

Bosello, Francesco; Roson, Roberto; Tol, Richard S.J.

Working Paper

Economy-Wide Estimates of the Implications of Climate Change: Human Health

Nota di Lavoro, No. 97.2005

Provided in Cooperation with:

Fondazione Eni Enrico Mattei (FEEM)

Suggested Citation: Bosello, Francesco; Roson, Roberto; Tol, Richard S.J. (2005) : Economy-Wide Estimates of the Implications of Climate Change: Human Health, Nota di Lavoro, No. 97.2005, Fondazione Eni Enrico Mattei (FEEM), Milano

This Version is available at:

<https://hdl.handle.net/10419/74106>

Standard-Nutzungsbedingungen:

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

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

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

Terms of use:

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

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

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

Economy-Wide Estimates of the Implications of Climate Change: Human Health

Francesco Bosello, Roberto Roson
and Richard S.J. Tol
NOTA DI LAVORO 97.2005

JULY 2005

CCMP – Climate Change Modelling and Policy
--

Francesco Bosello, *Fondazione Eni Enrico Mattei and International Centre for Theoretical Physics*
Roberto Roson, *Ca' Foscari University of Venice and International Centre for Theoretical Physics*
Richard S.J. Tol, *Centre for Marine and Climate Research, Hamburg University, Institute for
Environmental Studies, Vrije Universiteit and Center for Integrated Study of the Human
Dimensions of Global Change*

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=773926>

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

Economy-Wide Estimates of the Implications of Climate Change: Human Health

Summary

We study the economic impacts of climate-change-induced change in human health, viz. cardiovascular and respiratory disorders, diarrhoea, malaria, dengue fever and schistosomiasis. Changes in morbidity and mortality are interpreted as changes in labour productivity and demand for health care, and used to shock the GTAP-E computable general equilibrium model, calibrated for the year 2050. GDP, welfare and investment fall (rise) in regions with net negative (positive) health impacts. Prices, production, and terms of trade show a mixed pattern. Direct cost estimates, common in climate change impact studies, underestimate the true welfare losses.

Keywords: Impacts of climate change, Human health, Computable general equilibrium

JEL Classification: C68, D58, Q25

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.

We had useful discussions about the topics of this paper with Carlo Carraro, Marzio Galeotti, Guy Jakeman, Sam Fankhauser, Claudia Kemfert, Hans Kremers, Marco Lazzarin, Hom Pant, Katrin Rehdanz and Kerstin Ronneberger. The Volkswagen Foundation through the ECOBICE project, the US National Science Foundation through the Center for Integrated Study of the Human Dimensions of Global Change (SBR-9521914), the Michael Otto Foundation and the Ecological and Environmental Economics programme at ICTP-Trieste provided welcome financial support. All errors and opinions are ours.

Address for correspondence:

Francesco Bosello
Fondazione Eni Enrico Mattei
Campo S. Maria Formosa
Castello 5252
30122 Venice
Italy
Phone: +39 0412711459
Fax: +39 0412711461
E-mail: francesco.bosello@feem.it

1. Introduction

Of the many impacts of climate change, those on human health are often placed amongst the most worrying (e.g., Smith *et al.*, 2001). The impacts of climate change on human health are many and complex. Global warming would increase heat-related health problems, which mostly affect people with pre-established cardiovascular and respiratory disorders. On the other hand, global warming would reduce cold-related health problems, again most prevalent in people with cardiovascular disorders. Climate change would affect the range and abundance of species carrying diseases, and would affect the pathogens as well. Malaria, in particular, is generally thought to increase because of climate change. Other vector-borne diseases may increase or decrease, but currently make much less victims than does malaria. Climate change would allow diseases to invade immunologically naïve populations with unprepared medical systems. Climate change would affect food- and water-borne diseases too, with cholera and diarrhoea being potentially most problematic. Climate change would alter weather extremes, with floods and storms killing and injuring people. Climate change would affect air quality, and all diseases resulting from air pollution. Climate change may also affect human health indirectly, through changes in food production, water resources, migration and economic development (McMichael *et al.*, 2001).

Human health therefore figures prominently in assessments of the impacts of climate change. The welfare costs (or benefits) of health impacts contribute substantially to the total costs of climate change (Cline, 1992; Fankhauser, 1995; Tol, 2002a,b). The majority of estimates of the economic damages of global warming rely on the methodology of direct costs, that is, damage equals price times quantity. In case of human health, the price is typically equal to the value of a statistical life, which is based on estimates of the willingness to pay to reduce the risk of death or diseases, or the willingness to accept compensation for increased risk (see Viscusi and Aldy, 2003, for a recent review). This method ignores that human health impacts also affect labour productivity and the demand for health services. In this paper, we estimate the higher-order economic effects (or indirect costs) of human health impacts, and compare these to the direct costs.

This is part of a larger research programme, in which earlier papers looked at sea level rise (Bosello *et al.*, 2004) and tourism (Berrittella *et al.*, 2004). Jorgenson *et al.* (2004) do something similar, but their model is restricted to the USA. Their health impacts include cardiovascular and respiratory disorders (as do ours) and ozone-related health problems (which we exclude) but not vector- and water-borne diseases (which we include; note that these diseases are not very important in the USA). Jorgenson *et al.* (2004) include changes in labour productivity (as do we) but exclude the induced demand for health care (which we include).

The health effects assessed in this paper include cardiovascular diseases (heat and cold stress), respiratory diseases (heat stress), diarrhoea, malaria, dengue fever, and schistosomiasis. The first four diseases are major killers without climate change, and may therefore be important in the total health burden of climate change as well. For the last two diseases, climate change impacts happen to have been estimated at a global scale. For other diseases probably affected by climate change, no global estimates are available. Our selection of diseases is therefore one of convenience, rather than comprehensiveness. The numbers presented below are biased estimates of the full health effects. Unfortunately, the sign of this bias is unknown, let alone its size. As a further complication, health is affected not only by climate (change), but also by health care in all its forms, from nutrition and sanitation to hospitalisation. In the analysis, we include crude relationships between diseases incidence and development.

The structure of the paper is as follows. Section 2 presents the FEEM variant of the GTAP-E CGE model and the baseline scenario. Section 3 presents estimates of the health impacts of

climate change. Section 4 discusses how these impacts are brought into the CGE. Section 5 presents the results. Section 6 concludes.

2. Model and simulations

In order to assess the systemic, general equilibrium effects of health impacts, induced by the global warming, we made an unconventional use of a standard multi-country world CGE model: the GTAP model (Hertel, 1996), in the version modified by Burniaux and Truong (2002), and subsequently extended by ourselves.

First, we derived benchmark data-sets for the world economy at some selected future years (2010, 2030, 2050), using the methodology described in Dixon and Rimmer (2002). This entails inserting, in the model calibration data, forecasted values for some key economic variables, to identify a hypothetical general equilibrium state in the future.

Since we are working on the medium-long term, we focused primarily on the supply side: forecasted changes in the national endowments of labour, capital, land, natural resources, as well as variations in factor-specific and multi-factor productivity.

Most of these variables are “naturally exogenous” in CGE models. For example, the national labour force is usually taken as a given. In this case, we simply shocked the exogenous variable “labour stock”, changing its level from that of the initial calibration year (1997) to some future forecast year (e.g., 2050). In some other cases we considered variables, which are normally endogenous in the model, by modifying the partition between exogenous and endogenous variables. In the model, simulated changes in primary resources and productivity induce variations in relative prices, and a structural adjustment for the entire world economic system. The model output describes the hypothetical structure of the world economy, which is implied by the selected assumptions of growth in primary factors.

We obtained estimates of the regional labour and capital stocks by running the G-Cubed model (McKibbin and Wilcoxon, 1998).¹ This is a rather sophisticated dynamic CGE model of the world economy, with a number of notable features, such as rational expectations intertemporal adjustment, international capital flows based on portfolio selection (with non-neutrality of money and home bias in the investments), sticky wages, endogenous economic policies, public debt management. We coupled this model with GTAP, rather than using it directly, primarily because the latter turned out to be much easier to adapt to our purposes, in terms of regional and sectoral disaggregation and changes in the model equations.

We got estimates of land endowments and agricultural land productivity from the IMAGE model version 2.2 (IMAGE Team, 2001). IMAGE is an integrated assessment model, with a particular focus on the land use, reporting information on seven crop yields in 13 world regions, from 1970 to 2100. We ran this model by adopting the most conservative scenario about the climate (IPCC B1), implying minimal temperature changes.

A rather specific methodology was adopted to get estimates for the natural resources stock variables. As explained in Hertel and Tsigas (2002), values for these variables in the original

¹ Note that the projections of McKibbin and Wilcoxon (1998) are based on purchasing power parity (PPP) exchange rates. See McKibbin *et al.* (2004) for a discussion and a comparison to projections based on market exchange rates (MER). See Tol (2004) for a discussion of the climate change implications of scenarios based on PPP and MER.

GTAP data set were not obtained from official statistics, but were indirectly estimated, to make the model consistent with some industry supply elasticity values, taken from the literature. For this reason, we prefer to fix exogenously the price of the natural resources, making it variable over time in line with the GDP deflator, while allowing the model to compute endogenously the stock levels.

3. Health Impacts of Climate Change

We evaluate the impacts of human health changes in the eight regions of GTAP-EF (see Table 1). Tol (2002a) presents estimates of the change in mortality due to vector-borne diseases (viz., malaria, schistosomiasis, dengue fever) as the result of a one degree increase in the global mean temperature. The estimates result from overlaying the model-studies of Martens *et al.* (1995, 1997), Martin and Lefebvre (1995), and Morita *et al.* (1994)² with mortality figures of the WHO (Murray and Lopez, 1996). Martens *et al.* (1995, 1997) standardize their results to an increase in the global mean temperature of 1.16°C. Martin and Lefebvre (1995), and Morita *et al.* (1994), however, present their results (for malaria only) for various increases in the global mean temperature (2.8°C to 5.2°C). Both studies suggest that the relationship between global warming and malaria is linear.³ This relationship is assumed to apply to schistosomiasis and dengue fever as well. We follow the same methodology here.

We use data and models with different regional specifications, so we map all regional data to the country level and do all calculations there before aggregating to the GTAP-EF regions. We use the 14 region Burden of Diseases assessment of current vector-borne morbidity and mortality (Murray and Lopez, 1996)⁴. Within these regions, all countries are assumed to have the same diseases rates. We use the 9 region estimates of the change in disease burden by Tol (2002a), again mapping to the country level assuming that the countries within a region are homogenous. We use the relationship between per capita income and disease incidence developed by Tol and Heinzow (2003),⁵ using the projected per capita income growth of the 8 GTAP-EF regions for the countries within those regions. The resulting changes in national mortality and morbidity are then aggregated to the GTAP-EF regions. The annual loss of labour productivity is assumed to be equal to the number of additional malaria deaths plus the additional years of life diseased by malaria, divided by the total population. Table 1 summarizes the findings. The assumed global mean warming is 1.03°C in 2050 (relative to 1997).

For diarrhoea, we follow Link and Tol (2004), who report the estimated relationship between mortality and morbidity on the one hand and temperature and per capita income on the other hand, using the WHO Global Burden of Disease data (Murray and Lopez, 1996).

Martens (1998) reports the results of a meta-analysis of the change in cardiovascular and respiratory mortality for 17 countries. Tol (2002a) extrapolates these findings to all other

² Note that the relationship between malaria and climate is not uncontested (Hay *et al.*, 2002). This paper, however, is on the economic impacts of climate-change-induced changes in health risks, not on the health risks themselves.

³ Linearity may not hold in reality, but we have no information on the nature of the possible non-linearity.

⁴ This data is updated at http://www.who.int/health_topics/global_burden_of_disease/en/

⁵ Vulnerability to vector-borne diseases strongly depends on basic and preventative health care and the ability to purchase medicine, as well as on a range of other matters. Tol and Dowlatabadi (2001) suggest a linear relationship between per capita income and health. In this analysis, vector-borne diseases have an income elasticity of -2.7 (Tol and Heinzow, 2003).

countries, using the current climate as the main predictor. Cold-related cardiovascular, heat-related cardiovascular, and (heat-related) respiratory mortality are specified separately, as are the cardiovascular impacts on the population below 65 and above. Heat-related mortality is assumed to only affect the urban population. Scenarios for urbanization and aging are based on Tol (1996, 1997).⁶ We use this model directly on a country basis, before aggregating to the regions of GTAP-EF. Regional temperatures have been obtained through data elaboration from Giorgi and Mearns (2002).⁷

Besides the changes in labour productivity, the CGE is also shocked with the changes in demand for health care. The literature on the costs of diseases is thin. Substantial information appears to be in the grey literature on public health advice, specific for each country, but it is beyond this paper to review that. There are a few papers in the open literature, however. Kiiskinen *et al.* (1997) report the average costs of cardiovascular diseases, \$21,000 per case, for Finland. Blomqvist and Carter (1997), Gbesemete and Gerdtham (1992), Gerdtham and Jönsson (1991), Getzen (2000), Govindaraj *et al.* (1997), Hitires and Posnett (1992), and di Matteo and di Matteo (1998) estimate the income elasticity of health expenditures for countries in the OECD, Latin America and Africa for the period 1960-1991. The average is 1.3. We use this to extrapolate the Finnish costs of cardiovascular diseases to other countries. Weiss *et al.* (2000) report the costs of asthma for the USA. The direct costs⁸ amount to \$430 per case, or \$40,000 per year diseased.⁹ We assume that asthma is representative for all respiratory disease, and again extrapolate to other countries using an income elasticity of 1.3.

The costs of vector borne diseases are taken from Chima *et al.* (2003), who report the expenditure on prevention and treatment costs per person per month. Their data suggest the following relationships

$$(1) \quad P = 0.1406 + 0.0026Y$$

(0.3103) (0.0008)

$$(2) \quad T = -0.4646 + 0.0053Y$$

(0.8217) (0.0018)

where P is monthly prevention costs (\$/capita), T is monthly treatment costs (\$/cap) and Y is income per capita (\$/cap). We scale this up with the increase in mortality.

4. Including Impacts in the CGE model

To model the health-related impact of climate change in the computable general equilibrium model, we run a set of simulation experiments, by shocking specific variables in the model. Health impacts produce economic effects through two main mechanisms: first, there is a variation of working hours, which is equivalent to a change in the regional stock of labour force; second, there is a variation in the expenditure for health services, undertaken by public administration and private households. Both these effects could, in principle, be positive or negative in each region. This is because the incidence of some illnesses may be higher or

⁶ The income elasticity of the share of the population over 65 is 0.25. Urbanisation follows

$$U(t) = U(1995) \frac{0.031Y(t) - 0.011PD(t)}{1 + 0.031Y(t) - 0.011PD(t)} \frac{1 + 0.031Y(1995) - 0.011PD(1995)}{0.031Y(1995) - 0.011PD(1995)}$$

where U is the level of urbanisation, Y is per capita income and PD is population density.

⁷ Regional impacts differ in a range of 20%-40% when regional temperature is used instead of average world temperature. Temperature data for 22 climatic zones has first been applied at the country level and subsequently aggregated for the eight macro-regions of the model.

⁸ Weiss *et al.* (2000) also estimate the indirect costs to the economy.

⁹ The average treatment for asthma lasts 4 days.

lower when temperature increases. The “composition” also matters: some diseases are more costly to treat than are others.

Variations in the number of disease cases are estimated on the basis of specific relationships based on temperature changes and income levels described above. The number of cases has then been translated into changes of working hours; for mortality, we use years of life lost, for morbidity, years of life diseased. Next, the exogenous variable “regional labour productivity” has been shocked in the model, in a way similar to the one followed to get future equilibrium benchmarks.

Changes in the consumption of health services are more difficult to model, however, as these refer to variables which are normally endogenous in the model. One possibility is to alter the partition between exogenous and endogenous variables, by allowing the model to compute some parameter values, previously taken as a given.¹⁰

Here, we have chosen a different route. We interpreted our input data, expressing the additional health expenditure in terms of GDP, as coming from a partial equilibrium analysis, which disregards the simultaneous price changes occurring in all other markets. In practice, we imposed a shift in parameter values, which could produce the required variation in expenditure *if all prices and income levels would stay constant*.

It turns out that this is equivalent to a shift in factor-specific productivity, with opposite sign. A doubled factor productivity, for example, means that the same services can be obtained with half the original input. To achieve, say, an increase of health expenditure at constant prices and income, it is then sufficient to lower the health services productivity, for instance in terms of utility.

Consequently, we adopted the following procedure. We computed the magnitude of the absolute variation of expenditure from estimates expressed in terms of GDP share. Using data from the World Health Organization, we split this amount in private and public expenditure, deriving, in both cases, the percentage variation in the demand for health services. Subsequently, we shocked the productivity of health services for the final (private and public) demand, within the broader sector of non-market services. To comply with the budget constraint, we compensated the higher level of public consumption with a lower level of aggregate private consumption and, within the latter, we compensated the higher consumption of health services with reduced expenditure shares for all other industries.

The simulation experiment is then obtained through the three simultaneous shocks on labour endowments and on the structure of final demand (public and private). The scenario produced in this way is compared with the hypothetical equilibrium benchmark. Because of the general equilibrium effects on prices and income levels, the variation in health expenditure computed by the model output turns out to be slightly different from the initial variation in the productivity parameters.

5. Results

In this section, simulation results for the year 2050 are reported and commented, in terms of variation from the no-climate-change baseline equilibrium. Results for other reference years are qualitatively similar.

Two mechanisms drive the results. Changes in labour productivity (positive and negative) directly affect the economy resources, so they have the nature of a typical macroeconomic shock. Changes in health expenditure, on the other hand, only influence the composition of

¹⁰ For example, utility parameters, simulating a change in the structure of preferences.

demand. In particular, two effects take place here: a crowding out between private and public health expenditure and a crowding out within private expenditure between health care and the remaining commodities/services consumed by the household.

Labour productivity declines in Energy Exporting Countries [Eex] and Rest of the World [RoW] (Table 2). In the first case, the effect is mainly driven by the higher incidence of respiratory and gastro-enteric diseases, whereas in the latter case also by the incidence of malaria. In regions experiencing labour productivity gains (USA, European Union [EU], Eastern European and Former Soviet Union Countries [EEFSU], Japan [JPN], Rest of “Annex I” Countries [RoA1], China and India [CHIND]) vector borne diseases are practically absent, while the decrease in mortality/morbidity associated to cold stress related to cardiovascular diseases, more than compensates the increase in heat stress related diseases.

Higher (lower) incidence of illnesses is associated with more (less) demand for health care by the household and the public sector. The increase is particularly significant in EEx and RoW (see Table 2). Higher (lower) private demand for health care induces households to decrease (increase) their demand on other consumption items, while an increase (decrease) in public spending for health crowds out (in) total private consumption expenditure and lowers (raises) GDP (Figure 1).

The direct effect of a lower (higher) labour productivity is to lower (raise) GDP and utility (Table 5), notwithstanding the counteracting effect of the increased (decreased) health care demand (Table 3). The change in GDP is less than proportional to the change in labour productivity as the economy can substitute labour for other inputs (e.g., capital), or vice versa (Figure 1). Carbon dioxide emissions follow GDP (Table 5).

Table 5 also shows the direct costs. Following Tol (2002a), we value a premature death at 200 times per capita income, and a year of life diseased at 80% of the annual income. Note that these estimates include the immaterial welfare losses of health impacts only; economic impacts are excluded. The direct costs, expressed as percent of GDP, are much larger than the economic impacts: The direct costs of risks of death and illness outweigh the indirect costs. The direct costs have the same sign as the changes in GDP (that is, a direct cost corresponds to a GDP loss). This is intuitive: A loss of labour and forced purchase of health care are economic losses, just as death and illness are welfare losses. The direct costs, a welfare measure, also have the same sign as the change in the welfare index. Studies relying on direct costs only therefore underestimate the true welfare impact (that is, the direct plus the indirect costs).

Effects on prices (Table 4) are more difficult to trace, as changes in labour productivity, re-composition of demand and aggregate effects on production all influence the final result. For example, a lower labour productivity reduces labour demand, and thus wages. However, this is associated with a demand shift towards labour-intensive health care services, calling for higher wages.

A changing industry mix, for example with a higher share of services, implies a reduction in the overall propensity to import, with potential gains in the terms of trade. Also, lower labour productivity creates a relative scarcity of (differentiated) domestic goods, thereby increasing the price of exports and decreasing the price of imports. This is most evident in the case of RoW (Table 5).

In all regions, the price of capital resources moves in accordance with GDP (an exception is CHIND, but the negative figure is very small). This is particularly important for its consequences on the international capital flows. In the model, domestic investment is not constrained by the amount of domestic saving. Rather, investment is allocated in a diversified international portfolio, where higher returns on capital attract more investment (see the model

description in the Appendix for more details). Therefore, this mechanism amplifies the macroeconomic impact of variations in labour productivity, whereas changing terms of trade work to the opposite direction.

6. Discussion and conclusion

We estimate the economy-wide effects of the climate-change-induced impacts on health through changes in labour productivity and public and private demand for health care. This adds to the existing literature, which to date only included the *direct* costs of health impacts. The *indirect* costs may be positive or negative; in fact, they have the same sign as the health impacts themselves, so that direct costs are underestimates of the true impact. We find that, in 2050, climate-change-induced health impacts may increase GDP by 0.08% (Rest of Annex I) or reduce it by 0.07% (in the Rest of the World, which includes Africa).

The results presented here suffer from a number of drawbacks. We do not present any sensitivity analyses. However, the theory of computable general equilibrium models is sufficiently well understood to know that the results presented here would not change qualitatively if we were to impose different shocks, if we were to use different elasticities or a different sectoral or regional breakdown, or if we were to use different scenarios of climate change and economic development. More importantly, we use a static CGE, rather than a dynamic one. Although we do estimate the effects of climate-change-induced health impacts on investment, we do not include the effects of changing investment. We find that investment falls (rises) if health impacts are negative (positive), which would imply that the economy would shift away from those countries and sectors that are negatively affected by climate change. This would reduce global vulnerability to climate change, but increase the regional and sectoral impacts. More subtly, we omit the effects of direct impact of health on education, as well as the dynamic effects of changes in public health care via government expenditures. These issues are deferred to future research. This paper establishes that the indirect economic effects of climate-change-induced health impacts are substantial.

Acknowledgements

We had useful discussions about the topics of this paper with Carlo Carraro, Marzio Galeotti, Guy Jakeman, Sam Fankhauser, Claudia Kemfert, Hans Kremers, Marco Lazzarin, Hom Pant, Katrin Rehdanz and Kerstin Ronneberger. The Volkswagen Foundation through the ECOBICE project, the US National Science Foundation through the Center for Integrated Study of the Human Dimensions of Global Change (SBR-9521914), the Michael Otto Foundation and the Ecological and Environmental Economics programme at ICTP-Trieste provided welcome financial support. All errors and opinions are ours.

References

- Blomqvist, A. G. and Carter, R. A. L. (1997), 'Is health care really a luxury?', *Journal of Health Economics*, **16**, 207-229.
- Berritella, M., A. Bigano, R. Roson and R.S.J. Tol (2004), *A General Equilibrium Analysis of Climate Change Impacts on Tourism*, Research unit Sustainability and Global Change FNU-49, Hamburg University and Centre for Marine and Atmospheric Science, Hamburg.
- Bosello, F., M. Lazzarin, R. Roson and R.S.J. Tol (2004), *Economy-Wide Estimates of the Implications of Climate Change: Sea Level Rise*, Research Unit Sustainability and Global Change FNU-38, Centre for Marine and Climate Research, Hamburg University, Hamburg.
- Burniaux J-M., Truong, T.P., (2002) *GTAP-E: An Energy-Environmental Version of the GTAP Model*, GTAP Technical Paper n.16 (www.gtap.org).
- Chima, R. I., Goodman, C. A., and Mills, A (2003), 'The economic impact of malaria in Africa: a critical review of the evidence', *Health Policy*, **63**, 17-36.
- Cline, W. R. (1992), *The Economics of Global Warming* Institute for International Economics, Washington, D.C.
- Dixon, P. and Rimmer, M., (2002) *Dynamic General Equilibrium Modeling for Forecasting and Policy*, North Holland.
- Fankhauser, S. (1995), *Valuing Climate Change - The Economics of the Greenhouse*, 1 edn, EarthScan, London.
- Gbesemete, K. P. and Gerdtham, U-G. (1992), 'Determinants of Health Care Expenditure in Africa: A Cross-Sectional Study', *World Development*, **20** (2), 303-308.
- Gerdtham, U-G. and Jönsson, B. (1991), 'Conversion factor instability in international comparisons of health care expenditure', *Journal of Health Economics*, **10**, 227-234.
- Getzen, T. E. (2000), 'Health care is an individual necessity and a national luxury: applying multilevel decision models to the analysis of health care expenditures', *Journal of Health Economics*, **19**, 259-270.
- Giorgi, F. and L.O. Mearns (2001), "Calculation of Average, Uncertainty Range, and Reliability of Regional Climate Changes from AOGCM Simulations via the "Reliability Ensemble Averaging" (REA) Method", *Journal of Climate*, **15**, 1141-1158.
- Govindaraj, R., Chellaraj, G., and Murray, C. J. L. (1997), 'Health expenditures in Latin America and the Caribbean', *Social Science and Medicine*, **44** (2), 157-169.
- Hay,S.I., Cox,J., Rogers,D.J., Randolph,S.E., Stern,D.I., Shanks,G.D., Myers,M.F. and Snow,R.W. (2002), 'Climate change and the resurgence of malaria in the East African highlands', *Nature*, 415, 905-909.
- Hitiris, T. and Posnett, J. (1992), 'The determinants and effects of health expenditure in developed countries', *Journal of Health Economics*, **11**, 173-181.
- Hertel, T.W., (1996) *Global Trade Analysis: Modeling and applications*, Cambridge University Press.

Hertel, T.W., Tsigas, M. (2002), GTAP Data Base Documentation, Chapter 18.c “Primary Factors Shares” (www.gtap.org).

IMAGE (2001), *The IMAGE 2.2 Implementation of the SRES Scenarios*, RIVM CD-ROM Publication 481508018, Bilthoven, The Netherlands.

Jorgenson, D.W., Goettle, R.J., Hurd, B.H. and Smith, J.B. (2004), *US Market Consequences of Global Climate Change*, Pew Center on Global Climate Change, Washington, D.C.

Kiiskinen, U., Vartiainen, E., Pekurinen, M., and Puska, P. (1997), 'Does Prevention of Cardiovascular Diseases Lead to Decreased Cost of Illness? Twenty Years of Experience from Finland', *Preventive Medicine*, **26**, 220-226.

Link, P.M. and R.S.J. Tol (2004), 'Possible Economic Impacts of a Shutdown of the Thermohaline Circulation: An Application of *FUND*', *Portuguese Economic Journal*, **3**, 99-114.

Martens, W. J. M., Jetten, T. H., Rotmans, J., and Niessen, L. W. (1995), 'Climate Change and Vector-Borne Diseases -- A Global Modelling Perspective', *Global Environmental Change*, **5** (3), 195-209.

Martens, W. J. M. (1998), 'Climate Change, Thermal Stress and Mortality Changes', *Social Science and Medicine*, **46** (3), 331-344.

Martens, W. J. M., Jetten, T. H., and Focks, D. A. (1997), 'Sensitivity of Malaria, Schistosomiasis and Dengue to Global Warming', *Climatic Change*, **35**, 145-156.

Martin, P. H. and Lefebvre, M. G. (1995), 'Malaria and Climate: Sensitivity of Malaria Potential Transmission to Climate', *Ambio*, **24** (4), 200-207.

Matteo, L. D. and Matteo, R. D. (1998), 'Evidence on the determinants of Canadian provincial government health expenditures: 1965-1991', *Journal of Health Economics*, **17**, 211-228.

McMichael, A.J., Githeko, A., Akhtar, R., Carcavallo, R., Gubler, D., Haines, A., Kovats, R.S., Martens, P., Patz, J. and Sasaki, A. (2001), 'Human Health' in *Climate Change 2001: Impacts, Adaptation, and Vulnerability*, J. J. McCarthy et al., (eds.), Press Syndicate of the University of Cambridge, Cambridge, UK, pp. 451-485.

McKibbin, W.J., Pearce, D. and Stegman, A. (2004), *Long Run Projections for Climate Change Scenarios*, Working Papers in International Economics **1.04**, Lowly Institute for International Policy, Sydney.

McKibbin, W.J., Wilcoxon, P.J., (1998) The Theoretical and Empirical Structure of the GCubed Model, *Economic Modelling*, vol. 16(1), pp. 123-48.

Morita, T., Kainuma, M., Harasawa, H., Kai, K., & Matsuoka, Y. (1994), *An Estimation of Climatic Change Effects on Malaria*, National Institute for Environmental Studies, Tsukuba.

Murray, C. J. L. & Lopez, A. D. (1996), *Global Health Statistics* Harvard School of Public Health, Cambridge.

Smith, J. B., Schellnhuber, H.-J., Mirza, M. Q., Fankhauser, S., Leemans, R., Erda, L., Ogallo, L., Pittock, B., Richels, R., Rosenzweig, C., Safriel, U., Tol, R. S. J., Weyant, J. P., & Yohe, G. W. (2001), "Vulnerability to Climate Change and Reasons for Concern: A

Synthesis", in *Climate Change 2001: Impacts, Adaptation, and Vulnerability*, J. J. McCarthy et al., (eds.), Press Syndicate of the University of Cambridge, Cambridge, UK, pp. 913-967.

Tol, R. S. J. (1996), 'The Damage Costs of Climate Change Towards a Dynamic Representation', *Ecological Economics*, **19**, 67-90.

Tol, R. S. J. (1997), 'On the Optimal Control of Carbon Dioxide Emissions: An Application of *FUND*', *Environmental Modeling and Assessment*, **2**, 151-163.

Tol, R.S.J. (2002), 'New Estimates of the Damage Costs of Climate Change, Part I: Benchmark Estimates', *Environmental and Resource Economics*, **21** (1), 47-73.

Tol, R.S.J. (2002), 'New Estimates of the Damage Costs of Climate Change, Part II: Dynamic Estimates', *Environmental and Resource Economics*, **21** (1), 135-160. Tol, R.S.J. (2004), *Exchange Rates and Climate Change: An Application of FUND*, Research Unit Sustainability and Global Change **FNU-45**, Hamburg University and Centre for Marine and Atmospheric Science, Hamburg (submitted, *Climatic Change*).

Tol, R. S. J. and Dowlatabadi, H. (2001), 'Vector-borne diseases, development & climate change', *Integrated Assessment*, **2**, 173-181.

Tol, R.S.J. and T. Heinzow (2003), *Estimates of the External and Sustainability Costs of Climate Change*, **FNU-32**, Centre for Marine and Climate Research, Hamburg University, Hamburg.

Viscusi, W.K. and Aldy, J.E. (2003), 'The value of a statistical life: A critical review of market estimates throughout the world', *Journal of Risk and Uncertainty*, **27** (1), 5-76.

Weiss, K. B., Sullivan, S. D., and Lyttle, C. S (2000), 'Trends in the cost of illness for asthma in the United States, 1985-1994', *J Allergy Clin Immunol*, **106** (3), 493-499.

Appendix A

A Concise Description of GTAP-EF Model Structure

The GTAP model is a standard CGE static model, distributed with the GTAP database of the world economy (www.gtap.org).

The model structure is fully described in Hertel (1996), where the interested reader can also find various simulation examples. Over the years, the model structure has slightly changed, often because of finer industrial disaggregation levels achieved in subsequent versions of the database.

Burniaux and Truong (2002) developed a special variant of the model, called GTAP-E, best suited for the analysis of energy markets and environmental policies. Basically, the main changes in the basic structure are:

- energy factors are taken out from the set of intermediate inputs, allowing for more substitution possibilities, and are inserted in a nested level of substitution with capital;
- database and model are extended to account for CO₂ emissions, related to energy consumption.

The model described in this paper (GTAP-EF) is a further refinement of GTAP-E, in which more industries are considered. In addition, some model equations have been changed in specific simulation experiments. This appendix provides a concise description of the model structure.

As in all CGE models, GTAP-EF makes use of the Walrasian perfect competition paradigm to simulate adjustment processes, although the inclusion of some elements of imperfect competition is also possible.

Industries are modelled through a representative firm, minimizing costs while taking prices are given. In turn, output prices are given by average production costs. The production functions are specified via a series of nested CES functions, with nesting as displayed in the tree diagram of figure A1.

Notice that domestic and foreign inputs are not perfect substitutes, according to the so-called "Armington assumption", which accounts for - amongst others - product heterogeneity.

In general, inputs grouped together are more easily substitutable among themselves than with other elements outside the nest. For example, imports can more easily be substituted in terms of foreign production source, rather than between domestic production and one specific foreign country of origin. Analogously, composite energy inputs are more substitutable with capital than with other factors.

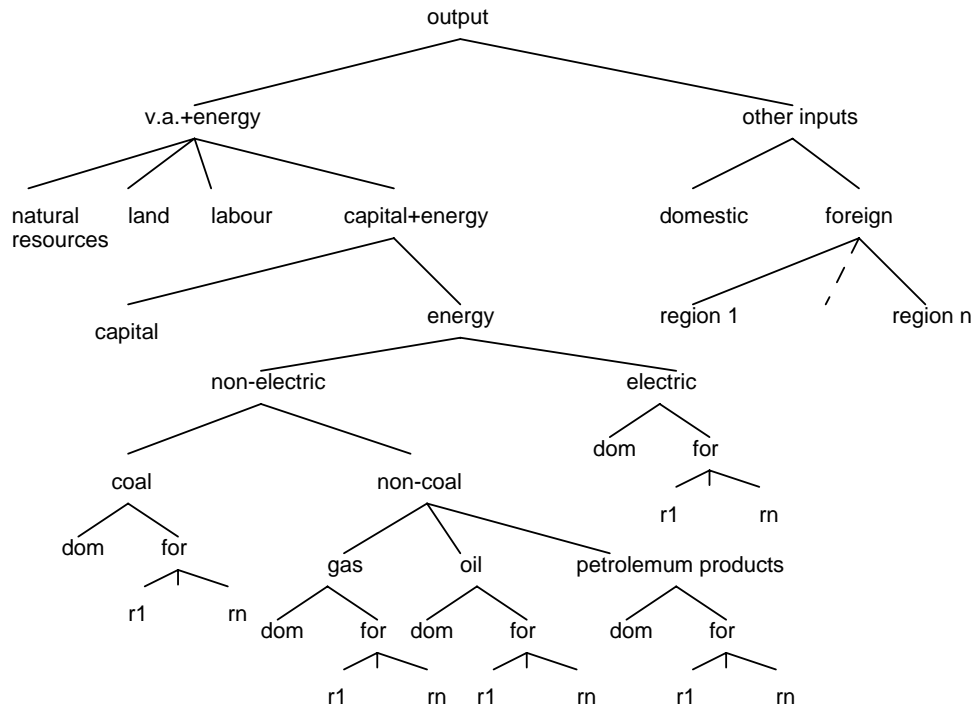


Figure A1 – Nested tree structure for industrial production processes

A representative consumer in each region receives income, defined as the service value of national primary factors (natural resources, land, labour, capital). Capital and labour are perfectly mobile domestically but immobile internationally. Land and natural resources, on the other hand, are industry-specific.

This income is used to finance the expenditure of three classes of expenditure: aggregate household consumption, public consumption and savings (figure A2). The expenditure shares are generally fixed, which amounts to saying that the top-level utility function has a Cobb-Douglas specification. Also notice that savings generate utility, and this can be interpreted as a reduced form of intertemporal utility.

Public consumption is split in a series of alternative consumption items, again according to a Cobb-Douglas specification. However, almost all expenditure is actually concentrated in one specific industry: Non-market Services.

Private consumption is analogously split in a series of alternative composite Armington aggregates. However, the functional specification used at this level is the Constant Difference in Elasticities form: a non-homothetic function, which is used to account for possible differences in income elasticities for the various consumption goods.

In the GTAP model and its variants, two industries are treated in a special way and are not related to any country, viz. international transport and international investment production.

International transport is a world industry, which produces the transportation services associated with the movement of goods between origin and destination regions, thereby determining the cost margin between f.o.b. and c.i.f. prices. Transport services are produced by means of factors submitted by all countries, in variable proportions.

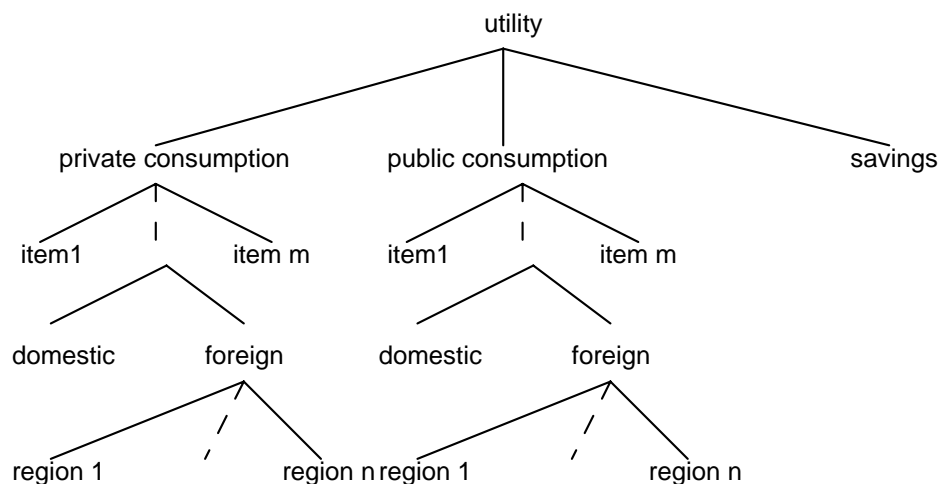


Figure A2 – Nested tree structure for final demand

In a similar way, a hypothetical world bank collects savings from all regions and allocates investments so as to achieve equality of expected future rates of return. Expected returns are linked to current returns and are defined through the following equation:

$$r_s^e = r_s^c \left(\frac{ke_s}{kb_s} \right)^{-\rho}$$

where: r is the rate of return in region s (superscript e stands for expected, c for current), kb is the capital stock level at the beginning of the year, ke is the capital stock at the end of the year, after depreciation and new investment have taken place. ρ is an elasticity parameter, possibly varying by region.

Future returns are determined, through a kind of adaptive expectations, from current returns, where it is also recognized that higher future stocks will lower future returns. The value assigned to the parameter ρ determines the actual degree of capital mobility in international markets.

Since the world bank sets investments so as to equalize expected returns, an international investment portfolio is created, where regional shares are sensitive to relative current returns on capital.

In this way, savings and investments are equalized at the international but not at the regional level. Because of accounting identities, any financial imbalance mirrors a trade deficit or surplus in each region.

Appendix B

Tables and Figures

Table 1. Health impacts of climate change.

<i>Number of additional deaths in 2050 by Region and Disease.</i>							
	Malaria	Schisto	Dengue	Cardio-Vascular	Respiratory	Diarrhea	Total
USA	0	0	0	-174158	2540	2006	-169613
EU	0	0	0	-178895	2389	590	-175916
EEFSU	0	0	0	-289210	3970	1074	-284166
JPN	0	0	0	-68009	3784	15	-64211
RoA1	0	0	0	-47070	1267	31	-45772
Eex	753	-62	53	-50088	82341	31244	64241
CHIND	632	0	626	-813307	92732	28709	-690608
RoW	63090	-568	535	-143466	175516	421683	516791
WORLD	64475	-630	1215	-1764202	364538	485352	-849252
<i>Additional Years of Life Diseased in 2050 by Region and Disease</i>							
	Malaria	Schisto	Dengue	Cardio-Vascular	Respiratory	Diarrhea	Total
USA	0	0	0	-167357	22257	83070	-62030
EU	0	0	0	-171908	20936	25608	-125364
EEFSU	0	0	0	-259884	46884	57717	-155283
JPN	0	0	0	-65353	33161	912	-31280
RoA1	0	0	0	-45232	11108	1361	-32763
Eex	7219	-1088	29	-66363	1706267	112633	1758698
CHIND	632	0	0	-1119902	770340	156271	-192659
RoW	232737	-154375	203	-194383	3683042	834294	4401519
WORLD	240588	-155462	233	-2090380	6293994	1271867	5560839
<i>Additional Cost of Illness (1997 MI US\$) in 2050 by Region and Disease</i>							
	Malaria	Schisto	Dengue	Cardio-Vascular	Respiratory	Diarrhea	Total
USA	0	0	0	-40220	9053	0.415	-31167
EU	0	0	0	-43084	4936	0.128	-38148
EEFSU	0	0	0	-4361	453	0.289	-3908
JPN	0	0	0	-34999	30057	0.005	-4941
RoA1	0	0	0	-9416	3209	0.007	-6208
Eex	0.074	-0.011	0	-826	27841	0.563	27015
CHIND	0.013	0	0	-2346	1527	0.781	-818
RoW	2.289	-1.562	0.003	-3518	50536	4.171	47023
WORLD	2.375	-1.573	0.003	-138770	127612	6.359	-11151

Table 2. Climate change impacts on health (2050): Model inputs and selected outputs.

	Inputs				Outputs	
	Labour productivity	Increase in public expend. for health care	Increase in private expend. for health care	Private demand for other comm.	Share of income devoted to public consumpt.	Share of income devoted to private consumpt.
USA	0.064	-0.557	-0.378	0.096	-0.599	0.131
EU	0.082	-0.488	-0.576	0.032	-0.588	0.18
EEFSU	0.110	-0.58	-0.481	0.039	-0.696	0.179
JPN	0.085	-0.198	-0.095	0.006	-0.273	0.044
RoA1	0.100	-0.631	-0.536	0.045	-0.719	0.222
Eex	-0.128	1.989	1.736	-0.122	2.161	-0.404
CHIND	0.028	-0.102	-0.149	0.006	-0.126	0.028
RoW	-0.152	0.87	3.219	-0.238	1.031	-0.229

Table 3. Climate change impacts on health (2050): Output by Sector/Industry

	USA	EU	EEFSU	JPN	RoA1	EEx	CHIND	RoW
Rice	0.0245	-0.0075	0.0938	0.0535	0.0763	-0.1211	0.0123	-0.1594
Wheat	0.0216	0.0301	0.0317	-0.0524	-0.0388	-0.0192	0.0079	-0.0468
CerCrops	-0.0254	-0.049	-0.032	-0.0532	-0.0714	0.0197	-0.0407	0.0979
VegFruits	-0.0252	-0.0744	-0.0409	-0.0335	-0.0787	-0.0566	-0.0004	-0.0557
Animals	0.0432	0.062	0.0422	0.0291	0.0487	-0.0419	0.0186	-0.0807
Forestry	-0.0003	0.0166	0.0287	0.0164	-0.0091	-0.2046	0.0081	-0.2719
Fishing	-0.0027	0.0596	0.0868	0.0316	0.0372	-0.2006	0.0259	-0.2223
Coal	0.0365	0.0462	0.0598	0.0667	0.0166	-0.035	0.0219	-0.0567
Oil	0.0182	-0.0101	0.0098	0.0029	0.0138	-0.0161	0.0076	-0.0469
Gas	0.0453	0.0976	0.0727	0.1057	0.0616	-0.043	0.0403	-0.1185
Oil_Pcts	0.1153	0.1163	0.0729	0.0442	0.1413	-0.1815	0.0243	-0.1891
Electricity	0.0453	0.062	0.0718	0.0145	0.0984	-0.0581	0.0236	-0.1075
Water	0.1029	0.0989	-0.1349	0.0445	-0.1181	0.209	0.001	-0.1581
En_Int_ind	0.0653	0.1181	0.1066	0.0587	0.0983	-0.2159	0.043	-0.2745
Oth_ind	0.0612	0.1016	0.108	0.0579	0.1198	-0.129	0.0212	-0.166
Mserv	0.1369	0.1685	0.1775	0.0864	0.173	-0.3405	0.0319	-0.3355
Nmserv	-0.2668	-0.4297	-0.4275	-0.109	-0.4763	1.5355	-0.0882	1.2064

Table 4. Climate change impacts on health (2050): Prices by Sector/Industry

	USA	EU	EEFSU	JPN	RoA1	EEx	CHIND	RoW
Primary Factors								
Land	-0.0341	0.0274	0.06	0.1151	-0.0441	-0.4209	0.0254	-0.6326
Lab	0.031	0.0139	0.0356	0.0505	0.0548	0.0893	-0.0091	0.1313
Capital	0.0721	0.0842	0.0917	0.05	0.0695	-0.0825	-0.0074	-0.0942
NatlRes	0.155	0.194	0.1954	0.1586	0.1013	-0.2762	0.0549	-0.8687
Sectors/Industries								
Rice	-0.0278	-0.0274	0.0428	0.0346	-0.0247	-0.314	-0.0134	-0.5005
Wheat	-0.0287	0.002	0.0105	-0.0119	-0.0721	-0.1536	-0.0193	-0.2457
CerCrops	-0.0642	-0.0483	-0.0231	-0.0217	-0.0892	-0.1885	-0.0485	-0.2416
VegFruits	-0.0609	-0.0629	-0.0306	-0.0098	-0.0891	-0.234	-0.0228	-0.3054
Animals	-0.0343	0.0109	0.0035	-0.0228	-0.0407	-0.1853	-0.0158	-0.2836
Forestry	-0.0035	0.034	0.03	-0.0175	-0.0503	-0.2658	-0.0367	-0.3033
Fishing	-0.0009	0.039	0.0575	0.0047	0.005	-0.1599	-0.0348	-0.0752
Coal	0.0057	0.0008	0.0169	-0.0175	-0.003	0.0006	-0.0247	0.0047
Oil	0.0284	0.01	0.0276	-0.0208	0.0019	-0.0356	-0.0264	-0.0711
Gas	-0.0101	0.0075	0.0241	-0.0307	0.0072	0.0217	-0.0344	0.02
Oil_Pcts	-0.0049	-0.0129	0.0195	-0.0298	-0.0109	-0.0307	-0.0322	-0.0245
Electricity	0.0085	-0.0047	0.0145	-0.0205	-0.0067	0.0078	-0.041	0.035
Water	-0.0306	-0.0046	-0.0286	-0.0295	-0.0232	0.0687	-0.0472	0.0895
En_Int_ind	-0.0183	-0.0336	-0.0307	-0.0379	-0.0319	0.0175	-0.0403	0.0402
Oth_ind	-0.0305	-0.0376	-0.0388	-0.0425	-0.0451	-0.0405	-0.0379	-0.028
MServ	-0.0216	-0.0292	-0.0467	-0.0462	-0.0455	0.0471	-0.0451	0.0922
NMserv	-0.0407	-0.0582	-0.0752	-0.059	-0.056	0.0847	-0.0487	0.1605

Table 5: Climate change impacts on health (2050): Other Macroeconomic indicators (% change from baseline, except direct cost: % of GDP)

	Direct cost	GDP	Household Utility Index	Terms of Trade	CO2 emissions	Investment /capital flows
USA	-9.339	0.042	0.045	0.011	0.087	0.070
EU	-9.664	0.070	0.071	-0.002	0.111	0.082
EEFSU	-14.234	0.072	0.073	0.001	0.081	0.095
JPN	-11.482	0.058	0.057	-0.017	0.027	0.040
RoA1	-11.710	0.077	0.076	-0.014	0.127	0.057
EEx	0.999	-0.073	-0.075	-0.018	-0.182	-0.144
CHIND	-4.435	0.014	0.013	-0.010	0.021	-0.016
RoW	3.257	-0.101	-0.093	0.023	-0.159	-0.123

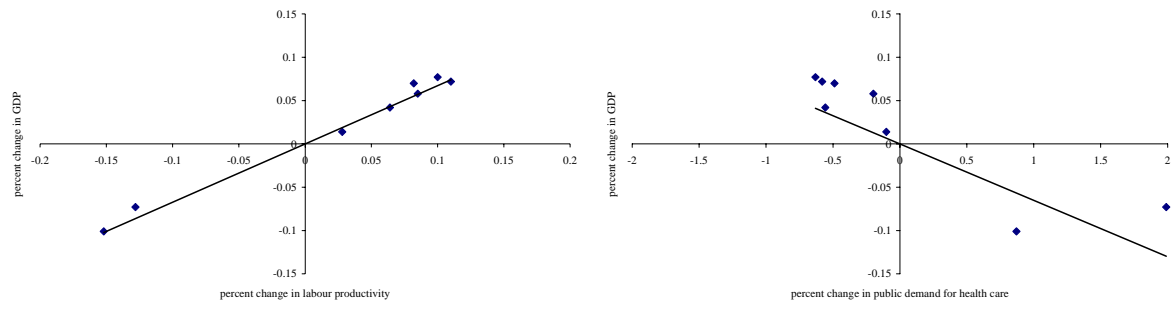


Figure 1. Change in GDP as a function of the change in labour productivity (right panel) and of the change in the public demand for health care (left panel).

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

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 GUIMERA 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 (lxv)</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 URGA</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 ONOFRI</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 MYSLIAK 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. STREBULAEV (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>

- (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.

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>