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Sandmo, Agnar

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Climate Change Policies

Burden Sharing in Climate Change Policy

Agnar Sandmo*

Economics has a long and proud tradition as regards the analysis of environmental issues, going back at least to the classic treatment by Pigou (1920). In the last few decades, environmental problems have been incorporated in the agenda of policy makers to a much larger extent than ever before, and new theoretical approaches have been developed to analyse problems that are increasingly acknowledged to be of major concern, both for individual domestic economies and for the world as a whole.

Of these problems none looms as large as that of global climate change.[1] This problem confronts public finance and environmental economists with at least two particular challenges. The first is that of designing policies that meet the twin objectives of efficiency and justice in burden sharing. To be effective, these policies have to be embedded in an international treaty (the Kyoto Protocol is a first step in this direction). The other challenge is to design a set of incentives that leads firms, individuals and national policy makers to comply with the policies adopted in the treaty. This paper will mainly be concerned with the first of these challenges.

The global climate can be seen as a leading example of what has come to be known as a global public good (Sandmo 2003). A global public good is one that is provided equally to all individuals in the world, and the global climate has exactly this property. Greenhouse gas emissions, in particular emissions of CO_2, that lead to global warming affect the quality of this public good, and they can accordingly be seen as a global externality. What does economic theory tell us about the design of policies to correct for this externality?

The principles of Pigouvian taxation

The policy that was recommended by Pigou (1920) as the best way to curb harmful emissions into the environment was a tax per unit of emissions.[2] Pigouvian taxation would have several advantages compared to direct regulation of each individual polluter. A tax on pollution gives the polluter a private incentive to cut back on emissions: it obviously pays him to do so as long as the marginal cost of reduced emissions is less than the tax rate, so that profit maximization implies equality between the marginal cost of reduced pollution and the tax rate. It follows from this that with a uniform tax the marginal cost of reduced emissions will be the same for all polluters, so that the total cost will be at a minimum: emissions will be cut back most by those consumers and firms that find it least costly to do so. This is socially efficient, because it means that any environmental target – in the form of a given environmental quality or a given reduction of emissions – can be achieved at the lowest possible aggregate cost to society. A further advantage of tax policy is that, compared to direct regulation, it reduces the costs of monitoring the activities of each single polluter. Moreover, by setting the tax at the level where it corresponds to the marginal social value of reduced emissions, one obtains an efficient balance between benefits and costs.

The Pigouvian tax accordingly achieves two objectives: It leads to an *efficient balancing of benefits and costs,* and it achieves *production efficiency* with respect to the quality of the environment.

Such a tax might conceivably have an undesirable effect on the distribution of real income among indi-

* Agnar Sandmo is Professor of Economics at the Norwegian School of Economics and Business Administration (NHH), Bergen, Norway.

[1] The importance of the problem was recently underlined by the award of the Nobel Peace Prize for 2007 to the Intergovernmental Panel on Climate Change and Al Gore "for their efforts to build up and disseminate greater knowledge about man-made climate change, and to lay the foundations for the measures that are needed to counteract such change."

[2] It should be kept in mind, however, that Pigou was concerned with local, not global environmental problems.

viduals since it cannot be ruled out that poor people would have to bear a relatively high share of the costs. A concern for equality might therefore lead the designers of policy to lower the tax relative to the efficient level: a more equitable distribution of the costs of environmental policy can be bought at the price of a higher aggregate cost. But there is another option. Society has a number of policy instruments that have been particularly designed with a view towards redistributing income from rich to poor. Leading examples of such policy instruments are income tax progressivity, social security payments and subsidies to low income earners. If a greater weight on environmental taxation were really to have a regressive impact on the distribution of income – which, however, is by no means certain – the best policy would be to stick to the standard of efficiency in environmental taxation, but combine it with the use of other policy instruments to neutralise the adverse effect on real income distribution.

This brief review of the principles of environmental taxation is set in the framework of national tax policy. Do these principles carry over to policies affecting the global environment, or do we have to rethink them in a fundamental way?

Global environmental policy

Global environmental policy must necessarily be analysed from a somewhat different point of view. The discussion of national policy choices was based on the supposition that there is a well-defined governmental authority that can set tax rates, enforce compliance and decide on other policy instruments in order to arrive at a socially acceptable package of policy tools. But there is no world government that has a similar authority, and in the global community of sovereign nations some careful thinking is required before we apply the principles of Pigouvian taxation to the problems of the environment.

Let us first consider the problem of production efficiency. From the point of view of the world as a whole, it would obviously be desirable if any given reduction in, e.g., CO_2 emissions could be achieved at the lowest possible cost for the world as a whole. This could be achieved by a globally uniform carbon tax, to be paid at the same rate per unit of emissions in rich and poor countries. This would give the strongest incentives to reduce emissions in those countries where it is least costly to do so, and lead to a situation where the global reduction in emissions is achieved at the lowest possible resource cost for the world as a whole. For this reason, a globally uniform carbon tax has been recommended by a number of policy analysts, and its desirability has been strongly emphasised by the Stern Review (2007).

A cutback of emissions requires the use of each country's resources for purposes that compete with their use for private and public consumption. This use of resources is particularly burdensome for poor countries whose standard of living is low. It is true that the imposition of this tax creates revenue for the public sector, but this revenue is basically a transfer from the private to the public sector. Even if the revenue were to be returned to private consumers, there will necessarily be a net decrease of consumption possibilities for the population. So a poor country that is required, by the criterion of efficiency, to reduce its emissions substantially may find itself in a situation where private and public consumption – already at a low level – may have to be reduced in the interests of global production efficiency. Thus, there may be a serious conflict between equity and efficiency considerations at the global level. What are the ways out of this dilemma? The previous discussion of the principles of national environmental policy gives us some clear guidelines to the available options.

An obvious possibility is differentiation of the tax according to the income level of the individual countries. Relative to the standard of production efficiency, the carbon tax in poor countries could be lowered, while being increased in the rich countries. In this way one could preserve the target regarding the reduction of world emissions, but the reduction would be achieved at a higher cost to the world as a whole. This policy eases the burden on the poor countries and increases it for the rich. The additional cost would have to be justified by the distributive gain of a more equitable distribution of the cost between rich and poor countries.

But there is also another option. Let us assume that the emission taxes are collected not by the national governments but by an international agency set up by the international treaty. This agency distributes the revenues not according to emission reduction but according to income, thereby redistributing aggregate revenue from rich to poor countries. Poor countries would receive more tax revenue than they collect from domestic emissions, while in the rich countries

the reverse would be the case. In this setup one achieves a separation between the problem of equitable distribution and that of the preservation of the environment, and an efficient and uniform carbon tax can be implemented without regard for its international redistributive effects. This is the option recommended by the Stern Review (2007, 364), which , after having argued the case for the uniform tax, adds that "[a]n additional mechanism would need to be put in place to transfer resources to developing countries".

The main conclusion of this analysis must be that whether global production efficiency in cost sharing is desirable or not depends crucially on the mechanisms that exist for income redistribution. The more developed these mechanisms are, the stronger is the case for distributing the cost burden on the basis of production efficiency. In a world with only limited scope for international redistribution, there is a strong case for deviating from production efficiency in order to ease the burden on developing countries.

Taxes versus quotas

A system of tradable quotas is an alternative to the regime of Pigouvian taxes, and this general insight holds also in the case of global climate policies. If agreement were reached on an international distribution of emission quotas corresponding to the target level of emissions, national governments could sell quotas to individual polluters (thereby raising public revenue just as under the tax regime). If polluters were given access to an international market for quotas, a uniform quota price would then be established with the same production efficiency properties as the Pigouvian tax. Indeed, if the total volume of quotas were set at the level corresponding to that achieved by the Pigouvian tax, the theoretical prediction is that the price of a quota unit would be exactly equal to the tax rate, and the same balance between marginal costs and benefits would be achieved.

The difference between the two systems is mainly that under a system of tradable quotas, restrictions on international quota trade would be necessary in order to differentiate the price of emissions between rich and poor countries, and these restrictions might be difficult to design and enforce. Instead, distributional objectives could more easily be achieved via an initial allocation of quotas in favour of developing countries. If these countries were supplied with an excess of quotas making them net sellers of quotas on the world market, international quota trading would serve as a mechanism for income transfers between the industrialised and the developing world. This system could be used to achieve the same distribution of the burden between countries as in the case of a uniform tax combined with redistribution of the revenue.

Gross vs. net burdens

In evaluating the distributive effects of global climate policy one needs to keep in mind that the distribution of net and gross burdens between countries may differ substantially. Although the climate is a global public good, this does not imply that the *benefit* from preventing global warming is the same for all countries. Benefits may be of different types. Following the classical Samuelson (1954) formulation of the theory of public goods, it has been common to think of public goods as yielding primarily consumption benefits, but in the case of the global climate one has to take a broader view. A change in the climate affects a country's production possibilities, so that an evaluation of the benefits should include the effects of climate change on both consumption and production possibilities. A rise in the level of the ocean in a country like Bangladesh, for example, will have serious direct effects on human well-being because periodic flooding may give rise to epidemics. But in addition a rising see level will affect the conditions for production, especially in agriculture. A rise in the level of the oceans will have serious consequences for all coastal areas, but they will be much more serious for Bangladesh than for most other countries. It seems likely that in most people's view of global welfare, a fair distribution of the costs of preventing climate change should take account not only of income levels, but also of the difference in benefits.[3]

But what is fair? Can one arrive at objective and universally accepted standards of fairness for the distribution of the burden of global climate policy? Clearly, the answer is no; judgements of fairness differ both between individuals and countries. What theory can provide is a framework for thinking about the issues of equity and efficiency in a systematic manner, there-

[3] The main implication of this conclusion is obviously not that developing countries should bear a higher burden of the cost, but that in allocating the burden between countries at the same level of income, one should also take the benefit side into account.

by helping to establish a "grammar of policy arguments" that may help to bring about a common frame of reference in international climate negotiations.

Nevertheless, some welfare judgements would probably command wide support. Most people, including most economists, would agree with the view expressed by Pigou (1920) that an extra pound of income is worth more for the poor than for the rich. But to arrive at a conclusion regarding the fair sharing of the burden of international climate policy one has to go further than this and ask: how much more? In the answer to this question individual ethical judgements will necessarily have to lead to different answers.

Additional considerations

Are considerations of economic efficiency and distributive justice sufficient to capture common notions of fair burden sharing in climate policy? In 1991 Lawrence Summers, then chief economist at the World Bank, circulated a memorandum,[4] subsequently published in *The Economist,* that aroused strong reactions. Briefly, the gist of his argument was that pollution was likely to be much less costly and a clean environment to be much less valued in poor countries, so that there was a good efficiency case for the migration of polluting industries from the industrialised to the developing world. Although the underlying assumption was that both rich and poor countries stood to gain by the proposal, many people reacted to what they perceived as the unacceptable cynicism of suggesting that rich countries could bribe the poor to take over their environmental problems.

Related controversies have arisen in the recent debate about burden sharing in climate policy. In Norway, there has been considerable discussion about how much of the national target for the emission of greenhouse gases should be achieved by domestic reductions and how much by quota purchases from developing countries. While the government's position has focused on the two strategies being combined, opposing environmentalists have criticised this policy as being a way to buy ourselves out of what is essentially a moral obligation. Other critical voices have argued that Norway should provide an example to the rest of the world and reduce its own emissions below the level at which it would be cheaper to buy quotas from others. These are interesting issues that should definitely be included in broader discussions of international burden sharing.

Problems of implementation

A difficulty in implementing the insights from the theory of public goods lies in the peculiar incentives that arise when one considers the possibility of voluntary or market-based provision of such goods. Once a public good has been provided it is impossible to prevent an individual agent from benefiting from it, whether he has paid a share of the cost or not. This gives the agent an incentive to under-report his benefits. Moreover, if the total cost of production is going to be distributed among agents on the basis of individual cost conditions they have an incentive to over-report their costs. But if all agents under-report their benefits and over-report their costs the result will be that the provision of public goods will be below the optimal level. This reasoning has led most economists to conclude that the provision of public goods is a natural task for the government, which in principle is able to overcome the incentives that characterise allocation mechanisms based on voluntary participation. The national government has the power to construct systems for benefit estimation and public goods provision that do not rely on individual preference revelation, and in addition it has the power to enforce payment through taxation. But in the absence of a world governmental authority, agreement on climate policy must be based on voluntary participation in international agreements. This raises all the incentive problems familiar from the theory of public goods: each country has an incentive to free ride on the policies adopted by other countries with the predicted result that policy efforts to prevent global warming will be severely inadequate. So far, experience seems sadly not to contradict this prediction.

The incentive problem for global public goods can be put somewhat differently. Let us go back to the case of global production efficiency, where the marginal cost of preventing global warming is the same for all countries. This common marginal cost should at the optimum be equal to the global benefit. But this means that at the optimum each country is required to contribute at a level where its marginal cost is higher than the domestic marginal benefit (which is necessarily less than the *global* marginal

[4] The memorandum is quoted in Hausman and McPherson (1996).

benefit). If each country takes account only of its national interest, narrowly defined, the result will be that the global public good is severely underprovided for the world as a whole.

Concluding remarks

The international burden sharing in climate policy is a challenging issue that raises central issues of welfare economics: How can we achieve a rational balance between benefits and costs, and distribute the costs between nations in a way that satisfies reasonable standards of efficiency and equity? Economic theory can make a substantial contribution to clarifying the basic issues involved.

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