

# THE ENVIRONMENT AND INTERNATIONAL TRADE NEGOTIATIONS

DEVELOPING COUNTRY STAKES

EDITED BY  
**DIANA TUSSIE**

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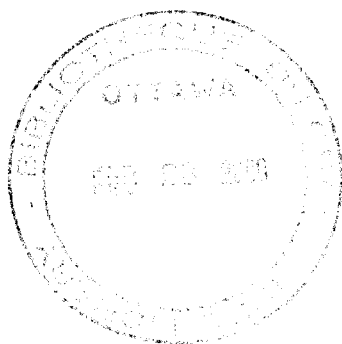
# The Environment and International Trade Negotiations

## Developing Country Stakes

Edited by

**Diana Tussie**

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To **Susan Strange**

to whom I am deeply indebted

in memory of her spirit and pioneering mind

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# 7 Lessons from Trade Theory for Environmental Economics

Partha Sen

Environmental degradation is a byproduct of production and/or consumption. Since the amount traded internationally for any good is the difference between a country's production and consumption of that good, the state of the environment and trade are intimately related. Even where goods are not traded, there could be concerns about cross-border pollution or the destruction of the "global commons". Trade liberalization could increase pollution by two principal mechanisms. First, countries may lower environmental standards in order to attract mobile and potentially polluting factors of production (e.g., capital), thereby "exporting" unemployment. Second, concentration on a country's comparative advantage, particularly in the presence of a balance of payments crisis and/or incomplete markets, could result in an overuse of natural resource endowments.

For about two centuries, the two dominant paradigms in international trade have been those of Ricardo and Heckscher, Ohlin and Samuelson. According to Ricardo, trade was determined by differences in technology. The Heckscher–Ohlin–Samuelson (HOS) model, abstracting from differences in technology, put forward factor supplies (endowments) as the crucial explanation of trade. Other explanations have been advanced, but these two continue to be the workhorses of trade theory. In the practical conduct of trade policy, at least since the World War II, the GATT rules have sought to remove trade barriers between countries. The GATT, as is well known, allows for trade intervention under certain circumstances.

The emergence of environmental concerns poses interesting dilemmas for both trade theory and practice. Is the environment a factor of production, which should be considered in the light of the Ricardian model? For the HOS model, are different countries with different concerns about the environment considered to be differently endowed with environmental factors of production? What form should a reform of GATT/WTO take to make it responsive to environmental concerns? Should Article XX be amended, or just its standards agreement? Or should

environmental subsidies be exempt from countervailing duties? Rather than presenting new results, this chapter surveys the existing field, and thereby attempts to shed some light on the principal areas of debate.

The main conclusion of this chapter is that some results of the competitive models are retrievable, if the models are interpreted broadly. But there are areas where these theoretical models run into serious trouble. If we extend our horizon to include strategic trade theory models, however, then we achieve a better understanding of the role of environmental considerations in the design of trade policy. These models suggest that countries could make use of the environment in a bid to lower costs and gain competitiveness in the foreseeable future. Trade policy is not the appropriate weapon in most cases to address environmental issues, because of problems of information and appropriate standards. However, in those situations where there is broad agreement among nations, trade sanctions could be used to punish deviant behaviour.

The rest of the chapter is organized as follows: in the next section, I look at some simple examples of environmental externalities and how they necessitate changes in our view of how comparative advantage determines trade. I then look at models that apply to interaction between North and South. Following this, I look at the strategic use of the environment in relations between countries. Transboundary pollution is discussed next, and the final section contains some concluding comments.

## SOME SIMPLE ANALYTICS

Trade offers the residents of a country an opportunity to buy goods at prices different from those that would prevail in the absence of trading opportunities. This is in addition to the ability to buy goods that are not produced at home because prices do not justify production. The traditional argument for trade, then, is that it cannot reduce welfare. The country in question now has all the options that it had before it opened up to trade, and more.

Neo-classical trade theory then goes on to show that for a small, open economy free trade is the optimal policy. It is, however, important to remember that the above is true only if perfect competition prevails everywhere and there are no distortions. It is easy to see that if there are distortions, free trade may not be optimal even for a small open economy. The environmental problem arises primarily because costs are not

internalised and there is a divergence between private and social costs. In principle, this divergence could be eliminated by the imposition of appropriate taxes and/or subsidies.

The specialization–trade–environment nexus presents the following dilemmas. First, suppose that there are no taxes on pollution, and that after opening up to trade the polluting sectors expand (see Gutman in this volume for some interesting examples). It is conceivable that welfare would fall even if conventionally measured incomes increase, with the result that free trade actually “immiserizes” the small, open economy. Second, standard models of international trade that account for the presence of distortions do not provide a good guide to how policy should be conducted, since they assume that the economy is in a situation approaching an optimum. The literature on piecemeal tax reform, however, looks at small changes from any initial equilibrium rather than in the neighbourhood of the optimum, and also suggests that trade reform and environmental reform must go together (see Copeland and Taylor, 1994).

Third, Chichilinsky (1994) presents an interesting model where trade between two countries, identical in every respect except for property rights on environmental use, leads the economy, with ill-defined property rights to export the environmentally intensive good leading to what she calls “apparent gains from trade”. It may not be comparative advantage, but rather an unregulated common property resource, that causes a country to “export environmentally intensive agricultural products or products produced from dirty industries even if its forest land, clean air and machinery were as expensive as they are in the industrial countries and even if it had the same technology and preferences” (Chichilinsky, 1994: 859).

The theory of policy that has important implications for trade policy in an economy with polluting economic agents holds that a distortion must be tackled at its source. Hence, a tariff used for other considerations (for example, to correct “distortions” in production) results in the economy achieving a lower level of welfare than if other policy instruments had been used (such as in the case of a production distortion by a tax or subsidy on production). Thus, in general, trade instruments are sub-optimal for correcting environmental distortions.

How does concern for the environment change the traditional view of trade? For a small economy, there are no terms of trade benefits to be gained from changing its environmental use or tax. It therefore should impose a Pigovian tax on pollution to eliminate the difference between social and private costs. The result accords with intuition. A low tax on pollution does not offer us any trading benefits, but we have to bear the

costs. The best policy is to eliminate the implicit subsidy to pollution. In the example above, if the small economy imposes a Pigovian tax then free trade cannot "immiserize" it. Pollution has the "right" price in that it reflects the social damage.

For the large economy, the situation is much more complex but also more interesting. In the absence of environmental considerations, and assuming no retaliation, a large economy can improve its welfare by imposing an optimal tariff. In other words, it "fixes" its terms of trade to secure the maximum benefit for itself. This lowers world welfare relative to the level that would have prevailed in its absence.

Once the environmental factor is introduced, we have an optimal tariff for each level of pollution tax, and an optimal pollution tax for each tariff level. Consider a situation where the tariff rate is bound at a certain level for a certain commodity, possibly owing to an international agreement. Now a pollution tax on production of this good will reduce its production at home, and hence change the world price. If the country imports this good, its tariff revenue collection would also be affected. The optimal pollution tax would have to take into account the (usual) difference between the private and the social cost of pollution, and, in addition, the terms of trade and the tariff revenue effects. As long as the country has available these instruments, it can attain a "first-best" situation for itself. Thus while a small economy that takes world prices as given cannot use the environment to improve its welfare above the free trade level, a large economy certainly can.

I now turn to an issue that makes the environmental problem in the open economy very different from that in a closed economy. In a closed economy, the issue of incidence of taxation is not usually important. If the level of activity in a sector is to be curtailed then this can be achieved by imposing a tax on production or consumption. These taxes have different income effects, but in a closed economy the tax-collecting agency (i.e., the government) is assumed to be unique. In an open economy things are not as straightforward.

Consider a commodity whose production pollutes the environment and this pollution is not of the transboundary variety. Suppose the commodity in question is produced at constant cost entirely for export. Without pollution consciousness, the price of this good is low because the externality is not "internalized" and more is produced and consumed than is "desirable". A tax could be levied to reflect the social cost of production by either the producer country or the importing country. In either case,

output and consumption would fall. So, from the production and consumption point of view in either case output would fall to the same level and the price would rise. This bears out the Coase conjecture that a variety of property rights can support an efficient equilibrium (Snape, 1992; Lloyd, 1992; Anderson, 1992b). But then the question of who keeps the revenue becomes important. And here the producer could tax it beyond the socially optimal level (from a world point of view) in order to secure a gain in terms of trade by pretending to be more “green” than is actually the case. If pollution occurs not in production, but in consumption then again the same output–price combination could be secured by either country imposing a tax. The importing country bears the pollution cost, so it might seem fair that it keeps the revenue. However, the exporter may then invoke its monopoly power as a supplier to corner the tax revenue.

In the two examples considered above, there is no presumption regarding who pays – the polluter or the other party. The polluter pays principle (PPP) is an article of faith for environmentalists, and has been reiterated in the Rio Declaration, Principle 16. The PPP gives no incentive for the pollutee to take evasive action. Quite a few economic models make the case that the polluter should pay, but not that the pollutee should receive, because this might prevent the latter from taking evasive action that otherwise may have been chosen.

Consider a third example – the international equivalent of passive smoking. The tobacco company (seller) sells to the cigarette smoker (buyer), but smoking adversely affects a passive smoker (a neighbouring country of the “buyer”). The neighbouring country could make payment to the seller (pollutee pays), but the buyer could try to compensate its neighbour (one of the polluters pays). If the pollutee pays then there is a moral hazard problem (see Snape, 1992, for a discussion). In any case, with a transboundary pollution problem the case for free trade no longer exists (Bhagwati and Srinivasan, 1995). In the analysis so far, we have assumed that the costs associated with pollution are real costs (which they are) and measurable (which they are not). Go back to the production externality example and imagine that instead of the actual pollution cost per unit of production  $x$ , the producer claims it is  $1.5x$ . The final outcome could depend on bilateral negotiations, but not on the verifiability of the actual cost (although sometimes this may be possible). Such disputes arise within national boundaries, but the national government imposes its will. In the international domain there is no equivalent authority. Revelation of preferences and costs becomes a major issue in the absence of such central authority.

It is also interesting that the Coase conjecture runs into problems in environmental issues in a closed economy because a large number of agents implies high transaction costs, but in the open economy with relatively few governments it regains its usefulness. (See Dasgupta, 1996, for a very good discussion on transaction costs and institutions.) The problem, however, does not disappear, because in the international economy there are fewer agents (governments), but no supranational agency to ensure that contracts are binding.

Bear in mind that the environmental degradation is not just a result of market failure. It could also be associated with what is called "government failure". The policies pursued by a government could exacerbate market failure. Examples abound. Consider the clearing of tropical forests in Brazil, largely due to the government not taxing agriculture and an undeveloped system of property rights so that trees have to be felled as proof of land occupancy. In India there is overuse of fertilizer, electricity and water in agriculture because the prices of these are artificially kept low. Agriculture subsidies in the US and the EC constitute another example. In short, study of the political economy of special interest groups and government failure is as pertinent to the trade-environment debate as are conventional issues of negative externalities and market failure.

## NORTH-SOUTH MODELS

I now turn to the issues of North-South trade, away from simple trade theory concerns. What does trade theory tell us about the effects of environmental regulation on North-South trade or an individual developing country? Let us look briefly at some evidence about a "Kuznets curve" for pollution. These tell us how emissions of various pollutants are related to economic development – the latter being represented by per capita income. Grossman and Krueger (1993) look for the level of income where urban emissions of suspended particulate matter (SPM) and sulphur dioxide ( $\text{SO}_2$ ) urban emissions become inversely related to income. The turning point is found around \$5000 of per capita (1985 US\$). Selden (1994), on the other hand, looked for turning points for aggregate (as opposed to per capita) emissions of  $\text{SO}_2$  and SPM. The turning points for the other two pollutants that they look at –  $\text{NO}_x$  and CO – are at higher levels of income, although these appear to be highly sensitive to the estimation method. There are good reasons why the urban turning points come earlier than the turning points

for aggregate emissions. These include urban residents having more political clout, and the fact that with high urban land prices industry tends to move out, taking pollution with it. This seems to have happened in Indonesia (see Hansen, 1995: 4). Holz-Eakin and Selden (1995) find that CO<sub>2</sub> emissions, which have global effects (and costly abatement), seem to have no turning point at all. Whalley (1991) reports fossil fuel emissions of various countries in 1987. In emissions per capita, the US is way ahead with 5.03 tons per capita, the world average being 1.08. The US, the USSR and China were responsible for over 50 per cent of total world emissions. In terms of inefficiency of fuel use (grams of carbon per US dollar of GNP), China topped the list with 2024, with the world average at 327.

The evidence, then, seems to suggest two things. First, if there is to be expansion in economic activity then, based on historical evidence (which, of course, need not be reproduced in the future), total emissions will rise. Second, this also happens if there exists a bias towards Southern growth for a given level of world economy activity. In a world where the richer countries value and have a cleaner environment than the poorer ones, there might be a demand on the part of the richer countries that the South should not use its lower valuation of the environment for economic gain. Thus there could be demand for the harmonization of environmental standards. Different countries in general will have different optimal pollution taxes. These could be due to, for instance, the environment being a normal good after a certain threshold is crossed (as in the evidence above), or to different geographical features (for example, an oil spill in the choppy North Sea is less harmful than in the placid Mediterranean).

Bhagwati and Srinivasan (1995) point out that the country forced to harmonise its standards upwards will lose, whereas it is not always the case that the high-standard country will always gain. This accords with intuition. The former effectively faces a reduction in its environment endowment, but, for the latter, producers' and consumers' surpluses go in different directions. Proponents of harmonization have a scenario in mind whereby countries that have a lower valuation of the environment attract "footloose" factors of production and hence gain jobs and capital at the expense of the countries with higher environmental standards.

To get a handle on these issues, we need a model where income effects are important. In the absence of these, the departure of mobile polluting factors from an economy is a blessing. It increases the supply response of a pollution tax and hence is to be welcomed (see Copeland and Taylor, 1994). An excellent example of a North-South trade model with income

effects is found in Copeland and Taylor (1994, 1995), although the environmental damage that they consider is of the global type. Each country has a utility function, which depends on the goods that it consumes and on the environment. They show that if trade leads to the equalisation of factor prices then increased trade is accompanied by an increase in Southern pollution and a decrease in Northern pollution, so that world pollution is left unaffected.

In this situation, the South must always gain from trade, while the North loses. Trade leads to an expansion of Southern incomes and pollution. The North then cuts back on pollution and production. Were an environmental agreement to freeze pollution level at autarky levels then the North would gain from trade and the South lose. We see a version of this being played out in the real world, where the richer countries want to link free trade with the environment while the developing countries are opposed to this.

On the other hand, were trade not to equate factor prices then world pollution would increase while pollution in the North would fall and that in the South rise. Copeland and Taylor also consider the effect of a unilateral cut in pollution by the North. This would raise the price of the pollution-intensive good and thus the South's terms of trade. Here the South also benefits from a clean environment.

## STRATEGIC INTERACTION

It is the prerogative of each individual sovereign country to choose its income–environment trade-off. A poor country places more emphasis on income, and for a rich country the reverse is true. Recall the discussion on “turning points” for pollutants above. In this sense, a low-income country would also be prepared to sacrifice the interests of its own future generation; we would expect the private rate of time preference to decrease with wealth, though theoretical models do not always deliver this.

From a theoretical perspective, the valuation of the environment is another area of diversity between nations on a par with wages, capital, skills etc. Furthermore, if a country has lower taxes in all industries then it does not imply that it will have an “unfair” advantage in all industries. To a trade theorist, this smacks of atavistic absolute advantage rather than comparative advantage (Bhagwati and Srinivasan 1995: 19). This leads to a related argument which has attracted a lot of attention. This is what Bhagwati and Srinivasan (1995), quoting John Wilson, call “the race to

the bottom". Would not footloose factors of production (such as capital and possibly skilled labour) be attracted to a low-environmental-tax country? This in turn could make the environmentally conscious country opt for a competitive abandoning of its standards. The two countries are thus engaged in a competitive downward spiralling of environmental standards. In technical jargon, there could be Nash equilibria, with too much pollution globally due to low environmental taxes. In the literature these are often referred to as the "pollution haven hypothesis" or the "industrial flight hypothesis."

To do justice to these issues, we need models that take account of the following three circumstances: (1) that there is environmental awareness, i.e., that people value a clean environment; (2) that there is strategic interaction in the goods market; and (3) that government policy can cause national industries to expand or contract. In the North-South models discussed above, there is no conception of strategic interaction. This is a *sine qua non* for any reasonable policy discussion. Multinational enterprises typically do not take prices as given, or earn normal profits. Policy must affect the distribution of rents across countries – a process known as rent-shifting. So the crucial question then is whether a government environment policy stance will induce sufficient rent-shifting for a country to become better off even after the environmental degradation is taken into account.

Peter Kennedy (1994) addresses these issues. He considers a second-best world where the governments in each of two countries have available to them one instrument – an environmental tax – with which to address the two objectives of trade policy and controlling pollution. He considers Nash equilibrium taxes, and shows that policy works through three channels. The first is operative if there is transboundary pollution. Each firm neglects the effects of its actions on aggregate pollution, as we saw in the section "Some Simple Analytics". Then there are the rent-shifting and pollution-shifting effects. He shows that the former dominates the latter. Thus a government has an incentive to lower its taxes, which raises domestic production and thus welfare, but also pollution. In a symmetric equilibrium, i.e., with every government lowering taxes, no country gains at the expense of any other but the world ends up with much higher pollution than were a cooperative solution feasible. Kennedy cautions us that this cooperation may not always be possible to achieve – that is, a Pareto optimal point may not be in the core.

Xing (1994) considers a variant of Kennedy's model. He considers two countries, with one of them producing only for export (the LDC) and the other one producing for domestic consumption. The governments set

pollution taxes, and the firms play a Cournot game. Suppose the importer sets its tariff at zero, and imposes the optimal environmental tax. In this setting, the exporting country's welfare could increase if it lowers its pollution tax below its marginal environmental damage level, because then its exports increase and thus it shifts "rents" towards itself. The importing country could gain or lose. This is because the consumers gain from cheaper imports, but domestic firms lose. If the importing country loses then it could still set the pollution tax at its optimal level, and impose the optimal tariff on imports. This would convince the exporting country to desist from starting the race to the bottom, because it would end up damaging its environment without being able to engage successfully in rent shifting. The credible threat of a tariff is enough to prevent the exporter from using lower pollution taxes as a strategic weapon. The result is only moderately interesting, because it gives the importers two instruments, a pollution tax and a tariff, for the two targets of rent-shifting and the environment.

How sensitive is this result to the Cournot formulation? One suspects it is very sensitive to the model specification, because, as Eaton and Grossman (1986) showed, when we move from a Cournot game to Bertrand game, rent shifting will involve the domestic government moving from an export subsidy to an export tax. However, much work remains to be done in this area. The virtue of the existing work here is that it shows at least how a strategic (hence non-competitive) partial equilibrium model can help our understanding of a phenomenon that otherwise appears to be xenophobic.

One can gain an understanding from these models of why the North may want to prevent the South from using the environment as a cost-reducing or rent-shifting factor. This could lead to a demand for the harmonization of standards. But even had we been shown convincingly that there may be a good case for harmonization of standards (which we have not), we would then have to worry about how it is going to be implemented. One cannot but agree with Bhagwati and Srinivasan (1995) that this poses formidable problems, and in the rich countries it is definitely going to be captured by protectionist lobbies just as in the case of the anti-dumping exercise.

The proposal that Bhagwati and Srinivasan put forward, however, is not appealing. This is a promise or agreement by OECD firms to maintain the same standard in the Third World as at home. Some multinationals already do that, though certainly not all. If their objective is to move to the Third World for environmental reasons, they could get around an agreement of this type very easily. Multinationals have been experts at sanction-busting.

Finally, I turn to the question of the empirical importance of the idea of a pollution haven. Is a low environmental tax an important consideration in plant location for firms? Markandya (1994b), summarizing a UNDP/UNCTAD multi-country project, finds that most firms tend to feel that the mean of the environmental factor is not as important as the variance. The Chinese report in that project felt that there was some migration to China due to higher standards elsewhere. Poland – a transitional economy – experienced a severe contraction in its steel and chemical industry due to stringent pollution standards, among other reasons. The earlier literature summarized in Dean (1992) finds that most dirty industries have moved within the North! At the aggregate level, the share of North America in pollution-intensive products fell from 21 per cent to 14 per cent between 1965 and 1988, while Southeast Asia's share increased from 3.4 per cent to 8.4 per cent during this period (Low and Yeats, 1992). Also, between 1973 and 1985 overall direct foreign investment by the US chemical and mineral industries increased at a slightly greater rate than that for all manufacturing industry (Jaffe et al., 1995). Environmental considerations (as measured by sulphur emissions in the recipient country) are important in the foreign investment choices of the US chemical industry.

What should one do if the other country does not share one's green preferences? Is imposing a trade barrier the right way? The tuna-dolphin case is the best example of such a trade sanction. Bhagwati and Srinivasan feel that education and other moral suasion or compensation are preferred alternatives. One cannot deny that this is a superior alternative to the flexing of economic muscles by a stronger nation – they point out that a weaker country could hardly resort to similar action on something that it found morally repugnant. Thus Germany can insist that Colombia use disposable packaging material for coffee, or that if it chooses to use metal containers then it should take those back. The latter course effectively would double Colombia's transport costs (see Markandya, 1994b).

One ostensible education device is eco-labelling. In principle, it is supposed to educate the consumer about the quality of the product. In practice, however, its performance has been far from satisfactory. In fact, it acts more like a non-tariff barrier. The criteria of award are not scientific, verification is unnecessarily strict and almost exclusively is imposed on importers by the importing country (Markandya, 1994b). (There is a large literature on the subject – see, e.g., the chapters by Motta Veiga and Bethlehem, Chapters 4 and 5 in this volume.) The suggestion of compensating the reduction in output suffered by a less developed country

in remedying something that a rich country finds “unethical” is unexceptionable. If the Amazon rainforests are important to the rest of the world then Brazil should be compensated for preserving these. There is, of course, a free-rider problem among both those making the payment and those receiving it. A trade sanction may or may not have achieved the desired objective of preserving the rain forests. A ban on the export of timber from Côte d’Ivoire forced that country to process timber in its sawmills, although these are highly inefficient. Clearly, trade policy should be used only if there are no other more efficient instruments available. This conclusion is shared by Sáez on the subject of forestry in this volume.

## TRANSBOUNDARY POLLUTION

In the analysis of transboundary pollution, it is necessary to distinguish between a cross-boundary acid-rain type pollution and emissions that damage the global commons. In both cases, if the offending country refuses to cut down its discharge of pollutants, trade sanctions could be used. But the efficacy of these in the first case is doubtful, given that cross-boundary pollution could coexist with very little trade between the countries, as was the case between the EC and Eastern Europe before the collapse of socialism. Even with trade, the gain from polluting the neighbour could outweigh the gains from trading with the neighbour. There could be a case for the pollutee paying, with the attendant moral hazard.

The destruction of the global commons is well understood, although international negotiations have had mixed fortunes. There have been successes like the Montreal Protocol, while there has been much less progress towards a comprehensive treaty to cut carbon emissions. Does global warming call for cooperative action? Does such cooperation imply a harmonization of pollution taxes? It is easy to see that small countries would have an incentive to free-ride if the problem is global. A small country cannot take any action to change relative prices that it faces, and will realize that its emissions constitute an insignificant part of global emissions (with global consequences). It could make itself better off by cutting back on abatement. If a sufficient number of such small economies followed suit, we could have a “tragedy of the commons” at the global level (see the discussion by Chichilinsky, 1994; also Copeland and Taylor, 1995). Hence an international agreement could penalize deviant behaviour through trade sanctions. The Montreal Protocol, for instance, provides for both sticks as well as carrots, at least for developing countries.

When a country is large and takes others' behaviour as given (Cournot behaviour), the resulting pollution is "excessive". It is only when all (large) countries take into account the repercussion of their actions on others and do not exploit their respective monopoly power that we have a global Pareto optimum. Bhagwati and Srinivasan show that tax rate harmonization (on pollution) occurs only when all countries have the same technology (Bhagwati and Srinivasan, 1995: 80). This implies that in the real world, where different technologies coexist, we would not observe tax rate harmonization. An interesting extension to this analysis arises when a large country wants to spend less than the resources required to support a global Pareto optimum. The question now arises: Is a departure from free trade required? The answer is No, if the pollutive activity is production. A departure from free trade will distort consumption choice, which makes it an inferior policy tool. While the notion of a global Pareto optimum is attractive from a theoretical point of view, a problem (from the implementation standpoint) is that equity requires lump-sum transfers between nations. Lump-sum transfers are not possible in practice.

To conclude, the progress or the lack of it made in phasing out CFCs and carbon emissions are important in identifying which factors are important in securing global cooperation and guarding against deviant behaviour. The carbon tax proceeds make a very big difference to the welfare of the various groups of countries. A tax levied by producers would act in much the same way as the oil price increases of the 1970s, with the oil importers (both the OECD countries and the developing ones) losing. A tax on consumption, with the proceeds staying with the national authorities, would inflict large losses on the oil producers and the developing countries. An international institution that collects a tax has to concern itself with the question of the subsequent redistribution of the tax. In this context, some CGE work suggests that international tradable permits for carbon emissions reduce the loss of welfare by making adjustment that much more easy. However, this is also going to be bedevilled by the allocation mechanism. Further, need to bear in mind the fact that the polluting effects of different fossil fuels vary greatly. Coal, for instance, is 25 per cent dirtier than natural gas. A carbon tax would therefore increase the price of coal relative to other fuels.

These problems did not surface in the negotiations over the phasing out of the CFCs. The Montreal Protocol banning the use of ozone-depleting substances was signed in 1987, barely two years after the discovery of the ozone hole over Antarctica. Can this scenario be repeated in other international negotiations like those limiting the emissions of greenhouse

gases, which cause global warming? There are several reasons why the Montreal Protocol achieved what it did in the short time span. First, the scientific evidence showed quite unambiguously that CFCs were responsible. Second, the emissions were mainly from a few rich countries which also had a high level of green consciousness. This made negotiations and post agreement cooperation easier. Third, the market for CFCs was controlled by a few firms, who also produced the CFC substitutes. A global ban is also a facilitating device to prevent others from using CFCs. Finally, the firms had to contemplate the prospect of facing lawsuits from skin cancer patients (see Anderson, 1992b; Enders and Porges, 1992). For the greenhouse gases, on the other hand, the exact scientific evidence is far from clear. Moreover, given the widespread use of fossil fuels, most industries would be affected. This would also pose problems in dealing with deviant behaviour. As pointed out above, any global effort to lower the emissions of greenhouse gases would involve large income transfers.

## CONCLUSIONS

In the immediate postwar period, it was the developing countries that were apprehensive about the implications of free trade. The OECD countries, with their comparative advantage in manufactures, were far keener on free trade. Some developing countries were able to take advantage of the liberal trading arrangements in place, and some forty years later it was the North that was importing manufactured goods. It was also the North that expressed concerns about human rights violations, labour standards and the environment.

The international dimension to the environmental problem adds two new elements missing from closed-economy models. First, the presence of many agents, with the attendant increased transactions costs (Cropper and Oates, 1992), is (almost) eliminated in international negotiations. Second, the incidence of taxation, which is consigned to a back burner in closed-economy models, comes to the fore in an international context. The absence of a supranational legal entity and a dispute over the sharing of revenues would make the implementation of tradable permits for pollution in the international context much less widespread than in a closed economy.

An environmental problem implies some sort of market failure. The solution lies in designing efficient mechanisms, and this may involve

taking a longer-term view. In the short term, fixing quantitative restrictions on emissions may be attractive (Copeland and Taylor, 1994). Tradable permits may be preferable, because they allow agents to take evasive action. A controversial point of view advanced by Porter (see Porter and van des Linde, 1995) suggests that government policy can make firms' profits go up by inducing firms to innovate. Be that as it may, environmental problems require some form of government intervention.

Does this imply that in the international context also government intervention is justified? In general, trade policy is not the appropriate instrument for addressing environmental concerns, especially when this policy is of the unilateral sanctions variety. There are good reasons for this. A country imports goods from many countries and many firms. An environmental tariff would require information on the pollution context of each producer, otherwise everyone will be tarred with the same brush. (See the discussion on countervailing duties and anti-dumping duties in Kevin Kennedy, 1994: 215-18.) Problems of measurement and allowing for differences in preferences and geography, etc., certainly call for not using trade policy. Lloyd (1992) points out that the standard environmental economics example, of a single upstream producer and a single downstream producer, may have something to do with not recognizing diversity, because the informational problems there are minimal. The ban in ivory trade penalizes all exporters of ivory, whether or not they cull their herds in a sustainable way.

Should free trade be abandoned as a basis for policy because the theoretical case for it is not so cut and dried anymore? We should probably follow Krugman (1995), who makes a political economy case for free trade after traditional trade theories have received a severe beating from non-competitive models. Since the problems of defining standards, verification, agreement on ethics, etc., are not easy to achieve, trade policy should be used only as a last resort for environmental ends. When trade measures are to be used, the larger is the number of signatories to an agreement that specifies trade restrictions, the less likely it is to be captured by protectionist lobbies.