



# *Global public goods: climate change and the Kyoto protocol*

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## **1. Introduction**

Global public goods can be defined as “goods with benefits that extend to all countries, people, and generations”<sup>1</sup>. In economic terms, they are a special case of externalities, where a global dimension is added to non-rivalry and non-excludability.

Climate is clearly included in this special category: who fails to pay cannot be excluded from enjoying its benefits (or suffering its damages) and the enjoyment of the good by someone does not affect its enjoyment by others. And it is difficult to deny the globality of climate.

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<sup>1</sup> Kaul, I., Conceicao P., Le Goulven, K. and Mendoza, R.U. (2003). “How to improve the provision of Global Public Goods”, in “Providing Global Goods – Managing Globalization”, UNDP, Oxford University Press

In particular, climate change is global in both causes and consequences. The impact of emissions of Greenhouse Gases (GHGs) on global warming is totally independent of their location (unlike air pollution) and local climatic changes depend only on the world climate system. Furthermore, global warming has also other important features which make it even more difficult to handle with the instruments provided by the standard economic theory of externalities. First, it is an inter-generational phenomenon, i.e. the effects of GHG concentration in the atmosphere on climate are persistent across time and the climate system is slow to react to increases of such concentration. Second, there is a high level of uncertainty, both about dimension and timing of climate change and about costs of the abatement of emissions. Finally, it is necessary to consider an important equity issue. Historically, developed countries have produced the majority of GHG emissions. But the effects of global warming will be much more severe on developing countries, because of their geographical location and their stronger dependence on the agriculture sector. In other words, the countries which have more responsibilities will face less consequences in the future and vice-versa.

The focus of this essay is on the solutions provided by the economic theory to the challenge of global warming and on the current answer given by the international community through the Kyoto Protocol.

## **2. How to control Global Warming?**

Given the global nature of climate change, it is easy to understand the necessity of an action at international level, in order to achieve a sustainable level of emissions. Following the analysis of Nordhaus (2005), three different approaches are possible: command-and control regulations, tax or price-based regimes, and quantity oriented market approaches.

Regulation is the traditional instrument of environmental policy. It consists of measures such as technology and performance-based standards or product standards.

This approach is generally rejected by the literature, which evaluates it unable to ensure cost efficiency. Moreover, Pan (2001) underlines how it could be not compatible with international agreement. Fixing national emission levels, in facts, would not consider the different marginal abatement costs of each nation and it would result in the rejection by a large number of countries, because of unnecessary high costs.

A second instrument consists of using price or tax mechanisms as a method of coordinating policies among countries. In the international environment, it could assume the form either of an international tax or of harmonized domestic taxes. In the case of an international tax, the nations (and not the firms) pay the tax to an international agency, which receives and redistributes the tax revenues. In this context, the form of the domestic regulation is irrelevant. On the other hand, in the case of harmonized domestic taxes, the international community should negotiate an agreed level of a domestic emission tax, establishing adequate compensation for the losing countries from the gaining countries. If correctly applied, it should induce firms to reduce emissions at the level where the marginal abatement cost is equal to the emission tax rate. This solution does not have international precedents in the field on environmental policy, but lately it is gaining consensus. Nordhaus (2006) hypothesizes the institution of an Harmonized Carbon Tax (HCM), essentially equivalent to a "dynamic Pigouvian pollution tax for a global public good", and points out ten different reasons to prefer it to a quantitative approach.

Finally, it is possible to establish an agreement which sets quantitative limits of emissions and allocates emission permits to firms (or States) but allows to trade among countries, in order to minimize abatement costs.

The starting allocation of permits can be set either through an auction or through a grandfather allocation. Under an auction, government (or the international community) sells the emission permits, while, under the grandfather rule, the allocation of emission permits is based on historical records. Quantity approaches are today the most common theoretical framework in environmental policy and this is the approach followed by the Kyoto Protocol.

### **3. The Kyoto Protocol and its mechanisms**

At the Rio Conference in 1992, the international community agreed for a common effort in order to mitigate climate change and signed the first international legally binding agreement aiming to curb GHG emissions – the United Nations Framework Convention on Climate Change (UNFCCC). In 1997, specific targets for limiting GHG emissions were established in the Kyoto Protocol. All major industrialised countries (162 nations included in Annex I) are bound to obtain a domestic reduction for carbon dioxide (CO<sub>2</sub>) equivalent emissions by an average of 5.2 % (reduction commitments of each country are contained in Annex B) below 1990 level, by the first commitment period (2008-2012), while developing countries are not bound to reduction goals.

Given that different nations have very different cost curves for emissions abatement, and that developed countries face generally high cost curves, while developing countries can decrease their emissions at lower costs, the Kyoto Protocol promotes emissions-trading schemes, in order to help high-cost countries to achieve their reduction goals.

In particular, three innovative mechanisms have been designed: Emissions trading, the Joint Implementation (JI) and the Clean Development Mechanism (CDM).

#### *Emissions trading*

Article 17 of the Kyoto Protocol provides for Annex I parties the possibility to acquire emission credits from other Annex I parties, which have been able to reduce their emissions under their reduction target contained in Annex B, and to use them to help fulfilling their own reduction goals. It means that countries can make use of lower cost opportunities to reduce emissions, wherever these opportunities are located.

This emission-trade scheme is reserved to Annex I countries and constitutes the general framework for regional and domestic emission-market, like the European Union Emission Trading Scheme.

#### *Joint Implementation*

Article 6 of the Protocol defines the principles of the mechanism generally called “Joint Implementation”. It allows Annex I parties to finance and to implement emission-reducing projects in the territory of another Annex I party, in order to obtain additional emission credits, equivalent to the difference between the estimated emissions produced in absence of the project and those actually produced after the implementation of the project. Such emission credits can be used to help reaching the country’s reduction target or can be sold on the emission market.

#### *The Clean Development Mechanism*

The Clean Development Mechanism, introduced by the Article 12 of the Protocol, is similar to the JI, but it involves developing countries. In particular, it allows Annex I parties to implement

in non-Annex I parties projects that reduce emissions or absorb GHG through afforestation or reforestation activities, in return for certified emission reductions. The goal of this mechanism is not only the achievement of an efficient abatement of emissions, but also to support a sustainable development in non-Annex I countries.

Since the Kyoto Protocol launched these market-based mechanisms, many scholars have studied their possible theoretical consequences, but an adequate empirical literature is still missing. Most researchers agree on the fact that the Emission Trading scheme is economically more efficient than JI/CDM. First, the application of project-based mechanisms implies that only a part of the potential parties would participate in international cooperation, while they would be all present in ET. The result is that the abatement costs efficiency will be optimal only in the case of ET. Second, JI/CDM are limited to reduce the emissions in those sectors (such as agriculture, energy and energy-intensive industries) which provide the possibility for a emission reduction project, whereas, in a ET scheme, parties can intervene in any domestic sector in order to reduce emissions. Finally, it is often underlined how JI/CDM are usually associated with higher transaction costs, given their nature of project-based mechanisms.

As for the comparison between JI and CDM, the abatement costs in Non-Annex I countries are usually much lower than in Annex I nations, and, consequently, CDM has higher potential for gaining in cost efficiency. However, other possible problems emerge from the application of CDM projects. Not being bound to emissions reduction targets, non-Annex I countries could tend to delay their own abatement measures in order to gain resources through the CDM mechanism. Moreover, the transaction costs are particularly high in this case, because of the amount of information required and the high costs of negotiation, monitoring and enforcement. An additional problem is constituted by energy price elasticity: developing countries have generally low demand for energy consumption, due to budget constraints. After the implementation of CDM projects, a cheaper opportunity for consumption will be provided and, consequently, the emission level will grow. It is possible that a CDM project, in presence of high elasticity, could have a negative overall effect on the quantity of emissions of the recipient country.

## **Conclusions**

The Kyoto Protocol is the first attempt of the International Community in controlling global warming. The basic idea was to set a quantitative restriction of GHG emissions on the basis of the 1990 level and to reach the efficiency in abatement costs by enhancing the creation of emission markets and by providing alternative, project-based, mechanisms in the cases where emission trading was not feasible.

Many criticisms have arisen against this approach, both on the theoretical side and on the empirical application. In particular, it has been argued that a tax mechanism could obtain better results in reducing emissions with less costs. Moreover, a key issue is the identification of the reduction target for each country. In the case of Kyoto, the base year is 1990, almost twenty years before the control period starts. In such a long period, things have changed in the world and such a wide time gap penalizes efficient or rapidly growing countries while it rewards economies with slow growth or with historically high-carbon intensity. Besides, some huge, fast developing economies, like China and India, do not participate to the international reduction target, both undermining the effort of the other countries in the abatement of global emissions and obtaining a competitive advantage. This situation has formally justified the missed ratification of the protocol by the United States. And, obviously, without the participation of the biggest world economy, the impact of the Protocol on reducing emissions is extremely limited.

But, although the many weaknesses highlighted in the essay, the Kyoto Protocol is, nowadays, the only available instrument to face global warming, an emergency which could

hit heavily the World economy. The Stern Review Report on the Economics of Climate Change, a recently published, independent study commissioned by the U.K. Government, estimates that, in case of inaction, the overall costs and risks of climate change will be equivalent to losing at least 5% of global GDP each year. And, if a wider range of risks and impacts is considered, the estimates of damage could rise to 20% of GDP or more.

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