ECONSTOR
Make Your Publications Visible.

A Service of

ZBW Leibniz-Informationszentrum Wirtschaft
Leibniz Information Centre for Economics

Rübbelke, Dirk T.G.; Löschel, Andreas

Working Paper

Impure Public Goods and Technological Interdependencies

Nota di Lavoro, No. 60.2005

Provided in Cooperation with:
Fondazione Eni Enrico Mattei (FEEM)

Suggested Citation: Rübbelke, Dirk T.G.; Löschel, Andreas (2005) : Impure Public Goods and Technological Interdependencies, Nota di Lavoro, No. 60.2005, Fondazione Eni Enrico Mattei (FEEM), Milano

This Version is available at:
https://hdl.handle.net/10419/74031

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.

WWW.ECONSTOR.EU

Mitglied der Leibniz-Gemeinschaft

Impure Public Goods and Technological Interdependencies

Andreas Löschel
and Dirk T.G. Rübbelke

NOTA DI LAVORO 60.2005

MAY 2005

CCMP – Climate Change Modelling and Policy

Andreas Löschel, *Zentrum für Europäische Wirtschaftsforschung*
Dirk T.G. Rübbelke, *Department of Economics, Chemnitz University of Technology*

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=717404

The opinions expressed in this paper do not necessarily reflect the position of Fondazione Eni Enrico Mattei
Corso Magenta, 63, 20123 Milano (I), web site: www.feem.it, e-mail: working.papers@feem.it

Impure Public Goods and Technological Interdependencies

Summary

Impure public goods represent an important group of goods. Almost every public good exerts not only effects which are public to all but also effects which are private to the producer of this good. What is often omitted in the analysis of impure public goods is the fact that – regularly – these private effects can also be generated independently of the public good. In our analysis we focus on the effects alternative technologies – independently generating the private effects of the public good – may have on the provision of impure public goods. After the investigation in an analytical impure public good model, we numerically simulate the effects of alternative technologies in a parameterized model for climate policy in Germany.

Keywords: Impure public goods, Climate policy, Rationing

JEL Classification: H41, C61, Q53, Q54

Address for correspondence:

Dirk T.G. Rübbelke
Department of Economics
Chemnitz University of Technology
Chemnitz 09107
Germany
Phone: +49 0 371 531 4212
Fax: +49 0 371 531 4372
E-mail: dirk.ruebbelke@wirtschaft.tu-chemnitz.de

1 Introduction

In economics public goods are regularly treated as pure public goods, although most public goods are not "purely public". The reason for doing so most likely lies in the simplicity of pure public goods analysis. In contrast, the analysis of public goods which are not purely public tends to become rather complex.

Pioneering work with respect to the issue of impure public goods has been provided by Cornes and Sandler (1984), who developed an approach to analyze impure public goods where the considered consumer's utility function is defined over three characteristics. They suggested to apply this approach to an activity like philanthropy. This idea has later been elaborated by Andreoni (1986, 1989, 1990). Andreoni's works initiated a new strand of literature which is associated with the expression "warm-glow giving".

Many further analyses of impure public goods followed which were based on the approach suggested by Cornes and Sandler. Results were obtained which could not be observed by employing the simple pure public good approach. So, Cornes and Sandler (1994) illustrated in a comparative static analysis that quite surprising results may arise within an impure public good model. In fact, in their modelling, they analyzed the joint production of characteristics of different degrees of publicness. Their analysis demonstrated that substitutability and complementarity of the private and pure public characteristics generated by the public good play a crucial role with respect to comparative static responses. Such effects could - of course - not be observed in pure public good models, since these models exclusively focus on the public good's pure public characteristic and disregard private ancillary characteristics of public goods. Ihori (1992,1994) analyses some further comparative static properties of impure public good models, but his modelling differs from the one suggested by Cornes and Sandler (1994).

And despite its complexity, joint production and impure public goods modelling became an attractive device in the economics discipline. Joint characteristic or joint production models have been used to analyze, e.g., climate protection (Sandler (1996), Rübbelke (2003)), environmentally friendly consumption (Kotchen (2005)), financing of public radio stations (Kingma and McClelland (1995)), military alliances (Sandler and Murdoch (1990), Sandler and Hartley (2001)), refuse collection (Dubin and Navarro (1988)), and terrorism (Rübbelke (2005)).

Additional interest in impure public goods models may arise because of the topicality of the global public goods discussion (Kaul et al. (1999)). Probably almost every global

public good provision represents a joint production of several characteristics of different degrees of publicness, i.e., global public goods production is an impure public goods production.[1]

So, preservation of tropical forests may be considered as a global impure public good. A pure public characteristic of this public good is the preservation of biodiversity which provides genetic material that may contain cures for diseases representing dangers for all humans. Another pure public characteristic is the global climate protecting impact of the forests' carbon storage. But as Sandler (1997: 97) points out: *"Not all of the benefits of the forests are global public goods; many are either private goods or public goods whose benefits are either specific to the host nation or to neighboring nations."* Such private benefits are derived, e.g., from reduced soil erosion and preservation of watersheds.

Reducing poverty by raising foreign aid also provides several characteristics of different degrees of publicness. In March 2002, US President George W. Bush announced the first significant raise in U.S. development assistance in a decade. This represents a 50 percent increase over current development assistance (Diamond 2002: 2). Before, the US aid budget has fallen from 0.24 percent of GDP in the mid-1980s to 0.1 percent in 2002. The recent sharp increase in the US foreign aid has been justified by the claim that the reduction of poverty will combat terrorism.[2] Therefore, we face a global public characteristic which we may denote "international security". Furthermore, the reduction of poverty by paying transfers generates monetary benefits in the poor regions. These benefits are mainly perceived regionally and are 'private' to the transfer-receiving region (the transfers can be employed to improve national infrastructure, to construct new hospitals or schools etc.).

The same line of reasoning can be applied to other global issues like climate protection, international combat of diseases or protection of international waters. Examples of impure public goods of smaller geographical dimension are, e.g., theaters or universities. Of course, there is an audience enjoying shows in the theater. However, according to Baumol and Bowen (1966), performing arts may also raise local identity and international prestige. Hence, we observe a kind of private (enjoyed exclusively by the audience) as well as a locally/regionally public (enjoyed by the whole region) characteristic. Similarly, students

[1] Sandler and Hartley (2001: 880) even stress: *"The joint product model is relevant for virtually every public good scenario."* And joint production is in general associated with characteristics of different degrees of publicness.

[2] President Bush pointed out in his speech at the United Nations Financing for Development Conference in Monterrey, Mexico: *"We fight against poverty because hope is an answer to terror."*

get education in universities (private characteristic), but a university also provides benefits to its whole region by attracting companies (regionally public characteristic).

Although impure public good models found application in many fields of economics, one issue has been widely neglected until recently: the effect of alternative technologies on the models' results. The neglect of alternative technologies may cause an overstatement of the benefits of a joint production technology and may therefore result in an inefficient level of joint production. Let us consider the example of climate policy. A climate policy which raises energy efficiency, for example, tends to reduce the required level of fossil fuels to be combusted. This reduction is, on the one hand, associated with a mitigation of greenhouse gas emissions and, consequently, provides climate-protection and primary benefits.[3] On the other hand, the reduction is associated with ancillary effects in the shape of, e.g., a decline in other pollutants' emissions like SO_2 emissions. Several studies predict that the associated ancillary benefits even exceed the primary benefits.[4] However, regularly, it is at least implicitly postulated that the ancillary benefits can only be acquired by climate policies. Yet, desulphurisation installations would also be an effective means to reduce SO_2 emissions and these installations do not protect the climate. A priori, it is not clear from a welfare economics' point of view whether it is more efficient to mitigate SO_2 by means of desulphurisation installations or by means of climate policies, since the implementation costs of the different technologies may diverge.[5] Provided a country would consider desulphurisation installations to be more attractive, an augmented use of such installations would reduce the ancillary benefits of climate policy and, therefore, would tend to reduce total benefits of climate protection. This, again, mitigates the attractiveness of climate policy.[6] As this example discloses, quantities and prices/costs of the alternative technologies exclusively producing the private characteristic, are crucial for the ancillary benefits of climate policy to be expected, and consequently, for the efficient policy design. Changes in these parameters have an impact on the efficient impure public good level, in our example, on the optimal climate policy level.

One of the rare exceptions in the literature that takes account of the role of alternative technologies, is the joint supply model suggested by Posnett and Sandler (1986).

[3]Since climate protection is the primary aim of climate policy, the benefits derived from climate protection are called the primary benefits of climate policy.

[4]For an overview of studies and ratios between primary and ancillary benefits, see Pearce (2000).

[5]Of course, if equal cost would prevail, the climate policy option is more attractive, since it additionally provides primary benefits.

[6]Yet, in the case where joint products are strong complements, different and quite surprising demand responses can be observed, see Cornes and Sandler (1994).

They analyze a consumer's decision between two different commodities. One commodity is a private good whose purchase is associated with and tied to the finance of a public output (joint production). The other commodity is a purely private good. Therefore, they consider two different technologies providing private good consumption, one which is associated with joint production and one without joint production. This idea is now revived in Section 2, where we present a more general setting of the comparative statics model suggested by Cornes and Sandler (1994).[7] The integration into the comparative statics model, however, requires the analysis of three instead of two commodities. By this extension different levels of substitutability between the jointly provided private goods/characteristics and other private goods can be captured, i.e. heterogeneity among private goods/characteristics is taken into account. Only a certain group of private goods is considered to represent an adequate substitute for the joint production's private characteristic, and this group is assumed to be regulated by a central authority. As we will show, these extensions are sensible for analyzing several real-world impure-public-goods examples. The focus of the comparative statics analysis in Section 3 will be on the two parameters directly associated with the substitute: its prices and quantities.

Afterwards, in Section 4, our paper goes beyond the analytical analysis of comparative statics by replicating the analytical approach into the sphere of numerical simulation. We employ the impure-public-good example of climate policy in Germany in order to simulate the comparative statics in the framework of a parameterized simulation model.

Section 5 stresses the main findings of the simulation model and compares them to the analytical findings. Results which could be found in the simulations but not in the analytical model are highlighted. Section 6 concludes.

2 An Impure Public Good Model

In the subsequent sections, an agent's decision on public good provision is analyzed in an impure public good model, where the comparative static properties are investigated with respect to modifications in the impure-public-good independent production technology of the private characteristic which is also generated by the public good. The agent's responses are expressed in terms of parameters associated with standard price taking functions.

[7] This modification has first been suggested by Rübbelke (2002, 2003).

2.1 Characteristics of Impure Public Goods

Similar to Posnett and Sandler (1986), we consider an impure public good whose private characteristic can also be generated independently of the public characteristic. We analyze the impact of the independent generation of the joint production's private characteristic on agents' willingness to provide the impure public good. Hence, the level of the independent generation as well as its price have to be considered. In order to analyze the impact of the independent generation of the private characteristic on agents' willingness to provide the public good, we have to formulate an agent's utility maximization problem in a way that takes explicit account of the characteristics of the joint production. Agents' preferences are not expressed in commodity space but in characteristic space, i.e. not the amount of commodities acquired but the amount of characteristics enjoyed are crucial for the agents' maximization problems.[8] We distinguish the characteristics provided by the impure public good according to their degree of publicness:

Pure public characteristic: No agent of the considered 'model world' can be excluded from its consumption and it exhibits non-rivalry.

Private characteristic: The private characteristic of an impure public good provision can be exclusively enjoyed by the agent making this provision. The public good contributing agent may be an individual, a region or a country.

2.2 Utility Function and Characteristics

We consider an agent whose preferences with respect to the consumption of three characteristics - y_1, y_2 and X - are represented by a continuous utility function, $U(y_1, y_2, X)$, that is strictly increasing and strictly quasi-concave and everywhere twice differentiable. The country consumes three commodities:

First private good : Each unit of the first generates one unit of y_1 for the country at a price $p_y = 1$. The commodity represents a bundle of private goods to the country and it may be thought of to be identical to the characteristic y_1. The symbol y_1 can consequently be used to denote either the first characteristic or the good that generates it. y_1 is used as the numeraire good in all that follows.

Second private good : The second commodity s generates the private characteristic y_2.

[8] For a distinction of characteristics and commodities see Cornes (1992: 139).

The generated characteristic y_2 is identical to the one which arises from the impure public good. One unit of s is assumed to have the price p_s and to generate one unit of characteristic y_2. Therefore, s does not only denote the consumption of the second commodity, it also stands for the amount of characteristic y_2 generated by this commodity.

Impure public good : The third good q represents the impure public good and has a price p_q. Each unit generates β units of the public characteristic X. Furthermore, the impure public good additionally produces α units of the private characteristic y_2.

The total consumption of the public characteristic X by agent i equals the sum of his own contribution $x_i = \beta q_i$ and the other $n-1$ agents' contributions $\tilde{X}_i = \beta \tilde{Q}_i$:

$$X = x_1 + x_2 + ... + x_n = \sum_{j=1}^{n} x_j = x_i + \tilde{X}_i = \beta \sum_{j=1}^{n} q_j = \beta(q_i + \tilde{Q}_i). \tag{1}$$

2.3 Constraints Limiting the Welfare Maximization

There are three constraints limiting the feasible consumption set from which the agent chooses his most preferred point:

- The first constraint is represented by the conventional budget constraint:

$$y_1 + p_s s + p_q q = I, \tag{2}$$

  with $p_q > p_s$. Hence, the agent spends his whole income on the consumption of the three commodities.

- The Nash-Cournot assumption is made that an individual agent takes the other agents' generation of the public characteristic

$$\tilde{X} = X - \beta q \tag{3}$$

  as exogenously given. Furthermore, the parameter β is considered to be the same across all agents, which is equivalent to assuming that $\tilde{Q}$ is taken as given.

- We assume that an agent has to provide an exogenously fixed quantity of s units of characteristic y_2 directly. It is assumed that this obligation is laid down by a national or international regulation. The unit cost of s is also assumed to be exogenously determined. Therefore,

$$s = \bar{s} \quad \text{and} \quad p_s = \bar{p_s}. \tag{4}$$

In the formulation of the agent's consumption problem, (4) is substituted into (2) and (3). Furthermore, the technological condition $q = \frac{y_2 - s}{\alpha}$, can be employed to remove q from the constraints and to express agent i's maximization problem as

$$\max_{y_1, y_2, x_i} U(y_1, y_2, X) \tag{5}$$

subject to

$$y_1 + \bar{p_s}\bar{s} + p_q(\tfrac{y_2 - \bar{s}}{\alpha}) = I \qquad \text{and} \qquad -\beta(y_2 - \bar{s}) + \alpha X = \alpha \tilde{X}.$$

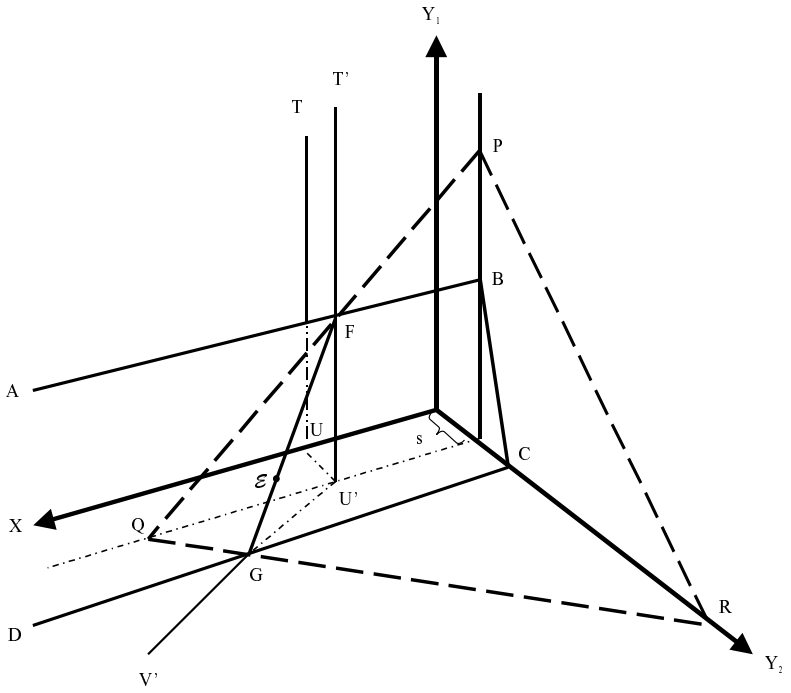

Figure 1: Constraints and Welfare Maximum.

Figure 1 illustrates the constraints restricting the agent's utility maximization: the constraint on the left-hand side is depicted by the plane ABCD and the constraint on the right-hand side is represented by plane T'U'V'. The distance between U and the origin of the three axis measures the total level of the pure public characteristic generated by the other agents, $\tilde{X}$. Starting from the point U the agent has to buy $\bar{s}$ units of the second characteristic directly (constraint 3). Thus, we move to point U'; starting from

this point the agent may buy units of the impure public good q or the private good y_1. The consumption of impure public good q and private good y_1 is limited by the aforementioned constraint depicted by plane ABCD. Therefore, the set of points that satisfy all three constraints lies on the line which links point F to the point G. One of the indifference curves from the set of indifference curves representing the agent's convex preferences over the three characteristics is tangent to the line FG.[9] The tangential point represents the allocation providing the highest attainable utility level. In Figure 1 the point $\mathcal{E}$ represents this point. Strict convexity of preferences guarantees that there is a unique point of tangency $\mathcal{E}$.

2.4 Virtual Magnitudes

Let us next formulate the restrictions limiting an agent's consumption by using parameters associated with familiar price-taking behaviour. Therefore, we have to introduce virtual magnitudes. These magnitudes (virtual prices and income) have to guarantee that a consumer chooses to take precisely the same amount of each commodity as he consumes on the efficient point $\mathcal{E}$. Since the externalities of the public characteristic have to be considered, not the monetary income is of main importance but the virtual income. The virtual income may also be denoted 'hypothetical income', 'full income' or 'social income'. Becker (1974: 1063) defines 'social income' as *"the sum of person's own income (his earnings, etc.) and the monetary value to him of the relevant characteristics of others"*. We denote the three hypothetical or virtual prices of the characteristics and the hypothetical income that would lead a price-taking agent to choose the characteristics bundle in $\mathcal{E}$ by ψ_1, ψ_2, ψ_3, and μ respectively.

If it is warranted that the virtual budget constraint containing the virtual magnitudes, $\mu = \psi_1 y_1 + \psi_2 y_2 + \psi_3 X$, induces a price-taking agent to choose the allocation $\mathcal{E}$, the virtual magnitudes could be employed in order to form the virtual budget plane PQR that allows for abandonment of the other restricting planes in Figure 1. The points $\mathcal{E}$, F and G have to be located in the plane PQR. Thus, the virtual magnitudes depend on the location of the tangential point $\mathcal{E}$ between FG and the indifference surfaces, and the point $\mathcal{E}$ itself depends on the observed parameters of the choice problem p_s, p_q, I, $\tilde{X}$, s, α, β. Consequently, it is required that:

$$\psi_i = f_i(y_1, y_2, X) = \psi_i(p_s, p_q, I, \tilde{X}, s, \alpha, \beta),$$

[9] The set of indifference curves are not depicted in Figure 1.

$$\mu = f_\mu(y_1, y_2, X) = \mu(p_s, p_q, I, \tilde{X}, s, \alpha, \beta).$$

The functions ψ_i reflect the slopes in the relevant directions of the indifference surface at the allocation $\mathcal{E}$. Since only the relative magnitudes are relevant, the virtual price of the first characteristic can be set equal to unity. The virtual income function μ determines the income that puts the budget plane on the level where it has the tangency point with the indifference surfaces in $\mathcal{E}$. Consequently, the plane PQR would support consumption of a price-taking agent at allocation the agent's efficient allocation $\mathcal{E}$.

2.5 Linkage Between Exogenous and Virtual Parameters

The linkage of the virtual magnitudes to the exogenous parameters has to meet the following requirements:

- The unit price the agent is willing to pay for the impure public good is equal to the price p_q that is actually paid. This price has to coincide with the valuation of the characteristics generated by the unit of the impure public good. The virtual prices reflect these valuations. Per unit of the impure public good α units of y_2 and β units of X are provided such that:

$$p_q = \alpha\psi_2(\Theta) + \beta\psi_3(\Theta). \tag{6}$$

  Here, $\beta\psi_3(\Theta)$ represents the benefits derived from the public and $\alpha\psi_2(\Theta)$ the benefits derived from the private characteristics of a unit of the impure public good. Furthermore, the vector Θ gathers the observed parameters $\bar{p}_s, p_q, I, \tilde{X}, \bar{s}, \alpha, \beta$.

- In addition to the provision of y_2 by s, the provision of the impure public good generates y_2. The amount by which characteristic 2 is augmented by the agent's provision of the impure public good has to be proportional to the amount by which the agent augments the other agents' provision of the public characteristic:

$$\beta\{D_2(\psi_2(\Theta), \psi_3(\Theta), \mu(\Theta)) - s\} = \alpha\{D_3(\psi_2(\Theta), \psi_3(\Theta), \mu(\Theta)) - \tilde{X}\}. \tag{7}$$

  D_k, with $k = 2, 3$, stands for the uncompensated demand functions with respect to characteristics 2 and 3 respectively.

- The virtual income of agent i must be consistent with the value of the chosen allocation at $\mathcal{E}$:

$$\begin{aligned} \mu(\cdot) &= y_1 + \psi_2(\cdot)y_2 + \psi_3(\cdot)X \\ &= y_1 + \psi_2(\cdot)y_2 + \psi_3(\cdot)(x + \tilde{X}) \end{aligned} \tag{8}$$

Using equations (6), (7), (8) as well as the facts that $I = y_1 + p_q\frac{y_2-s}{\alpha} + p_s s$ and $y_2 = \alpha q + s$, virtual income can be expressed:

$$\mu(\cdot) = y_1 + p_s s + p_q q + \psi_3\tilde{X} + (\psi_2 - p_s)s = I + \psi_3\tilde{X} + (\psi_2 - p_s)s. \tag{9}$$

The expression for $\mu(\cdot)$ in (9) deviates from the commonly employed expression of virtual income by the term $(\psi_2 - p_s)s$. This is due to the fact that in the considered case the production of s is allowed to be suboptimal low and the virtual price ψ_2 may not be equal to the price p_s. If no inefficient low level of s prevails, the prices p_s and ψ_2 coincide and the term $(\psi_2 - p_s)s$ vanishes.

3 Comparative Statics

An agent can modify the extent of impure-public-good independent generation of the second private characteristic. The raised efforts in such independent generation affect the attractiveness of impure-public-good provision. The same holds with respect to price variations of the impure-public-good independent generation of the second private characteristic. The impacts of these effort and price variations are analyzed in the subsequent sections.

3.1 Variation of the Independent Generation of the Second Characteristic

In order to determine the impact of an increased impure-public-good independent generation of the second characteristic on the impure-public-good provision level, we have – in a first step – to differentiate equations (6), (7) and (9) with respect to s. This differentiation yields

$$\begin{aligned} 0 &= \alpha\psi_{2s} + \beta\psi_{3s}, \\ \beta(D_{22}\psi_{2s} + D_{23}\psi_{3s} + D_{2\mu}\mu_s) - \beta &= \alpha(D_{32}\psi_{2s} + D_{33}\psi_{3s} + D_{3\mu}\mu_s), \\ \mu_s &= \tilde{X}\psi_{3s} + s\psi_{2s} + \psi_2 - p_s. \end{aligned}$$

where $D_{k2} = \frac{\partial D_k}{\partial \psi_2}$, $D_{k3} = \frac{\partial D_k}{\partial \psi_3}$, $D_{k\mu} = \frac{\partial D_k}{\partial \mu}$, $\psi_{2s} = \frac{\partial \psi_2}{\partial s}$, $\psi_{3s} = \frac{\partial \psi_3}{\partial s}$ and $\mu_s = \frac{\partial \mu}{\partial s}$.

This system can be written:

$$\begin{bmatrix} \alpha & \beta & 0 \\ \beta D_{22} - \alpha D_{32} & \beta D_{23} - \alpha D_{33} & \beta D_{2\mu} - \alpha D_{3\mu} \\ -s & -\tilde{X} & 1 \end{bmatrix} \begin{bmatrix} \psi_{2s} \\ \psi_{3s} \\ \mu_s \end{bmatrix} = \begin{bmatrix} 0 \\ \beta \\ \psi_2 - p_s \end{bmatrix}.$$

Second, we employ Cramer´s rule and set $\alpha = \beta = 1$ for simplicity reasons. This yields the following price and income responses:

$$\psi_{2s} = \frac{(D_{2\mu} - D_{3\mu})(\psi_2 - p_s) - 1}{\Omega},$$

$$\psi_{3s} = \frac{1 - (D_{2\mu} - D_{3\mu})(\psi_2 - p_s)}{\Omega},$$

$$\mu_s = \tilde{X}\frac{1 - (D_{2\mu} - D_{3\mu})(\psi_2 - p_s)}{\Omega} + s\frac{(D_{2\mu} - D_{3\mu})(\psi_2 - p_s) - 1}{\Omega} + \psi_2 - p_s,$$

where $\Omega = \frac{\partial C_2}{\partial \psi_3} - \frac{\partial C_2}{\partial \psi_2} - \frac{\partial C_3}{\partial \psi_3} + \frac{\partial C_3}{\partial \psi_2} > 0$. Here, C stands for compensated demand functions.

As already mentioned above, virtual prices and income can be expressed as functions of the exogenous parameters $p_s, p_q, s, \tilde{X}, I, \alpha, \beta$. By definition virtual magnitudes have to ensure that the succeeding condition holds with respect to the uncompensated demand of the agent:

$$D_k^*(\Theta) = D_k(\psi_2(\Theta), \psi_3(\Theta), \mu(\Theta)), \quad k = 1, 2, 3. \tag{10}$$

Now, in a third step, the differentiation of (10) with respect to s, substitution of the calculated price and income responses and application of the Slutzky decomposition yields the following responses (for an extensive discussion of the calculations see Rübbelke (2002, 2003)):

$$D_{2s} = \frac{C_{23} - C_{22}}{\Omega} + D_{2I}(\psi_2 - p_s), \tag{11}$$

$$D_{3s} = D_{2s} - 1 = \frac{C_{33} - C_{32}}{\Omega} + D_{3I}(\psi_2 - p_s). \tag{12}$$

Provided that the characteristics 2 and 3 do not represent very strong complements and as long as the virtual price ψ_2 of characteristic 2 exceeds the price p_s for direct provision of this characteristic, the response of the demand D_2 to an increase in s is positive. This is on the one hand due to the fact that – provided both characteristics behave like normal goods

– an income rise will increase the demand for both characteristics and hence, the second terms on the right-hand sides of both responses are positive (see Rübbelke (2002, 2003)). On the other hand this is due to the exclusion of the case of very strong complements, and therefore $C_{23} > C_{22}$.[10] The latter causes the first term of (11) also to be positive.

The sign of the response of D_3 is ambiguous since the difference between C_{33} and C_{23} is negative. Hence, it is ambiguous whether the provision of the impure public good will rise or decrease.

Yet, if it is assumed that p_s equals ψ_2, then the response D_{2s} is definitely positive and the response in D_{3s} is definitely negative. Then, the overall response of the provision of the impure public good is negative since direct provision of the second characteristic crowds out indirect provision via impure public good provision.

3.2 Variation of the Price of the Technology Which Generates the Second Characteristic Independently

Let us next analyze the impact of a change in the price of the impure-public-good independent generation of the second private characteristic. By differentiation of equations (6), (7) and (9) with respect to p_s, we get

$$\begin{aligned} 0 &= \alpha\psi_{2p_s} + \beta\psi_{3p_s}, \\ \beta(D_{22}\psi_{2p_s} + D_{23}\psi_{3p_s} + D_{2\mu}\mu_{p_s}) &= \alpha(D_{32}\psi_{2p_s} + D_{33}\psi_{3p_s} + D_{3\mu}\mu_{p_s}), \\ \mu_{p_s} &= \psi_{3p_s}\tilde{X} + (\psi_{2p_s} - 1)s. \end{aligned}$$

This can be expressed:

$$\begin{bmatrix} \alpha & \beta & 0 \\ \beta D_{22} - \alpha D_{32} & \beta D_{23} - \alpha D_{33} & \beta D_{2\mu} - \alpha D_{3\mu} \\ -s & -\tilde{X} & 1 \end{bmatrix} \begin{bmatrix} \psi_{2p_s} \\ \psi_{3p_s} \\ \mu_{p_s} \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \\ -s \end{bmatrix}.$$

By application of Cramer´s rule and setting $\alpha = \beta = 1$, we get the following price and income responses:

$$\psi_{2p_s} = \frac{-s(D_{2\mu} - D_{3\mu})}{\Omega},$$

[10] Consider, that compensated cross-price responses are symmetric; see Deaton and Muellbauer (1980: 43-45) as well as Cornes (1992: 71-72).

$$\psi_{3p_s} = \frac{s(D_{2\mu} - D_{3\mu})}{\Omega},$$

$$\mu_{p_s} = \tilde{X}\frac{s(D_{2\mu} - D_{3\mu})}{\Omega} + s\frac{-s(D_{2\mu} - D_{3\mu})}{\Omega} - s.$$

By differentiating (10) with respect to p_s, applying the Slutzky decomposition and substituting the calculated price and income responses, we get:

$$D_{2p_s} = D_{3p_s} = s\frac{(C_{22} - C_{23})D_{3\mu} + (C_{33} - C_{32})D_{2\mu}}{\Omega} = -(sD_{2I}). \tag{13}$$

Thus, a rise in the price for direct acquisition of characteristic 2 induces only an income effect. This is in line with Neary and Roberts (1980: 34) who point out that an increase in the price of a rationed good simply forces the consuming household to pay more for the rationed consumption level. Because the uncompensated demand for characteristics 2 and 3 decrease, the agent will lower his impure-public-good provision level. However, the latter result is a consequence of the model assumption that the independent generation of joint products cannot be substituted by a generation which is associated with the impure public good production. Otherwise, the higher opportunity cost of the independent generation may cause the impure-public-good provision level to rise.

4 Numerical Simulation

Since our analytical solutions are not clear-cut, we employ the impure-public-good example of climate policy in Germany to numerically simulate the effects of alternative technologies in a parameterized model. The simulation model reveals directions of impacts where the analytical model has ambiguous results and gives insights into the magnitude of effects associated with changes in the quantity and the price of the impure-public-good independent generation of the second private characteristic.

4.1 Impure Public Goods: The Example of Climate Policy

Since climate policy, e.g., in the shape of a CO_2 tax, provides pure public as well as private characteristics, it can be regarded as an impure public good. Pure public and private characteristics are provided by climate policy (see Figure 2).

The *pure public characteristic* subsumes the effects generated by climate policy that can be enjoyed globally, irrespective of which country abates. The pure public characteristic provided by climate policy is climate protection. No country can be excluded from

its consumption and it exhibits non-rivalry. Benefits resulting from climate protection are the primary benefits of climate policy.

Climate policy also provides some *private characteristic* with purely local/regional influence that can be exclusively enjoyed by countries/regions generating climate policy. The benefits, which countries enjoy from consuming the private characteristic are the ancillary or secondary benefits.

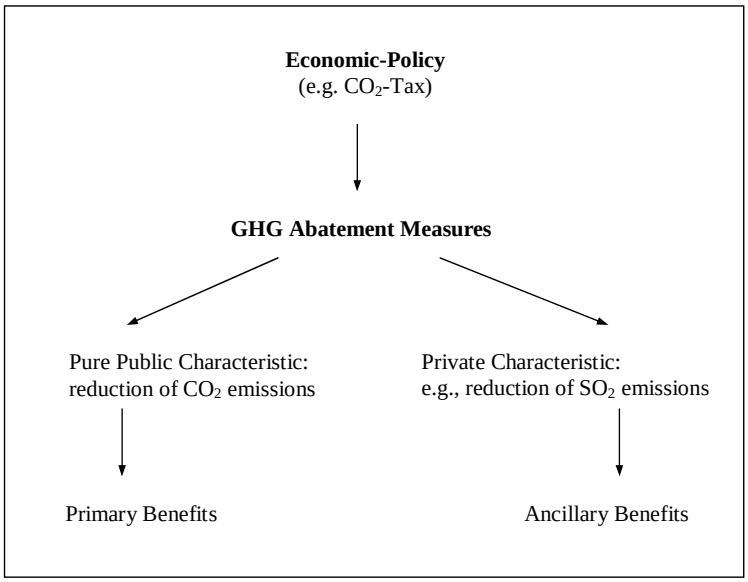

Figure 2: Primary and Ancillary/Secondary Benefits.

Yet, we have to take account of the fact that the ancillary benefits can also be generated independently of climate policy. Desulphurization installations, for example, reduce the emission of SO_2 independently of climate policy. So, the higher the level of such installations, the lower will be the (marginal) ancillary benefits of climate policy. Subsequently, we will focus on the ancillary effect of SO_2 emission mitigation.

4.2 The Simulation Model

This section describes the data used to parameterize the analytical model presented in Section 2 in order to simulate numerically the effects of changes in the quantity and prices of the alternative technology which are analyzed analytically in Section 3. For the calibration we consider the example of climate policy in Germany in the year 2010 where CO_2 emission reductions is the impure public good and SO_2 emission reduction is the

private environmental good.

To parameterize the benchmark demand for the impure public good and the private environmental good we assume that international obligations are revealed preferences for the national provision of the two goods, CO_2 and SO_2 emission reductions. The Kyoto Protocol to the United Nations Framework Convention on Climate Change (UNFCCC) which entered into force in February 2005 imposes greenhouse gas emission limits for industrialized countries (UNFCCC (1997)). In May 2002, the European Union (EU) ratified the Kyoto Protocol committing itself to a reduction of EU-wide greenhouse gas emissions by 8% vis-à-vis 1990 emission levels during 2008-2012. The aggregate EU reduction requirement has been redistributed among individual Member States according to an EU-internal Burden Sharing Agreement resulting in a reduction requirement for Germany of 21% (CEC (1999a)). Given CO_2 emissions of 952 $MtCO_2$ in Germany and 3,068 $MtCO_2$ in the EU in 1990, the emission targets associated with the Kyoto Protocol amount to 752 $MtCO_2$ for Germany and 2,823 $MtCO_2$ for the EU. Projected emissions for 2010 (the base-year for our model simulations) amount to 839 $MtCO_2$ for Germany and 3,311 $MtCO_2$ for the EU (CEC (2001a)). This yields a benchmark demand for CO_2 emission reduction for Germany of $q = 87$ $MtCO_2$. We assume that real emission reductions are only achieved in Europe and that the Kyoto Protocol is in addition reduced to symbolic policy (Löschel and Zhang (2003)). The other agents' provision of the impure public good is then $\tilde{Q} = 401$ $MtCO_2$. In 1990, SO_2 emissions were 5280 $ktSO_2$. They are projected to decrease to 740 $ktSO_2$ until 2010 (CEC (2001a)). Given the German SO_2 emission target of 520 $ktSO_2$ in 2010 stated in the EU directive on National Emission Ceilings for certain atmospheric pollutants (CEC (2001b)), the demand for the private environmental good SO_2 emission reduction is $y_2 = 220$ $ktSO_2$.

The parameter α that describes the extent of SO_2 emission reduction that is generated through the reduction of CO_2 emissions is estimated through simulation experiments with the GEM-E3 model for Europe (Capros et al. (1997)). It is a full scale general equilibrium model for 15 European countries, linked through endogenous bilateral trade. The environmental module of GEM-E3 concentrates on three environmental problems: (i) global warming, (ii) problems related to the deposition of acidification emissions and (iii) ambient air quality linked to acidifying emissions and tropospheric ozone concentration. Hence, it considers energy-related emissions of primary pollutants CO_2, NO_X, SO_2, VOC and particulates. There are two mechanisms of emission reduction explicitly specified in the model: substitution between fuels and between energetic and non-energetic inputs

and emission reduction due to a decline in production and consumption. We simulate with the GEM-E3 model a scenario where Germany reaches its burden sharing emission level of CO_2 through a domestic permit system. In this scenario the marginal cost of CO_2 abatement (price of the impure public good) is $p_q = 29.0\ Euro_{97}/tCO_2$ and $\alpha = 1.30\ ktSO_2/MtCO_2$. The amount of SO_2 emission reduction that is generated through reduction of CO_2 to reach the German Kyoto obligations is 113 $ktSO_2$. The benchmark quantity of SO_2 emission reduction that has to be provided independent of climate policy to reach the EU National Emission Ceilings is therefore $s = 107\ ktSO_2$.

The marginal costs of SO_2 reductions by different control technologies for Germany in the current legislation (baseline) scenario for 2010 is taken from the Regional Air Pollution Information and Simulation (RAINS) model (Cofala and Syri (1998)), which is applied as a scenario analysis tool in the context of the international negotiations under the UN/ECE Convention on Long-range Transboundary Air Pollution and for the development of the acidification and ozone strategies of the European Union (Alcamo et al. (1990)). RAINS concentrates on the technical emission control options, which do not imply structural changes of the energy system. Five broad groups of technical emission control options are distinguished: (i) the use of low-sulphur fuels, including fuel desulphurization, (ii) in-furnace control of SO_2 emissions, (iii) conventional wet flue gas desulphurization processes, (iv) advanced, high efficiency methods for capturing sulphur from the flue gas, and (v) measures to control process emissions. The marginal cost for 107 $ktSO_2$ reduction or equivalently the benchmark price of the alternative technology amounts to $p_s = 4,920\ Euro_{97}/tSO_2$.

The total budget is taken from the macroeconomic assumption for Germany in the baseline scenario "European Environmental Priorities" (Capros et al. (2000), CEC (1999b)): $I = 2,561,000$ million $Euro_{97}$.

We employ a linear logarithmic utility function of the form

$$U = \gamma_1 \ln y_1 + \gamma_2 \ln y_2 + \gamma_3 \ln X \tag{14}$$

and calibrate the parameter in the utility function such that our benchmark data set is replicated. Table 1 summarizes the benchmark parameter values for the numerical simulations. In the simulation runs we then vary the benchmark values of the quantity s and the price p_s of the alternative technology.

y_1	(in M Euro$_{97}$)	2,557.95	X	(MtCO$_2$)	488
p_y	(Euro$_{97}$)	1	I	(in 000 M Euro$_{97}$)	2,561
s	(ktSO$_2$)	107	α	(ktSO$_2$/ MtCO$_2$)	1.30
p_s	(Euro$_{97}$/t CO$_2$)	4,920	β		1
q	(MtCO$_2$)	87	U		29.52
p_q	(Euro$_{97}$/t CO$_2$)	29	Ψ_1		1
$\tilde{Q}$	(MtCO$_2$)	401	Ψ_2		1,6730.77
$\tilde{X}$	(MtCO$_2$)	401	Ψ_3		7.25
x	(MtCO$_2$)	87	μ		2,565.17

Table 1: Benchmark Parameter Values.

5 Simulation Results and the Impure Public Good Model

The simulation yielded some interesting results which either confirm our analytical investigation or reveal the direction of impacts given ambiguous results in the analytical model. Furthermore, our findings turn out to have surprising implications. In contrast to the analytical model, the simulation study allows us to have an explicit look on changes in utility levels induced by changes of individual parameters.

The effects induced by a change in the price of the second private good are in line with the predictions of the impure public good model (see Figure 3). A rising price causes the consumption of all goods y_1, y_2, q (as well as welfare) to decline, which is due to the negative income effect exerted by the increase in the price of the rationed good. The income effect is the only effect resulting from the increase in p_s, as Neary and Roberts (1980) as well as our analytical analysis show. Therefore, the simulation result is not very surprising but confirms the appropriateness of our analytical approach. We can observe from Figure 3, how virtual income and utility level decline with rising price levels of the rationed good.

In contrast to the unambiguous impacts of the increase in p_s predicted by the analytical impure public good model, the model's forecasts of effects of a change in the level s of the consumption of the second private good on the impure public good provision were ambiguous. The analytical model predicted that the increase in s may raise or reduce the provision level q of the impure public good. In our simulation model, we find a negative

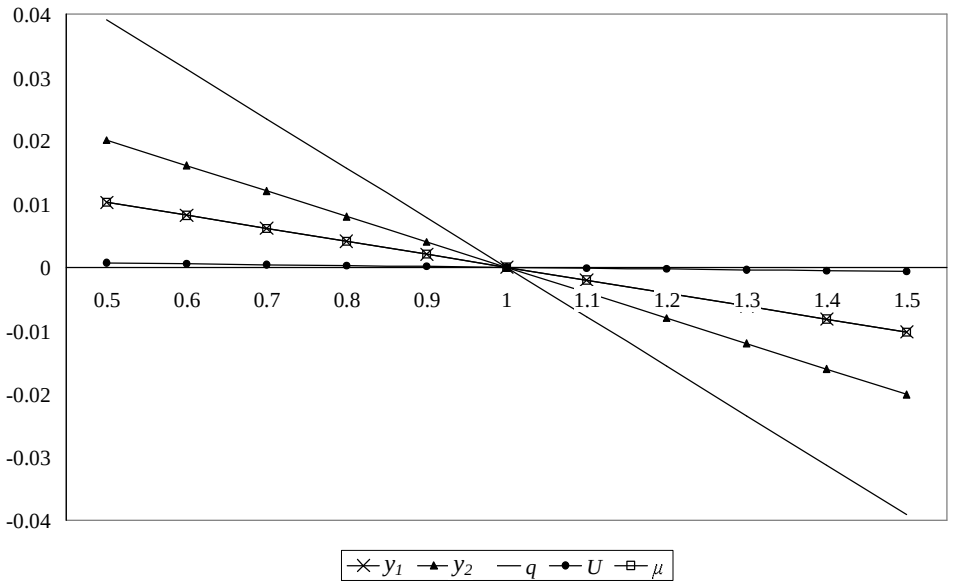

Figure 3: Effects induced by a change in the price of the second private good p_s (percentage change vs. benchmark value).

effect of the increase in the second private good consumption level on impure public good provision q. This decline in impure public good provision is accompanied by a rise in welfare and virtual income levels. Yet, utility levels increase at a declining pace with rising levels of s.

A very interesting and surprising result is that variations in the price p_s of the rationed second private good do only have minor negative impacts on climate protection levels q compared to variations in the levels of the rationed good s (see Figures 3 and 4). With respect to our example of climate policy, this means that an increase in the prices of technologies independently (of climate policy) generating private ancillary effects of climate policy (like desuphurisation installations reducing SO_2 emissions) does not have a very strong negative impact on climate protection levels. In contrast, regulations prescribing higher standards for pollution control of local or regional air pollutants tend to have a significant negative impact on climate protection levels. Nevertheless, these regulations tend to improve welfare, although the welfare improvement rises at a slower pace with increasing emission control. The welfare improvement is due to the suboptimal low provision of SO_2 emission control in the baseline scenario: with increasing control levels, the marginal benefits of SO_2 emission control decline.

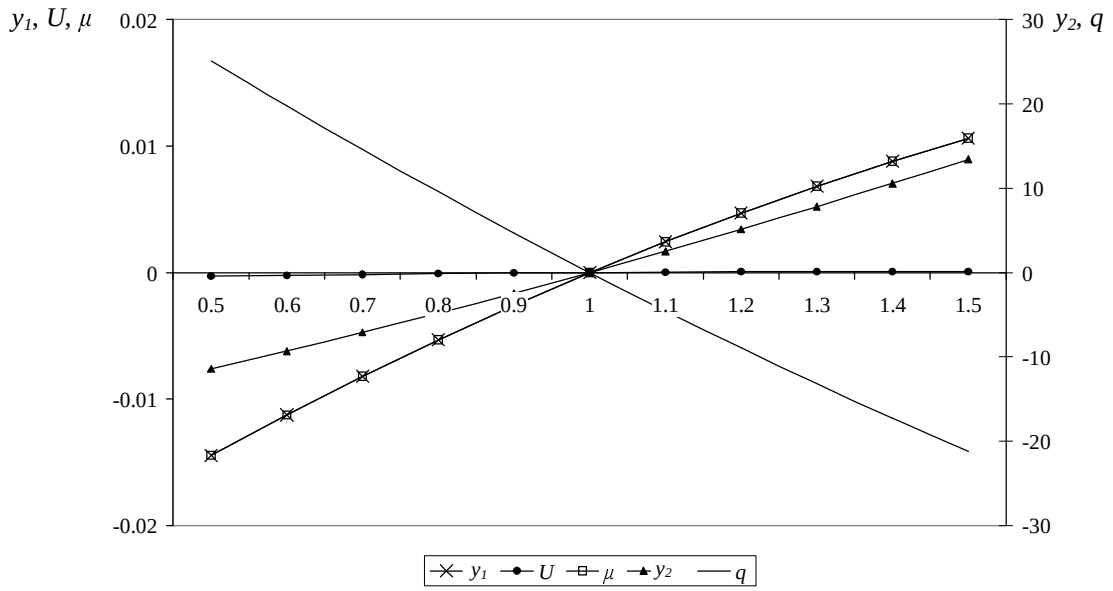

Figure 4: Effects induced by a change in the quantity s of the second private good (percentage change vs. benchmark value).

6 Conclusions

There exists a great variety of application options for impure public good models. In fact, almost every public goods has an impure public character especially when we regard international public goods.

The analytical model we presented in Section 2 addresses such impure public goods. Yet, in many cases, the private characteristic of the impure public good can be produced by different means. Therefore, in contrast to standard public good models, we introduced a third technology, generating the private characteristic of the impure public good independently. We supposed this technology to be rationed and it was in the center of the focus of our analysis. We derived by means of our analytical model the impact this technology's application and price have on the provision level of the impure public good. Therefore, we investigated influences which are omitted in standard pure public good models, which do not take account of private characteristics associated with public good provision.

In order to check and refine the results of the analytical study, we employed a simulation model for the example of climate policy in Germany. Here, climate protection represents the global public characteristic of the impure public good 'climate policy',

while SO_2 abatement represents the private characteristic, from an individual country's point of view. In fact, most options to reduce the emission levels of the greenhouse gas CO_2 turn out to be simultaneously reducing the emissions of SO_2. However, the emissions of SO_2 can also be mitigated independently of climate policy by means of desulphurisation installations, which represent the technology independently generating the private characteristic of the impure public good.

We had to take account of the fact that the degrees of publicness vary with divergent entities considered. So, in standard analyses local/regional air pollution reductions represent a public good for inhabitants of the respective local/regional area. Yet, on the international scale we considered, abatement of local/regional air pollution turns out to become a private good from an individual country's point of view (while still representing a public good for individual inhabitants living in the area enjoying higher air quality).

The results of the simulations confirmed the findings of the analytical model. So, the increase of the price of climate-policy independent SO_2 abatement exerts a negative income effect. Consequently, the abatement has a negative impact on impure public good provision, and therefore on climate protection levels. As our explicit illustration of welfare effects in the framework of the simulation model shows, welfare levels unambiguously decline with the considered price increases.

In contrast to the ambiguous results of our analytical representation with respect to the impacts of an increase in the provision of the rationed good, we found unambiguous effects of such an increase in our simulation model. The provision of the impure public good decrease with increasing levels of the rationed private good. Due to the inefficiently low provision level in the baseline scenario, the increased production of the rationed good caused an improvement of welfare.

Interestingly, the impact of the price increase of SO_2 abatement has minor effects on climate protection levels compared to increases in the climate-policy-independent enhancement of SO_2 abatement. Consequently, it turns out to be likely that stricter regulations on air-pollution may cause the attractiveness of climate policy to decline significantly, while price increases of this control tend to have only minor effects.

7 References

Alcamo J., Shaw R. and Hordijk L. (1990), *The RAINS Model of Acidification: Science and Strategies in Europe*, Kluwer (Dordrecht).

Andreoni, J. (1986), *Essays on Private Giving to Public Goods*, UMI (Michigan).

Andreoni, J. (1989), "Giving with Impure Altruism: Applications to Charity and Ricardian Equivalence," *Journal of Political Economy*, 97, 1447-1458.

Andreoni, J. (1990), "Impure Altruism and Donations to Public Goods: A Theory of Warm-Glow Giving," *The Economic Journal*, 100, 464-477.

Baumol, W.J. and Bowen, W.G. (1966), *Performing Arts: The Economic Dilemma*, Twentieth Century Fund (New York).

Becker, G.S. (1974), "A Theory of Social Interactions," *Journal of Political Economy*, 82, 1063-1093.

Capros, P., Georgakopoulos, T., Van Regemorter, D., Proost, S., Schmidt, T. and Conrad, K. (1997), "The GEM-E3 Model for the European Union," *Journal of Economic & Financial Modelling*, 4, 51-160.

Capros, P., Mantzos, L., Pearce, D.W., Howarth, A., Sedeem, C., and Strengers, B.J. (2000), *Technical Report on Climate Change, European Environmental Priorities: an Integrated Economic and Environmental Assessment*, RIVM Report, May 2000.

CEC (Commission of the European Communities) (1999a), *Preparing for Implementation of the Kyoto Protocol*, Commission Communication to the Council and the Parliament, COM (99)230, 19 May 1999 (Brussels).

CEC (Commission of the European Communities) (1999b), *European Union Energy Outlook to 2020*, Office for Official Publications of the European Communities (Luxembourg).

CEC (Commission of the European Communities) (2001a), *Environment 2010: Our Future, Our Choice, The Sixth Environment Action Programme of the European Community*, COM(2001)31 (Brussels).

CEC (Commission of the European Communities) (2001b), "Directive 2001/81/EC of the European Parliament and of the Council of 23 October 2001 on National Emission Ceilings for Certain Atmospheric Pollutants," in: *Official Journal of the European Communities*, L 309, 22-30.

Cofala, J. and Syri, S. (1998), *Sulfur Emissions, Abatement Technologies and Related Costs for Europe in the RAINS Model Database*, International Institute for Applied Systems Analysis Interim Report, IR-98-035 (Laxenburg).

Cornes, R.C. (1992), *Duality and Modern Economics*, Cambridge University Press (Cambridge).

Cornes, R.C. and Sandler, T. (1984), "Easy Riders, Joint Production, and Public Goods," *The Economic Journal*, 94, 580-598.

Cornes, R.C. and Sandler, T. (1994), "The Comparative Static Properties of the Impure Public Good Model," *Journal of Public Economics*, 54, 403-421.

Deaton, A. and Muellbauer, J. (1980), *Economics and Consumer Behaviour*, Cambridge University Press (Cambridge).

Diamond, L. (2002), "Reinventing Foreign Aid in the National Interest," *The Hoover Weekly Essay series*, Hoover Institution, Stanford University, 1-3.

Dubin, J.A. and Navarro, P. (1988), "How Markets for Impure Public Goods Organize: The Case of Household Refuse Collection," *Journal of Law, Economics, and Organization*, 4, 217-242.

Ihori, T. (1992), "Impure Public Goods and Transfers in a Three-Agent Model," *Journal of Public Economics*, 48, 385-401.

Ihori, T. (1994), "Immiserizing Growth with Interregional Externalities of Public Goods," *Regional Science and Urban Economics*, 24, 485-496.

Kaul, I., Grunberg, I. and Stern, M. (1999), *Global Public Goods*, Oxford University Press (New York).

Kingma, B.R. and McClelland, R. (1995), "Public Radio Stations Are Really, Really Not Public Goods: Charitable Contributions and Impure Altruism," *Annals of Public and Cooperative Economics*, 66, 65-76.

Kotchen, M.J. (2005), "Impure Public Goods and the Comparative Statics of Environmentally Friendly Consumption," *Journal of Environmental Economics and Management*, 49, 281-300.

Löschel, A. and Zhang, Z. (2002), "The Economic and Environmental Implications of the US Repudiation of the Kyoto Protocol and the Subsequent Deals in Bonn and Marrakech," *Review of World Economics - Weltwirtschaftliches Archiv*, 138, 711-746.

Neary, J.P. and Roberts, K.W.S. (1980), "The Theory of Household Behaviour Under Rationing," *European Economic Review*, 13, 25-42.

Pearce, D. (2000), "Policy Frameworks for the Ancillary Benefits of Climate Change Policies," in: *Ancillary Benefits and Costs of Greenhouse Gas Mitigation*, OECD (Paris), 517-560.

Posnett, J. and Sandler, T. (1986), "Joint Supply and the Finance of Charitable Activity," *Public Finance Quarterly*, 14, 209-222.

Rübbelke, D.T.G. (2002), *International Climate Policy to Combat Global Warming - An Analysis of the Ancillary Benefits of Reducing Carbon Emissions*, Edward Elgar (Cheltenham).

Rübbelke, D.T.G. (2003), "An Analysis of Differing Abatement Incentives," *Resource and Energy Economics*, 25, 269-295.

Rübbelke, D.T.G. (2005), "Differing Motivations for Terrorism," *Defence and Peace Economics*, 16, 19-27.

Sandler, T. (1996), "A Game-Theoretic Analysis of Carbon Emissions," in *The Political Economy of Environmental Protection - Analysis and Evidence*, edited by Congleton, R.D., Ann Arbor - The University of Michigan Press, 251-272.

Sandler, T. (1997), *Global Challenges - An Approach to Environmental, Political, and Economic Problems*, Cambridge University Press (Cambridge).

Sandler, T. and Murdoch, J.C. (1990), "Nash-Cournot or Lindahl Behavior? An Empirical Test for the NATO Allies," *Quarterly Journal of Economics*, 105, 875-894.

Sandler, T. and Hartley, K. (2001), "Economics of Alliances: The Lessons for Collective Action," *Journal of Economic Literature*, XXXIX, 869-896.

UNFCCC (United Nations Framework Convention on Climate Change) (1997), *Kyoto Protocol to the United Nations Framework Convention on Climate Change*, FCCC/CP /L.7/Add1, Kyoto.

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
http://www.repec.org

NOTE DI LAVORO PUBLISHED IN 2004

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

KTHC	36.2004	*Franca ECKERT COEN and Claudio ROSSI* (lxviii): Foreigners, Immigrants, Host Cities: The Policies of Multi-Ethnicity in Rome. Reading Governance in a Local Context
KTHC	37.2004	*Kristine CRANE* (lxviii): Governing Migration: Immigrant Groups' Strategies in Three Italian Cities – Rome, Naples and Bari
KTHC	38.2004	*Kiflemariam HAMDE* (lxviii): Mind in Africa, Body in Europe: The Struggle for Maintaining and Transforming Cultural Identity - A Note from the Experience of Eritrean Immigrants in Stockholm
ETA	39.2004	*Alberto CAVALIERE:* Price Competition with Information Disparities in a Vertically Differentiated Duopoly
PRA	40.2004	*Andrea BIGANO and Stef PROOST:* The Opening of the European Electricity Market and Environmental Policy: Does the Degree of Competition Matter?
CCMP	41.2004	*Micheal FINUS* (lxix): International Cooperation to Resolve International Pollution Problems
KTHC	42.2004	*Francesco CRESPI:* Notes on the Determinants of Innovation: A Multi-Perspective Analysis
CTN	43.2004	*Sergio CURRARINI and Marco MARINI:* Coalition Formation in Games without Synergies
CTN	44.2004	*Marc ESCRIHUELA-VILLAR:* Cartel Sustainability and Cartel Stability
NRM	45.2004	*Sebastian BERVOETS and Nicolas GRAVEL* (lxvi): Appraising Diversity with an Ordinal Notion of Similarity: An Axiomatic Approach
NRM	46.2004	*Signe ANTHON and Bo JELLESMARK THORSEN* (lxvi): Optimal Afforestation Contracts with Asymmetric Information on Private Environmental Benefits
NRM	47.2004	*John MBURU* (lxvi)*:* Wildlife Conservation and Management in Kenya: Towards a Co-management Approach
NRM	48.2004	*Ekin BIROL, Ágnes GYOVAI and Melinda SMALE* (lxvi)*:* Using a Choice Experiment to Value Agricultural Biodiversity on Hungarian Small Farms: Agri-Environmental Policies in a Transition al Economy
CCMP	49.2004	*Gernot KLEPPER and Sonja PETERSON:* The EU Emissions Trading Scheme. Allowance Prices, Trade Flows, Competitiveness Effects
GG	50.2004	*Scott BARRETT and Michael HOEL:* Optimal Disease Eradication
CTN	51.2004	*Dinko DIMITROV, Peter BORM, Ruud HENDRICKX and Shao CHIN SUNG:* Simple Priorities and Core Stability in Hedonic Games
SIEV	52.2004	*Francesco RICCI*: Channels of Transmission of Environmental Policy to Economic Growth: A Survey of the Theory
SIEV	53.2004	*Anna ALBERINI, Maureen CROPPER, Alan KRUPNICK and Nathalie B. SIMON:* Willingness to Pay for Mortality Risk Reductions: Does Latency Matter?
NRM	54.2004	*Ingo BRÄUER and Rainer MARGGRAF* (lxvi): Valuation of Ecosystem Services Provided by Biodiversity Conservation: An Integrated Hydrological and Economic Model to Value the Enhanced Nitrogen Retention in Renaturated Streams
NRM	55.2004	*Timo GOESCHL and Tun LIN* (lxvi): Biodiversity Conservation on Private Lands: Information Problems and Regulatory Choices
NRM	56.2004	*Tom DEDEURWAERDERE* (lxvi): Bioprospection: From the Economics of Contracts to Reflexive Governance
CCMP	57.2004	*Katrin REHDANZ and David MADDISON:* The Amenity Value of Climate to German Households
CCMP	58.2004	*Koen SMEKENS and Bob VAN DER ZWAAN:* Environmental Externalities of Geological Carbon Sequestration Effects on Energy Scenarios
NRM	59.2004	*Valentina BOSETTI, Mariaester CASSINELLI and Alessandro LANZA* (lxvii): Using Data Envelopment Analysis to Evaluate Environmentally Conscious Tourism Management
NRM	60.2004	*Timo GOESCHL and Danilo CAMARGO IGLIORI* (lxvi):Property Rights Conservation and Development: An Analysis of Extractive Reserves in the Brazilian Amazon
CCMP	61.2004	*Barbara BUCHNER and Carlo CARRARO*: Economic and Environmental Effectiveness of a Technology-based Climate Protocol
NRM	62.2004	*Elissaios PAPYRAKIS and Reyer GERLAGH*: Resource-Abundance and Economic Growth in the U.S.
NRM	63.2004	*Györgyi BELA, György PATAKI, Melinda SMALE and Mariann HAJDÚ* (lxvi): Conserving Crop Genetic Resources on Smallholder Farms in Hungary: Institutional Analysis
NRM	64.2004	*E.C.M. RUIJGROK and E.E.M. NILLESEN* (lxvi): The Socio-Economic Value of Natural Riverbanks in the Netherlands
NRM	65.2004	*E.C.M. RUIJGROK* (lxvi): Reducing Acidification: The Benefits of Increased Nature Quality. Investigating the Possibilities of the Contingent Valuation Method
ETA	66.2004	*Giannis VARDAS and Anastasios XEPAPADEAS*: Uncertainty Aversion, Robust Control and Asset Holdings
GG	67.2004	*Anastasios XEPAPADEAS and Constadina PASSA*: Participation in and Compliance with Public Voluntary Environmental Programs: An Evolutionary Approach
GG	68.2004	*Michael FINUS*: Modesty Pays: Sometimes!
NRM	69.2004	*Trond BJØRNDAL and Ana BRASÃO*: The Northern Atlantic Bluefin Tuna Fisheries: Management and Policy Implications
CTN	70.2004	*Alejandro CAPARRÓS, Abdelhakim HAMMOUDI and Tarik TAZDAÏT*: On Coalition Formation with Heterogeneous Agents
IEM	71.2004	*Massimo GIOVANNINI, Margherita GRASSO, Alessandro LANZA and Matteo MANERA*: Conditional Correlations in the Returns on Oil Companies Stock Prices and Their Determinants
IEM	72.2004	*Alessandro LANZA, Matteo MANERA and Michael MCALEER*: Modelling Dynamic Conditional Correlations in WTI Oil Forward and Futures Returns
SIEV	73.2004	*Margarita GENIUS and Elisabetta STRAZZERA*: The Copula Approach to Sample Selection Modelling: An Application to the Recreational Value of Forests

CCMP	74.2004	*Rob DELLINK and Ekko van IERLAND*: Pollution Abatement in the Netherlands: A Dynamic Applied General Equilibrium Assessment
ETA	75.2004	*Rosella LEVAGGI and Michele MORETTO*: Investment in Hospital Care Technology under Different Purchasing Rules: A Real Option Approach
CTN	76.2004	*Salvador BARBERÀ and Matthew O. JACKSON* (lxx): On the Weights of Nations: Assigning Voting Weights in a Heterogeneous Union
CTN	77.2004	*Àlex ARENAS, Antonio CABRALES, Albert DÍAZ-GUILERA, Roger GUIMERÀ and Fernando VEGA-REDONDO* (lxx): Optimal Information Transmission in Organizations: Search and Congestion
CTN	78.2004	*Francis BLOCH and Armando GOMES* (lxx): Contracting with Externalities and Outside Options
CTN	79.2004	*Rabah AMIR, Effrosyni DIAMANTOUDI and Licun XUE* (lxx): Merger Performance under Uncertain Efficiency Gains
CTN	80.2004	*Francis BLOCH and Matthew O. JACKSON* (lxx): The Formation of Networks with Transfers among Players
CTN	81.2004	*Daniel DIERMEIER, Hülya ERASLAN and Antonio MERLO* (lxx): Bicameralism and Government Formation
CTN	82.2004	*Rod GARRATT, James E. PARCO, Cheng-ZHONG QIN and Amnon RAPOPORT* (lxx): Potential Maximization and Coalition Government Formation
CTN	83.2004	*Kfir ELIAZ, Debraj RAY and Ronny RAZIN* (lxx): Group Decision-Making in the Shadow of Disagreement
CTN	84.2004	*Sanjeev GOYAL, Marco van der LEIJ and José Luis MORAGA-GONZÁLEZ* (lxx): Economics: An Emerging Small World?
CTN	85.2004	*Edward CARTWRIGHT* (lxx): Learning to Play Approximate Nash Equilibria in Games with Many Players
IEM	86.2004	*Finn R. FØRSUND and Michael HOEL*: Properties of a Non-Competitive Electricity Market Dominated by Hydroelectric Power
KTHC	87.2004	*Elissaios PAPYRAKIS and Reyer GERLAGH*: Natural Resources, Investment and Long-Term Income
CCMP	88.2004	*Marzio GALEOTTI and Claudia KEMFERT*: Interactions between Climate and Trade Policies: A Survey
IEM	89.2004	*A. MARKANDYA, S. PEDROSO and D. STREIMIKIENE*: Energy Efficiency in Transition Economies: Is There Convergence Towards the EU Average?
GG	90.2004	*Rolf GOLOMBEK and Michael HOEL* : Climate Agreements and Technology Policy
PRA	91.2004	*Sergei IZMALKOV* (lxv): Multi-Unit Open Ascending Price Efficient Auction
KTHC	92.2004	*Gianmarco I.P. OTTAVIANO and Giovanni PERI*: Cities and Cultures
KTHC	93.2004	*Massimo DEL GATTO*: Agglomeration, Integration, and Territorial Authority Scale in a System of Trading Cities. Centralisation versus devolution
CCMP	94.2004	*Pierre-André JOUVET, Philippe MICHEL and Gilles ROTILLON*: Equilibrium with a Market of Permits
CCMP	95.2004	*Bob van der ZWAAN and Reyer GERLAGH*: Climate Uncertainty and the Necessity to Transform Global Energy Supply
CCMP	96.2004	*Francesco BOSELLO, Marco LAZZARIN, Roberto ROSON and Richard S.J. TOL*: Economy-Wide Estimates of the Implications of Climate Change: Sea Level Rise
CTN	97.2004	*Gustavo BERGANTIÑOS and Juan J. VIDAL-PUGA*: Defining Rules in Cost Spanning Tree Problems Through the Canonical Form
CTN	98.2004	*Siddhartha BANDYOPADHYAY and Mandar OAK*: Party Formation and Coalitional Bargaining in a Model of Proportional Representation
GG	99.2004	*Hans-Peter WEIKARD, Michael FINUS and Juan-Carlos ALTAMIRANO-CABRERA*: The Impact of Surplus Sharing on the Stability of International Climate Agreements
SIEV	100.2004	*Chiara M. TRAVISI and Peter NIJKAMP*: Willingness to Pay for Agricultural Environmental Safety: Evidence from a Survey of Milan, Italy, Residents
SIEV	101.2004	*Chiara M. TRAVISI, Raymond J. G. M. FLORAX and Peter NIJKAMP*: A Meta-Analysis of the Willingness to Pay for Reductions in Pesticide Risk Exposure
NRM	102.2004	*Valentina BOSETTI and David TOMBERLIN:* Real Options Analysis of Fishing Fleet Dynamics: A Test
CCMP	103.2004	*Alessandra GORIA e Gretel GAMBARELLI:* Economic Evaluation of Climate Change Impacts and Adaptability in Italy
PRA	104.2004	*Massimo FLORIO and Mara GRASSENI*: The Missing Shock: The Macroeconomic Impact of British Privatisation
PRA	105.2004	*John BENNETT, Saul ESTRIN, James MAW and Giovanni URGA*: Privatisation Methods and Economic Growth in Transition Economies
PRA	106.2004	*Kira BÖRNER*: The Political Economy of Privatization: Why Do Governments Want Reforms?
PRA	107.2004	*Pehr-Johan NORBÄCK and Lars PERSSON*: Privatization and Restructuring in Concentrated Markets
SIEV	108.2004	*Angela GRANZOTTO, Fabio PRANOVI, Simone LIBRALATO, Patrizia TORRICELLI and Danilo MAINARDI*: Comparison between Artisanal Fishery and Manila Clam Harvesting in the Venice Lagoon by Using Ecosystem Indicators: An Ecological Economics Perspective
CTN	109.2004	*Somdeb LAHIRI*: The Cooperative Theory of Two Sided Matching Problems: A Re-examination of Some Results
NRM	110.2004	*Giuseppe DI VITA*: Natural Resources Dynamics: Another Look
SIEV	111.2004	*Anna ALBERINI, Alistair HUNT and Anil MARKANDYA*: Willingness to Pay to Reduce Mortality Risks: Evidence from a Three-Country Contingent Valuation Study
KTHC	112.2004	*Valeria PAPPONETTI and Dino PINELLI*: Scientific Advice to Public Policy-Making
SIEV	113.2004	*Paulo A.L.D. NUNES and Laura ONOFRI*: The Economics of Warm Glow: A Note on Consumer's Behavior and Public Policy Implications
IEM	114.2004	*Patrick CAYRADE*: Investments in Gas Pipelines and Liquefied Natural Gas Infrastructure What is the Impact on the Security of Supply?
IEM	115.2004	*Valeria COSTANTINI and Francesco GRACCEVA:* Oil Security. Short- and Long-Term Policies

IEM	116.2004	*Valeria COSTANTINI and Francesco GRACCEVA:* Social Costs of Energy Disruptions
IEM	117.2004	*Christian EGENHOFER, Kyriakos GIALOGLOU, Giacomo LUCIANI, Maroeska BOOTS, Martin SCHEEPERS, Valeria COSTANTINI, Francesco GRACCEVA, Anil MARKANDYA and Giorgio VICINI*: Market-Based Options for Security of Energy Supply
IEM	118.2004	*David FISK*: Transport Energy Security. The Unseen Risk?
IEM	119.2004	*Giacomo LUCIANI*: Security of Supply for Natural Gas Markets. What is it and What is it not?
IEM	120.2004	*L.J. de VRIES and R.A. HAKVOORT*: The Question of Generation Adequacy in Liberalised Electricity Markets
KTHC	121.2004	*Alberto PETRUCCI*: Asset Accumulation, Fertility Choice and Nondegenerate Dynamics in a Small Open Economy
NRM	122.2004	*Carlo GIUPPONI, Jaroslaw MYSIAK and Anita FASSIO*: An Integrated Assessment Framework for Water Resources Management: A DSS Tool and a Pilot Study Application
NRM	123.2004	*Margaretha BREIL, Anita FASSIO, Carlo GIUPPONI and Paolo ROSATO*: Evaluation of Urban Improvement on the Islands of the Venice Lagoon: A Spatially-Distributed Hedonic-Hierarchical Approach
ETA	124.2004	*Paul MENSINK*: Instant Efficient Pollution Abatement Under Non-Linear Taxation and Asymmetric Information: The Differential Tax Revisited
NRM	125.2004	*Mauro FABIANO, Gabriella CAMARSA, Rosanna DURSI, Roberta IVALDI, Valentina MARIN and Francesca PALMISANI*: Integrated Environmental Study for Beach Management:A Methodological Approach
PRA	126.2004	*Irena GROSFELD and Iraj HASHI*: The Emergence of Large Shareholders in Mass Privatized Firms: Evidence from Poland and the Czech Republic
CCMP	127.2004	*Maria BERRITTELLA, Andrea BIGANO, Roberto ROSON and Richard S.J. TOL*: A General Equilibrium Analysis of Climate Change Impacts on Tourism
CCMP	128.2004	*Reyer GERLAGH*: A Climate-Change Policy Induced Shift from Innovations in Energy Production to Energy Savings
NRM	129.2004	*Elissaios PAPYRAKIS and Reyer GERLAGH*: Natural Resources, Innovation, and Growth
PRA	130.2004	*Bernardo BORTOLOTTI and Mara FACCIO*: Reluctant Privatization
SIEV	131.2004	*Riccardo SCARPA and Mara THIENE*: Destination Choice Models for Rock Climbing in the Northeast Alps: A Latent-Class Approach Based on Intensity of Participation
SIEV	132.2004	*Riccardo SCARPA Kenneth G. WILLIS and Melinda ACUTT*: Comparing Individual-Specific Benefit Estimates for Public Goods: Finite Versus Continuous Mixing in Logit Models
IEM	133.2004	*Santiago J. RUBIO*: On Capturing Oil Rents with a National Excise Tax Revisited
ETA	134.2004	*Ascensión ANDINA DÍAZ*: Political Competition when Media Create Candidates' Charisma
SIEV	135.2004	*Anna ALBERINI*: Robustness of VSL Values from Contingent Valuation Surveys
CCMP	136.2004	*Gernot KLEPPER and Sonja PETERSON*: Marginal Abatement Cost Curves in General Equilibrium: The Influence of World Energy Prices
ETA	137.2004	*Herbert DAWID, Christophe DEISSENBERG and Pavel ŠEVČIK*: Cheap Talk, Gullibility, and Welfare in an Environmental Taxation Game
CCMP	138.2004	*ZhongXiang ZHANG*: The World Bank's Prototype Carbon Fund and China
CCMP	139.2004	*Reyer GERLAGH and Marjan W. HOFKES*: Time Profile of Climate Change Stabilization Policy
NRM	140.2004	*Chiara D'ALPAOS and Michele MORETTO*: The Value of Flexibility in the Italian Water Service Sector: A Real Option Analysis
PRA	141.2004	*Patrick BAJARI, Stephanie HOUGHTON and Steven TADELIS* (lxxi): Bidding for Incompete Contracts
PRA	142.2004	*Susan ATHEY, Jonathan LEVIN and Enrique SEIRA* (lxxi): Comparing Open and Sealed Bid Auctions: Theory and Evidence from Timber Auctions
PRA	143.2004	*David GOLDREICH* (lxxi): Behavioral Biases of Dealers in U.S. Treasury Auctions
PRA	144.2004	*Roberto BURGUET* (lxxi): Optimal Procurement Auction for a Buyer with Downward Sloping Demand: More Simple Economics
PRA	145.2004	*Ali HORTACSU and Samita SAREEN* (lxxi): Order Flow and the Formation of Dealer Bids: An Analysis of Information and Strategic Behavior in the Government of Canada Securities Auctions
PRA	146.2004	*Victor GINSBURGH, Patrick LEGROS and Nicolas SAHUGUET* (lxxi): How to Win Twice at an Auction. On the Incidence of Commissions in Auction Markets
PRA	147.2004	*Claudio MEZZETTI, Aleksandar PEKEČ and Ilia TSETLIN* (lxxi): Sequential vs. Single-Round Uniform-Price Auctions
PRA	148.2004	*John ASKER and Estelle CANTILLON* (lxxi): Equilibrium of Scoring Auctions
PRA	149.2004	*Philip A. HAILE, Han HONG and Matthew SHUM* (lxxi): Nonparametric Tests for Common Values in First-Price Sealed-Bid Auctions
PRA	150.2004	*François DEGEORGE, François DERRIEN and Kent L. WOMACK* (lxxi): Quid Pro Quo in IPOs: Why Bookbuilding is Dominating Auctions
CCMP	151.2004	*Barbara BUCHNER and Silvia DALL'OLIO*: Russia: The Long Road to Ratification. Internal Institution and Pressure Groups in the Kyoto Protocol's Adoption Process
CCMP	152.2004	*Carlo CARRARO and Marzio GALEOTTI*: Does Endogenous Technical Change Make a Difference in Climate Policy Analysis? A Robustness Exercise with the FEEM-RICE Model
PRA	153.2004	*Alejandro M. MANELLI and Daniel R. VINCENT* (lxxi): Multidimensional Mechanism Design: Revenue Maximization and the Multiple-Good Monopoly
ETA	154.2004	*Nicola ACOCELLA, Giovanni Di BARTOLOMEO and Wilfried PAUWELS*: Is there any Scope for Corporatism in Stabilization Policies?
CTN	155.2004	*Johan EYCKMANS and Michael FINUS*: An Almost Ideal Sharing Scheme for Coalition Games with Externalities
CCMP	156.2004	*Cesare DOSI and Michele MORETTO*: Environmental Innovation, War of Attrition and Investment Grants

CCMP	157.2004	*Valentina BOSETTI, Marzio GALEOTTI and Alessandro LANZA*: How Consistent are Alternative Short-Term Climate Policies with Long-Term Goals?
ETA	158.2004	*Y. Hossein FARZIN and Ken-Ichi AKAO*: Non-pecuniary Value of Employment and Individual Labor Supply
ETA	159.2004	*William BROCK and Anastasios XEPAPADEAS*: Spatial Analysis: Development of Descriptive and Normative Methods with Applications to Economic-Ecological Modelling
KTHC	160.2004	*Alberto PETRUCCI*: On the Incidence of a Tax on PureRent with Infinite Horizons
IEM	161.2004	*Xavier LABANDEIRA, José M. LABEAGA and Miguel RODRÍGUEZ*: Microsimulating the Effects of Household Energy Price Changes in Spain

NOTE DI LAVORO PUBLISHED IN 2005

CCMP	1.2005	*Stéphane HALLEGATTE*: Accounting for Extreme Events in the Economic Assessment of Climate Change
CCMP	2.2005	*Qiang WU and Paulo Augusto NUNES*: Application of Technological Control Measures on Vehicle Pollution: A Cost-Benefit Analysis in China
CCMP	3.2005	*Andrea BIGANO, Jacqueline M. HAMILTON, Maren LAU, Richard S.J. TOL and Yuan ZHOU*: A Global Database of Domestic and International Tourist Numbers at National and Subnational Level
CCMP	4.2005	*Andrea BIGANO, Jacqueline M. HAMILTON and Richard S.J. TOL*: The Impact of Climate on Holiday Destination Choice
ETA	5.2005	*Hubert KEMPF*: Is Inequality Harmful for the Environment in a Growing Economy?
CCMP	6.2005	*Valentina BOSETTI, Carlo CARRARO and Marzio GALEOTTI*: The Dynamics of Carbon and Energy Intensity in a Model of Endogenous Technical Change
IEM	7.2005	*David CALEF and Robert GOBLE*: The Allure of Technology: How France and California Promoted Electric Vehicles to Reduce Urban Air Pollution
ETA	8.2005	*Lorenzo PELLEGRINI and Reyer GERLAGH*: An Empirical Contribution to the Debate on Corruption Democracy and Environmental Policy
CCMP	9.2005	*Angelo ANTOCI*: Environmental Resources Depletion and Interplay Between Negative and Positive Externalities in a Growth Model
CTN	10.2005	*Frédéric DEROIAN*: Cost-Reducing Alliances and Local Spillovers
NRM	11.2005	*Francesco SINDICO*: The GMO Dispute before the WTO: Legal Implications for the Trade and Environment Debate
KTHC	12.2005	*Carla MASSIDDA*: Estimating the New Keynesian Phillips Curve for Italian Manufacturing Sectors
KTHC	13.2005	*Michele MORETTO and Gianpaolo ROSSINI*: Start-up Entry Strategies: Employer vs. Nonemployer firms
PRCG	14.2005	*Clara GRAZIANO and Annalisa LUPORINI*: Ownership Concentration, Monitoring and Optimal Board Structure
CSRM	15.2005	*Parashar KULKARNI*: Use of Ecolabels in Promoting Exports from Developing Countries to Developed Countries: Lessons from the Indian LeatherFootwear Industry
KTHC	16.2005	*Adriana DI LIBERTO, Roberto MURA and Francesco PIGLIARU*: How to Measure the Unobservable: A Panel Technique for the Analysis of TFP Convergence
KTHC	17.2005	*Alireza NAGHAVI*: Asymmetric Labor Markets, Southern Wages, and the Location of Firms
KTHC	18.2005	*Alireza NAGHAVI*: Strategic Intellectual Property Rights Policy and North-South Technology Transfer
KTHC	19.2005	*Mombert HOPPE*: Technology Transfer Through Trade
PRCG	20.2005	*Roberto ROSON*: Platform Competition with Endogenous Multihoming
CCMP	21.2005	*Barbara BUCHNER and Carlo CARRARO*: Regional and Sub-Global Climate Blocs. A Game Theoretic Perspective on Bottom-up Climate Regimes
IEM	22.2005	*Fausto CAVALLARO*: An Integrated Multi-Criteria System to Assess Sustainable Energy Options: An Application of the Promethee Method
CTN	23.2005	*Michael FINUS, Pierre v. MOUCHE and Bianca RUNDSHAGEN*: Uniqueness of Coalitional Equilibria
IEM	24.2005	*Wietze LISE*: Decomposition of CO2 Emissions over 1980–2003 in Turkey
CTN	25.2005	*Somdeb LAHIRI*: The Core of Directed Network Problems with Quotas
SIEV	26.2005	*Susanne MENZEL and Riccardo SCARPA*: Protection Motivation Theory and Contingent Valuation: Perceived Realism, Threat and WTP Estimates for Biodiversity Protection
NRM	27.2005	*Massimiliano MAZZANTI and Anna MONTINI*: The Determinants of Residential Water Demand Empirical Evidence for a Panel of Italian Municipalities
CCMP	28.2005	*Laurent GILOTTE and Michel de LARA*: Precautionary Effect and Variations of the Value of Information
NRM	29.2005	*Paul SARFO-MENSAH*: Exportation of Timber in Ghana: The Menace of Illegal Logging Operations
CCMP	30.2005	*Andrea BIGANO, Alessandra GORIA, Jacqueline HAMILTON and Richard S.J. TOL*: The Effect of Climate Change and Extreme Weather Events on Tourism
NRM	31.2005	*Maria Angeles GARCIA-VALIÑAS*: Decentralization and Environment: An Application to Water Policies
NRM	32.2005	*Chiara D'ALPAOS, Cesare DOSI and Michele MORETTO*: Concession Length and Investment Timing Flexibility
CCMP	33.2005	*Joseph HUBER*: Key Environmental Innovations
CTN	34.2005	*Antoni CALVÓ-ARMENGOL and Rahmi İLKILIÇ* (lxxii): Pairwise-Stability and Nash Equilibria in Network Formation
CTN	35.2005	*Francesco FERI* (lxxii): Network Formation with Endogenous Decay
CTN	36.2005	*Frank H. PAGE, Jr. and Myrna H. WOODERS* (lxxii): Strategic Basins of Attraction, the Farsighted Core, and Network Formation Games

CTN	37.2005	*Alessandra CASELLA and Nobuyuki HANAKI* (lxxii): Information Channels in Labor Markets. On the Resilience of Referral Hiring
CTN	38.2005	*Matthew O. JACKSON and Alison WATTS* (lxxii): Social Games: Matching and the Play of Finitely Repeated Games
CTN	39.2005	*Anna BOGOMOLNAIA, Michel LE BRETON, Alexei SAVVATEEV and Shlomo WEBER* (lxxii): The Egalitarian Sharing Rule in Provision of Public Projects
CTN	40.2005	*Francesco FERI*: Stochastic Stability in Network with Decay
CTN	41.2005	*Aart de ZEEUW* (lxxii): Dynamic Effects on the Stability of International Environmental Agreements
NRM	42.2005	*C. Martijn van der HEIDE, Jeroen C.J.M. van den BERGH, Ekko C. van IERLAND and Paulo A.L.D. NUNES*: Measuring the Economic Value of Two Habitat Defragmentation Policy Scenarios for the Veluwe, The Netherlands
PRCG	43.2005	*Carla VIEIRA and Ana Paula SERRA*: Abnormal Returns in Privatization Public Offerings: The Case of Portuguese Firms
SIEV	44.2005	*Anna ALBERINI, Valentina ZANATTA and Paolo ROSATO*: Combining Actual and Contingent Behavior to Estimate the Value of Sports Fishing in the Lagoon of Venice
CTN	45.2005	*Michael FINUS and Bianca RUNDSHAGEN:* Participation in International Environmental Agreements: The Role of Timing and Regulation
CCMP	46.2005	*Lorenzo PELLEGRINI and Reyer GERLAGH*: Are EU Environmental Policies Too Demanding for New Members States?
IEM	47.2005	*Matteo MANERA*: Modeling Factor Demands with SEM and VAR: An Empirical Comparison
CTN	48.2005	*Olivier TERCIEUX and Vincent VANNETELBOSCH* (lxx): A Characterization of Stochastically Stable Networks
CTN	49.2005	*Ana MAULEON, José SEMPERE-MONERRIS and Vincent J. VANNETELBOSCH* (lxxii): R&D Networks Among Unionized Firms
CTN	50.2005	*Carlo CARRARO, Johan EYCKMANS and Michael FINUS*: Optimal Transfers and Participation Decisions in International Environmental Agreements
KTHC	51.2005	*Valeria GATTAI*: From the Theory of the Firm to FDI and Internalisation:A Survey
CCMP	52.2005	*Alireza NAGHAVI*: Multilateral Environmental Agreements and Trade Obligations: A Theoretical Analysis of the Doha Proposal
SIEV	53.2005	*Margaretha BREIL, Gretel GAMBARELLI and Paulo A.L.D. NUNES*: Economic Valuation of On Site Material Damages of High Water on Economic Activities based in the City of Venice: Results from a Dose-Response-Expert-Based Valuation Approach
ETA	54.2005	*Alessandra del BOCA, Marzio GALEOTTI, Charles P. HIMMELBERG and Paola ROTA*: Investment and Time to Plan: A Comparison of Structures vs. Equipment in a Panel of Italian Firms
CCMP	55.2005	*Gernot KLEPPER and Sonja PETERSON*: Emissions Trading, CDM, JI, and More – The Climate Strategy of the EU
ETA	56.2005	*Maia DAVID and Bernard SINCLAIR-DESGAGNÉ*: Environmental Regulation and the Eco-Industry
ETA	57.2005	*Alain-Désiré NIMUBONA and Bernard SINCLAIR-DESGAGNÉ*: The Pigouvian Tax Rule in the Presence of an Eco-Industry
NRM	58.2005	*Helmut KARL, Antje MÖLLER, Ximena MATUS, Edgar GRANDE and Robert KAISER*: Environmental Innovations: Institutional Impacts on Co-operations for Sustainable Development
SIEV	59.2005	*Dimitra VOUVAKI and Anastasios XEPAPADEAS*: Criteria for Assessing Sustainable Development: Theoretical Issues and Empirical Evidence for the Case of Greece
CCMP	60.2005	*Andreas LÖSCHEL and Dirk T.G. RÜBBELKE*: Impure Public Goods and Technological Interdependencies

(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

(lxxi) This paper was presented at the EuroConference on “Auctions and Market Design: Theory, Evidence and Applications”, organised by Fondazione Eni Enrico Mattei and Consip and sponsored by the EU, Rome, September 23-25, 2004

(lxxii) This paper was presented at the 10th Coalition Theory Network Workshop held in Paris, France on 28-29 January 2005 and organised by EUREQua.

2004 SERIES	
CCMP	*Climate Change Modelling and Policy* (Editor: Marzio Galeotti)
GG	*Global Governance* (Editor: Carlo Carraro*)*
SIEV	*Sustainability Indicators and Environmental Valuation* (Editor: Anna Alberini)
NRM	*Natural Resources Management* (Editor: Carlo Giupponi)
KTHC	*Knowledge, Technology, Human Capital* (Editor: Gianmarco Ottaviano)
IEM	*International Energy Markets* (Editor: Anil Markandya)
CSRM	*Corporate Social Responsibility and Sustainable Management* (Editor: Sabina Ratti)
PRA	*Privatisation, Regulation, Antitrust* (Editor: Bernardo Bortolotti)
ETA	*Economic Theory and Applications* (Editor: Carlo Carraro)
CTN	*Coalition Theory Network*

2005 SERIES	
CCMP	*Climate Change Modelling and Policy* (Editor: Marzio Galeotti)
SIEV	*Sustainability Indicators and Environmental Valuation* (Editor: Anna Alberini)
NRM	*Natural Resources Management* (Editor: Carlo Giupponi)
KTHC	*Knowledge, Technology, Human Capital* (Editor: Gianmarco Ottaviano)
IEM	*International Energy Markets* (Editor: Anil Markandya)
CSRM	*Corporate Social Responsibility and Sustainable Management* (Editor: Sabina Ratti)
PRCG	*Privatisation Regulation Corporate Governance* (Editor: Bernardo Bortolotti)
ETA	*Economic Theory and Applications* (Editor: Carlo Carraro)
CTN	*Coalition Theory Network*