Climate Change Research: Evaluation and Policy Implications
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ASSESSMENT REPORT ON NRP SUBTHEME

"NATIONAL INSTRUMENTS FOR CLIMATE CHANGE POLICY"

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ABSTRACT

Economic instruments for environmental protection feature in textbooks for their superior performance in terms of effectiveness and both static and dynamic efficiency, especially in cases characterized by a large number of polluters with large differences in abatement cost.
These instruments are thus pre-eminently suited to be included in climate change policies. However, this proves to be very difficult as yet. The projects under this research sub-theme share a common interest in the complexities of implementing various types of economic instruments. The first project deals with the design of a European system of tradable emission rights. The second project is on the feasibility of ecological tax reform, with special reference to The Netherlands. The Climate Fund project, the third project, aims at investigating whether an international fund for side payments is an effective and efficient tool to reduce CO_2 emissions. To that purpose, the world is divided into 9 regions. Finally, the fourth project uses an applied general equilibrium model to analyze the effectiveness and especially the income distributional effects of differently designed CO_2 charges. The projects yield interesting results from which policymakers can benefit. There still are, however, blind spots. These and further research questions are identified.

1. INTRODUCTION

The projects under the research theme national and international instruments for greenhouse policy share a common interest in the complexities of implementing various types of economic instruments. It is commonly known that there appears to be a wide gap between, on the one hand, the rather abstract textbook version of a particular economic instrument and its implementation in practice on the other hand. This is so, because especially the category of economic instruments change

the system of relative prices most directly. This means, firstly, that these instruments have an immediate and clear-cut impact on the distribution of income within and among countries and on international competitiveness. To overcome the inherent societal resistance and increase the political feasibility of economic instruments, resort to tailor-made solutions has to be made. Secondly, for economic instruments to realize their presumed superior performance in terms of effectiveness and static and dynamic efficiency, they have to operate in well-functioning markets. And thirdly, economic instruments cannot stand alone, but have to be embedded in an institutional context and a supporting framework of regulations. If these conditions are not met and if no account is taken of these implementation difficulties, economic instruments will either not be used or their operation will be so distorted that they lose much of their imputed attractiveness.

In fact, a circular research process can be ascribed to all projects under this research theme, be it with different accents, namely:
1. Exploration of one or more prototypes of economic instruments.
2. Thorough investigation of implementation problems.
3. Design of improved and feasible instruments.

The major objective of the research is to come up with better designed instruments and/or complementary and supportive conditions in order to make the use of economic instruments more feasible, efficient and effective.

A preliminary assessment of the results reveals that, in general terms, the research projects have been successful. There are interesting results from which policymakers can benefit. Thus, the project on tradeable carbon emission permits focuses on the design of a feasible system on EU-scale and examines to that end the characteristics of the permit, its initial distribution and market allocation, the time path by which the number of permits available is reduced and monitoring an enforcement of the system. Attention is also paid to the economic consequences of such a system for industry and consumers and to specific problems such as the existence of entry barriers and other market imperfections that might thwart the functioning of the system. The project on the feasibility of an ecological tax reform in The Netherlands indicates that the feasibility of ecological taxes is determined by the tax design, the taxing authority and by the constitutional, institutional and fiscal structures in which these taxes are embedded. An important recommendation is that ecological taxes can best be imposed by a taxation authority that is directly related to the environmental good i.e. tax base, at hand. The project on the socio-economic impact of economic instruments makes use of a computable general equilibrium model of the Dutch economy. With the help of this empirically-based model, the income distributional effects of economic instruments to reduce CO_2 emissions are thoroughly investigated. It appears that changes in the design of these instruments might substantially mitigate these effects. Special attention is paid to a recently hotly debated issue, namely to what extent a shift of taxes from labour to environmental goods is conducive to employment generation. The final results of this analysis are not yet available. In addition, the project "Socio-economic Aspects of the Greenhouse Effect: Climate Fund" studied the impact of international capital transfers on the efficiency and efficacy of emission abatement. After putting considerable effort in identifying the international distribution of the costs and benefits of such policies, and including them in an integrated assessment model, the study shows that there is not much room for

international capital transfer, as emission abatement is economically rational only to a limited extent.

This assessment report is organized as follows. In the Sections 2-5, the following individual research projects will be discussed.

Table 1.1
List of projects in the NRP subtheme "National instruments for greenhouse policy"

Title	Project leader	Number
Tradeable CO_2 -emission permits	A. Nentjes	851052
The feasibility of an ecological tax reform in The Netherlands	J.G. Backhaus	851051
Socio-economic aspects of the greenhouse effect: Climate Fund	H.M.A. Jansen	851055
Socio-economic aspects of the greenhouse effect: Applied General Equilibrium Model	H.M.A. Jansen	851061

Per project, a description will be given of the objectives, progress, present state of affairs, (preliminary) research results and a (preliminary) evaluation. The evaluating Section 6 tries to assess the overall results of the research theme on national and international instruments for greenhouse policy. This assessment will be structured along the 3 different accents indicated in the introduction.

On 4 November, 1994, a workshop was organized among the project coordinators and researchers to discuss progress and results, as well as to investigate the possibilities for closer cooperation.

2. TRADEABLE EMISSION RIGHTS

The project consists of three parts:
a. design of a European system of tradable rights and investigation of the feasibility of the system;
b. investigation of side effects, in particular entry barriers;
c. investigation of effects of international coordination of environmental policy.

Parts (a) and (b) are now nearly finished, part (c) will be the main topic of the last year of the project.
It appears that a system of tradeable rights can indeed be designed. Monitoring and enforcement, issues that in many cases are problematic, can in the case of

CO_2 easily be solved by introducing the system there where the energy comes first in the market, i.e. producers and importers. The initial distribution can be achieved through auctioning or grandfathering. This choice has implication for the creation of entry barriers. A micro-economic approach was used to analyze side effects such as entry barriers. Grandfathering of permits creates such barriers for newcomers in a sector. Auctioning does less so, but auctioning reduces the acceptability of the system by the target group. Grandfathering provides the receiving instances actually with a capital transfer (the value of the permits). By using the so-called limit price model, the somewhat surprising conclusion was reached that transaction costs will raise the entry barriers. Another interesting conclusion, derived from the deep purse theory, is that imperfect capital markets may raise the entry barriers, in particular in the case of grandfathering. The third part of the project is still underway. A second-best two countries model is being developed. The second-best approach is attributable to the question how revenues are being channelled back to the economy. Due to differences in CO_2 damage functions and differences in reduction cost functions, cooperative behaviour can come about through applying side payments. A very preliminary and tentative conclusion that seems to follow from the model is that Joint Implementation may not be an optimal instrument. The project is an interesting one, and in particular the investigation of entry barriers, a subject that so far did not receive much attention in the literature, is innovative.

3. THE FEASIBILITY OF AN ECOLOGICAL TAX REFORM IN THE NETHERLANDS

The aim of the project is to describe and analyze feasible ecotaxes and environmental charges; to give advice to policy makers on this issue; and to provide policy makers with policy alternatives with respect to ecotaxes. The methodology of the project is based on the economic theory of environmental policy, the theory of public finance, fiscal federalism theory, club theory and transaction costs theory. Three types of taxes can be distinguished: Pigouvian taxes, revenue raising taxes and earmarked taxes. It seems that earmarked taxes have a larger public acceptability than other taxes. For ecotaxes to be both ecologically effective and acceptable, it is necessary that they are being levied by a tax authority that is closely connected to the ecological circumstances. This means that ecological taxes can best be imposed by a taxation authority that is directly related to (the management of) the environmental good, that is the tax base, at hand. It is therefore recommended that institutional framework with so-called ecological taxing units is created. Water authorities are an example of such units. For use by policy makers a checklist was drawn up so as to make sure that no important aspects are overlooked when introducing an earmarked tax, a revenue raising tax or a Pigouvian tax.

The problem is that the present taxing authorities tend to be political units, which do not coincide with ecological taxing units. This means that institutional and constitutional changes are required. The conclusion is that an ecological tax reform in The Netherlands is feasible, if each type of charge that aims at ecological improvement is being designed carefully. In bringing about the start of such a tax and institutional reform, local authorities (like municipalities, water authorities

and provinces) can play the important role of providing an example for the introduction of ecological taxing by higher authorities.

4. CLIMATE FUND

The Climate Fund project (IES) aims at investigating whether an international fund for side payments is an effective and efficient tool to reduce CO_2 emissions. First, an extensive literature review was made with respect to damage due to the enhanced greenhouse effect and with respect to costs of CO_2 reduction. Where possible, regional differences in damages and costs were identified. Then a model was constructed (Climate FUND: Climate Framework for Uncertainty, Distribution and Negotiation) in which 9 regions in the world are distinguished. The main emphasis in the model is on damages. In particular the intangible damages seem to grow over the next century. The spatial distribution of damages is unevenly distributed over the regions, with South and South East Asia and Africa as the main victims followed by Centrally Planned Asia, Latin America and the Middle East.

A probabilistic analysis with the model shows that best guesses (on which policy is mainly based) of tangible damages are lower than expected values, under optimistic assumptions on the available knowledge, but much more so under pessimistic assumptions.

An analysis was carried out on the effectiveness and the efficiency of an international fund, by comparing optimal reduction strategies in cooperative and non-cooperative games, with international side payments. The results are preliminary but indicate that international prisoners' dilemmas don't seem too sharp and that the opposite situation, where regions cooperate out of free will and self-interest, is more common. There are at least two possible explanations for this counter-intuitive result. First, countries that would benefit most from emission reduction have the least capital available to make cost-effective transfers. Moreover, these countries generally attach a low, or no priority to climate change. Second, the rich countries of the North are also hesitant to invest in abatement options in other countries, because then they lose the so-called secondary benefits, that go with CO_2 reductions, i.e. the local impact of sulphate aerosols and conventional air pollution.

The project had good seminal effects: articles were published and will be published in the international literature. The project researcher could, from the project results, contribute to the IPCC Working Group III 1995 report in Section 6 (The Social Costs of Climate Change) and 10 (Integrated Assessment) as one of the lead authors. The Climate Fund project is taken up in the Energy Modelling Forum 14: Integrated Assessment of Climate Change.

5. APPLIED GENERAL EQUILIBRIUM MODEL

The aim of the project is to construct a general equilibrium model to supplement the macro-economic results of the Central Planning Bureau (CPB) calculations

with more detailed information at the sectoral level, in particular with respect to distributional effects (60 firms and 44 households types). For this purpose, an existing general equilibrium model, developed by Keller at the Central Planning Bureau of Statistics, has been modified so as to be applicable to CO_2 charges. The classification of energy inputs has been subdivided to allow for changes in the fuel mix by individual firms (and households). Another change in the model is an iterative computing lemma for adaptation by the target groups to relatively large changes in taxes (including CO_2 charges). Since the model has a linear structure, it can originally only deal with small changes. In reality, the marginal demand functions of the target groups are non-linear. To avoid large linearisation errors, a relatively large tax impulse is subdivided in a series of small steps. After each step, the marginal adaptation behaviour of the target group is calculated, using the underlying non-linear relation. The model modifications and the updating of data as well as the gathering of additional data is now finalized. This has been a major effort.

Four energy charge *cum* rebate scenario have been analyzed. In the labour tax scenario a 50% charge on all energy carriers is implemented and the revenues are used to lower employers' contributions to social security. As a variant, the effects of a 100% charge were also calculated. Another scenario is the household scenario where only households are subject to the charge. In these two variants the revenues are recycled as in the labour tax scenario. The fourth variant is the 50% charge with lump sum recycling of the revenues.

The main results are:
1. Energy saving in households is ca. 6% in the 50% scenarios and 9% in the 100% variant. Energy saving of firms varies widely between sectors (between 0 and 30% in the labour tax scenario) and is for all sectors together ca. 16% in the 50% scenarios and 25% in the 100% scenario.
2. There is no indication that a sizeable double dividend (both lower energy use and higher employment) can be reaped. A small dividend can be realized in the household scenario.
3. In all scenarios where revenues were recycled as in the labour tax scenario, the effect on income distribution is increased inequality. Moreover the income differences between workers and non-workers are rather large. But in the lump sum scenario these effects are the other way around.

In the evaluation of the project, it appears that politically significant empirical results were derived:
1. Effects on the income distribution are significant in the chosen scenarios. As the income distribution is politically sensitive, more scenarios should be developed to investigate if this effect can be mitigated.
2. There are large differences in the energy savings and the economic impacts between the various sectors. These differences are more highly desegregated than in CPB's studies.
3. Energy savings are larger than calculated in the CPB studies.
4. No decisive conclusions can be derived on the existence of a significant double dividend.

6. EVALUATION

At the time of writing, all four projects are in the final stage. This makes it difficult to make a definite judgement. The project on tradable emission rights (UG) has very interesting conclusions, in particular with respect to entry barriers, a subject that has so far received little attention. It is reassuring that tradable emission rights will not face major problems with respect to monitoring and enforcement. The work on international aspects is not yet mature for judgement, but the plans look promising.

The project on the feasibility of an ecotax in The Netherlands (UL) is very much focused on practical aspects. This is commendable, because so far most literature on ecotaxes tends to be rather theoretical and to overlook such practical aspects. Although the results of the project are indeed very interesting, (to a certain extent) they seem to be of somewhat less relevance to the CO_2 issue, at least for the near future. The recommendation to introduce first ecotaxes at small scales (by lower authorities) is difficult to extend to CO_2 taxes. However, in the final phase of this project, attention is especially directed toward the use of ecotaxes for climate change issues. And as long as world-wide coordinated policies are not feasible, these insights might be useful.

The Climate Fund project (IES) has yielded a lot more results than could be foreseen at the start. The modelling effort for 9 regions in the world is of necessity based on rough assumptions. The stochastic analysis teaches us that the existence of uncertainty leads to the necessity to take measures earlier, not later, than one would do on the basis of information of the most probable effects alone; that result may look familiar to statistically trained economists, but politicians often use uncertainty as an argument to delay action.

The information gathered in Climate Fund can be used in last phase of the UG project that also treats international effects. Right now, we have in The Netherlands the IMAGE model, that is strong on physical effects but needs fortification at the economic side, and the Climate Fund model, that is basically an economic model and weak on the physical side. Integration of the two might result in a model that is strong on both sides.

It is somewhat puzzling and contrary to the intuition, that Climate Fund yields the - only preliminary - results that an international fund for side payments does not lead to considerable improvements of CO_2 reduction and lowering of reduction costs. This has to be investigated further.

In the light of the above-mentioned preliminary result, it is understandable that so far little attention was paid to practical, political issues of how such a fund should be institutionalized, which mechanisms can be applied, which side payments criteria could be used etc. This might be a follow-up study, if indeed it can be concluded that a fund mechanism is effective and efficient.

The analyses carried out with the applied general equilibrium model of The Netherlands (IES) indeed show that substantial energy savings are possible, but that the income distributional effects are worrisome from a political point of view.

The analyses also show that no substantial positive employment effects are to be expected from an ecological tax shift, at least not in a small open economy as The Netherlands.

Taken together, the four projects have led to a substantial improvement of information, aimed at application in the decision making on CO_2 reduction. A further extension of this information can be expected in the year to come.

Finally, at the November workshop, mentioned in the Introduction, the following blind spots and research questions were identified:

1. There was a general feeling among the project coordinators and researchers, based on their research experience, that the practical problems and complexities of implementation of economic instruments still constitute the major impediment to their application. These problems and complexities are closely related to the following issues, which are all in need of further research.
2. The very limited social, and hence, political acceptance of economic instruments both at the national and international level. It was even feared that the present tendency to minimise the distributional effects and the negative competitive effects on industry may seriously paralyse economic instruments. The instruments then become ineffective in promoting the internalisation of environmental costs, fostering the restructuring of industry, stimulating environmentally-sound technologies and/or achieving environmental policy objectives.
3. The imperfect operation of market forces, i.e. the existence of market failures in various respects. This is especially relevant for energy markets. These markets are characterized by government intervention, and a mixture of oligopolistic supply structures (with often a regulated distinction between production and distribution of energy) and diffuse and mobile demand structures. Moreover, a number of decisions have a long gestation period: a coal fire power plant or a nuclear energy plant last for 40 years or ore; the same holds for distribution networks.
4. The impact of uncertainty surrounding climate change on the decision making process and the design and implementation of environmental policy instruments, economic instruments in particular.
5. The influence of economic policy instruments on (environmentally-sound) technological development is not sufficiently analyzed and modelled.
6. Too often, research is carried out on one specific environmental policy instrument, whereas in reality a mix of instruments (direct regulation, communication, economic instruments) is applied. Research should rather be undertaken with respect to the optimal mix of policy instruments.

7. REFERENCES

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