

Markandya, Anil; Rübhelke, Dirk T.G.

Working Paper

Ancillary Benefits of Climate Policy

Nota di Lavoro, No. 105.2003

Provided in Cooperation with:

Fondazione Eni Enrico Mattei (FEEM)

Suggested Citation: Markandya, Anil; Rübhelke, Dirk T.G. (2003) : Ancillary Benefits of Climate Policy, Nota di Lavoro, No. 105.2003, Fondazione Eni Enrico Mattei (FEEM), Milano

This Version is available at:

<http://hdl.handle.net/10419/118135>

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.

Ancillary Benefits of Climate Policy

Anil Markandya and Dirk T.G. Rübelke

NOTA DI LAVORO 105.2003

DECEMBER 2003

CLIM – Climate Change Modelling and Policy

Anil Markandya, *FEEM, ECSSD, The World Bank Group, Washington D.C., USA*
Dirk T.G. Rübelke, *Department of Economics, Chemnitz University of Technology*
Chemnitz, Germany

This paper can be downloaded without charge at:

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

Ancillary Benefits of Climate Policy

Summary

The benefits of climate policy normally consist exclusively of the reduced impacts of climate change, i.e., the policy's primary aim. Our analysis of benefits of climate policy suggests, however, that researchers and policymakers should also take account of ancillary benefits, e.g., in the shape of improved air quality induced by climate protection measures. A consideration of both, primary and ancillary benefits, has a positive influence on global climate protection efforts, e.g., because the regional impact of ancillary effects attenuates easy-riding motives of countries with respect to their provision of climate protection. In this article, we analyze the nature of ancillary benefits, present an overview of European assessment studies and explain possible methods to estimate ancillary benefits. Main differences between primary and ancillary benefits are pointed out. Furthermore, we stress the major influences of ancillary benefits on climate policy. Finally, we present one of the first models integrating primary and ancillary benefits. By this model quantitative results are calculated with respect to ancillary benefits in the UK considering different green-house gas (GHG) control levels. It is observed that the ancillary benefits could cover about 4 percent of the full GHG reduction cost.

Keywords: Climate Policy, Ancillary Benefits, Pollution Control

JEL: H41, Q28

Address for correspondence:

Anil Markandya
Lead Economist, ECSSD
The World Bank, Mail Stop H5-503
1818 H Street NW
Washington DC 20433
USA
Phone: 202 473 9266
Fax: 202 614 0696
E-mail: amarkandya@worldbank.org

1 Ancillary Benefits

Climate policies initiate the reduction of atmospheric and biospheric GHG concentrations, and hence, the slowing of global warming, which provides primary benefits. But what has been widely omitted so far in the economic literature on climate change is that climate policies also induce ancillary benefits, i.e., benefits which result from climate policies but not from the slowing of climate change.¹ Since primary benefits are intensely discussed in the scientific literature, we mainly focus on the discussion of ancillary benefits. These ancillary benefits are not only considerable in size, they also exhibit characteristics which are different to those of primary benefits. Hence, the consideration of ancillary benefits has not only quantitative impacts with respect to the results of cost-benefit analyses, it additionally induces qualitative effects. Different climate policies have different impacts and may initiate different concrete actions reducing GHG concentrations. Consequently, they imply different ancillary benefits. This is illustrated by considering the control of the most important greenhouse gas CO_2 by way of example. Climate policies which intend to reduce CO_2 concentrations mainly initiate the reduction of CO_2 emissions (sequestration of carbon would be another option):

Implications of the Reductions of Carbon Dioxide Emissions:

Fuel combustion reductions - e.g. caused by the implementation of more efficient technologies or the reduction of road traffic - and the *substitution of carbon-intensive fuels* reduce CO_2 emissions. Ancillary benefits induced by activities reducing CO_2 emissions accrue from the abatement of non- CO_2 emissions, for example. In fuel combustion processes CO_2 emissions are accompanied by emissions of e.g. CO , NO_x , SO_2 , N_2O , CH_4 and particulate matter (PM). Therefore, measures reducing CO_2 not only cause a decrease in CO_2 emissions but also an emission reduction of other pollutants. In general, positive health effects of air pollution reduction that accompany GHG control are considered to represent the most important category of ancillary benefits (see e.g. Ayres and Walter (1991: 258) as well as Heintz and Tol (1996: 7)). According to Olsthoorn et al. (1999: 345) mortality is the crucial effect in the economic valuation of health effects. Other negative impacts of air pollution like accelerated surface corrosion, weathering of materials and impaired visibility are also mitigated by fuel combustion reductions. Improved air quality also causes

¹The term ancillary benefits is one of a number used to convey this idea. The others are secondary benefits, or co-benefits or spillover benefits (see IPCC 2001). The main difference is the relative emphasis given to the climate change mitigation benefits versus the other benefits. For some policies these 'other benefits' may be as important as the GHG reduction benefits, in which case the term 'co-benefits' is more appropriate. Indeed, the 3rd Assessment Report of IPCC prefers the term co-benefits on the grounds that it makes 'the case for an integrated approach, linking climate change mitigation to the achievement of sustainable development and other policy objectives' (IPCC 2001: 461). In this paper we stay with the term ancillary benefits simply on the grounds that it is more commonly used and understood. The types of impacts being covered, however, are the same as those discussed under each of their labels.

a reduction of the vegetation harming acidic deposition of photochemical oxidants. Furthermore, road traffic reduction as a means to reduce fuel combustion generates not only ancillary benefits by reducing the emission of air pollutants: less road traffic is also accompanied by lower noise levels and frequency of accidents, less traffic congestion and road surface damage. Only a minority of studies considers these non-pollution-specific ancillary benefits in the transport sector (as can be easily observed from the overview of European studies on ancillary benefits in Table 1). But though these benefits are regularly assessed to be small in comparison to the ancillary benefits arising from less air pollution, they are not negligible as e.g. Barker, Johnstone and O'Shea (1993) illustrate.

Measures reducing CO_2 emissions could also cause ancillary costs (Burtraw and Toman 2000a: 3). A switch from fossil fuels like oil, gas or coal in the generation of electricity to the application of nuclear technologies reduces CO_2 emissions but also causes negative externalities. External costs from nuclear electricity generation accrue e.g. from the higher risk of catastrophic accidents in power plants (Ewers and Rennings 1996: 418-419).

Ancillary benefits might also stem from the act of protecting the global climate itself (Rübbelke 2002: 13-14). Industrialized countries may enjoy a kind of 'warm glow' from supporting developing countries by mitigating global warming: "*A strong argument for trying seriously to slow climate change is that the developing countries are vulnerable and we care*" (Schelling 1992: 7). Climate protection can, therefore, be considered like a charitable giving to developing countries.² Some industrialized countries may also 'feel' guilty since the industrialized world represents the group of main GHG emitter countries, and is, thus, mainly responsible for the anthropogenic greenhouse effect.³ Consequently, a contribution to the mitigation of the greenhouse effect may relieve their conscience. This 'relief' may also be considered as a secondary effect of GHG control from which industrialized countries enjoy ancillary benefits.

Some authors consider ancillary benefits of climate policies that are associated with employment effects or technological change: By levying carbon taxes, funds are collected which could be used to remove distortionary labor taxes, i.e. taxes which raise labor cost and induce a sub-optimal low employment of labor force. With it, the price of the factor labor declines and employment is raised. In recent years a large strand of literature discussed double dividends of environmental tax schemes which recycle revenues by reducing labor cost.⁴ Not all contributions supported the

² "*Any action combating global warming will be, intended or not, a foreign aid program*" (Schelling 1997: 8).

³ "*The OECD is often held responsible for the larger part of the enhancement of the greenhouse effect while non-OECD countries appear to be the main victims of climate change*" (Tol et al. 1995: 59).

⁴ The dividends of such revenue recycling are on the one hand the carbon-tax induced improvement of environmental quality and on the other hand the increase of employment by reducing labor costs. For the double dividend debate see e.g. Bovenberg and de Mooij (1994); Goulder (1995);

double dividend hypothesis. With respect to technological change, Pearce (2000: 11) stresses that technological improvements induced by climate policies might diffuse outside of the sectors targeted for GHG control. Benefits associated with these spillover effects may also be regarded as ancillary benefits of climate policy.

2 European Studies

European studies of ancillary benefits show that secondary benefits are substantial. One of the earliest attempts to integrate secondary benefits into a cost-benefit analysis of GHG control was undertaken by Ayres and Walter (1991). They criticized the influential studies of Nordhaus, since these did not consider secondary benefits and thus, provided too low estimates of GHG control benefits. This view has been supported by Pearce (1992: 7), who points out that Nordhaus (1991a,b) has omitted a major category of benefits by neglecting the secondary benefit category.⁵

European models assessing ancillary benefits are heterogeneous from a methodological as well as from a geographical point of view. A couple of studies deal with Scandinavian countries. Glomsrød, Vennemo and Johnsen (1992) estimate secondary benefits in a computable general equilibrium model for Norway. They investigate a carbon-tax-induced CO_2 stabilization and consider the secondary benefits associated with an air pollution decrease as well as a transport activity reduction. Alfsen, Brendemoen and Glomsrød (1992) employ a macroeconomic model to assess ancillary benefits related to changes in air pollution and road traffic in Norway. Håkonsen and Mathiesen (1997) refer to the externality cost estimates provided by Alfsen, Brendemoen and Glomsrød (1992) in their general equilibrium analysis of ancillary benefits of CO_2 stabilization in Norway. A different approach is chosen by Alfsen, Birkelund and Aaserud (1995), who assess the reductions in the abatement costs required to meet the Sofia Protocol and the Helsinki Protocol brought about by an EC Carbon/Energy Tax for nine western European countries. Yet, they neglect traffic related benefits of CO_2 control. In contrast, Barker, Johnstone and O'Shea (1993) focus on measuring the importance of traffic related benefits of a carbon/energy tax in the UK and omit the benefits of reduced air pollution.

Meyer et al. (1998; 1999) and Lutz (1998) simulate the effects of CO_2 tax and permit schemes on emissions of non- CO_2 pollutants and CO_2 for Germany, but do not translate the secondary effects into monetary values. Their simulations, based on an econometric model, suggest that there are important air quality improvements associated with CO_2 control policies in Germany. Complainville and Martins (1994) consider emissions of CO_2 , SO_X and NO_X in a dynamic general equilibrium model (OECD GREEN). Their results suggest that air quality improvements may be as significant in developing countries as they are in industrialized countries. Morgen-

Kirchgässner (1996) as well as de Mooij (1999).

⁵ Nordhaus (1991b: 928) himself has pointed to the problem that his “*calculations omit other potential market failures, such as ozone depletion or air pollution*”.

Source	Region	Consideration of Ancillary Effects Associated with	Comments
Ayres and Walter (1991)	Western Germany, USA	air pollution	
Alfsen, Brendemoen and Glomsrød (1992)	Norway	air pollution and road traffic	
Glomsrød, Vennemo and Johnsen (1992)	Norway	air pollution and road traffic	
Pearce (1992)	UK, Norway	air pollution	
Barker (1993)	UK, USA, Norway	air pollution	two different methods of valuing benefits of emission reduction are considered
Barker, Johnstone and O'Shea (1993)	UK	road traffic, but no air pollution	
Brendemoen and Vennemo (1994)	Norway	air pollution and road traffic	
Complainville and Martins (1994)	world-wide	air pollution	oxides of nitrogen, oxides of sulphur, and carbon dioxide are reconsidered; not translated into monetary benefits
Alfsen, Birkelund and Aaserud (1995)	nine western European countries	air pollution	reduced technological abatement cost of reaching environmental targets are reconsidered
Ekins (1996a)	UK, Germany	air pollution	the analysis finds that these secondary benefits from abating sulphur dioxide alone beyond the limits of the Second Sulphur Protocol provide a substantial offset to the costs of a carbon tax
Aaheim, Aunan and Seip (1997)	Hungary	air pollution	
Håkonsen and Mathiesen (1997)	Norway	air pollution and road traffic	
Lutz (1998)	Western Germany	air pollution	not translated into monetary benefits
Meyer et al. (1998)	Western Germany	air pollution	not translated into monetary benefits
Capro et al. (1999)	European Union	air pollution	
Meyer et al. (1999)	Germany	air pollution	not translated into monetary benefits
Aunan, Aaheim and Seip (2000)	Hungary	air pollution	
Barker and Rosendahl (2000)	19 regions of Western Europe	air pollution	oxides of nitrogen, sulphur dioxide, some fine air-borne particles, and carbon dioxide are reconsidered
RIVM et al. (2000)	European Union	air pollution	data which consider ancillary effects from road traffic are also employed (see the first method, page 63)
Sommer et al. (2000)	Austria, France and Switzerland	air pollution	

Table 1: European Studies on Ancillary Benefits (Rübelke 2002: 19).

stern (2000: 7) stresses that the limited literature on ancillary benefits in developing countries suggests that the ancillary benefits there are even higher than in the US. Studies investigating regions outside industrialized countries are provided e.g. by Wang and Smith (1999a,b); Aunan et al. (2000) as well as Garbaccio, Ho and Jorgenson (2000) who analyze ancillary benefits in China, and Dessus and O'Connor (1999) as well as Cifuentes et al. (2000) who regard co-benefits of GHG control in Chile. Aaheim, Aunan and Seip (1997) as well as Aunan, Aaheim and Seip (2000) investigate ancillary benefits of energy saving in Hungary.

Ayres and Walter (1991) were among the first researchers who compared European ancillary benefit estimates with estimates for the US. They found out that ancillary benefits in Germany are likely to exceed those in the US, which might be due to the fact that the population density in Germany is higher than in the US.⁶ That population density matters for the importance of ancillary benefits is supported by Burtraw and Toman (1997: 22; 2000a: 10, 15; 2000b: 23) as well as Burtraw et al. (1999: 15). They compare European and US estimates of ancillary benefits, too. With respect to the European assessments their main focus is on a survey of studies provided by Ekins (1996a). Burtraw and Toman (1997: 21-22; 2000a: 15; 2000b: 23) as well as Burtraw et al. (1999: 15) point out that the discrepancies between the high European assessments and the US data may also be due to geographic differences. A greater proportion of sulfur emissions in the Eastern US is deposited off-shore rather than on-shore as in Europe. Apart from the demographic and geographic arguments, the discrepancies between the US and European studies considered by Burtraw and Toman (1997; 2000a,b) as well as Burtraw et al. (1999) are attributable to several other factors, e.g. the more aggregate level of modelling in the European studies (Burtraw et al. 1999: 15; Burtraw and Toman 2000b: 23), high economic valuations of environmental impacts employed by the European researchers (Morgenstern 2000: 7-8), and the application of a fixed coefficient procedure in the considered European studies (which does not allow for the possibilities of substitution in production, and therefore results in higher damage costs) (e.g. Pearce 1992 and Barker 1993).

3 Primary vs Ancillary Benefits

Primary and ancillary benefits can in general be distinguished with respect to the degree of publicness, the delay of occurrence and the scientific knowledge required for the assessment:

- *Publicness*: Primary benefits are global, while ancillary benefits are local or regional (IPCC 1996: 217; Pearce 1992: 5). Therefore, ancillary effects of climate policies have mainly the character of a private good to the policy

⁶ More recent estimates of ancillary benefits for western European regions provided by Barker and Rosendahl (2000) also exceed the estimates found in studies for the US, although the Barker/Rosendahl results are below the results found in earlier European studies.

providing region or country. This contrasts sharply with the primary effect because the mitigation of global warming is a global public good, i.e., everyone can enjoy this good without affecting other agents' consumption of it and nobody can be excluded from the consumption. Thus, a country's provision of climate policy can be considered as an impure public good since it contains pure public as well as private characteristics.⁷

- *Delay:* The intervals between the implementation of a GHG abatement policy and the occurrence of benefits differ among primary and secondary benefits. Secondary benefits can be enjoyed widely in the present, since the avoided damages, e.g. from air pollution or noise, would have otherwise occurred immediately or shortly after the GHG emitting activity.⁸ Primary benefits of GHG abatement on the other hand arise with a delay of about a half century. If economists discount benefits with a positive rate,⁹ today's ancillary benefits get a higher weight compared to the primary benefits in distant future. The time lag between GHG abatement measures and the occurrence of primary benefits raises questions on the 'correct' discount rate and, consequently ambiguity with respect to the assessment of these future benefits.
- *Required Scientific Knowledge:* A prerequisite to assess primary benefits is an immense knowledge of processes in local spheres *and* the whole global system. Because knowledge especially of processes in a global context is incomplete, uncertainties accompany the assessment of primary benefits which exceed the ones associated with the assessment of ancillary benefits.¹⁰

The claim that ancillary benefits arise only from avoided damages affecting the emitting region may hold as long as CO_2 control is regarded. It would not hold anymore if abatement of greenhouse gases such as CFCs is considered (Rübelke 2002: 23). The abatement of CFCs generates an important positive ancillary effect by protecting the ozone layer. The benefits enjoyed from this effect obviously represent *global* ancillary benefits.

4 Ancillary Benefit Modelling

Much of the discussion on ancillary benefits has focused on what would be gained from the associated reductions of other pollutants when greenhouse gas reductions

⁷For a discussion of climate policy as an impure public good, see Rübelke (2003).

⁸ "Unlike the benefits of reducing CO_2 emissions now in order to reduce damage from global warming in the future, reducing other emissions, which are causing damage now, yields benefits immediately" (Ekins 1996b: 15).

⁹Economists regularly discount future costs and benefits, e.g., because it is assumed that the present welfare level of people is more important from a politician's point of view than the welfare level of people living in future.

¹⁰ For the uncertainties surrounding the estimates of ancillary benefits and costs see Krupnick, Burtraw and Markandya (1999: 33-34).

are targeted. What is missing, however, is an analysis of the overall scope for such reductions, taking account of the fact that government has already undertaken measures to reduce non GHG emissions, and taking account of the fact that an optimal policy needs to balance the losses of output against the combined benefits of GHG and non GHG reductions in emissions.

In the appendix we present a simple but effective model to look at the scope for, and the amount of, ancillary benefits in this context. The model assumes that before climate change became an issue, governments concerned themselves only with the control of the 'ancillary' pollutants. They set their policies so as to limit emissions of these pollutants to the point where the marginal costs of reductions in the pollutants were equal to the benefits in the form of reductions in emissions. Once climate change became an issue, however, they had a new problem to solve - that of achieving a reduction in the emissions of greenhouse gases as well as paying attention to the ancillary pollutants. The model formalizes these choices and the solutions and compares them numerically. Data are taken from the UK to demonstrate the methodology and to show the impacts of reductions in GHG emissions in the range of 5-30 percent from the status quo.¹¹

A key issue in ancillary benefit modelling is to determine the level of ancillary benefits in the absence of GHG impacts. We have to assume that the level of ancillary related activities are determined in something approaching an optimal way and then see how they change when GHG considerations are brought in. In the model presented we work with ancillary benefits arising from fossil fuel emissions only.

The main results of our model is that we can report the implied estimates of ancillary benefits for

- (a) ancillary emissions that are 33 to 50 percent below maximum emissions in the absence of any climate change policy (i.e. for domestic pollution control reasons),
- (b) 'optimal' reductions in GHG emissions that range from 5 percent to 30 percent below 1999 levels.

The results are presented in Table 2, which shows:

- a. Additional ancillary emissions reductions resulting from introducing a GHG policy with a CO_2 price of \$10/MT are in the range of 3 to 6 percent, which is not so wide, given that the optimal reductions they cover range from 5 percent to 30 percent of baseline GHG emissions and the assumed optimal reductions in non GHG range for 33 to 50 percent of the maximum non GHG emissions.
- b. The ancillary benefits range from \$0.7 to 1.7 billion, which are about 4 percent of the full costs of the GHG reduction.

¹¹ It should be noted that the actual values are only indicative; a full deployment of this model would need a more careful and detailed analysis of the data.

OptimalReductioninNonGHG Emissions=33%	OptimalReductioninGH			GEmissions(%)		
	5	10	15	20	25	30
EstimateofAncillaryBenefit						
%ReductioninEmissions.	2.6	4	5.00	5.7	6.17	6.45
Benefitsin\$BN.	0.71	1.1	1.36	1.54	1.66	1.74
CostofGHGPolicywithoutAB						
In\$BN.	16.98	26.18	32.43	36.74	39.60	41.30
As%ofNoControlGDP.	1.16	1.78	2.20	2.48	2.67	2.78
CostofGHGPolicywithAB						
In\$BN.	16.26	25.2	31.07	35.20	37.94	39.56
As%ofNoControlGDP.	1.11	1.72	2.11	2.38	2.56	2.66
ABaspercentageoftotalcosts	4.18%	4.20%	4.19%	4.19%	4.19%	4.21%
OptimalReductioninNonGHG Emissions=50%	OptimalReductioninGH			GEmissions(%)		
	5	10	15	20	25	30
EstimateofAncillaryBenefit						
%ReductioninEmissions.	2.6	4	3.63	4.13	4.46	4.66
Benefitsin\$BN.	0.71	1.1	1.21	1.38	1.48	1.55
CostofGHGPolicywithoutAB						
In\$BN.	16.98	26.18	32.43	36.74	39.60	41.30
As%ofNoControlGDP.	1.12	1.78	2.2	2.48	2.67	2.78
CostofGHGPolicywithAB						
In\$BN.	16.45	25.37	31.42	35.60	38.37	40
As%ofNoControlGDP.	1.13	1.73	2.13	2.41	2.59	2.69
ABaspercentageoftotalcosts	4.18%	4.20%	3.73%	3.76%	3.74%	3.75%

Table 2: Ancillary Benefits and Cost of GHG Policy

- c. GHG reduction costs are in the range of 1.1 to 2.8 percent of GDP, depending on what is considered the optimal level of reduction.

5 Ancillary Benefits and Climate Policy

There are several differences between primary and ancillary benefits of climate policy, which have qualitative as well as quantitative impacts. The immediate occurrence of ancillary benefits makes discounting unnecessary and gives these benefits a higher weight compared to primary benefits which are expected in distant future. The requirement of scientific knowledge to assess primary benefits exceeds the one of the estimate of ancillary benefits. Therefore, less ambiguity is associated with the assessment of ancillary benefits. Furthermore, ancillary benefits could have a considerable impact on the GHG abatement levels as well as a privatizing impact on the 'global public good' nature of climate policy. The privatizing effect is induced by the private character of ancillary benefits: ancillary benefits are national/regional, while primary benefits are global. Consequently, climate policy should be treated as an impure public good from an individual country's point of view. The privatizing impact of ancillary benefits helps to narrow the gap between an individual country's optimal and the Pareto-efficient abatement level. Furthermore, as a result of the privatizing effect, easy-riding motives are attenuated (Cornes and Sandler 1994). The impure publicness is also of importance when international transfers as a means to increase the level of GHG abatement are considered. The neutrality of transfers does not hold if the public goods involved are of an 'impure' variety (see, e.g., Andreoni (1986; 1989; 1990)).

According to quantitative aspects, our simple model shows that additional ancillary emissions reductions resulting from introducing a GHG policy with a CO_2 price of \$10/MT are in the range of 3 to 6 percent. Furthermore, ancillary benefits would cover about 4 percent of the full GHG reduction cost.

The simple model developed here can be extended in the following directions:

- a. The fossil fuels can be separated so that each is treated individually.
- b. More sophisticated production functions can be used (e.g., CES).
- c. A range of values for the price of GHG emissions can be tried.

In spite of its great simplicity, however, the present version offers some real insights into the magnitude and relative importance of ancillary benefits at a macro level. Furthermore, the model itself tends to estimate low ancillary benefits as a percentage of the GHG reduction costs because it derives itself from a model of costs that is 'macro' or 'top down' based. It is well known that such costs are generally higher than those from a more 'bottom up' or mixed basis.

Therefore and in order to prevent the impression that ancillary benefits are negligible, we finally point out that the European ancillary benefit literature widely estimates higher ancillary benefits as a percentage/multiple of primary benefits than our paper does. As Pearce (2000) illustrates, European ancillary benefit studies estimate ancillary benefits as a multiple of primary benefits of between 0.98 and 6.93. However, newer estimates tend to be lower than the ones in the early 1990ies. And

yet, there are US studies on ancillary benefits which are very close to our results. Estimates (as a multiple of primary benefits) are between 0.07 and 6.67 in Pearce's overview. Considering such comparisons of studies is of course a questionable issue since almost all studies reveal to different kinds of ancillary benefits, different geographical regions and use different models of costs. We think it should be to the reader which modelling he believes to be adequate. And we share the view that ancillary benefits are an important category of benefits but it is likely to be much more important to developing and transformation countries than for the UK.

A Appendix

Define the following variables

Y_0 = Level of economic activity (e.g. as measured by GDP in \$BN.),

Y_1 = Reduction of level of ancillary emissions from a no control level (000 MT),

Y_2 = Reduction of level of GHG emissions from a no control level (000 MT),

P_0 = Price of output (=1 since only relative prices are of interest here, in \$BN.),

P_1 = “Price” of ancillary emissions, based on marginal damages (\$BN/000 MT),

P_2 = Price of GHG emissions (\$BN/000 MT, based on targets set by international agreements).

From the producer’s perspective what matters is the reduction in emissions he is required to make, always measured of course from the maximum desired emissions. From a consumer’s perspective, however, what matters is the difference between maximum emissions and the reductions. The present formulation allows both these perspectives to be represented.

In a world before climate change was an issue $P_2 = 0$ and the country obtained the solution values

$$Y_{0*}, Y_{1*}, Y_{2*}$$

as determined by

$$\max \quad Y_0 + P_1 Y_1 \quad (1)$$

$$\text{s.t.} \quad Y_0 = F(Y_1, Y_2). \quad (2)$$

In other words, emissions allow production and the lower the level of emissions the lower will be production. Of course other inputs are also needed but we can hold these constant for the time being. We can assume this production function has the usual properties of concavity.

In the post climate change world the country seeks to solve the following problem:

$$\max \quad Y_0 + P_1 Y_1 + P_2 Y_2 \quad (3)$$

$$\text{s.t.} \quad Y_0 = F(Y_1, Y_2). \quad (4)$$

The new solution is given by

$$Y_{0+}, Y_{1+}, Y_{2+}.$$

The following points may be observed:

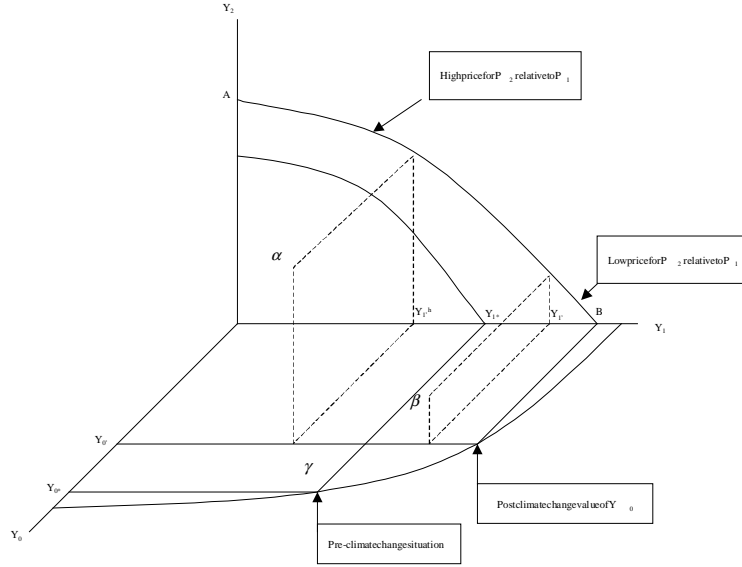


Figure 1: Emissions and Output

- We would expect $Y_{2+} > Y_{2*}$. Emissions of GHG should decline as the price rises. But we cannot guarantee that $Y_{1+} > Y_{1*}$. This will depend on how strongly complementary ancillary and GHG emissions are.
- Assuming $Y_{1+} > Y_{1*}$ we can formally define ancillary benefits as:

$$\bar{P}(Y_{1+} - Y_{1*}) \tag{5}$$

Note, \bar{P}_1 may be different from P_1 . As we go from one solution to another marginal damages from ancillary emissions may change.

- The true cost of the GHG mitigation policy is:

$$Y_{0*} - Y_{0+} - P_1.(Y_{1+} - Y_{1*}). \tag{6}$$

Figure 1 shows the solutions diagrammatically. The pre-climate change equilibrium is at γ , with $Y_{2*} = 0$. In the post-climate change situation P_2 becomes positive. Suppose further that Y_{0+} is as shown. Then the trade off between Y_1 and Y_2 is given by AB . If the price of Y_2 is relatively high the new equilibrium will be at α , with less reduction of Y_1 . If the price is relatively low the new equilibrium will be at β , with a greater reduction in Y_1 . It depends on how much Y_1 and Y_2 are substitutes or complements.

In general we would expect Y_1 and Y_2 to be complements, in which case the new solution has a greater reduction in Y_1 . This will be the case, for example, when Y_1 consists of fossil fuel emissions. But it may not be the case when Y_1 represents land

use. Reductions in GHG gases may require an increase in the use of land making these two factors substitutes.

In order to obtain some numerical values, let us consider a simple macro level model, which assumes that the ‘production function’ in equation (1) is of the is of the Cobb-Douglas form

$$Y_0 = A.(\bar{Y}_1 - Y_1)^\alpha(\bar{Y}_2 - Y_2)^\beta \quad (7)$$

$A > 0$, $\alpha > 0$, $\beta > 0$, and \bar{Y}_1 , \bar{Y}_2 are the maximum (no control) values of ancillary emissions and GHG emissions. Note that $\bar{Y}_i \geq Y_i$, $i = 1, 2$. This means that corner solutions must be investigated.

The optimal level of output for the problem defined by (3) and (4) is given by

$$Y_{0+} = K.P_1^{(-\alpha/(1-\alpha-\beta))}P_2^{(-\beta/(1-\alpha-\beta))}, \quad (8)$$

where K is

$$K \equiv (A\alpha^\alpha\beta^\beta)^{(1/(1-\alpha-\beta))}, \quad (9)$$

and the corresponding values of Y_{1+} and Y_{2+} are given by

$$Y_{1+} = \bar{Y}_1 - \alpha Y_{0+}/P_1, \quad (10)$$

$$Y_{2+} = \bar{Y}_2 - \beta Y_{0+}/P_2. \quad (11)$$

The model can be calibrated using the following data for the UK.¹²

Y_{0+} = Output of economic activity with climate change policy (\$1442 BN in 1999).¹³

\bar{Y}_1 = Maximum ancillary emissions, taken as the sum of SO_2 , NO_X , and $VOCs$ in 1990. It is assumed that these are fifty percent higher than current emissions, which are 6092 thousand metric tons. In other words pre GHG policy had reduced emissions by 50 percent, making the 1990 emissions level equal to 9200 thousand metric tons.

P_1 = Price of ancillary emissions. Estimates of damages are in the neighborhood of 4 percent of GDP, which would amount to \$9500/MT, or \$BN 0.0095 per thousand tons.

P_2 = Price of CO_2 emissions. As a rough guide these are taken as \$10/MT, based on IPCC 2001 studies of mitigation costs to meet plausible targets.

¹² Data on emissions are taken from WRI (2000).

¹³The model is calibrated with the 1999 level as optimal GDP. Of course in reality this is not the optimal level, but it does not matter much, as it is the variations in GDP we are interested in and choosing this value for calibration makes only a minor difference to the results.

Y_{1+} = Optimal reduction of level of ancillary emissions from a no control level. This reduction is not known and has to be determined from the model or different values tried.

\bar{Y}_2 = GHG emissions without controls, taken as 1990 level of 563,281 thousand tons of CO_2 .

Y_{2+} = Reduction of level of GHG emissions from a no-control level of GHGs (000 MT). This is to be determined within the model or different values tried.

In the model, if we knew the values of α and β from independent sources, we could use them to determine the optimal reduction in GHG emissions. It would be with a price of \$10/MT of CO_2 and the optimal reduction in ancillary emissions with a price of \$9500/MT. At present we do not know these parameters. Hence we can look at the implications of different levels of reductions in GHG gases and ancillary emissions being the optimal ones. If we assume we know Y_{1+} and Y_{2+} we can calculate the value of α from (10) and that of β from (11).

B References

- Aaheim, H.A.; Aunan, K. and Seip, H.M. (1997), *Social Benefits of Energy Conservation in Hungary - An Examination of Alternative Methods of Evaluation*, Working Paper 1997: 10, Center for International Climate and Environmental Research (Oslo).
- Alfsen, K.H.; Birkelund, H. and Aaserud, M. (1995), "Impacts of an EC Carbon/Energy Tax and Deregulating Thermal Power Supply on CO_2 , SO_2 and NO_X Emissions," *Environmental and Resource Economics*, 5, 165-189.
- Alfsen, K.H.; Brendemoen, A. and Glomsrød, S. (1992), *Benefits of Climate Policies: Some Tentative Calculations*, Discussion Paper No. 69, Central Bureau of Statistics (Oslo).
- 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," *Economic Journal*, 100, 464-477.
- Aunan, K.; Aaheim, H.A. and Seip, H.M. (2000), *Reduced damage to health and environment from energy saving in Hungary*, Paper Presented at the IPCC Workshop on Assessing the Ancillary Benefits and Costs of Greenhouse Gas Mitigation Strategies (Washington, DC).
- Aunan, K.; Fang, J.; Li, G.; Seip, H.M. and Vennemo, H. (2000), *Co-Benefits from CO_2 -Emission Reduction Measures in Shanxi, China - a First Assessment*, Working Paper 2000, Center for International Climate and Environmental Research (Oslo).
- Ayres, R.U. and Walter, J. (1991), "The Greenhouse Effect: Damages, Costs and Abatement," *Environmental and Resource Economics*, 1, 237-270.
- Barker, T. (1993), *Secondary Benefits of Greenhouse Gas Abatements: the Effects of a UK Carbon/Energy Tax on Air Pollution*, Nota Di Lavoro 32.93, Fondazione ENI Enrico Mattei (Milan).
- Barker, T.; Johnstone, N. and O'Shea, T. (1993), *The CEC Carbon/Energy Tax and Secondary Transport-Related Benefits*, Energy-Environment-Economy Modelling Discussion Paper No. 5, University of Cambridge (Cambridge).
- Barker, T. and Rosendahl, K.E. (2000), *Ancillary Benefits of GHG Mitigation in Europe: SO_2 , NO_X and PM_{10} Reductions from Policies to Meet Kyoto Targets Using the E3ME Model and ExternE Valuations*, Paper Presented at the IPCC Workshop on Assessing the Ancillary Benefits and Costs of Greenhouse Gas Mitigation Strategies (Washington, DC).
- Bovenberg, A.L. and de Mooij, R.A. (1994), "Environmental Levies and Distortionary Taxation," *American Economic Review*, 94, 1085-1089.
- Brendemoen, A. and Vennemo, H. (1994), "A Climate Treaty and the Norwegian Economy: A CGE Assessment," *Energy Journal*, 15, 77-93.

- Burtraw, D.; Krupnick, A.; Palmer, K.; Paul, A.; Toman, M. and Bloyd, C. (1999), *Ancillary Benefits of Reduced Air Pollution in the U.S. from Moderate Greenhouse Gas Mitigation Policies in the Electricity Sector*, Discussion Paper 99-51, Resources for the Future (Washington, DC).
- Burtraw, D. and Toman, M. (1997), *The Benefits of Reduced Air Pollutants in the U.S. from Greenhouse Gas Mitigation Policies*, Discussion Paper 98-01-REV, Resources for the Future (Washington, DC).
- Burtraw, D. and Toman, M. (2000a), “*Ancillary Benefits*” of Greenhouse Gas Mitigation Policies, Climate Change Issues Brief No. 7, Resources for the Future (Washington, DC).
- Burtraw, D. and Toman, M. (2000b), *Estimating the Ancillary Benefits of Greenhouse Gas Mitigation Policies in the US*, Paper Presented at the IPCC Workshop on Assessing the Ancillary Benefits and Costs of Greenhouse Gas Mitigation Strategies (Washington, DC).
- Capros, P.; Georgakopoulos, P.; van Regemorter, D.; Proost, S.; Schmidt, T.F.N.; Koschel, H.; Conrad, K. and Vouyoukas, E.L. (1999), *Climate Technology Strategies 2 - The Macro-Economic Cost and Benefit of Reducing Greenhouse Gas Emissions in the European Union*, Physica-Verlag (Heidelberg).
- Cifuentes, L.A.; Sauma, E.; Jorquera, H. and Soto, F. (2000), *Preliminary Estimation of the Potential Ancillary Benefits for Chile*, Paper Presented at the IPCC Workshop on Assessing the Ancillary Benefits and Costs of Greenhouse Gas Mitigation Strategies (Washington, DC).
- Complainville, C. and Martins, J.O. (1994), *NO_x/SO_x Emissions and Carbon Abatement*, OECD Working Papers, No.151 (Paris).
- Cornes, R.C. and Sandler, T. (1994), “The Comparative Static Properties of the Impure Public Good Model,” *Journal of Public Economics*, 54, 403-421.
- de Mooij, R.A. (1999), “The Double Dividend of an Environmental Tax Reform,” in *Handbook of Environmental and Resource Economics*, edited by van den Bergh, J.C.J.M., Free University (Amsterdam), 293-306.
- Dessus, S. and O’Connor, D. (1999), *Climate Policy Without Tears: CGE-Based Ancillary Benefits Estimates for Chile*, Technical Paper No. 156, OECD Development Centre (Paris).
- Ekins, P. (1996a), “How Large a Carbon Tax is Justified by the Secondary Benefits of CO₂ Abatement?,” *Resource and Energy Economics*, 18, 161-187.
- Ekins, P. (1996b), “The Secondary Benefits of CO₂ Abatement: How Much Emission Reduction Do They Justify?,” *Ecological Economics*, 16, 13-24.
- Ewers, H.-J. and Rennings, K. (1996), “Quantitative Ansätze einer rationalen umweltpolitischen Zielbestimmung,” *Zeitschrift für Umweltpolitik & Umweltrecht*, 4, 413-439.

- Garbaccio, R.F.; Ho, M.S. and Jorgenson, D.W. (2000), *The Health Benefits of Controlling Carbon Emissions in China*, Paper Presented at the IPCC Workshop on Assessing the Ancillary Benefits and Costs of Greenhouse Gas Mitigation Strategies (Washington, DC).
- Glomsrød, S.; Vennemo, H. and Johnsen, T. (1992), "Stabilization of Emissions of CO_2 : A Computable General Equilibrium Assessment," *Scandinavian Journal of Economics*, 94, 53-69.
- Goulder, L.H. (1995), "Environmental Taxation and the Double Dividend: A Reader's Guide," *International Tax and Public Finance*, 2, 157-183.
- Håkonsen, L. and Mathiesen, L. (1997), " CO_2 -Stabilization May Be a 'No-Regrets' Policy - A General Equilibrium Analysis of the Norwegian Economy," *Environmental and Resource Economics*, 9, 171-198.
- Heintz, R.J. and Tol, R.S.J. (1996), *Secondary Benefits of Climate Control Policies: Implications for the Global Environment Facility*, CSERGE Working Paper GEC 96-17.
- IPCC (1996), *Climate Change 1995 - Economic and Social Dimensions of Climate Change*, Cambridge University Press (Cambridge).
- IPCC (2001), *Climate Change 2001 - Mitigation*, Cambridge University Press (Cambridge).
- Kirchgässner, G. (1996), *Ökologische Steuerreform: Utopie oder realistische Alternative?*, Diskussionspapier Nr. 9621, Universität St. Gallen (St. Gallen).
- Krupnick, A.; Burtraw, D. and Markandya, A. (1999), *The Ancillary Benefits and Costs of Climate Change Mitigation: A Conceptual Framework*, Paper Presented at the IPCC Workshop on Assessing the Ancillary Benefits and Costs of Greenhouse Gas Mitigation Strategies (Washington, DC).
- Lutz, C. (1998), *Umweltpolitik und die Emissionen von Luftschadstoffen - Eine empirische Analyse für Westdeutschland*, Duncker & Humblot (Berlin).
- Meyer, B.; Bockermann, A.; Ewerhart, G. and Lutz, C. (1998), *Modellierung der Nachhaltigkeitslücke - Eine umweltökonomische Analyse*, Physica-Verlag (Heidelberg).
- Meyer, B.; Bockermann, A.; Ewerhart, G. and Lutz, C. (1999), *Marktkonforme Umweltpolitik - Wirkungen auf Luftschadstoffemissionen, Wachstum und Struktur der Wirtschaft*, Physica-Verlag (Heidelberg).
- Morgenstern, R.D. (2000), *Baseline Issues in the Estimation of the Ancillary Benefits of Greenhouse Gas Mitigation Policies*, Paper Presented at the IPCC Workshop on Assessing the Ancillary Benefits and Costs of Greenhouse Gas Mitigation Strategies (Washington, DC).
- Nordhaus, W.D. (1991a), "A Sketch of the Economics of the Greenhouse Effect," *American Economic Review*, 81, 146-150.
- Nordhaus, W.D. (1991b), "To Slow or Not to Slow: The Economics of the Greenhouse Effect," *Economic Journal*, 101, 920-937.

- Olsthoorn, X.; Amann, M.; Bartonova, A.; Clench-Aas, J.; Cofala, J.; Dorland, K.; Guerreiro, C.; Henriksen, J.F.; Jansen, H. and Larssen, S. (1999), "Cost Benefit Analysis of European Air Quality Targets for Sulphur Dioxide, Nitrogen Dioxide and Fine and Suspended Particulate Matter in Cities," *Environmental and Resource Economics*, 14, 333-351.
- Pearce, D. (1992), *Secondary Benefits of Greenhouse Gas Control*, CSERGE Working Paper 92-12 (London).
- Pearce, D. (2000), *Policy Framework for the Ancillary Benefits of Climate Change Policies*, Paper Presented at the IPCC Workshop on Assessing the Ancillary Benefits and Costs of Greenhouse Gas Mitigation Strategies (Washington, DC).
- RIVM, EFTEC, NTUA and IIASA (2000), *Technical Report on Climate Change*, RIVM Report 481505012 (Bilthoven).
- Rübelke, D.T.G. (2002), *International Climate Policy to Combat Global Warming: An Analysis of the Ancillary Benefits of Reducing Carbon Emissions*, Edward Elgar (Cheltenham).
- Rübelke, D.T.G. (2003), "An Analysis of Differing Abatement Incentives," *Resource and Energy Economics*, 25, 269-294.
- Schelling, T.C. (1992), "Some Economics of Global Warming," *American Economic Review*, 82, 1-14.
- Schelling, T.C. (1997), "The Cost of Combating Global Warming," *Foreign Affairs*, 76, 8-14.
- Sommer, H.; Künzli, N.; Seethaler, R.; Chanel, O.; Herry, M.; Masson, S.; Vergnaud, J.-C.; Filliger, P.; Horak Jr., F.; Kaiser, R.; Medina, S.; Puybonnieux-Texier, V.; Quénel, P.; Schneider, J. and Studnicka, M. (2000), *Economic Evaluation of Health Impacts Due to Road Traffic-Related Air Pollution - An Impact Assessment Project of Austria, France and Switzerland*, Paper Presented at the IPCC Workshop on Assessing the Ancillary Benefits and Costs of Greenhouse Gas Mitigation Strategies (Washington, DC).
- Tol, R.S.J.; van der Burg, T.; Jansen, H.M.A. and Verbruggen, H. (1995), *The Climate Fund - Some Notions on the Socio-Economic Impacts of Greenhouse Gas Emissions and Emission Reduction in an International Context*, R-95/03, Vrije Universiteit Amsterdam, Institute for Environmental Studies (Amsterdam).
- Wang, X. and Smith, K.R. (1999a), *Near-Term Health Benefits of Greenhouse Gas Reductions: A Proposed Assessment Method and Application in Two Energy Sectors of China*, WHO/PHE/99.1, World Health Organization (Geneva).
- Wang, X. and Smith, K.R. (1999b), "Secondary Benefits of Greenhouse Gas Control: Health Impacts in China," *Environmental Science and Technology*, 33, 3056-3061.
- WRI (2000), *World Resources: People and Ecosystems - The Fraying Web of Life*, World Resources Institute (Washington DC).

NOTE DI LAVORO DELLA FONDAZIONE ENI ENRICO MATTEI

Fondazione Eni Enrico Mattei Working Paper Series

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

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

<http://papers.ssrn.com>

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 Efthios 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 CIRAOLO: <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><u>The ANSEA Network: 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 (lv): <u>The Tradable Permits Approach to Protecting the Commons: What Have We Learned?</u></i>
CLIM	37.2002	<i>K. REHDANZ and R.J.S. TOL (lv): <u>On National and International Trade in Greenhouse Gas Emission Permits</u></i>
CLIM	38.2002	<i>C. FISCHER (lv): <u>Multinational Taxation and International Emissions Trading</u></i>
SUST	39.2002	<i>G. SIGNORELLO and G. PAPPALARDO: <u>Farm Animal Biodiversity Conservation Activities in Europe under the Framework of Agenda 2000</u></i>
NRM	40.2002	<i>S.M. CAVANAGH, W. M. HANEMANN and R. N. STAVINS: <u>Muffled Price Signals: Household Water Demand under Increasing-Block Prices</u></i>
NRM	41.2002	<i>A. J. PLANTINGA, R. N. LUBOWSKI and R. N. STAVINS: <u>The Effects of Potential Land Development on Agricultural Land Prices</u></i>
CLIM	42.2002	<i>C. OHL (lvi): <u>Inducing Environmental Co-operation by the Design of Emission Permits</u></i>
CLIM	43.2002	<i>J. EYCKMANS, D. VAN REGEMORTER and V. VAN STEENBERGHE (lvi): <u>Is Kyoto Fatally Flawed? An Analysis with MacGEM</u></i>
CLIM	44.2002	<i>A. ANTOCI and S. BORGHESI (lvi): <u>Working Too Much in a Polluted World: A North-South Evolutionary Model</u></i>
ETA	45.2002	<i>P. G. FREDRIKSSON, Johan A. LIST and Daniel MILLIMET (lvi): <u>Chasing the Smokestack: Strategic Policymaking with Multiple Instruments</u></i>
ETA	46.2002	<i>Z. YU (lvi): <u>A Theory of Strategic Vertical DFI and the Missing Pollution-Haven Effect</u></i>
SUST	47.2002	<i>Y. H. FARZIN: <u>Can an Exhaustible Resource Economy Be Sustainable?</u></i>
SUST	48.2002	<i>Y. H. FARZIN: <u>Sustainability and Hamiltonian Value</u></i>
KNOW	49.2002	<i>C. PIGA and M. VIVARELLI: <u>Cooperation in R&D and Sample Selection</u></i>
Coalition Theory Network Coalition Theory Network	50.2002	<i>M. SERTEL and A. SLINKO (liv): <u>Ranking Committees, Words or Multisets</u></i>
ETA	51.2002	<i>Sergio CURRARINI (liv): <u>Stable Organizations with Externalities</u></i>
ETA	52.2002	<i>Robert N. STAVINS: <u>Experience with Market-Based Policy Instruments</u></i>
ETA	53.2002	<i>C.C. JAEGER, M. LEIMBACH, C. CARRARO, K. HASSELMANN, J.C. HOURCADE, A. KEELER and R. KLEIN (liii): <u>Integrated Assessment Modeling: Modules for Cooperation</u></i>
CLIM	54.2002	<i>Scott BARRETT (liii): <u>Towards a Better Climate Treaty</u></i>
ETA	55.2002	<i>Richard G. NEWELL and Robert N. STAVINS: <u>Cost Heterogeneity and the Potential Savings from Market-Based Policies</u></i>
SUST	56.2002	<i>Paolo ROSATO and Edi DEFRANCESCO: <u>Individual Travel Cost Method and Flow Fixed Costs</u></i>
SUST	57.2002	<i>Vladimir KOTOV and Elena NIKITINA (lvii): <u>Reorganisation of Environmental Policy in Russia: The Decade of Success and Failures in Implementation of Perspective Quests</u></i>
SUST	58.2002	<i>Vladimir KOTOV (lvii): <u>Policy in Transition: New Framework for Russia's Climate Policy</u></i>
SUST	59.2002	<i>Fanny MISSFELDT and Arturo VILLAVICENCO (lvii): <u>How Can Economies in Transition Pursue Emissions Trading or Joint Implementation?</u></i>
VOL	60.2002	<i>Giovanni DI BARTOLOMEO, Jacob ENGWERDA, Joseph PLASMANS and Bas VAN AARLE: <u>Staying Together or Breaking Apart: Policy-Makers' Endogenous Coalitions Formation in the European Economic and Monetary Union</u></i>
ETA	61.2002	<i>Robert N. STAVINS, Alexander F. WAGNER and Gernot WAGNER: <u>Interpreting Sustainability in Economic Terms: Dynamic Efficiency Plus Intergenerational Equity</u></i>
PRIV	62.2002	<i>Carlo CAPUANO: <u>Demand Growth, Entry and Collusion Sustainability</u></i>
PRIV	63.2002	<i>Federico MUNARI and Raffaele ORIANI: <u>Privatization and R&D Performance: An Empirical Analysis Based on Tobin's Q</u></i>
PRIV	64.2002	<i>Federico MUNARI and Maurizio SOBRERO: <u>The Effects of Privatization on R&D Investments and Patent Productivity</u></i>
SUST	65.2002	<i>Orley ASHENFELTER and Michael GREENSTONE: <u>Using Mandated Speed Limits to Measure the Value of a Statistical Life</u></i>
ETA	66.2002	<i>Paolo SURICO: <u>US Monetary Policy Rules: the Case for Asymmetric Preferences</u></i>
PRIV	67.2002	<i>Rinaldo BRAU and Massimo FLORIO: <u>Privatisations as Price Reforms: Evaluating Consumers' Welfare Changes in the U.K.</u></i>
CLIM	68.2002	<i>Barbara K. BUCHNER and Roberto ROSON: <u>Conflicting Perspectives in Trade and Environmental Negotiations</u></i>
CLIM	69.2002	<i>Philippe QUIRION: <u>Complying with the Kyoto Protocol under Uncertainty: Taxes or Tradable Permits?</u></i>
SUST	70.2002	<i>Anna ALBERINI, Patrizia RIGANTI and Alberto LONGO: <u>Can People Value the Aesthetic and Use Services of Urban Sites? Evidence from a Survey of Belfast Residents</u></i>
SUST	71.2002	<i>Marco PERCOCO: <u>Discounting Environmental Effects in Project Appraisal</u></i>

NRM	72.2002	<i>Philippe BONTEMS and Pascal FAVARD: <u>Input Use and Capacity Constraint under Uncertainty: The Case of Irrigation</u></i>
PRIV	73.2002	<i>Mohammed OMRAN: <u>The Performance of State-Owned Enterprises and Newly Privatized Firms: Empirical Evidence from Egypt</u></i>
PRIV	74.2002	<i>Mike BURKART, Fausto PANUNZI and Andrei SHLEIFER: <u>Family Firms</u></i>
PRIV	75.2002	<i>Emmanuelle AURIOL, Pierre M. PICARD: <u>Privatizations in Developing Countries and the Government Budget Constraint</u></i>
PRIV	76.2002	<i>Nichole M. CASTATER: <u>Privatization as a Means to Societal Transformation: An Empirical Study of Privatization in Central and Eastern Europe and the Former Soviet Union</u></i>
PRIV	77.2002	<i>Christoph LÜLSFESMANN: <u>Benevolent Government, Managerial Incentives, and the Virtues of Privatization</u></i>
PRIV	78.2002	<i>Kate BISHOP, Igor FILATOTCHEV and Tomasz MICKIEWICZ: <u>Endogenous Ownership Structure: Factors Affecting the Post-Privatisation Equity in Largest Hungarian Firms</u></i>
PRIV	79.2002	<i>Theodora WELCH and Rick MOLZ: <u>How Does Trade Sale Privatization Work? Evidence from the Fixed-Line Telecommunications Sector in Developing Economies</u></i>
PRIV	80.2002	<i>Alberto R. PETRUCCI: <u>Government Debt, Agent Heterogeneity and Wealth Displacement in a Small Open Economy</u></i>
CLIM	81.2002	<i>Timothy SWANSON and Robin MASON (Ivi): <u>The Impact of International Environmental Agreements: The Case of the Montreal Protocol</u></i>
PRIV	82.2002	<i>George R.G. CLARKE and Lixin Colin XU: <u>Privatization, Competition and Corruption: How Characteristics of Bribe Takers and Payers Affect Bribe Payments to Utilities</u></i>
PRIV	83.2002	<i>Massimo FLORIO and Katuscia MANZONI: <u>The Abnormal Returns of UK Privatisations: From Underpricing to Outperformance</u></i>
NRM	84.2002	<i>Nelson LOURENÇO, Carlos RUSSO MACHADO, Maria do ROSÁRIO JORGE and Luis RODRIGUES: <u>An Integrated Approach to Understand Territory Dynamics. The Coastal Alentejo (Portugal)</u></i>
CLIM	85.2002	<i>Peter ZAPFEL and Matti VAINIO (Iv): <u>Pathways to European Greenhouse Gas Emissions Trading History and Misconceptions</u></i>
CLIM	86.2002	<i>Pierre COURTOIS: <u>Influence Processes in Climate Change Negotiations: Modelling the Rounds</u></i>
ETA	87.2002	<i>Vito FRAGNELLI and Maria Erminia MARINA (Iviii): <u>Environmental Pollution Risk and Insurance</u></i>
ETA	88.2002	<i>Laurent FRANCKX (Iviii): <u>Environmental Enforcement with Endogenous Ambient Monitoring</u></i>
ETA	89.2002	<i>Timo GOESCHL and Timothy M. SWANSON (Iviii): <u>Lost Horizons. The noncooperative management of an evolutionary biological system.</u></i>
ETA	90.2002	<i>Hans KEIDING (Iviii): <u>Environmental Effects of Consumption: An Approach Using DEA and Cost Sharing</u></i>
ETA	91.2002	<i>Wietze LISE (Iviii): <u>A Game Model of People's Participation in Forest Management in Northern India</u></i>
CLIM	92.2002	<i>Jens HORBACH: <u>Structural Change and Environmental Kuznets Curves</u></i>
ETA	93.2002	<i>Martin P. GROSSKOPF: <u>Towards a More Appropriate Method for Determining the Optimal Scale of Production Units</u></i>
VOL	94.2002	<i>Scott BARRETT and Robert STAVINS: <u>Increasing Participation and Compliance in International Climate Change Agreements</u></i>
CLIM	95.2002	<i>Banu BAYRAMOGLU LISE and Wietze LISE: <u>Climate Change, Environmental NGOs and Public Awareness in the Netherlands: Perceptions and Reality</u></i>
CLIM	96.2002	<i>Matthieu GLACHANT: <u>The Political Economy of Emission Tax Design in Environmental Policy</u></i>
KNOW	97.2002	<i>Kenn ARIGA and Giorgio BRUNELLO: <u>Are the More Educated Receiving More Training? Evidence from Thailand</u></i>
ETA	98.2002	<i>Gianfranco FORTE and Matteo MANERA: <u>Forecasting Volatility in European Stock Markets with Non-linear GARCH Models</u></i>
ETA	99.2002	<i>Geoffrey HEAL: <u>Bundling Biodiversity</u></i>
ETA	100.2002	<i>Geoffrey HEAL, Brian WALKER, Simon LEVIN, Kenneth ARROW, Partha DASGUPTA, Gretchen DAILY, Paul EHRlich, Karl-Goran MALER, Nils KAUTSKY, Jane LUBCHENCO, Steve SCHNEIDER and David STARRETT: <u>Genetic Diversity and Interdependent Crop Choices in Agriculture</u></i>
ETA	101.2002	<i>Geoffrey HEAL: <u>Biodiversity and Globalization</u></i>
VOL	102.2002	<i>Andreas LANGE: <u>Heterogeneous International Agreements – If per capita emission levels matter</u></i>
ETA	103.2002	<i>Pierre-André JOUVET and Walid OUESLATI: <u>Tax Reform and Public Spending Trade-offs in an Endogenous Growth Model with Environmental Externality</u></i>
ETA	104.2002	<i>Anna BOTTASSO and Alessandro SEMBENELLI: <u>Does Ownership Affect Firms' Efficiency? Panel Data Evidence on Italy</u></i>
PRIV	105.2002	<i>Bernardo BORTOLOTTI, Frank DE JONG, Giovanna NICODANO and Ibolya SCHINDELE: <u>Privatization and Stock Market Liquidity</u></i>
ETA	106.2002	<i>Haruo IMAI and Mayumi HORIE (Iviii): <u>Pre-Negotiation for an International Emission Reduction Game</u></i>
PRIV	107.2002	<i>Sudeshna GHOSH BANERJEE and Michael C. MUNGER: <u>Move to Markets? An Empirical Analysis of Privatisation in Developing Countries</u></i>
PRIV	108.2002	<i>Guillaume GIRMENS and Michel GUILLARD: <u>Privatization and Investment: Crowding-Out Effect vs Financial Diversification</u></i>
PRIV	109.2002	<i>Alberto CHONG and Florencio LÓPEZ-DE-SILANES: <u>Privatization and Labor Force Restructuring Around the World</u></i>
PRIV	110.2002	<i>Nandini GUPTA: <u>Partial Privatization and Firm Performance</u></i>
PRIV	111.2002	<i>François DEGEORGE, Dirk JENTER, Alberto MOEL and Peter TUFANO: <u>Selling Company Shares to Reluctant Employees: France Telecom's Experience</u></i>

PRIV	112.2002	<i>Isaac OTCHERE</i> : <u>Intra-Industry Effects of Privatization Announcements: Evidence from Developed and Developing Countries</u>
PRIV	113.2002	<i>Yannis KATSOULAKOS and Elissavet LIKOYANNI</i> : <u>Fiscal and Other Macroeconomic Effects of Privatization</u>
PRIV	114.2002	<i>Guillaume GIRMENS</i> : <u>Privatization, International Asset Trade and Financial Markets</u>
PRIV	115.2002	<i>D. Teja FLOTHO</i> : <u>A Note on Consumption Correlations and European Financial Integration</u>
PRIV	116.2002	<i>Ibolya SCHINDELE and Enrico C. PEROTTI</i> : <u>Pricing Initial Public Offerings in Premature Capital Markets: The Case of Hungary</u>
PRIV	1.2003	<i>Gabriella CHIESA and Giovanna NICODANO</i> : <u>Privatization and Financial Market Development: Theoretical Issues</u>
PRIV	2.2003	<i>Ibolya SCHINDELE</i> : <u>Theory of Privatization in Eastern Europe: Literature Review</u>
PRIV	3.2003	<i>Wietze LISE, Claudia KEMFERT and Richard S.J. TOL</i> : <u>Strategic Action in the Liberalised German Electricity Market</u>
CLIM	4.2003	<i>Laura MARSILIANI and Thomas I. RENSTRÖM</i> : <u>Environmental Policy and Capital Movements: The Role of Government Commitment</u>
KNOW	5.2003	<i>Reyer GERLAGH</i> : <u>Induced Technological Change under Technological Competition</u>
ETA	6.2003	<i>Efrem CASTELNUOVO</i> : <u>Squeezing the Interest Rate Smoothing Weight with a Hybrid Expectations Model</u>
SIEV	7.2003	<i>Anna ALBERINI, Alberto LONGO, Stefania TONIN, Francesco TROMBETTA and Margherita TURVANI</i> : <u>The Role of Liability, Regulation and Economic Incentives in Brownfield Remediation and Redevelopment: Evidence from Surveys of Developers</u>
NRM	8.2003	<i>Elissaios PAPYRAKIS and Reyner GERLAGH</i> : <u>Natural Resources: A Blessing or a Curse?</u>
CLIM	9.2003	<i>A. CAPARRÓS, J.-C. PEREAU and T. TAZDAÏT</i> : <u>North-South Climate Change Negotiations: a Sequential Game with Asymmetric Information</u>
KNOW	10.2003	<i>Giorgio BRUNELLO and Daniele CHECCHI</i> : <u>School Quality and Family Background in Italy</u>
CLIM	11.2003	<i>Efrem CASTELNUOVO and Marzio GALEOTTI</i> : <u>Learning By Doing vs Learning By Researching in a Model of Climate Change Policy Analysis</u>
KNOW	12.2003	<i>Carole MAIGNAN, Gianmarco OTTAVIANO and Dino PINELLI (eds.)</i> : <u>Economic Growth, Innovation, Cultural Diversity: What are we all talking about? A critical survey of the state-of-the-art</u>
KNOW	13.2003	<i>Carole MAIGNAN, Gianmarco OTTAVIANO, Dino PINELLI and Francesco RULLANI (lix)</i> : <u>Bio-Ecological Diversity vs. Socio-Economic Diversity. A Comparison of Existing Measures</u>
KNOW	14.2003	<i>Maddy JAASSENS and Chris STEYAERT (lix)</i> : <u>Theories of Diversity within Organisation Studies: Debates and Future Trajectories</u>
KNOW	15.2003	<i>Tuzin BAYCAN LEVENT, Enno MASUREL and Peter NIJKAMP (lix)</i> : <u>Diversity in Entrepreneurship: Ethnic and Female Roles in Urban Economic Life</u>
KNOW	16.2003	<i>Alexandra BITUSIKOVA (lix)</i> : <u>Post-Communist City on its Way from Grey to Colourful: The Case Study from Slovakia</u>
KNOW	17.2003	<i>Billy E. VAUGHN and Katarina MLEKOV (lix)</i> : <u>A Stage Model of Developing an Inclusive Community</u>
KNOW	18.2003	<i>Selma van LONDEN and Arie de RUIJTER (lix)</i> : <u>Managing Diversity in a Globalizing World</u>
Coalition Theory Network	19.2003	<i>Sergio CURRARINI</i> : <u>On the Stability of Hierarchies in Games with Externalities</u>
PRIV	20.2003	<i>Giacomo CALZOLARI and Alessandro PAVAN (lx)</i> : <u>Monopoly with Resale</u>
PRIV	21.2003	<i>Claudio MEZZETTI (lx)</i> : <u>Auction Design with Interdependent Valuations: The Generalized Revelation Principle, Efficiency, Full Surplus Extraction and Information Acquisition</u>
PRIV	22.2003	<i>Marco LiCalzi and Alessandro PAVAN (lx)</i> : <u>Tilting the Supply Schedule to Enhance Competition in Uniform-Price Auctions</u>
PRIV	23.2003	<i>David ETTINGER (lx)</i> : <u>Bidding among Friends and Enemies</u>
PRIV	24.2003	<i>Hannu VARTAINEN (lx)</i> : <u>Auction Design without Commitment</u>
PRIV	25.2003	<i>Matti KELOHARJU, Kjell G. NYBORG and Kristian RYDQVIST (lx)</i> : <u>Strategic Behavior and Underpricing in Uniform Price Auctions: Evidence from Finnish Treasury Auctions</u>
PRIV	26.2003	<i>Christine A. PARLOUR and Uday RAJAN (lx)</i> : <u>Rationing in IPOs</u>
PRIV	27.2003	<i>Kjell G. NYBORG and Ilya A. STREBULAEV (lx)</i> : <u>Multiple Unit Auctions and Short Squeezes</u>
PRIV	28.2003	<i>Anders LUNANDER and Jan-Eric NILSSON (lx)</i> : <u>Taking the Lab to the Field: Experimental Tests of Alternative Mechanisms to Procure Multiple Contracts</u>
PRIV	29.2003	<i>TangaMcDANIEL and Karsten NEUHOFF (lx)</i> : <u>Use of Long-term Auctions for Network Investment</u>
PRIV	30.2003	<i>Emiel MAASLAND and Sander ONDERSTAL (lx)</i> : <u>Auctions with Financial Externalities</u>
ETA	31.2003	<i>Michael FINUS and Bianca RUNDSHAGEN</i> : <u>A Non-cooperative Foundation of Core-Stability in Positive Externality NTU-Coalition Games</u>
KNOW	32.2003	<i>Michele MORETTO</i> : <u>Competition and Irreversible Investments under Uncertainty</u>
PRIV	33.2003	<i>Philippe QUIRION</i> : <u>Relative Quotas: Correct Answer to Uncertainty or Case of Regulatory Capture?</u>
KNOW	34.2003	<i>Giuseppe MEDA, Claudio PIGA and Donald SIEGEL</i> : <u>On the Relationship between R&D and Productivity: A Treatment Effect Analysis</u>
ETA	35.2003	<i>Alessandra DEL BOCA, Marzio GALEOTTI and Paola ROTA</i> : <u>Non-convexities in the Adjustment of Different Capital Inputs: A Firm-level Investigation</u>

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

KNOW	77.2003	<i>Richard PEARCE</i> (Ixii): <u>A Biologist's View of Individual Cultural Identity for the Study of Cities</u>
KNOW	78.2003	<i>Vincent MERK</i> (Ixii): <u>Communication Across Cultures: from Cultural Awareness to Reconciliation of the Dilemmas</u>
KNOW	79.2003	<i>Giorgio BELLETTINI, Carlotta BERTI CERONI and Gianmarco I.P. OTTAVIANO</i> : <u>Child Labor and Resistance to Change</u>
ETA	80.2003	<i>Michele MORETTO, Paolo M. PANTEGHINI and Carlo SCARPA</i> : <u>Investment Size and Firm's Value under Profit Sharing Regulation</u>
IEM	81.2003	<i>Alessandro LANZA, Matteo MANERA and Massimo GIOVANNINI</i> : <u>Oil and Product Dynamics in International Petroleum Markets</u>
CLIM	82.2003	<i>Y. Hossein FARZIN and Jinhua ZHAO</i> : <u>Pollution Abatement Investment When Firms Lobby Against Environmental Regulation</u>
CLIM	83.2003	<i>Giuseppe DI VITA</i> : <u>Is the Discount Rate Relevant in Explaining the Environmental Kuznets Curve?</u>
CLIM	84.2003	<i>Reyer GERLAGH and Wietze LISE</i> : <u>Induced Technological Change Under Carbon Taxes</u>
NRM	85.2003	<i>Rinaldo BRAU, Alessandro LANZA and Francesco PIGLIARU</i> : <u>How Fast are the Tourism Countries Growing? The cross-country evidence</u>
KNOW	86.2003	<i>Elena BELLINI, Gianmarco I.P. OTTAVIANO and Dino PINELLI</i> : <u>The ICT Revolution: opportunities and risks for the Mezzogiorno</u>
SIEV	87.2003	<i>Lucas BRETSCHGER and Sjak SMULDERS</i> : <u>Sustainability and Substitution of Exhaustible Natural Resources. How resource prices affect long-term R&D investments</u>
CLIM	88.2003	<i>Johan EYCKMANS and Michael FINUS</i> : <u>New Roads to International Environmental Agreements: The Case of Global Warming</u>
CLIM	89.2003	<i>Marzio GALEOTTI</i> : <u>Economic Development and Environmental Protection</u>
CLIM	90.2003	<i>Marzio GALEOTTI</i> : <u>Environment and Economic Growth: Is Technical Change the Key to Decoupling?</u>
CLIM	91.2003	<i>Marzio GALEOTTI and Barbara BUCHNER</i> : <u>Climate Policy and Economic Growth in Developing Countries</u>
IEM	92.2003	<i>A. MARKANDYA, A. GOLUB and E. STRUKOVA</i> : <u>The Influence of Climate Change Considerations on Energy Policy: The Case of Russia</u>
ETA	93.2003	<i>Andrea BELTRATTI</i> : <u>Socially Responsible Investment in General Equilibrium</u>
CTN	94.2003	<i>Parkash CHANDER</i> : <u>The γ-Core and Coalition Formation</u>
IEM	95.2003	<i>Matteo MANERA and Angelo MARZULLO</i> : <u>Modelling the Load Curve of Aggregate Electricity Consumption Using Principal Components</u>
IEM	96.2003	<i>Alessandro LANZA, Matteo MANERA, Margherita GRASSO and Massimo GIOVANNINI</i> : <u>Long-run Models of Oil Stock Prices</u>
CTN	97.2003	<i>Steven J. BRAMS, Michael A. JONES, and D. Marc KILGOUR</i> : <u>Forming Stable Coalitions: The Process Matters</u>
KNOW	98.2003	<i>John CROWLEY, Marie-Cecile NAVES</i> (Ixiii): <u>Anti-Racist Policies in France. From Ideological and Historical Schemes to Socio-Political Realities</u>
KNOW	99.2003	<i>Richard THOMPSON FORD</i> (Ixiii): <u>Cultural Rights and Civic Virtue</u>
KNOW	100.2003	<i>Alaknanda PATEL</i> (Ixiii): <u>Cultural Diversity and Conflict in Multicultural Cities</u>
KNOW	101.2003	<i>David MAY</i> (Ixiii): <u>The Struggle of Becoming Established in a Deprived Inner-City Neighbourhood</u>
KNOW	102.2003	<i>Sébastien ARCAND, Danielle JUTEAU, Sirma BILGE, and Francine LEMIRE</i> (Ixiii) : <u>Municipal Reform on the Island of Montreal: Tensions Between Two Majority Groups in a Multicultural City</u>
CLIM	103.2003	<i>Barbara BUCHNER and Carlo CARRARO</i> : <u>China and the Evolution of the Present Climate Regime</u>
CLIM	104.2003	<i>Barbara BUCHNER and Carlo CARRARO</i> : <u>Emissions Trading Regimes and Incentives to Participate in International Climate Agreements</u>
CLIM	105.2003	<i>Anil MARKANDYA and Dirk T.G. RÜBBELKE</i> : <u>Ancillary Benefits of Climate Policy</u>
	1000	Carlo CARRARO, Alessandro LANZA and Valeria PAPPONETTI: <u>One Thousand Working Papers</u>

- (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
- (lvii) This paper was presented at the First Workshop of “CFEWE – Carbon Flows between Eastern and Western Europe”, organised by the Fondazione Eni Enrico Mattei and Zentrum für Europäische Integrationsforschung (ZEI), Milan, July 5-6, 2001
- (lviii) This paper was presented at the Workshop on “Game Practice and the Environment”, jointly organised by Università del Piemonte Orientale and Fondazione Eni Enrico Mattei, Alessandria, April 12-13, 2002
- (lix) This paper was presented at the ENGIME Workshop on “Mapping Diversity”, Leuven, May 16-17, 2002
- (lx) This paper was presented at the EuroConference on “Auctions and Market Design: Theory, Evidence and Applications”, organised by the Fondazione Eni Enrico Mattei, Milan, September 26-28, 2002
- (lxi) This paper was presented at the Eighth Meeting of the Coalition Theory Network organised by the GREQAM, Aix-en-Provence, France, January 24-25, 2003
- (lxii) This paper was presented at the ENGIME Workshop on “Communication across Cultures in Multicultural Cities”, The Hague, November 7-8, 2002
- (lxiii) This paper was presented at the ENGIME Workshop on “Social dynamics and conflicts in multicultural cities”, Milan, March 20-21, 2003

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 Valuation</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)
ETA	<i>Economic Theory and Applications</i> (Editor: Carlo Carraro)

2003 SERIES

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