

Roson, Roberto

Working Paper

Dynamic and distributional effects of environmental revenue recycling schemes: Simulations with a general equilibrium model of the Italian economy

Nota di Lavoro, No. 15.2002

Provided in Cooperation with:

Fondazione Eni Enrico Mattei (FEEM)

Suggested Citation: Roson, Roberto (2002) : Dynamic and distributional effects of environmental revenue recycling schemes: Simulations with a general equilibrium model of the Italian economy, Nota di Lavoro, No. 15.2002, Fondazione Eni Enrico Mattei (FEEM), Milano

This Version is available at:

<https://hdl.handle.net/10419/119624>

Standard-Nutzungsbedingungen:

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

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

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

Terms of use:

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

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

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

Fondazione Eni Enrico Mattei

**Dynamic and Distributional Effects
of Environmental Revenue
Recycling Schemes:
Simulations with a General Equilibrium Model
of the Italian Economy**
Roberto Roson
NOTA DI LAVORO 15.2002

JANUARY 2002

CLIM – Climate Change Modelling and Policy

Roberto Roson *Dipartimento di Scienze Economiche Università Cà Foscari - Venezia
(Italy) and FEEM*

This paper can be downloaded without charge at:

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

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

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

Dynamic and Distributional Effects of Environmental Revenue Recycling Schemes:

Simulations with a General Equilibrium Model of the Italian Economy

Summary

A dynamic general equilibrium model of the Italian economy is used to assess the impact of carbon taxation (or auctioned carbon permits), where additional revenue is used to cut either existing taxes on labour or on capital income. Simulation results do not support the existence of the so-called “double dividend” when labour taxes are reduced, whereas lower tax rates on capital have mild positive effects on growth and welfare, with progressivity properties on income distribution. These findings hinge on the assumptions of open economy, given world interest rate, and capital mobility.

Keywords: Applied general equilibrium models, double dividend, environmental taxation, Italy

Address for correspondence:

Roberto Roson
Dipartimento di Scienze Economiche Università Cà Foscari
Cannaregio 873
30121 Venezia
Italy
E-mail: roson@unive.it

1. Introduction

The Kyoto Protocol specifies targets for emissions of carbon dioxide and other greenhouse gases, to be reached by signatory countries in the period 2008-2012. National governments are substantially free to choose the specific domestic initiatives that could achieve the prescribed objective (for Italy, see Montini (2000)), determining how “pollution rights” are explicitly or implicitly distributed within each country (Bohm (2000)).

One policy option that has been much discussed in scientific and political debates is the use of carbon tax (or auctioned carbon permits) revenues for reducing distortionary labour income taxation. It is often argued that a “double dividend” could be reaped in this way: a better environment and a lower level of unemployment. The double dividend hypothesis in its weak form proposes that this revenue-neutral fiscal policy can reduce the overall cost of controlling greenhouse emissions. The strong form of the double dividend hypothesis asserts that not only environmental quality but also non-environmental welfare could be improved.

In their seminal paper, Bovenberg and De Mooij (1994) have shown, in a simple general equilibrium model, that the double dividend hypothesis, in its strong form, does not generally hold. This is because labour supply is driven by real, not nominal, wages, and the tax swap amounts to replacing explicit labour taxes by higher implicit labour taxes (indirect taxes that reduce the purchasing power), thereby exacerbating distortions and eroding the tax base. This contribution has triggered a substantial body of literature, recently summarized by Bovenberg (1999), based on both theoretical and applied models (e.g., Schwartz and Repetto (2000), Parry and Bento (2000), Kahn and Farmer (1999))¹.

However, although there is now a vast literature on the double dividend issue, most of the literature has focused on labour tax recycling, disregarding alternative redistribution

¹ Some contributions explicitly consider the possible existence of involuntary unemployment, pointing out that the interest in this issue (especially in Europe) springs mainly from the existence of high and persistent unemployment. These papers typically find that a tax reform alleviates unemployment if the tax burden is shifted away from workers to the unemployed, making the formal labour sector relatively more attractive (Bovenberg and van der Ploeg (1994), Schneider (1997), Scholz (1998), Koskela and Schöb (1998), Marsiliani and Rengstöm (2000a)).

schemes based on other distorted markets, like those of capital goods (a notable exception is Jorgenson and Wilcoxon (1995)). This is most surprising, since there are significant contributions, in growth theory, showing that capital taxation may have substantial effects on growth rates, consumption and welfare. These include both theoretical (e.g., Lucas (1990), Rebelo (1991)) and computational models (Auerbach and Kotlikoff (1987))². The usefulness of these models for policy analysis is, however, limited by the adoption of rather unrealistic assumptions. For example, the models in this tradition usually consider a closed economy, where domestic savings generate all the capital stock³.

Also the theoretical models in the double dividend literature adopt simplifying assumptions, to make the analysis tractable. Typical hypotheses are: existence of only two consumption goods (e.g., a “clean” and a “dirty” commodity), no savings, simplified tax structure, closed economy. If a more complex model structure is introduced, there are other mechanisms through which a double dividend may emerge⁴. As stated in a recent IPCC report (2001): “it is unclear whether the empirical findings of the interaction effect are due more to the assumptions invoked for tractable general equilibrium analysis than to real-world considerations”.

A more realistic analysis of the different taxation schemes rely on the use of numerical models and simulation experiments, so it is possible that some findings may not be general but contingent on the specific structure of a particular economy. Econometric (e.g., Carraro, Galeotti and Gallo (1996)) and Applied General Equilibrium models have been used to this purpose⁵.

One advantage of using AGE models in this context is their explicit accounting of general equilibrium interactions, and the possibility to “isolate” the impact of fiscal policies from

² Daveri and Tabellini (1997) show also that high labour taxes, when real wages are rigid, may slow down economic growth through labour/capital substitution, which implies a lower marginal productivity of capital.

³ See, however, Sen and Turnovsky (1990).

⁴ A green tax reform could, for instance, shift the composition of the aggregated demand towards labour-intensive goods and services. Also the saving behaviour of households, and the consequent aggregate supply pattern, would be affected, and if domestic and foreign goods are imperfect substitutes, changes in the terms of traded could be induced.

⁵ Many of these models highlight the existence of a positive double dividend effect, larger than suggested by the theory.

the impact of other shocks. Since theoretical studies of the double dividend hypothesis are also rooted on general equilibrium effects, qualitative findings of AGE models are directly comparable with those obtained with purely theoretical models.

Early attempts in this direction include simulations of carbon taxation with static single-country models (Bussolo and Pinelli (2001), Edwards (1996, 1998), Harrison and Kriström (1998), Pench (1998, 2001), Stampini (2001)), while dynamic and multi-country models have appeared more recently (Jensen (1998), Springer (1998), Rutherford, Böhringer and Pahlke (1998), Pench (1999), Böhringer (1998, 1999), Böhringer, Jespen and Rutherford (2000))⁶.

In this context, it is often necessary to depart from the basic Arrow-Debreu paradigm of fixed endowments, closed economy and perfectly competitive markets. By explicitly considering labour markets imperfections, for example, one key ingredient of the debate on the double dividend hypothesis can be embodied into the model (Bye (1998)). Another useful amendment may be the explicit consideration of international capital movements (Roson (1998), Springer (1999)).

Policy assessment can be more effectively carried out if several household classes (distinguished by income levels or other characteristics) are considered in the models. As pointed out by Bovenberg (1999, *ibid.*), the existence of non-environmental distortions raises the question why governments have not reformed their tax systems to address these inefficiencies, suggesting that distributional considerations may have prevented the governments from doing this. With a disaggregated representation of the final consumption sector of the economy, AGE models can shed light in this direction, showing the distributional impact of alternative policies alongside the efficiency effects⁷.

In our opinion, this aspect is especially important when dealing with capital tax reductions. Carbon taxes are generally regarded as being regressive, since higher energy prices imply more expensive basic services, like heating, lightning and transportation.

⁶ Simplified general equilibrium models have also been merged with climate and energy models in the class of Integrated Assessment Models (e.g., Nordhaus and Yang (1996), Edwards and Hutton (1999), Roson (2000)).

Capital tax recycling may then be thought to aggravate the regressivity effect (but, as it will be shown later, this may not be the case).

In this paper, a dynamic general equilibrium model of the Italian economy is illustrated and used to simulate the introduction of “tax swap” schemes, in the context of a national carbon reduction policy, aimed at reducing CO₂ emissions at the level specified by the Kyoto protocol (for Italy, 97.5% of 1990 emissions). In particular, the double dividend case of labour tax cuts will be compared with the alternative case of capital tax cuts.

As it is typical in most applied models of this type, CO₂ emissions are seen as a by-product of the consumption of energy products, both at the intermediate and at the final consumption stage. Therefore, the emissions reduction target is achieved by introducing a tax (explicitly or implicitly, as in the case of a national emission permits market⁸) on energy consumption⁹, with varying rates, depending on the carbon content.

Thirty industries, one public sector, one foreign sector, and six representative households, distinguished by income class, are considered. Each household class is represented by a consumer, who maximizes his/her discounted intertemporal utility over an infinite horizon. Ten periods are considered, and it is assumed that emissions reduction measures are introduced in the third period, fixing a ceiling on total CO₂ emissions at the national level for all subsequent times. Each representative consumer has rational expectations and anticipates, since the first period, the shock occurring in the third period.

The rest of the paper is organized as follows. In the next section, the overall structure of the model and the general equilibrium conditions, which must be verified within each time period, will be presented (the model equations are reported in an appendix).

⁷ Marsiliani and Rengstöm (2000b) investigate the possible causal feedback from wealth equality to environmental protection, noticing that “egalitarian” countries generally have more stringent environmental policies.

⁸ One important difference is that carbon taxes may need to be adjusted over time in order to meet the national target. Here, the model automatically does this.

⁹ This means that reductions in the pollution intensity of energy consumption are not considered (primarily because of lack of data at a sufficiently disaggregated level). Substitution between different energy factors, and “end-of-pipe” abatement could reduce emissions per unit of energy input (on this, see Fullerton, Hong and Metcalf (2000)). Notice also that, because of the Leontief production technology, emission taxes are equivalent here to output taxes, with industry-variable rates.

Subsequently, the modelling of imperfections in the labour and capital markets will be illustrated. Intertemporal optimization and the consistency between static and dynamic optimality conditions will be discussed in the fourth section. Section five is devoted to presenting and commenting some results obtained by numerical simulations. Some concluding remarks will be drawn in the final section.

2. Model structure and intra-temporal equilibrium

The model simulates a dynamic path for the Italian economy as a sequence of static equilibria. This means that, on the basis of a capital stock owned by the households and the level of investments, the model computes a series of equilibria for all time periods, in which: demand equals supply in all markets for goods and services, including primary resources (taking exogenously some market imperfections); there are no extra profits in any industry (free entry), consumers maximize utility on the basis of an income constraint, the public sector has no budget surplus or deficit, and the foreign trade balance (including capital services) is in equilibrium. The link between two subsequent equilibria is given by the condition of capital adjustment: from one period to the next, a fixed share of the capital stock is lost by depreciation¹⁰, whereas the capital is augmented through the investment. It is assumed that there are no exogenous growth factors like changes in the labour force, or in the human capital, or in the technological progress¹¹.

In some periods, an exogenous constraint on total emissions of carbon dioxide is imposed. CO₂ emissions are assumed to be proportional to the input of energy in

¹⁰ The capital formation process is driven by two parameters: a reference real interest rate, which is assumed here 3.5%, and a rate of annual capital depreciation, which is here 5%.

¹¹ In other words, we abstract here from those exogenous processes, which may affect the economic growth, in addition to investment and capital formation. Observe, however, that environmental policies may well influence investment in research, and the introduction of cleaner technologies. This aspect is not considered here, because of lack of data: in a multisectoral model, this would require a complete specification of the new technologies and an assessment of its impact on the productivity of factors.

production and consumption¹²; as a consequence, the constraint on emissions translates into an implicit tax on energy inputs or, equivalently, on a rent on emission rights.

The structure of the model within each time period is similar to many static CGE/AGE models, with the exception of the modelling of primary markets, as it will be illustrated in the next section. Share parameters in production and utility functions are estimated via calibration, using a base year Social Accounting Matrix, whereas elasticity parameters are, in most cases, adopted from econometric studies (Roson (1998, *ibid.*)). The SAM matrix for the Italian economy is provided by Accardo and Cavalletti (2000) for the year 1990, and has been updated to the year 1997 through a maximum likelihood estimation procedure¹³.

The following principles have been adopted in the model calibration:

- all investments are interpreted as carried out, directly or indirectly, by the households. So, for example, retained earnings by firms are distributed to the households, who subsequently re-invest in capital assets.
- the trade deficit or surplus existing in the base year is interpreted as an income transfer assigned to the households, proportional to the transfers obtained from the public sector. Both the public sector and the representative foreign consumer are assumed to devote a fixed share of their revenues to transfers to the households.
- investment in bonds and interest payments on the public debt are interpreted as income transfers. Consequently, both the households and the representative foreign agent are assumed to receive transfers (possibly negative) equal to the difference between interest revenues and net investment in bonds.

The model parameters are calibrated such that the model replicates the values of the SAM matrix as the outcome of a general equilibrium allocation in the base year. Furthermore, the model computes a series of equilibria for the subsequent periods, assuming that all

¹² The amount of emissions generated per unit of energy input is sector-specific. Parameters on emissions by activity have been estimated from the CORINAIR data - base.

¹³ This procedure is based on the minimization of the sum of squared differences between corresponding cells of the two matrices, with constraints on several macroeconomic aggregates (for which information is available on official statistics), and with balance constraints on supply/demand of each good, and on the budget of each sector.

representative consumers carry out dynamic optimization under perfect information, in the absence of any exogenous shock (including policy changes). In this way, a “baseline trend” or a “business as usual” path is generated, against which policy impact simulations can be compared.

Each of the thirty industries is modelled through a representative firm, which allocates production factors on the basis of a cost minimization principle. A homogeneous labour factor is combined with a homogeneous and perfectly mobile capital factor into a value added composite, according to a CES function with industry-specific values for the substitution elasticity. The value added composite is then combined in fixed proportions with intermediate inputs in the production process. Each intermediate input is itself a composite of domestically produced and imported commodities, where the two types of good are regarded as imperfect substitutes into a CES function with variable elasticity parameters.

Six household classes are considered, on the basis of their 1990 income levels¹⁴, and each class is modelled through a representative consumer. This agent possesses a stock of capital, determined by past savings, and a stock of labour resources. Labour is entirely allocated to production, although the stock is adjusted on the basis of an exogenously given “pseudo” supply curve. Since capital and labour are both homogeneous and mobile, the factor demand generated by the firms is allocated to the different household groups in fixed shares, reflecting the base year relative supply.

Households-consumers also receive income transfers from the public sector, and possibly from the rest of the world. Income is used to buy a composite consumption commodity and an investment good. The income share devoted to consumption or saving is determined by intertemporal optimization, but it is taken as a given within each time period. The composite consumption commodity is obtained by a Cobb-Douglas combination of goods and services, where all items are in turn CES composites of

¹⁴ The classes are: F18 (households with annual income lower than 18 millions lire in the year 1990, corresponding to the 19.8 percentile), F27 (income between 18 and 27 millions, 19.8 – 39.8 percentile), F36 (income between 27 and 36 millions, 39.8 – 55.9 percentile), F45 (income between 36 and 45 millions, 55.9 – 67.6 percentile), F54

imports and domestic goods. The investment commodity is produced by a final demand sector, allocating the demand (in fixed proportions) to industries producing durable and investment goods.

The public sector finances its expenditure with taxes on primary factors supply¹⁵, on value added, on domestic production, on imports, and on consumption. Tax revenue is allocated between the production of the industry “Non market services” and transfers to the households. In all simulation exercises illustrated later in this paper, an exogenous constraint ensures that the level of public expenditure remains constant in all periods.

A representative foreign agent generates a demand for exported domestic goods and services, which are imperfect substitutes with foreign goods and services¹⁶. In addition, positive or negative income transfers to the domestic households are considered, as a result of a base year trade deficit or surplus. The level of these transfers is kept fixed.

When supply and demand equal in all markets, when production factors are allocated so as to minimize costs in all industries, and when the representative consumers efficiently allocate their budgets, the model reaches a short-term equilibrium. The equilibrium allocation may change between periods because of: changes in the endowment of capital goods (due to capital accumulation), changes in the endowment of labour (due to labour supply adjustments), and changes in the policy regime.

In the latter case we consider the imposition of a national constraint on carbon dioxide emissions. Within the model, this constraint translates into an exogenously adjusted carbon tax, with simultaneous re-determination of other taxes or, equivalently, into the existence of an additional production factor (the emissions) owned by the households. This additional factor may be considered to be in excess supply (that is, with a zero price) when the constraint is not binding. The basic difference between the various schemes that

(income between 45 and 54 millions, 67.6 – 77.9 percentile), FOV (income above 54 millions).

¹⁵ Taxation is proportional, but the tax rates on labour and capital supply do vary by household type, depending on base income levels.

¹⁶ The two types of good enter in a CES composite. The industry-specific elasticities of substitution in this function are derived from econometrically estimated export demand elasticities.

are considered here regards the different ways in which the tax revenue, or the emission rights, are allocated.

3. Primary factors markets

Traditionally, in most Applied General Equilibrium models the capital is assumed to be in fixed supply, with endogenous determination of the interest rate. This hypothesis clearly contradicts the Small Open Economy assumption adopted throughout in this model, where the price of all imported goods, which is normalized to one, is taken as a given.

It is then more natural to assume that the interest rate, alongside world commodity prices, is imposed from abroad¹⁷. In this case, the price of the capital factor is fixed exogenously and domestic demand and supply of capital may not match. When domestic supply falls short of demand, capital services may be imported from the rest of the world¹⁸. This element must be taken into account in the determination of the trade balance, which must be in equilibrium within each time period.

Another main difference with the traditional approach followed in many AGE models concerns the modelling of the labour market. Here, wages are not set by perfect competition but by a “wage curve”, linking real wages to unemployment levels (thereby accounting for a variety of labour market imperfections). Following Blanchflower and Oswald (1994), we use for the Italian economy a wage curve with a rather rigid real wage¹⁹:

¹⁷ Some other CGE models adopt the alternative assumption of imperfect substitutability between domestic and foreign capital goods, allowing for non-equality of domestic and international interest rates.

¹⁸ International capital flows are modelled here through the inclusion of two fictitious industries. One industry produces capital goods with only one input: an imported good. The second industry produces “imports”, with the absorption of capital services. Complementarity conditions ensure that only one industry is active in equilibrium. For example, when capital services are imported, these services are “paid” with a trade surplus in all other goods. One fictitious industry, therefore, generates the extra demand of imports that must be matched by additional exports, to keep the trade balance in equilibrium.

¹⁹ The elasticity parameter has been estimated econometrically.

$$\begin{aligned}
U &= U_B \left(\frac{\sum_i \omega_i p_i}{w} \right)^{10} & \sum_i \omega_i &= 1 \\
L &= L_B \left(\frac{1-U}{1-U_B} \right)
\end{aligned} \tag{1}$$

Where: L and U are labour supply (endowment) and unemployment level; the subscript B refers to calibration values (where all prices are equal to one); ω stand for weights in a consumer price index; w and p are wage and market prices, respectively.

Because of the auxiliary equation (1) the model endogenously generates involuntary unemployment.

4. Dynamic optimization

The sequence of short-term equilibria described so far is contingent on the marginal propensity to saving of each representative consumer in each period. This parameter is endogenously determined in the model as a result of a Ramsey intertemporal utility maximization problem.

Ruling out negative investment, the maximization of a discounted sum of utility functions provides the following intra-temporal optimality rule, expressed as a complementarity condition:

$$\begin{aligned}
I_t^h \left(U'(c_t^h) \frac{q_t}{p_t^h} - \lambda_t^h \right) &= 0 \\
I_t^h \geq 0 \quad U'(c_t^h) \frac{q_t}{p_t^h} - \lambda_t^h &\geq 0
\end{aligned} \tag{2}$$

Where: indexes h and t refer to household class and time, respectively; I stands for investment and c for consumption (determining temporal utility U); p is a consumption price index for household type h , q is the price of the investment good and λ is a costate variable, corresponding to the (undiscounted) marginal utility of capital.

Inter-temporal optimality provides a recursive definition for the costate variable:

$$\lambda_t^h = \alpha^h U'(c_{t+1}^h) \frac{r_t}{p_{t+1}^h} + \delta \alpha^h \lambda_{t+1}^h \tag{3}$$

Where: α is the subjective utility discount factor (assumed to be time-invariant), r is the capital interest rate, and δ is a capital depreciation factor.

For each household type, the model solves a series of equations (2) and (3) on the basis of two terminal conditions. The first terminal condition is the initial value of the capital stock, which is observed in the base year. The second terminal condition fixes a value for the terminal costate variable assuming, as it is customary in most applied models, that the economy reaches a steady state balanced growth path after the last period considered. This implies that the last value of costate variable can be expressed as the present value of an infinite stream of constant marginal utilities:

$$\lambda_T^h = \frac{\alpha^h}{1 - \alpha^h \delta} U'(c_h^{ss}) \frac{r_T}{p_T^h} \quad (4)$$

The functional form adopted in the model for the intertemporal utility is linear logarithmic²⁰, with household-specific discount factors. These factors are determined when the model is calibrated and a baseline growth path is computed. This is because the SAM matrix, used to calibrate the model, provides information both on the initial capital stocks and on investment levels in the first period. Contrary to standard Ramsey models, where investments are endogenous and discount factors are preference parameters, the information on initial investments allows the endogenous determination of discount factors²¹. However, when the model is run to generate counterfactual simulations, there is no need to replicate calibration values, so the estimated discount rates become exogenous. In principle, dynamic optimization could be carried out simultaneously with the determination of temporary equilibria. The complexity of the present model, however, makes this option computationally infeasible. The model is then solved iteratively in the following way. First a sequence of temporary equilibria is computed, taking a vector of

²⁰ For computational simplicity it is assumed that the argument of the logarithmic utility is the aggregate consumption level, instead of a nested CES quantity index.

²¹ These range from 2.67% to 3.31%, increasing monotonically with household income levels. This phenomenon depends on the ratio of investment to capital income flows in the calibration SAM, which is indeed decreasing in income levels. One possible explanation rests on the existence of a possible inverse relationship between income and risk aversity. Another possible explanation is the existence of rents and imperfect competition, benefiting higher income households.

saving propensities per household and period as a given (these parameters are kept fixed to calibration values in the first run). This allows the determination of a set of variables, which are needed for intertemporal optimization: consumers' price indexes, investment prices and interest rates, as well as "exogenous income" (transfers and labour income, independent of capital wealth). The solution of the intertemporal program, expressed as a system of non-linear equations, allows the computation of optimal saving rates, which are used as an input for the re-determination of the sequence of temporary equilibria. The whole process is repeated until convergence²².

5. Simulations

The model described above has been used in two simulation exercises. We consider the introduction of a carbon tax in the third period, with simultaneous adjustment of either taxes on the homogenous labour input, or of taxes on capital income. The carbon tax itself varies period by period, in order to meet the ceiling on national CO₂ emissions imposed by the Kyoto protocol. The tax reform is fully anticipated, since the first period, by all representative agents, and public expenditure, as well as income transfers to the households²³, is kept fixed in real terms.

The two simulation cases are compared against a baseline scenario. This scenario has been obtained by running the model from the calibration year onwards, using the same assumptions of the simulation exercises (e.g., in terms of public expenditure, kept constant by means of variable income taxes), but without any constraint on carbon emissions.

The interpretation of the very detailed output of the various simulations is possibly made easier by the identification of three major driving forces, shaping the results. First of all there is an *industry mix effect*, by which the structure of the economy is influenced by changes in intermediate and final demand patterns. These, in turn, are triggered by: (a)

²² Dynamic properties of the convergence process are unknown, but convergence has been achieved in all simulation exercises, through the control of the speed of adjustment of the vector of saving propensities.

²³ Whereas constant public consumption is obtained by scaling revenue according to a specific cost index, transfers are constant when measured in terms of foreign currency.

higher relative price of energy intensive goods, (b) lower relative price of labour intensive productions when labour taxes are reduced, (c) demand shifting towards durable goods industries when savings are increased, (d) relative decline of export oriented industries when capital outflows support a trade deficit in domestic industries' products.

Both in the double dividend scenario (hereafter, DD) and in the capital tax cuts scenario (CC) the two industries displaying the strongest reduction of activity levels are the two most energy intensive industries: Energy (first period: -11.34% (DD) -11.39% (CC), last period: -17.43% (DD) -17.40% (CC)) and Chemicals (first period: -8.73% (DD) -8.76% (CC), last period: -12.16% (DD) -14.39% (CC)). However, whereas the growing industries are those associated with zero or negative carbon emissions when cuts in labour taxation are considered (Agriculture, +1.87% / +2.63%, Renting, +1.14% / +0.52%), cuts on capital income taxation stimulates investment and the growth of industries Building (+17.87% / 16.70%) and Agricultural and Industrial Machinery (+15.72% / +12.98%).

Figure 1 shows the relative impact on unemployment rates, by period, of the two policy options. Unemployment rises in both cases, although the CC scenario produces higher long-term unemployment rates and a sharper labour demand reduction immediately after the introduction of carbon taxation in the third period.

The gross cost of capital services is imposed by a fixed international interest rate, even if domestic returns on capital may vary as a consequence of changes in capital taxation. The introduction of carbon taxes has an inflationary effect, which is especially evident at the final consumption stage, causing an increase in nominal wages. In the double dividend situation, however, this effect is counteracted by labour tax cuts. Indeed, the relative price of labour to capital decreases in the steady state, relative to the baseline, by 2.56%, triggering labour/capital substitution. Since employment levels nonetheless decrease, this means that domestic industries exhibit, on average, lower activity levels.

The latter effect is due to a loss of competitiveness induced by higher production costs. By substituting domestic inputs with imported inputs, industries and consumers partly avoid the carbon tax, meaning that some carbon emissions (associated with the

production of goods and services) are actually transferred abroad. The purchase of additional imports is financed by a capital outflow.

When revenues from carbon taxation are used to reduce capital taxes, the substitution effect works in the opposite direction (relative labour cost rises in the long term by 1.57%). Furthermore, the contraction of domestic activities is more severe, because production costs are higher (tax cuts have no impact on the production side since the gross rental cost of capital is fixed) and higher domestic net yields on capital stimulate a significant growth in the stock of capital assets owned by the households, generating a larger capital outflow, which is used to finance more import purchases.

There are here two effects that mitigate the overall cost of carbon emission control, and both of them are stronger when capital taxes are reduced. First, we have the “carbon leakage” phenomenon, which means that reduced domestic emissions may cause higher emissions abroad (Lee and Roland-Holst (2000), Roson (2001)). Second, since foreign and domestic goods are imperfect substitutes, there are changes in the terms of trade, implying that foreign consumers actually bear part of the carbon tax burden²⁴.

On the final demand side, consumption levels depend on a *permanent income effect*, and on a *temporal profile effect*. The first refers to the possibility of allocating consumption over time by an appropriate choice of savings in each period. In this way consumption levels do not depend directly on current income but on the accumulated wealth (here represented by the capital stock), as well as on current and future (discounted) incomes. A positive (negative) shock raises the global wealth and shifts upward (downward) consumption levels in all periods, so that there exists a complete correspondence between welfare effects and wealth effects, if environmental quality is not taken into account.

²⁴ In this paper, we focus on a single country, ignoring international policy feedbacks. However, the Kyoto protocol imposes similar reductions in CO₂ emissions for most of the Italian trade partners; if foreign prices also rise, there would be less scope for substituting domestic products with imports, and a less significant impact on the terms of trade. The two effects mentioned above would then be smaller but still present, because (1) many countries have not accepted binding commitments on emissions reductions, and (2) conditions imposed on signatory countries are different.

To highlight the impact on welfare and wealth of the different policies, it is possible to look at the relative level of steady state consumption²⁵ for the different household classes, which is displayed in figure 2.

The figure clearly shows that there is no double dividend in the strong form, since all households exhibit non-environmental welfare losses, quite evenly distributed among the different income classes. By contrast, some consumers obtain welfare gains in the capital tax cuts scenario, although aggregate consumption rises by only 0.13%.

Remarkably, the distributional impact of capital tax reductions benefits lower income classes. This is mainly due to the presence of constant income transfers, which constitute a significant share of total revenues for low-income households, and to the existence of different discount factors. Since labour is homogeneous, the decline of labour income has a larger impact for wealthier classes, whereas capital income increases as a consequence of higher levels of the capital stock, as shown in figure 3.

Policy shocks affects consumption levels, but also change the time profile of consumption. This can be seen more clearly by combining equations (2) and (3), assuming that investment are positive and remembering that utility functions are logarithmic. This provides a condition, determining the growth of consumption levels between two subsequent periods:

$$\frac{c_{t+1}^h}{c_t^h} = \alpha^h \frac{p_t^h}{p_{t+1}^h} \left(\frac{r_t}{q_t} + \delta \frac{q_{t+1}}{q_t} \right) \quad (5)$$

This equation highlight that the relative growth of consumption levels is driven by relative changes in consumption and investment prices.

The introduction of a carbon tax causes an inflationary push. However, whereas consumption prices are affected by direct taxation of energy consumption, investment prices are only indirectly affected by taxes on energy inputs in the production of investment goods. This means that the introduction of carbon taxation generally cause an

²⁵ This is possible because of the relatively short time length of the transitory period. Although the welfare of each representative consumer is an infinite sum of discounted logarithmic utilities, the constancy of consumption from the eleventh period onwards allow the transformation of the infinite series into a sum of eleven logarithmic terms, where the weight attached to the last term is much higher than the other ones.

immediate reduction of (relative) consumption levels, even when wealth effects are positive. In addition, there may be a reduction of the net interest rate. This also affects the consumption growth, both directly and through lower consumption and investment prices. Savings emerge from the difference between current income and consumption. Figure 4 shows how the *average* marginal propensity to consumption varies over time in the two regimes, in comparison to the benchmark case. Higher returns on capital create an incentive to save more in the CC scenario, whereas “consumption smoothing” implies, in the DD scenario, higher consumption propensities, rising over time.

5. Conclusion

In this paper, a dynamic general equilibrium model of the Italian economy has been used to assess the impact of alternative tax recycling schemes. At an aggregate level, results are in line with the theoretical literature on the “double dividend hypothesis”. For example, we found that a double dividend scheme do not yield non-environmental welfare. Cuts on capital income taxes, on the other hand, have mild positive effects on long-term economic growth. This effect is, however, obtained through a mechanism different from the conventional growth theory. If the economy is open and the interest rate is fixed, capital demand by domestic industries is independent from domestic capital accumulation. Excess supply in the national market for capital factors, then, becomes a way to finance the purchase of imported goods. By using imported goods instead of domestic goods, the economy avoids the generation of carbon emissions in the production sector.

The simulated impact on the income distribution of the two recycling schemes is counter-intuitive, since labour tax cuts are found to be neutral, whereas capital tax cuts turn out to be progressive. To understand how this result emerges in the model, remember that each representative consumer has three sources of income: transfers, labour and capital income.

The first component is fixed by hypothesis. Its share in total income is larger for low-income classes, which are therefore more protected in case of negative shocks, as in the DD scenario. On the other hand, when labour tax *rates* are scaled down proportionally,

the richer classes benefit relatively more. This mechanism offsets the former one, producing the distributional neutrality of the double dividend policy.

When capital taxes are cut, all classes are affected by a reduction of labour income, primarily due to the increase in the unemployment rate. In the model, this implies a reduction of the labour endowment for each representative consumer. Since neither the share of capital income in the total revenue, nor the capital tax rates are sufficiently differentiated among the different income classes, the net effect is a progressive one.

The simulation exercise suggests that capital tax recycling schemes are more effective than double dividend schemes. Furthermore, this policy is not a regressive one. This result has been obtained, however, by implicitly assuming that a reduction of employment affects symmetrically all income classes, and that all consumers have the same degree of access to foreign capital markets.

References

- Accardo B.M. and Cavalletti B. (2000), Costruzione di una base-dati microconsistente per l'implementazione di un modello di equilibrio economico generale dell'economia italiana, in IRER, *Matrici di contabilità sociale*, collana sintesi n. 25, Milan.
- Auerbach A.J. and Kotlikoff L.J. (1987), *Dynamic Fiscal Policy* (Cambridge University Press, Cambridge).
- Blanchflower D.G. and Oswald A.J. (1994), *The Wage Curve* (MIT Press, Cambridge, Mass.).
- Böhringer K. (1998), Unilateral Taxation of International Environmental Externalities and Sectoral Exemptions, in Fossati A. and Hutton J. (eds.), *Policy Simulations in the European Union* (Routledge, London).
- Böhringer K. (1999), *Cooling Down Hot Air – A Global CGE Analysis of Post-Kyoto Carbon Abatement Strategies*, Discussion Paper n. 99-43, ZEW, Mannheim.
- Böhringer K., Jensen J. and Rutherford T.F. (2000), Energy Market Projections and Differentiated Carbon Abatement in the European Union, in Carraro C. (ed.), *Efficiency and Equity of Climate Change Policy* (Kluwer Academic Publishers, Dordrecht).
- Bohm P. (2000), International Greenhouse Gas Emissions Trading – With Special Reference to the Kyoto Protocol, in Carraro C. (ed.), *Efficiency and Equity of Climate Change Policy* (Kluwer Academic Publishers, Dordrecht).
- Bovenberg A.L. (1999), Green Tax Reforms and the Double Dividend: An Updated Reader's Guide, *International Tax and Public Finance*, vol. 6(3), pp. 421-443.

- Bovenberg A.L. and De Mooij R.A. (1994), Environmental Levies and Distortionary Taxation, *American Economic Review*, vol. 84(4), pp. 1085-1089.
- Bovenberg A.L. and van der Ploeg F. (1994), Environmental Policy, Public Finance and the Labour Market in a Second-Best World, *Journal of Public Economics*, vol. 55(3), pp. 349-390.
- Bussolo M. and Pinelli D. (2001), *Green Taxes: Environment, Employment and Growth; A Computable General Equilibrium Analysis for Italy*, FEEM working paper n.4.01.
- Bye B. (1998), Labour Market Rigidities and Environmental Tax Reforms: Welfare Effects of Different Regimes, in *Proceedings of the conference Using Dynamic Computable General Equilibrium Models for Policy Analysis*, Gl. Avernoes, June 1998, Denmark.
- Carraro C., Galeotti M. and Gallo M. (1996), Environmental Taxation and Unemployment: Some Evidence on the Double Dividend Hypothesis in Europe, *Journal of Public Economics*, vol. 62(1-2), pp. 141-181.
- Daveri F. and Tabellini G. (1997), *Unemployment, Growth and Taxation in Industrial Countries*, CEPR Discussion Paper n. 1681, London.
- Edwards T.H. (1996), A Simplified CGE Approach to Modelling the Welfare Effects of Japanese Carbon Abatement Measures, in Fossati A. (ed.), *Economic Modelling Under the Applied General Equilibrium Approach* (Avebury, Aldershot).
- Edwards T.H. (1998), Modelling the Effects of Energy Market Distortions on the Costs of Carbon Abatement: Computable general Equilibrium and Partial Equilibrium Assessment, in Fossati A. and Hutton J. (eds.), *Policy Simulations in the European Union* (Routledge, London).
- Edwards T.H. and Hutton J.P. (1999), *The Effects of Carbon Taxation on Carbon, Nitrogen and Sulphur Pollutants in Europe: Combining General Equilibrium and Integrated System Approaches*, paper presented at the conference: Policy Evaluation with Computable General Equilibrium Models, October 1999, Genoa, mimeo.
- Fullerton D., Hong I., and Metcalf G.E. (2000), *A Tax on Output of the Polluting Industry is not a Tax on Pollution: the Importance of Hitting the Target*, FEEM working paper n.46.2000, Milan.
- Harrison G.W. and Kriström B. (1998), Carbon Emissions and the Economic Costs of Transport Policy in Sweden, in Roson R. and Small K.A. (eds.), *Environment and Transport in Economic Modelling* (Kluwer Academic Publishers, Dordrecht).
- IPCC – Intergovernmental Panel on Climate Change (2001), *Climate Change 2001: Mitigation*, Working Group III Report, available at: <http://www.ipcc.ch> .
- Jorgenson, D.W., and Wilcoxon P.J., (1995) Reducing U.S. Carbon Emissions: An Econometric General Equilibrium Assessment, in D. Gaskins, J. Weyant, (eds.), *Reducing Global Carbon Dioxide Emissions: Costs and Policy Options*, Stanford University Press, Stanford, CA (forthcoming).

- Jensen J. (1998), How Valuable are Delayed Cutbacks in Danish Carbon Emissions?, in *Proceedings of the conference Using Dynamic Computable General Equilibrium Models for Policy Analysis*, Gl. Avernoes, June 1998, Denmark.
- Kahn J.R. and Farmer A. (1999), The Double Dividend, Second-Best Worlds, and Real-World Environmental Policy, *Ecological Economics*, vol. 30(3), pp. 433-439.
- Koskela K. and Schöb R. (1998), Alleviating Unemployment: the Case for Green Tax Reforms, *European Economic Review*, vol. 42, pp. 1723-1746.
- Lee H. and Roland-Holst D. (2000) "Trade-induced Pollution Transfers and Implications for Japan's Investment and Assistance," *Asian Economic Journal*, vol.14(2), pp. 123-146 .
- Lucas R.E.Jr. (1990), Supply Side Economics: an Analytical Review, *Oxford Economic Papers*, vol. 42, pp. 293-316.
- Marsiliani L. and Renström T.I. (2000a), *Imperfect Competition, Labour Market Distortions, and the Double Dividend Hypothesis – Theory and Evidence from Italian Data*, FEEM working paper n.11.2000, Milan.
- Marsiliani L. and Renström T.I. (2000b), *Inequality, Environmental Protection and Growth*, FEEM working paper n.36.2000, Milan.
- Montini M. (2000), *Italian Policies and Measures to Mitigate and Adapt to Climate Change*, FEEM working paper n.37.2000, Milan.
- Nordhaus W.D. and Yang Z. (1996), A Regional Dynamic General Equilibrium Model of Alternative Climate-Change Strategies, *American Economic Review*, vol. 86(4), pp. 741-765.
- Parry I.W.H. and Bento A.M. (2000), Tax Deductions, Environmental Policy, and the Double Dividend Hypothesis, *Journal of Environmental Economics and Management*, vol. 39(1), pp. 67-96.
- Pench A.(1998), Efficiency and Distributional Effects of Ecotaxes in a CGE Model for Italy, in Fossati A. and Hutton J. (eds.), *Policy Simulations in the European Union* (Routledge, London).
- Pench A. (1999), *Ecotaxes in Italy: Evidence from a Multi Country Model of the European Union*, paper presented at the conference: Policy Evaluation with Computable General Equilibrium Models, October 1999, Genoa, mimeo.
- Pench A. (2001), *Green Tax Reforms in a Computable General Equilibrium Model for Italy*, FEEM working paper n.3.01.
- Rebelo S. (1991), Long-Run Policy Analysis and Long-Run Growth, *Journal of Political Economy*, vol. 99(3), pp. 500-521.
- Roson R. (1998), Wage Curves and Capital Mobility in a General Equilibrium Model of Italy, in Fossati A. and Hutton J. (eds.), *Policy Simulations in the European Union* (Routledge, London).

- Roson R. (2000), *Using an Integrated IAM-CGE Modelling Approach for Climate Change Policy Analysis*, Working Paper n.2000.06, Dip. Scienze Economiche, University of Venice.
- Roson R. (2001), *Carbon Leakage in a Small Open Economy with Capital Mobility*, FEEM working paper n. 50.01, Milan.
- Rutherford T., Böhringer C. and Pahlke A. (1998), Carbon Abatement, Revenue Recycling and Intergenerational Burden Sharing, in *Proceedings of the conference Using Dynamic Computable General Equilibrium Models for Policy Analysis*, Gl. Avernaes, June 1998, Denmark.
- Schneider K. (1997) Involuntary Unemployment and Environmental Policy: The Double Dividend Hypothesis, *Scandinavian Journal of Economics*, vol. 99(1), pp. 45-49.
- Scholz C.M. (1998), Involuntary Unemployment and Environmental Policy: The Double Dividend Hypothesis – A Comment, *Scandinavian Journal of Economics*, vol. 100(3), pp. 663-664.
- Sen P. and Turnovsky S.J. (1990), Investment Tax Credit in an Open Economy, *Journal of Public Economics*, vol. 42, pp. 277-299.
- Schwartz J. and Repetto R. (2000), Nonseparable Utility and the Double Dividend Debate: Reconsidering the Tax-Interaction Effect, *Environmental and Resource Economics*, vol. 15(2), pp. 149-157.
- Springer K. (1998), The Implications of Climate Policies for Trade and the Distribution of Burdens: Modelling a Recursive Dynamic CGE Model, in *Proceedings of the conference Using Dynamic Computable General Equilibrium Models for Policy Analysis*, Gl. Avernaes, June 1998, Denmark.
- Springer K. (1999), *The Kyoto Protocol: Implications of International Capital Mobility on Trade and Regional Welfare*, paper presented at the conference: Policy Evaluation with Computable General Equilibrium Models, October 1999, Genoa, mimeo.
- Stampini M. (2001), *Tax Reforms and Environmental Policies for Italy*, FEEM working paper n.5.01.

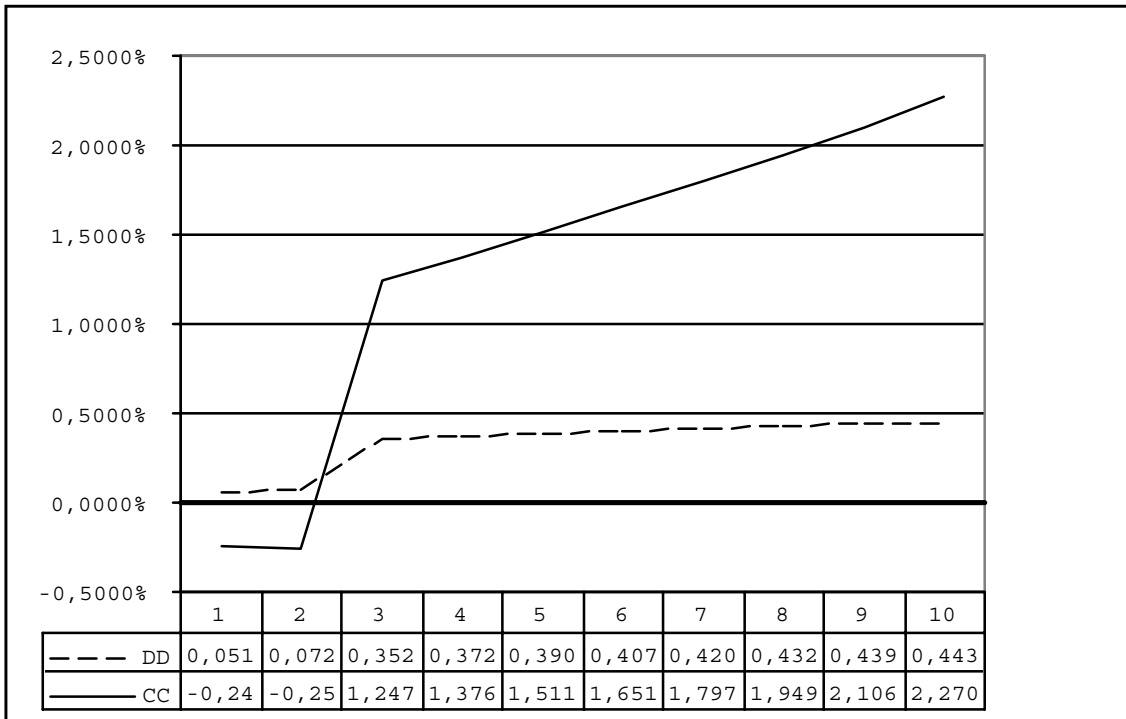


Figure 1 – Relative variations of unemployment rates

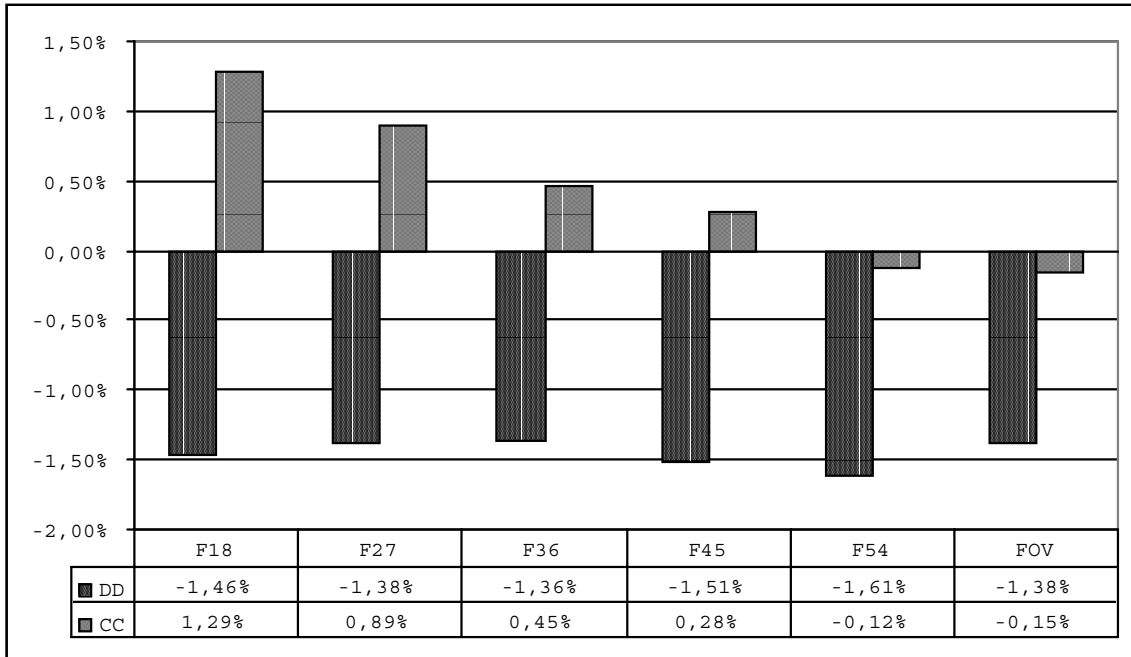


Figure 2 – Relative variation of steady state consumption by household class

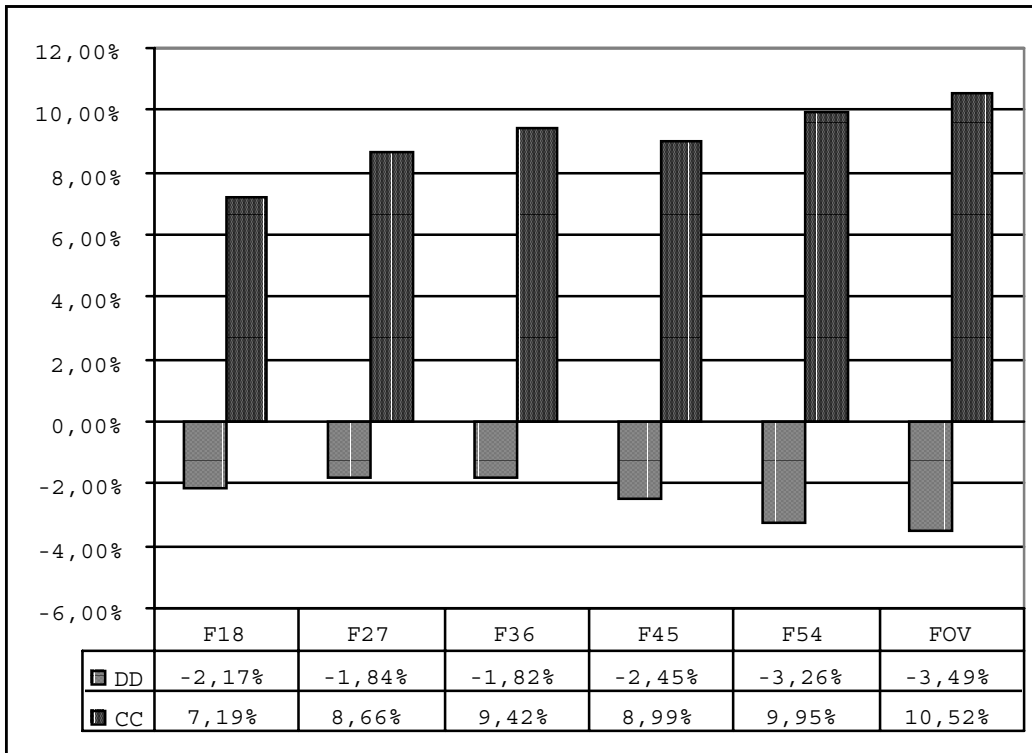


Figure 3 – Variation of steady state capital stocks

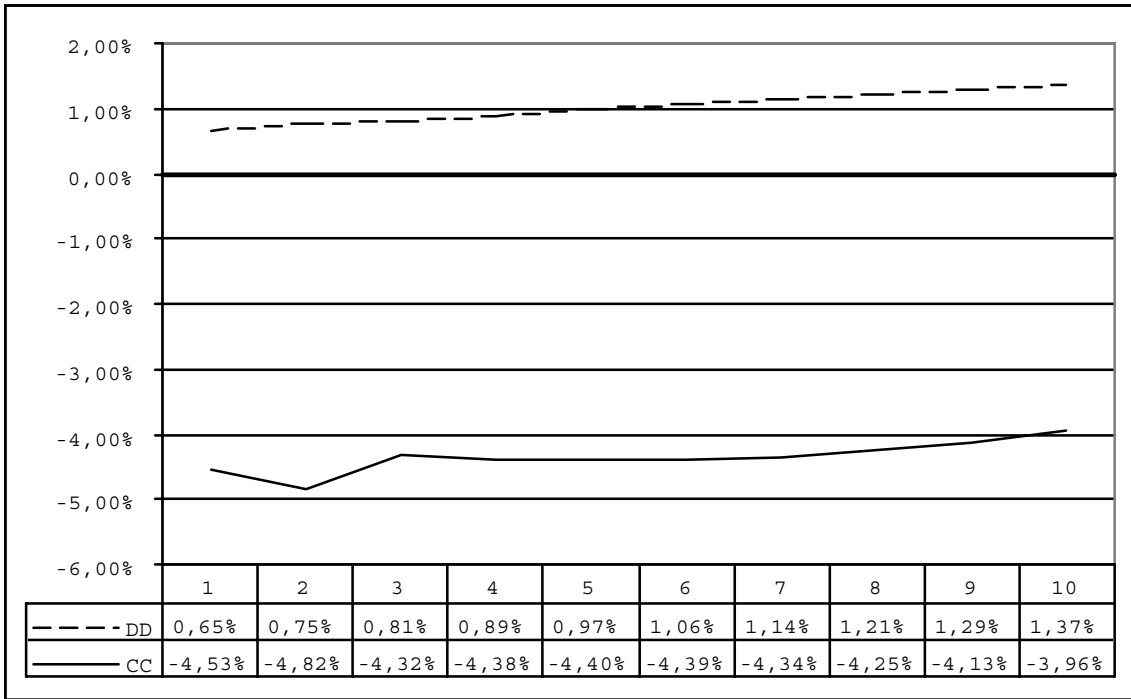


Figure 4 – Changes in marginal consumption propensity (averages)

The Structure of the Dynamic General Equilibrium Model

1. Notation

Production and utility functions are built as nested CES, Cobb-Douglas and Leontief functions. The following notation will be adopted:

$$CES(x_1, \dots, x_n) = \left(\sum x_i^\rho \right)^{1/\rho}$$

$$CD(x_1, \dots, x_n) = \prod x_i^{\alpha_i} \quad \sum \alpha_i = 1$$

$$LEO(x_1, \dots, x_n) = \min(a_1 x_1, \dots, a_n x_n)$$

The letters i and j will indicate the set of commodities and industries, h will refer to the set of households. Variables with a bar on top are exogenously given.

2. Static equilibrium equations

(A1) Domestic goods production functions of intermediate inputs, energy and value added

$$x_d^i = LEO(x^{li}, \dots, x^{ni}, x^{ei}, v^i)$$

(A2) Energy input associated with pollution rights

$$x^{ei} = LEO(\tilde{x}^{ei}, pr^{ei})$$

(A3) Supplied goods are Armington composites of domestic and imported goods

$$x^i = CES(x_d^i, x_m^i)$$

(A4) Value added is a composite of labour and capital

$$v^i = CES(\bar{l}^i, \bar{k}^i)$$

(A5) Primary factors supply has a fixed structure in terms of household contribution

$$l = LEO(l^h)$$

$$k_d = LEO(k^h)$$

(A6) Household utility (includes investment good)

$$U^h = CD(CD(x^{1h}, \dots, x^{nh}, x^{eh}), I^h)$$

(A7) Household income (includes transfers and pollution rights rents)

$$y^h = r\bar{k}^h + w\bar{l}^h + trasf^h + p_{pr} pr^h$$

(A7) Investment good composition

$$I = LEO(x^{1I}, \dots, x^{nI}, x^{eI})$$

(A8) Public expenditure composition (fixed level)

$$\bar{G} = CD(g, \text{trasf})$$

(A9) Public good composition

$$g = LEO(x^{1g}, \dots, x^{ng}, x^{eg})$$

(A10) Export demand

$$x^{ie} = e(p_d^i)$$

(A11) Fixed world interest rate

$$r = \bar{r}$$

(A12) Trade balance constraint (includes capital flows, exogenous world prices and capital endowments)

$$\sum_m \bar{p}_m^i x_m^i = \sum_d p_d^i x^{ie} + r \left(\sum_h \bar{k}^h - k \right)$$

(A13) Labour supply (as a function of the unemployment rate and the real wage [nominal wage / consumers price index])

$$l^h = l^h(u, w, cpi)$$

Domestic prices are computed by equating prices and production costs.

Constant marginal tax rates are applied on the prices of: domestic supply levels, primary factors supply (differentiated by household), imports and total supply (VAT). Tax revenue finances the public expenditure.

Pollution rights are assigned to the households, but there may be excess supply (zero price) in the absence of environmental constraints.

In equilibrium, industrial supply equals intermediate and final demand (households' consumption, public demand, investment demand and exports). Markets for labour and capital clear, where the labour endowments are exogenously adjusted on the basis of the wage curve, and capital flows to/from abroad absorb excess demand or supply created by the fixed interest rate.

3. Dynamic Optimization Equations

Intertemporal optimization determines the saving rates, that is the shares of the investment good consumption in the households' budget (eq.A6). Each representative consumer maximizes an intertemporal utility function, which is a discounted sum of logarithmic sub-functions of aggregate consumption.

This problem gives raise to the following set of equations.

(A13) Marginal utility of consumption equals marginal utility of capital (costate variable)

$$\frac{1}{c_t^h} \frac{p_t^I}{p_t^{c,h}} = \lambda_t^h$$

(A14) Marginal utility of capital equals one-period discounted marginal utility of consumption (made possible by capital yield) and next period marginal utility of capital, diminished by depreciation

$$\lambda_t^h = \alpha^h \left(\frac{1}{c_{t+1}^h} \frac{r_{t+1}}{p_{t+1}^{c,h}} + \delta \lambda_{t+1}^h \right)$$

(A15) Capital accumulation

$$k_{t+1}^h = \delta k_t^h + I_t^h$$

(A16) Expenditure in consumption and investment equals capital and non-capital income

$$c_t^h p_t^{c,h} + I_t^h p_t^I = r_t k_t^h + y_t^h$$

(A17) Steady state consumption is defined under constant prices and capital stock (T stands for terminal period)

$$c_{ss}^h p_T^{c,h} + \delta k_{T+1}^h p_T^I = r_T k_{T+1}^h + y_T^h$$

(A18) Terminal condition. Last period costate variable is defined as a discounted sum of an infinite stream of marginal utility of (constant) steady state consumption

$$\lambda_T^h = \frac{\alpha^h}{1 - \delta \alpha^h} \frac{1}{c_{ss}^h} \frac{r_T}{p_T^{c,h}}$$

(A19) The initial capital stock is given

$$k_1^h = \bar{k}_1^h$$

NOTE DI LAVORO DELLA FONDAZIONE ENI ENRICO MATTEI
Fondazione Eni Enrico Mattei Working Papers Series

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

Server WWW: WWW.FEEM.IT

Anonymous FTP: [FTP.FEEM.IT](ftp://FTP.FEEM.IT)

To order any of these papers, please fill out the form at the end of the list.

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

Coalition Theory Network	33.2001	<i>Shlomo WEBER and Hans WIESMETH</i> : <u>From Autarky to Free Trade: The Impact on Environment</u>
ETA	34.2001	<i>Margarita GENIUS and Elisabetta STRAZZERA</i> : <u>Model Selection and Tests for Non Nested Contingent Valuation Models: An Assessment of Methods</u>
NRM	35.2001	<i>Carlo GIUPPONI</i> : <u>The Substitution of Hazardous Molecules in Production Processes: The Atrazine Case Study in Italian Agriculture</u>
KNOW	36.2001	<i>Raffaele PACI and Francesco PIGLIARU</i> : <u>Technological Diffusion, Spatial Spillovers and Regional Convergence in Europe</u>
PRIV	37.2001	<i>Bernardo BORTOLOTTI</i> : <u>Privatisation, Large Shareholders, and Sequential Auctions of Shares</u>
CLIM	38.2001	<i>Barbara BUCHNER</i> : <u>What Really Happened in The Hague? Report on the COP6, Part I, 13-25 November 2000, The Hague, The Netherlands</u>
PRIV	39.2001	<i>Giacomo CALZOLARI and Carlo SCARPA</i> : <u>Regulation at Home, Competition Abroad: A Theoretical Framework</u>
KNOW	40.2001	<i>Giorgio BRUNELLO</i> : <u>On the Complementarity between Education and Training in Europe</u>
Coalition Theory Network	41.2001	<i>Alain DESDOIGTS and Fabien MOIZEAU</i> (xlv): <u>Multiple Politico-Economic Regimes, Inequality and Growth</u>
Coalition Theory Network	42.2001	<i>Parkash CHANDER and Henry TULKENS</i> (xlv): <u>Limits to Climate Change</u>
Coalition Theory Network	43.2001	<i>Michael FINUS and Bianca RUNDSHAGEN</i> (xlv): <u>Endogenous Coalition Formation in Global Pollution Control</u>
Coalition Theory Network	44.2001	<i>Wietze LISE, Richard S.J. TOL and Bob van der ZWAAN</i> (xlv): <u>Negotiating Climate Change as a Social Situation</u>
NRM	45.2001	<i>Mohamad R. KHAWLIE</i> (xlvii): <u>The Impacts of Climate Change on Water Resources of Lebanon-Eastern Mediterranean</u>
NRM	46.2001	<i>Mutasem EL-FADEL and E. BOU-ZEID</i> (xlvii): <u>Climate Change and Water Resources in the Middle East: Vulnerability, Socio-Economic Impacts and Adaptation</u>
NRM	47.2001	<i>Eva IGLESIAS, Alberto GARRIDO and Almudena GOMEZ</i> (xlvii): <u>An Economic Drought Management Index to Evaluate Water Institutions' Performance Under Uncertainty and Climate Change</u>
CLIM	48.2001	<i>Wietze LISE and Richard S.J. TOL</i> (xlvii): <u>Impact of Climate on Tourist Demand</u>
CLIM	49.2001	<i>Francesco BOSELLO, Barbara BUCHNER, Carlo CARRARO and Davide RAGGI</i> : <u>Can Equity Enhance Efficiency? Lessons from the Kyoto Protocol</u>
SUST	50.2001	<i>Roberto ROSON</i> (xlviii): <u>Carbon Leakage in a Small Open Economy with Capital Mobility</u>
SUST	51.2001	<i>Edwin WOERDMAN</i> (xlviii): <u>Developing a European Carbon Trading Market: Will Permit Allocation Distort Competition and Lead to State Aid?</u>
SUST	52.2001	<i>Richard N. COOPER</i> (xlviii): <u>The Kyoto Protocol: A Flawed Concept</u>
SUST	53.2001	<i>Kari KANGAS</i> (xlviii): <u>Trade Liberalisation, Changing Forest Management and Roundwood Trade in Europe</u>
SUST	54.2001	<i>Xueqin ZHU and Ekko VAN IERLAND</i> (xlviii): <u>Effects of the Enlargement of EU on Trade and the Environment</u>
SUST	55.2001	<i>M. Ozgur KAYALICA and Sajal LAHIRI</i> (xlviii): <u>Strategic Environmental Policies in the Presence of Foreign Direct Investment</u>
SUST	56.2001	<i>Savas ALPAY</i> (xlviii): <u>Can Environmental Regulations be Compatible with Higher International Competitiveness? Some New Theoretical Insights</u>
SUST	57.2001	<i>Roldan MURADIAN, Martin O'CONNOR, Joan MARTINEZ-ALER</i> (xlviii): <u>Embodied Pollution in Trade: Estimating the "Environmental Load Displacement" of Industrialised Countries</u>
SUST	58.2001	<i>Matthew R. AUER and Rafael REUVENY</i> (xlviii): <u>Foreign Aid and Direct Investment: Key Players in the Environmental Restoration of Central and Eastern Europe</u>
SUST	59.2001	<i>Onno J. KUIK and Frans H. OOSTERHUIS</i> (xlviii): <u>Lessons from the Southern Enlargement of the EU for the Environmental Dimensions of Eastern Enlargement, in particular for Poland</u>
ETA	60.2001	<i>Carlo CARRARO, Alessandra POME and Domenico SINISCALCO</i> (xlix): <u>Science vs. Profit in Research: Lessons from the Human Genome Project</u>
CLIM	61.2001	<i>Efrem CASTELNUOVO, Michele MORETTO and Sergio VERGALLI</i> : <u>Global Warming, Uncertainty and Endogenous Technical Change: Implications for Kyoto</u>
PRIV	62.2001	<i>Gian Luigi ALBANO, Fabrizio GERMANO and Stefano LOVO</i> : <u>On Some Collusive and Signaling Equilibria in Ascending Auctions for Multiple Objects</u>
CLIM	63.2001	<i>Elbert DIJKGRAAF and Herman R.J. VOLLEBERGH</i> : <u>A Note on Testing for Environmental Kuznets Curves with Panel Data</u>

CLIM	64.2001	<i>Paolo BUONANNO, Carlo CARRARO and Marzio GALEOTTI</i> : <u>Endogenous Induced Technical Change and the Costs of Kyoto</u>
CLIM	65.2001	<i>Guido CAZZAVILLAN and Ignazio MUSU (I)</i> : <u>Transitional Dynamics and Uniqueness of the Balanced-Growth Path in a Simple Model of Endogenous Growth with an Environmental Asset</u>
CLIM	66.2001	<i>Giovanni BAIOCCHI and Salvatore DI FALCO (I)</i> : <u>Investigating the Shape of the EKC: A Nonparametric Approach</u>
CLIM	67.2001	<i>Marzio GALEOTTI, Alessandro LANZA and Francesco PAULI (I)</i> : <u>Desperately Seeking (Environmental) Kuznets: A New Look at the Evidence</u>
CLIM	68.2001	<i>Alexey VIKHLYAEV (xlviii)</i> : <u>The Use of Trade Measures for Environmental Purposes – Globally and in the EU Context</u>
NRM	69.2001	<i>Gary D. LIBECAP and Zeynep K. HANSEN (I)</i> : <u>U.S. Land Policy, Property Rights, and the Dust Bowl of the 1930s</u>
NRM	70.2001	<i>Lee J. ALSTON, Gary D. LIBECAP and Bernardo MUELLER (I)</i> : <u>Land Reform Policies, The Sources of Violent Conflict and Implications for Deforestation in the Brazilian Amazon</u>
CLIM	71.2001	<i>Claudia KEMFERT</i> : <u>Economy-Energy-Climate Interaction – The Model WIAGEM -</u>
SUST	72.2001	<i>Paulo A.L.D. NUNES and Yohanes E. RIYANTO</i> : <u>Policy Instruments for Creating Markets for Biodiversity: Certification and Ecolabeling</u>
SUST	73.2001	<i>Paulo A.L.D. NUNES and Erik SCHOKKAERT (Ii)</i> : <u>Warm Glow and Embedding in Contingent Valuation</u>
SUST	74.2001	<i>Paulo A.L.D. NUNES, Jeroen C.J.M. van den BERGH and Peter NIJKAMP (Ii)</i> : <u>Ecological-Economic Analysis and Valuation of Biodiversity</u>
VOL	75.2001	<i>Johan EYCKMANS and Henry TULKENS (I)</i> : <u>Simulating Coalitionally Stable Burden Sharing Agreements for the Climate Change Problem</u>
PRIV	76.2001	<i>Axel GAUTIER and Florian HEIDER</i> : <u>What Do Internal Capital Markets Do? Redistribution vs. Incentives</u>
PRIV	77.2001	<i>Bernardo BORTOLOTTI, Marcella FANTINI and Domenico SINISCALCO</i> : <u>Privatisation around the World: New Evidence from Panel Data</u>
ETA	78.2001	<i>Toke S. AIDT and Jayasri DUTTA (I)</i> : <u>Transitional Politics. Emerging Incentive-based Instruments in Environmental Regulation</u>
ETA	79.2001	<i>Alberto PETRUCCI</i> : <u>Consumption Taxation and Endogenous Growth in a Model with New Generations</u>
ETA	80.2001	<i>Pierre LASSERRE and Antoine SOUBEYRAN (I)</i> : <u>A Ricardian Model of the Tragedy of the Commons</u>
ETA	81.2001	<i>Pierre COURTOIS, Jean Christophe PÉREAU and Tarik TAZDAÏT</i> : <u>An Evolutionary Approach to the Climate Change Negotiation Game</u>
NRM	82.2001	<i>Christophe BONTEMPS, Stéphane COUTURE and Pascal FAVARD</i> : <u>Is the Irrigation Water Demand Really Convex?</u>
NRM	83.2001	<i>Unai PASCUAL and Edward BARBIER</i> : <u>A Model of Optimal Labour and Soil Use with Shifting Cultivation</u>
CLIM	84.2001	<i>Jesper JENSEN and Martin Hvidt THELLE</i> : <u>What are the Gains from a Multi-Gas Strategy?</u>
CLIM	85.2001	<i>Maurizio MICHELINI (Iii)</i> : <u>IPCC “Summary for Policymakers” in TAR. Do its results give a scientific support always adequate to the urgencies of Kyoto negotiations?</u>
CLIM	86.2001	<i>Claudia KEMFERT (Iii)</i> : <u>Economic Impact Assessment of Alternative Climate Policy Strategies</u>
CLIM	87.2001	<i>Cesare DOSI and Michele MORETTO</i> : <u>Global Warming and Financial Umbrellas</u>
ETA	88.2001	<i>Elena BONTEMPI, Alessandra DEL BOCA, Alessandra FRANZOSI, Marzio GALEOTTI and Paola ROTTA</i> : <u>Capital Heterogeneity: Does it Matter? Fundamental Q and Investment on a Panel of Italian Firms</u>
ETA	89.2001	<i>Efrem CASTELNUOVO and Paolo SURICO</i> : <u>Model Uncertainty, Optimal Monetary Policy and the Preferences of the Fed</u>
CLIM	90.2001	<i>Umberto CIORBA, Alessandro LANZA and Francesco PAULI</i> : <u>Kyoto Protocol and Emission Trading: Does the US Make a Difference?</u>
CLIM	91.2001	<i>ZhongXiang ZHANG and Lucas ASSUNCAO</i> : <u>Domestic Climate Policies and the WTO</u>
SUST	92.2001	<i>Anna ALBERINI, Alan KRUPNICK, Maureen CROPPER, Nathalie SIMON and Joseph COOK (Ii)</i> : <u>The Willingness to Pay for Mortality Risk Reductions: A Comparison of the United States and Canada</u>
SUST	93.2001	<i>Riccardo SCARPA, Guy D. GARROD and Kenneth G. WILLIS (Ii)</i> : <u>Valuing Local Public Goods with Advanced Stated Preference Models: Traffic Calming Schemes in Northern England</u>
CLIM	94.2001	<i>Ming CHEN and Larry KARP</i> : <u>Environmental Indices for the Chinese Grain Sector</u>
CLIM	95.2001	<i>Larry KARP and Jiangfeng ZHANG</i> : <u>Controlling a Stock Pollutant with Endogenous Investment and Asymmetric Information</u>
ETA	96.2001	<i>Michele MORETTO and Gianpaolo ROSSINI</i> : <u>On the Opportunity Cost of Nontradable Stock Options</u>
SUST	97.2001	<i>Elisabetta STRAZZERA, Margarita GENIUS, Riccardo SCARPA and George HUTCHINSON</i> : <u>The Effect of Protest Votes on the Estimates of Willingness to Pay for Use Values of Recreational Sites</u>
NRM	98.2001	<i>Frédéric BROCHIER, Carlo GIUPPONI and Alberto LONGO</i> : <u>Integrated Coastal Zone Management in the Venice Area – Perspectives of Development for the Rural Island of Sant’Erasmo</u>

NRM	99.2001	<i>Frédéric BROCHIER, Carlo GIUPPONI and Julie SORS: <u>Integrated Coastal Management in the Venice Area – Potentials of the Integrated Participatory Management Approach</u></i>
NRM	100.2001	<i>Frédéric BROCHIER and Carlo GIUPPONI: <u>Integrated Coastal Zone Management in the Venice Area – A Methodological Framework</u></i>
PRIV	101.2001	<i>Enrico C. PEROTTI and Luc LAEVEN: <u>Confidence Building in Emerging Stock Markets</u></i>
CLIM	102.2001	<i>Barbara BUCHNER, Carlo CARRARO and Igor CERSOSIMO: <u>On the Consequences of the U.S. Withdrawal from the Kyoto/Bonn Protocol</u></i>
SUST	103.2001	<i>Riccardo SCARPA, Adam DRUCKER, Simon ANDERSON, Nancy FERRAES-EHUAN, Veronica GOMEZ, Carlos R. RISOPATRON and Olga RUBIO-LEONEL: <u>Valuing Animal Genetic Resources in Peasant Economies: The Case of the Box Keken Creole Pig in Yucatan</u></i>
SUST	104.2001	<i>R. SCARPA, P. KRISTJANSON, A. DRUCKER, M. RADENY, E.S.K. RUTO, and J.E.O. REGE: <u>Valuing Indigenous Cattle Breeds in Kenya: An Empirical Comparison of Stated and Revealed Preference Value Estimates</u></i>
SUST	105.2001	<i>Clemens B.A. WOLLNY: <u>The Need to Conserve Farm Animal Genetic Resources Through Community-Based Management in Africa: Should Policy Makers be Concerned?</u></i>
SUST	106.2001	<i>J.T. KARUGIA, O.A. MWAI, R. KAITHO, Adam G. DRUCKER, C.B.A. WOLLNY and J.E.O. REGE: <u>Economic Analysis of Crossbreeding Programmes in Sub-Saharan Africa: A Conceptual Framework and Kenyan Case Study</u></i>
SUST	107.2001	<i>W. AYALEW, J.M. KING, E. BRUNS and B. RISCHKOWSKY: <u>Economic Evaluation of Smallholder Subsistence Livestock Production: Lessons from an Ethiopian Goat Development Program</u></i>
SUST	108.2001	<i>Gianni CICIA, Elisabetta D'ERCOLE and Davide MARINO: <u>Valuing Farm Animal Genetic Resources by Means of Contingent Valuation and a Bio-Economic Model: The Case of the Pentro Horse</u></i>
SUST	109.2001	<i>Clem TISDELL: <u>Socioeconomic Causes of Loss of Animal Genetic Diversity: Analysis and Assessment</u></i>
SUST	110.2001	<i>M.A. JABBAR and M.L. DIEDHOU: <u>Does Breed Matter to Cattle Farmers and Buyers? Evidence from West Africa</u></i>
SUST	1.2002	<i>K. TANO, M.D. FAMINOW, M. KAMUANGA and B. SWALLOW: <u>Using Conjoint Analysis to Estimate Farmers' Preferences for Cattle Traits in West Africa</u></i>
ETA	2.2002	<i>Efrem CASTELNUOVO and Paolo SURICO: <u>What Does Monetary Policy Reveal about Central Bank's Preferences?</u></i>
WAT	3.2002	<i>Duncan KNOWLER and Edward BARBIER: <u>The Economics of a "Mixed Blessing" Effect: A Case Study of the Black Sea</u></i>
CLIM	4.2002	<i>Andreas LÖSCHEL: <u>Technological Change in Economic Models of Environmental Policy: A Survey</u></i>
VOL	5.2002	<i>Carlo CARRARO and Carmen MARCHIORI: <u>Stable Coalitions</u></i>
CLIM	6.2002	<i>Marzio GALEOTTI, Alessandro LANZA and Matteo MANERA: <u>Rockets and Feathers Revisited: An International Comparison on European Gasoline Markets</u></i>
ETA	7.2002	<i>Effrosyni DIAMANTOUDI and Eftichios S. SARTZETAKIS: <u>Stable International Environmental Agreements: An Analytical Approach</u></i>
KNOW	8.2002	<i>Alain DESDOIGTS: <u>Neoclassical Convergence Versus Technological Catch-up: A Contribution for Reaching a Consensus</u></i>
NRM	9.2002	<i>Giuseppe DI VITA: <u>Renewable Resources and Waste Recycling</u></i>
KNOW	10.2002	<i>Giorgio BRUNELLO: <u>Is Training More Frequent when Wage Compression is Higher? Evidence from 11 European Countries</u></i>
ETA	11.2002	<i>Mordecai KURZ, Hehui JIN and Maurizio MOTOLESE: <u>Endogenous Fluctuations and the Role of Monetary Policy</u></i>
KNOW	12.2002	<i>Reyer GERLAGH and Marjan W. HOFKES: <u>Escaping Lock-in: The Scope for a Transition towards Sustainable Growth?</u></i>
NRM	13.2002	<i>Michele MORETTO and Paolo ROSATO: <u>The Use of Common Property Resources: A Dynamic Model</u></i>
CLIM	14.2002	<i>Phillippe QUIRION: <u>Macroeconomic Effects of an Energy Saving Policy in the Public Sector</u></i>
CLIM	15.2002	<i>Roberto ROSON: <u>Dynamic and Distributional Effects of Environmental Revenue Recycling Schemes: Simulations with a General Equilibrium Model of the Italian Economy</u></i>

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

2001 SERIES

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

2002 SERIES

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

