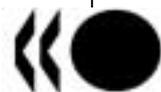


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**ENVIRONMENTAL TAXES AND COMPETITIVENESS: AN OVERVIEW OF ISSUES, POLICY
OPTIONS, AND RESEARCH NEEDS**

This paper, prepared by Prof. Stephen Smith of University College, London, gives an overview of issues and policy options concerning competitiveness and environmentally related taxes, and offers some suggestions on further research needs.

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FOREWORD

The 2001 OECD Ministerial Council Meeting identified Sustainable Development as an overarching objective for the organisation and its Member countries. To promote such a development OECD was asked help Member countries addressing how to overcome obstacles to a wider use of economic instruments in environmental policy, and the fear of loss of sectoral competitiveness has been identified as one of the main obstacles in this regard.

This paper, prepared by Prof. Stephen Smith of University College, London, gives an overview of the issues and policy options concerning competitiveness and environmentally related taxes, and offers some suggestions on further research needs. The author emphasises that the paper should be considered as “work in progress”, not as a finalised document.

The paper is being issued under the responsibility of the Secretary General of OECD.

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ENVIRONMENTAL TAXES AND COMPETITIVENESS:

An overview of issues, policy options and research needs

EXECUTIVE SUMMARY

Possible adverse effects of environmental taxes on sectoral and national competitiveness have been a major concern.

The possibility that environmental taxes would have adverse effects on sectoral and national competitiveness has been a major concern of policy-makers and industry. This paper provides an overview of key issues, discussing the concept of competitiveness, the channels by which environmental taxes and other environmental policy instruments might affect competitiveness, and the scope for policy responses to deal with competitiveness problems without undermining the benefits of the market-based approach. Areas where further research would potentially be useful are highlighted.

For an enterprise, competitiveness is about producing products that are cheaper or better than those of other firms. Applying the concept to industrial sectors or to whole economies is more controversial.

The term competitiveness is widely used in discussion of the effects of ecotaxes on individual firms, industrial sectors and the entire economy. At the level of an individual business enterprise, competitiveness is primarily a matter of being able to produce products that are either cheaper or better than those of other firms. Applying the concept of competitiveness to industrial sectors or to whole economies is more controversial. One key reason is that it is necessary to take account of the macroeconomic adjustment mechanisms (such as exchange rate changes) that would be prompted by a deteriorating trade balance, or rising output prices. The principle of comparative advantage implies that a country can always trade successfully in some commodity, even if its firms are inefficient (or burdened with environmental taxes or regulations), while the same is not true of an individual business enterprise. Whether environmental taxes harm a country's competitiveness might then be gauged by whether they require a fall in the country's exchange rate, to restore macroeconomic balance.

The impact of environmental taxes depends on the starting point, and on the comparison being made.

The effects of environmental taxes on the competitive position of individual firms, and on the performance of an economy in aggregate, will arise through a complex set of channels. The impact of environmental taxes clearly depends on the starting point, and on the comparison implicitly or explicitly being made. For example, are the effects of environmental taxes being assessed against a zero-policy baseline, or are they being compared with alternative policy instruments with equivalent environmental effect?

If environmental taxes replace existing, command-and-control measures with an equal environmental impact, the burden of environmental compliance may be lowered.

One relatively simple context for assessing the competitive effects of environmental taxes is where the environmental taxes replace existing, command-and-control environmental policy measures with an equal environmental impact, and where the revenues raised from the environmental tax are used to permit an equal-revenue-reduction in a pre-existing, origin-based sales tax. In these circumstances, the overall tax burden on firms is unchanged, and the aggregate burden of environmental compliance (costs of pollution abatement) may be lower, because of the efficiency gains from using market mechanisms rather than command-and-control regulation. Individual firms may experience a loss in competitiveness due to higher taxes and/or higher abatement costs, but other firms gain at least as much.

There is a range of complications to the analysis.

There is a range of complications to this initial analysis that need to be considered, including possible environmental effects on competitiveness, and the "double dividend" gains from using the revenues to reduce existing distortionary taxes.

It can be better to use an environmental tax or auctioned tradable permits than to allocate permits through a non-revenue-raising "grandfathering" procedure.

The paper provides a framework for comparing the competitiveness implications of different environmental policy instruments - environmental taxes, tradeable permits, and command-and-control regulations - in the form of a diagram, showing the effects on competitiveness of substituting one instrument for another. In general there are some very close similarities between instruments. While concerns about the possible adverse effects of environmental taxes on competitiveness have been particularly prominent in policy debate in many OECD countries, the differences between environmental taxes and other instruments are less clear-cut than this debate often assumes. One important policy conclusion is that, in terms of competitiveness, it will generally be preferable to employ an environmental tax (or, equivalently, auctioned tradable permits), and use the revenue raised to reduce the rates of existing, distortionary, taxes on business, than to allocate permits through a non-revenue-raising "grandfathering" procedure.

Revenue recycling, differentiated tax rates, border tax adjustments and international co-ordination can be used to mitigate adverse effects on sectoral competitiveness.

A number of strategies may be used to mitigate adverse effects of environmental taxes (and similar instruments) on sectoral competitiveness:

- Revenue recycling, targeted on measures that would reduce business tax burdens. The key issue here is how to alleviate the impact on competitiveness without significantly reducing the incentive to abate.
- Sectoral exemptions, or differentiated ecotax rates across sectors.
- Border tax adjustments. To the extent that ecotaxes place domestic firms at a disadvantage in competition with foreign firms that do not have to pay similar ecotaxes, this disadvantage could, in principle, be neutralised by charging taxes on imports and rebating taxes on export.
- International co-ordination, to ensure that, when environmental taxes are introduced, competing firms abroad also face similar taxes.

More research could address how revenue recycling affect firms' decisions about production and investment; impacts of combining taxes with abatement subsidies; impacts on overall abatement cost of shielding industrial plants from closures; etc.

The paper concludes with some observations on issues concerning competitiveness where the research community may be able to make a contribution to the development of more effective policy. These include:

- a) The implications for business of sectorally-targeted ecotax packages involving arrangements for recycling of revenue. How does recycling affect firms' decisions about the level of output, investment, closure, relocation, etc?
- b) The implications of employing pollution abatement subsidies as a supplement to environmental taxes.
- c) The relative merits of using ecotax revenues to reduce factor taxes (e.g. income tax, payroll taxes, etc), as compared with sales taxes.
- d) Criteria for defining "sectors" for the purposes either of selective exemptions from ecotaxes, or in order to devise revenue-recycling regimes for particular sectors.
- e) Economic issues in the definition and calculation of border tax adjustments to offset competitiveness effects.
- f) The significance of industrial plant closures in achieving cost-effective pollution reduction, both generally and in particular sectors. If we minimise effects on competitiveness, do we also shut off one of the most important channels to environmental improvement?

1 Introduction

1. This paper discusses a range of issues concerning the impact of ecotaxes and other environmental policy measures on sectoral and national competitiveness. The possibility of adverse effects on competitiveness has been a major concern of policy-makers in considering possible applications of ecotaxes to energy and other commodities associated with environmental problems. At the same time, there is perhaps scope for greater clarity about the nature of the issues concerning competitiveness, and the extent to which the range of available policy responses can deal with competitiveness problems without undermining the benefits of the market-based approach.

2 The concept of competitiveness

2. As a preliminary, it is useful to start by defining what is meant by "competitiveness". The term is widely used in discussion of the effects of ecotaxes on individual firms, on industrial sectors and on the entire economy of a country. Frequently, the same concept appears to be applied interchangeably, with apparently little distinction in meaning, at these different levels of analysis. There are, however, important differences between "business" and "national" competitiveness. Indeed, the use of the concept of competitiveness at the level of whole economies is controversial, and is scorned by some economists (see, for example, Krugman, 1994).

3. At the level of an individual business enterprise, competitiveness is primarily a matter of being able to produce products that are either cheaper or better than those of other firms. Ultimately, business competitiveness is a matter of *relative* performance. The impact of environmental regulation, whether in the form of conventional "command-and-control" measures or market mechanisms such as ecotaxes, may be complex, and may well vary between firms. Although pollution control requirements will generally increase business costs (except from a starting point of inefficiency, or other market failure), some firms may be affected significantly more than others, and it is conceivable that there would be a number of firms which would benefit (in terms of profitability) from environmental regulation - including firms which gain "first mover" advantages, or which may gain marketing benefits from a "green" image. It is relatively uncontroversial that some firms can benefit from undertaking more rigorous environmental protection. A more controversial claim is that made by Porter and van der Linde (1995) that whole economies can enhance their competitiveness through more stringent environmental standards.

4. It is perhaps often assumed that sectoral or national competitiveness can be interpreted simply as the economy-wide counterpart of the competitiveness of individual business enterprises. However, there are key differences between firms and economies. The principle of comparative advantage implies that a country will always trade successfully in some commodity, no matter how inefficient its firms are (or how burdened with environmental taxes or regulations), while the same is not true of a business enterprise.

5. A widely-used definition of a country's competitiveness, apparently originating in US government policy documents, was set out in an OECD report on technology policy (OECD, 1992). This defines a country's competitiveness as "the degree to which it can, under free and fair market conditions, produce goods and services which meet the test of international markets, while simultaneously maintaining and expanding the real incomes of its people over the longer term." A similar definition is employed by Charnovitz (1993) in his discussion of environmental trade measures.

6. An alternative definition, which makes explicit some of the elements underlying the requirement to "maintain" real incomes, is employed by Boltho (1996), who defines competitiveness as "the level of the real exchange rate which, in conjunction with appropriate domestic policies, ensures internal and (broadly-defined) external balance." This definition then naturally leads to a definition of a change in

competitiveness as the requirement for a change in the real exchange rate in order to maintain internal and external balance, and it suggests that the change in competitiveness could be measured by the size of the real exchange rate change needed to restore internal and external balance.

7. Ultimately, then, the question as to whether environmental taxes, or other environmental policy measures, have adverse effects (or beneficial effects) on a country's competitiveness can be judged by whether they give rise to a need for a fall (or rise) change in the real exchange rate in order to restore internal and external balance.

8. Jaffe et al (1995), in their discussion of the impact of environmental regulation on the competitiveness of US manufacturing, look at the issue of competitiveness solely from the perspective of external balance, and are primarily concerned with identifying a definition of competitiveness that can be used in empirical work. They note that the concept of competitiveness might be considered most naturally in the context of an analysis of trade flows (or, empirically, the commodity pattern of net exports) in terms of comparative advantage. Countries export the commodities in which they have a comparative advantage and import those in which they are at a comparative disadvantage. They then define the impact of a policy (such as environmental regulation) on competitiveness as the effect that the policy would have on net exports holding real wages and exchange rates constant. They observe that *"we would wish to measure the reduction in net exports 'before' any adjustments in the exchange rate (and hence in net exports of other goods) have taken place, because other industries whose net exports increase to balance a fall in exports should not be thought of as having become more competitive if their export increase is brought about solely by a fall in exchange rates. Similarly we should not construe an increase in exports brought about solely by a fall in real wages as an increase in 'competitiveness'."*

9. They note, however, that the difficulty with this definition is that it turns on a "counterfactual" simulation, in which the policy is imposed while all other variables are held constant. Although a structural econometric model relating net exports, wages and exchange rates might in principle be estimated, and then used for such a counterfactual simulation, they report that they have not identified any model which could be used for this purpose, and they doubt that such a model could be estimated with data of the quality available. In the absence of a model or data to study competitiveness using their ideal definition, they note that a number of less satisfactory, but more practical, indicators of competitiveness (or of change in competitiveness) might be employed:

- the change in net exports of goods subject to more and less stringent regulation
- a shift in the location of production of pollution-intensive goods away from countries with the most stringent regulation
- a shift in the pattern of investment away from locations with stringent regulation
- an adverse effect of regulation on measured productivity.

10. The Jaffe et al "ideal" definition of competitiveness in terms of the effect on net exports holding real wages and exchange rate constant provides a coherent definition of competitiveness, both at the sectoral and the economy-wide level, but one that is, as they note, empirically problematic. If we are primarily interested in the impact of policy measures on living standards across the economy as a whole, then the Boltho definition seems appropriate. However, it will often be the case that the scale of required sectoral adjustment will be the real focus of interest when discussing issues of competitiveness at the sectoral and economy-wide level. The sectoral impact of a particular policy measure might then simply be measured as the impact on sectoral net exports after adjustment in the exchange rate.

11. The counterpart concept, in the case of the European economies that are members of the European single currency, and for other economies with fixed exchange rates, is that the effect of policy measures on competitiveness might be measured after adjustments in real wage levels. Since these are likely to take place over a protracted adjustment period, this implies that the effect of policy measures on sectoral competitiveness will change over time. The initial impact of ecotax measures on sectoral competitiveness in such an economy may be larger than with floating exchange rates, and might then be expected to decline over time, as adjustments of real wage rates started to re-equilibrate the external sector of the economy.

3 Analysing the effects of environmental taxes on competitiveness: Key issues

12. The effects of environmental taxes on the competitive position of individual firms, and on the performance of an economy in aggregate, will arise through a complex set of channels which this section of the paper seeks to describe. An important function of this discussion is to clarify the range of effects that need to be considered in any particular context. The impact of environmental taxes clearly depends on the starting point, and on the comparison implicitly or explicitly being made. For example, are the effects of environmental taxes being assessed against a zero-policy baseline, or are they being compared with alternative policy instruments with equivalent environmental effect? In the former case, possible effects of environmental quality on competitiveness need to be considered, while they do not arise in the latter. Clarity about the policy context of the analysis is essential, if the full range of relevant effects are to be identified.

13. Section 3.1 describes the basic mechanisms through which environmental taxes might affect a firm's costs, and hence the price at which it can sell its output in the international market. It looks at the competitive effects of environmental taxes in what is probably the simplest context - where the environmental taxes replace existing, command-and-control environmental policy measures with an equal environmental impact, and where the revenues raised from the environmental tax are used to permit an equal-revenue-reduction in a pre-existing, origin-based sales tax. In these circumstances, the use of environmental taxes has implications for the competitive position of individual firms arising through the *redistribution* of the tax burden, and the *redistribution* of the costs of environmental compliance ("abatement costs"). Some firms gain, and others lose. In aggregate, if the revenues from the environmental tax fund tax reductions elsewhere, the overall tax burden on firms is unchanged. The aggregate burden of environmental compliance may be reduced, if the tax incentives lead to a more efficient pattern of abatement across firms.

14. Section 3.2 then discusses a range of complications to this initial analysis. These include the possibility of a "double dividend" effect from the use of environmental taxes, and the implications of the "double dividend" argument for the issue of competitiveness are discussed in more detail in Section 3.3.

15. Section 3.4 then provides a framework for comparing the competitiveness implications of different instruments - environmental taxes, tradable permits, and command-and-control regulations. Figure 1 summarises the differences between these instruments in terms of their impact on competitiveness. In general there are some very close similarities between instruments. While concerns about the possible adverse effects of environmental taxes on competitiveness have been particularly prominent in policy debate in many OECD countries, the differences between environmental taxes and other instruments are less clear-cut than this debate often assumes.

3.1 *Costs, taxes and competitiveness*

16. As a starting point for assessing the impact of environmental taxes on competitiveness, this section outlines some of the general mechanisms that may be involved. The main focus is on the impact of environmental taxes, and other related policy adjustments, on firms' costs. An environmental tax on energy, for example, would increase the production costs of firms depending on their energy use. Firms with the most energy-intensive production techniques would generally bear a higher burden, in additional taxation and/or abatement costs, than firms with less energy-intensive production activities.

17. As discussed in OECD (2001), the effect of an increase in a firm's costs on the price that it charges for its output will depend on market structure. Firms which sell a homogeneous product in a perfectly competitive market will be price takers, and have no opportunity to pass on additional costs to customers in the form of higher prices. Additional costs will be reflected in reduced profits, and for some firms may lead to losses, and hence exit from the market. Firms which have a degree of market power (either because they are selling a homogeneous product in an oligopoly or monopoly market, or because they are selling differentiated products) will be able to pass on additional costs to a certain extent in higher prices. There may be less exit, and reductions in sales may be more widely spread across firms.

18. It should also be noted that the impact of environmental taxes on the product market may vary depending on whether the taxes, and consequent adjustments, affect variable costs of production or fixed costs. A range of cases might be considered. One plausible scenario might be where environmental tax payments are a function of output, but abatement expenditures take the form of fixed costs. Polluting emissions might be broadly related to the level of production activity, and so, in the absence of pollution abatement, payments of a well-targeted environmental tax would be a function of output. On the other hand, the available technologies for pollution abatement might take the form of capital investments (fitting filters to discharge pipes, for example). Abatement costs would then add to fixed costs rather than variable costs.

19. Assessing the impact of environmental taxes on competitiveness requires clear specification of the counterfactual: what is the alternative "baseline" policy against which the impact is being assessed? Two dimensions are particularly relevant:

- ***the impact on the government budget:*** is the comparison done on a revenue-neutral basis, or are tax revenues assumed to be higher with the environmental tax than in the baseline case? Generally, comparisons need to be made on a revenue-neutral basis, or else the effects will be substantially complicated (and perhaps dominated) by the macroeconomic impact of the change in the government deficit.
- ***the impact on the environment:*** is the comparison between two equivalent ways of achieving a given standard of environmental protection, or does the level of environmental protection vary between the two scenarios? This choice is perhaps less critical to the assessment of the effect on competitiveness, since the effects are primarily confined to the sectors in question, and there are fewer economy-wide or general equilibrium effects than with a change in the budget deficit. (The main exception would be where the state of the environment has significant effects on the productivity of other significant sectors of the economy, such as agriculture or tourism).

20. The most straightforward case to begin with is to analyse the effects on competitiveness of the revenue-neutral introduction of an environmental tax on industrial emissions to replace an existing uniform commodity tax. As noted above, the revenue-neutral context means that we do not need to consider macroeconomic effects arising from changes in the government deficit. The specification of the tax which the environmental tax will replace as a uniform commodity tax (i.e. a general sales tax or VAT on goods

and services) means that we can look at the problem as a matter primarily of the redistribution of the tax burden between different firms or industrial sectors, and can avoid the complications that would arise if taxes on factor incomes were to be adjusted.

21. Also, again for simplicity, we assume initially that the commodity tax is levied according to the origin principle - i.e. it is levied on domestic activity, and thus applies both to domestic and export sales, while imports are not subject to the tax. The emissions tax, too, is an origin-principle tax, levied on polluting emissions from domestic activity.

22. With a revenue-neutral shift between two different origin-principle taxes levied on firms' outputs or sales, *tax burden effects* on competitiveness will arise through changes in the tax burden on different firms and sectors. For some the tax burden will rise, and for others the tax burden will fall. With an unchanged real exchange rate, the sectors with a higher tax burden are likely to lose market share in competition with foreign firms not subject to the environmental tax, either as a result of the exit of marginal firms, or as a result of higher prices. The opposite effect will be felt by sectors where the tax burden falls. Although the overall effect is assumed to be revenue-neutral, this does not necessarily imply that the impact on the trade balance will be neutral - this will depend on the relative price sensitivity of demand for the output of the sectors with increased and reduced tax burdens respectively.

23. In addition to the effects of the redistribution of the tax burden between sectors, there will also be *costs of environmental compliance* to be taken into account, and these may be unevenly distributed across firms and sectors. This effect will be greater, the greater the heterogeneity of firms in terms of marginal abatement costs.

24. Note that if, in addition to the assumption of revenue neutrality we also assume *environmental neutrality*, because the environmental tax *replaces* a pre-existing command-and-control policy, then these environmental compliance costs (total abatement costs) fall in aggregate with the introduction of the environmental tax (due to the static efficiency advantages of market mechanisms over uniform regulation). They may, nonetheless, rise for some firms.

25. In summary, therefore, in this simplified basic case, where environmental tax reform takes the form of a revenue-neutral shift away from origin-principle taxes on sales to environmental taxes, and where the environmental taxes replace existing, command-and-control environmental policy measures of equal stringency, we can identify effects on competitiveness arising through three possible routes:

- redistribution of the tax burden between firms
- redistribution of abatement costs between firms
- reduction in the overall costs of environmental compliance (total abatement costs).

3.2 *Further possible effects*

26. The basic framework set out in the previous section covers a relatively straightforward case, where environmental tax reform involves a revenue-neutral shift away from origin-principle taxes on sales to environmental taxes, with the "strength" of environmental policy maintained constant. In many cases, some of these simplifying assumptions will be inappropriate, and environmental tax reforms will have more complicated effects on competitiveness. Some of the possible ways in which an environmental tax reform might involve effects which differ from those in the base case include the following:

(a) *Competitiveness effects of reducing factor taxes and increasing ecotaxes*

27. In practice, a number of the ecotax reform packages which countries have implemented have been designed to permit reductions in taxes on labour and/or capital income, on the grounds that these are the most distortionary aspects of the existing fiscal system. What are the competitiveness implications of shifting the tax burden away from factor inputs to production such as labour (e.g. by reductions in payroll taxes), both sectorally and overall, and towards ecotaxes? How, if at all, would the effects on competitiveness of such an ecotax reform differ from the sales tax case described in the previous section?

28. One obvious difference is the pattern across firms of the tax reductions financed by the ecotax revenues. Where the tax being replaced is a payroll tax on labour, the tax reductions will be spread across firms in proportion to labour use, rather than in proportion to sales, with a tendency for greater tax reductions to be experienced by the firms with the most labour-intensive production processes. At first sight, it might be thought that there would be further significant effects to be taken into account in terms of the impact of such a reform on "work incentives", since the reduction in the payroll tax would reduce the "tax wedge" between labour supply and demand. However, it is unlikely that there will be any large difference in labour supply incentives between this case and the case where a general sales tax is reduced, because (except for its effects on savings incentives) a general sales tax has effects on labour supply decisions that are likely to be broadly equivalent to those of a payroll tax. Rather larger effects would be expected on factor markets if the revenue from an ecotax were to be used to reduce the rates of tax on capital. This would not only have effects varying between firms according to the capital intensity of their production techniques, but would also be liable to have significant factor market effects too, by reducing the tax wedge between pre-tax and post-tax rates of return.

(b) *Replacing destination-principle sales taxes with ecotaxes*

29. Most commodity taxes are levied on a destination principle basis (e.g. VAT in the EU, etc). This means that, in addition to the above effects, we also need to consider the impact on competitiveness of a revenue-neutral shift from destination principle (DP) to origin principle (OP) taxation. There is a well-known neutrality result that under certain conditions, including uniform tax rates applying to all commodities, an adjustment in the nominal¹ exchange rate (or in wages) ensures complete equivalence between the economic effects of DP and OP taxation.

30. This is clearly not the case here. Even if the commodity tax is uniform across all sectors, the environmental tax would not be. However it does imply that the competitiveness effects of a shift from uniform DP commodity taxation to OP environmental taxation can be fully assessed by comparing the environmental tax with uniform OP sales taxes.

(c) *Emissions taxes versus tax restructuring*

31. The competitiveness implications of the choice between (i) "purpose-built" ecotaxes, levied on measured emissions, and (ii) eco-motivated tax restructuring, increasing tax rates on commodities which proxy emissions. These different types of environmental tax have implications for the extent of additional costs of tax administration and enforcement, and for the effective targeting of the tax incentive to underlying pollution objectives. The choice between them may also affect the level of taxpayer compliance costs (in that purpose built ecotaxes will require taxpayers to deal with additional revenue administrations),

¹ Note that if prices are measured on a tax-inclusive basis, there is no real exchange rate change - only an adjustment to reflect higher prices due to OP taxation.

and there may also be competitiveness effects if tax restructuring is poorly targeted to environmental objectives.

(d) *Impact of improved environmental quality on competitiveness*

32. The basic case above is one in which the ecotax is assumed to have an environmentally-neutral effect - it replaces an existing command-and-control environmental policy, as well as generating revenues that can replace existing taxes. If, instead, the ecotax reform leads to an improvement in environmental quality, it is possible that this effect on the environment could have effects on competitiveness. Where reductions in pollution reduce marginal costs of firms affected by the pollution (for example, by reducing the need for cleaning) or improve the quality of the product (for the same marginal production cost), or where reductions in pollution reduce the fixed costs of footloose businesses, environmental policy (whether pursued by taxes or other instruments) could improve competitiveness.

33. These effects running from environmental quality to competitiveness are unlikely to be large in most industrialised economies, with the possible exception of the effect of ecotaxes on traffic congestion in urban areas, which might confer significant benefits on the competitiveness of economic activities requiring city-centre locations.

(e) *The "double dividend" argument*

34. If the double dividend literature suggests that employing ecotaxes confers a competitiveness benefit (in terms of more efficient revenue raising) on an economy, how far (if at all) does this offset the ecotax burden's impact on competitiveness? This is discussed at more length in Section 3.3 below.

3.3 *The "Double Dividend" and competitiveness*

35. The general idea of the "double dividend" argument (Pearce, 1991) is that environmental taxes have both merits as instruments of environmental policy and, in addition, the further benefit of tax revenues, allowing other, less-desirable, taxes to be reduced. In a dissection of the double dividend argument Goulder (1995) distinguishes "weak" and "strong" meanings. He defines a "weak" double dividend as the largely-uncontroversial claim that using ecotax revenue to reduce other tax rates reduces excess burdens, compared with lump-sum return of revenues to the private sector. A more controversial claim is that switching the structure of taxation towards a greater revenue contribution from ecotaxes would reduce excess burdens. Goulder defines this claim as a "strong" double dividend.

36. The "weak" and "strong" double dividend arguments differ in terms of the comparison that is being made.

37. The "weak" double dividend claim, that using ecotax revenue to reduce other tax rates reduces excess burdens, compared with lump-sum return of revenues to the private sector, involves a comparison of two cases with equivalent environmental impact, but a different use of revenues. It follows directly from the definition of excess burden, which is usually expressed in terms of the impact on economic welfare of a revenue-neutral substitution between a distortionary tax and a lump sum tax.

38. The "strong" double dividend claim, that switching the pattern of public revenue-raising towards ecotaxes would reduce excess burdens (as well as improve the environment) compares two cases with different effects on the environment. It also compares the excess burden of two distortionary taxes (ecotax and labour income tax, for example), and this is not straightforward, especially in the second-best context

where there are existing revenue-raising taxes. Generally, the literature suggests that a double dividend in the strong sense is unlikely to exist, if the starting point has an efficient pattern of revenue-raising taxes. A strong double dividend could arise if initial taxes are suboptimal (although other, non-environmental, tax reforms would also improve welfare, possibly by more), and in a few other special cases (e.g. Bovenberg and van der Ploeg, 1994).

39. The intuition of the argument against a strong double dividend may be seen as follows:

(a) Consider as a starting point a fiscal policy which aims at efficiency (minimising aggregate excess burden of raising revenues), but which disregards environmental effects.

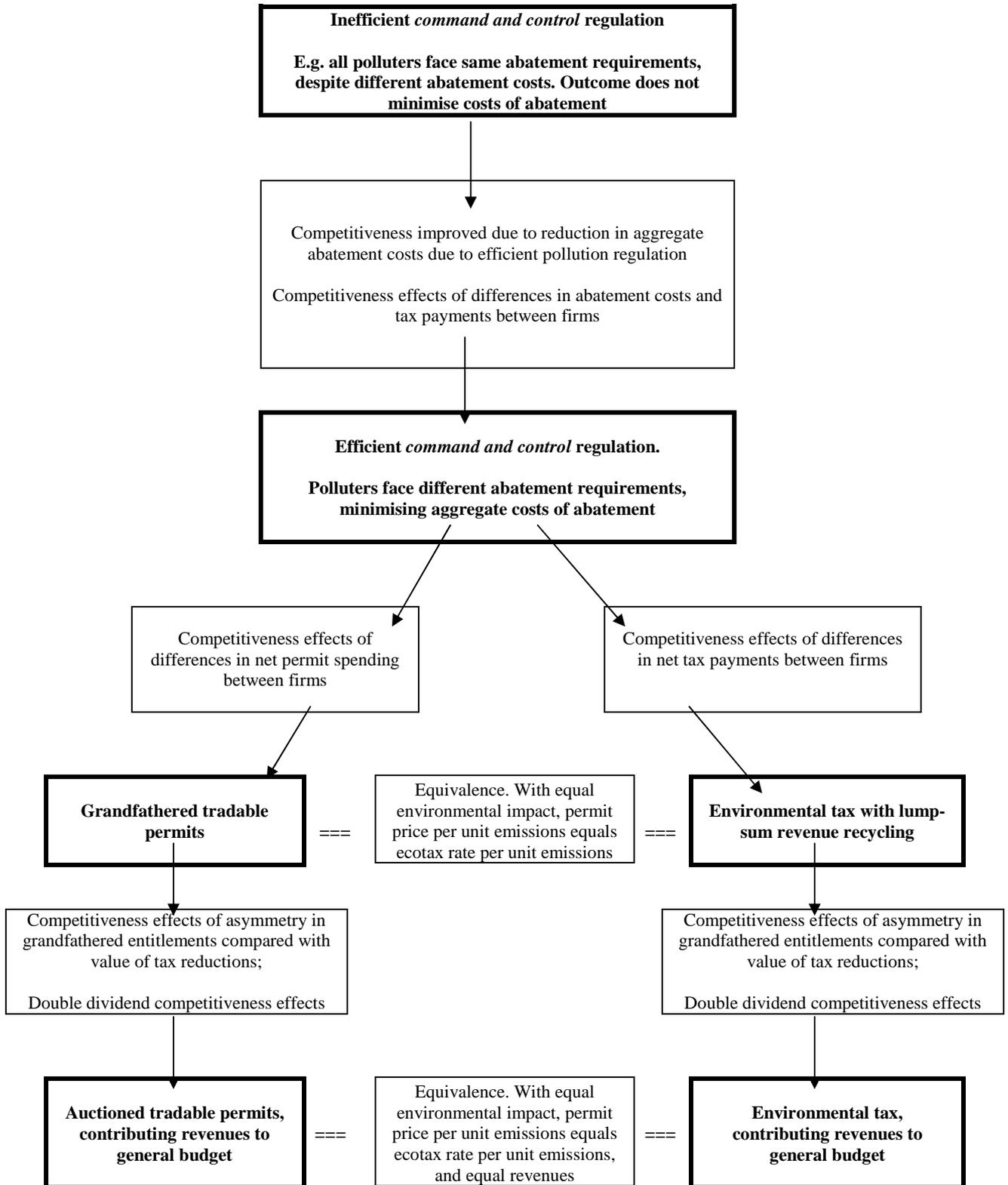
(b) Now take the environmental benefits of ecotaxes into account in designing the structure of taxation. This will generally imply increasing ecotaxes relative to other taxes, and hence has the first ("environmental") dividend. Does it also reduce excess burdens?

40. Generally, it will not, and, indeed, step (b) will normally increase excess burdens. Consider, for example, a switch from (i) tax on labour income to (iii) tax on energy, via an intermediate step of (ii) a tax on all spending. Tax (ii) has the same distortionary impact on the labour market as (i). But in addition tax (iii) distorts the goods market more than (ii). Typically, too, this additional distortion will be greater, the higher is the starting level of taxation.

41. Although the strong double dividend argument does not create a compelling case for ecotaxation, there are a number of significant policy implications which follow from recognition of the weak double dividend argument:

1. If ecotax revenues are used to make compensating lump-sum reductions in tax burdens (e.g. for distributional reasons, or to avoid disturbance to sectoral competitiveness), this foregoes possible efficiency gains, compared with reductions in marginal tax rates.
2. This generally implies a preference for revenue-raising instruments, compared with those that forego revenues. In choosing between "grandfathered" and "auctioned" tradable permits it will be noted that grandfathering is equivalent to a lump-sum return of revenues, and therefore foregoes potential efficiency gains from using the revenues to cut distortionary taxes.
3. The optimal level of pollution abatement is not independent of environmental policy instrument used (Lee and Misiolek, 1986). Assuming the ecotax rate is below the Laffer maximum-revenue tax rate, the efficient level of pollution abatement will be higher under a revenue-raising instrument than under a non-revenue-raising instrument.

Figure 1. Comparison of different environmental policy instruments in terms of competitiveness



3.4 *A comparison of different instruments*

42. As observed earlier, any analysis of the competitiveness effects of environmental taxes needs to be clear about the comparison is being made: *With what are environmental taxes being compared?* In the initial case which Section 3.1 analysed, the effects of environmental taxes were compared on a revenue-neutral basis, with an alternative "command-and-control" policy with equivalent impact on environmental variables. A broader range of alternative environmental policy instruments might, however, be brought into the analysis, each with differing implications for competitiveness. This section provides a framework for comparing the competitiveness effects of various instruments, including grandfathered and auctioned tradable permits, and different forms of command-and-control, as well as environmental taxes. The discussion is organised around the diagrammatic presentation in Figure 1, which summarises how the set of relevant effects on competitiveness changes in moving from one instrument to another. In the diagram, the boxes with thick borders show various different instruments, while the boxes with thin borders describe the competitiveness effects which would be experienced in moving in the direction indicated from one instrument to another. It is assumed throughout Figure 1 that all instruments are used to achieve the same overall impact on the environment.

43. In comparing the competitiveness effects of different environmental policy instruments, a useful benchmark is a hypothetical efficient command and control policy (shown just above the centre of Figure 1), in which the pattern of pollution abatement required across sources minimises the aggregate cost of abatement². The core of the argument for market mechanisms in environmental policy is, of course, that command and control regulation is unlikely to be able to achieve this efficient outcome, because it requires the regulator to be able to obtain full information about firms' abatement costs. Nevertheless, considering this hypothetical case makes it possible to identify various separate elements in the competitiveness effects of different instruments.

44. Comparing the "efficient" command-and-control benchmark with "real world" command-and-control (shown at the top of Figure 1), in which regulatory policies cannot take full account of the differences in abatement costs between firms, the "real world" policy involves higher aggregate costs of abatement, and hence aggregate inefficiency, and a loss of competitiveness for the economy as a whole. There will be differences between firms: some will incur higher abatement costs, but it is possible that abatement costs for others will be lower. Consequently, differential competitiveness effects - in the sense of gainers and losers among regulated firms - may arise.

45. With an efficiently-functioning permit market, a system of auctioned emissions permits and an emissions tax achieving the same effect on emissions have equivalent fiscal implications. The equilibrium permit price for one unit of emissions would equal the emissions tax per unit, and the payments by firms and the revenues derived would be the same. We can analyse the competitiveness effects of these two instruments interchangeably. Environmental tax instruments are shown in the lower right hand branch of Figure 1, and tradable permits in the lower left-hand branch.

46. Comparing the efficient command and control benchmark with an emissions tax achieving the same aggregate level of pollution abatement, the sole difference that would be encountered is the tax burden (distributed between sources according to their residual level of emissions), and the aggregate tax revenues derived. There would be no difference in the cost of environmental compliance (i.e. in abatement costs), as compared with the hypothetical efficient command and control baseline. The additional tax

² It is convenient to assume that the context is one where emissions from different sources are equally-damaging to the environment. Adding the possibility that pollution damage might vary between sources complicates the analysis, without introducing any useful additional insights on competitiveness effects.

payments by firms may generate costs in terms of a loss in competitiveness; this is perhaps the primary mechanism by which adverse effects of ecotaxes on competitiveness are thought to arise. In addition, or perhaps offsetting the effects of the extra ecotax burden on firms, are the competitiveness consequences of the revenues raised. The issue here is closely related to the “double dividend” literature. If the double dividend literature suggests that employing ecotaxes confers a competitiveness benefit (in terms of more efficient revenue raising) on an economy, how far (if at all) does this offset the ecotax burden’s impact on competitiveness?

47. Finally, we can compare the likely competitiveness effects of grandfathered tradable permits, as opposed to auctioned permits. As compared with auctioned permits, no net revenue is derived, and therefore the double dividend efficiency gains do not arise. Competitiveness effects at the firm level will depend on the relationship between the permit allocation and the number of permits the firm requires in equilibrium. Firms receiving excess permits will benefit to the value of the surplus permits; firms which are net purchasers of permits incur additional costs of permit purchase.

48. It will be noted that the case of grandfathered tradable permits is analytically equivalent to the case of emissions taxation, where revenues are recycled to taxpayers on the same basis as used for permit grandfathering.³

3.5 *Empirical evidence on the impact of environmental policy on competitiveness*

49. The research literature contains a number of papers on the relationship between environmental policies and competitiveness. A useful survey is Jaffe *et al* (1995).

50. Much of this research relates to the competitiveness effects of the general “level” of environmental protection in a country, which in most cases means the competitiveness impact of various forms of non-fiscal environmental regulation (since command and control remains the dominant form of regulation of most environmental problems). For example, they address the debate over whether there is empirical evidence that countries with high environmental standards displace certain types of industry to areas with lower standards, and the debate over whether there are competitiveness benefits from a country being at the leading edge of environmental policy.

51. Much existing evidence suggests that the impact of environmental policies on overall (“macroeconomic”) competitiveness is limited. A number of possible reasons have been suggested for this (Charnovitz, 1993):

- one is that environmental compliance costs are small (e.g. 1 - 2 % of turnover) relative to other costs of production, so that current environmental protection can be purchased at relatively low abatement cost. Additional increments in environmental quality may have so far been purchased at low cost, although this does not necessarily imply that further abatement would also be cheap. Although most industries may have so far been on the relatively low, flat portion of their marginal abatement cost curve, it is possible that the curve may steepen for further abatement.

³ Except for the dynamic efficiency incentives the case of grandfathered tradable permits is also similar to the case of efficient command and control. In terms of static efficiency, fiscal burden, etc, this is equivalent to grandfathered permits in the case where the permit allocation exactly corresponds to the efficient pattern of residual pollution (so that no post-allocation permit trades take place). However, under command-and-control firms face no incentive for further innovation in abatement technology, since changes in residual pollution have no financial implications.

- environmental policies may have been designed to minimise competitive effects, using mechanisms such as exemptions, rebates, subsidies, and phased implementation.
- data and methodological limitations may have meant that effects on overall competitiveness may not have been detected by research studies, even where these have been present.

4 Policy options

52. The principal options for mitigating competitiveness effects of ecotaxes would appear to be:

- revenue recycling, targeted on measures that would reduce business tax burdens (e.g. payroll taxes). The key issue here is how to alleviate the impact on competitiveness without significantly reducing the incentive to abate.
- sectoral exemptions, or differentiated ecotax rates across sectors. The issues have already been well covered in OECD (2001), and will not be repeated here.
- border tax adjustments. To the extent that ecotaxes place domestic firms at a disadvantage in competition with foreign firms that do not have to pay similar ecotaxes, this disadvantage could, in principle, be neutralised by charging taxes on imports and rebating taxes on export.
- international co-ordination, at different levels - EU, OECD, whole world.

4.1 Revenue recycling: issues

53. Recognition of the public sector budget constraint means that the effects of environmental taxes always need to be considered on a basis that includes a clear specification of the fiscal adjustments in response to the revenues raised from the environmental tax. In principle, the revenues raised could lead to one of three fiscal effects - a reduced level of public borrowing, increased public spending, or reductions in other, existing, taxes. The theoretical discussion in Section 2 has assumed that the environmental tax would be introduced on a revenue-neutral basis. This is conceptually most straightforward, and avoids the need to specify and consider the macroeconomic consequences of changes in public borrowing or of balanced budget increases in taxes and spending. These macro effects are, in any case, likely to be largely independent of the fact that the additional revenues are raised through an environmental tax.

54. It may be the case that, in terms of practical implementation as well as theoretical discussion, environmental taxes would be introduced on a revenue-neutral basis. One of the ways in which countries have succeeded in introducing significant new environmental taxes is through packages of explicitly revenue-neutral fiscal changes, in which the additional revenues from environmental taxes are offset by clearly-identified reductions in other taxes. Such packages may act to counter the perception that environmental taxes are simply another way for governments to extract further tax revenue from taxpayers. They may also allow two types of benefit to be perceived: not only the environmental gains from the environmental tax, but also gains from reducing revenues that have to be derived from existing taxes, that may be damaging or unpopular.

55. Explicit revenue-neutral packaging of environmental taxes together with offsetting reductions in existing taxes may also provide a way of dealing with some of the competitiveness issues arising from use of environmental taxes - either in terms of substance, or in terms of presentation:

- Recycling the revenues from an environmental tax on a particular sector back to the firms in that sector through reductions in other taxes that they pay may substantially eliminate the

consequences for business costs and pricing of the additional environmental tax burden, and may largely eliminate any tendency for the sector's output to contract relative to other sectors. The principal adjustments that will remain will be asymmetric effects within the sector: some individual firms may gain, and others lose, from the changes in the pattern of taxation.

- In terms of presentation, revenue-neutral packaging may reduce business opposition to environmental tax measures. Indeed, if firms are affected differentially, it may generate support from those that anticipate gains from the revenue-neutral package.

56. The Swedish NO_x charge provides an example of an environmental tax levied on a relatively small group of firms, and accompanied by revenue-neutral return of revenues to these taxpayers as a group. Payments of tax are based on measured emissions. Revenue is returned in proportion to output.

57. However, in addition to its practical and presentational attractions, revenue-recycling at the sectoral level, or to industry as a whole, involves a number of dangers.

58. *It may reduce the amount of pollution abatement achieved*, especially in cases where there are few opportunities for pollution reduction through changes in production technology within a sector, and where the main way in which the sector can reduce pollution is by reducing output. In this case, higher output prices would be one of the main mechanisms through which an environmental tax would reduce pollution, and recycling revenue in a way that allowed the sector to maintain prices unchanged would forego a significant part of the environmental benefit.

59. Contraction of a "dirty" sector may be one of the mechanisms by which environmental damage is reduced, and revenue-recycling may inhibit this. How far this is a problem will depend partly on the basis on which revenue is returned. For efficiency, firms which shut down should continue to retain their entitlement to revenue return in perpetuity, but this may frequently be difficult to sustain.

60. *It may require reductions to be made in taxes which are relatively-efficient revenue-raising instruments*, and may therefore fail to maximise the efficiency savings from the tax reductions. (Note, however, that this point is not as straightforward as it may at first sight seem. If the existing tax structure is optimised, the marginal excess burden from each tax will be the same. Higher gains from reducing a particular tax in the existing fiscal system might arise where the existing structure of taxes is sub-optimal, or where reductions in the fixed costs of compliance and administration could be made by eliminating a particular tax entirely.)

61. *The basis on which revenues are returned to taxpaying firms may be distortionary*. Some possibilities for defining the basis on which environmental tax revenues might be returned to taxpaying firms as a group can be drawn from the various US systems of grandfathered tradable permits:

- Fox River and Dillon Reservoir - permit allocation grandfathered in proportion to actual emissions prior to introduction. Advantages firms with poor environmental performance, or regulatory non-compliance, prior to the introduction of the trading regime.
- SO₂ allowance trading programme: permits allocated in proportion to actual (current) energy output, irrespective of actual emissions. Similarly, inter-refinery lead trading was grandfathered on the basis of gasoline output.
- RECLAIM - permits grandfathered on the basis of hypothetical emissions, assuming full compliance with existing command-and-control rules. This avoids the danger of rewarding past non-compliance, but carries greater dangers for competitiveness (if, for example, past non-compliance was a rational response to excessively-high marginal abatement costs for the firm in question).

62. Two ways in which the basis of the revenue return may distort behaviour are:

- There may be distortionary effects if firms change behaviour in anticipation of the allocation of permits on a particular basis, with the aim of maximizing their entitlement to permits (or in the revenue-recycling case with environmental taxes, their entitlement to recycled revenues).
- Problems may also arise if the revenue return basis needs to be re-based periodically. Again, there are incentives for firms to behave in ways that maximise their entitlement to future receipts.

4.2 *Border tax adjustments*

63. Ecotaxes charged on the production activities or products of domestic firms exposed to international competition may have the effect of placing them at a disadvantage in competition with foreign firms that do not have to pay similar taxes. This disadvantage could, in principle, be neutralised by charging taxes on competing imports and rebating taxes on exports. Imports would need to be charged a tax equal to the ecotax that would be charged if they had been produced within the domestic tax regime, while exports would be refunded tax equal to the ecotax that was paid in the course of their manufacture.

64. There are significant legal impediments to introducing arrangements for border tax adjustments, especially where the intention is that these should take account of the actual or assumed production processes involved in their manufacture, rather than the characteristics of the product. These legal issues were briefly summarised in OECD (1996).

65. There are, however, also significant economic difficulties with the border tax approach, in three areas, the erosion of incentives for cost-effective pollution abatement, the definition of "equivalent" policies, and the definition of appropriate rates of tax adjustment, where firms have a choice of production technique.

66. Where environmental policies are concerned with the reduction of pollution associated with the production of particular goods or services, taxes may be applied to emissions from production facilities to provide an incentive for emissions reductions. Alternatively, ecotaxes may be applied to products produced using "dirty" processes with the aim of approximating the incentive effect of emission taxes levied on polluting emissions. Either way, the taxes aim to discourage emissions. If, then, the tax is rebated on those sales which are made abroad, this will have the effect of reducing the incentive for pollution abatement. In addition, this erosion of abatement incentives will not be uniform across firms, but will be broadly in proportion to the fraction of the firm's sales that are exported. The result will be liable to be less pollution control, especially in firms that are most active in export markets.

67. It is an open question whether border tax adjustments for ecotaxes would apply to all imports and exports, or only to trade with countries that did not pursue broadly-equivalent environmental policies. At one extreme, border tax adjustments could apply to all trade; the ecotax would be uniformly rebated on all exports, and applied to imports from all trading partners. The effect of this would be that the erosion of incentives for pollution abatement noted above would be particularly severe (especially in the smaller open economies, where the ecotax might then apply to only a small proportion of total output). Alternatively, the border tax adjustments might be limited to trade with those countries that did not pursue environmental policies of similar stringency. This would ensure that the proportion of output affected by the adjustments would be smaller, but would introduce considerable difficulties in making systematic judgements about what level and forms of environmental protection would count as "equivalent". Where two countries pursue identical ecotaxes, there would be no problem, but should a foreign ecotax at half the domestic level trigger the border tax adjustment or not? (There would be additional complication if such adjustments were

made on a partial basis). More difficult still, how should border tax adjustments be applied to trade with foreign countries that operate equally-stringent (or more-stringent) policies, but not in the form of an ecotax?

68. Defining appropriate rates of border tax adjustment will be difficult in all cases where the ecotax is not calculated as a precise percentage of the value of the traded commodity. Ecotaxes on intermediate goods which are used as inputs to production of final goods, and then exported, will have an effect on the price of the traded final goods that cannot be judged from the characteristics or price of the traded good. This effect is discussed by Poterba and Rotemberg (1995). Exact rebating of ecotaxes will then be difficult, especially where there is a range of different production techniques involving different levels of pollution. If the border tax adjustments are calculated on the basis of average pollution characteristics then they will overcompensate some firms and provide inadequate compensation for others.

4.3 *Reducing competitiveness effects through international co-ordination*

69. International competitiveness is a matter of relative performance. If one country decides to employ ecotaxes while others do nothing, there may be effects on relative competitiveness. As we have seen above, some of the effects experienced by the country using ecotaxes may be negative, others positive.

70. Competitiveness effects may be substantially reduced (though not necessarily eliminated) if all countries pursue identical ecotax policies. Just as, within a country, some firms may gain and others lose from the choice of ecotaxes in preference to other environmental policy or fiscal policy instruments, so there may be uneven effects across countries (although the scale of the unevenness in fiscal impact will be substantially mitigated so long as ecotax revenues, and corresponding reductions in other taxes, arise in the context of national budgets). These effects in the context of co-ordinated implementation of identical policies would however, seem likely to be relatively small, and certainly less substantial than the large competitiveness impact which is widely assumed to result from large differences across countries in ecotax burdens.

71. A more interesting issue, with significant implications for policy, is the extent to which competitiveness problems of environmental taxes are mitigated if competitor countries pursue environmental policies of equal environmental stringency, but using non-tax instruments. Or, to put it another way, does it matter that some countries might choose to pursue environmental policy objectives such as the reduction in greenhouse gas emissions by using ecotaxes, while others may employ grandfathered tradable permits or command-and-control regulation (or even abatement subsidies), none of which impose any additional fiscal burden on the regulated firms?

72. Figure 1 provides a framework which may help to address these questions. The most obvious distinction is between instruments that raise revenues and those which do not. In the former case, the impact on competitiveness of firms arises partly through the impact of the ecotax burden (in net terms, after any revenue return) and partly through the abatement costs incurred in response to the tax incentive. In the case of non-revenue-raising instruments, the competitiveness effects arise primarily through differences in abatement costs.

73. A further issue is the way in which any co-ordination would be specified - in terms of taxes and tax rates, criteria for permitting exemptions, etc. These various elements can have a significant effect on the overall impact of the tax, its environmental effectiveness, and the pattern of protection conferred on different firms. In principle all would need to be co-ordinated, but it may be possible to identify some dimensions (e.g. criteria for exemption) which may have a particular impact on the pattern of competitiveness of different firms, and hence which may call for more urgent co-ordination.

5 Where research is needed

74. The following issues seem not to have been fully explored, either in terms of the underlying principles or in terms of policy implications, and may be worth further investigation by the research community:

- (a) The design of sectorally-targeted ecotax packages involving arrangements for recycling of revenue to the particular sectors on which a narrowly-defined ecotax is levied. What decision-making margins (level of output, investment, shut-down, location, etc) might be affected by the way in which the revenue is recycled? On what basis could revenue be recycled to minimise the potential distortionary effects?
- (b) Could combined tax/subsidy packages be used to enhance pollution abatement incentives in situations where concerns about competitiveness limit the rate at which ecotaxes can be set to well below the first-best level? As compared with lump-sum revenue recycling (which offsets the tax burden effect, but has, at best, a neutral impact on the incentive to abate), it might be possible to increase the abatement incentive by using revenues to finance pollution abatement subsidies, or clean-technology investment incentives. What are the issues involved in using abatement subsidies in this way?
- (c) Revenue recycling by reducing factor taxes (e.g. using ecotax revenues to cut income tax, payroll taxes, etc). How does this affect competitiveness? What are the channels involved? (This is really a more general tax policy question about the competitiveness implications of substitution between factor taxes and commodity taxes.) What evidence exists from theory, CGE and macro models about the conditions under which factor tax reductions might be more or less effective than reductions in sectoral output taxes at offsetting competitiveness effects, about the timing involved, etc.
- (d) Defining "sectors" for the purposes either of selective exemptions from ecotaxes, or in order to devise revenue recycling regimes for particular sectors. What criteria might be used to define the boundary between firms inside and outside the revenue recycling regime? How, for example, should firms with multiple outputs be treated? Are there particular dangers of distortion close to the boundary, and what forms of costs might these distortions involve?
- (e) Economic issues in the definition and calculation of border tax adjustments to offset competitiveness effects. The central issue, identified by Poterba and Rotemberg (1995), is that if there are a range of technologies available for production, the pollution content of imports and the appropriate level of pollution tax to be rebated on export can be defined only approximately. How far this is a problem will depend on the amount of variation in production and abatement technologies between sectors. How, if at all, is this handled in the case of the US BTAs on CFCs? Is it possible to devise workable guidelines for the calculation of BTAs?
- (f) How far is industrial exit a significant and desirable route to cost-effective pollution reduction, both generally and in particular sectors? The general idea of devising policies that limit the impact of ecotaxes on competitiveness is that these may largely neutralise the impact of ecotaxes on exit, while retaining incentives for pollution abatement through changes in technology by firms within the industry. Does this eliminate a significant mechanism for pollution abatement within particular industrial sectors, or one that is relatively unimportant? What evidence on exit and industrial restructuring might be obtained from case studies of various sectors in which sector-specific ecotaxes have been employed (e.g. NO_x in Sweden, Landfill Levy in UK, etc), accompanied by different forms of revenue recycling, or by other measures designed to mitigate the impact on competitiveness?

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