Addressing International Competitiveness in a World of Non-uniform Carbon Pricing: Lessons from a decade of OECD analysis

1. Introduction

While global leaders have recognized that tackling climate change is one of the crucial challenges of our time, the path to do so is not yet clear. A first step towards achieving a global policy response to this problem was the establishment of the UN Framework Convention on Climate Change (UNFCCC) and the subsequent Kyoto Protocol. Further progress was made through the development of the Copenhagen Accord in 2009, as noted by the UNFCCC, in which a goal to limit temperature increases to 2º Celsius was recognised and many countries announced domestic targets or actions to reduce greenhouse gas (GHG) emissions.

However, this patchwork of actual and proposed government policies to address climate change has led to growing concern among policymakers that the international competitiveness of domestic energy-intensive industries will be adversely affected if stringent emission reduction targets are adopted in some countries but not in others. These concerns have proven to be one of the principal hurdles to ambitious climate policies in many OECD countries. Yet delaying or reducing the ambition of action until a more globally-coordinated policy response to climate change, such as an international carbon market, can be agreed could be more costly than initiating fragmented regional action today (OECD, 2009a).

Key Messages

This policy brief highlights lessons learned from a decade of OECD and IEA policy analysis on the international competitiveness issue in climate policy. Key policy messages include:

- Adverse competitiveness impacts from climate change policy are generally limited to a small number of sectors representing a small share of economic activity in any national context.
- The first best option to address these concerns is to create a level playing field through the wide-spread adoption of climate policies across countries and sectors.
- Given the fragmented policy response to climate change that currently exists, policymakers are frequently urged by stakeholders to put in place measures to address these impacts.
- Targeted and time-bound measures that address these impacts can be viewed as a way of managing a transition to a low-carbon economy.
- Free allowance allocations, output-based revenue recycling and allocations, border tax adjustments, and industry exemptions are commonly promoted measures.
- Measures such as these should be scrutinised in terms of their economic efficiency, the incentives they create for GHG reductions, and their impacts on developing countries, in addition to their effectiveness in addressing competitiveness concerns. The domestic political economy aspects and the practicality of implementing measures also need careful consideration.

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2. What is the international competitiveness issue in the climate policy context?

Concerns over the international competitiveness of industrial sectors arise because applying an ambitious climate policy in some regions could entail, for some domestic producers, substantial increases in costs and potentially profit losses that producers of similar goods in other regions do not face. Impacts on international competitiveness, or ability to retain market share, of individual sectors of the economy are generally projected to be low. But they could be significant for a small number of energy-intensive industrial sectors with exposure to changes in international trade flows. Governments adopting climate policies will be concerned primarily about reductions in economic output, changes in trade flows, and jobs, while firms operating in energy-intensive industrial sectors will look to profits as the key indicator of a competitiveness problem from climate change policy (Reinaud, 2008). Governments may also be concerned by "emission leakage," wherein emission reductions from a specific sector in one country due to climate policy are negated by emissions increases outside the country (see Box 1).

Box 1: How do the issues of international competitiveness and emission leakage differ?

For the purpose of this policy brief, the competitiveness problem is defined as follows: cost increases from climate policy in one country can for some sectors potentially lead to shifts in production and trade flows. In the near term, in such a scenario, market share may be reduced in sectors operating in countries applying the policies, as competitors from abroad without similar policies in place gain market share. Over the longer term, investment and capital may shift to non-participating countries.

The environmental consequence of such shifts in production is known as "emission leakage." Leakage results from shifts in emissions from the country where climate policies are in place to another where the policies are less stringent. Its rate is measured as the proportion of emission reductions in one country negated by emission increases in another.

An additional channel of emission leakage unrelated to international competitiveness is called the "fossil-fuel channel." Through this channel, reduced demand in countries that adopt ambitious emission reduction policies leads to a decline in fossil-fuel prices globally. These lower prices in turn induce an increase in fossil-fuel use in regions with less stringent policies, leading them to emit more. Typically, the wider the country coverage of GHG reductions, the smaller the risk of leakage from international trade and production shifts and the higher the risk of leakage from fossil-fuel price changes (Burniaux et al, 2010).

While international competitiveness and emission leakage are clearly related, this review focuses on indicators of competitiveness, such as output and market share. These indicators are of particular concern for policymakers seeking to reduce the potentially negative effects of climate policies on energy-intensive industries, in a global policy context where the timing and stringency of such policies varies widely.

It is important to keep competitiveness concerns in perspective. Climate change policy will encourage substitution toward low-carbon products and processes; by *design*, policies reduce the relative competitiveness of firms using high-carbon production processes compared with those that are more carbon-efficient (OECD, 2010b). This will be fundamental for moving toward a low-carbon economy. In addition, climate policies can entail gross economic costs that reduce global income and demand for goods, although these costs are likely to be outweighed in the long-term by the economic, social, and environmental benefits of action (OECD, 2009a). These effects should not be considered part of the international competitiveness issue.[1]

[1] Similarly, many factors that affect an industrial sector's competitiveness, such as labor, capital, energy, transportation and other input costs, access to raw materials, product quality, and exchange rates, should not be confused with the issue of international competitiveness as it relates to climate policy (Reinaud, 2008). This issue is also not the same as that of *competition* issues within carbon markets, such as market power and oligopoly (OECD, forthcoming).

Regardless, concerns over impacts on sector-level international competitiveness continue to hinder widespread ambitious climate policy. Reducing the overall cost of climate change policy to all participants, while maintaining its environmental effectiveness, can help to ease these concerns. This can be accomplished for example through the use of the most efficient policy tools available, such as carbon pricing (Baron et al, 2007; OECD 2009a). This policy brief reviews OECD analysis of the remaining competitiveness impacts that carbon pricing policies may impose on energy-intensive industries, as well as some of the commonly proposed transitional measures to reduce these impacts.

3. How large is the international competitiveness issue for energy-intensive industries?

Using its economy-wide model, ENV-Linkages, the OECD has analysed the expected impacts on output of energy-intensive industries from climate policy (see Box 2 for a description of the model used). Energy-intensive industries in these analyses include chemicals, non-ferrous metals, fabricated metal products, iron and steel, pulp and paper, and non-metallic mineral products.[2] For example, in a stylised situation in which industrialised countries, or the Annex I countries under the UNFCCC, adopt a fully linked emissions reduction system with emissions cuts from 1990 levels of 20% in 2020 and 50% in 2050, output of energy-intensive industries decreases by about 3% in the Annex I participating ("acting") countries in 2030 (Table 1). At the same time, output of energy-intensive industries in non-acting countries increases 1%, relative to the baseline levels for that year.

Table 1: Impacts of Alternative Climate Policy Participation Assumptions in 2030
(an emissions reduction pathway from 2005 of -20% in 2020 and -50% in 2050)

Policy Scenario	% Change in 2030 from baseline of:							Leakage Rate (%)
	Output of Energy-Intensive Industries			Real Income (1)			World GHG Emissions	
	Acting Countries	Non-acting Countries	World	Acting Countries	Non-acting Countries	World		
Unilateral Action:								
European Union	-2.2	0.2	-0.2	-1.4	-0.1	-0.4	-2.4	7.9
USA	-4.6	0.6	-0.3	-1.2	-0.1	-0.4	-5.2	11.8
Japan	-1.4	0.1	0	-0.4	0	-0.1	-0.5	12.5
Coalition Action:								
Annex I	-3.2	1.1	-0.9	-1.6	-0.5	-1.2	-13	5.9

Source: Burniaux et al (2010)
(1) Defined here as equivalent variation in income. Benefits from climate policy are not considered.

In addition, Table 1 shows that substitution away from energy-intensive goods in Annex I countries and a general global reduction in demand for these goods leads to a small overall global decline in real income and output of energy-intensive industries. Greenhouse gas emissions are reduced by 13%, despite leakage rates on the order of 6%. These modeling results do not consider the benefits of climate policy in terms of potential future cost savings from innovation nor the environmental benefits of reducing greenhouse gas emissions. Many other analyses find similar magnitudes of competitiveness impacts in aggregate for energy-intensive industries.[3]

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[2] See Hood (2010) for a review of how various governments have proposed to define energy-intensive industries susceptible to competitiveness impacts.

[3] See, e.g., European Commission (2010), "Analysis of options to move beyond 20% greenhouse gas emission reductions and assessing the risk of carbon leakage," *Commission Staff Working Documen*t; Fischer, C., & A. K. Fox (2009), "Combining Rebates with Carbon Taxes: Optimal Strategies for Coping with Emissions Leakage and Tax Interactions", *Resources for the Future*; and U.S. Interagency Group (2009), "The Effects of H.R. 2454 on International Competitiveness and Emission Leakage in Energy-Intensive Trade-Exposed Industries: An Interagency Report Responding to a Request from Senators Bayh, Specter, Stabenow, McCaskill, and Brown."

Box 2: What can economy-wide and sector-specific analyses tell us about impacts on international competitiveness?

The economy-wide analysis described in Section 3 is developed using the OECD's global applied general equilibrium model, ENV-Linkages. The model is able to analyse the effects on competitiveness of multiple interactions between the different sectors and the rest of the economy, and to take into consideration important trade-related effects. Including the indirect effects passed on from other sectors is important for a global, economy-wide evaluation of sector-based policies. However, like all similar top-down models, the level of data aggregation may disregard some variation within aggregated sectors.

While sector-specific models lose the links with the rest of the economy, they tend to have greater focus on specific details, such as sub-sectors and processes, opportunities for mitigating emissions, and ability to pass through costs, in one or a few related sectors. As a result of the additional detail, these models may show larger competitiveness impacts on certain sectors. However, because such analyses omit trade outside of the central market of interest, they risk overstating competitiveness impacts (OECD, 2003).[4]

Economy-wide Analysis	Sector-specific Analysis
Best for understanding impacts in aggregate of: • Broad market interactions • Dynamic price and exchange rate effects • Fossil-fuel markets • Capital mobility • Changing trade dynamics	Best for understanding impacts on specific sectors of: • Sub-sector differentiation • Technology assumptions • Abatement costs • Transport costs

Neither economy-wide nor sector-specific analyses can fully reflect the broad suite of factors that define exposure to impacts on international competitiveness, nor do they typically reflect any positive impacts, such as the potential for positive technological spillovers. However, both types of analyses can complement each other and provide insights into the international competitiveness issue in climate policy.

4. How should approaches to address adverse international competitiveness impacts from climate policy be evaluated?

Given the uncertainty surrounding international competitiveness impacts on individual sectors from an ambitious climate policy, measures that address these impacts can be viewed as a way of managing a transition to a low-carbon economy. During the transition, new opportunities for growth, technology, jobs, and skills development will arise, and policymakers should preserve flexibility to respond to these evolving circumstances. For example, they might include provisions for monitoring and repeated reviews of the magnitude of competitiveness impacts and the effectiveness of the measures put in place to address those impacts, preferably in an institution or national commission removed from the political process (Stephenson & Upton, 2009). As more countries join efforts to reduce GHG emissions and compete for low-carbon technology, the competitiveness pressures related to uneven carbon pricing policies will subside and any transitional measures put in place to address competitiveness concerns should be scaled-back (OECD, 2010b).

[4] For example, the production costs of a sector's major competing materials (i.e., aluminium for steel) will also increase under a climate policy and shift substitution possibilities and effects. Sector-specific models do not capture these effects.

Table 2 provides a set of principles that policymakers can use in evaluating available measures, such as allocation and refund schemes, border adjustments, and industry exemptions, to address potential international competitiveness impacts on energy-intensive industries. These measures are discussed in further detail in Section 5, based on the criteria established below.

Table 2. Principles for developing measures to reduce adverse impacts on international competitiveness from climate policy.

Principle	Description	Indicators for Evaluation *(quantitative and qualitative)*
Effectiveness in addressing international competitiveness impacts	Policymakers should evaluate whether measures to address competitiveness impacts achieve their objectives, such as retaining market share of energy-intensive industries relative to foreign competitors, reducing job losses, or eliminating competitiveness-related emission leakage.	• Sectoral output and employment • Sectoral profits and market share • International trade and investment flows • Emissions and leakage rates
Economic Efficiency	Policymakers should minimise costs to the economy from the imposition of measures to address international competitiveness impacts. For example, the overall costs of achieving a given climate policy target will be increased for a country if the measures taken to address competitiveness impacts result in lowering the emissions reduction requirements for energy-intensive industries, as this would imply some low-cost reduction options are not exploited.	• Domestic welfare or GDP changes • Changes in carbon price • Cost per tonne of leakage reduced • Foregone government revenues
Incentives for GHG reductions and innovation	Given the stringency of proposed climate policy targets over time, measures should maintain significant incentives for GHG abatement and innovation. Exempting some sectors from climate policy, for example, would reduce their incentives for abating GHG emissions.	• Incentives for emissions reductions (such as a price signal) • Innovation impacts (e.g., patents and changes in abatement costs)
International Political Economy	Effects on other countries and on international climate negotiations from measures to reduce competitiveness impacts should be considered.	• International GDP or welfare changes (with particular regard to impacts on the poor)
Domestic Political Considerations	Tradeoffs among stakeholders should be considered, as well as impacts on government revenues and transfers.	• Impacts on affected stakeholder groups (e.g. employment, carbon prices, output) • Foregone government revenues
Implementability	The administrative costs and implementation burden should be evaluated by policymakers for each measure.	• Estimates of implementation burden • The ability to obtain data needed to implement policy measures

5. What is known about the available measures for addressing international competitiveness impacts?

A number of measures have been widely discussed, and in some cases deployed, to address international competitiveness concerns once a climate policy instrument, such as a carbon tax or trading scheme, has been put in place. Drawing on OECD analyses, several such measures are reviewed below according to the criteria described in Table 2 (see Table 3 for a summary of results).

Grandfathered free allocation

"Grandfathered" allowances in a permit system are distributed free in proportion to all or a percentage of a regulated sources' historic emissions or output. Free permits are a way of compensating existing owners for investments in assets that predate the imposition of a carbon constraint. The cost to governments of grandfathered permits is foregone fiscal revenues and the risk of conferring high windfall profits on some firms (Smith, 2008).

In theory, firms treat free allowances in the same way they would purchased allowances, by considering the holding of an allowance as an opportunity cost. Accordingly they would reduce emissions by the same amount they would if the allowances had not been free. It is thus likely that some of the costs – whether they are compliance costs or opportunity costs from holding allowances – would still be passed on to consumers so that firms can increase profits, and that international price competitiveness concerns would not be fully alleviated (OECD, 2009a).[5] There is some evidence from the European Union Emissions Trading System (EU ETS) that this has occurred, even at the expense of long-term market share (Smith, 2008).

Because they help defuse resistance from industry adversely affected by regulation, free permits are often supported politically (Smith, 2008). Yet expectations that permits will continue to be grandfathered in the future undermine recipients' incentives to lower their own emissions to avoid reducing their future expected entitlements. To help address this, policymakers could announce in advance that grandfathered free allocation will gradually be phased-out, as has been done under the EU ETS (OECD, 2009a). Policymakers could also provide allowances on the basis of best-practice benchmarks to strengthen incentives for innovation with respect to emissions reduction, as is currently being developed in the EU ETS, though this approach entails some administrative costs (Reinaud, 2008).

Output-based refunding or allocation

Within an output-based refund or allocation system, regulated sources compete for the lowest emissions per unit of output produced within their sector. Sources emitting exactly the sector benchmark emissions per unit of output produced will pay the same amount in emission charges or permit purchases as they receive back as refunds based on total output. Plants performing worse than the sector benchmark will make a net payment to the system, and plants performing better than the benchmark will receive a positive net refund. The benchmarks can be updated over time to reflect improvements in emissions intensity (OECD, 2010a).

Crucial for the system to operate effectively is the existence of comparable output across firms upon which the refunding can be based and that each plant's output is small enough relative to the total output to form a competitive market (OECD, 2010a). Because production is effectively subsidised, firms' competitiveness is in principle preserved. There should be little effect on sector-wide product prices, and new entrants are treated the same as existing facilities (Smith, 2008).

[5] Provisions for plant closures and new entrants could improve the effectiveness of free allocation measures in addressing international competitiveness impacts. See Reinaud (2008) and Smith (2008).

In an output-based refund system, part of the incentive to abate emissions remains, as the tax base is decoupled from the refund base. However, emission reductions that would have occurred via reductions in production in either a full auction or grandfathered allocation setting will have to be borne by others, thereby raising the carbon price or, in the case of a tax, not occur at all (OECD, 2010d). Output-based measures not differentiated by emissions intensity but rather by emissions will be even more costly (Smith, 2008).

An example of a successful output-based refunding system is that of the Swedish NO_x charge. In 1992, Sweden introduced a tax on emissions of nitrogen oxides (NO_x) from stationary combustion plants; a refund was provided based on plant output as a fraction of total energy output, and plants with an emissions intensity less than the average received a net payment. Since the charge was introduced, NO_x emissions per unit of useful energy produced by regulated plants have declined by 50% as a result of technology adoption and innovations in physical technology and management practices. Costs of mitigation also fell significantly (OECD, 2010a).

With output-based refunds or allocations, there are benefits to the domestic political process as polluters are less likely to protest an environmental charge, and it becomes politically easier to set a high enough charge to generate substantial environmental improvements, as is exemplified by the case of the Swedish NO_x charge. In addition, differential incentives that are inherent to the structure of the refund may even create a natural constituency in support of the refund (Smith, 2008).

Border tax adjustments

Border tax adjustments (BTAs) consist of placing a tax or permit requirement on imported goods that corresponds to the emissions associated with a good either in the importing country or the country of origin. Because both domestic firms and imports face the full costs of carbon, GHG mitigation and innovation incentives are preserved. However, BTAs can be difficult to design and administer.

While OECD simulations show that BTAs can reduce emission leakage related to shifts in production to some extent, they do not necessarily reduce output losses. For example, Figure 1 shows a simulation where BTAs are applied on the direct and indirect (electricity-based) carbon contents of imports to Annex I countries on an origin-specific basis. In this simulation, energy-intensive industries' output decreases slightly with the BTA applied across Annex I countries compared to when the acting countries adopt a climate policy without the BTA. Part of the reduction in output is the result of a slight increase in the carbon price required to meet the emission target when a BTA is implemented. This price increase affects energy-intensive industries both directly and indirectly, via non-energy inputs. Part of the output loss is also due to the impact of costlier imported inputs on the production costs of domestic firms. In the simulations, the negative impacts on energy-intensive industries' output from the increase in carbon price and cost of imported inputs outweigh the benefits to the industries' output from imposing carbon costs on foreign competitors (Burniaux et al, 2010).

Border tax adjustments based on domestic emission rates can further reduce energy-intensive industries' output compared with BTAs based on origin-specific rates, if domestic emissions rates are lower than those in the country of origin. Similarly, exempting exports from the domestic carbon pricing policy can improve domestic sectors' competitiveness abroad, but the exemption also raises the domestic carbon price even more, an effect which can have greater influence and again reduce domestic output (Burniaux et al, 2010).

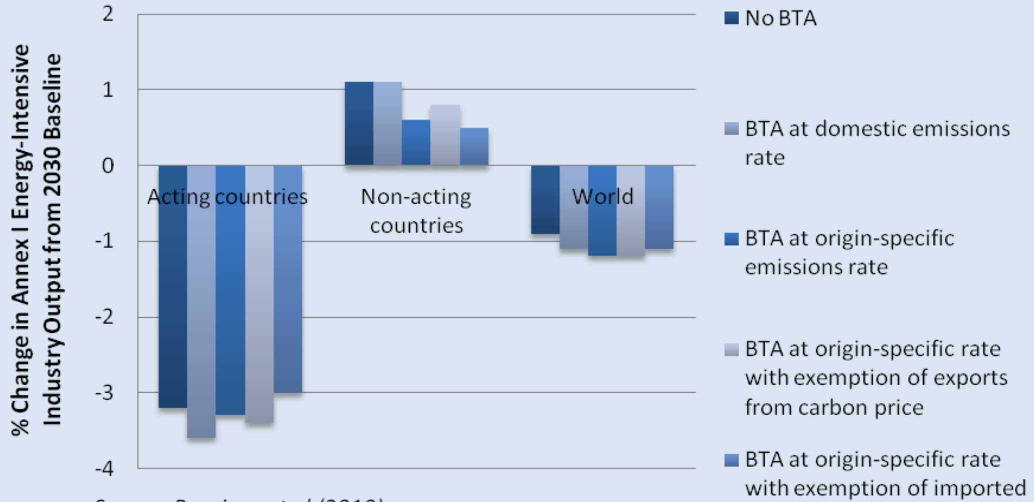
In Annex I countries and globally, BTAs are expected to have negligible impacts on welfare and GDP. However, they lead to cost increases for firms that rely on imports of energy-intensive goods.[6] They may

[6]For more information on the impact of import barriers on competitiveness, see the OECD's policy brief "How Imports Improve Productivity and Competitiveness" at www.oecd.org/trade.

also have a slight negative impact on developing countries, in addition to any impacts that overall climate policies adopted in Annex I countries are projected to have on developing countries. While some see this as an outcome that encourages developing countries to take action, others see a risk of trade retaliation (Duval, 2008).

Figure 1. Impact of Border Tax Adjustments on Annex I Countries under Alternative Implementation Assumptions

(Annex I countries reduce emissions from 2005 by -20% in 2020 and -50% in 2050)



Source: Burniaux et al (2010)

Industry exemption

In addition to the “active” measures described above, policymakers are likely to consider simply exempting energy-intensive industry from regulation or reducing the burden of the climate policy by reducing its tax rates. Over one thousand examples of exemptions and tax rate reductions for environmentally related taxes have been documented by the OECD (OECD, 2006). While in the short-term this option may be politically expedient, OECD analysis shows that it entails considerable costs. To achieve a stabilisation target of 550 ppm, for example, exempting energy-intensive industries from the global effort would increase the cost to world GDP by 50%, according to model simulations (OECD, 2009a). Exemptions for industry will also eliminate or reduce the incentive to develop more carbon-efficient production processes or shift to carbon-neutral energy sources (OECD, 2006).

Table 3: Evaluation of measures for addressing competitiveness impacts on energy-intensive industries from climate change mitigation policies

Measures / Principle	Full auction/tax ("Reference Case")	**Measures to Address Competitiveness Impacts from Climate Policy:** Change from Reference Case: "no change", "+" indicating improvement of criterion from reference case, "-" indicating reduction, and "+/-" indicating uncertain effect)				
		Free Allocation		**Border Taxes**		**Other**
		Grandfathered free allocation	**Output-based revenue recycling or allocation**	**Import Only**	**With Export Rebate**	**Industry exemption**
Effectiveness in addressing competitiveness impacts	Likely to impact some energy-intensive sectors	**+/-** Profits maintained, but market share impacts remain	**+** Incentivizes production	**+/-** Output further reduced; domestic market share may not change	**+/-** Preserves export market share but reduces output due to higher carbon price	**+** Though indirect costs still remain
Economic efficiency	Maximizes economic efficiency	**+/-** Efficiency of policy maintained, reduces fiscal revenues	**-** Production and emissions levels distorted and fiscal revenues reduced	**-** Barriers on imports increase costs	**-** Barriers on imports increase costs	**-** Some cost-effective abatement not implemented
Incentives for GHG mitigation and innovation	Full abatement incentives	**No change**	**-** Abatement from production reductions eliminated	**No change**	**-** Export exemption decreases abatement	**-** Very few incentives
International political economy	Mixed effect on developing country GDP and welfare	**No change**	**No change**	**+/-** Reduces developing country GDP/welfare further with uncertain effects on climate action		**No change**
Domestic political implications	Generally negative due to political power of energy-intensive industries	**+** Reduces industry concerns over profits	**+** Can allow for more ambitious policy	**+/-** Intermediate goods are more costly for all; some industries may perceive market share benefits from international competitors facing similar carbon costs		**+** Fewer stakeholders
Implementability	Similar for all participating sectors	**No change**	**-** Requires common output metrics and competitive domestic market	**-** Analyses of embedded carbon can be costly		**+** Fewer participating sectors

Other measures

While this list of options is by no means complete, it highlights the most commonly proposed measures to address international competitiveness impacts from climate policy.[7] Other measures discussed in the literature include technology policies, such as support for research and development, which are likely to be a complement to the measures discussed here, and sectoral agreements, which are likely to be considered as a supplement to industry exemption.

6. Looking forward

If every country taking action on climate change individually implements measures to address international competitiveness impacts, the possibility of a policy "race to the bottom" is heightened. This has the potential to exacerbate, rather than alleviate, the original challenges associated with policy fragmentation and further reduce the economic efficiency of climate policies. Countries can avoid the worst outcomes by co-ordinating the measures they use in order to prevent further competitive distortions, and by limiting the use of such measures both in number and over time. In time, a more level playing field should emerge as more countries participate in emissions reductions, and thus the pressures for measures to address competitiveness issues should be reduced.

[7] See Hood (2010) for a review of the tools and eligibility criteria used for measures addressing competitiveness impacts in current and proposed emissions trading scheme designs in several countries.

Further reading

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