

Rosata, Paolo; Defrancesco, Edi

Working Paper

Individual travel cost method and flow fixed costs

Nota di Lavoro, No. 56.2002

Provided in Cooperation with:

Fondazione Eni Enrico Mattei (FEEM)

Suggested Citation: Rosata, Paolo; Defrancesco, Edi (2002) : Individual travel cost method and flow fixed costs, Nota di Lavoro, No. 56.2002, Fondazione Eni Enrico Mattei (FEEM), Milano

This Version is available at:

<https://hdl.handle.net/10419/119665>

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.

Fondazione Eni Enrico Mattei

Individual Travel Cost Method and Flow Fixed Costs

Paolo Rosato and Edi Defrancesco

NOTA DI LAVORO 56.2002

JULY 2002

SUST – Sustainability Indicators and Environmental Evaluation
--

Paolo Rosato, *Department of Civil Engineering at the University of Trieste and
Fondazione Eni Enrico Mattei*

Edi Defrancesco, *Department of the Territory and Agro-forestal Systems
at the University of Padua*

This paper can be downloaded without charge at:

The Fondazione Eni Enrico Mattei Note di Lavoro Series Index:
http://www.feem.it/web/attiv/_attiv.html

Social Science Research Network Electronic Paper Collection:
http://papers.ssrn.com/abstract_id=XXXXXX

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

Individual Travel Cost Method and Flow Fixed Costs

Summary

The paper proposes an approach for evaluating the effect of flow fixed costs on the evaluation of environmental benefits with travel cost method. On a full annual perspective when recreational users incur relevant annual direct fixed expenses, their behaviour could be influenced by them. The approach introduces a) the notion of the minimal number of annual visits that justifies the annual fixed expenses incurred by the user and b) a method to estimate it. The estimate of this minimal number permits to forecast the user behaviour on a full annual perspective, taking into account a more accurate estimate of the number of visits at different additional fees.

Keywords: Travel cost method, fixed cost

JEL: D1, D4, Q3

This research was funded by a grant from the Consortium for Managing the Coordination Centre of the Research Activities concerning the Venice Lagoon System (CORILA) within its Research Programme 2000-2004, in particular the research line 1.1 "Economic valuation of environmental goods".

Address for correspondence:

Paolo Rosato
University of Trieste
Department of Civil Engineering
Piazzale Europa, 1
34127 Trieste
Italy
Phone: + 39 - 040 5582569
Fax: + 39 - 040 5583569
E-mail: paolo.rosato@libero.it

INDIVIDUAL TRAVEL COST METHOD AND FLOW FIXED COSTS

Abstract

The paper proposes an approach for evaluating the effect of flow fixed costs on the evaluation of environmental benefits with travel cost method. On a full annual perspective when recreational users incur relevant annual direct fixed expenses, their behaviour could be influenced by them. The approach introduces a) the notion of the minimal number of annual visits that justifies the annual fixed expenses incurred by the user and b) a method to estimate it. The estimate of this minimal number permits to forecast the user behaviour on a full annual perspective, taking into account a more accurate estimate of the number of visits at different additional fees.

1. Introduction

Travel cost method (TCM) has been developed by Clawson [1959], initially suggested by Hotelling [1949], in order to estimate social benefits from recreation in natural sites.

The method is based on the assumption that the recreational benefits in a specific site can be derived from the demand function, estimated observing users' behaviour, in relation to the costs sustained by them per number of visits. In other words, the classical model derived from economic theory of consumer behaviour postulates that a consumers' choice is based not only on price but on all sacrifices made to obtain the stream of benefits generated by a good or service. Obviously, if the paid price (p) is the only sacrifice made by consumer, the demand function for a good, with no substitutes, is $x=f(p)$, given his income and preferences.

However, the consumer often incurs other costs (c), in addition to the paid price, i.e. disbursements, travel expenses, time loss and stress from congestion and/or competition, e.g. crowded local

markets. In this case, the demand function is the following: $x = f(p, c)^1$. In other words, the price is an imperfect measure of the good's cost incurred by the purchaser. Under these conditions, the utility maximising consumer's behaviour should be reformulated in order to take into account such costs: given two goods or services (x_1, x_2), the prices (p_1, p_2), the access costs (c_1, c_2) and the income (R), the utility maximising choice of the consumer will be obtained as follows:

$$\begin{aligned} \max U &= u(x_1, x_2) \\ \text{subject to :} & \\ (p_1 + c_1)x_1 + (p_2 + c_2)x_2 &= R \end{aligned} \quad [1]$$

Now, assuming x_1 the aggregate of priced goods and services, x_2 the number of annual visits to a recreational site, negligible access costs to the market goods ($c_1=0$) and a free access to the recreational site ($p_2=0$), [1] can be written:

$$\begin{aligned} \max U &= u(x_1, x_2) \\ \text{subject to :} & \\ p_1x_1 + c_2x_2 &= R \end{aligned} \quad [2]$$

Under these conditions, the utility maximising behaviour of the consumer depends on: a) his preferences [$u(x_1, x_2)$], b) his budget (R), c) the prices of the private goods and services (p_1) and d) the access cost to the recreational site (c_2). Figure 1 shows the optimal choice between private goods and recreational activity, given the budget constraint: the point where the marginal rate of substitution is equal to the slope of the budget line and/or where the weighted marginal utility is equal $\frac{Um_1}{p_1} = \frac{Um_2}{c_2}$. Figure 1 also highlights other important issues that will be useful later, when

analysing the impact of different type of cost on consumers' optimal choice. First of all, the utility function shows that the user could renounce the recreational activity considered in the figure, allocating his budget only on x_1 , while he could not set x_1 to zero (the utility function curve cuts only the Y-axis in x_1^*).

In other words, access to the recreational site could be considered if the income is over a specific threshold, once other needs² have been satisfied. With an increased income, the marginal rate of substitution grows and the optimal solution moves from the corner solution [R/p_1], on the Y-axis, to point E³. TCM is based on the hypothesis that changes in the access costs to the recreational site

¹ Suppliers often internalise the difficulties faced by consumers in founding a good into their pricing policies using price differentiation.

² In other words, consumer utility function is non-homothetic.

³ Given that $u(x_1^e, x_2^e) = u(x_1^*, 0)$ and setting $R^* = p_1 x_1^*$, the willingness to accept a compensation (WTA) to renounce to x_2^e visits is $WTA = R^* - R$. In other words, WTA increases as marginal rate of substitution increases.

(c_2) have the same effect as price variations: as the number of visits to a site decreases as the cost per visit increases. If the implicit assumptions in [2] are reasonable, then the demand function of the recreational site is $x_2=f(c_2)$ and it can be estimated using the number of yearly visits and different costs per visit observed. There are two basic approaches to TCM: the Zonal approach (ZTCM) and the Individual approach (ITCM). The two approaches share the theoretical premises, but differ in the operational point of view. ZTCM takes into account the users frequency rate coming from different zones with increasing travel costs. ITCM, however, examines the behaviour of the single user in choosing the number of visits per time period, usually a year. The latter approach can be considered a refinement or a generalisation of ZTCM [Ward and Beal, 2000].

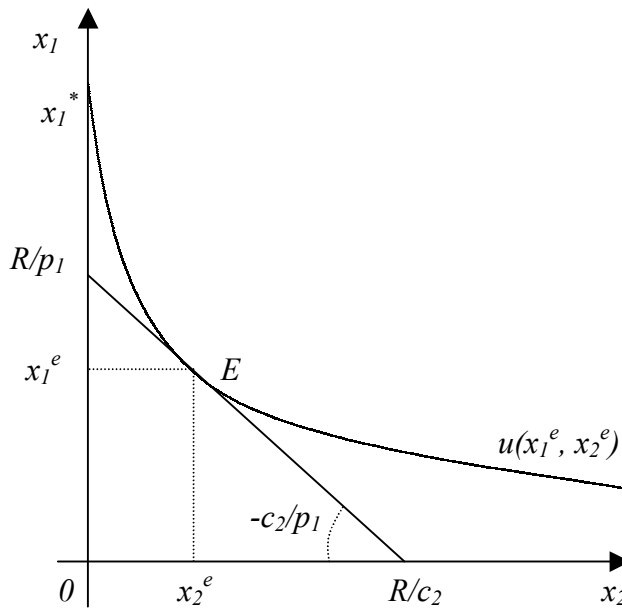


Fig. 1 – Utility maximization of a private and public recreational services user

ITCM, developed by Brown and Nawas [1973] and Gum and Martin [1974], estimates the consumer surplus by analysing the individual visitors' behaviour and the cost sustained for the recreational activity. These observations are used to estimate the relation between the number of individual's visits in a stated time interval, usually a year, the cost per visit and socio-economic variables. Figure 2 highlights the expected relation between the number of visits and cost per visit, given the other variables. It also shows that the number of visits decreases as the cost per visit increases. If we assume that all users have the same preferences and the same income, the number of visits are a function of the cost per visit:

$$x_2 = g(c_2) \quad [3]$$

Therefore, if an individual incurs c_2^e per visit, it carries out x_2^e visits a year and if the cost per visit increases to c_2^p the number of visits will decrease to x_2^p . In other words, for a homogenous group of individuals⁴, [3] shows the relationship between the number of visits and the cost per visit. The cost cap is the choke price: the cost per visit that sets the number of visits to zero. Equation [3] is the individual demand function for the recreational site use referred to an “average user”. The annual user surplus can be easily obtained integrating the demand function from zero to the present number of yearly visits and subtracting the visits costs.

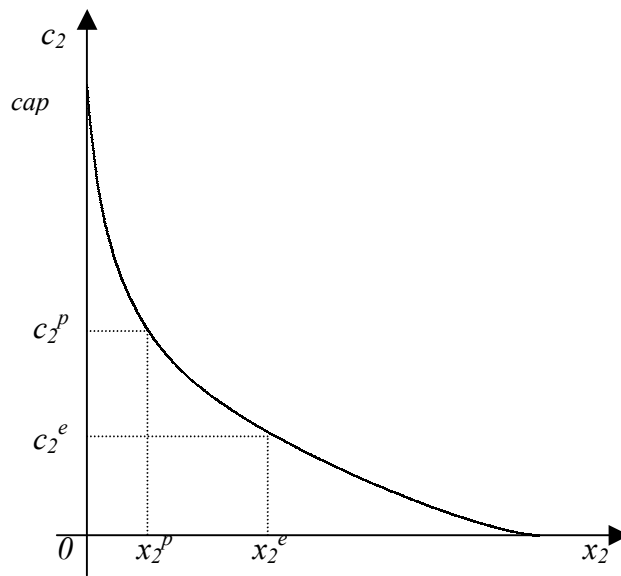


Fig. 2 – Individual's recreational demand function

Figure 3 shows the user's behaviour with increasing additional costs per visit. Briefly, the additional cost (ca) modify the slope of budget line that gradually reduce the number of visits until the point in which, for the aggregate effect of the reducing of the marginal rate of substitution and the increasing of slope of the budget line, the optimal solution excludes the visit (x_2), and the entire budget is spent on x_1 . The additional cost setting the visits to zero is cap , the choke price. Increasing the cost for visit to cap , the consumer's utility will be reduced to $u(R/p_1, 0)$. The demand function, subtracting the present travel cost, $[x_2=z(ca), ca=\delta(x_2)]$ is the curve I of figure 4.

The aggregate demand function (A) $[x_2 = h(ca), ca = \varphi(x_2)]$ is obtained summing up the individual demands (i) at the different additional costs. It cuts the X-axis at the total present visits' numbers $(\sum_i x_{i2}^e)$, and the Y-axis at the maximum additional cost incurred by the users. The

⁴ The function can also be estimated for non homogeneous sub-samples introducing among the independent variables income and socioeconomic variables expressing individual preferences [Hanley and Spash, 1993, p. 84].

recreational users' surplus is obtained taking the present value of the definite integral of the aggregate demand function (A) from zero to total annual visits' number. That is:

$$S = \frac{\int_0^{\sum_i x_{i2}^e} \varphi(x_2) dx_2}{r} \quad [4]$$

where r is an appropriate discount rate.

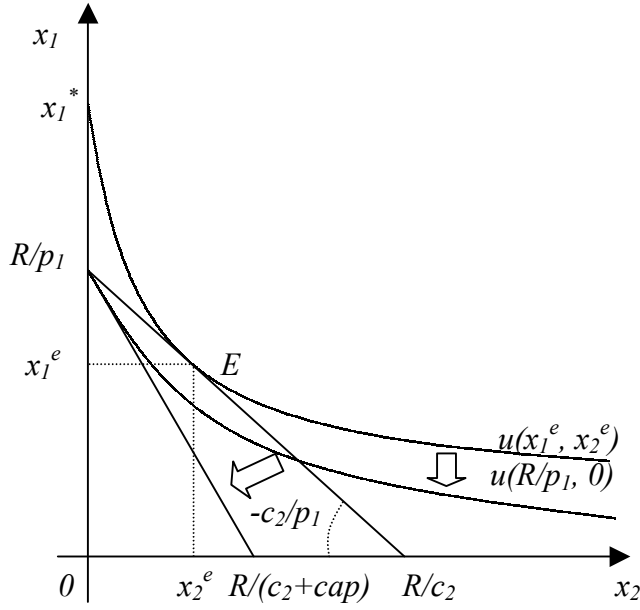


Fig. 3 – User's behaviour at increasing additional fees

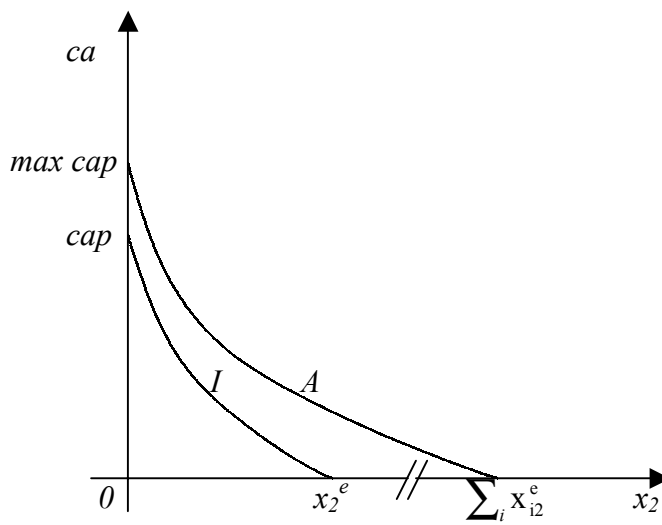


Fig. 4 – Individual's and aggregate recreational demand function

2. Types of Cost and User's behaviour

The previous model shows that the aggregate recreational demand function is closely related to a "travel generator function" [3] that includes the costs perceived as relevant by the users in their decision-making process in establishing the number of annual visits. Some relevant costs for the decision-making process are often not measurable and/or subjective⁵ [Randall, 1994; Common, Bull, Stoekl, 1999]. Usually, these costs are substituted with observable proxies. ITCM takes into account direct variable costs only (i.e. fuel, tolls, tickets, etc). On the other hand, the recreational use of natural resources often involves annual fixed costs, independent of the number of visits carried out. For example, with recreational fishing in open waters or sea, it is necessary to pay for an annual fishing licence and to incur boat-related annual expenses (i.e. laying-up, maintenance and assurance), generally independent from the annual number of visits. Such costs are irrecoverable in the short period (sunk costs), that is, on an infra-annual perspective, while, extending the analysis to a full annual perspective, they can be avoided, renouncing the recreational activity⁶. For example, the expenses in laying-up and for fishing licences, sunk costs already incurred, can be avoided the following year, renouncing the visits. With a longer time scale, the capital locked up in the boat is, at least partially, recoverable when selling it.

The literature on fixed costs and TCM is rather elusive. Some authors [Hanley and Spash, 1993, p. 88] argue that the welfare measures vary including the fixed costs or not and they suggest to exclude the fixed travel costs as "Individuals, maximising utility, are assumed to compare the marginal utility with the marginal costs of consumption". Likewise, Walsh [1986, p. 100] suggests considering the direct costs only since "... the concept of fixed costs is not applicable to consumer decisions to take an additional trip to recreation site ". Ward and Beal [2000, p. 44], assert "TCM uses the cash costs directly incurred by visitors to travel to given the demand equation to that site". Ward and Beal [2000] argue, moreover, that the presence of high fixed costs related to specific equipment required for the recreational activity, reduces the price elasticity of the demand.

These assumptions seem reasonable when a) the amount of flow fixed costs is low in comparison to the variable costs, b) it is referred to multi-purpose equipment or costs (i.e. car) and, above all, c) the analysis is closely of short period.

But are these assumptions reasonable in presence of relevant, specific annual fixed expenses and when the benefits' estimate are used to support medium-long run public decisions, i.e. a fee-policy? In our view, in these cases the opportunity cost of flow annual fixed expenses has to be taken into account, therefore conditioning the choices of the users on a full annual perspective. Indeed, a more

⁵ I.e. the problem of valuing travel time.

accurate approximation to the decision making process faced by a recreational user is needed in order to forecast better the number of visits with additional entry fees. In the case of recreational fishing and/or boating, for example, the decision-making process faced annually from a user involves two sequential decisions:

- a) '*Do I fish/boat this year?*' (full annual perspective). This decision to sustain the annual fixed costs related to the recreational activity (i.e. payment of the licence, boat-related expenses), or to assign the saved money to other goods, or recreational activities. This decision depends on the comparison between a subjective, generally optimistic, forecast of the number of visits he will carry out during the year and a minimal threshold. In general, this estimate, carried out annually, can be considered analogous to that one operated preliminarily with the investment in the recreational activity related equipment, but it is supported by past experience, of the estimate of the number of annual visits, the variable costs and annual fixed expenses.
- b) '*Do I fish/boat today?*', (infra annual perspective). After having incurred annual fixed expenses, the user decides on the number of visits to carry out on the base of the variable cost per visit. Obviously, the recreational demand function estimate, being based on the observed user's behaviour facing the direct variable travel cost, allows the modelling of the second step of the decision-making process only. However, this two step annual decision-making process, already highlighted by other authors [Walsh, 1986]: a) justifies the assumption not to include the equipment depreciation fixed costs in the cost per visit, but b) suggests taking into account annual fixed expenses, giving important influence both on the choke price and on surplus estimates in an annual perspective. The influence of flow fixed expenses can be measured estimating the minimum number of visits per year that allows the individual to sustain them, thus '*to remain in play*'.

This issue suggests to redefine the utility maximising behaviour of a recreational user incurring both a variable cost per visit and also an annual fixed cost (c_0). Assuming R the available budget (net from the annual fixed expenses, already sustained), p_1 the price of the other goods and services (x_1) and c_2 the variable direct cost per visit (x_2), on a full annual (or inter-annual) perspective, the optimal choice can be obtained solving:

⁶ The existence of fixed costs depends closely on the temporal interval considered [Tirole, 1991, p. 532]. I.e. the cost of a annual licence is fixed if an inferior interval to 12 months is considered; vice versa it is variable if the temporal horizon is extended to one year.

$$\begin{aligned}
& \max U = u(x_1, x_2) \\
& \text{subject to :} \\
& p_1 x_1 + c_2 x_2 = R \quad \text{se } x_2 > 0 \\
& p_1 x_1 = R + c_o \quad \text{se } x_2 = 0
\end{aligned} \tag{5}$$

The solution can be found comparing the utility $\left[u\left(\frac{R+c_o}{p_1}, 0\right) \right]$, reachable spending $R+c_o$ in x_1 , with the utility $[u(x_1^o, x_2^o)]$ obtained spending actual income (R) on the optimal combination between x_1 and x_2 . The optimal solution depends on the parameters of [5]: the shape of the utility function, the ratio between prices and variable average cost per visit, the budget constraint line and the annual fixed cost.

The presence of a annual fixed expenses does not modify the slope of the budget line but it produces a similar effect to an income variation. If the demand of the recreational site is elastic in regards to the income, then budget variations will modify the marginal rate of substitution. In other words, a low budget will favour the corner solution allocating all the income on x_1 . With the augmentation of income, the increase of the MRS favours intermediate solutions. It seems useful to thoroughly explore the equilibrium condition (indifference) between the recreational site use x_2 and the exclusive consumptions of x_1 . Such condition can be obtained solving the following equation:

$$u(x_1^m, x_2^m) = u\left(\frac{R+c_o}{p_1}, 0\right) \tag{6}$$

where x_1^m and x_2^m are the *optima* when the user accepts to incur annual direct fixed costs for recreational activity x_2 (fig. 5). Assuming a convex utility function, monotonic and non-homothetic, a relevant annual fixed expense implies the existence of a minimum number of yearly visits per user x_2^m , generally greater than zero. In fact, starting from optimal point M, an increase of the cost of recreation (increase of the annual fixed cost and/or the variable cost per visit) will not set the visit to zero. In other words, as costs increase, the recreational demand function does not approach to zero but x_2^m .

As a consequence, taking into account only the variable cost, we ignore the user's alternative of deciding every year, even with some rigidity due to an optimistic forecast of the number of visits, not to incur the annual fixed costs, freeing therefore an additional budget to be spent on other goods: in other words, it is assumed a decisional scenario, on an infra-annual base, more rigid than the real one.

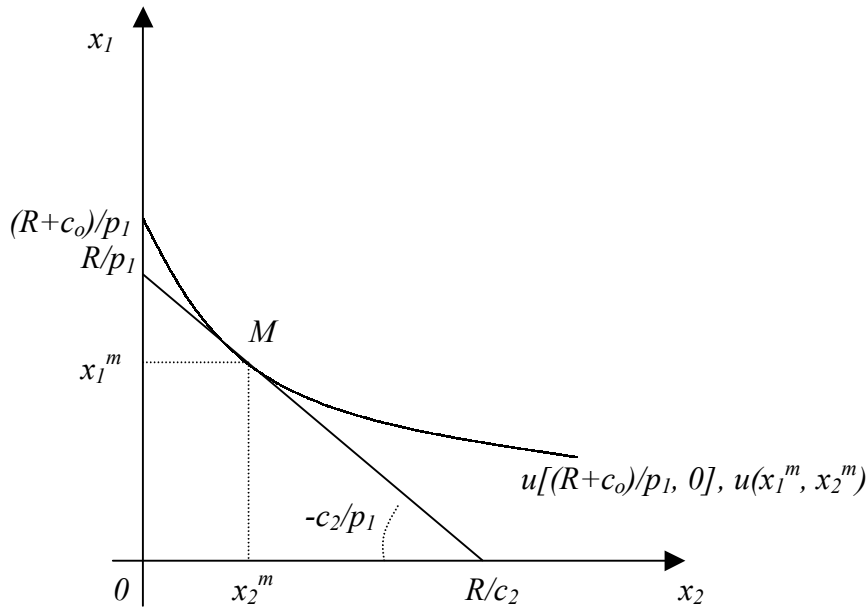


Fig. 5 – Utility maximization of a private and public recreational services user with annual direct fixed costs

3. ITCM and Flow Fixed Costs

When the user decision-making process is similar to that outlined above, the ITCM has to take into account the alternative of not incurring the annual fixed expenses. Therefore, on a full annual base, the estimated number of yearly visits decrease with increasing entry fees, will be higher than the reduction predicted on an infra-annual base. Further additional unit cost increases ultimately reduce visits to a minimal value x_2^m greater than zero. The minimal yearly visits number can be obtained from the equation [6] taking into account its corresponding ‘choke’ price (point M, fig. 6). In this particular case, the so-called ‘choke’ price is not the price at which all visits cease on an infra-annual perspective, but the price at which the user decides to avoid annual fixed costs. As a result, the ‘choke’ price on an annual perspective is lower than one on an infra annual perspective, when periodic fixed costs are not involved (cap^* , fig. 7).

On an annual perspective, with relevant fixed costs, the individual’s recreational demand function needs to be estimated using variable costs and the number of visits, based on observed data, per user. However, in order to avoid the overestimation of a recreational user’s surplus the demand function has to be truncated to the minimal number of visits (x_2^m), justifying the annual fixed cost (fig. 7)⁷.

⁷ Ward and Beal [2000, p.151] suggest to add the average unit annual fixed cost per visit to unit variable cost in a ZTCM approach, in order to eliminate extremely high predictions from nearby zones of origin.

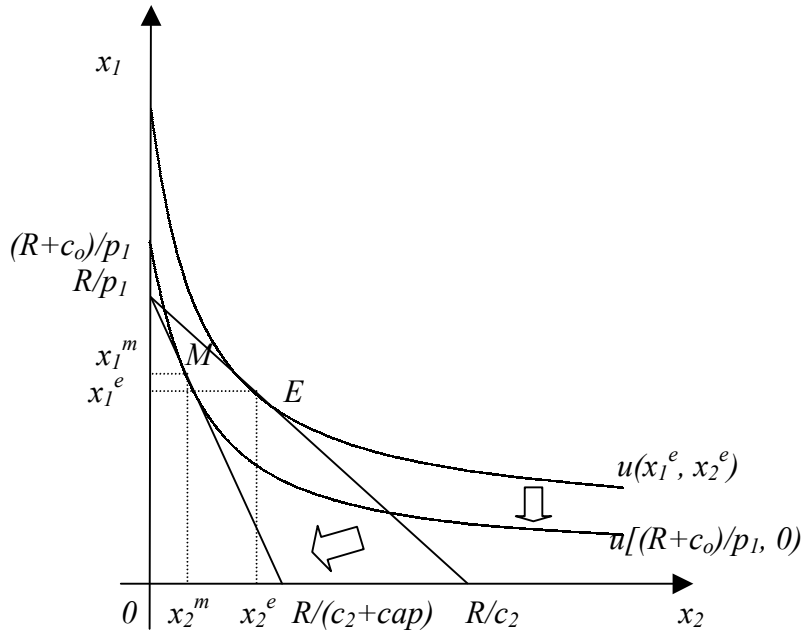


Fig. 6 – User's behaviour at increasing additional fees with annual direct fixed costs

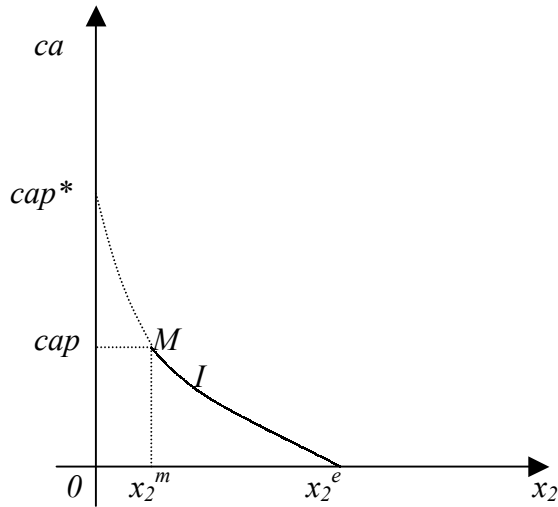


Fig. 7 – The individual's recreational demand function with annual fixed costs

Now we have to estimate x_2^m and/or cap . The minimal number of visits (x_2^m), is not observable, because it is evaluated by the user in phase (a) of his decision-making process, but it can be obtained from the equilibrium conditions of figure 6. Under this conditions, consumer surplus derived from allocating his entire budget ($R+C_0$) for the consumption of x_1 , is equal to the surplus that he obtains in M; since:

$$x_1^m = \frac{R - cap x_2^m}{p_1}$$

[6] can be written as:

$$u\left(\frac{R + C_o}{p_1}\right) = u\left(\frac{R - cap x_2^m}{p_1}, x_2^m\right) \quad [7]$$

assuming a marginal consumer and placing:

$$p_1 = 1$$

$$cap = \delta(x_2^m)$$

$$u(x_2^m) = \int_0^{x_2^m} \delta(x_2) dx_2$$

$$u[C_0 + x_2^m \delta(x_2^m)] = C_0 + x_2^m \delta(x_2^m)$$

we have:

$$C_0 + x_2^m \delta(x_2^m) = \int_0^{x_2^m} \delta(x_2) dx_2 \quad [8]$$

Solving [8] x_2^m can be obtained. Taking into account x_{i2}^m for every user i , based on his annual fixed expenses, the total recreational benefit of the site is:

$$S = \sum_i \frac{\int_0^{x_{i2}^e} \delta_i(x_2) dx_2 + \frac{\int_{x_{i2}^m}^{x_{i2}^e} \delta_i(x_2) dx_2}{r}}{1 + r} \quad [9]$$

We have to take into account x_2^m due to annual fixed costs sustained mainly when users are able to estimate with precision their future visits. On the other hand, x_2^m can be ignored when fixed costs do not influence the user decisions; in particular: a) when the fixed costs have been sustained a long time before the recreational activity, b) when the number of expected annual visits per user significantly differs from the real ones. In fact, as we said before, the investment in recreational equipment is based on an optimistic forecast of annual visits. By the way, usually, the best two days in a boat owners life is the day he buys the boat and the day he sells it to someone else.

4. A numerical example

In order to verify the impact of the proposed method both on the reduction of the number of annual trips due to increasing fees and on welfare measures, a numerical example has been carried out,

referring to recreational use of the Venice lagoon (boating and fishing). A detailed description of the collected data set can be found in a previous paper [Defrancesco, Rosato, 2000], showing the results of an on-site survey carried out during spring and summer 1999, aimed to estimate recreational benefits of the lagoon, using both contingent valuation and ITCM.

This exercise is based on an homogeneous sub-set of 129 recreational users, obtained selecting the visitors incurring high annual fixed expenses, paying an annual price to keep their boat in a marina. However, given the limited, non-random, sample size, our results have to be considered as an example and they can not be extended to the recreational users population of the lagoon.

ITCM has been based on the number of annual trips declared by those interviewed. The variable costs include: a) the direct variable cost sustained by each user in order to reach the boarding point, off-site travel time valued in proportion of wage (6€ per hour), b) the cost of fuel for the boat, c) the cost for food and beverages, d) in the case of the fishermen, the cost of bait. The annual fixed cost takes into account the cost sustained in order to keep the boat in a marina, boat insurance and maintenance costs, and, if applicable, the annual cost of fishing license (tab. 1). The estimated recreational demand function [3] predicts the individual annual trips as a linear function of the logarithm of variable costs per visit and income, closely fitting the data (adj $R^2=53\%$).

	Mean	Standard Deviation
Annual trips	26,8	5,8
Direct Variable Costs per Trip (€)	59,0	27,7
Annual Direct Fixed Expenses (€)	1071,0	592,9
Annual Income (.000€)	17,5	15,3

Tab. 1 - Descriptive statistics on variables

The OLS estimated coefficients (tab. 2) differ significantly from zero ($\alpha=1\%$) and have the expected sign. In order to evaluate the individual recreational surplus the demand function, being asymptotic to the Y-axis, has been truncated to one visit [Ward and Beal, 2000], valuing the first trip on the base of its marginal benefit obtained solving the demand function for the cost that would produce one trip. On an infra annual perspective, the net recreational surplus of an user is equal to the difference between the total yearly surplus (the area under the demand function between one visit and the actual trips, plus the surplus related to the first trip) and the total variable cost sustained.

The mean recreational surplus per visit is equal to 611,80€, the standard deviation over the mean equals to 48% and the median value is 567,3€⁸.

		Coefficient	Standard Error
Constant	(c)	42,56	2,25
Ln(Direct Variable Cost per Visit)	(α)	-6,94	0,62
Ln(Annual Income)	(β)	4,44	0,50

Tab. 2 – The individual's recreational demand function coefficients

On the other hand, under a full annual perspective the behaviour of the lagoon recreational user is influenced by annual fixed expenses sustained for recreation, given his income. So, his unobservable x_2^m has to be estimated, imposing the equality [8]. In this specific case, [8] is:

$$C_0 + x_2^m e^{\frac{x_2^m - (c + \beta \ln R)}{\alpha}} = \frac{1 - (c + \beta \ln R)}{\alpha} + \int_1^{x_2^m} \left(e^{\frac{x_2 - (c + \beta \ln R)}{\alpha}} \right) dx_2 - cax_2^m$$

where:

R = user income;

C_0 = annual fixed costs;

ca = variable cost per visit.

In this case, the annual recreational surplus of the user is equal to the difference between the definite integral of the demand function from x_2^m to actual number of yearly trips, and the related total variable costs. In other words, if the agency managing the lagoon estimates the net recreational users' surplus in order to better define a fee policy, it has to take into account the surplus under a full annual perspective, estimated using x_2^m . By increasing entrance fees many users could decide to renounce a visit the lagoon, because of the relevant annual fixed cost which involves a number minimal of annual visits.

In this particular case, this adaptation of TCM highlights:

- The individual minimal number of visits per year ranges between 2 and 12; the mean x_2^m is equal to 3,36 and standard deviation equals 1,22. The estimated coefficients of a regression model (tab. 3), expressing x_2^m as a function of logged income, logged variable cost and annual fixed costs (adj $R^2=0,85$), show that the minimal number of visits per user decrease with the increase of income and is positively related to the amount both of fixed and variable costs.

⁸ The high mean value is due to the algebraic form of the demand function and, above all, to the particular sub-sample analysed.

	Coefficient	Standard Error
Constant	4,89	0,28
Annual Fixed Costs	0,002	0,00
Ln(Variable Unit Cost)	0,182	0,08
Ln(Annual Income)	-1,62	0,07

Tab. 3 – The minimum annual number user's visits function

- b) The number of visits carried out by all users decreases more rapidly on a full annual perspective, i.e. taking into account their behaviour facing annual fixed cost. In fact, figure 8 clearly highlights that, extending the analysis in the medium run, an annual additional fee higher than 500€ several results in users renouncing recreational activity, due to the number of yearly visits that would be less than the minimum justifying the annual fixed costs sustained. Therefore, the dotted line showing annual trips taking into account the annual fixed cost lies under the line of visits on a infra-annual perspective (based only on variable cost). Obviously, the distance between the lines increases as additional fees increase.
- c) On a full annual perspective, the net mean surplus per visit is equal to 377,8€, the standard deviation over the mean equals 55% (median 352,1€). The unit mean surplus is, therefore, 38% less than the unit welfare estimate obtained applying the traditional TCM (infra-annual perspective). So, the exercise clearly highlights the impact of the varied estimation approaches on the lagoon's total recreational value.

5. Concluding remarks

The aim of this paper is to propose a modified ITCM approach, taking into account flow fixed costs. A full annual perspective, in our view, when recreational users incur relevant annual direct fixed expenses, their behaviour could be influenced by them, on a full annual perspective. As a result, the agency managing a natural site for outdoor recreation should use caution when valuing recreational users surplus, which has to be estimated on a full annual perspective, mainly in order to define a proper fee policy.

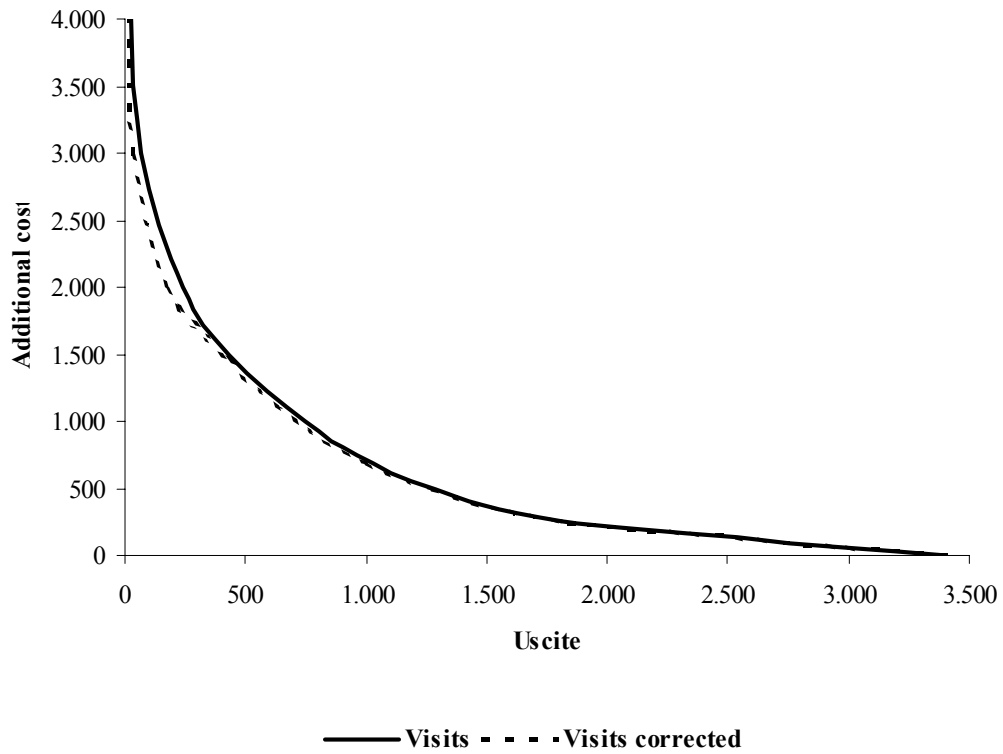


Fig. 8 – Number of total annual visits at increasing additional fees on an infra-annual perspective (traditional TCM) and taking into account yearly fixed expenses on a full annual perspective

By ignoring flow fixed costs TCM, both surplus estimate and yearly number of visits at different additional fees could be overestimated. So, on a medium run perspective it could be useful to take into account the annual fixed expense which is directly connected to recreation. When flow fixed costs are relevant in respect to variable costs, the proposed approach works as it follows:

- a) based on observable users' behaviour, the individual's recreational demand function, as usual, has to be estimated on actual yearly trips and related unit variable costs (infra annual perspective).
- b) users face a full annual decision-making process, involving the amount of direct fixed expenses. This process is unfortunately unobservable. It could be valued by introducing the notion of the minimal number of annual visits (x_2^m) that justifies the annual fixed expenses incurred by the user;
- c) using x_2^m the user behaviour can be described on a full annual perspective, taking into account a more precise estimate of the number of visits with different additional fees. Under a infra-annual perspective, i.e. ignoring x_2^m , both recreational surplus and the number of annual trips, at increasing additional fees, could be overestimated, in order to use them for medium-long run decision-making processes (i.e. fee policies). In actual fact, traditional

TCM approach could produce questionable results, when annual direct fixed costs are relevant.

On the other hand, the minimal number of annual visits x_2^m closely depends on both the amount of the direct annual fixed expenses incurred by the user and the accuracy of the perceived fixed cost by him. In conclusion, further investigations are needed, in order to achieve a better definition of the types of cost really valued by the users in their decision-making process, when relevant annual fixed costs are incurred.

References

- Brown W.G., Nawas F., 1973. Impact of Aggregation on the Estimation of Outdoor Recreation Demand Functions. *American Journal of Agricultural Economics*, 55, 246-249.
- Clawson M., 1959. Method for Measuring the Demand for, and Value of, Outdoor Recreation. *Resources for the Future*, 10, Washington D.C..
- Clawson M., Knetsch J.L. (1966). *Economics of Outdoor Recreation*. The Johns Hopkins Press, Baltimore.
- Common M., Bull T., Stoeckl N., 1999. The Travel Cost Method: an empirical investigation of Randall's Difficulty. *The Australian Journal of Agricultural and Resource Economics*, 43:4, 457-477.
- Defrancesco E., Rosato P., 2000, *Recreation Management in Venice Lagoon*. FEEM, Nota di lavoro 65.2000, Venezia.
- Gum R.L., Martin W.E., 1974, Problems and Solutions in Estimating the Demand for and Value of Rural Outdoor Recreation, *American Journal of Agricultural Economics*, 56, 558-566.
- Hanley N., Spash C.L., 1993. *Cost Benefit Analysis and the Environment*. Edward Elgar, Aldershot.
- Hotelling, H., 1949, Letter, In *An Economic Study of the Monetary Evaluation of Recreation in the National Parks*, Washington D.C., National Park Service.
- Nicholson W., 1995. *Microeconomic Theory*. Trydent Press, N.Y., 98-99.
- Randall A., 1994. A Difficulty with the Travel Cost Method. *Land Economics*, 70-1, 88-96.
- Tirole J., 1991. *Teoria dell'organizzazione industriale*. Hoepli, Milano.
- Walsh R.G., 1986. *Recreation Economic Decisions: Comparing Benefits and Costs*. Venture Publishing, Inc. State College, Pennsylvania.
- Ward F.A., Beal D., 2000. *Valuing Nature with Travel Cost Method: A Manual*. Edward Elgar, Northampton.

NOTE DI LAVORO DELLA FONDAZIONE ENI ENRICO MATTEI

Fondazione Eni Enrico Mattei Working Papers Series

Our working papers are available on the Internet at the following addresses:

Server WWW: WWW.FEEM.IT

Anonymous FTP: FTP.FEEM.IT

http://papers.ssrn.com/abstract_id=XXXXXX

SUST	1.2001	<i>Inge MAYERES and Stef PROOST: <u>Should Diesel Cars in Europe be Discouraged?</u></i>
SUST	2.2001	<i>Paola DORIA and Davide PETTENELLA: <u>The Decision Making Process in Defining and Protecting Critical Natural Capital</u></i>
CLIM	3.2001	<i>Alberto PENCH: <u>Green Tax Reforms in a Computable General Equilibrium Model for Italy</u></i>
CLIM	4.2001	<i>Maurizio BUSSOLO and Dino PINELLI: <u>Green Taxes: Environment, Employment and Growth</u></i>
CLIM	5.2001	<i>Marco STAMPINI: <u>Tax Reforms and Environmental Policies for Italy</u></i>
ETA	6.2001	<i>Walid OUESLATI: <u>Environmental Fiscal Policy in an Endogenous Growth Model with Human Capital</u></i>
CLIM	7.2001	<i>Umberto CIORBA, Alessandro LANZA and Francesco PAULI: <u>Kyoto Commitment and Emission Trading: a European Union Perspective</u></i>
MGMT	8.2001	<i>Brian SLACK (xlv): <u>Globalisation in Maritime Transportation: Competition, uncertainty and implications for port development strategy</u></i>
VOL	9.2001	<i>Giulia PESARO: <u>Environmental Voluntary Agreements: A New Model of Co-operation Between Public and Economic Actors</u></i>
VOL	10.2001	<i>Cathrine HAGEM: <u>Climate Policy, Asymmetric Information and Firm Survival</u></i>
ETA	11.2001	<i>Sergio CURRARINI and Marco MARINI: <u>A Sequential Approach to the Characteristic Function and the Core in Games with Externalities</u></i>
ETA	12.2001	<i>Gaetano BLOISE, Sergio CURRARINI and Nicholas KIKIDIS: <u>Inflation and Welfare in an OLG Economy with a Privately Provided Public Good</u></i>
KNOW	13.2001	<i>Paolo SURICO: <u>Globalisation and Trade: A "New Economic Geography" Perspective</u></i>
ETA	14.2001	<i>Valentina BOSETTI and Vincenzina MESSINA: <u>Quasi Option Value and Irreversible Choices</u></i>
CLIM	15.2001	<i>Guy ENGELN (xlii): <u>Desertification and Land Degradation in Mediterranean Areas: from Science to Integrated Policy Making</u></i>
SUST	16.2001	<i>Julie Catherine SORS: <u>Measuring Progress Towards Sustainable Development in Venice: A Comparative Assessment of Methods and Approaches</u></i>
SUST	17.2001	<i>Julie Catherine SORS: <u>Public Participation in Local Agenda 21: A Review of Traditional and Innovative Tools</u></i>
CLIM	18.2001	<i>Johan ALBRECHT and Niko GOBBIN: <u>Schumpeter and the Rise of Modern Environmentalism</u></i>
VOL	19.2001	<i>Rinaldo BRAU, Carlo CARRARO and Giulio GOLFETTO (xliii): <u>Participation Incentives and the Design of Voluntary Agreements</u></i>
ETA	20.2001	<i>Paola ROTA: <u>Dynamic Labour Demand with Lumpy and Kinked Adjustment Costs</u></i>
ETA	21.2001	<i>Paola ROTA: <u>Empirical Representation of Firms' Employment Decisions by an (S,s) Rule</u></i>
ETA	22.2001	<i>Paola ROTA: <u>What Do We Gain by Being Discrete? An Introduction to the Econometrics of Discrete Decision Processes</u></i>
PRIV	23.2001	<i>Stefano BOSI, Guillaume GIRMANS and Michel GUILLARD: <u>Optimal Privatisation Design and Financial Markets</u></i>
KNOW	24.2001	<i>Giorgio BRUNELLO, Claudio LUPI, Patrizia ORDINE, and Maria Luisa PARISI: <u>Beyond National Institutions: Labour Taxes and Regional Unemployment in Italy</u></i>
ETA	25.2001	<i>Klaus CONRAD: <u>Locational Competition under Environmental Regulation when Input Prices and Productivity Differ</u></i>
PRIV	26.2001	<i>Bernardo BORTOLOTTI, Juliet D'SOUZA, Marcella FANTINI and William L. MEGGINSON: <u>Sources of Performance Improvement in Privatised Firms: A Clinical Study of the Global Telecommunications Industry</u></i>
CLIM	27.2001	<i>Frédéric BROCHIER and Emiliano RAMIERI: <u>Climate Change Impacts on the Mediterranean Coastal Zones</u></i>
ETA	28.2001	<i>Nunzio CAPPUCCIO and Michele MORETTO: <u>Comments on the Investment-Uncertainty Relationship in a Real Option Model</u></i>
KNOW	29.2001	<i>Giorgio BRUNELLO: <u>Absolute Risk Aversion and the Returns to Education</u></i>
CLIM	30.2001	<i>ZhongXiang ZHANG: <u>Meeting the Kyoto Targets: The Importance of Developing Country Participation</u></i>
ETA	31.2001	<i>Jonathan D. KAPLAN, Richard E. HOWITT and Y. Hossein FARZIN: <u>An Information-Theoretical Analysis of Budget-Constrained Nonpoint Source Pollution Control</u></i>
MGMT Coalition Theory Network	32.2001	<i>Roberta SALOMONE and Giulia GALLUCCIO: <u>Environmental Issues and Financial Reporting Trends</u></i>
ETA	33.2001	<i>Shlomo WEBER and Hans WIESMETH: <u>From Autarky to Free Trade: The Impact on Environment</u></i>
ETA	34.2001	<i>Margarita GENIUS and Elisabetta STRAZZERA: <u>Model Selection and Tests for Non Nested Contingent Valuation Models: An Assessment of Methods</u></i>

NRM	35.2001	<i>Carlo GIUPPONI</i> : <u>The Substitution of Hazardous Molecules in Production Processes: The Atrazine Case Study in Italian Agriculture</u>
KNOW	36.2001	<i>Raffaele PACI and Francesco PIGLIARU</i> : <u>Technological Diffusion, Spatial Spillovers and Regional Convergence in Europe</u>
PRIV	37.2001	<i>Bernardo BORTOLOTTI</i> : <u>Privatisation, Large Shareholders, and Sequential Auctions of Shares</u>
CLIM	38.2001	<i>Barbara BUCHNER</i> : <u>What Really Happened in The Hague? Report on the COP6, Part I, 13-25 November 2000, The Hague, The Netherlands</u>
PRIV	39.2001	<i>Giacomo CALZOLARI and Carlo SCARPA</i> : <u>Regulation at Home, Competition Abroad: A Theoretical Framework</u>
KNOW	40.2001	<i>Giorgio BRUNELLO</i> : <u>On the Complementarity between Education and Training in Europe</u>
Coalition	41.2001	<i>Alain DESDOIGTS and Fabien MOIZEAU</i> (xlv): <u>Multiple Politico-Economic Regimes, Inequality and Growth</u>
Theory		
Network		
Coalition	42.2001	<i>Parkash CHANDER and Henry TULKENS</i> (xlv): <u>Limits to Climate Change</u>
Theory		
Network		
Coalition	43.2001	<i>Michael FINUS and Bianca RUNDSHAGEN</i> (xlv): <u>Endogenous Coalition Formation in Global Pollution Control</u>
Theory		
Network		
Coalition	44.2001	<i>Wietze LISE, Richard S.J. TOL and Bob van der ZWAAN</i> (xlv): <u>Negotiating Climate Change as a Social Situation</u>
Theory		
Network		
NRM	45.2001	<i>Mohamad R. KHAWLIE</i> (xlvii): <u>The Impacts of Climate Change on Water Resources of Lebanon- Eastern Mediterranean</u>
NRM	46.2001	<i>Mutasem EL-FADEL and E. BOU-ZEID</i> (xlvii): <u>Climate Change and Water Resources in the Middle East: Vulnerability, Socio-Economic Impacts and Adaptation</u>
NRM	47.2001	<i>Eva IGLESIAS, Alberto GARRIDO and Almudena GOMEZ</i> (xlvii): <u>An Economic Drought Management Index to Evaluate Water Institutions' Performance Under Uncertainty and Climate Change</u>
CLIM	48.2001	<i>Wietze LISE and Richard S.J. TOL</i> (xlvii): <u>Impact of Climate on Tourist Demand</u>
CLIM	49.2001	<i>Francesco BOSELLO, Barbara BUCHNER, Carlo CARRARO and Davide RAGGI</i> : <u>Can Equity Enhance Efficiency? Lessons from the Kyoto Protocol</u>
SUST	50.2001	<i>Roberto ROSON</i> (xlviii): <u>Carbon Leakage in a Small Open Economy with Capital Mobility</u>
SUST	51.2001	<i>Edwin WOERDMAN</i> (xlviii): <u>Developing a European Carbon Trading Market: Will Permit Allocation Distort Competition and Lead to State Aid?</u>
SUST	52.2001	<i>Richard N. COOPER</i> (xlviii): <u>The Kyoto Protocol: A Flawed Concept</u>
SUST	53.2001	<i>Kari KANGAS</i> (xlviii): <u>Trade Liberalisation, Changing Forest Management and Roundwood Trade in Europe</u>
SUST	54.2001	<i>Xueqin ZHU and Ekko VAN IERLAND</i> (xlviii): <u>Effects of the Enlargement of EU on Trade and the Environment</u>
SUST	55.2001	<i>M. Ozgur KAYALICA and Sajal LAHIRI</i> (xlviii): <u>Strategic Environmental Policies in the Presence of Foreign Direct Investment</u>
SUST	56.2001	<i>Savas ALPAY</i> (xlviii): <u>Can Environmental Regulations be Compatible with Higher International Competitiveness? Some New Theoretical Insights</u>
SUST	57.2001	<i>Roldan MURADIAN, Martin O'CONNOR, Joan MARTINEZ-ALER</i> (xlviii): <u>Embodied Pollution in Trade: Estimating the "Environmental Load Displacement" of Industrialised Countries</u>
SUST	58.2001	<i>Matthew R. AUER and Rafael REUVENY</i> (xlviii): <u>Foreign Aid and Direct Investment: Key Players in the Environmental Restoration of Central and Eastern Europe</u>
SUST	59.2001	<i>Onno J. KUIK and Frans H. OOSTERHUIS</i> (xlviii): <u>Lessons from the Southern Enlargement of the EU for the Environmental Dimensions of Eastern Enlargement, in particular for Poland</u>
ETA	60.2001	<i>Carlo CARRARO, Alessandra POME and Domenico SINISCALCO</i> (xlix): <u>Science vs. Profit in Research: Lessons from the Human Genome Project</u>
CLIM	61.2001	<i>Efrem CASTELNUOVO, Michele MORETTO and Sergio VERGALLI</i> : <u>Global Warming, Uncertainty and Endogenous Technical Change: Implications for Kyoto</u>
PRIV	62.2001	<i>Gian Luigi ALBANO, Fabrizio GERMANO and Stefano LOVO</i> : <u>On Some Collusive and Signaling Equilibria in Ascending Auctions for Multiple Objects</u>
CLIM	63.2001	<i>Elbert DIJKGRAAF and Herman R.J. VOLLEBERGH</i> : <u>A Note on Testing for Environmental Kuznets Curves with Panel Data</u>
CLIM	64.2001	<i>Paolo BUONANNO, Carlo CARRARO and Marzio GALEOTTI</i> : <u>Endogenous Induced Technical Change and the Costs of Kyoto</u>
CLIM	65.2001	<i>Guido CAZZAVILLAN and Ignazio MUSU</i> (l): <u>Transitional Dynamics and Uniqueness of the Balanced-Growth Path in a Simple Model of Endogenous Growth with an Environmental Asset</u>
CLIM	66.2001	<i>Giovanni BAIOCCHI and Salvatore DI FALCO</i> (l): <u>Investigating the Shape of the EKC: A Nonparametric Approach</u>
CLIM	67.2001	<i>Marzio GALEOTTI, Alessandro LANZA and Francesco PAULI</i> (l): <u>Desperately Seeking (Environmental) Kuznets: A New Look at the Evidence</u>
CLIM	68.2001	<i>Alexey VIKHLYAEV</i> (xlviii): <u>The Use of Trade Measures for Environmental Purposes – Globally and in the EU Context</u>
NRM	69.2001	<i>Gary D. LIBECAP and Zeynep K. HANSEN</i> (li): <u>U.S. Land Policy, Property Rights, and the Dust Bowl of the 1930s</u>

NRM	70.2001	<i>Lee J. ALSTON, Gary D. LIBECAP and Bernardo MUELLER</i> (li): <u>Land Reform Policies. The Sources of Violent Conflict and Implications for Deforestation in the Brazilian Amazon</u>
CLIM	71.2001	<i>Claudia KEMFERT</i> : <u>Economy-Energy-Climate Interaction – The Model WIAGEM -</u>
SUST	72.2001	<i>Paulo A.L.D. NUNES and Yohanes E. RIYANTO</i> : <u>Policy Instruments for Creating Markets for Biodiversity: Certification and Ecolabeling</u>
SUST	73.2001	<i>Paulo A.L.D. NUNES and Erik SCHOKKAERT</i> (lii): <u>Warm Glow and Embedding in Contingent Valuation</u>
SUST	74.2001	<i>Paulo A.L.D. NUNES, Jeroen C.J.M. van den BERGH and Peter NIJKAMP</i> (lii): <u>Ecological-Economic Analysis and Valuation of Biodiversity</u>
VOL	75.2001	<i>Johan EYCKMANS and Henry TULKENS</i> (li): <u>Simulating Coalitionally Stable Burden Sharing Agreements for the Climate Change Problem</u>
PRIV	76.2001	<i>Axel GAUTIER and Florian HEIDER</i> : <u>What Do Internal Capital Markets Do? Redistribution vs. Incentives</u>
PRIV	77.2001	<i>Bernardo BORTOLOTTI, Marcella FANTINI and Domenico SINISCALCO</i> : <u>Privatisation around the World: New Evidence from Panel Data</u>
ETA	78.2001	<i>Toke S. AIDT and Jayasri DUTTA</i> (li): <u>Transitional Politics. Emerging Incentive-based Instruments in Environmental Regulation</u>
ETA	79.2001	<i>Alberto PETRUCCI</i> : <u>Consumption Taxation and Endogenous Growth in a Model with New Generations</u>
ETA	80.2001	<i>Pierre LASSERRE and Antoine SOUBEYRAN</i> (li): <u>A Ricardian Model of the Tragedy of the Commons</u>
ETA	81.2001	<i>Pierre COURTOIS, Jean Christophe PÉREAU and Tarik TAZDAÏT</i> : <u>An Evolutionary Approach to the Climate Change Negotiation Game</u>
NRM	82.2001	<i>Christophe BONTEMPS, Stéphane COUTURE and Pascal FAVARD</i> : <u>Is the Irrigation Water Demand Really Convex?</u>
NRM	83.2001	<i>Unai PASCUAL and Edward BARBIER</i> : <u>A Model of Optimal Labour and Soil Use with Shifting Cultivation</u>
CLIM	84.2001	<i>Jesper JENSEN and Martin Hvidt THELLE</i> : <u>What are the Gains from a Multi-Gas Strategy?</u>
CLIM	85.2001	<i>Maurizio MICHELINI</i> (liii): IPCC “Summary for Policymakers” in TAR. <u>Do its results give a scientific support always adequate to the urgencies of Kyoto negotiations?</u>
CLIM	86.2001	<i>Claudia KEMFERT</i> (liii): <u>Economic Impact Assessment of Alternative Climate Policy Strategies</u>
CLIM	87.2001	<i>Cesare DOSI and Michele MORETTO</i> : <u>Global Warming and Financial Umbrellas</u>
ETA	88.2001	<i>Elena BONTEMPI, Alessandra DEL BOCA, Alessandra FRANZOSI, Marzio GALEOTTI and Paola ROTA</i> : <u>Capital Heterogeneity: Does it Matter? Fundamental Q and Investment on a Panel of Italian Firms</u>
ETA	89.2001	<i>Efrem CASTELNUOVO and Paolo SURICO</i> : <u>Model Uncertainty, Optimal Monetary Policy and the Preferences of the Fed</u>
CLIM	90.2001	<i>Umberto CIORBA, Alessandro LANZA and Francesco PAULI</i> : <u>Kyoto Protocol and Emission Trading: Does the US Make a Difference?</u>
CLIM	91.2001	<i>ZhongXiang ZHANG and Lucas ASSUNCAO</i> : <u>Domestic Climate Policies and the WTO</u>
SUST	92.2001	<i>Anna ALBERINI, Alan KRUPNICK, Maureen CROPPER, Nathalie SIMON and Joseph COOK</i> (lii): <u>The Willingness to Pay for Mortality Risk Reductions: A Comparison of the United States and Canada</u>
SUST	93.2001	<i>Riccardo SCARPA, Guy D. GARROD and Kenneth G. WILLIS</i> (lii): <u>Valuing Local Public Goods with Advanced Stated Preference Models: Traffic Calming Schemes in Northern England</u>
CLIM	94.2001	<i>Ming CHEN and Larry KARP</i> : <u>Environmental Indices for the Chinese Grain Sector</u>
CLIM	95.2001	<i>Larry KARP and Jiangfeng ZHANG</i> : <u>Controlling a Stock Pollutant with Endogenous Investment and Asymmetric Information</u>
ETA	96.2001	<i>Michele MORETTO and Gianpaolo ROSSINI</i> : <u>On the Opportunity Cost of Nontradable Stock Options</u>
SUST	97.2001	<i>Elisabetta STRAZZERA, Margarita GENIUS, Riccardo SCARPA and George HUTCHINSON</i> : <u>The Effect of Protest Votes on the Estimates of Willingness to Pay for Use Values of Recreational Sites</u>
NRM	98.2001	<i>Frédéric BROCHIER, Carlo GIUPPONI and Alberto LONGO</i> : <u>Integrated Coastal Zone Management in the Venice Area – Perspectives of Development for the Rural Island of Sant’Erasmus</u>
NRM	99.2001	<i>Frédéric BROCHIER, Carlo GIUPPONI and Julie SORS</i> : <u>Integrated Coastal Management in the Venice Area – Potentials of the Integrated Participatory Management Approach</u>
NRM	100.2001	<i>Frédéric BROCHIER and Carlo GIUPPONI</i> : <u>Integrated Coastal Zone Management in the Venice Area – A Methodological Framework</u>
PRIV	101.2001	<i>Enrico C. PEROTTI and Luc LAEVEN</i> : <u>Confidence Building in Emerging Stock Markets</u>
CLIM	102.2001	<i>Barbara BUCHNER, Carlo CARRARO and Igor CERSOSIMO</i> : <u>On the Consequences of the U.S. Withdrawal from the Kyoto/Bonn Protocol</u>
SUST	103.2001	<i>Riccardo SCARPA, Adam DRUCKER, Simon ANDERSON, Nancy FERRAES-EHUAN, Veronica GOMEZ, Carlos R. RISOPATRON and Olga RUBIO-LEONEL</i> : <u>Valuing Animal Genetic Resources in Peasant Economies: The Case of the Box Keken Creole Pig in Yucatan</u>
SUST	104.2001	<i>R. SCARPA, P. KRISTJANSON, A. DRUCKER, M. RADENY, E.S.K. RUTO, and J.E.O. REGE</i> : <u>Valuing Indigenous Cattle Breeds in Kenya: An Empirical Comparison of Stated and Revealed Preference Value Estimates</u>
SUST	105.2001	<i>Clemens B.A. WOLLNY</i> : <u>The Need to Conserve Farm Animal Genetic Resources Through Community-Based Management in Africa: Should Policy Makers be Concerned?</u>
SUST	106.2001	<i>J.T. KARUGIA, O.A. MWAI, R. KAITHO, Adam G. DRUCKER, C.B.A. WOLLNY and J.E.O. REGE</i> : <u>Economic Analysis of Crossbreeding Programmes in Sub-Saharan Africa: A Conceptual Framework and Kenyan Case Study</u>
SUST	107.2001	<i>W. AYALEW, J.M. KING, E. BRUNS and B. RISCHKOWSKY</i> : <u>Economic Evaluation of Smallholder Subsistence Livestock Production: Lessons from an Ethiopian Goat Development Program</u>

SUST	108.2001	<i>Gianni CICA, Elisabetta D'ERCOLE and Davide MARINO: <u>Valuing Farm Animal Genetic Resources by Means of Contingent Valuation and a Bio-Economic Model: The Case of the Pentro Horse</u></i>
SUST	109.2001	<i>Clem TISDELL: <u>Socioeconomic Causes of Loss of Animal Genetic Diversity: Analysis and Assessment</u></i>
SUST	110.2001	<i>M.A. JABBAR and M.L. DIEDHOU: <u>Does Breed Matter to Cattle Farmers and Buyers? Evidence from West Africa</u></i>
SUST	1.2002	<i>K. TANO, M.D. FAMINOW, M. KAMUANGA and B. SWALLOW: <u>Using Conjoint Analysis to Estimate Farmers' Preferences for Cattle Traits in West Africa</u></i>
ETA	2.2002	<i>Efrem CASTELNUOVO and Paolo SURICO: <u>What Does Monetary Policy Reveal about Central Bank's Preferences?</u></i>
WAT	3.2002	<i>Duncan KNOWLER and Edward BARBIER: <u>The Economics of a "Mixed Blessing" Effect: A Case Study of the Black Sea</u></i>
CLIM	4.2002	<i>Andreas LÖSCHEL: <u>Technological Change in Economic Models of Environmental Policy: A Survey</u></i>
VOL	5.2002	<i>Carlo CARRARO and Carmen MARCHIORI: <u>Stable Coalitions</u></i>
CLIM	6.2002	<i>Marzio GALEOTTI, Alessandro LANZA and Matteo MANERA: <u>Rockets and Feathers Revisited: An International Comparison on European Gasoline Markets</u></i>
ETA	7.2002	<i>Effrosyni DIAMANTOUDI and Eftichios S. SARTZETAKIS: <u>Stable International Environmental Agreements: An Analytical Approach</u></i>
KNOW	8.2002	<i>Alain DESDOIGTS: <u>Neoclassical Convergence Versus Technological Catch-up: A Contribution for Reaching a Consensus</u></i>
NRM	9.2002	<i>Giuseppe DI VITA: <u>Renewable Resources and Waste Recycling</u></i>
KNOW	10.2002	<i>Giorgio BRUNELLO: <u>Is Training More Frequent when Wage Compression is Higher? Evidence from 11 European Countries</u></i>
ETA	11.2002	<i>Mordecai KURZ, Hehui JIN and Maurizio MOTOLESE: <u>Endogenous Fluctuations and the Role of Monetary Policy</u></i>
KNOW	12.2002	<i>Reyer GERLAGH and Marjan W. HOFKES: <u>Escaping Lock-in: The Scope for a Transition towards Sustainable Growth?</u></i>
NRM	13.2002	<i>Michele MORETTO and Paolo ROSATO: <u>The Use of Common Property Resources: A Dynamic Model</u></i>
CLIM	14.2002	<i>Philippe QUIRION: <u>Macroeconomic Effects of an Energy Saving Policy in the Public Sector</u></i>
CLIM	15.2002	<i>Roberto ROSON: <u>Dynamic and Distributional Effects of Environmental Revenue Recycling Schemes: Simulations with a General Equilibrium Model of the Italian Economy</u></i>
CLIM	16.2002	<i>Francesco RICCI (I): <u>Environmental Policy Growth when Inputs are Differentiated in Pollution Intensity</u></i>
ETA	17.2002	<i>Alberto PETRUCCI: <u>Devaluation (Levels versus Rates) and Balance of Payments in a Cash-in-Advance Economy</u></i>
Coalition Theory Network	18.2002	<i>László Á. KÓCZY (liv): <u>The Core in the Presence of Externalities</u></i>
Coalition Theory Network	19.2002	<i>Steven J. BRAMS, Michael A. JONES and D. Marc KILGOUR (liv): <u>Single-Peakedness and Disconnected Coalitions</u></i>
Coalition Theory Network	20.2002	<i>Guillaume HAERINGER (liv): <u>On the Stability of Cooperation Structures</u></i>
NRM	21.2002	<i>Fausto CAVALLARO and Luigi CIRAULO: <u>Economic and Environmental Sustainability: A Dynamic Approach in Insular Systems</u></i>
CLIM	22.2002	<i>Barbara BUCHNER, Carlo CARRARO, Igor CERSOSIMO and Carmen MARCHIORI: <u>Back to Kyoto? US Participation and the Linkage between R&D and Climate Cooperation</u></i>
CLIM	23.2002	<i>Andreas LÖSCHEL and ZhongXIANG ZHANG: <u>The Economic and Environmental Implications of the US Repudiation of the Kyoto Protocol and the Subsequent Deals in Bonn and Marrakech</u></i>
ETA	24.2002	<i>Marzio GALEOTTI, Louis J. MACCINI and Fabio SCHIANTARELLI: <u>Inventories, Employment and Hours</u></i>
CLIM	25.2002	<i>Hannes EGLI: <u>Are Cross-Country Studies of the Environmental Kuznets Curve Misleading? New Evidence from Time Series Data for Germany</u></i>
ETA	26.2002	<i>Adam B. JAFFE, Richard G. NEWELL and Robert N. STAVINS: <u>Environmental Policy and Technological Change</u></i>
SUST	27.2002	<i>Joseph C. COOPER and Giovanni SIGNORELLO: <u>Farmer Premiums for the Voluntary Adoption of Conservation Plans</u></i>
SUST	28.2002	<i>The ANSEA Network: <u>Towards An Analytical Strategic Environmental Assessment</u></i>
KNOW	29.2002	<i>Paolo SURICO: <u>Geographic Concentration and Increasing Returns: a Survey of Evidence</u></i>
ETA	30.2002	<i>Robert N. STAVINS: <u>Lessons from the American Experiment with Market-Based Environmental Policies</u></i>
NRM	31.2002	<i>Carlo GIUPPONI and Paolo ROSATO: <u>Multi-Criteria Analysis and Decision-Support for Water Management at the Catchment Scale: An Application to Diffuse Pollution Control in the Venice Lagoon</u></i>
NRM	32.2002	<i>Robert N. STAVINS: <u>National Environmental Policy During the Clinton Years</u></i>
KNOW	33.2002	<i>A. SOUBEYRAN and H. STAHN : <u>Do Investments in Specialized Knowledge Lead to Composite Good Industries?</u></i>
KNOW	34.2002	<i>G. BRUNELLO, M.L. PARISI and Daniela SONEDDA: <u>Labor Taxes, Wage Setting and the Relative Wage Effect</u></i>
CLIM	35.2002	<i>C. BOEMARE and P. QUIRION (lv): <u>Implementing Greenhouse Gas Trading in Europe: Lessons from Economic Theory and International Experiences</u></i>

CLIM	36.2002	<i>T. TIETENBERG</i> (lv): <u>The Tradable Permits Approach to Protecting the Commons: What Have We Learned?</u>
CLIM	37.2002	<i>K. REHDANZ and R.J.S. TOL</i> (lv): <u>On National and International Trade in Greenhouse Gas Emission Permits</u>
CLIM	38.2002	<i>C. FISCHER</i> (lv): <u>Multinational Taxation and International Emissions Trading</u>
SUST	39.2002	<i>G. SIGNORELLO and G. PAPPALARDO</i> : <u>Farm Animal Biodiversity Conservation Activities in Europe under the Framework of Agenda 2000</u>
NRM	40.2002	<i>S. M. CAVANAGH, W. M. HANEMANN and R. N. STAVINS</i> : <u>Muffled Price Signals: Household Water Demand under Increasing-Block Prices</u>
NRM	41.2002	<i>A. J. PLANTINGA, R. N. LUBOWSKI and R. N. STAVINS</i> : <u>The Effects of Potential Land Development on Agricultural Land Prices</u>
CLIM	42.2002	<i>C. OHL</i> (lvi): <u>Inducing Environmental Co-operation by the Design of Emission Permits</u>
CLIM	43.2002	<i>J. EYCKMANS, D. VAN REGEMORTER and V. VAN STEENBERGHE</i> (lvi): <u>Is Kyoto Fatally Flawed? An Analysis with MacGEM</u>
CLIM	44.2002	<i>A. ANTOCI and S. BORGHESI</i> (lvi): <u>Working Too Much in a Polluted World: A North-South Evolutionary Model</u>
ETA	45.2002	<i>P. G. FREDRIKSSON, Johan A. LIST and Daniel MILLIMET</i> (lvi): <u>Chasing the Smokestack: Strategic Policymaking with Multiple Instruments</u>
ETA	46.2002	<i>Z. YU</i> (lvi): <u>A Theory of Strategic Vertical DFI and the Missing Pollution-Haven Effect</u>
SUST	47.2002	<i>Y. H. FARZIN</i> : <u>Can an Exhaustible Resource Economy Be Sustainable?</u>
SUST	48.2002	<i>Y. H. FARZIN</i> : <u>Sustainability and Hamiltonian Value</u>
KNOW	49.2002	<i>C. PIGA and M. VIVARELLI</i> : <u>Cooperation in R&D and Sample Selection</u>
Coalition Theory Network	50.2002	<i>M. SERTEL and A. SLINKO</i> (liv): <u>Ranking Committees, Words or Multisets</u>
Coalition Theory Network	51.2002	<i>Sergio CURRARINI</i> (liv): <u>Stable Organizations with Externalities</u>
ETA	52.2002	<i>Robert N. STAVINS</i> : <u>Experience with Market-Based Policy Instruments</u>
ETA	53.2002	<i>C.C. JAEGER, M. LEIMBACH, C. CARRARO, K. HASSELMANN, J.C. HOURCADE, A. KEELER and R. KLEIN</i> (liii): <u>Integrated Assessment Modeling: Modules for Cooperation</u>
CLIM	54.2002	<i>Scott BARRETT</i> (liii): <u>Towards a Better Climate Treaty</u>
ETA	55.2002	<i>Richard G. NEWELL and Robert N. STAVINS</i> : <u>Cost Heterogeneity and the Potential Savings from Market-Based Policies</u>
SUST	56.2002	<i>Paolo ROSATO and Edi DEFRANCESCO</i> : <u>Individual Travel Cost Method and Flow Fixed Costs</u>

- (xlii) This paper was presented at the International Workshop on "Climate Change and Mediterranean Coastal Systems: Regional Scenarios and Vulnerability Assessment" organised by the Fondazione Eni Enrico Mattei in co-operation with the Istituto Veneto di Scienze, Lettere ed Arti, Venice, December 9-10, 1999.
- (xliii) This paper was presented at the International Workshop on "Voluntary Approaches, Competition and Competitiveness" organised by the Fondazione Eni Enrico Mattei within the research activities of the CAVA Network, Milan, May 25-26, 2000.
- (xliv) This paper was presented at the International Workshop on "Green National Accounting in Europe: Comparison of Methods and Experiences" organised by the Fondazione Eni Enrico Mattei within the Concerted Action of Environmental Valuation in Europe (EVE), Milan, March 4-7, 2000
- (xlv) This paper was presented at the International Workshop on "New Ports and Urban and Regional Development. The Dynamics of Sustainability" organised by the Fondazione Eni Enrico Mattei, Venice, May 5-6, 2000.
- (xlvii) This paper was presented at the Sixth Meeting of the Coalition Theory Network organised by the Fondazione Eni Enrico Mattei and the CORE, Université Catholique de Louvain, Louvain-la-Neuve, Belgium, January 26-27, 2001
- (xlviii) This paper was presented at the RICAMARE Workshop "Socioeconomic Assessments of Climate Change in the Mediterranean: Impact, Adaptation and Mitigation Co-benefits", organised by the Fondazione Eni Enrico Mattei, Milan, February 9-10, 2001
- (xlviii) This paper was presented at the International Workshop "Trade and the Environment in the Perspective of the EU Enlargement", organised by the Fondazione Eni Enrico Mattei, Milan, May 17-18, 2001
- (xlix) This paper was presented at the International Conference "Knowledge as an Economic Good", organised by Fondazione Eni Enrico Mattei and The Beijer International Institute of Environmental Economics, Palermo, April 20-21, 2001
- (l) This paper was presented at the Workshop "Growth, Environmental Policies and Sustainability" organised by the Fondazione Eni Enrico Mattei, Venice, June 1, 2001
- (li) This paper was presented at the Fourth Toulouse Conference on Environment and Resource Economics on "Property Rights, Institutions and Management of Environmental and Natural Resources", organised by Fondazione Eni Enrico Mattei, IDEI and INRA and sponsored by MATE, Toulouse, May 3-4, 2001
- (lii) This paper was presented at the International Conference on "Economic Valuation of Environmental Goods", organised by Fondazione Eni Enrico Mattei in cooperation with CORILA, Venice, May 11, 2001
- (liii) This paper was circulated at the International Conference on "Climate Policy – Do We Need a New Approach?", jointly organised by Fondazione Eni Enrico Mattei, Stanford University and Venice International University, Isola di San Servolo, Venice, September 6-8, 2001
- (liv) This paper was presented at the Seventh Meeting of the Coalition Theory Network organised by the Fondazione Eni Enrico Mattei and the CORE, Université Catholique de Louvain, Venice, Italy, January 11-12, 2002
- (lv) This paper was presented at the First Workshop of the Concerted Action on Tradable Emission Permits (CATEP) organised by the Fondazione Eni Enrico Mattei, Venice, Italy, December 3-4, 2001
- (lvi) This paper was presented at the ESF EURESCO Conference on Environmental Policy in a Global Economy "The International Dimension of Environmental Policy", organised with the collaboration of the Fondazione Eni Enrico Mattei, Acquafredda di Maratea, October 6-11, 2001.

2002 SERIES

CLIM	<i>Climate Change Modelling and Policy</i> (Editor: Marzio Galeotti)
VOL	<i>Voluntary and International Agreements</i> (Editor: Carlo Carraro)
SUST	<i>Sustainability Indicators and Environmental Evaluation</i> (Editor: Carlo Carraro)
NRM	<i>Natural Resources Management</i> (Editor: Carlo Giupponi)
KNOW	<i>Knowledge, Technology, Human Capital</i> (Editor: Dino Pinelli)
MGMT	<i>Corporate Sustainable Management</i> (Editor: Andrea Marsanich)
PRIV	<i>Privatisation, Regulation, Antitrust</i> (Editor: Bernardo Bortolotti)