Controlling Pollution: Using Taxes and Tradable Permits

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Preface

The Economic Issues series aims to make available to a broad readership of nonspecialists some of the economic research being produced on topical issues by IMF staff. The series draws mainly from IMF Working Papers, which are technical papers produced by IMF staff members and visiting scholars, as well as from policy-related research papers.

This Economic Issue is based on IMF Working Paper 00/13 “Taxes and Tradable Permits as Instruments for Controlling Pollution: Theory and Practice.” Citations for the research referred to in this shortened version are provided in the original paper which readers can purchase ($10.00) from the IMF Publication Services, or download from www.imf.org. Jackie Irving prepared the text for this pamphlet.
In December 1997, 160 nations meeting in Kyoto, Japan agreed to cut back emissions of carbon dioxide and other greenhouse gases. While ratified by only a very small number of countries so far, the "Kyoto Protocol" calls for industrial countries to reduce their average emissions during 2008-12 to about 5 percent below 1990 levels. Some countries pledged to go further: the European Union set an 8 percent target, while the United States and Japan agreed to cut emissions by 7 and 6 percent, respectively. The Protocol allows some industrial countries to modestly increase their emissions in the near term, while special terms apply to members of the former Soviet Union. Since developing countries face potential technical and economic constraints, the Protocol does not oblige them to cut back their emissions.

Because the proposed targets are likely to impose large costs on the global economy, the Kyoto agreement sets the stage for long and complex discussions at the national and international levels. A key issue is how these costs will be shared among countries. While recent public opinion polls show greater concern about climate change and some willingness to share burdens to curb greenhouse gas emissions, recent events in energy markets provide evidence that the public is unwilling to accept significant hikes in energy prices or other costs. If countries prove unwilling to ratify the Kyoto Protocol in its present form, however, the discussions will undoubtedly continue.

Even after questions about the Protocol and its associated costs are resolved, domestic policy choices for meeting targets and timetables will still require further consideration. No international agreement exists yet on this policy menu, but policymakers basically have
a choice between two types of economic instruments—environmental taxes and tradable permits—to supplement more traditional policy instruments in the form of direct intervention and regulations (so-called “command and control” measures).

This pamphlet examines the relative merits of these two major economic instruments for reducing pollution—“green” taxes and tradable permits. Country experiences provide a number of lessons on the design and use of both types of instruments. So far, most countries have relied more heavily on taxes than on permits to control pollution. While many—particularly European—countries now have long-term programs involving green taxes in place, a willingness to experiment with tradable permits seems to be growing, especially given the Kyoto Protocol emission targets.

What Are Green Taxes?

This pamphlet provides a practical review of country experiences with the main focus on green taxes broadly defined. There seems to be little consensus on what constitutes an environmental tax, however. Current definitions can include one or more of the following:

- emissions taxes that set their rates according to the amount of emissions and extent of environmental damage—known as, “Pigouvian taxes”;
- indirect taxes on production inputs or consumer goods whose use can damage the environment (for example, excise taxes on gasoline);
- environment-related provisions in other taxes; and
- accelerated depreciation provisions and lower tax rates for equipment and production methods that save energy and reduce pollution.
The lack of a generally accepted definition has complicated any consistent classification of such taxes, but the Organization for Economic Cooperation and Development is working with other institutions to try to address this problem. To this end, the OECD has also put together a comprehensive database with information on environmentally-related taxes in its member countries.

How Are Countries Using Green Taxes?

The share of revenues from green taxes in gross domestic product was less than 2 percent in 1995 for each of the 19 developed countries covered by the OECD databank. (See Figure 1, which uses a broader definition of green (or eco) taxes to include all environmentally-related taxes on products.) At well above 4 percent, Denmark had the highest ratio of green tax revenue to GDP, with ratios for Greece, the Netherlands, Norway, and Portugal slightly below this level. Mexico and the United States had the lowest ratios for the group, at just about 1 percent.

For the 19 industrial countries, unleaded petrol raises more revenue by far from green taxes than any other product (see Figure 2). In fact, unleaded petrol accounted for nearly 40 percent of the total revenue raised in 1995, followed by motor vehicles, accounting for more than 20 percent. Taken together, taxes on petroleum, diesel fuel and the sale or use of motor vehicles raised more than 91 percent of all environmentally-related revenue covered by the OECD study. So, in general for developed countries, revenue raised from taxes on pure emissions is relatively modest. But a closer look at trends in individual countries—especially the leading ecotax advocates known as the "ecotax leaders"—reveals that emission taxes can
Figure 1. Revenues from Environmentally Related Taxes in Percent of Total Tax Revenue and GDP, 1995

Figure 2. Revenues from Environmentally Related Taxes in 1995

(Millions of U.S. dollars)

- Measured or estimated emissions to air
- Ozone depleting substances
- Measured or estimated effluents to water
- Certain non-point sources of water pollution
- Waste management
- Unleaded petrol
- Leaded petrol
- Diesel
- Other energy products for transport purposes
- Light fuel oil
- Heavy fuel oil
- Natural gas
- Coal
- Coke
- Biofuels
- Other fuels for stationary use
- Electricity consumption
- Electricity production
- Motor vehicles, one-off import or sales taxes
- Registration or use of motor vehicles, recurrent

generate significant amounts of revenue. Despite these broad developments, any strong, general move toward comprehensive green tax reforms has been limited to just a handful of countries.

Developed, reform-oriented countries can be divided into two groups. Countries in the first group—the "ecotax leaders," including Denmark, the Netherlands, Norway, and Sweden—have radically reformed their tax systems to rely increasingly on green taxes. The second group—Austria, Belgium, Finland, France, Germany, and Switzerland—has made important, though more incremental, progress in this area. Below we attempt to draw useful lessons, based on a thorough review of country experiences on how best to implement ecotaxes, along with the associated complications in administering these taxes, and expected revenues.

**Lessons Learned from Ecotax Leaders**

Generally, ecotax leaders have tended to take three approaches to reform of environmental taxes: removing or modifying distortionary subsidies and tax provisions, restructuring taxes to take account of environmental considerations, and introducing new green taxes. Another tendency among these countries is for reform of green taxes to comprise just one part of a wider, more fundamental reform of national tax policy.

Six major observations can be made following a review of the recent experiences of ecotax leaders.

*First*, the ecotax leaders did not carry out reform of green taxes in a vacuum. Rather, they have adopted these reforms against the common background of the Kyoto Protocol and other international agreements to cut greenhouse gas emissions in response to growing...
evidence of global warming. The lead role played by some countries, such as Norway, in the international arena assured a prominent position for ecotax reform on the domestic policy agenda. And because the OECD and European Union have taken innovative steps toward ecotax reform, these organizations have become key focal points for discussions and information exchange on these issues among developed countries. Indeed, the EU has adopted a separate burden-sharing agreement to enable its 15 member countries to meet the targets under the Kyoto Protocol.

Second, the introduction of taxes on carbon dioxide emissions has been the common key element of all the ecotax reforms. All the countries have found that the most efficient way to reach environmental goals is through taxes targeting emissions of carbon dioxide—by far the dominant greenhouse gas. But because it is difficult to accurately measure carbon dioxide emissions, taxes are imposed on the estimated carbon content of the products emitting this gas. So, in practice, these taxes fall somewhere in between product taxes and pure emissions taxes. Tax rates vary markedly across the ecotax leaders, with Norway and Sweden having by far the highest rates.

Third, the green tax reforms discussed here generally have not had, as their main aim, the generation of large amounts of revenue. In most cases, these reforms have had the dual aim of improving environmental conditions and using the funds raised to ease distortions created by other taxes—especially taxes that adversely affect employment. For example, the introduction of ecotaxes allowed Denmark to cut marginal tax rates on labor income and social security contributions. And Sweden implemented a major general reduction in income taxation.

Fourth, in the absence of compensating measures, green taxes may harm international competitiveness. This line of argument has led even some ecotax leaders to grant tax exemptions to some heavy emitters of greenhouse gases—although these exemptions tend to weaken the link between the tax paid and the gases emitted and, of course, also reduce revenues raised and thus the potential for cutting labor and other taxes. For example, Finland has exempted the electricity sector from the carbon tax. Denmark “recycles” the yield from emissions taxes to industry and, in some cases, has replaced taxation
with voluntary agreements. And, Norway has been considering scaling back its carbon tax in response to falling investment in the oil sector. So, policy interactions between environmental goals and industries' competitiveness considerations have played a major role in the way green taxes are actually designed and used.

**Fifth**, studies show that the public perceives green taxes to be regressive. But at their current levels, ecotaxes generally do not seem to have any major regressive impact. Also, the distributional consequences of green taxes should be measured in relation to the taxes they replace (often, labor taxes—which can be heavily regressive) and in terms of the environmental improvements they generate.

**Sixth**, a typical ecotax may well involve trade-offs that are lacking in other types of taxes: there is frequently a conflict between the fiscal and environmental goals of ecotaxes since most ecotaxes aim to eliminate or reduce their own tax bases. For example, high excise taxes on leaded gasoline caused this fuel to disappear from the market in Austria, Denmark, Finland, Norway, and Sweden. But as this example shows, ecotaxes may change consumption patterns (in this case, gasoline consumption) by giving the consumer incentives to substitute cleaner for highly polluting products, while keeping intact a fairly stable and large tax base (in this case, unleaded gasoline).

The conflict between fiscal and environmental goals becomes an issue only at certain levels of taxation and should, therefore, not be exaggerated. For instance, the tax base for many taxes on carbon dioxide emissions seems to be stable or even growing in countries using these taxes. And, the current levels of these taxes are not likely to change consumer habits in any major way. There also seems to be broad scope for adding new or raising existing taxes on pollutants. This could, of course, change in future with increased use of these taxes.
Setting Up Tradable Permit Systems

So far, with one exception, tradable permits have not been a favored policy tool for pollution control. The exception is the United States—the first country to give tradable permits a prominent place in environmental protection programs. Most of the permits are used in the control of air pollutant emissions.

Policymakers considering the use of a tradable permit system as a pollution control tool must first decide on the basic purpose and nature of the system. Will the system be set up as an extra measure to meet existing environmental goals? Will the system be designed and set up simultaneously with the setting of environmental goals? What geographic areas will be covered? Will the system be designed to cap overall emissions and permit trade of the right to emit a certain amount of a pollutant—known as a cap-and-trade system? Or will the system permit the trade of a “credit” that is granted to a seller that proves he has cut emissions below a certain level—known as a credit-based system?

Once these basic questions have been answered, policymakers can consider the system’s design features. If a cap-and-trade system is chosen, how will initial allowances be distributed? Will those holding tradable permits be allowed to cut emissions more than required and “bank” the surplus for future use or sale? Which sources of pollutant emissions will be required or allowed to participate in the system? Should new institutions be created to facilitate trading of the permits?

Finally, policymakers must work out certain implementation issues. Must permits be certified by some authority before they can be traded? How will pollutant emissions be monitored and reported under the system? How will the system be enforced?
Lessons Learned from the United States

 Tradable permits are still somewhat controversial—even in the United States, where they are used most extensively. But the U.S. experience can provide helpful lessons to other countries considering tradable permits as policy tools for pollution control.

Political support for tradable permit systems in the United States generally seems highest when they are introduced as completely new initiatives, rather than as additions to existing programs. This is largely explained by new programs not having to face the difficulty of modifying expectations that are already in place for existing programs.

In the United States, successful programs for tradable permits range from those that are in effect throughout the country to those that are restricted to one or a few geographic areas. But no existing program so far has involved the trading of permits across different states. This could be explained by the trade-off between the greater efficiency that would result from an expansion of the permits market and the risk of creating environmental "hot spots"—or particular locations where the increased trading of permits would cause pollution to concentrate.

Cap-and-trade programs are more common—and so trading volumes are higher—than credit-based programs. This is at least partly because, in the case of credit-based programs, the calculation of the baselines needed as reference points for future emissions reductions can be arbitrary and even controversial.

Most tradable permit systems in the United States have allowed "banking"—when permit holders cut emissions more than required and reserve the surplus for future use or sale. This flexibility seems especially important in cases where pollutant reductions are phased in over time, as in the case of the lead-in-gasoline program. Cutting emissions more than is required in the early stages of a program—when emissions are highest—can increase the benefits to the environment.

Private institutions have developed to facilitate trading of permits and provide market information. Brokers of permits have evolved as important players who lower the overall transactions costs of trades.
and increase the volume of permits traded and the overall costs savings. For example, brokers and other private market transactions make up most of the allowed sales and purchases of permits in the sulfur dioxide emissions program in the United States.

Emissions under cap-and-trade programs must be monitored to ensure that the quantity of permits bought and sold is accurate. Continuous emission monitoring systems offer some degree of certainty in the monitoring process and so are often required by tradable permits programs. But the high cost of these monitoring systems can keep many small companies from participating in permits programs. The U.S. experience with the Regional Clean Air Incentives Market (RECLAIM) program shows that it is possible for both large and small companies to participate, if different monitoring regimes apply to each group. The RECLAIM program estimated the emissions of small firms using emission technology and fuel meters. This approach, however, has so far only been used in the United States, where emitters tend to be covered by a complex and well-established system of supplementary environmental controls.

Conclusions

From a practical point of view, the vast majority of countries have favored taxes over tradable permits in pollution control. This is presumably because taxes are a more familiar type of policy tool and can be implemented through an existing administrative apparatus.

But the use of tradable permits is expected to continue—perhaps at a rising rate—in the United States, which stands out among developed countries as preferring tradable permits to ecotaxes. The results so far from their use in various U.S. programs have been positive.
Among developed countries in general, willingness to experiment with tradable permits seems to be expanding. Increasing experience with permits at the national level may help spread their use internationally and could eventually give rise to an international tradable permits system, as envisaged in the Kyoto Protocol. There is considerable potential for wider use of tradable permits and the key challenge now is to realize that potential.

The current political climate for tradable permits in Europe is not certain, however. Indeed, several European governments have recently put in place or are now considering long-term pollution control programs centered mainly around ecotaxes. These countries can benefit from three key lessons drawn from the experiences of the ecotax leaders:

- Green tax reforms should not be expected to yield significant revenue. True ecotaxes are more likely to be successful in meeting environmental rather than fiscal goals.
- Ecotax leaders have found that the most efficient way to achieve environmental goals is to target emissions of carbon dioxide—by far the dominant greenhouse gas.
- There is an important trade-off between environmental goals and the potential loss of international competitiveness to countries that impose lower or no green taxes. Since considerable opposition should be expected from industries most affected by ecotaxes, policymakers should be sure to consult extensively with and target information campaigns at these industries in advance of any green tax reform. Careful consideration also should be given to phasing-in mechanisms and the design of “recycling” mechanisms for the revenues generated by ecotaxes.
The Economic Issues Series


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