

STRATEGIC ASPECTS OF IMPLEMENTING THE INTERNATIONAL AGREEMENT ON CLIMATE CHANGE

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Summary

The article provides criteria for the economic assessment of international environmental agreements (IEA) in general and with special regard to the Framework Convention on Climate Change including the Kyoto Protocol.

In the first part, the essential elements of any IEA, necessary to induce countries to sign and to comply with its terms are specified. Due to the voluntary character of any international commitment and the lack of a central enforcement authority, a prerequisite for the participation of a country is its expectation of a welfare improvement. Hence, a treaty must be designed, such as to divide welfare gains more or less symmetrically among signatories. Therefore, direct transfers or a permit market with a suitable initial

distribution may be implemented. Advantages and disadvantages of these methods are discussed. Moreover, credible, simple and transparent punishment options must be institutionalized to deter free-riding in order to stabilize an agreement.

In the second part, a socioeconomic assessment of the impact of climate change is given. The empirical literature evaluating damages of climate change and the costs of various abatement policies is reviewed. Distributional impacts of different abatement policies, e.g. the reduction quotas specified in the Kyoto protocol, and their incentive structure for the various countries are derived.

1. Introduction

In recent years, scientists, economists and politicians have become increasingly concerned about the problem of global warming which is, apart from the ozone depletion, one of the main causes of global atmospheric change over the last decades. For instance, global temperature in 1998 was the highest within the past 119 years since reliable data are available. Global warming is caused by the so-called greenhouse gases to which carbon dioxide (CO₂) is the main contributor. For instance, CO₂-emissions have risen from about 6.0 to 7.5 billion tons per annum over the last 20 years. The main causes of global warming are the burning of fossil fuels (which is responsible for about 75 percent of greenhouse gas emissions), deforestation and intensive land use. It is expected by the Intergovernmental Panel of Climate Change that at the end of the twenty-first century, greenhouse gas emissions will have doubled compared to pre-industrial levels, if abatement activities are not substantially intensified. It is expected that this will lead to a rise in the mean temperature of about 2.5–3°C, causing, for example, damages to areas of low altitude due to higher sea-levels, having an impact on agricultural and industrial production and increasing the mortality rate of human beings. So far, however, there remains a great uncertainty about the extent of possible damages to be expected in the future. Moreover, it is also not clear what would be the economic consequences if abatement efforts were intensified over the next decades to avoid possible damages from global warming.

In 1992, the Framework Convention on Climate Change was signed in Rio de Janeiro, by 160 parties. In this convention, the parties stated their intentions to control global warming in the future by taking appropriate measures. However, the Rio Declaration was basically only a “statement of good will” and was *not* associated with any specific abatement obligations. In subsequent years efforts have been made to agree on binding abatement targets. After much diplomacy, the parties agreed on the Kyoto Protocol in 1997. The parties to this protocol are only industrialized countries (listed in Annex I to the Protocol), including those countries which are undergoing the process of transition to a market economy. Developing countries (non Annex I parties) did not accept any abatement obligations but may accede to the protocol at any time if they want to. So far, the Kyoto-Protocol has not been ratified by any country and therefore it has not entered into force yet. The main problem is that, at the time the protocol was drafted, important institutional details of “various forms of trading in emission entitlements” had not been finally settled. First, under Joint Implementation (JI) the protocol mentions the possibility that Annex I countries can jointly fulfill their abatement obligations (bubble policy). Second, the Protocol allows for the possibility that emission quotas assigned to

each party are tradable among the Annex I countries. Third, under the clean development mechanism (CDM) Annex I parties may foster “incremental” abatement measures in developing countries which may be substituted for their own reduction efforts. The main opponents in the current debate are the US and the European Union (EU). Whereas the US advocate unrestricted trade in emission entitlements (JI, permit trading and CDM) to reap all efficiency gains associated with trading, the EU wants to impose a cap on trading. The EU argues that industrialized countries should set a good example to developing countries by realizing most emission reductions within their boundaries and not to shop around buying emission entitlements from developing countries and countries in transition. In contrast, the US argue that without trade, their abatement costs would be unacceptably high and that they would have never agreed on the Kyoto-targets without the unrestricted permit trading, JI- and CDM-options. The position of the US is supported by the countries of the former Soviet Union, which hope that they will be the main beneficiaries of permit trading and JI.

In the light of this background, this text proceeds in two steps:

In the first step, laid out are the *theoretical foundations* to evaluate international environmental agreements (IEAs). An *optimal agreement* is defined, and various forms of “*sub-optimal*” agreements. In particular, we identify the essential elements of a treaty in order for countries to sign an IEA and to comply with its terms. Due to the voluntary character of any international commitment and the lack of a central enforcement authority, we stress that IEAs must be designed, such that they provide a welfare gain to all participants and that credible, simple and transparent punishment options must be institutionalized within the treaty to ensure compliance and to avoid “loophole-effects.”

In a second step, there is a review of the *empirical literature*, evaluating the damages of climate change and the costs of various abatement policies. We look at the distributional impacts of different abatement policies and their implied incentive structure for the various countries.

The results of the theoretical and empirical work presented in this paper will be of twofold use for future research and policy: First, they define criteria according to which existing international environmental agreements may be assessed. Second, they provide tools with which the efficiency and efficacy of future agreements may be improved.

2. Game Theoretical Fundamentals of International Environmental Treaties

2.1 The Need for Cooperation: Global Rationality

From an economic point of view, global environmental quality is a public good. This good can be produced by reducing global pollutants at any source from which they emanate. The questions at the beginning of an economic analysis are: (a) What is the *globally optimal* level of global pollution? and (b) What is the *equilibrium* level of pollution generated if the countries do not cooperate with each other?

In welfare economics, the global optimum is defined by the level of emissions

reductions which maximizes the difference between the benefits and the cost of these reductions. Benefits and costs have to be aggregated worldwide.

Under the assumption that each government strives for maximizing national welfare it decides to reduce national emissions to an extent which maximizes the difference between national benefits and national cost. The situation where this condition is met is called the *Nash-equilibrium*.

Since national emission reduction creates external benefits (i.e. benefits to other countries), it follows from traditional economic reasoning that the level of emission reduction in the Nash-equilibrium falls short of the one required for global optimality: Since global environmental quality is a public good, it is underprovided by uncoordinated individual optimization.

Consequently, the question arises: Why do countries not simply get together and agree to reduce global emissions to their globally optimal level? There are two main obstacles to international cooperation, the problem of the lack of *individual rationality* and the *free-rider incentive*.

The Problem of Cooperation

2.1.10 Individual Rationality

By definition, the move from the Nash-equilibrium to the global optimum increases welfare worldwide (since the additional aggregate damage reduction is higher than aggregate abatement costs). Thus this move is rational for the community of all countries seen as a whole entity (“global rationality”). However, there may be some countries—those suffering little from global pollution—for which national welfare is reduced if the world community strives for the common good. For those countries it is not *individually rational* to join a globally optimal agreement.

There has been an extensive discussion on the problem of individual rationality in the literature. Summarizing this discussion we conclude that an agreement may fail to be individually rational if (a) some countries have to contribute much to a cooperative policy (e.g. since they have low opportunity costs of abatement compared to other countries) and/or (b) some countries evaluate environmental damages substantially lower than their neighbors. Whenever the differences are pronounced, the fundamental interests of some countries may be violated. (c) Of course, asymmetries resulting from an abatement policy in the first place may be compensated via transfers or concessions in other policy fields. However, as will later be seen here, it will turn out that the application of these options is very limited in reality for various reasons.

Conclusion 1

Since accession to an agreement is voluntary, treaties must be individually rational. Therefore treaties must either specify abatement targets which lead to a relatively symmetric welfare distribution or must be accompanied by some form of compensation. Later, we will look at the design of “symmetric” abatement policies.

2.1.11 The Free-Rider Incentive

Assume the problem of individual rationality away for a moment and suppose that each individual country gains from moving to the global optimum. Even under these favorable circumstances an important obstacle to cooperation remains:

Since global environmental quality is a public good, countries that join a globally optimal agreement face a *prisoner's dilemma* when it comes to the question of whether to comply with or to breach the contract. It is tempting for each member to behave as a *free-rider*. The free-rider improves its situation beyond country specific welfare in the global optimum because it saves abatement costs and still benefits from the emission reductions of all other countries. Since this incentive holds for each country, a globally optimal contract (and even cooperative contracts falling short of the goal of global optimality) is (are) threatened by inherent instability.

The extensive discussion in the literature on this issue may be summarized as follows: (a) As a tendency, the more a government has to reduce emissions from its non-cooperative (“Nash-equilibrium”) emission level, the stronger will be the incentives to take a free-ride. (b) Abatement policies which lead to an asymmetric allocation of abatement burdens imply for some governments a low but for others a high free-rider incentive. (c) Any abatement policy implying emissions below non-cooperative levels faces the problem of free-riding. Thus, cooperation in international pollution control constitutes a typical *social dilemma*.

Conclusion 2

Thus, due to the free-rider incentive partial and full cooperative abatement, policies can only be effective if they are accompanied by threats to sanction the violation of a treaty. Far reaching and/or asymmetric emission reductions compared to the status quo can only be achieved if severe and credible threats to sanction non-compliance are available.

Sanctions

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