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Efficient and Effective Use of Tradeable Permits in Combination with other Policy Instruments

by

Nick Johnstone

Organisation for Economic Co-operation and Development
Organisation de Coopération et de Développement Economiques

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FOREWORD

This paper was prepared by Nick Johnstone (National Policies Division, OECD Environment Directorate), for the OECD Global Forum on Sustainable Development: Emissions Trading and Concerted Action on Tradeable Emissions Permits (CATEP) Country Forum, held at the OECD Headquarters in Paris on 17-18 March 2003. The aim of the Forum was to bring representatives from OECD and non-OECD country governments together with representatives from the research community, to identify and discuss key policy issues relating to greenhouse gas emissions trading and other project based mechanisms for GHG emission reduction, such as Joint Implementation and the Clean Development Mechanism. The Forum also aimed to promote dialogue between the various stakeholder groups, and discuss policy needs in the design and implementation of tradeable emissions schemes. Forum participants included representatives from OECD and non-OECD governments, as well as from the research community. Those from industry and other institutions involved with emissions trading, joint implementation and clean development mechanism projects such as the European Commission and the World Bank were also represented.

The OECD Global Forums are one of the two pillars of the new architecture of the Centre for Co-operation with Non-Members, agreed upon by the Committee on Co-operation with Non-Members. The Global Forum on Sustainable Development (GFSD) provides a mechanism for achieving the OECD Ministers' outreach objective and will complement other work on sustainable development. Within the organisational framework of OECD, the GFSD will aim to facilitate a constructive dialogue between non-member and OECD economies on key issues on the sustainable development agenda.

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The ideas expressed in the paper are those of the author and do not necessarily represent the views of the OECD or its Member Countries.

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1. INTRODUCTION

The use of environmental policy mixes has been advocated by the OECD Environment Directorate (and others) for many years (see for instance, the OECD *Environmental Outlook and Strategy*). However, surprisingly little work has been done on the conditions under which the use of multiple environmental policy instruments is likely to be preferable to the application of a single policy instrument. Moreover, little work has been done on examining the combinations of policy instruments which are likely to serve as effective and efficient complements.

The links between tradeable permits and other policy instruments is explored in this report. It builds on previous work (Johnstone 2002) which discussed these issues from a theoretical perspective in a more detailed manner, and examined the links between tradeable permits and five types of environmental policy instruments:

- direct regulations;
- taxes and charges;
- environmentally-motivated subsidies;
- voluntary agreements; and,
- other tradeable permit systems.

The earlier report focussed on instances in which the instruments were targeted at the same environmental damage arising from the same sector. As such, important related questions such as the links between measures which target different sources, or the links between measures which target technologically-related (i.e. joint product) or environmentally-related (i.e. synergistic) pollutants were not addressed in a systematic manner. However, as an initial exploratory study it was felt necessary to focus on the simplest cases.

The earlier report also found that in many cases the use of an environmental policy mix can decrease economic efficiency, and in some cases also reduce environmental effectiveness. In most cases, administrative costs are also likely to rise. Thus, using "two stones to kill one bird" is not usually a sensible policy prescription. However, this is by no means always the case – and some of the conditions under which the use of two instruments might be warranted were identified. In this report, these conclusions are explored in greater detail – focussing on the implications for policy design.

Four motivations for introducing different policy instruments as part of a policy mix are addressed in this paper:

- Reducing abatement cost uncertainty;
- Overcoming technology market failures;

- Increasing behavioural responsiveness; and,
- Addressing local environmental impacts.

It will be argued that under certain conditions a combination of instruments may be preferable to the use of one or other on their own. As in the previous report, this paper concentrates on cases in which more than one instrument is used to hit the same environmental target - i.e. a given environmental damage.

2. REDUCING ABATEMENT COST UNCERTAINTY

One of the great advantages of tradeable permit schemes (or at least cap-and-trade tradeable permit schemes) is their environmental certainty. Relative to all other environmental policy instruments, they provide – assuming perfect monitoring and complete enforcement – complete certainty with respect to the total level of emissions. This is not true of performance standards since even if they are expressed in absolute terms (i.e. emission limits) they can not address issues of firm entry and exit. Nor is it true of technology standards, for which there is additional uncertainty arising from the abatement effort - emission level relationship. Even taxes and charges do not provide environmental certainty since they are dependent upon the firms' behavioural responses, which are unknown ex ante.

The flip-side of this relative certainty with respect to emission levels is, of course, considerable uncertainty with respect to abatement costs. This issue was addressed almost thirty years ago by Roberts and Spence (1976). In effect by fixing the environmental impacts with greater certainty, ex ante estimates of abatement costs become more uncertain. In political terms this is not unimportant. In some cases excessively lenient caps have been introduced in order to ensure that abatement costs are not excessive. In other cases proposals to introduce tradeable permit schemes have been abandoned altogether.

One solution would, of course, be to introduce a different instrument when there is considerable abatement cost uncertainty. However, it is possible to do better still. Through the use of combinations of policy instruments it is possible to "bound" this uncertainty in a way which increases the economic efficiency of the environmental policy regime. In effect, by introducing taxes when abatement costs are greater than expected, the policy maker is able to place an upper bound on permit prices. Analogously, by providing subsidies to firms when abatement costs are lower than expected, the policy maker places a lower bound on permit prices.

This is important from a social welfare perspective. Assuming that the cap was initially set at a level which was assumed to be optimal, deviations from the expected equilibrium permit price indicate that marginal costs will not equal marginal benefits. By placing upper and lower bounds on the possible deviation – the use of taxes and subsidies serve to constrain welfare losses relative to the optimal equilibrium.

Do environmental policy makers actually do this? The answer is quite clearly yes, although usually only in the upward direction. For instance, in the Danish CO_2 permit trading case for the electricity supply industry, the penalty for non-compliance was set at a relatively low DKK 40/ton. In effect this has set an upper bound on permit prices. While the permit price has not reached this level, it is clear that the presence of the "cap" helped to ensure that the measure was politically acceptable (Pedersen 2003).

Similarly in the original proposals for the EU Directive on greenhouse gas emissions trading, the permit price cap was set at 50 EUR/ton in the first phase and 100 EUR/ton in the second phase (CEC 2001). However, it also included the provision that the penalty shall be twice the average market price if higher than these levels. In a subsequent amendment to the Directive this provision was removed (CEC 2002). In effect, by removing this clause the penalty becomes a price cap, which would have not been the case under the previous system proposed. Indeed, the Commission explicitly stated that price certainty was the objective of the amendment.[1]

There are not any obvious examples of cases in which countries have explicitly introduced subsidies which are "triggered" if the permit price falls too low. However, it is clear that there are many on-going subsidy programmes which serve to depress permit prices on a continuous basis. For instance, capital depreciation allowances for carbon-free technologies would serve this role.

The down-side of "bounding" permit price uncertainty is, of course, that emission levels become more uncertain. In particular, emission reductions with abatement costs in excess of the cap will increase indefinitely. Analogously, when the magnitude of the subsidy has been pre-determined, emission reductions will continue to be undertaken as long as the magnitude of the subsidy exceeds marginal abatement costs.

Arguably this increased cost certainty can also be achieved with the permit trading programme by keeping permit reserves available for use. For instance, under the US SO_2 Allowance Trading program the government initially held reserves of permits which it could have released onto the market if the price had reached $US 1,500 (see Tietenberg 1998). In practice, permit prices never approached this threshold, but some initial estimates were sufficiently high to elicit some concern about compliance costs. However, such a scheme has the disadvantage that the price can only be capped for as long as the reserve holds - excessive demand will eventually drive the price higher. Thus, the price effects are less certain, undermining the benefits in terms of reduced uncertainty. On the other hand, of course, the environmental effects are more certain with a permit reserve since under a tax-based price cap the government has no direct control over emissions.

Whether or not a regulatory authority decides to bound permit prices through the joint use of taxes and subsidies alongside tradeable permits is likely to be more of a political question than an economic one. Getting acceptance for tradeable permit schemes has not been politically easy in OECD Member countries, and amongst others, those firms which are directly affected by the programme have presented some of the most significant obstacles. This is of course, not surprising if permits are auctioned, but in some cases it has also been true when permits have been allocated gratis.

[1] Conversely, in the UK's landfill permit scheme for biodegradable municipal waste, the government considered the possibility of introducing a cap through a penalty/tax, but felt that this was unnecessary since there was little uncertainty concerning the costs of waste diversion (UK DETR 2001).

3. OVERCOMING TECHNOLOGICAL MARKET FAILURES

The incentive effects associated with the introduction of tradeable permits is, of course, entirely a consequence of changes in relative prices. A tradeable permit system increases the opportunity cost associated with emitting a particular pollutant, and thus production technologies and management practices which are relatively intensive in the emission of that pollutant become relatively less attractive in the marketplace. Firms and households will respond by reducing their demand.

In the long run, this should result in significant benefits in terms of the innovation and diffusion of environmentally-less damaging technologies. Indeed, it should do so more effectively than other types of policy instruments. Firstly, given that all emissions face an opportunity cost and not just those beyond a prescribed level, it will provide incentives above and beyond the levels arising from other policies such as performance standards or emission limits. Secondly, given uncertainties about the optimal direction of environment-saving technologies, the non-prescriptive nature of tradeable permit regimes which are targeted relatively directly on the externality concerned are less likely to result in sub-optimal technology choices than other measures such as technology-based standards or input or capital subsidies.

There is a vast body of theoretical literature which supports the view that tradeable permits (along with environmental taxes) provide the strongest and most efficient incentives for environmentally-preferable technological change (see Johnstone 1999 for a discussion of some of the literature). However, most such literature assumes that the only market failure which exists is that which relates to the existence of the environmental externality. Other markets are behaving perfectly. In many cases this is clearly not the case.

In particular, it is generally argued that due to the pervasiveness of positive externalities in technology development and diffusion, market forces will not generally provide the optimal rate of innovation in the absence of government intervention. These externalities arise due to the "spillovers" which exist in technological development and diffusion. A number of related factors may be at work (see Jaffe et al. 2002), including:

- Difficulty of excluding others from the benefits of applied research and product development, resulting in firms not having sufficient incentive to undertake the necessary investments; and,

- Credit market failures which discourage lenders from providing loans to firms for low-probability high-return investments such as research and development of new technologies.

Such failures can slow the direction of technological change. Even if the tradeable permit system should be providing the types of incentives for innovation in newer environmentally-preferable technologies, the rate of such innovation may be slower than that which is optimal. Thus, in the presence of joint market failures (environmental and technological) there may be a case to be made for the joint application of two environmental policy instruments. More particularly, it may be preferable to use a tradeable permit system to address the environmental externality and another complementary measure to address the technology market failure.

The appropriate tool to address the latter is dependent upon the nature of the failure. In some cases, OECD Member country governments support research "clusters" to encourage the internalisation of external

benefits across firms. In other cases, they become more directly involved through public-private partnerships, perhaps underwriting some of the risks associated with technological development. And in still other cases, they provide direct support for environment-related research and development (see OECD 1998a and 1998b for discussions).

There is no such question that such measures are likely to increase the rate of technological change. However, in all such cases it is important to bear in mind that one of the great benefits of tradeable permits is undermined – namely the benefits of neutrality with respect to the direction of technological change. Any measure which seeks to overcome such technology market failures is almost always prescriptive with respect to the direction of technological change – picking winners is no easy task, and thus it may be better to use 'neutral' policies such as support for basic research and strengthened intellectual property rights.

There is, therefore, a trade-off. Policy makers must balance the potential benefits of increasing the rate of environmentally-preferable technological change with the costs of misdirecting the trajectory of such change. Jointly applying tradeable permits and technology-oriented policies can provide a means of making these trade-offs in a more satisfactory manner. However, a recognition of the links between the two types of policy, and an understanding of the potential dangers associated with using policies which are prescriptive with respect to the direction of technological change is key.

4. INCREASING BEHAVIOURAL RESPONSES

Market failures may not only affect the supply side of the market for environmentally-preferable technologies, but also the demand side. There are two principal reasons why this might arise:

- Due to the presence of consumption externalities potential demanders of a new technology may be unwilling to undertake initial purchases until there is evidence that the technology is economic; and,

- Due to inadequate information about the environment-related environmental characteristics of different potential substitute goods and services, households and firms may not be able to express their preferences effectively in the marketplace.

In both cases, demand for environmentally-preferable goods and services may be less than optimal – even in the presence of a tradeable permit scheme which affects relative prices in such a way as to encourage their diffusion. The potential market for environmentally-preferable technologies is constrained by information failures in the market. In such cases it may be economically efficient to complement a tradeable permit system with measures which are targeted at potential consumers, increasing responsiveness on the demand side. For instance:

- Consumption externalities might be addressed through a demonstration project or an information campaign related to environmental technologies; and,

- Other information failures might be addressed through measures such as eco-labels and certification schemes which give consumers the information necessary to express their preferences in the markets.

A good example of the potential importance of the latter case is provided by Newell et al., (1998), in a study of product innovations for energy-using household appliances. Looking at the energy-efficiency of air conditioners and water heaters offered for sale in the United States, Newell et al. (1998) estimated the responsiveness of manufacturers to rising energy prices, before and after the introduction of an energy labelling scheme in 1975. The results indicate that the effects of energy price changes on the mean efficiency of appliances supplied by manufacturers rose appreciably (and became statistically significant) once appliances were labelled.

While the introduction of such policies are not costless they can be effective complements to tradeable permits. This is likely to be true in cases where there are significant differences in short-run and long-run behavioural responses. In effect, the provision of information may serve to reduce adjustment lags.

5. ADDRESSING LOCAL IMPACTS FOR POLLUTANTS WITH HETEROGENEOUS IMPACTS

Another great advantage of tradeable permits is their ability to equalise marginal abatement costs across different emission sources. For any given environmental target this minimises total abatement costs. This is, of course, untrue of other environmental policy measures such as performance standards or technology standards. With heterogeneous firms such measures can never result in the minimization of total abatement costs, except at inordinate administrative cost.

However, while this means that tradeable permits are a cost-effective means of meeting given levels of emissions, it does not necessarily mean that they are economically efficient. For any pollutant in which the impacts differ by place of emission (i.e. which is not a pure public bad such as carbon dioxide or ozone-depleting substances), the equalisation of marginal abatement costs will not be economically optimal. In effect if the spatial scale of the tradeable permit market incorporates sources with heterogeneous environmental impacts, a single undifferentiated market for tradeable permits will not be economically optimal.

In such circumstances, regulatory constraints are often used to protect local environmental conditions. For instance, in the United Kingdom, the architects of the proposed trading programme for NO_x and SO_x have made it clear that the regime would have to protect local environmental conditions. However, it is not yet clear whether this would require the application of “Best Available Technologies” as directed under the IPPC Directive, which would severely restrict trading opportunities (see Palmer and Davies 2002).

Even in the American SO_2 Allowance Trading program – arguably the ‘purest’ existing tradeable permit system - there are regulatory constraints imposed to protect local environmental conditions. For instance, in Wisconsin, local air pollution regulations prevented generators from buying permits even though their marginal costs exceeded the prevailing permit price. In Illinois, the use of scrubbers was mandated (see Conrad and Kohn 1996 and Fullerton et al., 1997). In New York, the Department of Environmental Conservation filed a suit to force the EPA to use "deposition standards" to restrict the use of permits in environmentally-sensitive areas (see Tietenberg 1995).

It would, of course, be possible to protect local environmental conditions within the tradeable permit scheme itself. For instance, in the Los Angeles RECLAIM program for NO_x and SO_x permits are restricted between sellers in the coastal zone to buyers in the inland zone due to the more significant ozone

concentrations in the latter area. In the EPA's NO_x programme for the northeast of the United States, there were discussions about the use of trading ratios, with sellers from high-ambient zones receiving proportionately more for each permit sold (see Nash and Revesz 2001).

However, all such measures complicate and 'thin' the market for tradeable permits. Given the widespread concerns about the need for markets to be simple and deep (see OECD 2001), it may therefore be preferable to use direct regulations as a 'backstop', ensuring that particular thresholds are not exceeded. This is further supported by the fact that trade restrictions of the sort described above will have uncertain environmental consequences unless the regulator is able to forecast market developments in the affected zones with precision.

6. CONCLUSIONS

As a general principle it is unlikely to be economically efficient and environmentally effective to "kill one bird with two stones". In many instances it is likely to be administratively costly, economically inefficient, and/or environmentally ineffective. However, there are conditions under which it may be necessary to use two instruments, and this report has discussed four such cases. Indeed, there are certainly other cases as well, indicating that efficient environmental policy is often likely to involve the use of mixes of instruments, even when targeting the same environmental damage arising from the same source.

However, in all cases the objective of each instrument must be clearly defined, and the relationship between the two instruments must be properly understood. Thus in order for the use of an additional policy instrument to be increase efficiency and effectiveness in the presence of a tradeable permit system, the "complementary" instrument must:

- meet a legitimate policy objective which can not be met more efficiently through the tradeable permit system itself;
- be the best instrument available to the regulatory authority if it is to meet that policy objective;
- preserve the benefits of the tradeable permit system (i.e. abatement cost reduction, dynamic incentives, environmental certainty) to the greatest extent possible; and,
- be administratively feasible at reasonable cost.

These conditions are by no means easy to fulfill. As such, designing an efficient and effective combination of environmental policy instruments is one of the great challenges facing policy makers today.

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