Reflections on the Double Dividend Debate

The Importance of Interest Groups and Information Costs

JOHN C.V. PEZZEY1 and ANDREW PARK2
1Environment Department, University of York, York Y010 5DD, UK
(email: jcvp1@york.ac.uk); 2Department of Economics, University of Edinburgh, UK

Abstract. We survey the history of carbon taxation, the range of market-based instruments (MBIs) of environmental control, and the state of the double dividend debate, in order to suggest directions for future research into MBIs. Returning MBI revenues as lower distortionary taxes rather than as lump sums raises aggregate welfare, but we favour MBIs which raise little or no revenue, for reasons of political acceptability to interest groups. At the same time, the overall case for any environmental improvement is weaker because of general equilibrium interactions with prior distortionary taxes. Research seems most necessary on quantifying the efficiency benefits of market control of heterogeneous polluters, the benefits of environmental improvement, the tax interaction effect, and the various information costs of an MBI, all on a case-by-case basis for different pollutants and places.

Key words: double dividend, information costs, market-based instruments, political acceptability, pollution control

JEL classification: Q28, H23

1. Introduction

To meet the aim of this special issue and survey an exciting new research area in environmental economics, one must first decide how loose or tight the focus of the research area should be, and there is no obviously correct way to do this. Our chosen area is a familiar one: the lack of progress in introducing market-based instruments (MBIs) of environmental control to improve social welfare. Within this area, we focus on the double dividend debate, which has received a large share of research effort on MBIs in the 1990s. Our aim is to relate recent double dividend results to the wider MBI agenda, rather than contribute to the double dividend debate as such. The debate is over the well-known claim, notably by Pearce (1991), that new environmental taxes, whose revenues are used to lower existing, distortionary taxes on capital or labour, can achieve a (strong) double dividend: a first dividend of improved environmental quality, and a second dividend of a net economic benefit, in the form of higher individual welfare, GDP, GDP growth, or employment. To the extent that the difference between social and individual welfare (that is, equity) can be ignored, such a marvellous “win-win” property
would therefore avoid the difficult task of evaluating the size, rather than just the sign, of environmental improvements.

Our principal conclusion will be that some research effort should now be shifted away from double dividend modelling, and back to older, more political and practical, and perhaps less economically exciting, problems with MBIs, identified for example by Pezzey (1988) and Hahn (1989). We support this conclusion with two main arguments. One is that starting with Bovenberg and de Mooij (1994a) and perhaps ending with Goulder (1997), the strong double dividend claim has been largely rejected, and it no longer features so prominently in policy debates. The other argument is that in any case, significantly revenue-raising environmental taxation would have been, and still will be, politically blocked by powerful interest groups, even if double dividends were or are possible. However, the need for some degree of general equilibrium modelling of MBIs is a permanent outcome of the double dividend debate.

As noted below, a number of double dividend papers have already considered the effects of environmental taxation on different income groups, or a wider range of MBIs beyond the simple Pigovian tax, or both. However, in a wide though not exhaustive survey of the literature in a companion paper (Park and Pezzey 1998), we found four very common restrictions in double dividend papers:

- to cover only the one empirical case of carbon taxation (though this is often called “environmental” taxation), or an idealised theoretical pollutant;
- to consider only environmental taxes, rather than other MBIs such as grandfathered tradable emission permits (TEPs) and environmental tax-subsidy schemes, and to ignore any resulting problems of political acceptability to interest groups;
- to ignore variations in the marginal costs of environmental control across society and over time; and
- to ignore monitoring and administration costs.

For understandable reasons of modelling convenience, the third and fourth restrictions are almost universal. Yet variable control costs provide the main remaining motive for using MBIs instead of regulation, for the former control pollution1 in a statically and dynamically efficient way. And information costs provide the main obstacle to doing this. With zero information costs, it would be much easier to avoid blocking by interest groups, by allocating emission rights as necessary to win overall political acceptability. So moving a greater proportion of future research effort beyond the above restrictions forms the core of our recommendations.

The next section surveys the history of the double dividend idea as a palliative to carbon taxes. Section 3 sets a broader policy context by classifying five main types of environmental control instruments (regulation, and four MBIs), and Section 4 surveys the current state of the double dividend debate. Section 5 uses the three previous ones to develop recommendations for the choice of MBIs, and for the further research that is needed into them. We also illustrate the importance of a
case-by-case approach by summarising the practical differences between carbon and sulphur control, and Section 6 concludes. None of this is particularly original or exciting, but we feel that the synthesis is important to focus future research on policy relevance, rather than on further refinements of the double dividend debate for their own sake.

2. History of the Double Dividend Debate

The possibility of a static efficiency benefit from using MBIs rather than uniform regulation to control heterogeneous environmental degradation has been central to environmental economics since Pigou (1920), though the dynamic efficiency benefit is a more recent idea (Downing and White 1986). Together, we refer to them as the “efficiency benefits” of MBIs, distinct from any first or second dividends. The static efficiency argument existed independently of mainstream literature on optimal taxation, until Sandmo (1975) showed how to blend the Ramsey rules for taxing commodities according to their (in)elasticities of demand, with the Pigovian rules for taxing them according to their marginal environmental damages. The origins of the double dividend idea lie in a proposition by Tullock (1967) and empirical calculations by Terkla (1984), but the ideas had little impact at the time, and neither paper actually mentioned “dividends”.

Not until the early 1990s was there a surge of papers on double dividends. What triggered the debate, we suggest, was more or less the following chain of events. First, the U.S.A. experienced a severe drought in the long, hot summer of 1988. This brought scientists’ predictions of global warming, caused primarily by cumulative CO₂ pollution, to widespread public attention for the first time. The resulting search for ways to reduce CO₂ emissions then ran into the problem that emissions are pervasive, and no economic technology exists for end-of-pipe CO₂ control. It therefore seemed that controlling CO₂ by regulation was daunting, but taxes on carbon inputs could perhaps bring about pervasive and cost-effective control, by spurring appropriate increases in carbon efficiency by heterogeneous users.

However, calculations soon showed that carbon tax rates, and hence the revenues raised, would have to be huge to achieve anything like the emission reductions that scientists were calling for. Political opposition to the idea of such large transfers of wealth mounted. Little thought was given to the idea of grandfathering tradable permits for carbon, because of the administrative and distributional problems we discuss later. To reduce political opposition, it was therefore argued that carbon tax revenues should be used to significantly reduce existing taxes, and hence the distortionary cost of those taxes. For example:

Governments may then adopt a fiscally neutral stance on the carbon tax, using revenues to finance reductions in incentive-distorting taxes such as income tax, or corporation tax. . . . This ‘double dividend’ feature of a [CO₂] pollution tax is of critical importance in the political debate about the means of securing a ‘carbon convention’ (Pearce 1991).
This idea then caught the interest of public finance economists, and set off a huge technical debate. It has been particularly well developed in Europe, in response to the European Commission’s proposal for a carbon-energy tax. Given rising unemployment in continental Europe, much attention there has also been given to double dividend claims where the second dividend is in terms of extra employment. Two notable features of the debate have been that the double dividend hypothesis is capable of many definitions; and that many contributions claim to be relevant beyond the specifics of carbon dioxide control, to environmental control in general.

The latter feature has been truest for theoretical modellers, who have almost always abstracted from carbon-specific details and analysed a general pollutant, emitted by homogeneous firms, and measurable at zero cost. It has also largely been true of the environmentalists who used the double dividend debate to relaunch the long-standing idea of general ecological (environmental, or green) tax reform (see for example von Weizsacker and Jesinghaus 1992). This is despite the absence of much empirical work on the double dividend outside the CO2 case, and environmental tax reform still has a long way to go in practice. The shares of tax and social security revenues in industrialised countries that are raised by taxes on labour, capital, and environmental resources remained roughly constant over the period 1970-90 at about 50%, 25% and 5%, respectively (EEA 1996, Annex 1).

We suggest a number of reasons for this in what follows.

3. Classification of Instruments of Environmental Control

To set our commentary on the double dividend debate in a broad policy context, we now define five classes of environmental control instruments in a general equilibrium context: regulation, and four types of MBIs. However, the choice of instrument is not always discrete, since there are many hybrid instruments along the dimensions between regulation and MBIs, and between revenue-raising and non-revenue-raising instruments. The list should thus be seen as a sample from a wider, continuous range. We extend Goulder’s (1995, 1997) notation to denote the three main features of each instrument as \((t_E, \Delta t_X, E')\), where:

\[
\begin{align*}
  t_E &= \text{tax rate or permit price per unit of emissions} \\
  \Delta t_X &= \text{change in a pre-existing, distortionary tax on } X; \text{ or perhaps } \Delta T_L, \text{ change in lump sum refunds, or } S_E, \text{ subsidies for emission control} \\
  E' &= \text{general equilibrium emission level resulting from the combined effects of } t_E \text{ and } \Delta t_X, \text{ with } E' \text{ assumed to be below the initial level } E_0, \text{ giving the first or environmental dividend.}
\end{align*}
\]

The status quo is thus \((0, 0, E_0)\). This includes distortionary taxes on capital, labour, etc, which raise a given tax revenue net of environmental expenditures (not shown in the notation). Initial emissions \(E_0\) may or may not be constrained by regulation. For ease of comparison, we constrain all the control instruments to achieve both the same emissions level \(E', 2\) and the same revenue level. A purely
“revenue-retaining” MBI, where the government uses the revenue to increase non-environmental expenditures or reduce borrowing, is therefore excluded. Crucially, we also assume a wide variation in the marginal costs of emission control among emitters, though this does not feature in our discussion till Section 5. The five classes of control instruments are:

1. **Regulation**, \((0, \Delta t_{X1}, E)\), is extra “command-and-control” regulation, assumed to be uniform and either technology-based or emission-based, beyond what is already part of the status quo. The tax change \(\Delta t_{X1}\) is needed to neutralise the general equilibrium effects of the extra regulation on revenues.

2. **Tax-reducing MBIs**, \((t_{E2}, \Delta t_{X2}, E)\), are either emission taxes or auctioned tradable emission permits (TEPs). \(t_{E2}\) is the emission tax rate or permit price which, together with a reduction, \(\Delta t_{X2}\), in the distortionary tax rate, reduces emissions to \(E\), while leaving revenue unchanged. Tax reductions that are commonly analysed are in (a) personal income taxes; (b) corporate income taxes; (c) employment taxes, especially employers’ social security contributions; (d) specific commodity taxes; and (e) general commodity taxes (on sales, or on value added).

Ecological (environmental, or green) tax reform can refer to either one or several tax-reducing MBIs. Auctioned TEPs as well as taxes should in principle have a role in ecological tax reform, but the relevant literature rarely mentions this.

3. A **zero-revenue MBI**, \((t_{E3}, E’, \Delta t_{X3}, E)\), is either a set of grandfathered TEPs equal to new emissions level \(E\), or the often-overlooked combination of a tax rate and free tax allowances \(E’\) equal to \(E\). In either case \(E’\) is treated as a de facto property right, as in the USA’s SO\(_2\) trading programme (Joskow and Schmalensee 1997, note 4), and the net payment by emitters for emissions \(\hat{E}\) is \(t_{E3}(\hat{E} - E’)\). The emission price, \(t_{E3}\), and other tax change, \(\Delta t_{X3}\), jointly reduce emissions to \(E\) with no change in revenue. In ideal circumstances, the tax-plus-allowance has the same short and long run efficiency as a tax or TEP (Pezzey 1992a, where it is called a charge-subsidy).

4. A **hybrid MBI**, \((t_{E4}, E, \Delta t_{X4}, E)\), is a tax \(t_{E4}\), plus tax-free allowance \(E\), set anywhere between zero and emissions \(E\), or any combination of auctioned and grandfathered TEPs which total \(E\), as suggested by Pezzey (1992a).

5. An **environment-subsidising MBI**, \((t_{E5}, S_E, E)\), is a tax \(t_{E5}\) whose revenues are used to subsidise expenditure on emission control by an amount \(S_E\), and thus lower emissions to \(E\). There is no TEP equivalent to this. An obvious concern is that subsidies may distort control efforts towards visible, end-of-pipe technologies and away from broader managerial efforts (Pezzey 1988, p. 220, where the MBI is called a distributive charge).
Table I. Classifying market-based instruments (MBIs) of emission control by method of control, use of any revenue, and emission rights owned (TEP = tradable emission permit)

<table>
<thead>
<tr>
<th>Number and name of MBI (with de facto emission rights owned by emitter in brackets)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tax-reducing MBI (none)</td>
<td>Zero-revenue MBI (final emission level)</td>
<td>Hybrid MBI (intermediate)</td>
<td>Environment-subsidising MBI (ambiguous)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Method of control</th>
<th>By price</th>
<th>Emission tax + lower distortionary tax</th>
<th>Emission tax + tax-free allowance + lower distortionary taxes</th>
</tr>
</thead>
<tbody>
<tr>
<td>By auctioned quantity</td>
<td>TEPs</td>
<td>TEPs</td>
<td></td>
</tr>
</tbody>
</table>

Many further variants of MBIs are possible (see for example Sterner and Hoglund 1998, and Vollebergh et al. 1997), but we restrict ourselves to the above selection. Table I now classifies them, according to their method of control, and their use of revenue and thus the de facto emission rights they embody. The result is a more comprehensive set of MBIs than listed by either Pezzey (1988) or Hahn (1989).

We have used different terminology ("tax-reducing", etc) from the emerging convention, used for example by Goulder, Parry and Burtraw (1997) (GPB), for the following reasons. GPB call both instruments (1) and (3) "non-revenue-raising (NRR)", but we want to distinguish regulation from zero-revenue MBIs. GPB call instrument (2) "revenue-raising (RR)", but do not consider instruments (4) and (5). Each of (2), (4) and (5) raise revenue which is neutralised somehow, so we will call them all revenue-neutral.

Other names for revenue-neutrality are earmarking or hypothecation. Tax-reducing or hybrid MBIs are only weakly hypothecated, since government claims that their revenues will result in lower general taxes on labour or capital are hard to verify. However, such promises can sway a political debate, as with the introduction of a weakly-hypothecated landfill tax in the UK (Powell and Craighill 1997). By contrast, an environment-subsidising MBI would be strict hypothecation if all the tax revenue raised, net of administration costs, is legally bound to be spent on the subsidy scheme. Such schemes are quite common in continental Europe (EEA 1996), but not in the UK, where they are felt to impose too great a restriction on the efficient allocation of public expenditures (Spackman 1997).
4. The State of the Double Dividend Debate

Firstly, note in more detail the various “currencies” in which the double dividend debate is transacted. The most common, used throughout Goulder (1995, 1997), on which much of this section is based, is a representative-agent measure of individual welfare or utility derived from consumption, leisure and environmental quality, which ignores distributional equity. By contrast, some papers include different income classes of agent, and either maximise a Bergson-Samuelson social welfare function with an aversion to income inequality (for example Proost and van Regemorter 1995; Mayeres and Proost 1997), or at least note any equity effects of policies (for example Bovenberg and de Mooij 1994b; Bovenberg 1997).

A common alternative currency, especially in continental Europe, is employment (see for example Carraro, Galeotti and Gallo 1996; and Majocchi 1996), and other currencies, used only by empirical models, are output and output growth. None of these can be used to measure environmental improvements. For simplicity, we focus here on the individual or social welfare, and pay little further attention to papers covering effects on employment, output or growth, which can be opposite in sign to effects on welfare. Though this omits a fair portion of the double dividend literature, as reviewed by Park and Pezzey (1998), it loses little in terms of discussion of instrument choice and political economy.

With \( W(.) \) as the aggregate welfare function, the \textit{weak} form of the double dividend claim is that \( W(t_{E2}, \Delta t_{X2}, E' > W(t_{E2}, \Delta T_L, E) \), also known as the “revenue-recycling effect”.3 That is, welfare is raised by using the revenue of the environmental tax \( t_{E2} \) to lower the distortionary tax by \( \Delta t_{X2} \), instead of to give taxpayers lump sum subsidies of \( \Delta T_L \). In individual terms, this weak claim is true by the normal definition of a distortionary tax, though it may be false socially, since tax cuts and lump sum subsidies fall on rich and poor people in different ways.

The \textit{strong} form is that \( W(t_{E2}, \Delta t_{X2}, E') > W(0,0,E) \). That is, there is an economic benefit from the revenue-neutral substitution of a new environmental tax \( t_{E} \) for a change \( \Delta t_{X2} \) in a typical distortionary tax. If this is true, then a move to a tax-reducing MBI is desirable, whatever the (non-negative) size of the environmental dividend, though this leaves undefined how the target level of emissions \( E' \) should be chosen. Starting with Bovenberg and de Mooij (1994a), there has been intense academic debate over the strong form. There is some support for a positive dividend in terms of GDP or employment from the empirical literature, though Schob (1996) and Goulder (1992) provide counterexamples.

Though the theoretical literature sometimes supports the strong claim in welfare terms (see for example Nielsen et al. 1995), in general it does not. The general consensus is that the strong double dividend can arise only in special, questionable circumstances. Switching from labour or capital taxation to environmental taxation narrows the tax base from which a given revenue can be raised, thus requiring a higher environmental tax rate and giving rise to a negative “tax-interaction effect”.4 Together with what would be the cost of a revenue-neutral environmental tax with no other prior taxes present, this outweighs the revenue-recycling effect, unless
substantial changes in the income distribution currently achieved by very inefficient, distortionary taxation are acceptable (Bovenberg and de Mooij 1994b; de Mooij 1998). If they are not, the only way to justify a double dividend proposal is if combining environmental reform with an existing need for general tax reform. In this way one can build a winning political coalition, where two separate reform campaigns would fail.

The justification would therefore vanish if general tax reform is impossible because of good political (i.e. distributional) reasons for existing inefficiencies in the tax system. Many of these reasons ultimately derive from information costs, for consider what would happen with zero information costs. People’s inherent talents could be known directly rather than through their achievements, so that socially equitable, non-distorting lump sum taxes could be widely used. Human capital markets would work much better, reducing the need for public expenditure on education. Many other public goods, and the need for welfare-distorting revenues to pay for them, would be eliminated. Hence the importance we attach below to research on information costs.

As for the policy agenda considered by the double dividend literature, most of it considers just the move from the status quo (0) to a tax-reducing MBI (2) (Park and Pezzey 1998). And most of it ignores explicit interest group issues, although many writers would acknowledge equity concerns as the main reason for not being able to use lump sum taxes, and hence having distortionary taxation in the first place.

Some exceptions to the first observation are Bovenberg and de Mooij (1994b), who considered the use of a pollution tax with tax-free allowances (a zero-revenue or hybrid MBI); Bovenberg and de Mooij (1994c, p. 11 and p. 18), who considered both abatement subsidies (an environment-subsidising MBI) and free pollution permits (a zero-revenue MBI); and Carraro et al. (1996), who considered technology subsidies. As for interest groups, Nielsen et al. (1995, p. 203) noted the shift in property rights in going from regulation to pollution taxes, though they did not consider this any political obstacle. Nevertheless, we still hold that the broad thrust of the double dividend debate has been towards technical questions of model design and general equilibrium effects, and away from questions of instrument choice and the political economy of interest groups.

5. Implications for the Broader MBI Debate

5.1. TO RAISE OR NOT TO RAISE REVENUE? OR, THE BEST AS THE ENEMY OF THE GOOD?

What can be said about the future use of MBIs, and research into them, in the light of the above? The clearest, and most disheartening, conclusion to be drawn from the double dividend debate is that the tax-interaction effect is pervasive, and can greatly reduce the welfare benefit that any environmental control can achieve. And somewhat paradoxically, the overall outcome is worse for an MBI which raises no revenue, since there is then no revenue-recycling effect to offset the tax interaction.
Bovenberg and Goulder (1996, p. 990) showed that marginal welfare costs would be two to three times higher in the USA for a zero-revenue (lump sum replacement) carbon tax than for a tax-reducing (personal income tax replacement) carbon tax. So returning revenues lump-sum greatly increases the chance that any positive carbon tax will reduce net welfare at the margin, a result shown by Pezzey (1992b, p. 33) using a simple numerical model, and stressed by Goulder, Parry and Burtraw (1997).

Nevertheless, we recommend shifting some research effort away from tax-reducing MBIs towards zero-revenue, hybrid or environment-subsidising MBIs (see Table I), and thus away from the double dividend debate proper. This is for a minor and a major “equity” reason. The minor reason has already been mentioned: tax reductions tend to favour the rich, and thus make income distribution less equitable.

The major reason is that tax-reducing MBIs regrettably face an overwhelming political problem, already hinted at above. Pure emission taxes or auctioned tradable emission permits the transfer of large sums of money away from emitters. Existing, regulated levels of emissions tend to be regarded as de facto rights, and will be defended politically by the interest groups which benefit from them (Pezzey 1988; Hahn 1989). These include both major emitters, and their factor suppliers and customers to whom some of the transfer costs will be passed, depending on the relevant elasticities (Cramton and Kerr 1997). Even if a tax-reducing MBI achieved a strong double dividend, this resistance to changes in interest-group (rather than income) distribution would still be there, which is why pure Pigovian taxes or auctioned permits have never been adopted for emission control.

To this extent, much of the double dividend debate has therefore been directed at revenue-raising ideas which would never be politically viable anyway. To continue campaigning for a welfare-maximising, but politically unattainable, tax-reducing MBI therefore risks making the best into the enemy of the good. It may spoil the chance of moving to whatever welfare-improving MBI, such as grandfathered or partly-grandfathered TEPs, or a small emission tax hypothecated for environmental subsidies, is the best compromise between maximising aggregate welfare and achieving political acceptability. Ultimately, the only good welfare-improving schemes are accepted ones.6

5.2. OLD AND NEW TOPICS FOR CONTINUING RESEARCH: EFFICIENCY BENEFITS, ENVIRONMENTAL VALUATION, TAX INTERACTIONS, AND INFORMATION COSTS

Having chosen MBIs other than tax-reducing ones, what are the main topics that remain for economists to research? There are three old ones, and one new one added by the double dividend debate, which together form the element of the necessary cost-benefit analyses.
The first, old research topic is to measure the efficiency benefits of MBIs. This unglamorous, empirical task has been done for relatively few cases of major water and air pollutants (e.g. SO$_2$ in the USA), and in any case it changes over time as technology advances. In particular, dynamic efficiency effects remain poorly quantified: relatively little is known about just how much having to pay a price for pollution spurs on better control technologies. Measurement is important, for without efficiency benefits, thanks to what we now know from the double dividend debate, there is much less case for using MBIs instead of conventional regulation to improve the environment. The extra distortion in favour of leisure created by MBIs (an underlying reason why the strong double dividend fails) will always cause a \textit{ceteris paribus} reduction in conventional welfare. Only by stepping towards applied psychology could one regard this distortion as welfare-improving, because it might counterbalance the distortion in favour of consumption created by pervasive relative income effects (Boskin and Sheshinski 1978).

The second, also old, research topic is as in Goulder (1997). With no strong double dividend, the benefits of environmental improvements need to be valued better, if by no means perfectly.

The next, new research topic is to include the general equilibrium, tax-interaction effect when calculating the marginal welfare costs even of quite small MBIs, which can have a dramatic effect on optimal tax/subsidy rates. A further, important question is if it can have a similar effect on the size of efficiency benefits. To our knowledge, none of the double dividend literature has addressed this question, even in theory. Our intuition says No, but general equilibrium effects can often be counterintuitive.

The last, old topic is to measure all the information costs of MBIs in comparison with regulation, which are a pure deadweight loss. This is where our preferred, alternative MBIs may score poorly, since there will be extra costs of establishing the ownership and monitoring the use of the de facto emission rights implicit in them. (Think for example of the administrative difficulty of creating rights to peak hour road space.) In addition, choosing which income, business or geographical sector is to receive rights may result in wasteful rent-seeking activity. This is especially true when the value of such rights would be or is substantial, as discussed for grandfathered tradable permits in carbon (Cramton and Kerr 1997) or sulphur (Joskow and Schmalensee 1997), two pollutants considered in more detail below.

A good example of the pragmatic kind of research needed is Fullerton and Kinnaman’s (1996) study of household responses to pricing garbage by the bag. The environmental cost of garbage depends more on weight than volume, but garbage was charged by the bag to avoid the information costs of weighing. The result was that households stomped more rubbish into each bag, total garbage weight was little reduced, illegal dumping increased, and the net benefits of avoided landfill were judged less than the administrative costs of bag pricing. Contrast this with Mayeres and Proost (1997), the sophistication of whose general equilibrium model of transport congestion prevents them from including any administrative
costs of a congestion tax, or from distinguishing among vehicle consumption, fuel consumption and road use as tax bases. Both approaches are useful and necessary.

5.3. THE IMPORTANCE OF POLLUTANT-SPECIFIC FACTORS: COMPARING CARBON CONTROL WITH SULPHUR CONTROL

As a more detailed example of why MBIs need to be researched on a case-by-case basis, consider the practical differences between CO₂ control and SO₂ control, as set out in Table II.

Consider carbon control first. Because carbon is a valued commodity, a tax-reducing MBI would create a gap between the net price that carbon buyers pay and the net price that carbon sellers receive. The initial revenue transferred to the government (to be recycled as tax cuts), equal to the gap times the amount of taxed carbon sold, would be enormous. The initial burden of the transfer would fall on both buyers and sellers, according to the relative slopes of demand and supply. And because carbon-containing goods are widely traded with countries who might not control CO₂, unilateral reductions in emissions would mainly cause painful reductions in output and employment in carbon-intensive sectors, rather than higher CO₂ efficiency. Both effects would generate fierce political resistance.
Trying to avoid the revenue transfer would still run into political or administrative problems. Politically, the most attractive option would probably be to use a zero-revenue MBI to give emission rights to carbon buyers, which would reduce the net price they pay for carbon. But this would be administratively impossible, because almost every adult buys carbon, and many purchases (e.g. of motor fuel, and domestic coal) are completely unmonitored. Vollebergh et al. (1997) suggested solving the administrative problem by giving emission rights only to large, thus administratively-manageable buyers (such as large, carbon-intensive firms), but whether this is politically viable remains to be seen.

The alternative of giving all emission rights to carbon sellers, such as the major oil, gas and coal companies, is viable administratively, yet it still produces competitive markets, which is important if grandfathered TEPs are the MBI chosen (Cramton and Kerr 1997). But it is even less palatable politically, since it would transfer a significant percentage of GDP to these companies, and their upstream and downstream trading partners. A similar dilemma occurs internationally with carbon taxes, as the regional incidences of taxes on carbon producers and on carbon consumers are very different (Whalley and Wigle 1991).

A third alternative would be the hybrid approach of giving some carbon rights to sellers, and retaining some for the state. The initial, partial equilibrium impacts of this are shown for a TEP system in Figure 1. \( E_g \) permits are grandfathered to sellers, and the remaining \( (E_0 - E_g) \) are auctioned. The pre-control carbon price is \( P_0 \), and after reduction of emissions from \( E_0 \) to \( E' \), the demand price rises to \( P_d \) and the supply price falls to \( P_s \). The proportion of grandfathering \( E_g/E_0 \) can be used to optimise the political balance of the taxpayer’s net revenue \((P_d - P_s)(E_0 - E_g)\) and the carbon sellers’ net revenue \((P_d - P_0)E_g - (P_0 - P_s)(E_0 - E_g)\). But buyers of carbon are still clear losers by an amount \((P_d - P_0)(E_0 - E_g)\), since they all face a higher buying price. So there is no workable yet painless option for “full-price” carbon control. This explains the attraction of the “low-price” alternative of an environment-subsidising MBI: a modest tax whose revenues are used to subsidise innovation and diffusion of carbon-efficient technologies, thus shifting down the demand curve for emissions and reducing the costs of control. In all cases a full general equilibrium study would also be desirable to find the ultimate incidence of the MBIs by income class, though this would not show the initial impacts on interest groups.

These complications do not arise to anything like the same extent with SO₂, as is shown by the existence of tradable SO₂ allowances in the USA since 1990 (reviewed by Stavins 1997 and Joskow and Schmalensee 1997). Table II showed that a very high proportion of emissions come from large sources, so that the administration cost of granting SO₂ rights to most buyers of sulphurous fuels is manageable. (The alternative of giving sulphur, rather than SO₂, rights to fuel sellers would have been not just administratively unnecessary, but also inefficient, since it would remove any incentive to use flue scrubbers. So it was not even contemplated.) There were one-off, rent-seeking costs to buyers before the scheme was set up, and there are continuing costs to the sellers of high-sulphur coal, as some
buyers switch to low-sulphur coal (Joskow and Schmalensee 1997). But because the cost of sulphur control is a fairly small part of production costs, and the major sulphur-using product (electricity) is little traded internationally, both these costs have proved economically and politically manageable.

This illustrates the lack of any simple rule for choosing the best instrument to control a particular pollutant. Raising some revenue from carbon control seems administratively unavoidable, so it is sensible to draw attention to the welfare benefits of recycling revenue, even if the strong double dividend claim is dropped. But raising revenue from sulphur control can be avoided, and it is significant that few US commentators after Terkla raised double dividend arguments in support of using taxes or auctioned tradable permits for SO₂ control.

6. Conclusions

Our review of market-based instruments (MBIs) of emission control in the context of the double dividend debate has yielded several conclusions. None is very novel or exciting, but they are all worth stating in our view, given the amount of research effort which could be relatively unproductive in policy terms if they are ignored. Firstly, the instrument which could theoretically maximise aggregate welfare should almost certainly not be chosen. It will probably be a tax-reducing MBI, such as a tax or auctioned tradable permit, raising large revenues which are returned to taxpayers as reductions in pre-existing distortionary taxes. But raising large
revenues would face powerful resistance from the interest groups who initially have to pay them. Welfare benefits are achieved only if an instrument is used, and it will not be used if is not politically acceptable. A zero-revenue, hybrid or environment-subsidising MBI, such as grandfathered or partly-grandfathered tradeable permits, or a pollution tax hypothecated for emission control subsidies, is much more likely to be acceptable.

Secondly, the double dividend debate has weakened the overall case for further environmental control, because of general equilibrium interactions with existing distortionary taxes which had previously been ignored. In some cases it is even questionable whether control below free market levels is desirable at all, even though environmental damage is being caused at the margins. Case by case, intellectually unglamorous but vital, empirical research will therefore be needed to better estimate the benefits of further control using MBIs (the value of environmental improvement, and of controlling heterogeneous emissions in an efficient way), and the costs (the general equilibrium tax-interaction effects, and the information costs of creating and monitoring the emission rights inherent in some MBIs). Attention must be paid to cost impacts on interest groups, as well as to the ultimate incidence of costs on income classes. Information costs are a fundamental cause of the need for public expenditures and the inability to fund them equitably by lump sum taxes, so a wide variety of information costs of MBIs should also be researched. The best overall instrument may be very different for different pollutants, as illustrated by a comparison of carbon and sulphur control.

Overall, some research effort should be shifted away from the intricacies of double dividend models which find it difficult to include the efficiency benefits of market-based control of diverse polluters, information costs, and the political resistance to raising revenue; and towards measuring the benefits and costs of acceptable instruments which can actually achieve welfare gains.

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Notes

1. We use “pollution” or “emissions” here to mean all forms of environmental degradation.
2. One could instead constrain the instruments to keep emissions constant. However, to avoid localised increases in emissions which might result in practice, MBIs are usually considered only when total emissions are reduced. Optimality would actually require different emissions levels for each instrument.
3. Strictly speaking, either $t_t E_2$ or $E'$ should also change, because of the second order general equilibrium effect of replacing $\Delta t_t X_2$ by $\Delta T_t$, but we ignore this here.

4. General equilibrium interactions such as cross-price effects between emissions and the taxed quantity $X$ can also cause a negative first dividend (i.e. higher emissions in response to the environmental tax, or $E' > E_0$ in our notation) in some theoretical cases (Bovenberg and de Mooij 1994b; Schob 1996). However, we are not aware of any convincing empirical examples of a negative first dividend for sensible levels of the environmental tax.

5. However, neither of these interesting features appeared in the published version (Bovenberg and de Mooij 1997).

6. The introductions of carbon or energy taxes in Denmark and The Netherlands in 1996, kindly conveyed by a referee, provide useful illustrations of these points. In the Danish case, a substantial amount of the revenues was returned through technology subsidies to the industries paying the tax. In the Netherlands, a minimum level of household gas and electricity use was exempt from taxation, which kept tax incentives at the margin but avoided raising large revenues.

References


