultural Environmental Safety: Evidence from a Survey of Milan, Italy, Residents</u>

- (lix) This paper was presented at the ENGIME Workshop on “Mapping Diversity”, Leuven, May 16-17, 2002
- (lx) This paper was presented at the EuroConference on “Auctions and Market Design: Theory, Evidence and Applications”, organised by the Fondazione Eni Enrico Mattei, Milan, September 26-28, 2002
- (lxi) This paper was presented at the Eighth Meeting of the Coalition Theory Network organised by the GREQAM, Aix-en-Provence, France, January 24-25, 2003
- (lxii) This paper was presented at the ENGIME Workshop on “Communication across Cultures in Multicultural Cities”, The Hague, November 7-8, 2002
- (lxiii) This paper was presented at the ENGIME Workshop on “Social dynamics and conflicts in multicultural cities”, Milan, March 20-21, 2003
- (lxiv) This paper was presented at the International Conference on “Theoretical Topics in Ecological Economics”, organised by the Abdus Salam International Centre for Theoretical Physics - ICTP, the Beijer International Institute of Ecological Economics, and Fondazione Eni Enrico Mattei – FEEM Trieste, February 10-21, 2003
- (lxv) This paper was presented at the EuroConference on “Auctions and Market Design: Theory, Evidence and Applications” organised by Fondazione Eni Enrico Mattei and sponsored by the EU, Milan, September 25-27, 2003
- (lxvi) This paper has been presented at the 4th BioEcon Workshop on “Economic Analysis of Policies for Biodiversity Conservation” organised on behalf of the BIOECON Network by Fondazione Eni Enrico Mattei, Venice International University (VIU) and University College London (UCL), Venice, August 28-29, 2003
- (lxvii) This paper has been presented at the international conference on “Tourism and Sustainable Economic Development – Macro and Micro Economic Issues” jointly organised by CRENoS (Università di Cagliari e Sassari, Italy) and Fondazione Eni Enrico Mattei, and supported by the World Bank, Sardinia, September 19-20, 2003
- (lxviii) This paper was presented at the ENGIME Workshop on “Governance and Policies in Multicultural Cities”, Rome, June 5-6, 2003
- (lxix) This paper was presented at the Fourth EEP Plenary Workshop and EEP Conference “The Future of Climate Policy”, Cagliari, Italy, 27-28 March 2003
- (lxx) This paper was presented at the 9th Coalition Theory Workshop on "Collective Decisions and Institutional Design" organised by the Universitat Autònoma de Barcelona and held in Barcelona, Spain, January 30-31, 2004

2003 SERIES

CLIM	<i>Climate Change Modelling and Policy</i> (Editor: Marzio Galeotti)
GG	<i>Global Governance</i> (Editor: Carlo Carraro)
SIEV	<i>Sustainability Indicators and Environmental Valuation</i> (Editor: Anna Alberini)
NRM	<i>Natural Resources Management</i> (Editor: Carlo Giupponi)
KNOW	<i>Knowledge, Technology, Human Capital</i> (Editor: Gianmarco Ottaviano)
IEM	<i>International Energy Markets</i> (Editor: Anil Markandya)
CSR	<i>Corporate Social Responsibility and Management</i> (Editor: Sabina Ratti)
PRIV	<i>Privatisation, Regulation, Antitrust</i> (Editor: Bernardo Bortolotti)
ETA	<i>Economic Theory and Applications</i> (Editor: Carlo Carraro)
CTN	<i>Coalition Theory Network</i>

2004 SERIES

CCMP	<i>Climate Change Modelling and Policy</i> (Editor: Marzio Galeotti)
GG	<i>Global Governance</i> (Editor: Carlo Carraro)
SIEV	<i>Sustainability Indicators and Environmental Valuation</i> (Editor: Anna Alberini)
NRM	<i>Natural Resources Management</i> (Editor: Carlo Giupponi)
KTHC	<i>Knowledge, Technology, Human Capital</i> (Editor: Gianmarco Ottaviano)
IEM	<i>International Energy Markets</i> (Editor: Anil Markandya)
CSR	<i>Corporate Social Responsibility and Management</i> (Editor: Sabina Ratti)
PRA	<i>Privatisation, Regulation, Antitrust</i> (Editor: Bernardo Bortolotti)
ETA	<i>Economic Theory and Applications</i> (Editor: Carlo Carraro)
CTN	<i>Coalition Theory Network</i>