green fiscal commission

Competitiveness and Environmental Tax Reform

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About the Green Fiscal Commission

The Green Fiscal Commission is an independent body and is not affiliated to any political party or government. Its membership includes experts from business, leading academics, senior MPs from all three main UK political parties, three members of the House of Lords, and representatives from consumer and environmental organisations.

The Commission's aim is to assess the social, environmental and economic implications of a substantial green tax shift, such that 15-20 per cent of tax revenues come from environmental taxes. The Commission has reviewed and collated the existing evidence on the implications of a green tax shift as well as conducting new research. The results from this work have been placed in the public domain to stimulate debate and, we hope, action on this agenda.

This briefing is one in a series of briefings intended to cover the main issues associated with green fiscal reform. Other briefings have already been published on topics ranging from 'Public Opinion on a Green Tax Shift' to 'How effective are green taxes?'. These are available on the Green Fiscal Commission website: www.greenfiscalcommission.org.uk

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Competitiveness and Environmental Tax Reform

Summary

The concept of competitiveness is different depending on the level at which it is applied. For firms, it is simply the ability to sell their products in competitive markets, at home or abroad. For sectors in a particular country, it is their ability to maintain their market share in markets at home and internationally. For countries it is their ability to engage in international trade such that they maintain or increase their national income and employment with an acceptable balance of payments. This briefing is about the implications for competitiveness at all levels of environmental tax reform (ETR), a reform of the national fiscal system that shifts the burden of taxation from labour and other production factors to pollution and the use of natural resources.

There is no theoretical reason why the tax shift of ETR should have negative effects on national competitiveness, provided that reductions in other business taxes compensate for increased environmental taxes on business. There is also little evidence that environmental policies in general, or environmental (mainly carbon/energy) taxes and ETRs in particular, have had negative effects on competitiveness. However, in the future, without mitigating policies, more stringent energy and climate policies have the potential to increase the threat to the competitiveness of vulnerable sectors. The relocation of these sectors would redistribute, rather than reduce, global emissions, offsetting the environmental benefits of the ETR. This threat could be addressed in a number of ways, but all of them require international action if the full environmental benefits of ETR are to be realised.

In a world in which carbon emissions are an increasing cost and liability, the development of international comparative advantage in new low-carbon technologies could become a major new source of competitiveness. The development of such new technologies will take large-scale investment, which, if it is to be private investment, will have to be profitable for the companies concerned. Through ambitious ETR, while making appropriate arrangements to protect vulnerable sectors from the worst short-term competitiveness effects, governments can create the context for this investment and long-term competitiveness in the future.

Definitions of competitiveness

In recent years, as trade and globalisation have become perceived as increasingly important sources of economic growth and development, concern has intensified about the possible effects of more stringent environmental policies within the EU; in particular the EU energy and climate policy plans on the competitive situation of European industry compared to their main foreign competitors. This briefing is intended to address this concern.

While on first consideration the concept of competitiveness seems straightforward, in fact its meaning varies with the level at which it is being considered. Most simply, for the firm it relates to whether the firm's products can be sold in competitive markets, whether domestic or foreign. An industrial sector consists of many firms, some of which will be more competitive than others. The sectoral competitiveness of a given country therefore relates to whether the sector as a whole can retain or expand its share of markets. Again, the markets may be domestic or international.

At the national level the concept is different again. The OECD defines national competitiveness as the "degree to which a country 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" (OECD 1993, p.237).

There are many factors which affect competitiveness at the firm, sectoral and national level. The international dimension of competitiveness is affected by factors such as the existence and the nature of trade barriers between countries and exchange rate variations. In contrast at the national level such factors as real wage rates, factor prices and national policies and regulations, and their interaction, are significant. Although it may be thought that these factors are common for all businesses in the same industrial sectors, in fact wide differences exist in the competitiveness of individual firms. The economic performance of a whole industrial sector is a reflection of the performance of individual firms, some of them over-performing and others under-performing with respect to the average firm.

There is no single measure of competitiveness. Factors found in the literature as being relevant in assessing competitiveness are costs of production, market share (share of global production), and import and export intensity, as well as sector profitability. All these factors have in common that they are quantifiable as compared to non-price factors, such as the quality of the workforce, infrastructure, and the legislative and regulatory framework (how it is implemented and whether it is adhered to), corruption, and so on, which can also affect the competitiveness of firms, sectors or nations.

It is clear, therefore, that despite its apparent simplicity, the competitiveness concept is actually rather complex, and the complexities are multiplied when one seeks to find evidence as to whether past environmental tax reforms have damaged competitiveness, or whether they might do so in the future. In order to address these questions, the evidence at the national level, the firm level and the sectoral level needs to be examined separately.

Environmental taxes, ETR and competitiveness

Since the early 1990s several European countries have made more widespread use of environmental taxes in environmental policy. Some have also embraced the concept of environmental tax reform (ETR), which is an increase in environmental taxes that is accompanied by a corresponding reduction in other taxes, such that the overall tax burden is unchanged. The reasons for this are that environmental taxes and ETR are perceived to have major economic advantages over other instruments for achieving certain kinds of environmental improvement (see Ekins 1999), so that, other things being equal, they will achieve a given environmental benefit at lower cost, and therefore with a smaller impact on competitiveness than other policy instruments.

Competitiveness considerations are the major reason why EU member states have granted special tax provisions in the form of partial tax exemptions to industries, in particular when they have introduced special energy/carbon taxes during the last two decades (see Ekins and Speck 1999, 2008). These special tax provisions can have serious implications for the efficiency and effectiveness of environmental taxes.

Increases in energy costs can impair competitiveness

There is a relatively simple logic behind the fear of loss of competitiveness caused by energy/carbon taxes or having to pay for emission permits under the EU Emissions Trading Scheme (EU ETS). Energy/carbon taxes, or paying for permits, make energy for production processes more expensive and therefore, other things being equal, lead to an increase in production costs. If these taxes or permit schemes are implemented unilaterally (either at the national level or at the EU level), the extra production costs may impair the international competitiveness of the affected firms and industrial sectors. However, other things are typically not equal.

Differences in national energy prices

Import prices of the same energy product can vary greatly, even between EU member states, and are of course affected by exchange rate movements. End-user electricity prices can also differ between EU member states because of the relatively big differences in the network charges between European countries. Such changes are historically larger, and can affect competitiveness more, than changes in energy/carbon taxation.

Competitive markets and international trade

If increases in energy or environmental taxes increase the prices of the affected fuels or activities, producers will be able to pass on to consumers a greater or lesser proportion of those price increases and so maintain their profitability and competitiveness (to a greater or lesser extent, depending on whether they are in less or more competitive markets). In addition, international competitiveness effects will obviously only be relevant to goods and services that are highly internationally traded. By no means all energy-intensive goods are in this category.

Increased energy efficiency

One result of any tax increase may be to cause firms to discover and implement cost-effective energy efficiency measures which they had previously overlooked, or seek to reduce their energy use by purchasing energy-efficient products from appropriate companies. This could have multiple economic effects. First, it will reduce the energy use of the company implementing the measures or making the investment, and this will serve to offset wholly or partly the increased tax expenditures (so that company energy expenditure may actually be *lower* than before the tax increase). Second, it may add to the output of energy efficiency companies, serving to offset wholly or partly any reduction in output from the increased taxes on energy. Third, the investment may increase productivity in other ways – more energy-efficient equipment is often more productive in other ways as well.

Increased innovation

The stimulation of energy efficiency is just one example of how increasing the costs of environmental damage or resource use may stimulate industrial innovation. This may even increase competitiveness (Porter and van der Linde 1995), as companies seek to develop less environmentally intensive products and processes, and environmental industries are created to help other companies reduce their environmental impact. A number of studies suggest that environmental industries are likely to be a fast-growing sector of the economies of many European countries, and will make a substantial contribution to their national income (Ernst & Young 2006, UKCEED 2006).

ETR and revenue-recycling

The environmental taxes may be imposed as part of an ETR, which the European Environment Agency has defined as "a reform of the national tax system where there is

a shift of the burden of taxes from conventional taxes such as labour to environmentally damaging activities, such as resource use or pollution" (EEA 2005, p.84). So ETR is a tax *shift*, rather than a tax increase. In this case the effect of ETR on competitiveness depends on which taxes have been reduced to compensate for the increase in environmental taxes, which is called 'revenue recycling'. Most commonly the tax reductions have been in income tax or social security contributions (called National Insurance contributions in the UK).

If the reduced taxes are business taxes, then this will tend directly to offset any competitiveness effect on businesses. Of course, different firms will be affected differently; some will emerge from the tax shift as net gainers, others will be worse off. If, for example, the tax increase is on energy and the tax decrease is on the business costs of employment (such as a reduction in employers' social security contributions), then winning sectors and companies will be those with relatively high labour, compared to energy, intensity. Losing sectors and firms will have the opposite characteristic.

If the reductions are in labour taxes, and there is involuntary unemployment in the economy, then the reduction in the cost of labour may stimulate increased labour demand and cause unemployment to fall and output to increase – the so-called 'double dividend' effect. The revenue recycling mechanism will also affect prices, perhaps directly by reducing the cost of other inputs into production. This may reduce the prices of goods and services, therefore wholly or partly offsetting the inflationary effect of the tax increase.

All these effects act in different ways on different companies (depending on how their managements respond to the tax increase), different sectors (depending, among other things, on their energy intensities and openness to international trade) and different countries (depending on their overall economic structure). Moreover, there is continuous interaction and feedback at all levels between these effects and all the other influences on economic activity. The effects of ETR on international competitiveness are, therefore, multi-faceted and complex.

The next section briefly reviews the evidence on the effects of ETRs at different levels of the economy.

Competitiveness effects at different levels

The National Level

One way that insights can be generated into such effects in a complex system like a national economy is through economic modelling. Economic models are constructed using both theoretical insights about the relationships between different economic variables (for example, it is normally assumed that the quantity of a good demanded is reduced if its price is increased, and vice versa), and through statistical estimation of the parameters of these relationships. There are different kinds of economic models which make different theoretical assumptions and therefore have different structures (see Ekins and Barker 2001). Researchers rely on different modelling approaches, assumptions, and parameter estimates whose signs and magnitudes are disputed. Many of these models do not consider the induced development and diffusion of technologies, as well as information, policy and political changes brought about by the environmental taxes or Environmental Tax Reform (ETR). Thus, different models can give different outcomes in their modelling of economic interventions such as ETR.

There is general agreement in the literature that the international competitiveness of economies and

sectors may be affected by mitigation actions (see, for example, Barker and Köhler (1998)), such as ETR. In the long run, exchange rates change to compensate for persistent loss of national competitiveness, but this is a general effect and particular sectors can lose or gain competitiveness. In the short run, higher costs of fossil fuels may lead to a loss in sectoral price competitiveness especially in energy-intensive industries, which may lead to the relocation of industry. Where the policy measures are intended to reduce carbon emissions, relocation may cause what is called 'carbon leakage', a situation in which "part of the CO2 reduction that is achieved by countries that abate CO2 emissions is offset by an increase in CO2 emissions in non-abating countries" (Sijm et al. 2004, p.11), because of the non-abating countries' increased relative competitiveness.

Sijm et al. (2004, p.14) summarise the results of modelling studies of carbon leakage, concluding that, in practice, carbon leakage is unlikely to be substantial because transport costs, local market conditions, product variety and incomplete information all favour local production, and the cost effects of environmental regulation are found to be small.

One comprehensive modelling exercise of ETRs in six European countries was carried out as part of the European research project COMETR. The model used was a macro-econometric European model (including the 25 countries which were members of the EU in 2006, plus Norway and Switzerland) called E3ME, which is described in some detail in the relevant COMETR[1] working paper (Barker, Junankar et al. 2007).

The modelling results are reported in detail in Andersen and Ekins (2009), in each case showing the difference between what did happen with the ETR and associated provisions for energy-intensive sectors, and what would have happened had there been no ETR (with both cases projected to 2012). In this briefing only the briefest summary of the results is reported.

As the taxes (mainly carbon taxes) included in the analysis increased fuel prices, the primary expected effect was a reduction in the demand for energy, and a reduction in emissions. This is in fact what the modelling showed. In most cases the reduction in fuel demand was in the region of 4 per cent, and the fall in emissions is relatively larger than the fall in fuel demand (because the taxes reduce use of the most carbon intensive fuels most), indicating that the tax policies are efficient at reducing emissions.

Most importantly from the point of view of national competitiveness, all six of the ETR countries showed a small increase in GDP as a result of the ETR (see Chart 1 overleaf). In Sweden, the effects take slightly longer to come through, as the very large increase in household electricity taxes depresses real incomes in the short run. Finland has a short-term boost to GDP from the effects of the taxes on fuel demand, because a reduction in the demand for imported fuel improves the country's trade balance.

As the ETRs result in higher fuel prices it is likely that there will be an increase in the overall price level. The degree of this is likely to be dependent on the scale of the increase in fuel costs, how easy it is for industry and consumers to switch between fuels to cheaper alternatives (and non-energy inputs) and how much of the cost is passed on by industry to consumers (this is dependent on the level of competition in the industry, which is estimated econometrically for each region and sector). It should also be noted that the revenue recycling may reduce prices when the revenues are recycled through reductions in employers' social security contributions (i.e. labour costs).

[1] *COMETR – Competitiveness effects of environmental tax reforms*, (2004-2006), FP6 Proposal 501993 funded by DG Research of the European Commission.

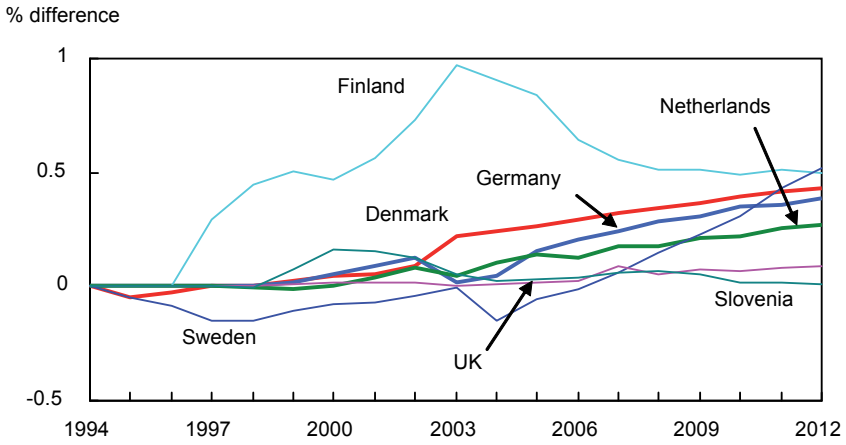


Chart 1: The Effect of ETR on GDP

Note(s) : % difference is the difference between the base case and the counterfactual reference case
Source(s) : CE.

The measure of inflation, the consumer price index, will record a larger increase in cases where the taxes are levied on households rather than industry. The reason for this is that the consumer price index is a weighted average of the price of consumer products, including energy. In the cases where the tax is levied on households the whole tax is reflected in the consumer price index, rather than just the share that is passed on by industry. Therefore it is not unexpected that the largest increases are in the Netherlands and, in particular, in Sweden(see Chart 2). In Denmark and the UK, there were no significant increases in the overall price index. In the UK this is because the tax is relatively small and was compensated with slightly cheaper labour costs. In Denmark the tax was larger, but was again compensated with lower labour costs.

Modelling results of this kind from different models should be examined and compared in detail before conclusions are drawn. For example, the modelling exercise of Oxford Economics (2007), which shows a 0.5 per cent reduction in EU GDP by 2023 from a carbon price of €25 per tonne CO2 might seem to contradict the E3ME results above, until inspection reveals that the carbon price is not matched by any revenue recycling, i.e. it is an exogenous shock to the economy that simply increases the price level. It is hardly surprising that this leads to a loss in output. The revenue recycling effect, which reduces taxes elsewhere, plays a key role in compensating for the increased price of carbon/energy.

The Firm and Sectoral Levels

Firm Competitiveness

In principle, it is clearly possible for environmental policy, including environmental taxes, to increase costs and reduce the competitiveness of firms. However, pollution prevention can also save money and stimulate cost-saving and market-creating innovation (Porter and van der Linde 1995, Christie et al. (1995).

Through comparative analysis of firms in a number of different sectors, EFILWC (1998) found that marginal firms might be seriously challenged by environmental regulations, but averagely competitive firms tended to be able to take them in their stride, while well-managed firms often did respond to them in ways that spurred innovation and reinforced competitiveness.However,concluding from such results that environmental regulation in general can lead to 'win-win' outcomes of economic as well as environmental improvement remains controversial, clearly running counter to economists' normal assumptions of

efficient, competitive markets and the standard economic trade-off model, whereby environmental benefits are gained at the expense of growth and competitiveness.

It is unlikely that this debate will ever reach a definitive resolution, because it is clear that there are different impacts of environmental regulations on different firms, and it will always be possible to find case studies that show net costs of regulation, or induced innovation leading to net benefits. Moreover, most of the above analysis was carried out in relation to environmental regulations rather than environmental taxes, which may raise more serious competitiveness issues than regulations for firms in environmentally intensive sectors.

This is because =after compliance with regulations, firms may use the environment without further payment; yet with environmental taxes, firms pay for *all* use of the environment (which is why environmental taxes give an incentive for continuous environmental improvement), and this may result in the costs imposed by environmental taxes on firms being higher than the costs of regulation.

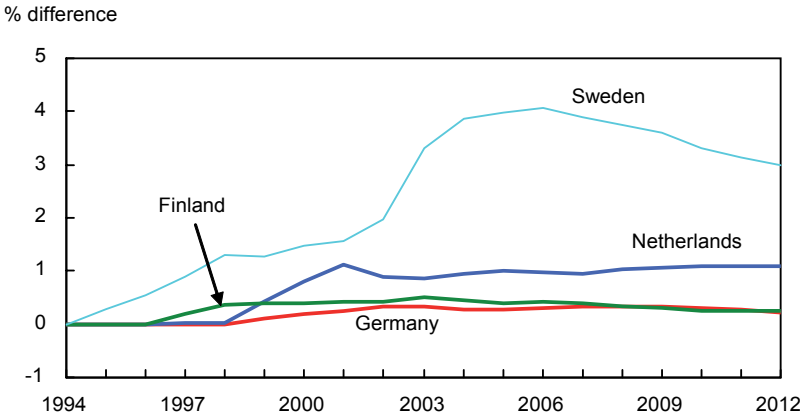


Chart 2: Consumer Price Index

Note(s) : % difference is the difference between the base case and the counterfactual reference case.
Source(s) : CE

Because of the varying impacts on different firms, it may therefore be more fruitful to seek to identify competitiveness impacts of environmental policy in general (and environmental taxes in particular) on particular economic sectors, on which there is now a substantial literature.

Sectoral Competitiveness

With the advent of modern environmental policy in the 1970s, and its increasing stringency over the years, a 'pollution haven hypothesis' emerged suggesting that this policy would cause 'dirty' industrial sectors to migrate from countries with relatively high environmental standards to those that were less regulated. While it is clearly not easy to separate out relocation of sectors for environmental reasons from the sectoral relocation that occurs on an ongoing basis for a host of other reasons, the 'pollution haven' literature that has since emerged has, like that on firms, arrived at some conflicting conclusions but an overall consensus that if there are such displacement effects, they are not very great.

Thus, Sijm et al. (2004, p.165) concluded on this subject that "existing studies ... indicate that – if a relation between environmental policy and relocation should exist – it is statistically weak". Specifically in relation to carbon reduction policies, the IPCC concluded that "reported effects on international competitiveness are very small ... at the firm and sector level, given well-designed policies, there will not be a significant loss of competitiveness from tax-based policies to achieve targets similar to those of the Kyoto Protocol" (IPCC

2001, p.589). Similarly, Oikonomou et al. (2006, p.3663) concluded that the "prevailing conclusion of the pollution haven literature is that environmental requirements have a small or negligible effect on relocation".

Rather than focus on whether industries have migrated, another approach is to examine the performance of particular sectors in countries with high environmental standards or, in the case of the COMETR project, that have implemented ETRs based on energy or carbon taxes in the past. The project selected a number of industrial sectors that might have been thought to be particularly at risk and sought insights as to their energy intensities; whether their product prices were set in world markets or by the producer or in the local markets; the extent to which the products were traded internationally; and the flexibility of the production process in responding to an increase in costs.

Fitz Gerald et al. (2007) selected seven economic sectors, as shown in Table 1, which were considered to be potentially vulnerable to ETR because of their high energy or trade intensity, and low labour intensity. The price setting power of these sectors was econometrically determined.

Figure 1 (overleaf) combines the price-setting power with the share of energy expenditure to show the overall vulnerability of the sector to a carbon/energy tax. Basic metals (with no price-setting power and fairly high energy intensity) and chemicals (with medium price-setting power and high energy intensity) are the most vulnerable sectors on this analysis, with non-metallic mineral products and food etc. the least vulnerable.

There is then the issue of labour intensity as shown in Table 1. This is relevant when tax revenues are recycled back through reductions in employers' labour taxes, and it can be seen that this would benefit basic metals (with high labour intensity) relative to chemicals (with low labour intensity). In the case of the German ETR, Bach (2005) showed that the reduction in the employers' social security contributions (SSC) substantially reduced the energy tax burden on both chemicals and basic metals.

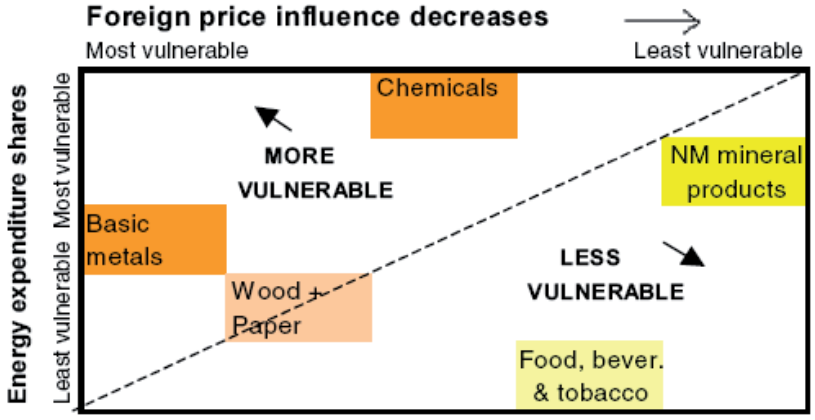
Miltner and Salmons (2007) used a similar methodology to determine the overall impact of an ETR on the production costs of selected economic sectors: Food and food products; paper and paper products; basic chemicals; pharmaceuticals; glass and glass products; cement, lime and plaster; ferrous metals, and non-ferrous metals in Germany and the UK. They identified the trends in these sectors for seven countries and eight sectors (providing fifty-six observations) against four indicators: relative unit costs, export and import intensity, and

Table 1: Characteristics of different manufacturing sectors

	Nace code	Characterisitics: intensity			
		Energy	Labour	Export	Import
Food and beverages	15	high	low	low	low
Pulp, paper and board	21	high	medium	low	low
Wood and wood products	20	medium	low	low	low
Basic chemicals excl. pharmaceuticals	24 less 24.4	high	low	high	high
Pharmaceuticals	24.4	low	low	high	high
Non-metallic mineral products	26	high	medium	low	low
Basic metals	27	high	high	medium	medium

Source: Fitz Gerald et al. 2007, p. 34

Figure 1: Vulnerability analysis with respect to price-setting power and energy costs



Source: Fitz Gerald et al. 2007, p. 36

share of global production. They found that in forty-five of the fifty-six cases considered (i.e. 80 per cent), there is no consistent evidence that there were any changes in competitiveness between 1990 and 2002; in only nine cases (16 per cent), do the trends in the indicators suggest there was a loss of competitiveness over this period with four of these cases relating to the United Kingdom, three to Germany, and one each to Finland and the Netherlands; in two cases (4 per cent), the trends in the indicators suggest that there was actually an improvement in competitiveness (Miltner and Salmons 2007, p.251). Furthermore, in all of the nine sectors that lost competitiveness, the change in unit costs due to the ETR was less than or equal to 1 per cent, so it is highly unlikely that any loss of competitiveness was induced by the ETR.

The results of Bach (2005) and Miltner and Salmons (2007) regarding the increases in production costs caused by new or increased energy/carbon taxes make no allowance for possible increases in energy efficiency in production technologies due to the tax.

Important evidence on this issue is provided by the UK Climate Change Agreements (CCAs), negotiated between the Department for Environment, Food and Rural Affairs (Defra) and energy-intensive sectors in March 2001, through which around 50 sectors have accepted targets related to increasing their energy efficiency in return for an 80 per cent rebate from the climate change levy (CCL). The majority of sectors chose targets related to their energy intensity. Several studies of the CCAs have shown that, even in these energy-intensive sectors, there were substantial opportunities for cost-effective improvements in industrial energy efficiency (for details, see Ekins and Etheridge 2006; Barker, Ekins and Foxon et al. 2007; Salmons 2007). These analyses of the CCAs reveal the existence of widespread opportunities for cost-effective energy efficiency improvements at the sectoral level, which if implemented can further offset any costs related to increased carbon/energy taxation. It appears that even in large companies in energy-intensive sectors, managers are frequently not aware of these potentials.

Mitigation of competitiveness effects from ETR

Policy makers have listened to the concerns of businesses about the threat of environmental taxes and environmental tax reform (ETR) to competitiveness, and have implemented these policy measures quite differently from the recommendations of environmental economic theory. Tax rates are generally set at different rates for different energy users, with energy-intensive users usually facing lower tax rates. In addition, the energy/carbon tax rates are regularly not set according to the energy or carbon content of the energy products.

These policies all have in common that they are aiming to protect domestic industries because of the fear of the threat of a loss of competitiveness caused by the unilateral introduction of energy/carbon taxes. The different approaches of granting special tax provisions to industries are extremely complex, but they basically involve varying the tax treatment by energy product, industrial sector or level of energy consumption (see Ekins and Speck 2008 for details). For the EU ETS the solution to competitiveness concerns that has been adopted is to delay the auctioning or permits to the most vulnerable sectors.

All these policies can be classified either as mitigation measures or as compensation measures (OECD 2001). The key difference is that the former provide for reductions of tax rates or some form of modifications of tax bases as opposed to the latter which are outside of the realm of taxes. Compensation measures can include revenue recycling and the granting of subsidies and could also include the provision of border tax adjustments (see below). One of the differences between mitigation and compensation measures concerns environmental effectiveness, with the OECD stating that "Mitigation measures reduce the environmental effectiveness of the tax by cancelling out some of the incentives to change consumption and investment behaviour", (OECD 2001, p.29).

There are two other possible approaches to mitigating competitiveness impacts, which do not have the effect of blunting the efficiency and effectiveness of the policy measure. One is to adjust import and export taxes at the European border or make some other "carbon equalisation" provisions (EC 2008, p.8) for international trade in the output of vulnerable sectors.

The second option is to arrive at some global agreement for the limitation of carbon emissions from vulnerable sectors, which would ensure that sectors from Europe subject to energy/carbon taxes or the EU ETS were not at a competitive disadvantage, because the same sectors in other countries were committed to similar levels of effort. Negotiations on such agreements are part of the negotiating process under the Framework Convention on Climate Change. The relevant issues, outside the scope of this paper, are discussed in Bodansky (2007). It is too early at the time of writing to know whether the negotiations on international sectoral agreements will have any substantive outcome.

Conclusions

National competitiveness is quite different from sectoral competitiveness, because it takes account of all the impacts of revenue recycling in non-energy intensive sectors, and the effects of investments in energy efficiency and low-carbon energy supplies which are missed by sectoral studies. There is no theoretical reason why a shift in the taxation of factor inputs of the kind discussed in this report should have a large or negative impact on GDP, and, as seen earlier, the modelling of such shifts has not found such impacts to be significant.

A number of conclusions can be drawn from the extensive work on the competitiveness implications of European and US environmental policy, including environmental taxes and environmental tax reforms (ETRs), to date.

The first is that there is no convincing evidence that environmental policy has influenced business location. It is clear that other factors influence location more than environmental policy.

The second is that possible international competitiveness effects are limited to relatively few vulnerable sectors.

In respect of carbon/energy taxation, these are the sectors which simultaneously exhibit the characteristics of high energy intensity and share of energy expenditures in costs, low market power (and therefore a low ability to pass costs through to consumers), and high trade intensity. For such sectors, as with the simulations with regard to the steel and cement sectors in a recent OECD report (OECD 2006), the conclusion may be that the use of economic instruments "is likely to have negative impacts on the international competitiveness position of some industrial sectors" (OECD 2006, p.75). Although even so, it may be pointed out that the low trade intensity of cement is likely to limit the extent of these impacts.

For the ETRs that have been introduced so far, no adverse sectoral competitiveness effects have been discovered by research, but this may be due to the very great efforts which most countries have made to shield their vulnerable sectors from these effects, by giving them tax rebates or making other tax provisions, as discussed above. In addition to reducing effects on competitiveness, these special provisions are likely to have reduced the effectiveness and efficiency of the policy instrument.

If future efforts at carbon abatement are more stringent than they have been in the past (which seems likely) and in the absence of global international agreement on carbon abatement, the competitiveness implications for vulnerable sectors will be more pronounced. Either these sectors are likely to be exempted from some of the provisions of measures like the EU ETS, or other arrangements such as border tax adjustments or international sectoral agreements will need to be put in place to mitigate competitiveness effects.

At the same time, faced with the prospect of increasingly stringent carbon reduction, governments are more and more looking to new competitiveness advantages that might be gained through the development of new, low-carbon industries. A case in point is the report from the UK Government's Commission on Environmental Markets and Economic Performance (CEMEP 2007). First, the CEMEP report notes that "A transition to a low-carbon, resource-efficient economy is needed to meet the global challenges of climate change and sustainable development." (CEMEP 2007, p.5). This transition can only be achieved by large investments in new technologies, processes and products. It is clear that CEMEP expects business to make the investments, rather than government. The role of government is firstly to support the innovation process and secondly to establish the market conditions that stimulate the investment.

It is this role that provides the rationale for the kind of ambitious ETR that is being explored and promoted by the Green Fiscal Commission.

The key issue now for climate policy is whether governments will price carbon so that high-carbon investments become economically unviable, and low-carbon investments become businesses' first choice and the foundation for competitiveness in the future.

While such a policy may be challenging for energy-intensive sectors in the short term, these challenges can be addressed by a mixture of mitigation and compensation measures, and more far-reaching international measures in the future. It is difficult to see how the kind of ambitious carbon targets that are now being accepted, by European countries at least, can be reached in any other way.

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