AgEcon SEARCH
RESEARCH IN AGRICULTURAL & APPLIED ECONOMICS

The World's Largest Open Access Agricultural & Applied Economics Digital Library

This document is discoverable and free to researchers across the globe due to the work of AgEcon Search.

Help ensure our sustainability.

Give to AgEcon Search

AgEcon Search
<http://ageconsearch.umn.edu>
aesearch@umn.edu

*Papers downloaded from **AgEcon Search** may be used for non-commercial purposes and personal study only. No other use, including posting to another Internet site, is permitted without permission from the copyright owner (not AgEcon Search), or as allowed under the provisions of Fair Use, U.S. Copyright Act, Title 17 U.S.C.*

**Mitigation Strategies and Costs of
Climate Protection:
The effects of ETC in the hybrid
Model MIND**

Ottmar Edenhofer, Kai Lessmann
and Nico Bauer

NOTA DI LAVORO 150.2005

DECEMBER 2005

CCMP – Climate Change Modelling and Policy
--

Ottmar Edenhofer, *Potsdam Institute for Climate Impact Research*
Kai Lessmann, *Potsdam Institute for Climate Impact Research*
Nico Bauer, *Paul Scherrer Institute (PSI)*

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=871447>

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

This paper is one of a series published by FEEM on the theme of innovation modeling in the context of the challenge of stabilising atmospheric concentrations of greenhouse gases, as part of the Innovation Modeling Comparison Project. This is an international project launched and overseen by the Steering Committee of the informal International Programme on the Economics of Atmospheric Stabilisation.* The broad aim of the collaboration is to advance understanding of the economic issues surrounding atmospheric stabilisation, and the specific aims of the IMCP are to provide insights into the "state of the art" and implications of endogenous modeling of technical change in global energy-environment models when applied to various levels of atmospheric stabilisation.

Members of the Steering Committee provided review comments on earlier drafts and the paper has been forwarded to external review, the final results will be published as a Special Issue of the Energy Journal. The papers have all been encouraged to draw on a common baseline (the "Common Poles-Image baseline") and to report results in comparable formats, so as to facilitate intercomparison of the different modeling results. All the results and judgements expressed here remain the responsibility of the authors.

The work presented here was funded by the Volkswagen Foundation, Project II/78470, which the authors gratefully acknowledge. FEEM fund the working papers series, and seed money for the coordination work of the Innovation Modeling Comparison Project was provided by UK Department of Environment, Food and Rural Affairs and the German Ministry of Environment.

The authors are also grateful to Elmar Kriegler for productive discussions and helpful comments on an earlier version of this paper.

Mitigation Strategies and Costs of Climate Protection: The Effects of ETC in the Hybrid Model MIND

Summary

MIND is a hybrid model incorporating several energy related sectors in an endogenous growth model of the world economy. This model structure allows a better understanding of the linkages between the energy sectors and the macro-economic environment. We perform a sensitivity analysis and parameter studies to improve the understanding of the economic mechanisms underlying opportunity costs and the optimal mix of mitigation options. Parameters representing technological change that permeates the entire economy have a strong impact on both the opportunity costs of climate protection and on the optimal mitigation strategies, e.g. parameters in the macro-economic environment and in the extraction sector. Sector-specific energy technology parameters change the portfolio of mitigation options but have only modest effects on opportunity costs, e.g. learning rate of the renewable energy technologies. We conclude that feedback loops between the macro-economy and the energy sectors are crucial for the determination of opportunity costs and mitigation strategies.

Keywords: Endogenous technological change, Climate change mitigation costs, Integrated assessment, Growth model, Energy sector, Integrated assessment

JEL Classification: O41, Q40, Q43, Q55, C61, D99

We are grateful to Elmar Kriegler for productive discussions and helpful comments on earlier version of this paper. This work was funded by the Volkswagen Foundation, Project II/78470, which we gratefully acknowledge.

Address for correspondence:

Kai Lessmann
Potsdam Institute for Climate Impact Research (PIK)
P.O. Box 60 12 03
14412 Potsdam Germany
E-mail: lessman@pik-potsdam.de

1. Setting the Scene

The Innovation Modeling Comparison Project (IMCP) explores the consequences of endogenous technological change (ETC) for the economics of stabilizing atmospheric carbon dioxide (CO_2) concentration. This paper contributes to the IMCP by presenting an analysis of technological change at different levels and in different sectors in the Model of Investment and technological Development (MIND). MIND combines an intertemporal endogenous growth model of the macro-economy with sector-specific and technological details taken from the field of energy system modeling. In particular, we explore the impact of endogenous technological change on opportunity costs and mitigation strategies in the framework of a social cost-effectiveness analysis.

We explore the impact of ETC in a social cost-effectiveness framework because we want to understand how technological change is induced by climate policy. Several studies have already incorporated aspects of ETC in this framework (Buonanno et. al. 2003, Chakravorty et. al. 1997, Goulder and Mathai 2002, Kypreos and Barreto 2000, Nordhaus and Boyer 2000, Nordhaus 2002, Popp 2004a, 2004b). The added value of MIND arises mainly from two features: First, we incorporate a wide spectrum of relevant mitigation options at least at a highly aggregate level. MIND incorporates improvement of energy efficiency, carbon capture and sequestration (CCS), renewable energy technologies, and traditional non-fossil fuels (large hydropower and nuclear). Second, technological change in MIND has an endogenous formulation with R&D investments in labor and energy productivity, learning-by-doing, and vintage capital in the different energy sectors. We believe that including these features of ETC is essential for the assessment of macro-economic mitigation costs and the portfolio of mitigation options. MIND is a hybrid model merging features from bottom-up models and top-down models. It resembles a bottom-up model because it comprises several energy sectors. However, the technologies are represented at a more aggregated level than in energy system models. We have embedded these sectors within a macro-economic environment in order to evaluate the feedbacks between the macro-economy and the energy sector (for another example of such an exercise, see Manne et. al. 1995). We will show that these feedbacks are crucial for an understanding of opportunity costs and mitigation strategies in an economy faced with climate policy.

The next section briefly introduces the model and its calibration, highlighting the improved treatment of CCS in MIND 1.1. The main part of this paper is the discussion of technological change within MIND in section 3. Section 4 concludes.

2. The model structure of MIND 1.1

The model equations of MIND are introduced and discussed in Edenhofer, Bauer and Kriegler (2005). The model version 1.0 presented therein has been extended by Bauer (2005). In his work, Bauer replaces exogenous scenarios of Carbon Capture and Sequestration (CCS) with a technologically detailed, endogenous treatment of the CCS option (model version 1.1). This study uses MIND 1.1, slightly adjusted to meet the requirements of the IMCP and enhanced by a more sophisticated carbon cycle (Hoos et al. 2001). The following section

provides a summary of the model structure and parameter calibrations. Model equations are restricted to the parameters treated in the sensitivity analyzes and parameter studies in this article; for a comprehensive discussion of the model structure we refer to Edenhofer et al. (2005) and Bauer (2005).

MIND is an integrated assessment model comprising a model of the world economy with particular attention paid to the energy sector, and a climate module computing global mean temperature changes. MIND therefore allows us to assess the impacts of constraints to climatic change on the economy in cost-effectiveness analyzes.

MIND models economic dynamics by adopting an endogenous growth framework. It calculates time paths of investment and consumption decisions that are intertemporally optimal. The objective is to maximize social welfare, which is defined as the present value of utility (pure rate of time preferences is 1 %), which is a function of per capita consumption exhibiting diminishing marginal utility. Most economic activity is subsumed in an aggregate CES production function (equation 1), the output Y_A of which describes the gross world product (GWP).¹

$$Y_A = \Phi_A \left[\xi_A^L (A * L_A)^{-\rho_A} + \xi_A^E (B * E)^{-\rho_A} + \xi_A^K K_A^{-\rho_A} \right]^{-1/\rho_A} \quad (1)$$

The income share related parameters ξ_A are calibrated so that the actual income shares of labor L_A , energy E , and capital K_A relate to each other as 66:4:30. Total factor productivity Φ_A is a fixed scalar calibrated to such a value that historical output of 2000 is reproduced. The elasticity parameter ρ_A determines the elasticity of substitution $\sigma_A = (1+\rho_A)^{-1}$. In some integrated assessment models, the elasticity of substitution between capital and energy is 0.4 for developed countries and 0.3 for developing countries (Manne et al. 1995). We have chosen an overall elasticity of substitution for all three factors of $\sigma_A = 0.4$. Labor L_A is described by an exogenous population scenario adopted from the common POLES/IMAGE baseline (CPI, Vuuren et al. 2003), and the capital stock K_A is built up through investments and depreciates at a rate of 5 %. The initial value of K_A is derived from Y_A and an estimated capital coefficient. Capital coefficients computed from the OECD database and from PWT6.1 for different countries cluster around 2.5. Since energy sector capital is separate from K_A , we assume a lower capital coefficient of 2.0. Variables A and B denote the productivities of labor and energy, respectively, and are stock variables determined by R&D investments according to equation (2):

$$\frac{\dot{A}}{A} = \alpha_A \left(\frac{RD_A}{Y} \right)^{\gamma_A}, \quad \text{with } A(t = \tau_1) = A_0 \quad (2)$$

$$\frac{\dot{B}}{B} = \alpha_B \left(\frac{RD_B}{Y} \right)^{\gamma_B}, \quad \text{with } B(t = \tau_1) = B_0 \quad (3)$$

RD_A and RD_B are investment flows controlled by the central planner. The role of parameters γ_A and γ_B is to decrease marginal productivity of R&D investments, which happens for values lower than unity. They are set to 0.05 and 0.1, respectively. Parameters α_A and α_B determine the productivity of R&D

¹ MIND is implemented in discrete time steps of 5 years. In the model equations of this text we present the more intuitive continuous formulations, e.g. in case of derivatives.

investment. They are calibrated at such a rate that spending 1% of the GWP on energy R&D increases the energy efficiency parameter by 2.25%; when 2.5% of GWP is spent on labor R&D, the labor efficiency parameter increases by 2%.

The energy input to aggregate production, E , is an additive composite of fossil energy, renewable energy, and traditional non-fossil energy, the latter given exogenously. Fossil energy is produced from energy conversion capital and primary energy input in a CES production function. Fossil resources are converted to primary energy using an exogenous assumption about the carbon/energy ratio of the fossil fuel mix, its availability being described by a model of resource extraction. Resource R is extracted by capital K_{res} , the average productivity of which is subject to a scarcity effect ($\kappa_{res,s}$) and a learning-by-doing effect ($\kappa_{res,l}$):

$$R = \kappa_{res} K_{res} \quad (4)$$

$$\kappa_{res} = \kappa_{res,s} \kappa_{res,l} \quad (5)$$

The initial resource extraction is $R = 6.4$ GtC (SRES), assumed to be produced by a capital stock of $K_{res} = 5$ trillion \$US. This determines $\kappa_{res,l}$ because $\kappa_{res,s}$ is normalized to unity.

The scarcity effect $\kappa_{res,s}$ is determined by the marginal costs of resource extraction C_{res}^{mar} :

$$\kappa_{res,s} = \frac{\chi_1}{C_{res}^{mar}} \quad (6)$$

In equation 6, parameter χ_1 as well as the marginal costs in 2000 are set to \$113. During the simulation, marginal costs C_{res}^{mar} increase with cumulative resource extraction CR_{res} according to equations 7 and 8.

$$C_{res}^{mar} = \chi_1 + \chi_2 \left(\frac{CR_{res}}{\chi_3} \right)^{\chi_4} \quad (7)$$

$$CR_{res}(t) = \int_{\tau_1}^t R(t') dt', \text{ with } CR_{res}(t = \tau_1) = 0 \quad (8)$$

Parameter χ_1 denotes initial costs of the fossil resource, the exponent χ_4 controls the curvature of the function, i.e. the timing of increasing costs, χ_2 gives the marginal costs once the amount described by χ_3 has been extracted. We parameterize this function in accordance with Rogner's (1997) empirical assessment of world hydrocarbon resources arriving at the values $\chi_2 = 700$, $\chi_3 = 3500$ and $\chi_4 = 2$.

The learning-by-doing effect of capital productivity $\kappa_{res,l}$ depends on the ratio of actual resource extraction $E_{res,l}$ to initial resource extraction $E_{res,l}^0$.

$$\dot{\kappa}_{res,l} = \frac{\kappa_{res,l}}{\tau_{res,l} \kappa_{res,l}^{max}} (\kappa_{res,l}^{max} - \kappa_{res,l}) \left(\left(\frac{E_{res,l}}{E_{res,l}^0} \right)^{\beta_{res,l}} - 1 \right) \quad (9)$$

with $\kappa_{res,l}(t = \tau_1) = \kappa_{res,l}^0$

The factor $\beta_{res,l} = 0.4$ dampens the learning-by-doing effect: a rapid increase in extraction induces a loss in productivity gains relative to the same increase in extraction spread over a longer time period. Furthermore, productivity gains from learning saturate when productivity approaches its maximum value $\kappa_{res,l}^{max}$ which is set to twice its initial value. Parameter $\tau_{res,l}$ determines the speed of learning and is set to 100 years.

Renewable energy E_{ren} is produced by capital Kap_{ren} which is employed at $FLH_{ren} = 2190$ full load hours per year.

$$E_{ren}(t) = FLH_{ren} * Kap_{ren}(t) \quad (10)$$

$$Kap_{ren}(t) = \int_{t_0}^t \omega(t-t') \kappa_{ren}(t') I_{ren}(t') dt' \quad (11)$$

The available renewable energy capital stock in each point in time is determined by summing over the investments into renewable energy I_{ren} in preceding time steps multiplied with the productivity of installed capital κ_{ren} . Depreciation is modeled by weights ω which determine the fraction of capital that still remains, ω_1 to ω_7 are set to 1.0, 0.9, 0.8, 0.7, 0.5, 0.15, 0.05, and $\omega_i = 0$ if $i > 7$. This allows to model different capital productivities for different vintages of the capital stock. Capital productivity κ_{ren} indeed changes in time because the costs of renewable energy equipment c_{ren} decrease, subject to learning-by-doing.

$$\kappa_{ren} = \frac{1}{c_{ren}(t') + c_{floor}} \quad (12)$$

The inverse of floor costs $c_{floor} = 500$ US\$/kW constrains capital productivity from above, while c_{ren} starts out at $c_{ren,0} = 700$ US\$/kW and decreases with cumulative installed capital $CKap_{ren}$:

$$CKap_{ren} = \int_{\tau_0}^t Kap_{ren}(t') dt' \quad (13)$$

The following equation describes the dynamics of learning-by-doing in the renewable sector:

$$c_{ren,t} - c_{ren,t-1} = c_{ren,0} CKap_{ren,0}^{\mu_{ren}} (CKap_{ren,t}^{-\mu_{ren}} - CKap_{ren,t-1}^{-\mu_{ren}}) \times \left(\frac{CKap_{ren,t-1}}{CKap_{ren,t}} \right)^{\beta_{ren}} \quad (14)$$

with $c_{ren}(t = \tau_1) = c_{ren}^0$,

The learning parameter μ_{ren} determines the learning rate lr and reflects a learning rate of 15 %, i.e. investment costs decrease by 15 % with every doubling of cumulative installed capacity. Parameter β_{ren} within the last factor of the right hand side of the equation causes a dampening similar to $\beta_{res,l}$ in the learning-by-doing equation of the fossil resource extraction (equation 9). Set to $\beta_{ren} = 0.4$, it prevents learning that is too fast.

There are three sources of carbon dioxide emissions: fossil fuel combustion, leakage from sequestered CO₂, and emissions from land-use and land-use change. The latter are described by an exogenous time series. Since fossil resources are measured in tons of carbon, resource use R and emissions Em coincide, except for land-use emissions and Carbon Capturing and Sequestration (CCS):

$$Em(t) = R(t) + LULUC(t) - R_{cap}(t) + LEAK(t), \quad (15)$$

where R_{cap} denotes the amount of CO₂ captured in a given year; $LEAK$ denotes leakage.

CCS is modeled as a chain process distinguishing six steps: CO₂ is captured at point sources (1) and transported via pipelines to sequestration sites (2). There, the CO₂ needs to be compressed (3) before it is injected into the sequestration site (4). Then, it either remains in the site (5) or leaks into the atmosphere (6). Processes 1-4 are capital intensive and are modeled as capital stocks representing available capacities for the individual processes. Capacities are built up by investments according to the following equation:

$$K_{pq}(t) = \int_{t_0}^t \omega_q(t-t') t_{pq}^{-1}(t') I_{pq}(t') dt' \quad (16)$$

Variables K_{pq} denote the capacities, index p denotes the process step, and the index q denotes different investment alternatives such as one of five distinct capture technologies or one of six distinct sequestration alternatives. Weighting parameters ω introduce a depreciation scheme for different vintages of the capital stocks, similar to equation 11 in case of renewable energy. Investments are denoted I_{pq} and the investment costs are ι_{pq} . Investment costs for capturing capacity range from ~100 \$US/tC to ~450 \$US/tC depending on the specific capture technology. When the productivity of CCS investments is varied in parameter studies later on in this paper, the same relative change is applied to the investment costs of each technology.

In addition to the limitation inflicted by the necessity to build up capacity, the amount of carbon that may be captured is limited by a static and a dynamic constraint. The static constraint limits the amount of carbon which can be captured from a large power plant as a fraction of the resource use in the business-as-usual scenario. The dynamic constraint defines an upper limit of investments into the specific capture technologies in each period. The upper limit is defined as a share of the investments in the power generation sector. The

rationale is that the capability of retrofit investments in large power plants depends on the total amount of investments undertaken in the power generation sector.

The injection of CO₂ into particular sequestration sites demands two different kinds of facilities: compressors and injection wells (steps 3 and 4). The modeling approach takes into account that both facilities demand investments and secondary energy. In steps 5 and 6, the modeling approach considers the capacity constraint of each sequestration alternative j and leakage of sequestered carbon: Leakage is described by a rate, and the capacity of each sequestration alternative is the upper bound for the cumulative amount of CO₂ that is injected into each sequestration alternative.

3. The Role of Endogenous Technological Change in MIND

In which ways does endogenous technological change matter in policy scenarios computed with MIND? In the following sections, we provide an answer to this question with the help of a sensitivity analysis and miscellaneous parameter studies (for a first parameter study with MIND see Bauer et. al 2005). In the sensitivity analysis, we rank important technology-related model parameters according to their influence on two model outputs: the opportunity costs of climate protection and the mix of options used for CO₂ mitigation. We then study the effect of parameter variations on the same model outputs and analyze the underlying economic dynamics. All model runs constrain the atmospheric CO₂ concentration level to 450 ppm.

3.1 Local Sensitivity Analysis

Figure 1a and 1b show the influence of important parameters of MIND on opportunity costs of climate policy (1a) and on the mix of mitigation options (1b). The former are measured as losses of gross world product (GWP), accumulated from 2000 to 2100 and discounted to present value at a rate of 5 %, relative to the business-as-usual scenario. The latter is represented by the ratio of the two dominant options, renewable energies and CCS, where a ratio of unity implies that the same amount of CO₂ reductions may be attributed to each of the mitigation options. Parameter influence is measured by the response of the model to a 5 % variation of the parameter. Starting point is the set of parameters from model calibration. We vary one parameter at a time, hence the effects reflect local sensitivity. Local sensitivity analysis only assesses parameter sensitivity at one point in parameter space. It neglects the fact that sensitivities may be tremendously different at other points in parameter space. A measure of global sensitivity, i.e. a measure that takes into account simultaneous variation of several parameters, would remedy this shortcoming and is hence preferable. In this paper we stick with the analysis of local sensitivity for two reasons: First, the model response to a change in a single parameter under *ceteris paribus* condition is an intuitive measure. Second, the computational burden for a local analysis is much lower. We stress that while our analysis assesses model sensitivities as a property of the model and hence sheds light on the influence of parameters and the potential influence of their uncertainties on model results, we do not take into account parameter uncertainties. Therefore, we make no statements about the relative importance of parameters for the uncertainty of the computed results but about the potential influence on the results.

a

b

Figure 1: Sensitivity analysis. Figures 1a and 1b show the influence of important technological parameters on opportunity costs and mix of mitigation options, respectively. Metric is the deviation of the output in response to an up to 5 % increase (decrease) of the parameter. The parameter name “e.o.s. production” refers to the elasticity of substitution σ_A in aggregate industrial production, i.e. production of the gross world product.

As figure 1a indicates, the greatest influence on opportunity costs is exerted by the elasticity of substitution σ_A , followed by the parameters describing the availability of fossil resources, and the effectiveness of R&D investments in labor productivity. The latter and the top three parameters have a positive effect on costs, i.e. costs increase with the parameters, whereas assuming higher future costs of fossil resources decreases costs. The following ranks are occupied by the productivity of energy efficiency R&D and the learning rate of the renewable energy technologies, followed by two more sector specific parameters, the learning parameter in fossil resource extraction and the efficiency of investments in CCS. Overall, the relatively small responses of the model to parameter variations (less than 5 %) increase the confidence in the

robustness of the computed opportunity costs. In the next two sections we will explore the reasons for this observation and explore the role of technological change in it.

Figure 1b shows in which way the same parameters influence the mix of mitigation options. A comparison between figure 1a and figure 1b indicates that the ranking has changed. Most notably, the elasticity of substitution has dropped to the last rank, but also two resource related parameters, χ_2 and χ_3 , have dropped a few slots. Conversely, the parameterization of labor R&D, the learning rate of renewable technologies, and the efficiency of CCS investments have risen in the hierarchy. Overall, the mitigation mix is more sensitive (with variations up to 10 %) than the mitigation costs in figure 1a. This does not come as a surprise: GWP losses are closely related to social welfare, the maximization of which is the objective of MIND. Therefore, GWP loss is deliberately kept at a minimum. The mix of mitigation options, on the other hand, is determined to be cost-effective. Naturally, when parameter changes alter the competitiveness of mitigation options, the influence on the mitigation mix is significant.

3.2 Determinants of the Opportunity Costs

This section takes a closer look at the opportunity costs of climate protection. In the following we present parameter studies varying two parameters simultaneously. This enables us to discuss the effects of varying these parameters, as well as analyzing the interdependencies between them, hence taking a first step beyond a sensitivity analysis that is only local. Naturally, many parameters remain fixed at their default levels, so this analysis is still very much local in character. But by restricting us to the variation of two parameters at a time, we maintain the possibility of an intuitive graphical presentation of the results providing deeper insights into the workings of MIND.

Figure 2: Figures in this panel show discounted gross world product loss (discount rate is 5 %) for several parameter studies. In figure 2a, energy R&D and labor R&D refer to the productivity of investment into research that enhances the efficiency of the corresponding factor. In 2b, e.o.s. production refers to the elasticity of substitution of production function in the aggregate industrial production sector. Parameters χ_3 and χ_4 in figure 2b and 2c refer to the size of the fossil resource base and the exponent of the Rogner curve, respectively. Figure 3d treats the learning rate of renewable technologies and the efficiency of investments in CCS technology. The pairs of default parameter values are indicated with a bold cross.

We start out by taking a look at the engine of endogenous growth in MIND: R&D investments that drive labor and energy efficiencies. Figure 2a displays the productivity of these investments. While the two parameters are similar with respect to the process they describe – accumulation of a knowledge stock increasing the productivity of an input factor to aggregate production – their effects on opportunity costs are contrary. An enhanced effectiveness of labor productivity R&D raises costs, while better energy efficiency R&D reduces GWP losses. This is due to opposite effects on the mitigation gap, i.e. the discrepancy of CO₂ emissions between business-as-usual and climate policy scenarios: More effective labor R&D stimulates additional economic growth and implies higher CO₂ emissions in the baseline. More effective energy R&D investments on the other hand facilitate much better energy efficiency in the baseline, and hence lower CO₂ emissions. The mitigation gap characterizes the challenge for the economy posed by climate protection goals and manifests itself in the opportunity costs.

Figure 2b compiles two parameters with an effect of the second type: the elasticity of substitution in the aggregate production sector, and the estimated size of the available fossil resources. Figure 2b shows that costs increase with the elasticity of substitution. This, too, we attribute to baseline effects: Higher elasticity of substitution implies a more flexible production technology which induces higher economic growth in business-as-usual. Therefore, achieving 450 ppm requires a substantial departure from the baseline and is relatively costly. A variation of the resource base has a bigger impact on the mitigation costs if the elasticity of substitution is relatively high. Low values of the elasticity of substitution lessen economic growth and consequently imply a lower demand for energy. At low energy demand, relaxing the scarcity of the resource has less of an effect. In general, a larger resource base allows higher economic growth in business-as-usual. When climate policy constrains resource use, it devaluates exhaustible resource as an economic asset and diminishes the rent income of their owners. The loss of rent income increases with the resource base because a relatively cheap and abundant resource can no longer be used as input in production.

We take yet a closer look at the fossil resource base. Figure 2c studies the variation of the size of the resource base χ_3 and parameter χ_4 . Parameter χ_4 as well as the resource base are proxy variables for the technological progress in the extraction sector. Increasing χ_3 , i.e. assuming more abundant resources, results in cheaper short to medium term supply of the fossil resource. Increasing χ_4 trades a slow and steady increase of the marginal costs for a steeper increase at a later time – thus making the resource cheaper and more easily available in the short to medium term. High values of χ_4 allow higher economic growth in the business-as-usual case and induce a relatively large mitigation gap. For high values of χ_4 the marginal costs of extraction are essentially constant. Under this condition an increased resource base has a moderate impact on macro-economic mitigation costs. For low values of χ_4 , an increased resource base has a slightly higher impact on the macro-economic costs because marginal improvements in extraction already increase the shadow price of the resource. This parameter study shows that climate protection becomes relatively costly if there is a high rate of technological progress in the exploration and extraction of fossil fuels. Accelerated technological progress in the extraction sector makes climate policy more costly, because such policy devaluates assets (resources and capital stock in the corresponding sectors). Therefore, special attention ought to be paid to assumptions about resource availability and their uncertainties.

Contrary effects can be observed if technological progress decreases the costs of mitigation technologies. The impact on opportunity costs is shown in figure 2d. We explore two parameters which are both closely related to mitigation options: the efficiency of investments into Carbon Capture and Sequestration technologies (CCS) and the learning rate of renewable energy technologies. Varying these two parameters shifts the competitive advantage between the two mitigation options and, consequently, the extent to which they are used. It turns out that the efficiency of CCS investments has no strong impact on the overall opportunity costs if the learning rate of renewable energy technologies is relatively high. The reason is that renewables are modeled as a backstop technology, i.e. as a carbon-free energy source, and need no non-reproducible input for energy production. In contrast to the renewables, CCS investments only bridge from the fossil fuel age to a carbon-free era. CCS makes the transition of the energy system smoother but has severe limitations if fossil fuels become more costly because of increasing marginal extraction costs at the end of the 21st century. At the same time, renewable energy becomes cheaper because of learning-by-doing. It is plausible that this effect cannot be altered by high efficiencies of CCS investments. At low learning rates of the backstop technology CCS becomes more important.

3.3 *Mitigation strategies*

In this section we analyze the impact of the same parameters explored in the previous section on the option portfolio of an optimal mitigation strategy. Mitigation options are compared on the basis of the amount of CO₂ that they enable the economy to reduce. For the CCS option, this is straightforward: it is simply the amount of captured and sequestered CO₂ (less the amount that leaks from the sequestration site). In case of energy related mitigation options, i.e. renewable energy and energy efficiency improvements, the corresponding amount of "mitigated CO₂ emissions" was derived from the equivalent amount of energy from fossil fuels. In MIND, the degree of efficiency on converting primary- into final energy is determined endogenously in the production

function of the fossil sector. In this ex post analysis, however, we estimate the "equivalent" amount of fossil energy by assuming a fix coefficient. The remaining mitigation options, namely energy savings by substitution of energy at the levels of energy transformation and aggregate production, are visualized as the difference to the total reduction of CO₂.

Figure 3: Figures 3a-f show how the mix of mitigation options varies in parameter studies. CO₂ reductions caused by avoiding the use of fossil fuels (renewable energy, energy efficiency improvements, and substitution) are estimated from the alternative use of fossil fuels. Dashed lines indicate the default parameter value.

Figure 3a shows that the amount of CCS within the portfolio of mitigation options increases with the assumed resource base. The cumulative amount of CO₂ reduced by renewables within the next century decreases, energy efficiency remains constant and energy savings increase. An increasing resource base

implies increasing rents for the owners. This increasing rent income makes CCS a more profitable option. Due to high economic growth and relatively cheap fossil fuels, the return on investment in renewables falls short of the returns on CCS investments.

In figure 3b, energy savings (reduction of energy consumption by substituting energy by capital in different sectors) become more profitable if the elasticity of substitution increases; at the same time, the importance of energy efficiency decreases.

A more surprising result is obtained in figure 3c and 3d. In figure 3c an increasing productivity of R&D investment in labor enhancing activities also increases the share of renewables in the mitigation portfolio. The explanation is as follows: Economic growth induces additional energy demand that is met by carbon-free technologies. Due to high economic growth, marginal extraction costs of fossil fuels increase sooner, and thus CCS is less competitive compared to renewables. In contrast, when R&D investments in energy efficiency become more productive, the mitigation gap shrinks, and the share of renewables within the mitigation portfolio decreases (3d). Interestingly, changes in the productivity of energy R&D investments affect the baseline rather than providing a more attractive mitigation option: In this study, the energy efficiency parameter varies from 63 to 245 % of its regular value in 2100 in the baseline, the latter implying that energy use in 2100 is decreased by 60%. In contrast, climate policy only induces 0.4 to 2.7 % additional increases of the efficiency parameter. In conclusion, higher energy efficiency and a lower baseline for economic growth reduce the demand for renewables. The importance of the renewable energy option depends heavily on the underlying economic growth path.

As figure 3e shows, high learning rates in the renewable energy sector reduce the optimal amount of CCS substantially. In that sense CCS can be seen as a joker-option if the learning rate of the renewables is relatively low. It is also remarkable that energy savings are less important when the learning rate is relatively high because the energy demand can be met by the carbon-free renewables. Learning-by-doing reduces the price of electricity produced by renewables and increases the demand for renewables which reduces their costs further. This feedback loop makes CCS less important. As figure 3f indicates, this effect can be counteracted by an increasing efficiency of CCS-investments.

4. Concluding Remarks

In which ways does technological change matter? Our analysis shows that technological change works in two “directions”: We identify technological progress that permeates the entire economy and technological progress that is restricted in its effects to a single sector. Examples for such sector-specific technological change are learning-by-doing effects associated with renewable energy technologies and resource extraction, as well as technological progress in CCS, here modeled via its investment efficiency. In MIND, parameters associated with such sector specific technological change have a significant impact² on the optimal mix of mitigation options. For example, an increased learning rate increases the share of renewables, and improved investment efficiency in CCS increases the share of CCS within the entire portfolio of mitigation options

² We refer to the impact of a parameter in terms of a relatively large potential influence, i.e. a large sensitivity of results to changes of this parameter. Recall, however, that the actual uncertainty about parameters is not taken into account.

(figures 1b and 3ef). However, these parameters are less important in determining the overall opportunity costs of climate protection which measure the impact on the overall economy (figure 1a).

In contrast, there is technological change with significant impact on the macro-economic growth process, evident in its influence on opportunity costs. Such technological change is described by parameters of the macro-economic environment, like the elasticity of substitution, and the parameters characterizing the effectiveness of labor- and energy R&D investments. Labor R&D investments in particular have a strong influence on macro-economic growth as well as the mix of mitigation options. Progress in resource extraction is an example of sector-specific technological change with a macro-economic impact. This progress is characterized by the parameters of Rogner's scarcity curve and has been shown to exert a significant influence on opportunity costs. The most prominent effect of these parameters is their impact on the baseline.

We conclude that feedbacks between the macro-economy and the energy system are crucial for determining mitigation costs and the development of the mitigation portfolio in time. The case of technological change in resource extraction shows how sector-specific processes may exert significant influence on the macro-economy, while the impact of labor R&D productivity on the share of renewable energy is an example of macro-economic influence on a distinct sector.

This has implication for policies. A sector-specific policy that fostered technological change in the extraction sector induced by increasing prices in the oil or gas market would increase the opportunity costs of climate protection. A policy that increased the economy-wide energy efficiency in all energy related sectors would reduce the costs of climate protection substantially. Enhancing technological change in the extraction sector made sense if decision makers only intended to increase energy security. However, they ought to take into account the impact of such a policy on the opportunity costs of climate protection.

The results presented here indicate that partial-equilibrium models omitting intertemporal and inter-sectoral aspects can be misleading for designing a climate- and energy policy. Thus, they stress the utility of hybrid models incorporating endogenous technological change at the sector level as well as at the macro-economic level. Moreover, hybrid models pose a coherent framework not only for the assessment of the opportunity costs and portfolios of mitigation strategies but also for the design of climate- and energy policy instruments.

REFERENCES

- Bauer, N., (2005), "Carbon Capturing and Sequestration. An Option to Buy Time?" Unpublished Ph.D. Thesis at University Potsdam, Faculty of Economics and Social Sciences.
- Buonanno, P., C. Carraro and M. Galeotti (2003). "Endogenous Induced Technical Change and the Costs of Kyoto." *Resource and Energy Economics* 25:11–34.
- Chakravorty, U., J. Roumasset and K. Tse (1997). "Endogenous Substitution among Energy Sources and Global Warming." *Journal of Political Economy* 105:1201–1234.
- Edenhofer, O., N. Bauer and E. Kriegler (2005). "The Impact of Technological Change on Climate Protection and Welfare." *Ecological Economics* 54:277-292.
- Goulder, L. H. and K. Mathai (2002), "Optimal CO₂ Abatement in the Presence of Induced Technological Change." In A. Grübler, N. Nakicenovic and W. D. Nordhaus, eds., *Technological*

- Change and the Environment*. Resources for the Future, Washington, USA, 210–250.
- Hoos, G., R. Voss, K. Hasselmann, E. Maier-Reimer and F. Joos (2001). “A Nonlinear Impulse Response Model of the Coupled Carbon Cycle Climate System (NICCS).” *Climate Dynamics* 18:189–202.
- Kypreos, S. and L. Barreto (2000). “A Simple Global Electricity MARKAL Model with Endogenous Learning.” Paul Scherrer Institute, General Energy Research Department-ENE, Energy Modelling Group, Villigen, Switzerland.
- Manne, A., R. Mendelsohn and R. Richels (1995). “MERGE. A Model for Evaluating Regional and Global Effects of GHG Reduction Policies.” *Energy Policy* 23, 17–34.
- Nakicenovic, N. and K. Riahi (2002), “An Assessment of Technological Change across Selected Energy Scenarios.” IASA-Report RR-02-005, IASA, Laxemburg, Austria.
- Nordhaus, W. D. (2002). “Modelling Induced Innovation in Climate-Change Policy.” In A. Grübler, N. Nakicenovic and W. D. Nordhaus, eds., *Technological Change and the Environment*. Resources for the Future, Washington DC, USA, 182–209.
- Nordhaus, W. D. and J. Boyer (2000). *Warming the World. Models of Global Warming*. MIT Press, Cambridge, Massachusetts, USA.
- Popp, D. (2004a). “ENTICE: Endogenous Technological Change in the DICE Model of Global Warming.” *Journal of Environmental Economics and Management* 48:742–768.
- Popp, D. (2004b). “ENTICE-BR: The Effects of Backstop Technology and R&D on Climate Policy Models.” NBER Working Paper #10285.
- Rogner, H.-H. (1997). “An Assessment of World Hydrocarbon Resources.” *Annual Review of Energy and Environment* 22:217–262.
- Vuuren, D. P. van, M. G. J. den Elzen, M. M. Berk, P. Lucas, B. Eickhout, H. Eerens, R. Oostenrijk (2003). “Regional costs and benefits of alternative post-Kyoto climate regimes – Comparison of variants of the Multi-stage and Per Capita Convergence regimes.” RIVM report 728001025/2003. National Institute of Public Health and the Environment, Bilthoven, The Netherlands.

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

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

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

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

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

NOTE DI LAVORO PUBLISHED IN 2005

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

CTN	37.2005	<i>Alessandra CASELLA and Nobuyuki HANAKI</i> (lxxii): <u>Information Channels in Labor Markets. On the Resilience of Referral Hiring</u>
CTN	38.2005	<i>Matthew O. JACKSON and Alison WATTS</i> (lxxii): <u>Social Games: Matching and the Play of Finitely Repeated Games</u>
CTN	39.2005	<i>Anna BOGOMOLNAIA, Michel LE BRETON, Alexei SAVVATEEV and Shlomo WEBER</i> (lxxii): <u>The Egalitarian Sharing Rule in Provision of Public Projects</u>
CTN	40.2005	<i>Francesco FERI</i> : <u>Stochastic Stability in Network with Decay</u>
CTN	41.2005	<i>Aart de ZEEUW</i> (lxxii): <u>Dynamic Effects on the Stability of International Environmental Agreements</u>
NRM	42.2005	<i>C. Martijn van der HEIDE, Jeroen C.J.M. van den BERGH, Ekko C. van IERLAND and Paulo A.L.D. NUNES</i> : <u>Measuring the Economic Value of Two Habitat Defragmentation Policy Scenarios for the Veluwe, The Netherlands</u>
PRCG	43.2005	<i>Carla VIEIRA and Ana Paula SERRA</i> : <u>Abnormal Returns in Privatization Public Offerings: The Case of Portuguese Firms</u>
SIEV	44.2005	<i>Anna ALBERINI, Valentina ZANATTA and Paolo ROSATO</i> : <u>Combining Actual and Contingent Behavior to Estimate the Value of Sports Fishing in the Lagoon of Venice</u>
CTN	45.2005	<i>Michael FINUS and Bianca RUNDSHAGEN</i> : <u>Participation in International Environmental Agreements: The Role of Timing and Regulation</u>
CCMP	46.2005	<i>Lorenzo PELLEGRINI and Reyer GERLAGH</i> : <u>Are EU Environmental Policies Too Demanding for New Members States?</u>
IEM	47.2005	<i>Matteo MANERA</i> : <u>Modeling Factor Demands with SEM and VAR: An Empirical Comparison</u>
CTN	48.2005	<i>Olivier TERCIEUX and Vincent VANNETELBOSCH</i> (lxx): <u>A Characterization of Stochastically Stable Networks</u>
CTN	49.2005	<i>Ana MAULEON, José SEMPERE-MONERRIS and Vincent J. VANNETELBOSCH</i> (lxxii): <u>R&D Networks Among Unionized Firms</u>
CTN	50.2005	<i>Carlo CARRARO, Johan EYCKMANS and Michael FINUS</i> : <u>Optimal Transfers and Participation Decisions in International Environmental Agreements</u>
KTHC	51.2005	<i>Valeria GATTAI</i> : <u>From the Theory of the Firm to FDI and Internalisation: A Survey</u>
CCMP	52.2005	<i>Alireza NAGHAVI</i> : <u>Multilateral Environmental Agreements and Trade Obligations: A Theoretical Analysis of the Doha Proposal</u>
SIEV	53.2005	<i>Margaretha BREIL, Gretel GAMBARELLI and Paulo A.L.D. NUNES</i> : <u>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</u>
ETA	54.2005	<i>Alessandra del BOCA, Marzio GALEOTTI, Charles P. HIMMELBERG and Paola ROTA</i> : <u>Investment and Time to Plan: A Comparison of Structures vs. Equipment in a Panel of Italian Firms</u>
CCMP	55.2005	<i>Gernot KLEPPER and Sonja PETERSON</i> : <u>Emissions Trading, CDM, JI, and More – The Climate Strategy of the EU</u>
ETA	56.2005	<i>Maia DAVID and Bernard SINCLAIR-DESGAGNÉ</i> : <u>Environmental Regulation and the Eco-Industry</u>
ETA	57.2005	<i>Alain-Désiré NIMUBONA and Bernard SINCLAIR-DESGAGNÉ</i> : <u>The Pigouvian Tax Rule in the Presence of an Eco-Industry</u>
NRM	58.2005	<i>Helmut KARL, Antje MÖLLER, Ximena MATUS, Edgar GRANDE and Robert KAISER</i> : <u>Environmental Innovations: Institutional Impacts on Co-operations for Sustainable Development</u>
SIEV	59.2005	<i>Dimitra VOUVAKI and Anastasios XEPAPADEAS</i> (lxxiii): <u>Criteria for Assessing Sustainable Development: Theoretical Issues and Empirical Evidence for the Case of Greece</u>
CCMP	60.2005	<i>Andreas LÖSCHEL and Dirk T.G. RÜBBELKE</i> : <u>Impure Public Goods and Technological Interdependencies</u>
PRCG	61.2005	<i>Christoph A. SCHALTEGGER and Benno TORGLER</i> : <u>Trust and Fiscal Performance: A Panel Analysis with Swiss Data</u>
ETA	62.2005	<i>Irene VALSECCHI</i> : <u>A Role for Instructions</u>
NRM	63.2005	<i>Valentina BOSETTI and Gianni LOCATELLI</i> : <u>A Data Envelopment Analysis Approach to the Assessment of Natural Parks' Economic Efficiency and Sustainability. The Case of Italian National Parks</u>
SIEV	64.2005	<i>Arianne T. de BLAEIJ, Paulo A.L.D. NUNES and Jeroen C.J.M. van den BERGH</i> : <u>Modeling 'No-choice' Responses in Attribute Based Valuation Surveys</u>
CTN	65.2005	<i>Carlo CARRARO, Carmen MARCHIORI and Alessandra SGOBBI</i> : <u>Applications of Negotiation Theory to Water Issues</u>
CTN	66.2005	<i>Carlo CARRARO, Carmen MARCHIORI and Alessandra SGOBBI</i> : <u>Advances in Negotiation Theory: Bargaining, Coalitions and Fairness</u>
KTHC	67.2005	<i>Sandra WALLMAN</i> (lxxiv): <u>Network Capital and Social Trust: Pre-Conditions for 'Good' Diversity?</u>
KTHC	68.2005	<i>Asimina CHRISTOFOROU</i> (lxxiv): <u>On the Determinants of Social Capital in Greece Compared to Countries of the European Union</u>
KTHC	69.2005	<i>Eric M. USLANER</i> (lxxiv): <u>Varieties of Trust</u>
KTHC	70.2005	<i>Thomas P. LYON</i> (lxxiv): <u>Making Capitalism Work: Social Capital and Economic Growth in Italy, 1970-1995</u>
KTHC	71.2005	<i>Graziella BERTOCCHI and Chiara STROZZI</i> (lxxv): <u>Citizenship Laws and International Migration in Historical Perspective</u>
KTHC	72.2005	<i>Elsbeth van HYLCKAMA Vlieg</i> (lxxv): <u>Accommodating Differences</u>
KTHC	73.2005	<i>Renato SANSA and Ercole SORI</i> (lxxv): <u>Governance of Diversity Between Social Dynamics and Conflicts in Multicultural Cities. A Selected Survey on Historical Bibliography</u>
IEM	74.2005	<i>Alberto LONGO and Anil MARKANDYA</i> : <u>Identification of Options and Policy Instruments for the Internalisation of External Costs of Electricity Generation. Dissemination of External Costs of Electricity Supply Making Electricity External Costs Known to Policy-Makers</u> <u>MAXIMA</u>

IEM	75.2005	<i>Margherita GRASSO and Matteo MANERA: <u>Asymmetric Error Correction Models for the Oil-Gasoline Price Relationship</u></i>
ETA	76.2005	<i>Umberto CHERUBINI and Matteo MANERA: <u>Hunting the Living Dead A “Peso Problem” in Corporate Liabilities Data</u></i>
CTN	77.2005	<i>Hans-Peter WEIKARD: <u>Cartel Stability under an Optimal Sharing Rule</u></i>
ETA	78.2005	<i>Joëlle NOAILLY, Jeroen C.J.M. van den BERGH and Cees A. WITHAGEN (lxxvi): <u>Local and Global Interactions in an Evolutionary Resource Game</u></i>
ETA	79.2005	<i>Joëlle NOAILLY, Cees A. WITHAGEN and Jeroen C.J.M. van den BERGH (lxxvi): <u>Spatial Evolution of Social Norms in a Common-Pool Resource Game</u></i>
CCMP	80.2005	<i>Massimiliano MAZZANTI and Roberto ZOBOLI: <u>Economic Instruments and Induced Innovation: The Case of End-of-Life Vehicles European Policies</u></i>
NRM	81.2005	<i>Anna LASUT: <u>Creative Thinking and Modelling for the Decision Support in Water Management</u></i>
CCMP	82.2005	<i>Valentina BOSETTI and Barbara BUCHNER: <u>Using Data Envelopment Analysis to Assess the Relative Efficiency of Different Climate Policy Portfolios</u></i>
ETA	83.2005	<i>Ignazio MUSU: <u>Intellectual Property Rights and Biotechnology: How to Improve the Present Patent System</u></i>
KTHC	84.2005	<i>Giulio CAINELLI, Susanna MANCINELLI and Massimiliano MAZZANTI: <u>Social Capital, R&D and Industrial Districts</u></i>
ETA	85.2005	<i>Rosella LEVAGGI, Michele MORETTO and Vincenzo REBBA: <u>Quality and Investment Decisions in Hospital Care when Physicians are Devoted Workers</u></i>
CCMP	86.2005	<i>Valentina BOSETTI and Laurent GILOTTE: <u>Carbon Capture and Sequestration: How Much Does this Uncertain Option Affect Near-Term Policy Choices?</u></i>
CSRM	87.2005	<i>Nicoletta FERRO: <u>Value Through Diversity: Microfinance and Islamic Finance and Global Banking</u></i>
ETA	88.2005	<i>A. MARKANDYA and S. PEDROSO: <u>How Substitutable is Natural Capital?</u></i>
IEM	89.2005	<i>Anil MARKANDYA, Valeria COSTANTINI, Francesco GRACCEVA and Giorgio VICINI: <u>Security of Energy Supply: Comparing Scenarios From a European Perspective</u></i>
CCMP	90.2005	<i>Vincent M. OTTO, Andreas LÖSCHEL and Rob DELLINK: <u>Energy Biased Technical Change: A CGE Analysis</u></i>
PRCG	91.2005	<i>Carlo CAPUANO: <u>Abuse of Competitive Fringe</u></i>
PRCG	92.2005	<i>Ulrich BINDSEIL, Kjell G. NYBORG and Ilya A. STREBULAIEV (lxv): <u>Bidding and Performance in Repo Auctions: Evidence from ECB Open Market Operations</u></i>
CCMP	93.2005	<i>Sabrina AUCI and Leonardo BECCHETTI: <u>The Stability of the Adjusted and Unadjusted Environmental Kuznets Curve</u></i>
CCMP	94.2005	<i>Francesco BOSELLO and Jian ZHANG: <u>Assessing Climate Change Impacts: Agriculture</u></i>
CTN	95.2005	<i>Alejandro CAPARRÓS, Jean-Christophe PEREAU and Tarik TAZDAÏT: <u>Bargaining with Non-Monolithic Players</u></i>
ETA	96.2005	<i>William BROCK and Anastasios XEPAPADEAS (lxxvi): <u>Optimal Control and Spatial Heterogeneity: Pattern Formation in Economic-Ecological Models</u></i>
CCMP	97.2005	<i>Francesco BOSELLO, Roberto ROSON and Richard S.J. TOL (lxxvii): <u>Economy-Wide Estimates of the Implications of Climate Change: Human Health</u></i>
CCMP	98.2005	<i>Rob DELLINK, Michael FINUS and Niels OLIEMAN: <u>Coalition Formation under Uncertainty: The Stability Likelihood of an International Climate Agreement</u></i>
CTN	99.2005	<i>Valeria COSTANTINI, Riccardo CRESCENZI, Fabrizio De FILIPPIS, and Luca SALVATICI: <u>Bargaining Coalitions in the Agricultural Negotiations of the Doha Round: Similarity of Interests or Strategic Choices? An Empirical Assessment</u></i>
IEM	100.2005	<i>Giliola FREY and Matteo MANERA: <u>Econometric Models of Asymmetric Price Transmission</u></i>
IEM	101.2005	<i>Alessandro COLOGNI and Matteo MANERA: <u>Oil Prices, Inflation and Interest Rates in a Structural Cointegrated VAR Model for the G-7 Countries</u></i>
KTHC	102.2005	<i>Chiara M. TRAVISI and Roberto CAMAGNI: <u>Sustainability of Urban Sprawl: Environmental-Economic Indicators for the Analysis of Mobility Impact in Italy</u></i>
ETA	103.2005	<i>Livingstone S. LUBOOBI and Joseph Y.T. MUGISHA: <u>HIV/AIDS Pandemic in Africa: Trends and Challenges</u></i>
SIEV	104.2005	<i>Anna ALBERINI, Erik LICHTENBERG, Dominic MANCINI, and Gregmar I. GALINATO: <u>Was It Something I Ate? Implementation of the FDA Seafood HACCP Program</u></i>
SIEV	105.2005	<i>Anna ALBERINI and Aline CHIABAI: <u>Urban Environmental Health and Sensitive Populations: How Much are the Italians Willing to Pay to Reduce Their Risks?</u></i>
SIEV	106.2005	<i>Anna ALBERINI, Aline CHIABAI and Lucija MUEHLENBACHS: <u>Using Expert Judgment to Assess Adaptive Capacity to Climate Change: Evidence from a Conjoint Choice Survey</u></i>
CTN	107.2005	<i>Michele BERNASCONI and Matteo GALIZZI: <u>Coordination in Networks Formation: Experimental Evidence on Learning and Salience</u></i>
KTHC	108.2005	<i>Michele MORETTO and Sergio VERGALLI: <u>Migration Dynamics</u></i>
NRM	109.2005	<i>Antonio MUSOLESI and Mario NOSVELLI: <u>Water Consumption and Long-Run Urban Development: The Case of Milan</u></i>
SIEV	110.2005	<i>Benno TORGLER and Maria A. GARCIA-VALIÑAS: <u>The Determinants of Individuals’ Attitudes Towards Preventing Environmental Damage</u></i>
SIEV	111.2005	<i>Alberto LONGO and Anna ALBERINI: <u>What are the Effects of Contamination Risks on Commercial and Industrial Properties? Evidence from Baltimore, Maryland</u></i>
SIEV	112.2005	<i>Anna ALBERINI and Alberto LONGO: <u>The Value of Cultural Heritage Sites in Armenia: Evidence from a Travel Cost Method Study</u></i>
CCMP	113.2005	<i>Mikel GONZÁLEZ and Rob DELLINK: <u>Impact of Climate Policy on the Basque Economy</u></i>
NRM	114.2005	<i>Gilles LAFFORGUE and Walid OUESLATI: <u>Optimal Soil Management and Environmental Policy</u></i>

NRM	115.2005	<i>Martin D. SMITH and Larry B. CROWDER (lxxvi): <u>Valuing Ecosystem Services with Fishery Rents: A Lumped-Parameter Approach to Hypoxia in the Neuse River Estuary</u></i>
NRM	116.2005	<i>Dan HOLLAND and Kurt SCHNIER (lxxvi): <u>Protecting Marine Biodiversity: A Comparison of Individual Habitat Quotas (IHQs) and Marine Protected Areas</u></i>
PRCG	117.2005	<i>John NELLIS: <u>The Evolution of Enterprise Reform in Africa: From State-owned Enterprises to Private Participation in Infrastructure — and Back?</u></i>
PRCG	118.2005	<i>Bernardo BORTOLOTTI: <u>Italy's Privatization Process and Its Implications for China</u></i>
SIEV	119.2005	<i>Anna ALBERINI, Marcella VERONESI and Joseph C. COOPER: <u>Detecting Starting Point Bias in Dichotomous-Choice Contingent Valuation Surveys</u></i>
CTN	120.2005	<i>Federico ECHENIQUE and Mehmet B. YENMEZ: <u>A Solution to Matching with Preferences over Colleagues</u></i>
KTHC	121.2005	<i>Valeria GATTAI and Corrado MOLTENI: <u>Dissipation of Knowledge and the Boundaries of the Multinational Enterprise</u></i>
KTHC	122.2005	<i>Valeria GATTAI: <u>Firm's Intangible Assets and Multinational Activity: Joint-Venture Versus FDI</u></i>
CCMP	123.2005	<i>Socrates KYPREOS: <u>A MERGE Model with Endogenous Technological Change and the Cost of Carbon Stabilization</u></i>
CCMP	124.2005	<i>Fuminori SANO, Keigo AKIMOTO, Takashi HOMMA and Toshimasa TOMODA: <u>Analysis of Technological Portfolios for CO2 stabilizations and Effects of Technological Changes</u></i>
CCMP	125.2005	<i>Fredrik HEDENUS, Christian AZAR and Kristian LINDGREN: <u>Induced Technological Change in a Limited Foresight Optimization Model</u></i>
CCMP	126.2005	<i>Reyer GERLAGH: <u>The Value of ITC under Climate Stabilization</u></i>
PRCG	127.2005	<i>John NELLIS: <u>Privatization in Africa: What has happened? What is to be done?</u></i>
PRCG	128.2005	<i>Raphaël SOUBEYRAN: <u>Contest with Attack and Defence: Does Negative Campaigning Increase or Decrease Voters' Turnout?</u></i>
PRCG	129.2005	<i>Pascal GAUTIER and Raphael SOUBEYRAN: <u>Political Cycles : The Opposition Advantage</u></i>
ETA	130.2005	<i>Giovanni DI BARTOLOMEO, Nicola ACOCCELLA and Andrew HUGHES HALLETT: <u>Dynamic Controllability with Overlapping targets: A Generalization of the Tinbergen-Nash Theory of Economic Policy</u></i>
SIEV	131.2005	<i>Elissaios PAPYRAKIS and Reyner GERLAGH: <u>Institutional Explanations of Economic Development: the Role of Precious Metals</u></i>
ETA	132.2005	<i>Giovanni DI BARTOLOMEO and Nicola ACOCCELLA: <u>Tinbergen and Theil Meet Nash: Controllability in Policy Games</u></i>
IEM	133.2005	<i>Adriana M. IGNACIUK and Rob B. DELLINK: <u>Multi-Product Crops for Agricultural and Energy Production – an AGE Analysis for Poland</u></i>
IEM	134.2005	<i>Raffaele MINIACI, Carlo SCARPA and Paola VALBONESI: <u>Restructuring Italian Utility Markets: Household Distributional Effects</u></i>
SIEV	135.2005	<i>Valentina ZANATTA, Paolo ROSATO, Anna ALBERINI and Dimitrios REPPAS: <u>The Impact of Speed Limits on Recreational Boating in the Lagoon of Venice</u></i>
NRM	136.2005	<i>Chi-CHUR CHAO, Bharat R. HAZARI, Jean-Pierre LAFFARGUE, Pasquale M. SGRO, and Eden S. H. YU (lxxviii): <u>Tourism, Jobs, Capital Accumulation and the Economy: A Dynamic Analysis</u></i>
NRM	137.2005	<i>Michael MCALEER, Riaz SHAREEF and Bernardo da VEIGA (lxxviii): <u>Risk Management of Daily Tourist Tax Revenues for the Maldives</u></i>
NRM	138.2005	<i>Guido CANDELA, Paolo FIGINI and Antonello E. SCORCI (lxxviii): <u>The Economics of Local Tourist Systems</u></i>
NRM	139.2005	<i>Paola De AGOSTINI, Stefania LOVO, Francesco PECCI, Federico PERALI and Michele BAGGIO (lxxviii): <u>Simulating the Impact on the Local Economy of Alternative Management Scenarios for Natural Areas</u></i>
NRM	140.2005	<i>Simone VALENTE (lxxviii): <u>Growth, Conventional Production and Tourism Specialisation: Technological Catching-up Versus Terms-of-Trade Effects</u></i>
NRM	141.2005	<i>Tiago NEVES SEQUEIRA and Carla CAMPOS (lxxviii): <u>International Tourism and Economic Growth: a Panel Data Approach</u></i>
NRM	142.2005	<i>Francesco MOLA and Raffaele MIELE (lxxviii): <u>An Open Source Based Data Warehouse Architecture to Support Decision Making in the Tourism Sector</u></i>
NRM	143.2005	<i>Nishaal GOOROOCHURN and Adam BLAKE (lxxviii): <u>Tourism Immiserization: Fact or Fiction?</u></i>
NRM	144.2005	<i>S. MARZETTI Dall'ASTE BRANDOLINI and R. MOSETTI (lxxviii): <u>Social Carrying Capacity of Mass Tourist Sites: Theoretical and Practical Issues about its Measurement</u></i>
NRM	145.2005	<i>Sauveur GIANNONI and Marie-Antoinette MAUPERTUIS (lxxviii): <u>Environmental Quality and Long Run Tourism Development a Cyclical Perspective for Small Island Tourist Economies</u></i>
NRM	146.2005	<i>Javier LOZANO, Carlos GÓMEZ and Javier REY-MAQUIEIRA (lxxviii): <u>An Analysis of the Evolution of Tourism Destinations from the Point of View of the Economic Growth Theory</u></i>
CCMP	147.2005	<i>Valentina BOSETTI and Laurent DROUET: <u>Accounting for Uncertainty Affecting Technical Change in an Economic-Climate Model</u></i>
NRM	148.2005	<i>Mondher SAHLI and Jean-Jacques NOWAK (lxxviii): <u>Migration, Unemployment and Net Benefits of Inbound Tourism in a Developing Country</u></i>
ETA	149.2005	<i>Michael GREENSTONE and Justin GALLAGHER: <u>Does Hazardous Waste Matter? Evidence from the Housing Market and the Superfund Program</u></i>
CCMP	150.2005	<i>Ottmar EDENHOFER, Kai LESSMANN and Nico BAUER: <u>Mitigation Strategies and Costs of Climate Protection: The effects of ETC in the hybrid Model MIND</u></i>

- (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.
- (lxxiii) This paper was presented at the 2nd Workshop on "Inclusive Wealth and Accounting Prices" held in Trieste, Italy on 13-15 April 2005 and organised by the Ecological and Environmental Economics - EEE Programme, a joint three-year programme of ICTP - The Abdus Salam International Centre for Theoretical Physics, FEEM - Fondazione Eni Enrico Mattei, and The Beijer International Institute of Ecological Economics
- (lxxiv) This paper was presented at the ENGIME Workshop on “Trust and social capital in multicultural cities” Athens, January 19-20, 2004
- (lxxv) This paper was presented at the ENGIME Workshop on “Diversity as a source of growth” Rome November 18-19, 2004
- (lxxvi) This paper was presented at the 3rd Workshop on Spatial-Dynamic Models of Economics and Ecosystems held in Trieste on 11-13 April 2005 and organised by the Ecological and Environmental Economics - EEE Programme, a joint three-year programme of ICTP - The Abdus Salam International Centre for Theoretical Physics, FEEM - Fondazione Eni Enrico Mattei, and The Beijer International Institute of Ecological Economics
- (lxxvii) This paper was presented at the Workshop on Infectious Diseases: Ecological and Economic Approaches held in Trieste on 13-15 April 2005 and organised by the Ecological and Environmental Economics - EEE Programme, a joint three-year programme of ICTP - The Abdus Salam International Centre for Theoretical Physics, FEEM - Fondazione Eni Enrico Mattei, and The Beijer International Institute of Ecological Economics.
- (lxxviii) This paper was presented at the Second International Conference on "Tourism and Sustainable Economic Development - Macro and Micro Economic Issues" jointly organised by CRENoS (Università di Cagliari and Sassari, Italy) and Fondazione Eni Enrico Mattei, Italy, and supported by the World Bank, Chia, Italy, 16-17 September 2005.

2004 SERIES

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

2005 SERIES

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