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**ECONOMIC INSTRUMENTS: ACCELERATING THE MOVE
FROM CONCEPTS TO PRACTICAL APPLICATION***

* / This document has been prepared by Mr. Anil Markandya, University of Bath, United Kingdom.
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ECONOMIC INSTRUMENTS: ACCELERATING THE MOVE FROM CONCEPTS TO PRACTICAL APPLICATION

A. Markandya

EXECUTIVE SUMMARY

There is considerable interest in the potential that is offered by using economic instruments (EIs) not only as a means of achieving a cost-effective regulation of the environment, but also as a means of "greening the tax system". The desirability of using **some** EIs as part of environmental policy has now been established, although economists still disagree on **how much** emphasis can be placed on economic incentives as opposed to more conventional and direct regulations. EIs are analyzed under the following headings: (a) pollution charges and taxes, (b) environmental subsidies, (c) charges on inputs or outputs that damage the environment, (d) removal of environmentally harmful subsidies, (e) permit trading schemes, (f) resource pricing schemes and (g) recycling schemes.

Emissions charges and taxes have a role to play when the goal is a national reduction in emissions, and when the sources of the emission can be easily monitored. They are not the best instrument when the spatial dimension is important, when the sources are 'non-point' and when the goal is to raise revenue.

Environmental subsidies can be effective in reducing pollution but the costs in economic terms are high. If the subsidies come from earmarking of environmental taxes, this is not a desirable system to introduce, and not as effective as non-earmarked programmes, for OECD countries.

The use of **charges on inputs** (such as energy) and **outputs** (such as electricity or transportation) that are environmentally damaging can work as a very effective environmental instrument. Costs of compliance are generally lower than for emissions charges and rebates can be offered to deal with end of pipe clean-up. They would probably be the easiest to integrate into the general system of taxation, although care should be taken in proposing tax increases on the grounds that they will substitute for other economic taxes. As with all economic instruments, they will need to be imposed in conjunction with some direct controls, to deal with local, and specific problems.

The removal of **environmentally harmful subsidies** has no objections as far as economic efficiency is concerned, and the scope for reductions in environmental damage and increased resources for sustainable development is very large. The issues that need to be addressed are more on the implementation side. It is also important to note that not all subsidies to energy and inputs are environmentally harmful; some do serve to reduce overall environmental damage.

Permit trading schemes are an important part of the arsenal of tools at the disposal of a regulator. They have somewhat wider application than pollution charges, and can be introduced in stages, making them more acceptable to the affected parties. Applications where successes have been noted are national and international air emissions reductions, phase out of lead and CFCs, and trading in development rights over conservation and urban land. Gradual phase-in and limited regulation to the process are important ingredients to their success.

Resource pricing schemes can be important in capturing rents from the exploitation of natural resources and in internalising the costs of such exploitation. However, the issue also needs to be tackled at the legal and institutional level, and in fact changes in the legal and institutional framework may offer a more effective solution than one that emphasizes the fiscal element.

Recycling schemes can and have been successful in reducing waste. There is definitely a role for such schemes but the danger is that they are too successful and too much emphasis is placed on them, compared to other instruments for the regulation of waste.

Impediments to the adoption of EIs are analysed under the following headings: (a) lack of familiarity, (b) Problems of reconciling gainers and losers, (c) problems of design, (d) administrative difficulties, (e) anxiety about competitiveness and (f) adverse economic and structural conditions

Lack of Familiarity. Policy-makers are reluctant to adopt a new measure unless they can clearly see the advantages, and are convinced that it will not result in embarrassment or, worse, failure. To overcome this it is not enough to demonstrate the virtues of the instrument in theory. It has to be shown to have worked in practice. Unfortunately most of the 'evidence' in favour of EIs is of the theoretical variety. To overcome the credibility problem it is important to collect all the possible evidence that is available (and the amount is increasing continually) and present it in a way that makes the case for the EI as clearly as possible. Dissemination consists not only of providing written evidence, but also of hands-on experience with the instruments. The latter can only be acquired by working with regulators who have implemented certain EIs successfully.

Gainers and losers. This is possibly the most critical issue to be addressed in promoting any EI. The difficulty with such instruments is that the beneficiaries are frequently a large number of people (the pollutees) who each suffer a little from the pollution and will benefit from the improvements. In order to address this problem, the regulator has, first and foremost, to have a good idea of who the gainers and losers are, and how big is the impact. Given accurate measures of the losses, the interest of the losers can be safeguarded in various ways. One would be to recycle the revenues so that the costs of undertaking pollution prevention measures are funded out of the tax or charge. Although this is not always desirable, some earmarking is justified, especially when those facing the losses are the more vulnerable groups in society. Another is to phase-in the changes. A third is to make transparent the benefits of the policy, so that public opinion favours the change even if there are a few losers.

Design of the Instrument. The right design of the instrument requires information about the marginal damages, which is mostly missing or not available. This is not an obstacle to the implementation of **some** kind of EI, but an impediment to the implementation of the **right** kind of EI. To develop the right design, regulators need to have access to existing studies on damages, and existing experience on implementation in other countries. This will typically require the transfer of data from one country to another and rules for such transfer need to be understood.

On practical experience with the application of EIs, sharing experience is essential. It is only through trial and error that one can know which corners can be cut and where compromise between accuracy and practicability is to be made. The CSD, UNDP and other such bodies can play an important role in disseminating the knowledge gained from actual implementation, both through publications and exchange visits of regulators to countries that have such experiences.

Administrative Difficulties. The implementation of EIs needs different administrative capability and know-how than the implementation of command and control policies. Most authorities responsible for environmental regulations have few or no economists. Specific administrative problems arise with regard to monitoring and measurement of pollution, how frequently to adjust the fiscal incentives, when to make allowances for special conditions etc. These are partly design issues; and as with design issues there is no substitute for experience. In addition, there are often difficulties in meeting the costs of monitoring and implementing the regulations.

Anxiety about Competitiveness. There are two dimensions to the concern with competitiveness. First there is the worry that, by facing domestic environmental regulations, polluters will become less competitive in international markets, and second there is the possibility that the method of regulation will itself increase monopoly power in the regulated sector. The paper shows, however, that both these are exaggerated and the empirical evidence strongly indicates that international issues can be addressed without sacrificing the use of economic instruments. In some respects EIs will have less of an impact than command and control policies.

Adverse Economic and Structural Conditions. In economies where major structural changes are taking place there is a concern that any environmental regulations will have adverse impacts on output and employment. Hence there is a reluctance to adopt fiscal measures which impose a financial burden on the polluter. There is no doubt that these problems are serious, especially in the transition economies of Eastern Europe. They can be mitigated by phasing in the policies, so that the impacts are less pronounced. Another measure that can be taken is earmarking the taxes/charges, so that the financial burden is reduced.

The final section focuses on the policies that will promote the use of EIs , under the following headings: dissemination of information, provision of training and provision of financial support:

Dissemination of Information. This can be done through publications of the CSD, OECD, EC, World Bank and other international bodies, surveying the use of EIs. Since the scene is a fast changing one, regular updates of policy changes is desirable. Dissemination should not be seen as a propaganda activity on behalf of EIs, but rather as a fair review of the actual experience in environmental regulation. Where EIs are the most appropriate forms of regulation, this will come out, as will the cases where a mixed system is required to achieve the environmental goals.

Training and Support to Policy-makers

Training and capacity building has to take place at several levels and in a number of ways. Broad training in environmental economics and policy is clearly important, and can be carried out through short and regular courses at universities and centres of learning. More practical training in design and administration is less easily provided through such institutions, but needs visits by regulators to countries with more sophisticated regulatory regimes. Short term assignments whereby those with experience in this area work in countries which are seeking to develop new economic instruments are also required.

Financial Support for the Adoption of New EIs

In many developing countries and economies in transition, the budgets of the Ministries of Environment are extremely small and staff simply do not have the time to think about new regulatory instruments. Assistance for sustainable development could be provided by supporting such regulatory bodies with funding for additional personnel and equipment. Such staff need not be expatriate; indeed it is probably better if most of them are not.

The adoption of EIs, and change in the environmental regulation framework is a process that is under way in most countries. Lessons are being learnt and shared through fora such as this. The process will be accelerated by devoting more resources to: the dissemination of these lessons, support and training in applying the instruments and increased funding for their administration.

I. INTRODUCTION

1. Although economists have been advocating the use of economic incentives as an effective means of regulating the use of the natural environment for over 50 years, it is only in the last decade or so that policy-makers have begun to make use of such instruments. There is now considerable interest in the potential that is offered by using economic instruments or 'market based instrument' (EIs or MBIs), not only as a means of achieving a cost-effective regulation of the environment, but also as a route by which the general burden of taxation can be switched away from labour and capital, and onto activities that pollute or degrade the environment. At the professional level, the desirability of using **some** EIs as part of environmental policy has now been established, although economists still disagree on **how much** emphasis can be placed on economic incentives as opposed to more conventional and direct regulations¹.

2. The point of departure of this paper is that there are a number of circumstances in which the use of EIs is the most appropriate policy to pursue the goal of sustainable development. The paper begins by identifying these situations and describing them in a little more detail. This is important because it would be counterproductive to promote the use of EIs in situations where they would not be the best kind of policies to implement. EIs are analysed under the following headings: (a) pollution charges and taxes, (b) environmental subsidies, (c) charges on inputs or outputs that damage the environment, (d) removal of environmentally harmful subsidies, (e) permit trading schemes, (f) resource pricing schemes and (g) recycling schemes. Following CSD (1995) the discussion is divided into policies for industrialised countries, policies for economies in transition and policies for developing countries. This is done in Section II. Section III looks at the impediments to the implementation of these policies, which, again following CSD (1995) include political acceptability, distributional issues, design problems, competitiveness issues and costs of implementing the policy. Again this discussion is separated into the three types of economies. Section IV discusses policies that can accelerate the implementation of these policies, which include: (a) measures to increase information and knowledge about the EIs, (b) measures to ensure that losers are compensated for their losses, at least to the extent that their objection to the implementation of the EI is removed, (c) transparency in the impacts of existing policies -- their costs, who benefits from them and who loses out from them, (d) assistance in implementing EIs, through support to the regulators who are often not familiar with how this

¹For a discussion of how much scope there is for EIs versus direct controls see, Tietenberg (1996). For an enthusiastic position about what can be achieved by EIs, see Panayotou (1995). For a somewhat more skeptical, but still positive view, see Markandya (1996).

should be done and (e) use of experimental programs to increase understanding and build up confidence in how successful such policies can be.

3. In implementing any EI there is inevitably a compromise between the 'ideal' of how that policy should work, and the way in which it actually works. The process of accelerating the use of EIs will inevitably involve some such compromises. These can be exemptions for vulnerable groups, longer phase-in periods where the social impacts are negative, subsidies to those impacted etc. There is nothing wrong in principle with such compromises, and indeed they are an important part of the tools to be used for the implementations of economic based instruments. There are some compromises, however, that can render the EI virtually useless, or certainly less effective than a direct regulation. It is important not to accept proposals that modify the instruments to such an extent that this happens. In Section IV the discussion is sensitive to this issue, as are the recommendations on which measures should be used to accelerate the use of EIs.

II WHEN ARE EIs THE BEST POLICIES TO IMPLEMENT?

4. The debate on which instruments should be used for environmental regulation has been going on for a long time and will not be repeated here. Based on reviews of the experience with the implementation of EIs (EEA, 1996; Markandya, 1996, Panayotou, 1995) it is clear that they are better suited to some situations than others. Consequently they should only be promoted where they are the most effective instrument, either on their own or in conjunction with other forms of regulation. In Section I the types of economic instruments were listed. In this section the conditions in which each of them should be used are analysed. This discussion focuses mainly on the effectiveness of the instruments. Issues relating to the problems of introducing them are reviewed in the next section.

5. Pollution Charges and Taxes. In practice such charges have been introduced mainly on air emissions, and solid waste with some taxes on water. There are charges for CO₂² in the Scandinavian countries (Sweden, Denmark, Finland and Norway) and in the Netherlands. Sweden has charges for NO_x (for large power stations only), HC and sulphur, Norway has charges on sulphur and lead, and France has very low charges on HCL, NO_x, SO₂ and H₂S (about one percent of those in Sweden). Switzerland is considering the introduction of a

²Some commentators refer to the carbon tax as a product tax because it is levied at the fuel stage. Given the lack of realistic technologies for collecting carbon dioxide after combustion, this is equivalent to an emissions tax. Where the tax is partly an energy tax, however, the situation is different.

charge on VOCs and CO₂ (Jeanrenaud and Stritt (1994)). Rates even within this small group of countries vary widely (OECD, 1995). Water effluent taxes, where the charge is dependent on the composition of the waste water are implemented in France, Germany and the Netherlands. General waste disposal charges exist in all OECD countries but volume based ones are to be found in Australia, Belgium, Canada, Denmark, France, Germany, Italy, Netherlands, Switzerland, and the United States (OECD, 1993; OECD, 1995). The rates vary widely and also depend on whether the waste goes to landfill or whether it is incinerated (Denmark, Germany, Switzerland). Hazardous waste disposal is charged by the state or regional authority in Austria, Finland, Germany and the US³.

6. Several countries in Eastern Europe have pollution emissions charges, including the Baltic States, Czech Republic, Slovak Republic, Poland and Russia. The levels range from the extremely low (Baltic States) to those higher, but of the same order of magnitude as that of France (Poland, Czech and Slovak Republics). The countries of the former Soviet Union are in the process of reforming their taxes, but the present structure is extremely complex and the number of pollutants taxed is very large. (Markandya and Lehoczki, 1994; Klarer, 1994).

7. Among developing countries the present use of pollution charges is more limited. China has introduced effluent charges for discharges from industrial plants in a nationwide scheme. Under this scheme, enterprises are required to pay a fee for discharges above a certain norm, with the fee varying according to the pollutant. The system's original purpose was to induce individual firms to reduce the amount of pollutants discharged at source through economic incentives. This applied to both air and water effluent. Malaysia had a scheme for the taxation of palm oil effluent, which has now been largely phased out. As with the China system it taxed releases in excess of a contravention limit⁴. The Philippines has a charge on mine wastes and tailings.

8. Pollution charges can serve as both an incentive to reduce emissions in a cost effective way, as well as generating revenue for the regulator to invest in pollution reduction equipment. In terms of the incentive effects, these

³For solid waste disposal the charge is not really a pollution charge if a private operator of a waste disposal site has to ensure proper maintenance of the site and to pay the government a fee to ensure that full remediation is undertaken. The operator is then responsible for collecting the fee from the waste generators. Hence it is better covered under resource pricing.

⁴Such a tax system, where the charge is applied only above an arbitrary limit is less efficient than one where the tax is applied for all emissions (Markandya, 1996a).

instruments are best used when the environmental goals can be defined in terms of relatively simple objectives with little spatial variation, such as a reduction in ambient concentrations of a pollutant nationally. If the goal is, for example, to limit ambient concentrations over a small area, or to have very different levels of concentrations in different areas, then the pollution charge is not the best instrument, or at best has to be supplemented by direct controls. Pollution charges are also inappropriate where there are many small sources of the emissions, or where the sources are not stationary. Hence they are not appropriate for the regulation of vehicles, or run-off from the application of fertilizers and pesticides. Pollution charges can always be used as a revenue raising device, but in this respect they are less effective than charges on inputs or outputs that generate the emissions in the first place (see below). The latter are easier to tax (there are fewer points of collection) and mechanisms for their taxation are already in place.

9. Environmental Subsidies. Subsidies to reduce emissions and to improve environmental performance are given in many countries, and indeed the rationale for the taxation of effluent is often that the revenues can be used to finance programs of environmental remediation. Examples of such subsidies include: rebate for air and water effluent charges when investment is undertaken (France, Germany, all of Eastern Europe), accelerated tax depreciation of pollution abatement equipment, and rebates on import taxes for such equipment (several developing countries (CSD, 1995; Markandya, 1996a).

10. Environmental subsidies can be partly effective in achieving reductions in pollution, but the reductions may be bought at an excessive cost. If taxes are earmarked for environmental protection and the revenues recycled, the resulting level of protection may be too low (as in the case of water protection investment in France) or too high (as in the case of the Netherlands). Hence in industrialised countries, where tax regimes are sophisticated and budgetary provision for environmental protection is possible, earmarking for environmental protection is generally not desirable. In economies in transition and developing countries, on the other hand, such budgetary provision is very small or non-existent. Consequently the benefits of having access to some funds from this source for the environment probably outweigh the costs of an inefficient earmarking system, at least in the short run, and especially in the economies in transition in Eastern Europe where revenues from taxation of emissions are a critical source of funds for mitigation. The use of special tax treatment as a form of subsidy is more questionable. In general they do not provide the enterprises with incentives to choose the least cost options and they increase the polluters profits, which may lead to further pollution problems (Murty, 1996).

11. In the light of the above discussion, the use of environmental subsidies outside of the recycling of tax revenues to support environmental investments is not an effective economic instrument. Even in the case of the former, strict guidelines are necessary to ensure that the investments that are supported are indeed cost effective in terms of achieving the desired environmental goals.

12. Charges on Inputs or Outputs that Damage the Environment. Although ideally the pollution charge should be imposed on the pollution, in practice this is often impossible. Hence, as a second best, the charge can be levied on the input, frequently the energy source or chemical that is generating the pollution. Examples are taxes on petrol, including differentiated taxes where less damaging fuel is taxed at a lower rate⁵, taxes on diesel oil based on the sulphur content of the fuel, taxes on fertilizers and pesticides to take account of their environmental impacts, and taxes on ozone depleting substances.

13. By taxing the source of the pollution rather than the pollution itself, one does not allow for (a) the possibility that mitigation measures can be undertaken at the 'end of the pipe' and (b) the fact that the impacts in terms of damages vary spatially, so that a general tax overtaxes use in a place where there is no environmental problem, and undertaxes it in places where the problem is very serious. The first issue can be addressed by giving rebates for payments when the polluter makes such an investment in end of pipe clean-up. Examples would be rebating a sulphur content tax for polluters who have flue gas desulphurisation equipment. This is possible in a number of cases, but not always. The second problem of spatial variation is more difficult to address. To get round it one would have to have different rates of taxation depending on where the inputs were used and practically this is difficult to do, except at a rather crude level. The compromise in using input charges is acceptable in a number of situations, although the detailed analysis of the net benefits of moving to such a tax from a command and control situation are not available, certainly not in an *ex post* calculation.

14. The other big advantage of using taxes on polluting inputs and outputs is that they can be a major source of revenue, which can generate resources for environmental protection (see above), and even help shift the structure of taxation away from taxing 'goods' such as consumption and employment to taxing 'bads' such as pollution. The argument for using environmental taxes in this way has been elaborated and analysed in recent years and there is certainly a case for considering a shift to 'Green Taxation' as a number of countries are doing (Denmark, The Netherlands, Norway). There are, however, concerns that such a

⁵Arguably this is an example of an environmental subsidy, where the 'clean' fuel pays a lower rate of tax.

shift may not yield the 'double dividend' of improved economic performance as well as reduced environmental damage and these have to be taken into account⁶. A careful analysis of the impacts of the tax modifications has to be made before recommending its implementation. (For such an analysis see Capros et al (1996)).

15. In conclusion then, the case for using input/output charges as an economic instrument for environmental protection, and as part of the program of action for a move to sustainable development, as has been advocated in previous CSD documents is strong but not without qualification. For many applications, such as non-point sources taxes on inputs are the only possibility for dealing with the issue. This will not solve the problem of 'hot spots' or local concentrations of the pollutant, for which direct controls of some kind will be required. **Hence it is clear that the optimal mix of policy instruments is going to be one that combines economic instruments with direct controls.** A second argument in favour of input/output charges is that they are easier to implement and to collect. Since emissions charges can be much more difficult to collect, and spatial variation may be impossible for them, the case for moving to input charges is even stronger. Finally, there may be a case for raising environmental charges as part of a broader tax reform. This has to be considered carefully in a detailed economy-environmental model before any conclusions can be made of what kinds of reforms are desirable.

16. Removal of Environmentally Harmful Subsidies. As Panayotou (1996), Markandya (1994) and others have pointed out, removing or phasing out costly subsidies that distort the economy and cause environmental damage is one of the most cost effective means for achieving the twin goals of environmental protection and economic development. Areas where such subsidies are significant include: the consumption of fossil fuels, electricity, water, pesticides, logging, land clearing and construction. Panayotou, 1996, reports estimates of subsidies world-wide as follows: Energy (US\$300-400bn); Agriculture (US\$350-380bn); Transport (US\$100-200bn); Water (US\$10-20bn), and Extractive Industries (up to US\$240bn). This amounts to around \$1 trillion world-wide, or about 5 percent of

⁶ The idea is that an pollution charge is beneficial, not only because it addresses the environmental problem, but also because it provides revenue to the government from a (paradoxically) 'clean' source; clean in the sense that there is no loss of welfare associated with its collection. This issue has been analysed recently by Bovenberg and de Mooij (1994), Goulder (1994) and van Regermorter (1995). Certainly there is no demonstration that, because of the double dividend argument, environmental charges should be raised above their Pareto Optimum level, starting from a zero base. What has been established is that the costs of a scheme where the revenues from the environmental tax are returned on a lump sum basis are less than those where the revenues are used to reduce distortionary taxes. This is called the 'weak double dividend argument'. The strong argument contends that there are net benefits from substituting an environmental tax for a distortionary tax, leaving total revenues unchanged. This claim is not generally correct. More information on precisely what taxes are being considered is required before a statement can be made of the net gains/losses (Goulder, 1994). Since it is generally the stronger version that people have in mind, one should be careful in using the double dividend argument.

the world's GNP. If such subsidies were removed, the benefits will take the form of reduced environmental damage, which has a real economic value, as well as the more efficient use of natural and other scarce national resources. Panayotou contends that removing one dollar of subsidies generates 24 cents of reduction in environmental damages. Hence the overall benefit of removing all subsidies is estimated at \$240bn. In addition to this, the reductions in subsidies have a macroeconomic benefit, in that they reduce the fiscal deficits and make the process of structural adjustment easier. This can be very significant and very important.

17. Although the above figures are very crude, and can only be regarded as orders of magnitude, they indicate the extent of savings in economic costs that are available if the subsidies are removed. In a companion paper to this, de Moor (1996) has analysed the issue of subsidies in more detail, and so they will only be treated cursorily in this paper. In principle, the case for removing or sharply reducing such subsidies is very strong. The arguments against such action are on the social and political side, and are discussed in the next section. From a sustainable development viewpoint, removing such subsidies must precede the imposition of taxes on inputs or outputs, as subsidies are merely negative taxes. There are two points to make at this stage with regard to subsidies. First, as de Moor shows, the problem is not limited to any one set of countries, but applies across the whole world, industrialised and developed; market economy based and central-planning based. This raises difficulties with regard to international competition, if one country or set of countries is to take action, knowing that another set will continue to subsidise its enterprises in key areas, thereby giving them a competitive advantage. The second point is that there are some subsidies that are not environmentally harmful, and indeed could benefit the environment. A case in point is subsidy to the use of Liquefied Petroleum Gas (LPG) or kerosene, which can lead to a switch away from more damaging fuels (for LPG), or from fuelwood consumption (for kerosene). Such benefits are a definite 'second best' in the sense that the environmental benefits can be obtained without the high cost associated with a general subsidy on the fuel, and there are serious concerns about misuse of the subsidy⁷. Nevertheless their removal has to be accompanied by appropriate secondary measures to prevent the negative environmental impacts from occurring.

18. Permit Trading Schemes. The use of permits that could be traded developed over a period of time in the United States (Hahn, 1987; Sorrell, 1994) and started with the air pollution control laws in that country in the late 1970s.

⁷In Pakistan, the kerosene subsidy to low income households was resulting in truck owners mixing kerosene with diesel for their vehicles, which in turn caused severe pollution problems. Similar stories can be told about many such subsidies.

At first 'trades' were very limited, and a new set of 'instruments' was developed: netting, offsets, bubbles and banking. The point of departure was the notion that a firm had to meet a given reduction from **each** of its sources of pollution. This was clearly inflexible, and netting allowed the firm that wanted to generate pollution from a new source to count greater than required reductions somewhere else. Initially netting was only an internal trade. Offsets were introduced to allow new firms to set up in areas where the quality standards were not being met and where the normal regulations would not permit another enterprise to establish itself. If, however, the new firm could acquire a reduction in emissions from another firm by more than the amount the latter would have emitted, it could set up operations (as the degree of non-attainment would in fact be reduced). Bubbles were a similar instrument to netting and offsets, except that trading was only permitted within a firm and for existing sources of pollution. Finally there was banking, which allowed a firm to save emissions reductions, over and above those required, for future trading. All these developments took place between 1974 and 1979.

19. From the present perspective, and with the hindsight of even 15 years, these seem unnecessarily complex notions. Why not simply allow trade in emissions? The reasons of course lie in the fact that policy implementors are naturally cautious, and will not try something new unless it is forced by circumstances. The need for flexibility was forced upon them and the instruments evolved gradually, as a wide range of administrative issues were addressed (Rico, (1995)). The lessons from this experience are therefore of great importance for this paper in understanding which policies are likely to work in shifting to a greater use of EIs.

20. More recent programs of emissions trading such as that applied to the reductions in SO₂ and NO_x under the US Clean Air Act take a more liberalised approach to emissions trading. Each trading unit is allocated an allowance based on historical emissions which are "generally issued in perpetuity" (Rico, 1995). The program is not concerned to address local pollution problems -- i.e. the issue of 'hot spots' -- places where emission become concentrated, affecting the health of the local population -- is not of direct relevance. All utilities are therefore subject to meeting local pollution standards as well, so any spatial problem arising from excessive local emissions is addressed in that way. In Western Europe there is no real experience with tradeable permits, although they are being evaluated for the control of nitrogen oxides and VOCs in the canton of Basle in Switzerland (Stritt, 1994). The scheme was set up in 1992 but no trade has occurred as yet. In Eastern Europe, Poland has experimented with this instrument in the city of Chorzów, with some success (Dudek et al. , 1992). However, its wider application there, and elsewhere in Eastern Europe, will need

some amendments in the law (Anderson and Żylich, 1993). Among developing countries, permit trading is being introduced in some regions of China.

21. For water pollution, tradeable permits have had a more limited success. Hahn (1990) reports on the Wisconsin Fox River scheme where tradeable permits were introduced to reduce the costs of limiting biochemical oxygen demand on sections of the river. The scheme did not work, mainly because trade were very restricted; both by location (you could only purchase from firms in your location group, making the market very thin) and by a number of administrative requirements for each trade to be sanctioned. Finally the participants did not conform to competitive market agent profile. Either they were oligopolistic firms or they were municipal waste treatment plants that did not necessarily behave as cost minimisers. As a result, the simulated model, which had predicted benefits of around \$7 mn a year proved to be incorrect, and the actual benefits were negligible.

22. Marketable permits have also been used in other areas. For the phaseout of lead in gasoline in the US, it was recognized that the costs of meeting the short deadlines could be very high for some petroleum refiners. Hence the Environmental Protection Agency (EPA) instituted a trading system whereby refiners who achieved more than the required reduction could sell the surplus to those who did not meet the reductions by the appropriate dates. The scheme was very effective and, by end December 1987, complete phase out had been achieved. A similar application was the phase out of CFCs in the US. The international Protocol for the phase out of these ozone depleting substances demanded reductions by specified percentages by specified dates. Each producer of CFCs was allocated an allowance equal to that percentage of his original production. The allocation was tradeable, so that those who could not make the cuts were able to buy from those who overachieved their targets. The trades were, however, restricted; the amounts any producer could increase production were very limited, even if he acquired the permits. The process of acquiring the permits on the basis of past pollution resulted in windfall profits for the producers who were then taxed for the sale of CFCs. A similar scheme has been introduced in Singapore.

23. More generally, the idea of allowing some trading in an attempt to achieve environmental goals has caught on. One form that has had some applications is that of transferable development rights (TDRs) (Panayotou, 1994). The idea is that if a conservation area is declared, the owner of the land or buildings does not completely lose the right to develop the property. Rather s/he can exercise that right elsewhere, in a place where further development is restricted and the right has some value. Usually the terms allow an increase in development beyond

existing legal limits by about 10-15 percent. Such rights have been used in urban areas in the US and for coastal development in Puerto Rico. TDRs are somewhat different from marketable permits, in that they consist of giving groups who would lose out from the development a compensation that is acceptable and that does not involve raising a large amount of resources through taxation. Marketable permits exploit trade between different agents all of whom have to meet a given environmental objective.

24. From this brief review, permit trading schemes can be seen as having considerable potential, in industrialised as well as developing countries. They can play a role in the control of air emissions, during the transition to a phaseout of a damaging chemical, and protection for biodiversity. They almost always have to be implemented in conjunction with direct controls, and, like emissions taxes, they are not suitable for dealing with local pollution problems, where the number of traders may be very few. Related to this, if the restrictions on trades is too great, there will be less chance of success. The choice between tradeable permits and emissions taxes will depend partly on cultural factors (how acceptable taxes are) as well as on technical considerations about the costs of making errors in fixing the tax rates or the number of permits.

25. Resource Pricing Schemes. In many instances the persons or organizations exploiting natural resources do not bear the full social cost of that exploitation; in particular they do not have to take account of the environmental damages they cause. By changing institutions and laws, the market mechanism can be made to work more effectively, so that resources are not underpriced in this way. The problems are specially severe when existing management systems for resource use have broken down, so that the resource is of the 'open access' type. The breakdown can occur because traditional systems of management no longer operate, or because the government, as the owner of the resource, is incapable of managing it effectively. Such underpricing is prevalent for forest and fishery resources in many developing countries (Panayotou, 1995).

26. Changes in fiscal instruments such as royalties, licences etc, to increase prices for the exploitation of natural resources, will only work if the necessary legal changes can be made and enforced. For privately owned land, internalising the environmental costs may be better done through requirements for remediation, replanting etc., rather than through a tax or fiscal instrument.⁸ In other cases, where local management can be restored by making the appropriate legal changes, that may prove to be more effective than staying with government ownership and implementing a taxation system that is difficult to enforce. Where

⁸ Frequently a bond has to be placed with the authorities, to ensure that the remediation is carried out.

government ownership of the resources is necessary and desirable, different types of licences will suit different situations and cultures. With limited competition, it may be better to have long term agreements with the exploiters, making them responsible for the environmental protection as well as the exploitation. In other cases auctions may be the better instrument.

27. The rents from resource exploitation should, in part, be reinvested in capital development if a strategy of sustainable development is to be pursued. Governments have always sought to capture these rents and generally are successful in doing so (CSD, 1996). They are not so good, however, at increasing the levels of investment to accompany the increased revenues. In some cases it may be better **not** to increase extraction too much following an unanticipated increase in resource prices, because the proceeds tend to be misused. A slower expansion in exploitation will serve the interests of sustainable development better than one in which the revenues are drawn too quickly, ostensibly for the purposes of economic development, but in fact to finance sharp increases in consumption and to support investment projects that are of doubtful merit.

28. Recycling Schemes. Under recycling schemes are included deposit-refund programs, as well as subsidies to recycling. They could be considered under taxes and subsidies respectively but they are separated because they raise special issues. Many countries have such schemes. In the OECD, deposit refund schemes operate in Austria, Belgium, Canada, Denmark, Finland, France, Germany, Netherlands, Norway, Sweden, Turkey and the United States. (OECD, 1993). Within developing countries deposit refund schemes have been introduced in Bangladesh, Indonesia, Korea and Singapore, among others. Recycling schemes involving manufacturers have been set up in France and Germany. In the United Kingdom disposal authorities have to compensate collection authorities when the latter retain materials for recycling, the payment depending on the net saving in disposal costs.

29. Both the deposit refund schemes and the recycling there is evidence that they have reduced waste (OECD (1993)). The bottle bills in the US have reduced litter by 10 to 39 percent and solid waste by 1 to 6 percent. In the same country, kerbside collection programmes obtain recycling percentages of around 35 percent for glass containers and 25 to 56 percent for aluminium cans (Repetto et al., 1992). As far as the impact of the producer- based recycling schemes is concerned, it is considered too early to make an evaluation (that was the case in 1993). Nevertheless it is encouraging to note that the German Green Dot scheme has obtained the participation of over 50 percent of households by 1993, and over 80 percent is expected by this year.

30. Deposit refund schemes are by largely justified in economic and environmental terms but some recycling subsidies, which are quite popular with governments and the public, and which can be very effective, may be oversold, with too much being devoted in resources to collect waste that can be safely and cheaply disposed off. This is one area where the EIs could be **too successful**. If recycling results in a reduction of one ton of waste per annum at a cost of \$100, and the marginal social cost of one ton disposed is ECU50, then there is too much recycling; it would be better to dispose of the last ton of waste and save ECU50.

31. The marginal social costs of the different options that are available: deposit refund schemes, waste landfill, waste incineration and manufacturer recycling schemes should therefore be equalised. In order to know whether this is the case, the correct marginal costs of each of the options have to be ascertained. Such a calculation has not been carried out, although some estimate must have been made of the relative costs of landfill versus incineration. Certainly a **full social cost** comparison has not been carried out before deciding on the selection and relative use of the different instruments related to recycling. At the same time the rationale for subsidizing recycling has not been fully analysed. As a second best policy it may be justified to subsidise one form of waste reduction when other forms are underpriced. The analogy is with subsidizing public transport when private transport is priced below its social cost. But it is generally better to price private transport at its social cost, as it is to price waste disposal properly. The economics of what the subsidy should be and how it should be phased out as waste disposal prices increase has not been studied in a policy context.

32. Conclusions on The Introduction of Different EIs In this section the main economic instruments used for environmental regulation have been reviewed. The purpose of the review was to see where they can be most effectively employed, and where their use is less desirable. In promoting the different instruments it is important to bear in mind what the strengths and weaknesses of the EIs are and how cases where they have been successfully applied evolved.

33. From this review it appears that **emissions charges and taxes** have a role to play when the goal is a national reduction in emissions, and when the sources of the emission can be easily monitored. They are not the best instrument when the spatial dimension is important, when the sources are 'non-point' and when the goal is to raise revenue. In this context it is important to note that, for historic reasons, the use of such charges in economies in transition in Eastern Europe is justified. Reforms would be desirable but will take time to implement and temporarily the present structure serves a useful purpose. **Environmental**

subsidies can be effective in reducing pollution but the costs in economic terms are high. If the subsidies come from earmarking of environmental taxes, this is not a desirable system to introduce, and not as effective as non-earmarked programmes, for OECD countries. In Eastern Europe earmarking is still desirable because it is virtually the only source of local funds for environmental protection. Programmes of accelerated depreciation and tax write-offs are not as efficient as other economic instruments that could achieve similar goals.

34. The use of **charges on inputs and outputs** that are environmentally damaging can work as a very effective environmental instrument. Costs of compliance are generally lower than for emissions charges and rebates can be offered to deal with end of pipe clean-up. They would probably be the easiest to integrate into the general system of taxation, although care should be taken in proposing tax increases on the grounds that they will substitute for other economic taxes. As with all economic instruments, they will need to be imposed in conjunction with some direct controls, to deal with local, and specific problems.

35. The removal of **environmentally harmful subsidies** has no objections as far as economic efficiency is concerned, and the scope for reductions in environmental damage and increased resources for sustainable development are very large. The issues that need to be addressed are more on the implementation side. It is also important to note that not all subsidies to energy and inputs are environmentally harmful; some do serve to reduce overall environmental damage.

36. **Permit trading schemes** are an important part of the arsenal of tools at the disposal of a regulator. They have somewhat wider application than pollution charges, and can be introduced in stages, making them more acceptable to the affected parties. Applications where successes have been noted are national and international air emissions reductions, phaseout of lead and CFCs, and trading in development rights over conservation and urban land. Gradual phase-in and limited regulation to the process are important ingredients to their success.

37. **Resource pricing schemes** can be important in capturing rents from the exploitation of natural resources and in internalising the costs of such exploitation. But one must be aware that the issue also needs to be tackled at the legal and institutional level, and in fact changes in the legal and institutional framework may offer a more effective solution than one that emphasizes the fiscal element.

38. Recycling schemes can and have been successful in reducing waste. There is definitely a role for such schemes but the danger is that they are too successful and too much emphasis is placed on them, compared to other instruments for the regulation of waste.

III. IMPEDIMENTS TO THE INTRODUCTION OF EIs

39. In this section the impediments to the introduction of the different EIs are reviewed. CSD (1995) identified the following obstacles:

- Insufficient political acceptability
- Difficulties in design
- Administrative difficulties
- Conflicting policy objectives
- Anxiety about competitiveness
- Adverse economic and structural conditions

Not all these conditions apply to all countries. Furthermore there is considerable overlap between political acceptability and the others, but especially the last three. Political acceptability depends on being able to secure the support of those who have the power to block the proposal, which in turn is closely tied to who gains and who loses from the introduction of the instrument. It also arises as a result of 'risk aversion' -- a fear that the an unknown instrument may not work, or worse have negative side effects. The conflict about policy objectives arises mainly because of the distributional impacts of the proposal and the concern with social equity (apart from competitiveness and other economic considerations, which are treated separately).

40. Hence in the analysis that follows 'political acceptability' is replaced with: 'lack of familiarity' and 'gainers and losers'. 'Conflicting political objectives' is also covered under gainers and losers.

41. Lack of Familiarity. Policy-makers are reluctant to adopt a new measure unless they can clearly see the advantages, and are convinced that it will not result in embarrassment or, worse, political and/or bureaucratic failure. To overcome this it is not enough to demonstrate the virtues of the instrument in theory. It has to be shown to have worked in practice, and the experience has to be clear and relevant to them. Unfortunately most of the 'evidence' in favour of economic instruments is of the theoretical variety. Where there is 'empirical evidence' it is often of the 'simulation kind'. The latter involves comparing the costs of the instrument against an alternative direct control option. This makes a number of assumptions about the costs of abatement and, possibly, the damages, that are not always verified from the actual data. Moreover, some assumption has to be made about what the regulators know when they set the direct controls or fix the EIs. If they are taken to be omniscient, the result may be very different from that obtained if they are assumed to have only partial knowledge. This

issue has been noted and addressed by Tietenberg (1985) and others, but there is no basis for deciding **what** the policy makers actually do know.

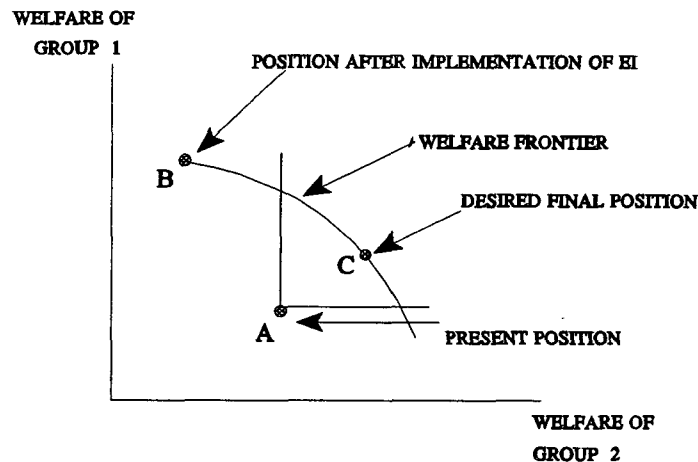
42. In view of the importance of overcoming the credibility problem it is important to collect all the possible evidence that is available (and the amount is increasing continually) and present it in a way that makes the case for the EI as clearly as possible. Dissemination consists not only of providing written evidence, but of hands on experience with the instruments. The latter can only be acquired by working with regulators who have implemented certain EIs successfully.

43. Gainers and losers. This is possibly the most critical issue to be addressed in promoting any economic instrument. The regulator needs to know who will benefit from the new policy and who will lose. The difficulty with most economic instruments is that the beneficiaries are frequently a large number of people (the pollutees) who each suffer a little from the pollution and will benefit from the improvements. Alternatively they are the voters who will benefit from lower government expenditure, because the new policy places less burden on the fiscal budget. But in both cases the individual benefits are small for any one marginal policy change. On the other side, are the losers, typically the polluters, who are now required to bear the social costs of their actions. In the final analysis the impacts of internalising the environmental costs of pollution through economic instrument will fall on consumers through higher prices, but the direct impact will be on profits and employment and household welfare of the polluters. In the case of the removal of a subsidy the effect is even more pronounced. The losers, dollar for dollar, are the recipients of the subsidy and they will put up a great deal of resistance to the measure.

44. The problem of gainers and losers from a policy that is socially beneficial is not a new one. If the actions taken are indeed economically efficient (which they will be if the EI is properly designed) then, by design, the total value of the gains exceeds the total value of the losses. Hence it should be possible to find a solution where the gainers compensate the losers and are still better off than they were before⁹. The situation can be demonstrated in Figure 1 below.

⁹ This is known as the Kaldor-Hicks criterion in the economics literature.

Figure 1: Gainers and Losers and Possibility of Compensation



45. In this Figure the *status quo* is A. As a result of the

policy measure the distribution of welfare moves to B, where Group 1 is better off but Group 2 (the polluter) is worse off. Naturally this will not be acceptable to Group 2. The curved line present the 'welfare frontier' which shows what can be achieved by transferring resources from Group 1 to Group 2, starting from the position B. By making such transfers it is possible to arrive at a point such as C, where both Group 1 and Group 2 are better off than at A.

46. The difficulty with this solution is that there are no direct mechanisms for reaching solution C. The government has to undertake this role through the budget though its control of resources. It is well known, however, that transferring resources through the medium of taxation raises its own inefficiencies. For every dollar raised for transfer, the process of collecting that dollar imposes a cost on society of some additional amount¹⁰. Hence it may not be possible to make the necessary transfers, and therefore it may not be possible to end up at C.

47. What answer can one propose to the problem? First and foremost, the regulator has to have a good idea of who the gainers and losers are, and how big is the impact. As is shown in some examples below, the losses are often exaggerated by those who stand to lose from the measures. Given accurate

¹⁰The social cost of taxation has been discussed at some length recently. See (Callin and Thomas, 1996). It will depend on how efficient the government tax system is. With very inefficient tax systems the cost of raising one dollar could be as high as seven dollars (J. Whalley, pers. comm.).

measures of the losses, the interest of the losers can be safeguarded in various ways. One would be to recycle the revenues so that the costs of undertaking pollution prevention measures are funded out of the tax or charge. This runs into the problem of earmarking which has been discussed above and which, in general, it is better to avoid. Moreover, if the revenues are recycled in such a way that they are closely tied to the taxes paid, there will be no incentive effect and the benefits of the EI will be lost. In spite of these difficulties, however, some earmarking is justified, especially in developing countries and economies in transition, especially when those facing the losses are the more vulnerable groups in society.

48. Where the polluter is a large enterprise, or generally a less vulnerable section of society, a more desirable solution is for the government to hold out against too strict a compensation package. This can be done if there is enough public pressure for the change, which in turn requires transparency and dissemination of the benefits of the policy. Such dissemination can create a demand for 'eco-friendly' behaviour on the part of enterprises, which will help implement the policy. Another way of softening the blow is to phase in the new policy over a number of years. Apart from reducing the opposition to the measure, this will also allow for a learning phase, which can be beneficial. Although the title of this paper indicates that the objective is to search for measures that "accelerate the move from concepts to practical application", it may, paradoxically, not be the most desirable course of action to propose too rapid implementation of the new policy.

49. Design of the Instrument. The right design of the instrument requires information about the marginal damages, which is mostly missing or not available. This is not so much an obstacle to the implementation of **some** kind of EI, rather it is an impediment to the implementation of the **right** kind of EI. As was noted in the introduction, it may be worse to have an EI which sets charges or fiscal incentives at the completely wrong level than not to have one at all. There are also practical design issues that have to be addressed, and where mistakes can result in poor implementation.

50. In addressing these problems the regulators need to have access to existing studies on damages, and existing experience on implementation in other countries. It is unlikely that a full study of the marginal damages can be conducted for each application of an EI in each country. Some pooling of data is both necessary and desirable. The process for doing so is called **benefit transfer**, and a substantial literature has been developed for making transfers of damage estimates from one situation in one country to another (Navrud, 1994). The results of recent work in this area indicate that benefit transfer is easier for some

impacts than others and is easier when the estimates of damages are made in 'conditional terms' -- e.g. damages per head of population, per unit exposure, etc. Greatest difficulties arise when one is trying to estimate damages that are highly site specific, such as the impacts of changes in the landscape, use of land, or loss of biodiversity. In such cases additional studies are unavoidable and have to be undertaken.

51. On practical experience with the application of EIs, sharing experience is essential. It is only through trial and error that one can know which corners can be cut and where compromise between accuracy and practicability is to be made. The CSD, UNDP and other such bodies can play an important role in disseminating the knowledge gained from actual implementation, both through publications and exchange visits of regulators to countries that have such experiences.

52. Administrative Difficulties. The implementation of EIs needs different administrative capability and know-how than the implementation of command and control policies. Most authorities responsible for environmental regulations have few or no economists. The staff are either administrators or engineers. This has to change if EIs are to be implemented successfully. Specific administrative problems arise with regard to monitoring and measurement of pollution, how frequently to adjust the fiscal incentives, when to make allowances for special conditions etc. These are partly design issues; as with those there is no substitute for experience. In addition, there are often difficulties in meeting the costs of monitoring and implementing the regulations. International assistance in this area, especially when governments are moving toward more effective instruments of environmental protection can help overcome this problem. A good example is support for regulations to phaseout ozone depleting substances, where UNDP and the World Bank, as implementing agencies of the Interim Fund of the Montreal Protocol, are providing exactly this kind of assistance.

53. Anxiety about Competitiveness. There are two dimensions to the concern with competitiveness. First there is the worry that, by facing domestic environmental regulations, polluters will become less competitive in international markets, and second there is the possibility that the method of regulation will itself increase monopoly power in the regulated sector. The anxiety about international competitiveness is real and particularly strong in developing countries. First, it should be noted that this is not particularly a problem with EIs; rather it occurs whenever the Polluter Pay Principle (PPP) is implemented. In fact some EIs offer more flexibility to the polluter and could therefore have a smaller impact on competitiveness than more stringent direct controls.

54. Losses of International Competitiveness. Studies on this subject show that losses of competitiveness are exaggerated. Industrialists frequently claim that the imposition of stricter standards will result in loss of competitiveness, employment and growth but such claims are largely unsubstantiated¹¹. Furthermore one should not ignore the costs of environmental degradation on the business community, in terms of work days lost, congestion etc., costs that are reduced when the environment is improved.

55. There are several studies that have looked at these issues for developed countries, principally the US (see Dean, 1992 for a survey). In general their findings are:

- (a) the cost of pollution abatement measures in the US have been only a small proportion of industry's costs (around 1.5 per cent);
- (b) the percentage decrease in output attributable to environmental control costs in the US has averaged less than one percent (the exceptions are industries such as petroleum);
- (c) when allowance is made for general equilibrium effects, the cost impacts are lower and more evenly spread throughout the economy;
- (d) if abatement costs were to raise prices by one percent in the US, one study estimated the impact to be a reduction in exports of 2.7 percent, with sectoral impacts varying from virtually zero (special industry machinery), to 7 percent (copper) (Robison, 1988). Another study, however, using a different methodology, concludes that the impact on exports is negligible.

56. In contrast to the negative impacts of environmental regulation there are also some positive effects to consider. There will be some growth of a domestic pollution abatement industry. Even if much of the technology is imported, various studies have shown that adaptation to local conditions is almost always necessary. This will generate some economic activity. Then there is the view that stricter regulations will benefit the more innovative and enterprising firms (Porter, 1991). This may be because they are able to find ways of meeting the standards at lower cost, or because they can respond more quickly and more effectively. Some commentators have even inferred that the regulated industry as a whole can benefit from the regulations (Jaffe et al, 1993).

¹¹ One study which has looked at the effects on a developing country's exports of higher environmental costs is Low (1992). He examined the effects of an pollution abatement and control expenditure tax (PACE) on Mexico, raising its costs to the level of the US. The results obtained show that such a measure would have very modest trade effects, amounting to at most 2 percent of Mexico's export revenues.

57. Some developing countries have taken the view that the adoption of stricter standards may be beneficial in the long term. For example, when the Montreal Protocol for the phase out of ozone depleting substances was signed, developing countries¹² were given a grace period of ten years relative to developed countries to meet the terms of the Protocol. However, at least two (China and Mexico) have voluntarily decided to follow a more rapid phase out schedule, on the grounds that not to do so would place them at a technological disadvantage.

58. The concern of most developing countries is less that EIs will reduce their international competitiveness, but rather that measures taken in developed countries, ostensibly to protect the environment, will reduce their exports. They see many such measures and non-tariff barriers to trade. A number of case studies of developing countries attests to this anxiety, although it is not all pervasive, and some countries with strong export sectors claim that they have adjusted without too much difficulty to changes in environmental regulations in the OECD markets (Markandya, 1994a)¹³. Interestingly the 'complaints' about trade restrictions were not against **measures that were not EIs**, but direct regulations, and measures such as eco-labeling which give special prominence to products that meet environmental criteria.

59. Concerns about monopoly impacts of trade measures. When some EIs are introduced, there is concern that big enterprises will be able to dominate the response, to such an extent that they will increase their market power and keep out smaller operators. The problem has been raised particularly in relation to the use of tradeable permits. If a few actors in the market have enough power, it is argued that they could drive up the price of permits temporarily, thereby driving out their competitors, and resulting in increased market share for themselves. There are suggestions that such behaviour was practiced in New Zealand, when the government attempted to issue permits for fish catch. Outside of that example, there is the possibility that those with market power could manipulate any auction price (bidding it down by not demanding permits or by holding down the number of permits issued). There is some theoretical work on the issue of strategic behaviour in these markets. Most of it suggests that the impacts of such behaviour on the costs of achieving a given level of control on environmental quality is small (Hahn, 1984; Tietenberg, 1985). This does not, however, address the question of its impact on industrial structure through market entry and exit.

¹² Strictly speaking the grace period was given to small users of ozone depleting substances.

¹³The countries included in the study were: Brazil, China, Colombia, India, Jamaica, Philippines, Poland, Uganda, Turkey and Zimbabwe.

On this issue Misiolek and Elder (1989) and Tietenberg (1985) suggest that the problem is rare but may need to be addressed on a case by case basis.

60. What measures can be taken to overcome the difficulties associated with competitiveness? As far as international trade issues are concerned, the government has to accept a small impact, which is the price for improved environmental conditions, which in turn can have positive productivity effects. In understanding the issue there is an important role for dissemination of information on the true costs, and these are often exaggerated. Studies of the kind referred to above should help allay fears that there will be large negative trade effects if EIs are introduced. It is also worth drawing attention to the fact that **any** application of the PPP will have trade effects, and that EIs can offer some flexibility to the polluter, which may reduce the trade impacts. One policy which is sometimes advocated to get round the trade effects is to recommend that all countries adopt similar measures for environmental protection, thus creating a 'level playing field'. While there may be some advantages to this, there are also serious costs, in that countries will be forced to adopt environmental standards that are not appropriate for their level of development, or for their country and environment. Unless there are compelling reasons for adopting common standards therefore, they should be avoided¹⁴.

61. On the question of internal competition, the recommendation is that governments should be vigilant against problems in this area, and take measures to protect competition, if necessary. But the evidence so far is that the problem is not likely to be a major one.

62. Adverse Economic and Structural Conditions. In economies where major structural changes are taking place there is a concern that any environmental regulations will have adverse impacts on output and employment. Hence there is a reluctance to adopt new measures, not only fiscal incentives but also direct regulations. However, fiscal measures which impose a financial burden on the polluter are particularly unpopular. There is no doubt that these problems are serious, especially in the transition economies of Eastern Europe. They can be mitigated by phasing in measures, so that the impacts are less pronounced. Another measure that can be taken is earmarking the taxes/charges, so that the financial burden is reduced. In fact this is the current position in Eastern Europe, with emissions charges being recycled through environmental funds. Of

¹⁴ The GATT and WTO specifically protect countries against the imposition of external standards in production by distinguishing between product standards, which one country can impose on its imports, and process standards, which it cannot.

course this does not guarantee that all polluters will be left unaffected but it does reduce the impact on firms that are unable to respond to the charges by investing in pollution abatement. Finally some financial instruments, such as tradeable permits can actually **increase** financial resources for some firms. Usually the permits are 'grandfathered', so that the present polluters receive them without payment. If they are able to make reductions in emissions, they may be able to sell the permits to others who want to expand production, or set up new industries.

63. Summary of Impacts in Industrialized Countries. From the above discussion one can summarize the obstacles to the introduction of EIs in industrialized countries, in economies in transition, and in developing countries. Table 2 below provides a summary for industrialized countries. Obstacles are rated as Low (L), Medium (M), High (H) or Negative (N)

Table 1: Obstacles to Introduction of EIs in Industrialized Countries

	Pollution Charges	Environmental Subsidies	Charges on Inputs and Outputs	Removal of Harmful Subsidies	Permit Trading	Resource Pricing	Recycling
Lack of Familiarity	M	M	L	M	H	L	L
Gainers and Losers	M	L	M/H	H	M	L	L
Design Problems	H	H	M	L	H	M	M
Administrative Difficulties	M	M	L	M	H	M	L
Competition Issues	M	L(*)	M	M/H	M	L	L
Costs to Budget	N	H	N	N	L	N	L

(*) Subsidies may run into problems with the WTO.

64. The following points are worth noting from Table 1:

- a. For pollution charges most of the obstacles are relevant, but design problems are likely to dominate. Which emissions to charge, how to monitor them and how to design any rebate system for polluters investing in pollution abatement are all issues with which there is little experience or familiarity.
- b. For environmental subsidies, similar design problems are dominant. Also of importance here are the costs of implementation. Finance for the subsidies has to come from existing revenues or new sources of finance, the economic costs of which are high. Also an issue with subsidies is international trade rules, which may prohibit them.
- c. Charges on inputs and outputs are attractive in that the obstacles are not generally high. It is possible that there could be significant losers from such

a charge if it hits the general public. That would be the case, for example, with increased fuel charges for transport, or energy. In that case a long phase-in period, and even some exemptions for vulnerable groups may be necessary.

- d. The main obstacles to the removal of harmful subsidies are the 'losers/gainers' issue and the competition issue. The later can be important if strong competitors continue to offer the subsidies. A coordinated removal of such subsidies is therefore an important way of overcoming this obstacle.
- e. For permit trading there are a number of issues. Lack of familiarity has to be addressed, as do design problems and administrative difficulties. Most of these can, however, be overcome without too much in the way of resources.
- f. Problems with resource pricing are less serious in industrialised countries where present arrangements generally capture a high percentage of the rents. To raise prices to cover social costs would entail design problems and face some administrative difficulties.
- g. Recycling schemes are relatively easy to implement, as is evident from their widespread adoption. The design problems identified earlier of how much incentive to give to recycling, and the issue of how an economically efficient, as opposed to environmentally effective scheme is administered are the key issues.

65. Summary of Impacts on Economies in Transition Table 2 below summarises the key obstacles to the introductions of EIs in economies in transition. The following key points emerge:

- a. There is greater experience with emissions charges in transition economies than there is in other parts of the world, so that is less of an issue. The problems are mainly with regard to design, the present system being too complex, with charges that are too low. These can be overcome, but any big losers from a change that could have employment consequences have to be compensated. Too fast a phase-in can also have a backlash effect¹⁵.
- b. Environmental subsidies are even less desirable in these economies, given their extremely limited government resources.
- c. Charges on inputs or outputs generally take second place to the removal of subsidies that are environmentally harmful. The main difficulty with imposing such charges is the possibility of vulnerable groups being losers

¹⁵ Poland had to reverse large increases in emissions charges two years ago for exactly this reason, although present charges are still among the highest in Eastern Europe.

and the adverse economic impacts such measures could have, through loss of output and employment. Their incentive impacts (as those of pollution charges) will depend critically on whether the enterprises are motivated by profits. This is increasingly the case, but is not so for all enterprises.

- d. The removal of subsidies in general is a major part of the program of economic restructuring in these countries, and subsidies with negative environmental effects are among them. The main consideration is the impact on vulnerable groups, such as pensioners, for whom some special revisions have to be made. Also of concern is the short run impact on output and employment, and on exports.
- e. Permit trading is unfamiliar in these countries, even more so than in industrialised countries. The nature of trading and the weakness of the profit motive may render such schemes unsuccessful. Also of concern is the negative economic impact that trading could have, although this is likely to be less with permits than with pollution charges.
- f. Resource pricing reforms are much more important in economies in transition, where existing pricing systems capture very little of the rents, and often ignore the environmental costs of exploitation. The obstacles are dealing with vested interests, which can be very powerful, problems of designing the right kind of instruments and avoiding any negative economic impacts.

Table 2: Obstacles to Introduction of EIs in Economies in Transition

	Pollution Charges	Environmental Subsidies	Charges on Inputs and Outputs	Removal of Harmful Subsidies	Permit Trading	Resource Pricing	Recycling
Lack of Familiarity	L	M	L	M	H	M	H
Gainers and Losers	L	L	H	H	M	M/H	L
Design Problems	M	H	M	L	H	H	M
Administrative Difficulties	M	M	L	M	H	M	L
Competition Issues	L	L(*)	M	M/H	M	M	L
Costs to Budget	N	H	N	N	L	N	L
Adverse Economic Impacts	M	L	M/H	M/H	L/M	M	L/M

(*) Subsidies may run into problems with the WTO.

- g. Recycling is a relatively new concept in economies in transition, where solid waste problems (excluding hazardous wastes) have been less serious than in industrialised countries. The main issues arise in dealing with hazardous materials both present and past. For these EIs are less important than appropriate changes in the legal liability. For household and other non-hazardous wastes, lack of familiarity is a key obstacle.

66. Summary of Impacts in Developing Countries Table 3 below summarizes the key obstacles to the introduction of EIs in developing countries. The following key points emerge:

- a. There is not much familiarity with schemes of pollution charges in developing countries. Obstacles to be overcome are therefore lack of familiarity, design of instrument and lack of administrative support.
- b. As in economies in transition, environmental subsidies are a very costly way of achieving environmental goals. There are also serious problems of corruption that arise whenever subsidies are being given. These could render such schemes totally ineffective¹⁶. Subsidies in the form of accelerated depreciation are less effective than other instruments that achieve the same goals.

Table 3: Obstacles to Introduction of EIs in Developing Countries

	Pollution Charges	Environmental Subsidies	Charges on Inputs and Outputs	Removal of Harmful Subsidies	Permit Trading	Resource Pricing	Recycling
Lack of Familiarity	H	M	L	M	H	M	L
Gainers and Losers	M	L	H	H	M	M/H	L
Design Problems	H	H	M/H	M	H	H	M
Administrative Difficulties	H	M	M	M	H	M	L
Competition Issues	M	L(*)	M	M/H	M	L	L
Costs to Budget	N	H	N	N	L	N	L
Adverse Economic Impacts	L	L	M	M	L	L	L

(*) Subsidies may run into problems with the WTO.

- c. Charges on inputs and outputs run into the obstacle that the worst polluters are also often (though not always) the small enterprises and the poorer households, using energy inefficiently. The design of the instrument has to be such that these impacts are mitigated, which is one of the most difficult problems to be addressed in developing countries. Some experience with these instruments is accumulating as governments adopt, for example, differentiated fuel pricing based on environmental considerations.

¹⁶ Although corruption is a problem for all types of regulation, and has to be tackled under the administrative arrangements, it is more serious when government funds are being dispensed.

- d. The same applies to the removal of subsidies. The prescription 'remove the subsidies' is one of the most frequently heard pieces of advice to policy-makers in developing countries. Less frequently are those providing the advice able to suggest ways in which the policy can be made acceptable to a public, parts of which would be badly hurt by the removal. Possible measures to mitigate the impacts include: timed phase-out; targeting the subsidies so that their fiscal and environmental impact is smaller but their impact in terms of social equity is retained; and providing assistance to those dependent on energy subsidies to switch over to equipment that is less polluting (thus reducing the need for subsidies in the future).
- e. Permit trading is a largely unknown instrument in developing countries. There are some experiments in China that are being conducted, and there is some use of tradeable development rights in Thailand and a number of Central and South American countries, but lack of familiarity remains a major factor. Introducing such measures will require providing assistance to these countries, both in the design of the instrument as well as in making the administrative arrangements for their implementation.
- f. Resource pricing is improving in many countries, particularly in the mineral sectors, but there is scope for improvement. Forest resources still tend to be underpriced and with strong vested interests in retaining the present level of royalties and taxes. The design of acceptable instruments is likely to be a major problem, especially as areas where these resources are used involve multiple users and complex tenure arrangements.
- g. Recycling is widely practiced in developing countries, in some respects more so than in industrialised countries where costs of collection are higher. Hence there is considerable experience of how the private sector can be used to achieve recycling goals. The main objectives here are to assist that sector to become more efficient, and to collect materials for which the demand will come from sources that do not normally have contact with small operators who do the recycling (e.g. large enterprises)¹⁷.

¹⁷ As an example of how effective such recycling in the private sector can be see Beukering et al.(1996)

IV. MEASURES TO PROMOTE THE ADOPTION OF EIs

67. The previous section reviewed the major obstacles to the adoption of EIs. This section discusses measures that should be adopted if these instruments are to be adopted. As noted in the introduction, the adoption should be such that the rationale for the EI is retained. Measures to promote an instrument that modify the instrument itself have to be treated with care. The principle actions that have been identified for promoting EIs are:

- . Disseminate information on when and where the use of EIs increases the effectiveness of environmental policy
- . Provide training and support to policy makers in the design and administration of EIs
- . Provide financial support to regulators to make a change in policy from a command and control system to a mixed system of regulations, including economic instruments.

68. Dissemination of Information. This can be done through publications such as are put out by the CSD, OECD, EC, World Bank and other international bodies, surveying the use of EIs, and reporting on the successes achieved and difficulties encountered. The information has to be got through not only to technical regulators, but also to senior policy-makers, implying a number of different levels of dissemination. Also useful here are short seminars and presentations, bringing together policy makers who can be shown what is being achieved in this area. Since the scene is a fast changing one, regular updates of policy changes is desirable. Particularly useful would be to consolidate the experience of the use of these instruments in developing countries, where the problems encountered are somewhat different from those of industrialised countries and of the economies in transition. For the latter two, information is more readily available.

69. Dissemination should not be seen as a propaganda activity on behalf of EIs, but rather a fair review of the actual experience in environmental regulation. Where EIs are the most appropriate forms of regulation, this will come out, as will the cases where they are not, and where a mixed system is required to achieve the environmental goals.

70. Recent experience that does need to be brought more clearly into the public domain includes:

- Success with pollution charges in China and some South American countries

- Results of imposing the carbon taxes and sulphur taxes in Scandinavia
- Effects of increased charges on fossil fuels in Eastern Europe and some developing countries
- Removal of subsidies for the use of pesticides in several Asian and African countries, as well as some countries in Europe.
- Permit trading schemes for CFCs in Singapore and the US
- Permit trading schemes for sulphur and Nox in the US
- Experience with tradeable development rights in Central and South America
- Joint implementation programs for greenhouse gases and sulphur reductions
- Reforms in resource pricing in Eastern Europe

71. Training and Support to Policy-makers

Training and capacity building has to take place at several levels and in a number of ways. Broad training in environmental economics and policy is clearly important, and can be carried out through short and regular courses at universities and centres of learning. More practical training in design and administration is less easily provided through such institutions, but needs visits by regulators to countries with more sophisticated regulatory regimes. Short term assignments whereby those with experience in this area work in countries which are seeking to develop new economic instruments are also required.

72. The design questions which need to be addressed are:

- What kind of research is needed to determine who are the gainers and losers from a new policy?
- What is a reasonable period to phase-in a new policy and how is this determined?
- In some cases an experimental introduction of the instrument is desirable. When is this so, and how should the experiment be designed?
- How can the most serious impacts on groups that lose from the policy be mitigated?
- How much direct control should overlay the economic instrument that is being introduced?
- In evaluating the impacts of one instrument versus another, when is it acceptable to take evidence from another country or situation and when does new evidence have to be collected?
- How frequently should the charge levels, or levels of permits be altered, and what criteria should determine the new levels at which they are set?
- Where revenues are earmarked what criteria should be used to decide on their dispersal?

Almost all these questions need regulators with **practical experience** to answer them. Such people are in short supply and their services as trainers and advisors is urgently needed.

73. Financial Support for the Adoption of New EIs

In many developing countries and economies in transition, the budgets of the Ministries of Environment are extremely small. The few trained bureaucrats working there are very hard pressed dealing with day-to-day problems, and simply do not have the time to think about new regulatory instruments. As support for sustainable development, resources provided to such ministries and other regulatory bodies, in order to fund additional personnel and equipment would be money very well spent. Such staff need not be expatriate; indeed it is probably better if most of them are not. Often there are locals who would be interested and willing to work in this field, and who could easily be trained to do so. The problem is that pay and conditions are generally very poor and government regulations make changing these conditions very hard. Hence one often finds highly paid expatriates working in Ministries of Environment in developing countries, performing tasks that could easily be performed by locals at much lower cost, but locals either cannot be hired or are offered such poor pay that they will not work on those terms.

74. Some support for the adoption of new regulations has come from sources such as the Interim Fund of the Montreal Protocol, which supports local hiring to administer the terms of the Protocol. The World Bank has also been providing support to countries in preparing Environmental Action Plans and to some extent in administering the policy changes required to implement them. A review of the success of them and other similar programmes would be useful in designing a broader program of assistance to promote the adoption of economic instruments.

75. The adoption of EIs, and change in the regulatory framework for environmental protection is a process that is under way in most countries. Lessons are being learnt and shared through fora such as this. The process will be accelerated by devoting more resources to: the dissemination of these lessons, support and training in applying the new instruments and increased funding for the administration of the programmes.

References

- Anderson, G. and Żylicz, T. (1993) "Environmental Policy in Poland: Prospects for Economic Instruments ". Paper presented at a seminar on Industrial Pollution Permitting in Central and Eastern Europe, Vilnius, Lithuania.
- Bovenberg, A. and de Mooij, B. (1994). "Environmental Levies and Distortionary Taxation ". *American Economic Review*, 84.
- Beukering, P. Van, E. Schoon and A. Mani (1996) "The Informal Sector and Waste Paper Recovery in Bombay", CREED Working Paper No 5 (London: IIED).
- Callin, S.J and J.M. Thomas (1996). *Environmental Economics and Management: Theory, Policy and Applications* (Chicago: Irwin, Inc.)
- Capros, P.T. et al. (1996). "Results from the General Equilibrium Model GEM-E3", Commission of the European Communities, DGXII, Brussels, Belgium.
- CSD (Commission on Sustainable Development) (1996). "Financial Resources and Mechanisms ", E/CN.17/1995/8, United Nations Economic and Social Council, New York.
- CSD (Commission on Sustainable Development) (1996). "Financial Resources and Mechanisms: Addendum ", E/CN.17/1996/4/Add.1, United Nations Economic and Social Council, New York.
- Dean, J. (1992) "Trade and the Environment: A Survey of the Literature " in P. Low (ed.), *International Trade and the Environment* (Washington DC: World Bank Paper 159).
- De Moor, A. (1996) "Subsidies and Sustainable Development ", paper presented to the Third Expert Group Meeting on Financial Issues of Agenda 21, Manila, Philippines.
- Dudek, D.J. et al (1992). "Implementing Tradeable Pollution Rights in Poland ". Paper presented at the Third Annual Conference of the European Association of Environmental and Resource Economists, Cracow, Poland.
- EEA (European Environment Agency) (1996). *Environmental Taxes* (Copenhagen: EEA).

Goulder, L.P. (1994). "Environmental Taxation and the Double Dividend: A Reader's Guide" Paper presented to the 50th Congress of the International Institute of Public Finance, Harvard University, Cambridge, USA.

Hahn, R.W. (1984). "Market Power and Transferable Property Rights". *Quarterly Journal of Economics*, 99: 753-765.

Hahn, R.W. (1987). "Economic Prescriptions for Environmental Problems: Not Exactly What the Doctor Ordered". School of Urban and Public Affairs, Working Paper 88-4, Carnegie-Mellon University, USA.

Hahn, R.W. (1990). *Meeting the Growing Demand for Environmental Protection: A Practical Guide to the Economists Toolchest*. (Washington DC: American Enterprise Institute)

Jaffe, A. S. Peterson, P. Portney and R. Stavins (1993). *Environmental regulations and the Competitiveness of US Industry*. Report prepared for the United States department of Commerce, The Economic Resources Group, Cambridge MA.

Jeanrenaud, C. and Stritt, M.A. (1994). "Market Based Instruments: A Way to Reduce the Cost of Air Pollution Control: Some Empirical Results for Switzerland". IRER Working Paper N° 9301, Neuchâtel University, Switzerland.

Klarer, J. (ed.) (1994). "Use of Economic Instruments in Environmental Policy in Central and Eastern Europe: Case Studies of Bulgaria, The Czech Republic, Hungary, Poland, Romania, The Slovak Republic and Slovenia". The Regional Environmental Center, Budapest, Hungary.

Low, P. (1992) "Trade Measures and Environmental Quality" in P. Low (ed.), *International Trade and the Environment* (Washington DC: World Bank Paper 159).

Markandya, A. and Lehoczki, Z. (1994). "Environmental Taxation: A Review of OECD Countries and Prospects for Economies in Transition". REC Paper Series No. 1, The Regional Environmental Center, Budapest, Hungary.

Markandya, A. (1994). "Financing Sustainable Development: Agenda 21", HIID, Cambridge, MA.

Markandya, A. (1994a) "Is Free Trade Compatible with Sustainable Development", *UNCTAD Review*, pp. 9-22.

Markandya, A. 1996. "What Have We Learned About Market-based Instruments?" in *Between Market and Regulation*, C. Jeanrenaud (ed.) (Basle: Birker)

Markandya A. (1996a) "Environmental Control Costs, Policy Options , Instruments and Abatements ", Paper prepared for the Asian development Bank Study on Emerging Asia, Bath University, UK.

Misiolek, W.S. and Elder, H.W. (1989). "Exclusionary Manipulation of Markets for Pollution Rights ". *Journal of Environmental Economics and Management*, 5, 395-418.

Murty, M.N. (1996). "Role of Government in Environmental Management: Is it Catalytic or Coercive?", in Murty et al. *Economic Instruments and Other Institutions for Water Pollution Abatement*, Institute of Economic Growth, Delhi, India.

Navrud, S. "Economic Evaluation of External Costs of Fuel Cycles: Testing the Benefit Transfer Approach " in Almeida, A.T. de (ed.) *Models for Integrated Electricity Resource Planning* (Amsterdam: Kluwer Academic Publishers).

OECD. (1993). "Environmental Taxes in OECD Countries: A Survey". OECD Monographs No 71, OECD, Paris.

OECD. (1995). "Environmental Taxes in OECD Countries ". OECD, Paris.

Panayotou, T. (1994). "Conservation of Biodiversity and Economic Development: The Concept of Transferable Development Rights ". *Environmental and Resource Economics*, 4: 95-110.

Panayotou, T. (1995). "The Use of Economic Instruments in Developing Countries ". UNEP, Nairobi.

Panayotou, T. (1996). "Matrix of Policy Options and Financial Instruments", Paper prepared for the Third Expert Group Meeting on Financial Issues of Agenda 21, Manila, Philippines.

Porter, M. (1991). "America's Green Strategy ", *Scientific American*, p. 128 (April).

Repetto. R. et al. (1992). "Green Fees: How a Tax Shift Can Work for the Environment and the Economy". World Resources Institute, Washington DC.

Rico, R. (1995). "The US Allowance Trading System for Sulfur Dioxide: An Update of Market Experience ". *Environmental and Resource Economics*, 5: 115-129.

Robison, H. (1988). "Industrial Pollution Abatement: The Impact on the Balance of Trade ", *Canadian Journal; of Economics*, Vol 21.

Sorrell, S. (1994). "Pollution on the Market: The US Experience With Emissions Trading for the Control of Air Pollution ". STEEP Report No. 1, Science Policy Research Unit, University of Sussex.

Striit, M-A. (1994). "Certificats Échangeables: Applications Possible Dans le Domaine de l'Environnement ". IRER Working Paper N° 9401, Neuchâtel University, Switzerland.

Tietenberg, T.H. (1985). "Emissions Trading: An Exercise in Reforming Pollution Policy. Resources for the Future ", Washington DC.

Tietenberg, T.H. (1996). *Environmental and Natural Resource Economics*, 4th edition, (New York: Harper Collins).

van Regermorter, D. (1995). "Do Ecological Taxes Produce a Double Dividend? " in *Between Market and Regulation*, C. Jeanrenaud (ed.) (Basle: Birker)