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BORDER CARBON ADJUSTMENT AND FREE ALLOWANCES: RESPONDING TO COMPETITIVENESS AND LEAKAGE CONCERNS

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Purpose and Structure

This paper aims to assess the efficiency and effectiveness of the options available to respond to competitiveness and leakage concerns. Its principal focus is economic and technical; as such, it complements the more political focus of the shorter main paper produced for the OECD Round Table on Sustainable Development meeting in Singapore on July 22-23, 2009.[1] The two papers have strongly informed each other and were developed in close collaboration.

Free allowances[2] are currently in place and border carbon adjustment (BCA) has been much discussed.[3] This does not mean that both or either of the options are necessarily efficient or effective. Granting free allowances is politically expedient in that it largely avoids discussions around international trade and climate change negotiations and agreements. BCA is intuitively attractive, but practical and legal issues may severely constrain what taxes could be raised. The impacts of BCA on the wider economy are also likely to reduce its effectiveness.

This paper therefore asks whether current responses to competiveness and leakage are appropriate, noting that current provisions could well become 'locked in' and difficult to move away from in the future.[4] Its analysis leads to conclusions giving answers to **key questions currently facing policy makers around the world**:

1. Are free allowances effective in reducing competitiveness and leakage impacts?
2. How many free allowances should be given?
3. Do we have the data we need? Will we?
4. Are free allowances a subsidy?
5. Would BCAs be an effective alternative?
6. Could BCAs be implemented?
7. What account should be taken of alternative policies in other countries?

The paper is structured in four parts. **Part I** sets the background to the analysis, first discussing what is meant by competitiveness and by leakage, how they are measured and what these measurements mean. Options for responding to competitiveness and leakage concerns are then presented. The choice and design of options are governed by what is known about products' carbon content, whether countries, sectors or individual plants are accountable for the emissions generated and whether these be measured cost-effectively. The paper reviews in detail what is known about the range of carbon contents 'embedded' during production by different plant types and countries for the key carbon-intensive products considered to be at risk of significant change to their competitive positions and to leakage. Context is provided by a set of scenarios which compare potential global financial flows from the widespread imposition of a BCA to a range of economic indicators.

[1] Stephenson, J. and S. Upton. "Competitiveness, Leakage and Border Adjustment: Climate Policy Distractions?" Round Table on Sustainable Development background paper, OECD, Paris, July 2009. SG/SD/RT(2009)3.

[2] 'Free allowances' is shorthand for allowances granted free to emitters under emissions trading schemes.

[3] Notably the imposition of taxes on imports of goods, a form of Border Tax Adjustment (BTA).

[4] Support measures and subsidies, once granted, are rapidly seen as entitlements and governments find it difficult to remove them. Thus there is benefit in not granting them in the first place.

Part II analyses the effectiveness of options. This requires an understanding of the economic principles governing the impacts of their implementation. Results from the range of sector-only and full economy models[5] which have been developed to estimate these impacts are reviewed.

Implementation is considered in **Part III**. Whilst there is little direct experience of differential carbon policies between countries, there is a range of practical information which allows us to scope which options could be implemented and what the issues around their implementation might be. The paper reviews what provisions for competitiveness and leakage are included in the major schemes (notably the European Union's Emission Trading Scheme and the United States' Waxman-Markey Bill).

Adjustments at the border are not new. For example, a working party under the GATT published a report on Border Tax Adjustment (BTA) as early as 1970. This paper draws a number of lessons on the legality of options under World Trade Organization law by considering how rules have been applied to other environmental issues.

Moving from the trade to the climate change perspective, and considering the key issue of "common but differentiated responsibility" (CBDR), the paper then reviews how responses to competitiveness and leakage concerns interact with the other greenhouse gas Policies and Measures (PAMs) which have been or are being implemented. It then looks at the experience from implementing other schemes which have differentiated on the basis of the process used to make a product and/or have used labels.

Based on the analysis contained within the paper, **Part IV** concludes by giving answers to key questions currently facing policymakers around the world.

5 Partial equilibrium models and Computable General Equilibrium (CGE) models respectively.

Overview

Competitiveness and leakage concerns arise when countries implement policies and measures (PAMs) which other countries do not, or when PAMs differ between countries. This leads to different costs and risks to producers, leading to concerns that production of goods will relocate to other countries. Such concerns have been sufficient to dilute or even derail proposed environmental policies and measures in the past. This scenario applies to climate change, as countries enact and propose a wide range of PAMs of widely-varying designs and stringency levels. Concern is expressed principally by energy intensive industry and the electricity generation sector.

Most PAMs specifically aimed at reducing GHG emissions have been introduced relatively recently. Many of these envisage a gradual ramping up of their stringency, allowing affected industry sufficient time to adjust. It is expected that many more GHG PAMs will be introduced in the near future, both within countries that already have many and those where there are currently few or none, and that their stringency will increase over time.

There is thus little empirical evidence of the impacts of differential GHG PAMs on competitiveness and leakage. Our understanding relies on theoretical considerations ranging from relatively simple analyses to models encompassing varying complexity and economic and geographical scope.[6] These models predict widely varying results. Underlying the disparity is the complex reasoning behind why production changes location, notably in the longer term when producers decide where to build new plants. Whilst climate change policies and measures may play a role in such decisions, they are far from the only factor[7]– they may play a significant role or a minor one.

Whatever the evidence, it is clear that governments face strong political pressure to respond to competitiveness and leakage concerns. Responding to these concerns may be politically necessary if a country wishes to introduce GHG PAMs, even where the economic necessity to do so is not yet clearly established. The industries that express concern tend to be concentrated in a relatively small number of large plants whose supply chains are responsible for a large number of jobs in their home regions. Their closure or expansion would have a major impact on local employment.

Implementation of emissions trading schemes (ETSs) currently causes the most concern. ETSs give rise to cost differences between countries covered by them and those which are not. The European Union's ETS is currently the largest market for carbon emission allowances in the world; the Waxman-Markey Bill, currently before the US Senate, would create a large US market if enacted. Both schemes currently grant for free (in the EU), or propose to grant for free (in the US), the majority of allowances needed by producers in industries considered at risk of competitiveness and leakage impacts to meet current production levels.[8] The relatively small share of allowances not provided for free to individual plants would need to be purchased, either through auction or directly from the carbon market.

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6 See Sections 2.2 and 2.3 for a full analysis of the results of sector-based and full economy models.

7 Others include differences in energy prices, the cost of capital, environmental regulation, wage costs, exchange rate risk, transport infrastructure, transparency, etc.

8 In summary, phase 3 of the EU ETS (covering the period 2013-2020) proposes to allocate allowances for free to the best 10% of technologies within the EU, for sectors considered at risk of leakage; the latest proposals under the Waxman-Markey Bill would rebate sectors at risk 85% of their direct emissions costs and 100% of their indirect costs. See Section 3.1 for further details.

The EU and US schemes both propose performance reviews of their current response to competitiveness and leakage concerns (i.e. granting the majority of allowances for free to sectors considered to be at risk). These reviews would consider new evidence and take into account climate change policies and measures implemented in other parts of the world. The result of the reviews could also be to fully or partially replace the granting of free allowances with other measures. Explicitly listed in the US proposal, and considered to be one of the options for redress in the EU scheme, is the possibility of imposing some form of BCA on imports from countries not covered by the ETS. Industries considered at risk would pay for their allowances, but competitive effects would be at least partially levelled by also requiring importers to pay for carbon emissions released during production.

The difference in government revenue between granting free allowances and requiring industry to pay for them can be extremely large (in the order of billions of US dollars per year in the EU or US). In itself, this suggests that the public has a legitimate interest in asking whether government policy is an efficient use of resources. More detailed analysis also reveals that there is a major question regarding effectiveness: the options (free allowances and BCA have been the most discussed, though others, such as subsidies for investment, could be employed) affect competitiveness and leakage in different ways.

None of the options is likely to be fully effective at levelling the playing field between domestic and foreign producers. Design specifics are important: economically, there is the possibility that certain options may be costly but do little to alleviate competitiveness and leakage concerns; practically, difficulties in measuring the carbon emitted during production could require a trade-off between administrative cost and effectiveness.

Climate change policies and measures cannot be applied in a vacuum. Options for addressing competitiveness and leakage concerns need to take account of international agreements governing trade and climate change. Both fields are complex. The potential for compliance with various options has been the subject of numerous studies,[9] but a simple analysis is that the issues can be boiled down to two key principles:

1. *Climate Change*: A key principle within the United Nations Framework on Climate Change[10] is "common but differentiated responsibilities" (CBDR). Embedded throughout the Convention, and espoused in the Bali Action Plan of 2007, this allows countries to respond to reducing GHG emissions in line with their historical responsibility and current capacity. A BTA or other PAM which applied an equal cost of carbon to production from all countries would appear to be at odds with this principle.[11]

2. *Trade*: A key principle of World Trade Organization law is non-discrimination between "like" goods. The definition of "like" does not take account of how a good was produced, but GATT Article XX does allow for exceptions against a limited number of criteria, one of which is environmental benefit.[12] Whether this exception can be invoked for one or all of the options for

[9] See Section 3.2 for a fuller analysis.

[10] The UNFCCC is the basis for international negotiations and agreements, including the commitments agreed on absolute emissions by most developed countries under the Kyoto Protocol and the Bali Action Plan, and is part of the process for agreements to cover the post-2012 period.

[11] Noting that both the design of options (for example using best available technology as the basis for a Border Tax Adjustment) and the possibility of compensatory measures (e.g. financial transfers) may allow an option to partially or fully respond to the principle of CBDR.

[12] Such as when "necessary to protect human, animal or plant life or health" and "relating to the conservation of exhaustible natural resources" (see Section 3.2 for details).

responding to competitiveness and leakage impacts is not clear and depends on design specifics. What is clear is that there must be an environmental rationale: options which seek only to protect domestic producers for economic reasons will not be saved by this exception.

PART I: BACKGROUND

1.1 Competitiveness and Leakage

Competitiveness

1. Governments and firms continually seek ways to increase industry competitiveness.[13] Governments aim to provide, *inter alia*, skilled, healthy workers, transport infrastructure and incentives to innovate; firms aim to increase productivity, reduce costs and improve marketing.

2. Within the climate change debate, competitiveness is generally discussed at the level of national or regional industrial sectors (e.g. steel in Indonesia or chemicals in the European Union). It can be defined as “the ability [of a sector] to sell goods and services under free and fair market conditions” (Lipsey, 1991). An increase in competitiveness would be expected to result in an increase in market share and/or profit (Reinaud, 2008).

3. Competitiveness is a comparative concept and its measurement is challenging (Krugman, 1994). The competitiveness of a sector in a particular country depends on a wide range of factors, from the costs of labour, energy, raw materials and services to physical proximity to major markets and fiscal factors such as interest and exchange rates. These factors interact with each other and change with time; it is difficult to perform a *ceteris paribus*[14] analysis of the impacts on competitiveness arising from a single factor.

4. Product differentiation and market access further complicate the picture. Whilst it is often assumed that commodities such as steel, basic chemicals and paper are homogenous, there are often important differences which alter the relative demand for these products. Examples include quality, after-sales service and the existence of a long-term relationship between a particular customer and supplier.[15] It is also wrong to assume that firms are always powerless to resist threatened reductions in their market share; they may be able to discount prices for a period of time or use the political system to erect defensive measures.[16]

5. International trade agreements do not aim to equalise production costs between countries. Rather, they seek to promote fair competition by, *inter alia*, reducing import tariffs and protectionist non-tariff barriers (e.g. discretionary standards). The benefits of trade occur because trading partners realize allocative efficiency when they allow trade to follow the pattern of comparative advantage. The current debate on the need to minimise protectionist policies in order to reduce the impacts of the financial crisis

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13 A government example is Ireland’s National Competitiveness Council (http://www.competitiveness.ie/).

14 Keeping all other factors equal.

15 Neuhoff (2008) categorises premia for local goods as coming from customer trust, tailored product attributes, delayed response to new specifications and political weight of labour impact. Trade adds a further barrier to competing in the import market; also included are transport cost, port facilities, storage, interruption risk, tariff risk and exchange rate risk.

16 Most global economic models include the ‘Armington elasticity’ formulation (Armington, 1969) in order to distinguish between locally-produced and imported goods. Its application requires imported goods to have a lower price than locally-produced goods in order to compete with them. Its value is typically derived from econometric analysis and thus does not tend to explain why the origin of a product is important, only that it is.

which started in 2008 is a striking example of the accepted benefits that trade can bring to the world economy.[17]

Leakage

6. "Leakage" occurs when the reductions in GHG emissions resulting from the introduction of a PAM in one country are partially or fully offset by increased GHG emissions in others. The most commonly-used definition is from the IPCC,[18] which defines leakage due to a particular policy as:

> [an] increase in emissions outside the country / decrease in emissions inside the country

7. Countries worry that leakage will dilute the effectiveness of climate change PAMs, but also that reduced competitiveness will result in losses of jobs and profit. It is often difficult to disentangle the stated and real goals. Whereas the term "competitiveness" is generally used consistently, "leakage" is not. Lobbyists whose key concern is loss of competitiveness often disguise this by focusing on the leakage they claim will occur when "clean" local production is replaced by "dirty" foreign production.[19] When production moves from a country with an absolute cap to one without, leakage can occur even if local production is more carbon-intensive than foreign production, although in this case such leakage would certainly be less than 100% (i.e. it would not be possible for all emissions reductions made in a country with PAMs to be offset by increased emissions elsewhere).

8. Figure 1 illustrates some of the issues associated with leakage. When a climate change policy is introduced within the 'Domestic Economy', the price of goods rises and their consumption falls. Domestic producers are also incentivised to invest in carbon abatement. These effects are desired impacts of climate change policy and lead to 'Desired Reductions' of GHG emissions in the 'Domestic Economy'. What is not desired by the 'Domestic Economy' policy maker is that its producers should lose competitiveness, with net imports increasing and domestic producers losing market share[20] to countries which have not implemented equally stringent climate change policies. The associated reduction in domestic production would further reduce emissions in the 'Domestic Economy', but increase them in the 'Foreign Economy' and in the transport resulting from extra trade. Domestic policy-makers do not regard this 'production leakage' as a desirable outcome. Supporters of domestic production have been quick to point out this potential downside, often using emissions leakage as a proxy in a discussion which is in fact about competitiveness and market share.

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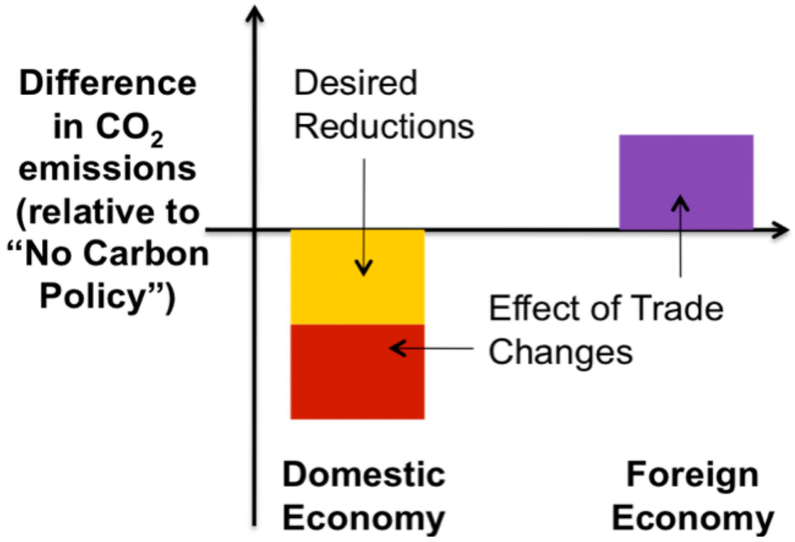
17 For a survey of concerns over protectionism in the current fiscal crisis, see Richard Baldwin and Simon Evenett (eds.) The Collapse of Global Trade, Murky Protectionism and the Crisis. London: Centre for Economic Policy and Research, 2009.

18 IPCC 2007: Mitigation. Contribution of Working Group III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change (eds Metz, B., Davidson, O. R., Bosch, P. R., Dave, R. & Meyer, L. A.).

19 IBEW/AEP (2007).

20 Loss in market share and/or profits is often described as "financial leakage".

Figure 1. Short-term CO_2 emission changes following a carbon cost applied only in a domestic economy



Channels of leakage

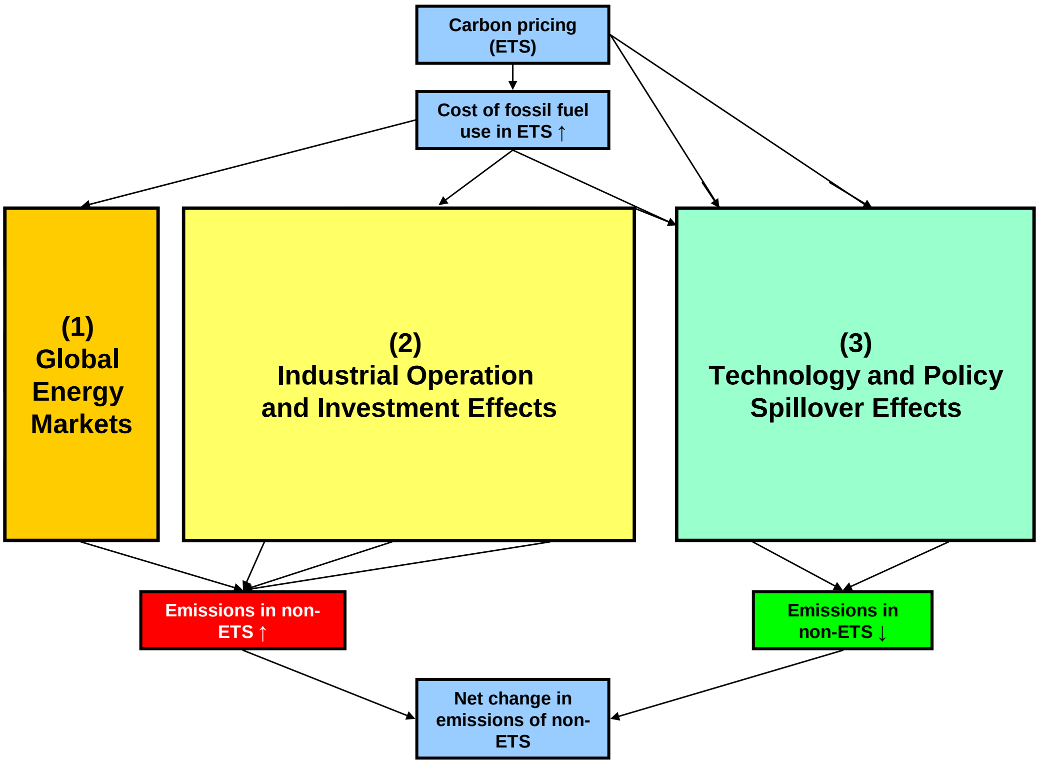
9. Figure 1 identifies leakage driven by a decrease in short-term international market share, often referred to as the "competitiveness-driven leakage" channel. In the longer term, differences in cost levels could lead to a relocation of energy-intensive industries to countries with less stringent climate policies. This is generally referred to as the "investment channel" for leakage. These two channels are intuitive; other forms of leakage are less so. Reinaud (2008) also identifies:

- "**reduction in global energy prices** due to reduced energy demand in climate-constrained countries which, all things being equal, triggers higher energy demand and CO_2 emissions elsewhere;
- **increases in prices of low emitting feedstocks** (e.g. scrap metal for recycling), lowering their consumption in non-carbon constrained countries;
- lower unitary emissions in new vintages outside the region, as the constrained producers' **process innovations may spill over to other regions**."[21]

10. The links between channels of leakage are complex. Figure 2 illustrates how carbon pricing within an ETS can alter emissions outside it.

[21] i.e. new technologies and processes developed within constrained countries can then be employed in unconstrained countries. Their introduction would reduce GHG emissions compared to a baseline case, thus reducing leakage.

Figure 2. Relationships between channels of leakage (Dröge, 2009)



11. For a given sector or economy, any of the forms of leakage may be the most important. Results from studies and analyses which do not take account of all possible channels of leakage should therefore be treated with care.

Measuring leakage and environmental integrity

12. The IPCC formula for the impacts of a particular policy or measure is:

$$\text{Leakage} = \frac{\text{increase in emissions outside the country}}{\text{decrease in emissions inside the country}}$$

13. In other words, in Figure 1, the size of the second column relative to the first.

14. While simple to state, it is important to understand what leakage measurements mean. Again referring to Figure 1.1, leakage rates will be higher when production moves out of a domestic economy to a foreign one. They will also be higher when production moves out of a system governed by absolute caps, and also when the carbon intensity of foreign production is high relative to domestic production.

15. The measure of "leakage" has most utility in the case of production moving from a country with an absolute cap to one without. Here, all the emissions from foreign production represent extra emissions in the global system, as the reduced emissions from decreased domestic production reduce the effort required by that country to meet its absolute cap. The higher the carbon intensity of the foreign producer, the higher the leakage and the higher world GHG emissions will be. However, it is wrong to state that the

main driver of leakage is "dirty" foreign production replacing "clean" local production. Unless the difference between carbon intensities is very high, it is more likely to be how much production has moved.

16. Under an intensity-based cap there will be a loss in environmental integrity if foreign production is more carbon-intensive than domestic production, but only to the extent of the difference between the carbon intensities (remembering that under an absolute cap, leakage is from *all* the emissions from production which has moved abroad).[22]

17. Measures of leakage must therefore be treated with care. For the absolute cap ETSs in place in the EU and proposed for the US, it is important to note that environmental integrity is likely to be driven more by the movement of production than by differences in the relative carbon intensity of producers. In this respect, the debate around leakage often includes competitiveness, where production should be located and industrial policy.

18. When interpreting a claim that a particular PAM will result in a leakage rate of, say, 30%, the following should be considered:

1. *It is necessary to understand the formula governing the calculation*. Leakage calculations are almost universally based on models – there is very little empirical experience of the impact of differential GHG policies. The methodology and assumptions employed in the model, including those related to how factors other than GHG PAMs[23] will change and interact, are critical drivers of the results it produces. Key factors include the carbon price(s) assumed[24] and the account taken of how other sectors of the economy will be affected by changes in sectors covered by the PAM.[25] Furthermore, models are often designed to estimate only one or a limited number of leakage channels.
2. *The time period the model covers*. In the short-term, there is relatively limited potential for shifts in production as there is no opportunity to build new plants. In the longer term, new plants can be built and the potential for shifts in the location of production are much higher.
3. *Details of the scheme design*. PAMs which result in a carbon price will have different impacts than those which lead to a change in technological choice. If the PAM is an ETS and results in a carbon price, variables such as absolute or relative caps; free or auctioned allowances; and provisions governing new entrants, plant closures and updating rules will all affect incentives to firms.
4. *Other GHG PAMs countries have implemented or are planning to implement*. The EU ETS, which covers approximately half of CO_2 emissions from the EU, is the world's largest. However, it is only one in the portfolio of EU PAMs: the application of others relating to, *inter alia*, renewable energy, energy efficiency, product standards and best available technology (BAT)[26] alters the cost structure of both the electricity generation and energy-

[22] Loss in Environmental Integrity = change in emissions from production moving abroad / desired reductions.

[23] See 'Competitiveness', previous section.

[24] It is likely that carbon prices in different schemes will differ, perhaps significantly. The prices of allowances under the EU ETS and the US' RGGI scheme differed by a factor of 5 in June 2009, even though both are examples of Emission Trading Schemes (www.pointcarbon.com).

[25] Such impacts can be non-intuitive. A carbon constraint in one country may serve to reduce fuel demand, thus reducing world market prices and leading to increased fuel consumption.

[26] European Parliament legislative resolution of 17 December 2008 on the proposal for a directive of the European Parliament and of the Council amending Directive 2003/87/EC so as to improve and extend the greenhouse gas

intensive industrial sectors covered by the EU ETS and those less energy-intensive sectors lying outside it. Other countries and regions also implement, or plan to implement, their own portfolio of GHG PAMs. Prominent in the discussions are China's commitment to reduce its energy intensity by 20% over the period 2006-10,[27] Japan's support of technology-oriented approaches,[28] South Africa's Long-Term Mitigation Strategy[29] and the US's Waxman-Markey Bill.[30] Each of these PAMs adds its own tilts and undulations to the playing field, and all must be taken into account in order to fully assess leakage (and competitiveness and environmental integrity) impacts.

Options for responding to competitiveness and leakage concerns

19. A border carbon adjustment (BCA), applied to imports into a country with a GHG PAM, is only one of the available options. Options can be categorised on the basis of whether or not they are border carbon measures (Wooders, Reinaud and Cosbey, forthcoming; Dröge, 2009):

1. Border Carbon Adjustment (BCA)
   a. Border Taxes (as tariffs on imports and, less commonly, rebates on exports);
   b. Mandatory Allowance Purchase by importers;
   c. Embedded Carbon Product Standards;
2. Alternative Options[31]
   a. Aid to Industry (e.g. through direct compensation in the form of investment subsidies to low carbon technologies);
   b. Free Allocation (of allowances to domestic producers);
   c. Sectoral Approaches.

20. BCAs have yet to be implemented anywhere in the world, though they have been discussed within the context of almost all mandatory GHG ETSs implemented or proposed to date. Within the BCA category, the requirement for mandatory purchase of allowances by importers and a BTA on imports are very similar - the main difference being that the timing of the carbon price calculation may vary.

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emission allowance trading system of the Community (COM(2008)0016 – C6-0043/2008 – 2008/0013(COD)). Position of the European Parliament adopted at first reading on 17 December 2008 with a view to the adoption of Directive 2009/.../EC of the European Parliament and of the Council amending Directive 2003/87/EC so as to improve and extend the greenhouse gas emission allowance trading system of the Community. http://www.europarl.europa.eu/sides/getDoc.do?pubRef=-//EP//TEXT+TA+P6-TA-2008-0610+0+DOC+XML+V0//EN&language=EN#title2.

27 OECD (2007).

28 For example, the Asia-Pacific Partnership on Clean Development and Climate, within which Japan has a prominent role (http://www.asiapacificpartnership.org/english/default.aspx).

29 Van Schalwyk (2008). Includes the idea of SD-PAMs within UNFCCC context.

30 H.R. 2454: America Clean Energy and Security Act 2009. It includes a large portfolio of measures, from cap and trade to energy efficiency to sectoral policies in areas such as transportation and power.

31 Both a global market for carbon and consumption-based accounting (rather than production-based accounting) would also have impact on competitiveness and leakage. These are radical changes from the status quo: they entail a different set of discussions rather than being simply alternative "options". Exemptions from the provisions of the options would also be possible.

21. Embedded carbon standards are very different from BTAs or the mandatory purchase of allowances. Rather than requiring a payment to be made on the basis of a good's carbon content, they would distinguish goods into two or more categories (e.g. 'acceptable' and 'non-acceptable' or rated from A to E). This grading could be used to prohibit the import of goods which do not meet a certain standard or simply as a source of information to consumers. The impact of standards on production and trade is likely to be radically different from BCAs or free allowances.

22. The free allocation of allowances has been part of the European Union's ETS since its introduction in 2005; provisions are included within proposed ETSs in the US (the Waxman-Markey Bill), Australia and other jurisdictions. Countries granting allowances for free assume that GHG PAMs impose costs on producers that erode their competitiveness, and that free allowances will, by compensating producers for financial losses, allow them to stay competitive.[32]

23. Sectoral approaches have been proposed as a solution to competitiveness and leakage concerns in the most carbon-intensive industrial sectors.[33] A transnational sectoral approach which sets up a market for carbon within a particular sector across many countries and hence a common carbon price, would eliminate carbon cost differences. However, its implementation is considered unlikely, at least in the short- to medium-term, so it is not explored further as an option within this paper.[34] A closer inspection of other options reveals that the majority of sectoral approaches proposed to date would not reduce the carbon cost differential which leads to competitiveness and leakage concerns: indeed, any sectoral approaches based on crediting mechanisms[35] would increase the production cost differential between developed and developing countries. Dröge (2009) includes international agreements to achieve a global carbon price as an option, listing sectoral agreements as one of the potential agreement types. Whilst agreements leading to global carbon prices are clearly desirable and would effectively reduce competitiveness and leakage concerns, they are considered beyond the scope of this paper.

24. Financial transfers to industry have much in common with the granting of free allowances: both have relatively minor links to production levels. If aid to industry were to take the form of investment support, it would have a different character.

25. The key differences between these options concern whether and how they relate to the carbon price, to the quantity of production and whether they take account of a continuum of carbon contents or impose an 'on/off' hurdle. The effectiveness of the options in reducing competitiveness and leakage impacts is far from uniform and the costs they impose on economies and sectors within them can vary widely. Within any of the options, specific design choices also have the ability to significantly alter effectiveness and the distribution of costs. This paper concentrates on the two main options under consideration: BCAs and free allowances.

26. Any of the options can be combined with flanking measures designed to compensate for the extra costs imposed on industry, i.e. reduced income taxes. These measures are discussed in Sections 3.3 and 3.4.

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32 Countries may still be concerned about competitiveness even after they have granted free allowances (see Section 3.1 for a discussion of current and proposed policy in the EU, US and elsewhere).

33 See Figure 2.1 and the accompanying text for this list: iron and steel, aluminium and cement are key sectors.

34 Stephenson, J. (2009) "Post-Kyoto Sectoral Agreements: A Constructive or Complicating Way Forward?" Round Table on Sustainable Development background paper, OECD, Paris, 13 March 2009.

35 Thus having analogous characteristics to the CDM.

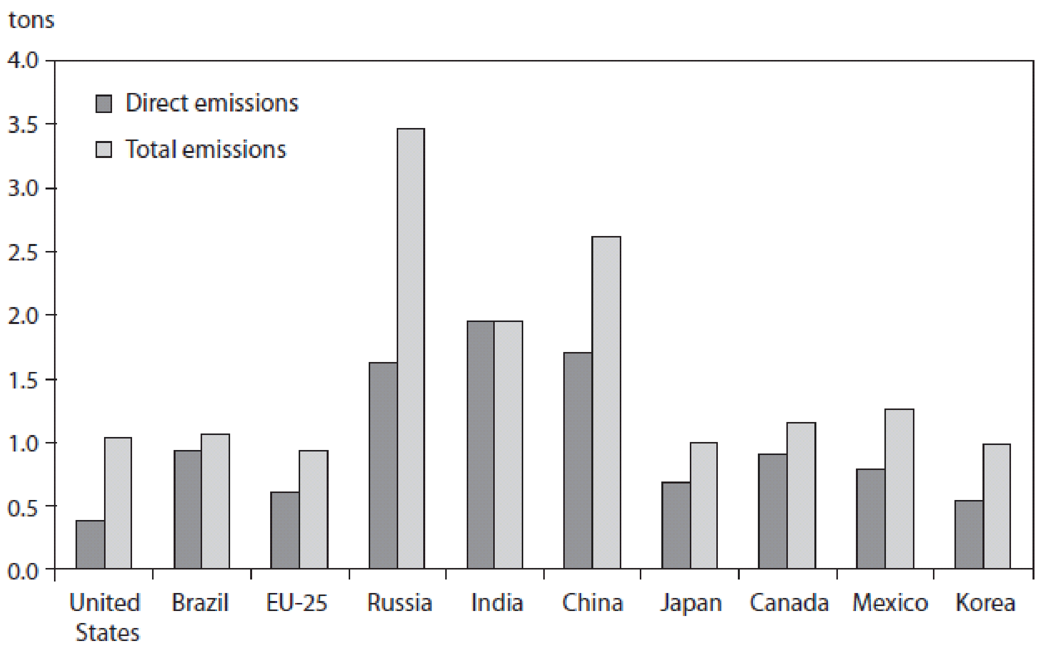
1.2 Product Carbon Content

27. How effective the various options will be in reducing competitiveness and leakage impacts depends on: a) differences in GHG emissions between "like" products from different sources; and b) options producers have for reducing these emissions. The choice and design of options are governed by what is known about products' carbon content, whether countries, sectors or individual plants are accountable for the emissions generated and whether these can be measured cost-effectively.

Average figures

28. Studies on competitiveness and leakage tend to use aggregated estimates of GHG emissions resulting from the production of products such as cement and steel. Figure 3 below shows the carbon intensity of steel by country or region. Total emissions from US steel production are, on average, 40% of those from Chinese steel production. A major part of the difference is due to the much higher share that plants which recycle steel play in the US compared to China. These plants require electricity to melt recycled scrap, a far less energy- and GHG-intensive process compared to steel production starting with iron ore in a blast furnace.

Figure 3. Carbon intensity of steel, 2005 (Houser et al, 2008)
(tons of CO_2 per ton of steel)



Sources: International Iron and Steel Institute, *Steel Statistical Yearbook*, 2006; IEA (2007c); authors' estimates.

Drivers of product carbon content

29. Drivers of product carbon content, and the consequent range of carbon contents in products, are important for two main reasons:

1. 'best available technology' (BAT) emissions factors can be used in certain free allowance and BCA schemes;
2. an understanding of whether there are typical differences between national product carbon contents also informs scheme design.

30. The example given above shows that the comparison of average GHG emissions from steel production requires an understanding of the relative rates of scrap steel usage; for steel, the process employed is an important determinant of product carbon content. Generically, drivers of product carbon content include:

a. process;

b. management of the process;

c. energy efficiency of equipment and techniques employed;

d. mix of fuels used (coal, gas, oil; biomass; wastes; electricity);

e. source(s) of electricity consumed,[36]

f. extent to which recycled materials can be integrated into the process or product;

g. extent to which blends can be added to the product of the primary process, thus effectively requiring less primary product per unit of final product.[37]

31. The relative importance of these drivers depends on the product. Table 1 summarises the drivers for cement, steel and aluminium. All three processes are relatively mature; within a particular plant design the difference between the best-managed facilities with high levels of energy efficiency and the lowest-performing facilities is generally under 10%.

[36] Defining the provenance of electricity is not always straightforward., Where a plant is tied through a physical connection, the case is relatively simple. Even here, the electricity that such a plant generates would find ready customers elsewhere, given that plants such as hydro and nuclear are capital-intensive but have low operating costs and low GHG emissions. For the longer term, premia paid by customers for hydro-electricity or some other source may have only a minor impact on altering the generating mix in the long term.

[37] Perhaps the key example is the addition of fly ash, ground granulated blast furnace slag (ggbfs) and other pozzolans to clinker (the output of the primary cement process) in order to increase the quantity of final cement per unit of clinker produced. Such blending is one of the most important options cement manufacturers have for reducing their GHG emissions.

Table 1. Drivers of Product Carbon Content in Cement, Steel and Aluminium

Product	Process	Fuel Mix	Electricity source(s)	Use of Scrap	Blending
Cement	All cement processes use kilns. The dry kiln is the most energy efficient and is now the technology of choice across the world, except when the limestone available is wet (when a process which is at least partly wet is used.)	Tends to dominate where coal is available. Gas use common in parts of Eastern Europe and the Middle East. Biomass and waste use can save costs and reduce GHG emissions.	Not process dependent. Waste heat recovery can generate a relatively small amount of electricity and is the industry standard in many countries.	Not possible at present.[38]	Average rate worldwide 10%. Rates of 30% and higher possible.[39]
Steel	Iron ore reduction in the blast furnace is the key primary route, with basic oxygen smelters then used for steel production. Direct Reduction of Iron (DRI) allows the construction of smaller, simpler plants. The 'sponge iron' from DRI is then refined in an Electric Arc Furnace. EAFs also refine scrap steel.	Substituting coal and natural gas within the blast furnace lowers costs and emissions. Little current potential to use biomass or waste.	On-site generation typical, often using gases from coke oven and blast furnace.	A large and growing scrap metal market, including international trade. Primary and secondary production largely separate.[40]	Not strictly possible – different types of steel can lead to the reduction of steel needed in products.[41]
Aluminium	Primary process is electrolysis of aluminium oxide ore. Recycling of scrap either within remelters (clean scrap only) or refineries (all grades) Process essentially fixed with various propriety secrets.	Fuel use is negligible compared to electricity and is not part of the primary production process.	Source of electricity the key cost driver. Plants tend to be built with dedicated power plants, often hydro-electric.	The majority of aluminium is now recycled.[42]	Not strictly possible – different types of aluminium can lead to the reduction of aluminium needed in products.[43]

38 The Cement Sustainability Initiative is one of several organizations investigating the possibility.

39 The rate possible depends predominantly on whether blending materials are available, whether blends are allowed under national legislation and whether there is consumer acceptance for blended cements. The cement industry has varying influence over these issues.

40 It is possible to introduce a limited amount of scrap into the basic oxygen furnace associated with the blast furnace route. EAF can use 100% scrap.

41 For example the use of advanced high-strength steels in cars (see World Steel Association website: http://www.worldsteel.org/index.php?action=publicationdetail&id=87).

42 See the International Aluminium Institute's 'Recycling' page at http://www.world-aluminium.org/Sustainability/Recycling.

43 See the International Aluminium Institute's 'Sustainability' page at http://www.world-aluminium.org/Sustainability.

32. The drivers of product carbon content are analysed in Table 2. The table concludes that the ranges of emissions from steel and aluminium production are extremely wide, with the key factor being whether the route is a primary one (starting with the metal ore) or whether scrap material can be used. For cement, a best technology is more easily identified as the absence of a secondary production route. The difference between the lowest and highest emission factors is far less extreme than for steel and aluminium, but there is still more than a doubling between the low and high ends of the range.

33. Regarding national characterisation, the only link between the producing country and the GHG emissions factor for aluminium is how electricity is generated (notably whether a country has large hydro-electricity plants). For steel, the share of production from scrap is a very important determinant and a level of national characterisation can be made on relative emissions factors at the average level. As ever, many countries, notably those in the developing world, may have a mix of best-of-class modern plants with inefficient older ones. There is also some possibility for national characterisation in cement, notably with regard to fuels used to fire kilns and the amount of blending in the final product. Again, there can be mixes of technologies, with China (responsible for 50% of world cement production) combining the most modern plants with aged, small 'shaft' kilns and a number of wet kilns. An illustration of the variability of performance between cement kilns is given in Figure 4, which shows the amount of thermal energy per tonne of clinker production. This is only one driver of the final variability of emissions from cement production, which also needs to take account of the fuel mix used and the share of blending materials in the final product.

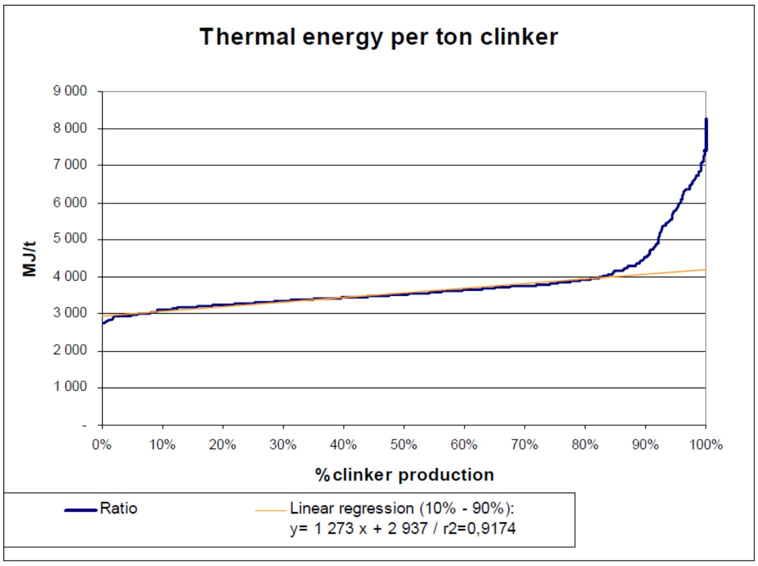
Table 2. Ranges of GHG emissions from three key products, best technology and national characteristics

Product	Emissions Range (tCO_2/t product)	Best Technology	National Characteristics
Cement	The calcination of limestone feedstock produces a fixed 0.53 tCO_2/t clinker; dry kilns in the EU (at or near best practice) add a further 0.35 tCO_2/t clinker.[44] Wet and semi-dry kiln processes add approximately 25% energy demand, shaft kilns (a smaller plant unique to China) a further 25%. Average addition of gypsum and blending materials is on the order of 20% of final cement, giving an EU average of 0.67 tCO_2/t cement. Higher blend rates and use of biomass and wastes can reduce this figure to around 0.5 tCO_2/tonne. High end of the range approximately 1.2 tCO_2/tonne cement.	Dry kiln with pre-calciner and 6-stage pre-heater. Blending of product and use of waste fuels and biomass. Use of natural gas could be specified but is considered uneconomic in many countries.	High efficiency dry kilns are now the standard for new plants, except when the limestone feedstock is wet (for example in parts of Russia and China). China is responsible for 50% of world cement production and has a policy to close its smaller, low efficiency 'shaft' plants. An important national difference is the use of natural gas in parts of Eastern Europe, the former Soviet Union and the Middle East.

[44] Oeko Institut and Ecofys, 2009.

Steel	Best practice blast furnace route has direct emissions on the order of 1.6 tCO_2/t steel. Electricity requirement of 4 MWh/t steel adds 0-0.4 tCO_2/t steel. Older, less efficient systems can result in emissions up to twice this amount or more. EAF using scrap requires 6-10 MWh/t steel, giving emissions of 0-1.0 tCO_2/t steel depending on the electricity source. DRI plus EAF route using natural gas reduction typically has emissions a little below good blast furnace route, again dependent on electricity source. Range from close to zero to 3.5 tCO_2/t steel.	Electric Arc Furnace using scrap metal, with electricity supply from low carbon source. But there will still be the need to use the blast furnace route or an alternative such as DRI for introducing new steel into the system.	The use of scrap steel in EAFs has brought down average energy use and GHG emissions. Scrap usage rates vary across the world and there is an international market for scrap. Older plants, often under national ownership, can have much higher emissions than newer ones and are prevalent in many parts of the developing world.
Aluminium	For the primary process, anode use and emissions of PFCs are approximately 2.6 tCO_2/tonne. Average electricity is 15.3 MWh/tonne. With coal-fired electricity, this equates to 15.3 tCO_2/tonne. Secondary aluminium is 5% of this figure, (i.e. 0.75 tCO_2/tonne) with negligible direct emissions. Range is therefore 0 to 18 tCO_2/tonne.	Secondary aluminium only has 5% electricity consumption of primary. If hydro-electricity is used, emissions close to zero. Still needed for the primary aluminium route for introducing new aluminium into the system.	Energy efficiency is highest for most modern plants, which can be anywhere in the world. Key issue is the source of electricity, which tends to have a national characteristic, notably whether the country has large hydro plant or not.

Figure 4. Primary process cement efficiency, world plants in the CSI's GNR Database[45]



Source: CSI (Cement Sustainability Initiative)

45 As reported in Oeko Institut and Ecofys (2009).

Tools for measuring product carbon content

34. The quality and disaggregation of data required for studies which simulate responses to competitiveness and leakage concerns is much lower than that which would be required to support the implementation of the options. An embedded carbon product standard which imposed a maximum permissible carbon content on imports would demand the highest level of data quality, as it would effectively decide access to a market. Faced with the prospect of being denied access, producers would be likely to consider legal action which could involve a thorough review of data collection processes and procedures.[46]

35. Tools, techniques and protocols to measure the carbon content of products exist. This does not imply that complete data sets exist or that collecting such data would be quick or cheap. Measuring carbon content requires: the definition of the product or products from an industry; a specification of the boundary of the process, including how far up and down the supply chain the process should go; and decisions on accounting principles, notably whether average emission factors for electricity supply can be used or marginal factors are required.

36. The experience of the Cement Sustainability Initiative[47] in setting up their "Getting the Numbers Right" database is instructive. The CSI rapidly decided that plant-level data was essential. They collected only physical, current data, excluding financial data or any future projections. The administrative management of the database was contracted out to a professional services company.

37. The CSI data was collected to allow cement companies to understand and report on their relative GHG emissions and also to provide the basis for schemes such as exploring a new Clean Development Mechanism (CDM) methodology and investigating sectoral approaches for the cement sector. It uses a variant of the WBCSD/WRI GHG Protocol, the accepted protocol for measuring GHG emissions under ISO standards. [48] The costs of developing and maintaining the database are met by the companies themselves on a voluntary basis.

38. Carbon footprinting and life cycle assessment (LCA) is a developed, growing business offered by environmental and other consultancies. Experience to date has focused on specific products (e.g. carbon labels for retailers such as Tesco in the UK) and on producing inventories of total emissions for companies who wish to set themselves GHG emissions targets and/or make claims around them.[49] While it is difficult to give an exact cost for the carbon footprinting of a GHG-intensive process, Tesco's experience in producing carbon labels for over 200 of their products has required a contract with environmental consultancy ERM over a two-year period.[50] The work is based on measuring a set of inputs and outputs

46 See Section 3.2 for detail on the legal issues associated with carbon product standards and other options to reduce competitiveness and leakage.

47 A voluntary grouping of cement producers, currently including 18 companies responsible for 30% of world cement production.

48 The ISO Standard (14060 has been used as a standardised form since 2001; see also 14064 and 14065 for GHG quantification and reporting) identifies four main steps when conducting an LCA: the first two (Goal and Scope Development and Inventory Analysis) apply to calculating embodied carbon; the two later steps (Impact Assessment and Interpretation of Results) do not.

49 See for example Eurostar (2009). "Tread Lightly" Report. See web page (accessed June 24, 2009). http://www.eurostar.com/UK/uk/leisure/about_eurostar/environment/tread_lightly.jsp.

50 ERM's work is referenced as a case study on their web-site (http://www.erm.com/Analysis-and-Insight/Case-Studies/Case-Study-Tesco/, accessed 24 June 2009. Tesco's carbon labelling initiative is described in their

(e.g. electricity consumption in particular countries, transport miles driven by vehicle type, quantities of steel and concrete used in construction) and then looking up the life cycle emissions associated with these within a specialised database.[51] The database is populated with data from academic and research studies. The emissions factors it contains have uncertainty ranges and, depending on the source, are differentiated by different technologies and production processes. Certain assumptions must be made, for example the electricity generating mix in a particular country. For electricity-intensive processes, the choice made at this point can fundamentally alter the emissions factor of the particular product.

39. Measuring the carbon content for BCAs, particularly when these would lead to the imposition of carbon standards, requires more detailed data. The CSI experience of collecting plant-by-plant data is highly relevant. The development of the CSI's GNR database took several years and required agreeing protocols and taking decisions around 'grey areas' (e.g. that emissions factors for fuels derived from wastes and whether on-site electricity generation should be included within the system boundary). The development was within a self-selected group of volunteers; it could have been slowed were it less co-operative.

40. For BCAs, there is a trade-off between accuracy/effectiveness and administrative cost. An exercise which established the GHGs emitted from the 'best available technology' (BAT) and applied this amount to all producers would eliminate the need for estimating the GHG emissions from individual plants. Ismer and Neuhoff (2007) advocate such an approach, claiming that it would also likely be WTO-compliant.[52] But it would clearly be an underestimate of GHG emissions for almost all plants, and would also eliminate firms' incentive to abate GHG emissions from their processes, as they could not reduce their emissions below BAT. Thus it would be effective only as a trade measure. The analysis presented above, notably in Table 1.3, shows both that identifying a best available technology is not always straightforward and that the range of GHG emissions factors can be very wide.

41. A compromise between the need for each plant to measure its own emissions and a BAT-based approach would be to apply a default value, for example the sector average emissions factor, and allow companies to prove that their emissions were lower at their own cost. Such an approach was used for chemicals imported into the US under the "Superfund" proposals (see Section 3.2). It could reduce the overall administrative burden and associated costs whilst retaining a reasonably stringent level of taxation.

1.3 Potential BCA Revenue Flow

42. Table 3 makes an order-of-magnitude estimate of possible annual BCA revenue flows across the world for cement, steel and aluminium. It has been assumed that all international trade results in the import of products from countries without carbon policies into those them, and thus that BCAs can be applied to all these imports in full. In reality, the figure is likely to be lower. As an example, Norway is an exporter of aluminium to many countries including the EU, but would not be expected to pay a BCA levy on all these exports.[53]

43. The estimates indicate that BCA levies could be as high as \$30 billion/year at a carbon price of \$20/tCO_2 or \$75 billion/year at a price of \$50/tCO_2. As context against which to assess the magnitude of these estimates:

"Carbon Labelling and Tesco" document, downloadable from their web pages on Greener Living (http://www.tesco.com/greenerliving/cutting_carbon_footprints/carbon_labelling.page?, accessed 24 June 2009).

51 For example the Swiss 'Ecoinvent' database (http://www.ecoinvent.ch).

52 See Section 3.2 for a full discussion of WTO/GATT legality.

53 Norway is not a member of the EU but is a member of EFTA (the European Free Trade Area). It therefore is unable to raise export levies on aluminium going to the EU.

- the current world value of the carbon market was estimated to be $126 billion in 2008 (World Bank, 2009);
- the UNFCCC reports that finance on the order of $200 billion per year will be needed for mitigation and tens, possibly hundreds, of billions per year for adaptation (UNFCCC, 2008).

44. USD thirty billion is equivalent to the GDP of Bulgaria or the Dominican Republic.[54] The estimates are significantly higher than the value of primary credits from CDM projects, estimated at $6.5 billion in 2008 (World Bank, 2009). How large the levies are with respect to existing trade flows can be analysed by performing a simple calculation comparing the BCA levy charged to the price of the product: for cement, $20/t$CO_2$ would add approximately 20% to the price of the product. For steel the figure is around 5% and for aluminium it is in the range 0-20%, depending on the source of electricity.

Table 3. Estimate of potential BCA revenue flow, $bn/year

Product	World Production (Mt)	International Trade (%)	Traded Volume (Mt)	Typical Emissions (tCO_2/tonne)	Carbon Imported (MtCO_2)	BCA Levied at $20/t$CO_2$ ($billion)	BCA Levied at $50/t$CO_2$ ($billion)
Cement	2,700[55]	6%	162	0.75	122	2	6
Steel	1,350[56]	40%	540	1.75	945	19	47
Aluminium	Primary: 33.6[57]	77%[58]	26	0-18	0-466	0-9	0-23
TOTAL					1067-1533	21-30	53-76

54 See http://data.un.org/Data.aspx?q=gdp&d=CDB&f=srID%3a29919.

55 CEMBUREAU figures for 2007.

56 World Steel Association, all producers in 2007 (http://www.worldsteel.org/?action=stats_search).

57 In 2006, EAA figure reported in Reinaud (2008b).

58 Baron, Reinaud, Genasci and Philibert, 2007, as reported in Reinaud (2008b).

PART II: EFFECTIVENESS

2.1 Economic Principles

45. Understanding how efficient and effective options are likely to be in responding to competitiveness and leakage impacts requires an understanding of the economic principles governing them. There is the temptation to make intuitive judgements about how policies and measures may affect industries and the wider economy. A proper analysis requires the consideration of a number of steps. This section presents:

a. the impact of GHG PAMs on production costs;

b. the impact of carbon costs on production costs;

c. the effective cost of carbon faced by firms;

d. the ability of firms to pass on carbon costs to customers.

The impact of GHG PAMs on production costs

46. Firms respond in different ways to different GHG PAMs. At the primary level is the distinction between PAMs which impose a cost on carbon and those which seek to reduce GHG emissions in other ways. At the secondary level, scheme details have a significant impact on firms' behaviour; for emissions trading schemes, the type and stringency of cap, allocation rules and market structure are important considerations.

47. The starting point of the analysis is to represent production costs. Table 4 illustrates cash costs[59] for cement production in Latin America in 2004. Raw materials, consumables, electricity and fuel account for 50% of cash costs, i.e. $12/t cement. Neither a profit element nor any contributions to investment, either that already undertaken (in the form of depreciation) or for new investments, are included.

[59] i.e. operating costs (fixed and variable).

Table 4. Cement production costs, Latin America [60]

Item	Cash Cost (US$/ton)
Raw Materials	2.00
Consumables	1.50
Electricity	4.50
Fuel	4.00
Manpower	2.00
Maintenance	1.50
Sales & General Administration	3.50
Packaging	5.00
Total	24.00

48. Carbon dioxide emissions from cement production are dominated by the production of clinker. Direct emissions[61] in Latin America average around 0.85 tCO_2/t clinker, of which 0.5 tCO_2 is from the calcination of limestone[62] and the remainder from fuel combustion. Clinker is ground and mixed with gypsum and other blending materials to form cements of various grades and properties; this process uses a relatively small amount of electricity. Latin American cement typically contains 74% clinker,[63] and thus direct emissions are 0.63 tCO_2/t cement.

49. A GHG PAM which resulted in a carbon cost of $20/$tCO_2$ would thus add approximately $12 to the production cost of a tonne of cement. Other GHG PAMs could have very different impacts on production costs; some hypothetical possibilities, which may not have the same overall impact in terms of GHG reductions, are:

- feed-in tariffs to renewable electricity typically offer a premium on the order of US cent 5/kWh to renewable generation.[64] If a policy resulted in a 5% increase in electricity costs, it would add $0.23 to the production cost of a tonne of cement;
- there is little potential for energy efficiency within existing cement plants; much of what is possible is from reductions in electricity use.[65] Assuming a mandated 10% reduction in electricity consumption would see a reduction in production costs of $0.45/t cement.

60 Latin American Cement Industry: Looking Ahead. George Thomas, Principal Industry Specialist IFC, Washington DC. October 2004.

61 Excluding the emissions associated with electricity or any transport of raw materials or products.

62 Limestone is calcium carbonate, $CaCO_3$. Calcination, an unavoidable part of the clinker production process, involves heating limestone to 850°C at which point CO_2 bubbles out from the limestone structure.

63 See OneStone Consulting Group (2006).

64 Wind-works.org summarises feed-in tariffs from around 30 countries at: http://www.wind-works.org/articles/feed_laws.html#Renewable Energy Tariffs by Country.

65 Energy Technology Perspectives, 2008. Scenarios and Strategies to 2050. OECD/IEA 2008.

Achieving this reduction would generally require an up-front investment, typically of several times this annual cost saving;[66]

- for a particular plant, a technology standard could result in the need to improve management, to add new equipment, refurbish part of the plant or shut down the plant and build a new one. New cement plants typically cost $150-350/t cement capacity at a greenfield site.[67] A hypothetical refurbishment requiring equivalent to 10% of this capital cost being repaid using a 10% loan over ten years would be equivalent to $4/t cement produced, but would be expected to reduce fuel or electricity costs. Significantly higher or lower cost estimates could be derived by altering the capital cost and the terms over which it is repaid.

50. These hypothetical examples illustrate that changes to production costs can vary significantly as a function of the GHG PAM applied. This is the case even when different GHG PAMs result in the same national reductions in GHG emissions. There can clearly be a wide distribution of costs across particular sectors, and hence of incentives to reduce GHG emissions.

Impact of carbon costs on production costs

51. Cement production presents a particularly extreme example, as its GHG emissions per unit value of production (i.e. GHG-intensity) is amongst the highest of all products. Figure 5 gives an estimate of the incremental cost to the UK manufacturing sector which would result from a €20/tCO_2 carbon cost applied to both direct emissions and to electricity purchases.[68] It is estimated that sectors responsible for 0.7% of UK GDP would face cost increases equivalent to 10% or more of their value added, with a further 0.3% of UK GDP included if incremental costs are at 4% or more of value added.

52. The list of sectors where production cost increases are significant is confirmed by a range of studies. The list includes:

- lime and cement;
- basic iron and steel (i.e. excluding the electric arc furnace route for steel recycling);
- refined petroleum;
- aluminium (where the majority of the cost increase comes from increased electricity costs);
- inorganic basic chemicals;
- pulp and paper.

53. Typically the studies show that 0.5%-2% of national GDP is exposed to a potentially high increase in production costs from the imposition of a carbon cost.[69]

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66 Ibid.

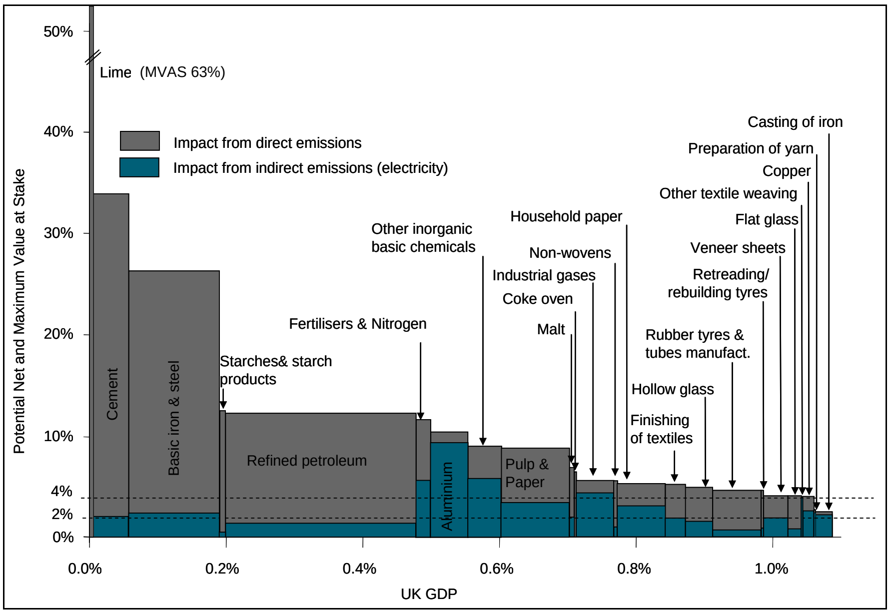
67 OneStone Consulting Group (2006).

68 Where it was assumed that that increased electricity generation costs at an emissions factor of 0.5 tCO2/MWh (approximately the UK grid average) would be fully passed onto consumers.

69 See for example studies for Germany (Öko Institute, 2008), Netherlands (CE Delft, 2008), Australia (CISA, 2008), and the United States (Herrnstadt et al, 2007 and Aldy and Pizer, forthcoming).

Figure 5. Possible impacts of EU-ETS on the UK manufacturing sector (20EUR/tCO_2)

Direct and indirect cost impacts on manufacturing sub-sectors in the UK - assuming 20EUR/tCO_2 carbon price and a corresponding 10EUR/MWh electricity price increase: 2004 data.



Source: Sato and Mohr, 2008 adapted from Hourcade et al 2007

The effective carbon cost faced by firms

54. The introduction of different GHG PAMs in different countries will alter the relative production costs faced by plants in a particular sector. The majority of the literature has considered the case where an emissions trading scheme is introduced in a country or region, affecting that country or region's competitiveness with regard to the rest of the world (which is assumed to have no carbon policies or at least less stringent ones).

55. Emissions trading schemes create a market price for carbon. The specifics of an ETS dictate how this carbon price leads to a carbon cost to firms within it. Faced with this carbon cost, firms then adjust their production decisions, altering their market share and profit. How much they do so depends on the level of competition in the particular market, the technologies available and their costs.

56. How a carbon price translates into an effective cost of carbon is driven by the type of cap placed on firms' GHG emissions and by the allocation rules. The EU ETS imposes absolute caps, i.e. caps that are independent from the level of a firm's production. The key drivers of how the carbon price is related to the effective cost of carbon faced by firms are the rules relating to the updating of allowances and to the treatment of new entrants and plant closures.

57. The first two phases of the EU ETS saw allowances 'grandfathered' as a function of historical emissions. Plant closures led to the loss of allowances from the calendar year following closure.[70] Under these conditions, firms had less incentive to close plants than they would have had otherwise, as an installation would continue to gain allowances in the future as long as it continued to operate (i.e. its emissions allocation would be 'updated'). A rational firm would include the (discounted) value of these future allowances within its current production decisions, reducing the effective cost of carbon faced.

58. Calculating the potential value of future allowances requires a number of assumptions to be made. Neuhoff et al (2005) state that the cost of current emissions can be calculated by taking the current market price and subtracting from it the net present value of future allowances, multiplied by the fraction of updated allowances.[71] Extra factors could be added to this calculation: *inter alia*, an estimate of the probability of a scheme continuing in its current form and/or factors relating to the value of allowances if the scheme continued in a different form.

59. In effect, updating and plant closure rules "dilute" the effective cost of carbon to below the current market price. Whilst the calculation of the level of "dilution" faced by firms may require a number of assumptions, it is a potentially important factor. Governments should not compensate firms for the market carbon price if they do not face this full price in practice.

60. Importantly, economic theory shows that profit-maximising firms[72] under absolute caps should include this carbon cost in their short-term decisions regardless of whether they have to buy allowances or are allocated them for free. The explanation is based on the concept of 'opportunity cost': a firm with an absolute cap considering whether or not to produce an extra unit would either have to purchase extra allowances (if it did not already have enough) or forego the opportunity to sell an allowance on the market (if it had an excess). In either case, the opportunity cost of the extra unit of production would be the firm's carbon cost.

61. This conclusion that the level of production is unrelated to the provenance of allowances holds in the short-term. In the longer term, a firm receiving free allowances would be in a stronger financial position than one which had paid for them. This would allow for extra expenditure for R&D, marketing, energy efficiency, investment in new plants or any other priority. Such expenditure could be used by the firm to prop up its market share within the country where it faced a carbon cost, but this is far from the only possibility. The firm could equally decide to invest in a new plant overseas. Many firms in energy-intensive sectors are multi-nationals and would consider their best opportunities across the world rather than show an affinity for any particular country. A stronger financial position would also tend to result in secondary benefits such as lower cost of capital.[73]

62. The economic efficiency of an ETS – i.e. maximising the quantity of carbon reduction for a given cost – is highest when allowance allocation is 'perfect'. This is achieved either by a one-off free allocation

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70 For example, the UK's allocation for the EU ETS saw allowances allocated as a function of the installation's historical average emissions in the period 1998-2003 (Phase 1) and the average of 2000-03 excepting the lowest year of emissions (Phase 2). In both cases, an installation which ceased operation would receive allowances for the calendar year within which it closed but not for the next or any subsequent years (Defra, 2007 and Defra, 2009).

71 $c_t = p_t - u\beta p_{t+1}$.

72 Economic theory states that profit maximization is the only viable strategy over the long-term.

73 As with many factors within the competitiveness and leakage debate, finding data that shows the relationship between the value of free allowances and a lower cost of capital is extremely challenging. Firms relocate for a variety of reasons and tend to keep those reasons and the financial calculations behind them confidential.

of allowances or by regular auctions. The European Commission has stressed before[74] and throughout the development of the EU ETS[75] that it considers auctioning to be the preferred allocation option. Waxman-Markey (June 26 2009, as passed by the House of Representatives) also features absolute caps but, by applying output-based rebates for "vulnerable" sectors, the scheme takes on the character of an output-based cap. Such caps are understood to be less economically efficient: they preclude the option of reducing emissions by reducing production, thus requiring higher levels of GHG abatement (Demailly and Quirion, 2008). They are attractive to industry in that they do not place a limit on output and require emissions reductions to be made by industry itself.

63. The analysis above stated that firms faced with absolute caps would always factor the effective cost of carbon into their production decisions, whether allowances are granted free or auctioned. For firms with output-based allocation, the effective cost of carbon they face reduces as a function of the allowances they are rebated. Thus a firm rebated 50% of their emissions would face an effective carbon cost of 50% of the market price. A rebate of 85% of direct emissions and 100% of indirect (envisaged as the average for sectors considered to be at risk of leakage under Waxman-Markey) would reduce the effective carbon cost faced to close to zero – i.e. firms would have little incentive to reduce emissions.

The ability of firms to pass on carbon costs to customers

64. Whether, and to what extent, firms can pass on their increased carbon costs to consumers depends on both supply (the level of competition within the market) and demand (how consumers react to changes in the price of a product).

65. It is straightforward to formulate a range of hypothetical supply and demand curves and to show how carbon costs would alter the market equilibrium and ultimately the profitability of firms. Figure 6 shows, for a case where supply and demand curves are linear, how the carbon cost 'c' increases the cost of supply from S_0 to S_1, resulting in a new equilibrium at a reduced production level (Q_1) and an increased price (P_1). The two graphs are for fully competitive and monopolistic markets; in the example of linear supply and demand curves, monopoly suppliers are less able to pass through carbon costs[76] as they are already charging higher prices. Market structure is an important determinant of pass-through cost. Markets for energy-intensive goods tend to have a few major suppliers and are often oligopolistic in structure, i.e. lie between full competition and monopoly.

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[74] The Green Paper which led to the EU ETS (European Commission, 2000) stated in Article 7.2.2 that, *"periodic auctioning is technically preferable [to allocation free of charge]"*, in that it *"would give an equal and fair chance to all companies to acquire the allowances they want in a transparent manner"*, would apply the polluter pays principle, would avoid *"the need to take the difficult and politically delicate decisions about how much to give each company"* and *"the complex issues raised ... about state aid and competition would largely disappear"*.

[75] Explaining its proposed directive amending the EU ETS for Phase 3 (European Commission, 2008), the EC stated that it *"believes that auctioning should be the basic principle for allocation from the third phase onwards"*, since it *"best ensures the efficiency, transparency and simplicity of the system and creates the greatest incentive for investments in a low-carbon economy. It best complies with the 'polluter pays' principle and avoids giving windfall profits to certain sectors that have passed on the notional cost of allowances to their customers despite receiving them for free"*.

[76] The price increase from P_0 to P_1 is smaller for monopolies in this example.

Figure 6. Pass-through of carbon costs under full competition versus monopoly, facing variable marginal costs and linear demand[77]

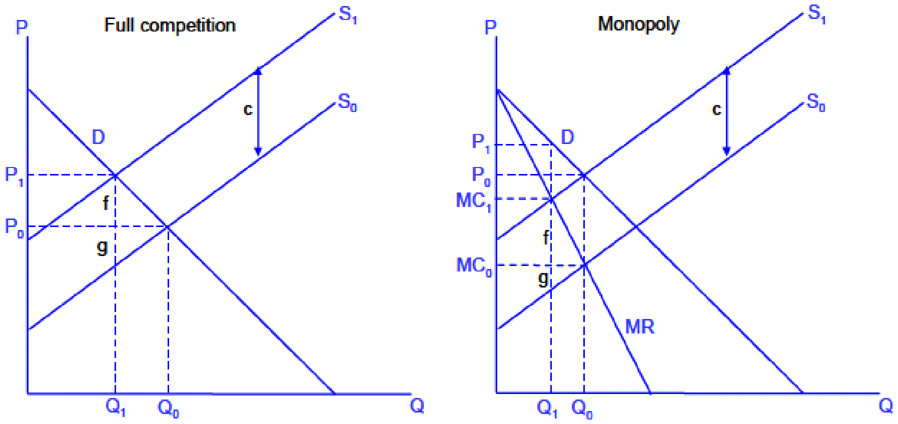

Figure 2.6 *Pass-through of carbon costs under full competition versus monopoly, facing variable marginal costs and linear demand*

Note: S_0 is the supply (i.e. marginal cost) curve excluding carbon costs, while S_1 includes carbon costs. D is the demand curve, while MR is the marginal revenue curve.

66. Sijm et al (2008) present curves for full competition and monopoly market structures with supply and demand curves whose slope and shape varies. For each variant, the loss in profit can be calculated and used to estimate what share of allowances would need to be given for free to compensate. For the case presented in Figure 6, assuming both supply and demand are inelastic (i.e. price changes do not induce much fluctuation in production or consumption), pass-through rates of 50% and 33% would be possible for fully competitive and monopoly markets.[78] In order to compensate for lost profit, 50% of allowances would need to be granted free to firms under perfect competition and 100% under monopoly conditions.[79] With inelastic demand but elastic supply,[80] perfectly competitive markets can pass-through 90% of their costs and monopolies, 50%.

67. Fully compensating firms for lost profit is only one possible formulation of what can be considered ‘fair’. One would expect carbon costs to lead to lower sales of GHG-intensive goods and hence to lower profits for firms if they did not alter their strategies.

68. Ideally, countries and regions would take account of specific market conditions when determining the expected impacts of carbon costs and how they might compensate firms for losses. In practice, such calculations are fraught with difficulties:

- It is necessary to categorise the level of competition in the market. Fischer (2001) concludes that quantifying market power is difficult. Market regulation and imperfections must be accounted for (Sijm et al, 2008).

77 Sijm, J.P.M. et al (2008). The impact of the EU ETS on electricity prices. Final report to DG Environment of the European Commission. ECN-E--08-007.

78 Author’s own calculations, assuming that elasticities are point values at the initial equilibrium point and that the loss in profit is simply the loss in producer surplus.

79 This seems counter-intuitive, but part of the compensation required is needed to cover lower production (hence the profit per unit of production needs to increase).

80 Assuming a price elasticity demand of -0.2 and price elasticity of supply of 2.

- Firms' strategies may differ from profit-maximisation behaviour, for instance because they are seeking to maximise some other variable (e.g. market share) or because they do not have sufficient information on the market in which they operate (Demailly and Quirion, 2008).
- The form and slopes of the supply and demand curves must be characterised. Estimates of the price elasticity of demand are available for certain products, generally from single country studies and covering the short-term. However, such estimates have significant uncertainties and transferring them between countries is a challenge. Supply curve characterisation is even less well understood.
- The analysis refers to the short-term, whereas long-term considerations of where firms will choose to locate future plants are at least as important.
- Account must be taken of allocation specificities and how these translate the market carbon price into an effective carbon cost to firms.

69. Given the number of uncertainties in the analysis, it is fair to ask what can be concluded about the ability of firms to pass on carbon costs through their product prices. It can be stated that suppliers cannot pass costs through if demand is perfectly elastic and can pass through 100% of costs if it is perfectly inelastic (in practice, it is much more likely that demand elasticity will lie between these two extremes). Calculating the pass-through cost requires assumptions on the shapes of the supply and demand curves and on the level of competition in the market. One proxy measure for demand elasticity used within the EU and US proposals is trade intensity: a high level of trade intensity is taken to show a market where producers have relatively low ability to pass their costs through. This is nothing more than a rough measure – attempting to estimate expected levels of cost pass-through as any more than this is likely to be impossible.

70. The European Commission's considerations[81] of how to assess which sectors are "at significant risk of carbon leakage" recognised that an "assessment of the possibility of passing through higher costs into prices" was required and that "a refined analysis, including the estimation of price elasticities, would be desirable". It concluded, however, that a much simpler, more approximate method based on simple indicators of cost increase and trade intensity would "seem a more practical way forward offering sufficiently robust results".

2.2 Partial Equilibrium Modelling Results

71. Partial equilibrium models (PEMs) generally seek to analyse a single sector using micro-economic principles. PEMs typically represent the supply, demand and international trade of a particular product and simulate how these will be altered by the introduction of one or more GHG PAMs. PEMs tend to be developed as bespoke models and hence are flexible enough to take account of the specificities of a particular sector.

72. PEMs have concentrated on the iron/steel and cement sectors, generally for the European Union and/or other developed countries. They have employed a range of methodologies, time periods of interest, assumptions and data sets and can be viewed as "best suited to understanding the mechanisms ... that may drive carbon leakage" (Reinaud, 2008).

73. The differences between models mean that it is difficult to compare their results on an absolute basis. Reviewing three models looking at iron/steel and three more considering cement, Reinaud (2008) summarises that leakage rates could range from 0.5% to 70% in the iron and steel sector and from 20%-

81 European Commission (2008b).

73% in the cement sector. The carbon cost applied is generally on the order of €20/tCO_2. The study by Gielen and Moriguchi (2002) on the steel sectors in Japan and the EU-15 shows a doubling of the leakage rate from 35% to 70% when the carbon cost applied is increased from \$11/tCO_2 to \$42/tCO_2. Reinaud (2008) tentatively concludes that leakage rates of 100% are unlikely. Demailly and Quirion (2008) add that, as PEMs tend to assume that climate policies are applied perfectly and that there are no climate policies in other countries, their leakage estimates are at the high end of the range.

74. Reinaud (2008) makes the interesting observation that the modelling results are ambiguous as whether higher levels of trade intensity (as seen in the steel sector) lead, as expected, to higher levels of leakage.

75. An illustration of the importance of market-specific conditions is provided by Ponssard and Walker (2008) and Demailly and Quirion (2008b), who both take account of the increased costs of serving inland markets with cement. Ponssard and Walker model this as a separation of markets into coastal and inland regions; Demailly and Quirion include a detailed nodal model of ports and demand centres.

76. The models provide useful insights into how cap types and allocation modes impact leakage and other outcomes. Demailly and Quirion (2008) compare cap types and allocation modes for the EU, looking at the cement, aluminium, steel and electricity sectors. They consider five different futures of the EU ETS: GF (pure grandfathering); OB (output-based allocation); AU (auctioning); AU-BA (auctioning with border adjustment[82]) and OB-AU (output-based allocation in industry sectors and auctioning in electricity generation). The conclusions around 'OB' are of interest: in line with economic theory, output-based allocation appears to be the least efficient policy (i.e. the one where cost per unit of emissions reduction is highest). OB allocation effectively reduces the carbon cost faced by firms and thus acts as an effective tool in reducing leakage. Given that it also precludes the option of reducing emissions by decreasing output, Demailly and Quirion note that OB is often promoted by industry. They also note that allocation has an effect on economic efficiency and that only in specific cases is it an issue of distribution alone; they give the example that auctioning of allowances would give the full price signal to a regulated electricity industry whereas grandfathering may not. In terms of welfare, they conclude that auctioning with border adjustment is the most efficient policy for both the world and the EU region, with OB the least efficient and the other three options closely bunched together.

77. Monjon and Quirion (2009) extend their model to assess different forms of BTA. Their "Full" option includes a BTA applied to direct and indirect costs (i.e. to fuel and electricity) and consisting of both a cost applied to imports and a rebate on exports (based on EU average emissions factors). "BA EU Average" uses the EU average as the basis for the tax in all cases; "BA Direct" applies only to direct emissions (fuel) costs; "BA Import" limits the tax only to imports and "BA Import Direct" limits it only to direct emissions from imports. The study yields some extremely interesting results. For cement, the leakage ratio is reduced from around 20% under auctioning to around 5% in all options. "BA Import Direct" retains most of the benefits, as leakage is driven by imports and the contribution of emissions from electricity is low. For steel, leakage of around 40% under auctioning is reversed to -25% under "BA Full" with the combination of export rebates and import tariffs allowing EU producers to gain world market share. Aluminium results also show the potential for negative leakage. The study also compares BTAs with output-based free allocation, concluding that "the performance of different output-based free allocation models reduces leakage compared to auctioning, but it does so only to a limited extent if compared to border adjustments" (italics added).

82 Border adjustment is applied to both imports into the EU and (as a rebate) to exports from the EU, at the level of the best available technology in each industry. Ismer and Neuhoff (2007) claim this is WTO-legal.

78. The models[83] serve to illuminate drivers of leakage and allow sensitivity analyses to be conducted to determine which are the most important. The leakage estimates they give should however be treated as indicative at best. This has important policy implications: any policy which relies on a precise estimate of potential leakage will be based on premises which are uncertain, possibly highly. Such uncertainty can encourage a range of claims to be made by advocacy parties. Due to the many factors which affect competitiveness and leakage (see Section 1.1), this conclusion is likely to hold even if many years of good data from markets with different climate policies were available.

2.3 General Equilibrium Modelling Results

79. The previous section concluded that leakage estimates from Partial Equilibrium Models were likely to be highly uncertain. A further issue, perhaps of even higher importance, is that the focus of PEMs on single sectors of the economy may miss extremely important secondary impacts which can fundamentally alter the conclusions drawn about the performance of policies modelled. All model types ideally need to make assumptions on how technological change is incorporated (GHG PAMs incentivise the development and implementation of less carbon-intensive technologies). If they do not, they will overstate competitiveness and leakage impacts.

80. Demailly and Quirion (2008) state that their use of a PEM does not “account for pre-existing distortions or macro-economic feedbacks – on world energy prices for example”. Braathen (2008)[84] notes that leakage related to the loss of competitiveness of individual sectors is small compared to that triggered by changes in international fossil fuel prices when quantified in a general equilibrium setting, noting that “findings indicate that the most important leakage normally would stem from the fossil fuel markets”.

81. General equilibrium analyses cast doubt over the effectiveness of border adjustments for offsetting competitiveness and leakage.[85] A review of studies to date (see Table 5) suggests that, based on what it can achieve, BTA may be useful for reducing costs facing carbon-intensive domestic industry, while the effect on reducing leakage is less clear and might only be modest. BTA is likely to be less useful for minimising the overall costs of climate policy.

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[83] See Dröge (2009) for a more detailed review of the model results.

[84] As reported in Reinaud (2008).

[85] We are not aware of any global equilibrium models which explicitly consider the use of free allowances to reduce competitiveness and leakage impacts.

Table 5.Economy-wide and international effects of BTA

	Coalition implementing BTA	Preservation of industry competitiveness	Coalition welfare	Global welfare	Leakage reduction
Alexeeva-Talebi et al. (2008a)	EU	Partial	Reduced	--	Modest
Babiker and Rutherford (2005)[86]	Annex I (excludes US)	Partial	EU improves Losses in some OECD countries	Reduced	Modest
Burniaux et al (2008)	EU	No	Reduced	Reduced	Substantial
Burniaux et al (2008)	Annex I (includes US)	--	Reduced	Reduced	Moderate
EPA (2008)	US	Partial	Reduced	--	Negligible
Manders and Veenendaal (2008)	EU	Partial	Improved	--	Substantial
McKibbin and Wilcoxen, (2009)[87]	US	Partial	Unchanged	Reduced	Substantial
Peterson and Schleich (2007)	EU	Partial	--	--	Modest

82. The table summarises studies to date which take a general equilibrium or economy-wide approach to analysing competitiveness and leakage and the possible responses to it. The focus is on what these studies say about the general direction of effects that BTA policies may have on the economy at large[88] and the degree of certainty about their impact on economic growth, GHG emissions, and leakage from an aggregate or societal perspective. The focus is not on quantifying the impacts of BTAs; studies based on slightly different perspectives, data sets, methodologies and assumptions are apt to give a range of results that are not strictly comparable and certainly not in terms of absolute impacts. Indeed, a cursory review of the literature will uncover divergent findings in terms of magnitudes of effects and directions of impact of BTAs. In spite of this, the scope of findings are instructive because they illustrate that the effects of BTA are not straightforward and that the effects of climate policy and BTA work in many ways –often in opposite directions with ambiguous net impact.

83. General equilibrium or economy-wide analysis is an important complementary tool for understanding the impacts of BTAs because any such policy impact not only directly regulated sectors but the wider economy and, potentially, trading partners. Whilst PEMs can be criticised for their narrow focus on sectors, Global Equilibrium Models (GEMs) also have their critics. Dröge (2009) notes that GEMs rely on a high level of disaggregation, with lack of disaggregation across the value chain leading to an over- or under-estimation of carbon cost impacts. Reinaud (2008) questions whether this lack of detail will allow GEMs to assess leakage based on changes to intermediate inputs to specific industries (e.g. recycled scrap metal), adding that they do not describe technological progress and spill-overs (and therefore will overstate

86 Scenario with flexible wage and access to Kyoto flexibility mechanisms.

87 Scenario based on a US carbon tax and BTA.

88 Compared to a counterfactual with carbon costs but no response to competitiveness and leakage concerns.

impacts). Demailly & Quirion (2008) note that the Armington elasticity figures needed to model changes in trade tend to be short- to medium-term in scope. Concerns over whether relationships derived from past behaviour will be applicable in the future grow as the time frame increases.

84. When a carbon price or BTA is introduced, several adjustment effects take place which alter the impact of increased costs on firms and transmit costs to other parts of the economy. For example, an adjustment in exchange rates can increase import costs and raise export returns. This kind of adjustment can help to offset competitiveness impacts from increased costs in affected sectors. However, consumers may be worse off, as they will face higher costs for the products and services they use and consume. The net effect is ambiguous and depends on the speed and magnitude of adjustments in different sectors of the economy. However, these kinds of general equilibrium effects can mean that ostensibly positive effects at the sector level reduce welfare in the overall economy.

85. Examples of BTAs reducing domestic economic welfare can be found in nearly all general equilibrium analyses of the effects of BTA [Burniaux et al (2008), EPA (2008), Alexeeva-Talebi (2008a), Manders and Veenendaal (2008)]. In the one study that shows potential for a net economic gain from BTA the gain is small and confined to a subset of countries amongst those adopting the measure. Babiker and Rutherford (2005) find that most OECD countries are economically worse off adopting BTA but that the EU may be better off.

86. In addition to reduced economic welfare, BTAs may not have the intended effect of preserving industry competitiveness. The literature is equivocal in this regard. A majority of studies suggest that BTAs would have at least a “mild protective effect” (McKibbin and Wilcoxen, 2009) on trade-exposed and energy-intensive industries while others show the opposite. Burniaux et al (2008) find that output from energy-intensive industries would decline in the EU if BTAs were used to offset the domestic costs of unilateral action to reduce emissions. A similar result can be found in McKibbin and Wilcoxen (2009) and EPA (2008) analysis of the Warner-Lieberman Bill, both with respect to BTAs employed in the United States.[89]

87. Such results are aggregated and obscure potentially positive effects of BTAs on some industries and firms, but suggest that the sectoral benefits of BTAs, in terms of preserving competitiveness, may be a lottery. This is most likely to be the case in the presence of domestic emissions reduction targets where BTAs would raise the domestic costs of mitigation, thereby suppressing domestic demand, including for the output of sectors being assisted through BTAs. Further, the cost of imported inputs to production rise, which increases costs faced by some energy-intensive producers. The net impact can be a decline in output in energy-intensive industries. This is not proven, but the finding that it can occur, under plausible assumptions about economic adjustment to BTAs, shows that the protective effects of BTAs are by no means certain.

[89] The EPA analysis (2008) shows that while industry benefits in the short run, higher domestic carbon prices lead to a reduction in output over time compared to a case where no border adjustment was implemented. Usefully, the EPA analysis can be used to compare a situation of “low international action” and the effects of border adjustment measures such as the international reserve allowance under the Lieberman-Warner Bill, against a situation of high international action, the latter being the appropriate benchmark for decomposing the unavoidable costs to industry of mitigation policy and the more regrettable costs of lost competitiveness in a world without comparable international mitigation efforts. Manders’ and Veneendaal’s analysis also considers a “Grand Coalition” policy scenario against which BTA policies although the limited presentation of their results does preclude a comprehensive analysis.

88. That BTAs can increase the domestic cost of mitigation is a key finding of studies into their economy-wide effects. In all studies where emissions targets or caps are considered, BTAs are shown to increase the domestic cost (or price) of carbon.[90] Moreover, the incidence of this increased cost increasingly falls on sectors that are not targeted for assistance via BTAs (Alexeeva-Talebi, 2008a). This finding is important in terms of the scope of implementation of BTAs. Another effect working to the same end is that taxed imported goods increase costs to domestic manufacturers.

89. While many commentators have suggested that BTAs should be narrowly targeted to energy-intensive trade-exposed sectors, this shows that such targeting may simply transfer emissions costs from high polluting industries to low polluting ones with potentially no net environmental gain. A BTA scheme with wider scope may minimise this transference of cost, but could be costly to administer. Further reducing the possibility of lower cost imports is likely to add to compliance costs.

90. Much as policies can shift the incidence of carbon costs across sectors in the economy, so too can the effects of domestic policy be transmitted beyond a country's borders. This is true even in the absence of trade-related policies. For example, Manders and Veenendaal (2008) find that when the EU acts unilaterally to reduce emissions, accompanied by minimal effort in other Annex I countries, non-Annex I countries experience a decline in national income of 0.1% as a result of the spill-over effects from reduced growth in developed countries.[91] This compares to a 0.7% decline in national income in the EU and a 0.3% decline in Annex I countries. This is important context for policy makers who, when evaluating competitiveness impacts of climate policy, are apt to consider domestic impacts in isolation of impacts abroad. Non-Annex I countries "benefit" from actions taken in Annex I countries only to the extent that their loss in welfare tends to be lower than that in Annex I; the models almost uniformly show welfare loss to both groups.

91. BTAs are likely to have a negative effect on economic growth in some countries. Burniaux et al estimate that if Annex I countries cut their emissions unilaterally by 50% by 2050, GDP in non-participating countries would fall by 0.1% (compared with a fall of 2.7% in Annex I countries), while the presence of BTAs would result in a fall of 0.5% (compared to a decline of 2.9% in Annex I countries). McKibbin and Wilcoxen (2009) and Babiker and Rutherford (2005) also estimate that growth in non-participating countries will be constrained by border adjustment policies.[92]

92. While global aggregate costs are likely, it is unlikely that all countries facing BTAs would bear a net cost. This would depend on the intensity of trade and economic relationships between countries, the concentration of BTA-applicable products in a country's exports, and the extent to which countries are able to shift production in response to BTAs. Countries likely to face the highest costs are those with strong economic ties to other countries implementing BTAs, energy intensive exports, and rigid or possibly small economies.

93. Negative effects on trading partner growth could offset the beneficial effects of BTAs. McKibbin and Wilcoxen (2009), in a simulation of the effects of BTA in the United States, find that the protective effects of BTAs are more than offset by reduced demand for US exports as a result of their negative effects on economic growth in major trading partner countries.

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90 This rests on the assumption that sectors not supported through BTAs have higher mitigation costs than those supported through them, a common finding from marginal abatement cost studies.

91 Based on Manders' and Veenendaal's IMPASSE scenario for future climate policy.

92 Other studies do not pay much attention to global impacts of BTAs but focus on the impacts on firm competitiveness and economic growth in the home market or on global effects on energy-intensive industries. The appendix in one such study (Alexeeva-Talebi et al. 2008a) shows that output in non-EU economies grows as a result of EU BTAs, but these numbers are not supported by sufficient discussion or numerical results.

94. While BTAs may impose economy-wide and global economic costs and may not adequately resolve competitiveness issues, they do appear to have potential for reducing global emissions and going some way to reduce emissions leakage. The key question, however, is whether such reductions are likely to be very significant. On this the literature is also equivocal.

95. The range of estimates of the effectiveness of BTAs in reducing leakage runs from almost zero (the EPA's analysis of the Lieberman-Warner Bill) to nearly 100% (McKibbin Wilcoxen).

96. Of those studies that have considered the dynamics of leakage in some detail – conducting sensitivity analyses on key parameters or on the size of coalitions employing BTAs and taking action on climate change – some important insights have emerged. Burniaux et al., for example, consider how the size of a coalition of countries taking action on climate change impacts the costs and benefits of BTAs. They show that the benefit of BTAs in terms of reducing leakage declines rapidly as the number of countries in the coalition increases. At the same time, the global economic costs of BTAs are shown to increase.

> *For instance, in a scenario where Annex I countries cut their emissions unilaterally by 50% by 2050, imposing a countervailing duty achieves a small additional world emissions reduction of about 0.6 Gt (or about 0.8% of projected 2050 world emissions) at a cost of about 1% of world GDP (1.7% instead of 0.8%) [see Table 3.6, p.25 of Burniaux et al].*

97. Implicit in this statement is an assessment that the additional benefit of reduced leakage may not be worth the rather sizeable costs imposed by BTAs. This judgement is echoed elsewhere in the literature [Rutherford and Babiker, McKibbin and Wilcoxen, Mander and Veenendaal, Peterson and Schleich (2007)].

Could GHG PAMs have positive economic impacts?

98. The insufficient incorporation of induced technological change was raised in the previous section as being a weakness of GEMs. Grubb et al (2002a, 2002b) argue that not accounting for the global diffusion of induced technological change will overstate net leakage; i.e. a spill-over of technologies developed within GHG-constrained countries would reduce emissions in unconstrained countries. A further issue raised is that responding to competitiveness concerns may bring short-term costs but lead to benefits in the longer term. The argument is that imposing constraints on GHG emissions will encourage a country's sector to become more efficient and to develop and introduce new technology more quickly.[93] [94]

99. Whilst there is little specific modelling to support the contention, the maximum limit the EU ETS has placed on offsets from the CDM is a manifestation of this objective (Council of the European Union, 2008). Part of the rationale behind the limit is the desire for EU industry to innovate and therefore improve their chances in a future clean energy market, gaining a "first mover advantage".

[93] See Houser et al (2008).

[94] See Reinaud (2008) pp. 38-39.

PART III: IMPLEMENTATION

3.1 Current and Proposed Policy

100. This section presents how current and proposed policies practically respond to competitiveness and leakage concerns. In part, responses are dependent on the outcomes of international negotiations at Copenhagen and beyond. One important aspect of the considerations is the UNFCCC's "common but differentiated responsibility" (CBDR) provision, which accounts for differences in countries' historical responsibility and capacity to respond to GHG emissions.[95] Detailed analysis around CBDR is presented in Section 3.3.

European Union

101. The EU ETS was designed to be phased in gradually, allowing 'learning by doing' and ensuring that there would be no major disruptions to the EU's internal market. For the first two phases of the EU ETS (2005-07 and 2008-12 respectively), it was decided that the vast majority of allowances[96] should be allocated for free, with caps calculated on the basis of historical[97] emissions. Net costs to regulated sectors were therefore related only to the difference in their emissions when compared to the allowances they received for free.

102. Although discussed and studied, competitiveness and leakage issues did not achieve high prominence until the European Commission (EC) proposals for Phase 3 of the EU ETS, which will run from 2013-2020. The January 2008 proposals (European Commission, 2008a) included a major revision of several elements of the scheme, including a greater role for auctioning. Those sectors not considered to be "exposed to a significant risk of carbon leakage" were expected to purchase all or most of their allowances through auctions from the start of the period. Sectors considered to be exposed to a significant risk were to be allowed a phasing-in period before full auctioning from 2020.

103. The January 2008 proposals sparked a major debate. Regulated sectors suddenly faced the prospect of costs which were not covered by free allowances and began to lobby for a weakening of the proposals; the EC began detailing how sectors would be assessed as being "exposed to a significant risk of carbon leakage"; and the academic and policy research community published studies on how the scheme could affect regulated sectors in practice.

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[95] UNFCCC Article 4 states, "All Parties, taking into account their common but differentiated responsibilities and their specific national and regional development priorities, objectives and circumstances", before listing a series of commitments
(see http://unfccc.int/files/cooperation_and_support/ldc/application/pdf/article4.pdf).

[96] At least 95% in Phase 1 and at least 90% in Phase 2. In practice, most Member States allocated 100%, or very close to it, of their allowances for free in both Phases.

[97] ' Grandfathering' is used to relate current allowances to past emissions, using an algorithm.

104. The final package (Council of the European Union, 2008) was agreed in December 2008 as part of the EC's Energy and Climate Change package, which also included targets for increasing renewable energy use and energy efficiency. Table 6 shows that those sectors considered at significant risk would receive free allowances "to the extent that they use the most efficient technology". The definitions and algorithms for assessing which sectors could be considered at significant risk can be interpreted as having been weakened, allowing more sub-sectors into the category, although the data to be used in the assessments has not yet been fully collected and analysed.

105. A number of subsidiary conditions were attached to allocation. Of key importance was the requirement that the "total number of allowances allocated for free to installations will decline annually in line with the decline of emissions caps". Given that the EU ETS will see a reduction of 1.74% per year of the original number of allowances in the periods 2013-2020 and 2021-28,[98] even those sub-sectors continuing to receive free allocations will see the number declining over time. The provisions can therefore be viewed as a gradual phase-in of auctioning over a long period, allowing time for industry to adjust.

106. The possibility of financial compensation for indirect emissions was also included. The revised Directive (European Parliament, 2008), Article 10a6 provides for the possibility for Member States to compensate their most electro-intensive sectors for increased electricity costs resulting from the ETS through national state aid schemes. Therefore, the Commission will correspondingly modify the Environmental State Aid Guidelines by 31 December 2010.

Table 6. Proposed allocation under EC proposal of 23 January 2008, 12 December 2008

Sector Allocation	EC Proposal, 23 January 2008	Final Energy & Climate Package 12 December 2008
Electricity Generation, Carbon Capture and Storage	100% auctioning from 2013**	100% from 2013 in electricity generation but with a derogation for certain Member States (at least 30%, rising linearly to 100% in 2020)*** 100% auctioning for CCS
Sectors "at significant risk of carbon leakage"*	Sectors receive up to 100% of their allowances for free in 2013-2020	100% free allowances "to the extent that they use the most efficient technology"
Sectors not "at significant risk of carbon leakage"*	20% auctioning 2013, linear increase to 100% in 2020	20% auctioning 2013, linear increase to 70% in 2020 with a view to reaching 100% by 2027

* Meaning they could be forced by international competitive pressures to relocate production to countries outside the EU that did not impose comparable emissions constraints. This would simply increase global emissions without any environmental benefit.

** Takes account of sectors' ability to pass on the increased cost of emission allowances.

*** The provision refers to new Member States in the east of the European Union. They are required to submit national plans showing how the value of their free allocations will be spent on retrofitting and upgrading infrastructure and clean technologies (submitting an annual report detailing investments) and diversifying their energy mix.

107. Looking further ahead, the design of the EU ETS' competitiveness and leakage provisions continues to be conditional on the outcome of the international agreements. The proposed amendments to Article 10a of the amended Directive now include the provision, under paragraph 9d, that the list of sectors or sub-sectors exposed to a significant risk of carbon leakage shall be determined after taking into account

98 With a review by 2025 at the latest.

"the extent to which third countries, representing a decisive share of world production of products in sectors deemed to be at risk of carbon leakage, firmly commit to reducing GHG emissions ... and the extent to which carbon efficiency of installations located in these countries is comparable to that of the EU". A proviso is made that "the relevant data are available".

108. After the outcome of the international negotiations is known, the Commission is required to prepare a report to the European Parliament and Council (expected no later than June 2010), including proposals on how to take the outcome into account in the functioning of the EU ETS. The proposals include the following with respect to competitiveness and leakage concerns: "By 30 June 2010, the Commission shall, in the light of the outcome of the international negotiations and the extent to which these lead to global greenhouse gas emission reductions, and after consulting with all relevant social partners, submit to the European Parliament and to the Council an analytical report assessing the situation with regard to energy-intensive sectors or (sub-)sectors that have been determined to be exposed to significant risks of carbon leakage. This shall be accompanied by any appropriate proposals." Such proposals could include the granting of extra free allowances, including to importers in the EU ETS or border measures.

109. In common with allocation, the net effect of these provisions is to add some uncertainty to the questions of which sub-sectors will receive free allocations and how the quantity they receive may change over time.

110. Government collaboration with industry is the usual way to develop the databases necessary for calculating free allowance allocations based on benchmarking. At least within developed countries, certain data already exists (e.g. companies tend to report their fuel consumption to government statistics departments). Other data are collected for energy efficiency best practice programmes and other government-led initiatives. The European Union's experience appears relevant: in order to establish which sectors considered to be at "serious risk of leakage", they are working with industry to collect datasets at the sub-sector level.[99]

US Proposal: Waxman-Markey Bill

111. The development of the Waxman-Markey Bill as it has moved through its consultation phase has also seen a move towards granting free allowances as a response to competitiveness and leakage concerns. The proposals contained in the 15 May 2009 draft envisage absolute caps for industrial sectors but allow for the output-based rebate of costs associated with direct emissions (85%) and indirect emissions (100%) to those sectors considered "vulnerable" to competitiveness and leakage impacts. In economic terms, these firms face an intensity-based cap with their effective carbon cost reduced from the market carbon price at the level of the rebates. They therefore face a very weak incentive to reduce GHG emissions.

112. In common with the EU ETS, a review following international negotiations is planned. In the 15 May 2009 version in the US House, the provision was that by 2022, and after establishing sectors which remained vulnerable in spite of the rebate scheme, the President could choose to modify the rebate phase-out or implement a BCA, or both. From 2025, and if BCA were chosen, the Administrator would have established a price for allowances that reflected the difference between the direct and indirect costs that the US sectors must bear under the Act and the direct and indirect costs of GHG reduction policies that foreign governments impose on their sectors. The impacts of free allocation in the US have to be factored in. A provision in the draft that foreign countries would only need to impose 60% of the costs faced by US producers. This would have required calculations to be made for all countries across all their policies and

99 See the European Commission's "Carbon Leakage" page at http://ec.europa.eu/environment/climat/emission/carbon_en.htm.

measures. There is of course a risk that such difficult and complex calculations, performed unilaterally and in the absence of multilaterally defined principles or methodologies, could potentially be politically influenced.

113. As the Waxman-Markey Bill has progressed through the US House, options for responding to competitiveness and leakage have been strengthened. Vulnerable industry would now be compensated for 100% of their direct and indirect emission costs. Reflecting a preference for international agreement to address leakage, negotiating objectives have been introduced in the Bill. If the US cannot reach international agreement on how to address leakage, border measures will be introduced.

114. The assessment as to which sectors and countries will be covered by border measures is no longer based on of the cost imposed by different GHG PAMs. The new assessment uses three tests:

1. Countries having accepted a binding economy-wide reduction commitment under an international agreement that is "at least as stringent as" that accepted by the US;
2. Countries whose energy or emissions efficiency in the respective sector is "equal to or less than" that of the US;
3. Parties to a bilateral or multilateral agreement aimed at emissions reductions in the specific sector.[100]

115. Energy and trade-intensive sectors where less than 85% of US imports come from countries not meeting at least one of these tests will be included in the border measure scheme. If a sector is covered by border measures, they will be applied only to imports from countries not meeting at least one of the criteria.[101] When determining the amount of allowances to be purchased by importers, free allowances received by domestic producers need to be taken into account in order to avoid the risk of double-compensation.

116. Additionally, the proposal of Congressman Sander Levin of 25 June 2009, [102] based on an agreement between him and Henry A. Waxman of the Energy and Commerce Committee, changes the burden of proof for the introduction of border measures. The President "shall impose a border adjustment to address uncompensated increases in costs for all industries receiving free allowances unless he determines it is not in the national interest and Congress passes a privileged resolution agreeing with that determination." Additionally, the date for the assessment has been moved forward, with border measures now required by 2020, providing that a multilateral environmental agreement according to the US' negotiating objectives is not in place. These negotiating objectives include the equitable contribution of all major GHG-emitting countries, provisions that recognise and address the competitive imbalances that lead to carbon leakage and include sanctions for any party to the agreement that fails to meet its GHG reduction obligations.

[100] Section 767(c) of the Bill as of June 26 2009.

[101] Additionally, least developed countries and countries responsible for less than 0.5% of global GHG emissions and less than 5% of US imports in the relevant sector would be exempt from border measures.

[102] Press Release of Sander M. Levin, Ways and Means Trade Subcommittee Chairman, 25 June 2009, "Trade Revisions to Climate Change Legislation Support Environment and Jobs".

Other Countries

117. Australia (Australia, 2008) has made the support to "EITE" (emissions-intensive, trade–exposed industries) a key principle within its proposed ETS.[103] Industrial sectors would face absolute caps but would, similarly to Waxman-Markey, receive output-based rebates. These rebates would be calculated "according to the industry's historic average emissions intensity per unit of production". Ninety percent rebates would be given to activities whose emissions intensity was at least 2000 tCO_2–e per million dollars of revenue, and 60% for activities that had at least 1000 tCO_2–e per million dollars of revenue. Indirect emissions would be included from electricity use, steam purchases and from activities relating to "emissions associated with the extraction and production of natural gas and its derivatives such as methane and ethane when used as a feedstock". In common with Waxman-Markey, the proposals would give a very weak incentive for industries to reduce their GHG emissions and can be seen as a capacity-building phase.

118. Japan's JETS was launched in October 2008. The pilot phase incorporates voluntary caps, target levels and verification. There is a planned move to a mandatory scheme in 2013 but some commentators (e.g. Takamura and Kameyama, 2009) believe that Japanese industry opposition to such a scheme could delay or even result in its cancellation.

119. Emissions Trading Schemes have also been proposed for countries including New Zealand, Canada, South Africa and South Korea. These schemes are each at a relatively early stage of development and it is difficult to draw any firm conclusions as to how they might deal with competitiveness and leakage, either now or in the future.

3.2 WTO/GATT Legality

Border carbon adjustment

120. Whether BCA would be legal under WTO/GATT rules has been much discussed. It is possible to say more than simply "it depends", but uncertainty remains in some areas. Only a WTO Dispute [Settlement] Panel ruling can give a definitive answer on whether a BCA is legal. A ruling can only be made about a specific BCA, and then only when it has been implemented and a challenge against it has been raised.[104]

121. Whilst it is not possible to establish in advance whether a BCA would be legal, legislation and experience point to which characteristics would make legality more, or less, likely. The legal treatment would differ depending on whether the measure was in the form of a tax designed to make importers pay in the same way that domestic producers paid in a domestic carbon tax regime (BTA), or in the form of a requirement to buy allowances at the border in parallel to a domestic requirement for producers to participate in a cap and trade scheme where allowances are assigned and/or auctioned.[105]

122. The 1970 report of the GATT Working Party on Border Tax Adjustments was inconclusive on the question of whether a border tax could be applied in the case of energy used in the production of a good. The same uncertainty carries over to tax adjustment on the basis of the emissions embodied in that energy use.[106] A tax adjustment would probably be ruled to contravene GATT's Article III:2, which

[103] Known as the "Carbon Pollution Reduction Scheme".

[104] Assessing BCAs in this way is not the WTO's preferred course of action. They would rather refer to an agreed set of external guidelines than be the *de facto* judges of climate change policy. Nevertheless, such am eventuality remains a real possibility.

[105] For further discussion see Ismer (2009).

[106] *Supra* at XX.

demands that taxes and internal charges on imports not be applied in excess of those applied to like domestic goods. A key question here is therefore whether a cleanly produced domestic good is "like" an imported good which has been produced in a GHG-intensive manner, as the latter would be charged well in excess of the former. WTO jurisprudence suggests that they probably would be considered "like".[107]

123. The answer to the question of "likeness" also addresses in part the long-standing question of whether the GATT allows for discrimination on the basis of how a product is produced – in trade parlance, on the basis of processing and production methods (PPMs). If a good produced using a relatively clean PPM is considered "like" a good produced in a polluting manner, then Article III and Article I demand that they be treated equally. This is not the final answer to the question of PPMs, however. As discussed below, PPM-based discrimination can still be avoided by a resort to the GATT's General Exceptions.

124. If the measure in question was a requirement to purchase offsets at the border as opposed to a tax adjustment, it would, as a regulation, be covered by GATT Article III:4, which requires that imports be accorded regulatory treatment "no less favourable" than that accorded to like domestic products. "Likeness" under this obligation is slightly more loosely interpreted than under Article III:2,[108] so it is not clear how a panel would interpret it in a case that discriminated on the basis of the GHG-intensity of production. If the products were ruled "unlike", the regulatory discrimination would of course be allowed.

125. For both taxes and requirements to purchase allowances, GATT Article I would still need to be respected. This article demands "most-favoured nation" treatment, i.e. that any favourable treatment granted to goods from one country must be granted in the same measure to like goods from all other WTO Member Countries. The key here is that any BCA would need to be equally applied to all exporting countries and not just to those that were deemed to be lagging behind in the fight against climate change. This is a process concern, however, and not related to the question of PPMs and like goods.

126. For both taxes and purchase requirements, the Article I and Article III obligations, if breached, would not be the final word on GATT legality. GATT's Article XX sets out general exceptions; circumstances under which countries may breach GATT's other provisions. The two circumstances that would be relevant are for measures:

> "(b) necessary to protect human, animal or plant life or health;"
>
> and
>
> "(g) relating to the conservation of exhaustible natural resources if such measures are made effective in conjunction with restrictions on domestic production or consumption;"

127. While XX(b) might be invoked, most analysts agree that climate change measures are more likely to be considered under XX(g), a life-sustaining atmosphere arguably being an exhaustible natural resource.[109] This language has been interpreted so as to contain two key tests. First, does the measure in

[107] Japan—Alcohol – GATT Panel Report, Japan – Customs Duties, Taxes and Labelling Practices on Imported Wines and Alcoholic Beverages, L/6216, adopted 10 November 1987, BISD 34S/83. Even if goods were not considered "like", Article III:2 would probably be violated, as the charge would have to be exactly the same or better for the import – a daunting challenge that would involve precise calculation of embedded carbon in the imported product.

[108] EC—Asbestos gave "like" in this sentence a "relatively broad product scope," and ruled that the health risks inherent in a product could be part of a likeness determination.

[109] Hufbauer, Charnovitz and Kim (2009).

question "relate" to the conservation of natural resources? Second, is it made effective in conjunction with domestic restrictions? Both a border tax and a request to purchase allowances would likely pass the first test. If treatment of the imports and domestic goods were generally even-handed, the second test would also likely be passed. Note, however, that even-handedness would arguably be violated if domestic producers were given free allowances while importers had to pay for them.

128. The final question to be considered if Article XX(b) or (g) were cleared would be Article XX's "chapeau" obligations, an additional set of tests designed to weed out protectionist measures. The chapeau requires that:

> "... measures are not applied in a manner which would constitute a means of arbitrary or unjustifiable discrimination between countries where the same conditions prevail, or a disguised restriction on international trade ..."[110]

129. The Article XX chapeau has important implications for how a BCA is applied, and to some extent how it is designed,[111] but its interpretation is still in the process of evolution so how it would apply to any particular measure is hard to predict. Based on existing jurisprudence, however, it is possible to derive several important guidelines for any BCA that hopes to conform to WTO obligations:

- The measure should allow for "inquiry into the appropriateness of the regulatory program for the conditions prevailing" in the countries of export.[112] Meaning that if the application of the BCA is triggered by a judgement that the exporting country is not serious enough in its climate efforts, that judgement should be formally challengeable. Moreover, the systems of certification and assessing comparable actions should probably involve some degree of input from the affected countries[113] and include an appeals mechanism.[114]
- The measure should allow other countries to meet the conditions of entry in their own ways (a finding that applied to a trade ban, but which would probably hold for regulations as well).[115] For example, a BCA triggered by the lack of a cap-and-trade scheme identical to that in the importing country would probably be unjustifiable. The trigger should allow for the exporting country to have regulatory regimes that are "comparable in effectiveness".
- It may be that the chapeau demands efforts at international agreement as a prerequisite to the fallback of unilateral measures.[116] If so, and if a successor agreement to the Kyoto Protocol

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110 It is interesting to note that this language was directly imported into Article 3.5 of the UNFCCC, which commits Parties to not employ protectionist trade measures to achieve climate change objectives.

111 Though design is more the ambit of Articles I and III.

112 United States – Import Prohibitions of Certain Shrimp and Shrimp Products, Report of the Appellate Body, WT/DS58/AB/R, October 12, 1998, (hereinafter, Shrimp-Turtle AB Report), paragraph 164. "Shrimp-Turtle" is the only mandatory Processing and Production Methods (PPM)-based law to be challenged under the WTO thus far. It concerned the US requirement that imported shrimp be caught using nets that excluded sea turtles – a measure that was cleared as WTO-legal, though many aspects of its application violated trade law obligations. It is the case most widely referred to when trying to assess whether Article XX would cover climate-related trade measures.

113 This is not a threshold test, but the AB in Shrimp-Turtle (para. 172) held that unilateral determinations underscored the unjustifiability of the measure.

114 Shrimp Turtle AB report, paragraphs 180-181.

115 Shrimp-Turtle AB report (art. 21.5), paragraph 144.

116 This is not clear cut. The Shrimp-Turtle AB report is often credited for this principle, but in fact the finding was that treatment was arbitrary not simply because international negotiations were not pursued, but rather that the US pursued international negotiations with some Members and not others. US—Gasoline (GATT Panel Report,

is signed, it could be difficult for a WTO Member that is party to the successor agreement to apply BCA against another WTO Member Party[117] (international agreement would have been achieved, and the fallback made unnecessary). Any discrimination in the application of the BCA should "relate to the pursuit" of the measure.[118] For example, exceptions for LDCs on economic development or equity grounds, as they are arguably not relevant to the environmental aims of the measure, might constitute unjustifiable discrimination.

130. Political considerations are important in this context. A trade dispute would likely arise if a unilateral BCA were implemented. The result of a WTO dispute settlement panel[119] would require one of two findings:

- that the measure does not violate WTO law, thus undermining the UNFCCC's legitimacy as the global standard-setting body for climate policy;
- that the measure does violate WTO law, thus exposing the trade regime to criticism from the environmental community for sitting in judgement of climate policies.

131. There remains the possibility of flexibility: WTO Members could amend WTO law, reach specialised agreements or grant waivers for the use of certain BCAs.[120] Such changes would require agreement between a majority or all WTO Members that the issue was sufficiently important, and the solutions fair and effective enough, to warrant their attention.

Carbon product standards

132. Voluntary PPM-based discrimination happens all the time – it is a fact of business. Consumers typically buy products and services on the basis of a number of criteria; increasingly, one of these is how the good in question was produced. For example, Home Depot (a US-based home improvement store) now buys only sustainably harvested wood. Perhaps more importantly, many European countries – and other OECD and non-OECD governments – have now developed prescriptive public sector sustainable procurement policies based on various standards and eco-labels (such as the Blue Angel and FSC). Voluntary discrimination also occurs under eco-labelling schemes that incorporate PPM-based criteria (not all do).

133. Mandatory standards would almost certainly be referred to the WTO dispute settlement panel, where precedent shows that recourse to the Technical Barriers to Trade (TBT) provisions would likely result in the standard being deemed a barrier to trade and thus illegal.

United States – Taxes on Petroleum and Certain Imported Substances, L/6175, adopted 17 June 1987, BISD 34S/136) might also be read as requiring attempts at international agreement (paras. 27-28).

[117] Alternatively, it could be argued that a future international climate agreement may not include a provision on how to deal with leakage and thus that the need for trade measures persists.

[118] Brazil – Measures Affecting Imports of Retreated Tyres, Report of the Appellate Body, WT/DS332/AB/R, December 3, 2007-Tyres, paragraph 93.

[119] Werksman, JD (Ibid).

[120] Cosbey, Aaron. Border Carbon Adjustment. Trade and Climate Change Seminar, June 18-20, 2008, Copenhagen Denmark. International Institute for Sustainable Development.

Free allowances

134. WTO rules are clear that it would not be possible to allocate allowances for free within a country and then require importers to pay for them. Proposals of this type have not currently been tabled under the EU ETS or other schemes, but have occasionally been voiced in the US debate.

135. The provision of free allowances under the EU ETS has been tested to some extent within the European Union's courts. Conclusions which can be drawn[121] are:

- The question of whether the granting of free allowances amounts to state aid under Article 87 of the European Treaty has not been clarified by the European Courts.
- The legal challenge of allocation rules by affected competitors is fraught with difficulties.
- The European Commission remains the strategic 'master' of the state aid 'instrument'.[122] This allows it to avoid that legal action puts the functioning of the EU ETS at risk and allows it to use the state aid 'instrument' as a 'stick' against Member States.

136. Bordoff (2009) considers the eligibility of free allowances within WTO rules. Under the WTO Agreement on Subsidies and Countervailing Measures (SCM Agreement), free allocation would be a subsidy if it 1) were a "financial contribution" by the government; 2) conferred a "benefit"; and 3) was "specific" to certain industries or sectors. Each of these conditions appears to be met, suggesting that free allowances are a subsidy. To be actionable under the WTO, they need to cause adverse effects to other WTO Members. Bordoff concludes that free allowances may not meet this criteria because of the opportunity cost principle, i.e. that whether allowances are given for free or auctioned does not alter a firm's decision on how much it will produce. This may be true in the short term, but free allowances would clearly benefit a firm's profitability and hence its ability to invest in future plants.

137. Other commentators argue, invoking the concept of property rights, that there is no case to answer and that free allowances do not constitute a subsidy. No case law has been established either way.

3.3 Interaction with other Fiscal Instruments/Policies and Measures

138. The analysis so far has sought to establish what impact options such as BCAs and free allowances would have in reducing competitiveness and leakage impacts. The picture is complicated by the possibility of implementing fiscal instruments and other PAMs in countries without a carbon cost.

Flanking measures in countries with GHG PAMs

139. There is some evidence that sectors subjected to more onerous environmental regulations or whose treatment becomes less favourable in another way (e.g. via a reduction of government subsidy or

[121] *The EU Emission Trading Scheme put to the test of State aid*. Presentation by Joëlle de Sépibus to the NCCR, Berne, January 2009. World Trade Institute, Berne, Switzerland.

[122] Within the EU, "The objective of State aid control is, as laid down in the founding Treaties of the European Communities, to ensure that government interventions do not distort competition and intra-community trade. In this respect, State aid is defined as an advantage in any form whatsoever conferred on a selective basis to undertakings by national public authorities. (http://ec.europa.eu/competition/state_aid/overview/index_en.html).

support) can be at least partially compensated by other ‘flanking measures’. [123] These measures will dilute the impact of the carbon cost on the sector in question, reducing competitiveness and leakage impacts and subsequently reducing the scale of response needed from BCAs, free allowances or other options.

140. How flanking measures interact with carbon costs and responses is measure and sector-specific. Measures could fall within four categories:

- those that directly affect short-term production decisions, e.g. reduction in the cost of an input (e.g. in VAT on electricity consumption);
- those that relate to investment, either to a specific piece of equipment or more generally to make investment more attractive (e.g. by allowing higher depreciation rates);
- support for longer term R&D, e.g. demonstration schemes for carbon capture and storage (CCS);
- those that have a more general impact, effectively improving the financial position of a company (e.g. a reduction in labour taxes).

141. It is difficult to generalise as to the impacts of flanking measures. It can be concluded, however, that their use reduces the need to compensate firms and that their exact impacts require case-specific economic analysis.

Fiscal instruments and PAMs in countries outside the GHG PAM regime

142. Fiscal instruments and other PAMs that other countries have, or could, implement make the challenge of accurately assessing the level of stringency needed in a BTA that much more difficult. What is ultimately required is a calculation of how PAMs in other countries compare in their final regulatory impact to those in the country imposing a BTA. This sort of comparison directly leads to considerations around the responsibilities of different countries to reduce the emissions that lead to climate change.

143. Under the UNFCCC’s Kyoto Protocol, some countries have taken on absolute emissions caps. The UNFCCC and Kyoto Protocol include the principle of “common but differentiated responsibility” (CBDR), with the Bali Action Plan adding that all countries should take on “nationally appropriate mitigation actions” (NAMAs). It is accepted that different countries will act to reduce their emissions in different ways with any combination of PAMs; the UNFCCC has never attempted to prescribe policies or their stringencies. Rather, the role of the UNFCCC has been to facilitate agreements on the scale of national commitments and on the common mechanisms which can be used. Further analysis leads to three questions:

1. What measures are non-Annex I countries planning?
2. How would different national approaches be treated under the UNFCCC’s CBDR provision?
3. What considerations are included within the major Emissions Trading Schemes?

[123] See forthcoming papers by Professor David Victor and Professor Nigel Lucas on the political economy of subsidy reform and lessons learned from domestic policy (See the Global Subsidies Initiative of the IISD, Geneva www.globalsubsidies.org/en, forthcoming).

What measures are non-Annex I countries planning?

144. While the multilateral climate regime does not require developing countries (Non-Annex I countries) to set overall caps or reduction targets for their GHG emissions, these countries have implemented or proposed a very wide range of PAMs which have either the primary aim of reducing GHG emissions or would lead to reductions as a secondary impact. China's 11th 5-year plan,[124] including the commitment to reduce energy intensity, has received much attention, but China has many PAMs – covering, *inter alia*, membership in the Asia Pacific Partnership on Clean Development and Climate; the Cleaner Production Promotion Law; electricity and coal price increases; import duties and a green lighting programme.[125] Similarly wide sets of PAMs are planned for countries including Brazil, Mexico, South Africa and South Korea.

145. Section 2.1 illustrated the differences in costs that a Latin American cement producer could face from different GHG PAMs, noting that whether or not PAMs resulted in a carbon cost was a key discriminator. There are clearly major challenges in assessing what the impacts of various PAMs would be as carbon cost equivalents. Evaluating the costs and impacts of policies and measures has a long history but does not give easy answers.[126]

146. One of China's simpler policies with associated climate change impacts is its adjustment of import and export taxes and tariffs. Over the past two decades, Chinese policy has progressively removed incentives to energy-intensive high-polluting exporters and replaced them with export tariffs. It is generally understood that these changes have been pursued primarily for economic reasons, with China aiming to export higher value added products (Dröge, 2009).

147. However, it is possible to calculate the equivalent value in terms of carbon. For 2006-08 these were (Voituriez and Wang, 2009):

- Steel: €30-43/tCO_2;
- Aluminium: €18-26/tCO_2;
- Cement: €2.5-3.5/tCO_2.

148. The impacts of these tariffs depend on China's position in product markets and on the options Chinese industry has for reducing its GHG emissions. Again, specific economic analysis is required to ascertain the type and scale of impacts tariff changes would have within a world system featuring, for example, the EU ETS with a certain carbon market price.

How would different national approaches be treated under the UNFCCC's CBDR provision?

149. Inasmuch as equal reductions, or comparable efforts, are the aim of BTAs, there is a clear tension between such schemes and the principle of "common but differentiated responsibility" as elaborated in the UNFCCC.[127] That principle holds that developed countries, because of their historical responsibility and increased capacity to act, should bear a heavier burden of responsibility for action on addressing climate

[124] China's 11th 5-year Plan, http://www.china.org.cn/english/features/guideline/156529.htm.

[125] See the World Resource Institute's SD-PAMs Database for details of policies and measures for 18 key developing countries at http://projects.wri.org/sd-pams-database/.

[126] See for example Wooders (2006) paper for Energy Charter Secretariat.

[127] See UNFCCC preamble, Article 3.1 and Article 4.1.

change. It serves as the basis for much text that differentiates commitments based on economic circumstances. For example, Article 3.4 states:

> *"Policies and measures to protect the climate system against human-induced change should be appropriate for the specific conditions of each Party and should be integrated with national development programmes, taking into account that economic development is essential for adopting measures to address climate change."*

150. It is possible for BCA schemes to reflect the principle of CBDR. The US Waxman-Markey Bill, for example, exempts least developed countries from coverage. In earlier drafts, countries were also considered to have "commensurate greenhouse gas regulation" if:

> *"... the country has implemented policies, including sectoral caps, export tariffs, or production fees, that individually or collectively place a price on greenhouse gas emissions from a sector or subsector that is at least 60 percent of the cost of complying with title VII of the Clean Air Act in the United States for such sector or subsector, averaged over a two-year period."*[128]

151. The fact that 100% equivalence is not required is a concession that goes in the same direction as the UNFCCC principle of CBDR. But the question remains: is CBDR appropriately interpreted at the national level, or should it be decided through international negotiations under the UNFCCC? That is, it may be that even 60% is too high, and that the global community under a post-2012 regime will agree to something quite different.

152. The possibilities for tension between the principle of CBDR and nationally-administered BCAs are obvious. This does not mean that BCAs would be impossible within a system governed under the principle of CBDR, but it would require the channelling back of BCA revenues to developing countries and/or some other form(s) of flanking measures.

153. Furthermore, it is clear that even in countries committed to equal reductions in national GHG emissions the reductions expected from different sectors may differ. Fiscal and other costs and incentives to sectors would also vary as a function of the set of PAMs they are subjected to. Also, the costs of GHG emissions reductions differ by country, tending to be lower (in terms of percentage reductions from business as usual) in developing countries.[129] It can be concluded, therefore, that equal reductions would not result in comparable costs and incentives to the same sector in different countries.

What considerations are included within the major Emission Trading Schemes?

154. Section 3.1 reviewed the considerations. Waxman-Markey (15 May 2009) would exclude LDCs or countries responsible for less than 5% of global GHG emissions and covers only primary products. The programme has to be established in a manner "consistent with international agreements to which the United States is a party." This provision would include, of course, the UNFCCC and any post-2012 climate regime that the US ratified.

155. The EU (Council of the European Union, 2008) would also limit its consideration to countries "representing a decisive share of world production". After taking account of whether these countries

[128] Section 405 (b)(2), May 15 2009 version (now superseded).

"firmly commit to reducing greenhouse gas emissions" and "the extent to which carbon efficiency of installations located in these countries is comparable to that of the EU", the EU would determine which of its sectors were at significant risk of carbon leakage and apply relevant measures.

156. Australia (Australia, 2009) has ventured an approach that seems to only partially reflect CBDR. It makes its proposed reductions in GHG emissions conditional on a number of criteria including "advanced economy reductions, in aggregate, of at least 25 per cent below 1990 levels by 2020" and "major developing economy commitments to slow growth and then reduce their absolute level of emissions over time, with a collective reduction of at least 20 per cent below business-as-usual by 2020 and a nominated peak year for individual major developing economies".

3.4 Experience of Implementing Similar Schemes

157. The options being considered for responding to competitiveness and leakage impacts have few direct precedents. Whilst there have been a number of emissions trading schemes implemented, there is minimal experience outside the Kyoto Protocol of trading of allowances between countries.[130] Thus is it not possible to draw lessons around free allowance schemes.

158. A large number of environmental labelling schemes exist. Carbon labels have typically been attached to retail products such as washing powders and foodstuffs. While clearly dissimilar to the commodities on which competitiveness and leakage concerns are focused, the most important difference is that these schemes are voluntary in nature. This is critical for WTO legality: voluntary schemes have traditionally not been covered by the WTO unless they have government involvement. This government involvement is strictly interpreted: even relatively limited activities are enough to lead to a scheme coming under the WTO's coverage. Under the WTO, recourse to a dispute settlement almost always concludes that labels breach the TBT rules and are deemed illegal.

159. There is little doubt that carbon eco-labels will continue to proliferate, with the range of offerings from private companies (e.g. Tesco), standards organisations (e.g. ISO) and NGOs (e.g. WRI and WBCSD) continuing to expand. Of concern is that there is no agreed, international standard for PPMs and the claims and benefits of different labels can vary widely. More positively, it should prove easy to add carbon information to existing labels. The experience of eco-labelling does provide some lessons around design and governance, for example the benefits of an open process with wide consultation (Aguilar et al, 2009).

160. The BTAs being considered would have international coverage and the tax levied would be proportional to the carbon content of the product (i.e. it would not be levied on an 'on/off' basis). Importantly for WTO legality, they would be mandatory and implemented by governments. The only example of a PPM-based BTA implemented to date is the US "Superfund" case (US-Superfund, 1987). In order to create a "Superfund" for the clean-up of dumps, this scheme established levies on imports of crude oil and certain chemicals. Interestingly for BCAs, it also included a list of secondary products which had used the chemicals within their manufacture and applied levies on the basis of embodied chemical content. After an initial attempt by the US to charge a higher levy on foreign importers of crude oil than on domestic producers had been replaced by equal treatment, the GATT dispute settlement panel ruled that the scheme was legal; equivalent levies were raised on both domestic producers and importers.

[130] The only experience outside the Kyoto Protocol of trading between countries has been limited sulphur oxide trading between the US and Canada.

PART IV: ANSWERS TO KEY QUESTIONS CURRENTLY FACING POLICYMAKERS

Conclusions

161. The first section of this paper asked seven questions as to whether currently considered responses to competitiveness and leakage are appropriate, noting that the responses could easily become 'locked-in' over the medium- and long-term. Based on the analysis presented in the paper, answers to these questions are now presented.

4.1 Are free allowances effective in reducing competitiveness and leakage impacts?

162. Free allowances are currently the tool used within the European Union's Emission Trading Scheme (the world's largest) and form the basis for compensating potentially-affected industry under the US's proposed Waxman-Markey Bill. The attraction of using free allowances is clear: *inter alia*, they do not have a direct link to trade and thus largely avoid discussions around WTO legality and possible trade disputes; they do not require detailed measurement of the embodied carbon content of goods; they are administratively relatively simple; and they are popular with affected industry.

163. For policymakers concerned with getting an ETS into legislation, free allowances are thus an appealing option. This does not mean that they would also be effective or efficient at responding to competitiveness and leakage. Under absolute emissions caps, firms' short-term production decisions will factor in the cost of carbon whether they are paying for allowances or receiving them for free. The cost of carbon a firm is exposed to can be significantly lower than the allowance price in the market; this depends on the scheme specifics related to how allocations are updated and closure and new entrant provisions. Under intensity-based caps, rebates of allowances similarly reduce the effective cost of carbon below the allowance price in the market. While such rebates will reduce competitiveness and leakage concerns, they do so at the cost of reducing the environmental effectiveness of policy. At the limit, rebating 100% of allowances under output-based allocation would eliminate leakage concerns, but would give firms no incentive to reduce GHG emissions. Output-based allocation (OBA) is attractive to firms in that it does not constrain their production, but again there is a downside: by giving no value to plant closure, firms will over-produce and over-abate compared to the economic optimum. Economic efficiency for a particular environmental outcome is lowest for OBA.

164. In the longer term, firms have greater flexibility as to where they can locate production and thus competitiveness and leakage impacts can be higher. The impacts of OBA can be factored into a firm's decisions by their estimating the future carbon market price and level of rebated allowances. The impact of free allowances granted under an absolute cap is more difficult to ascertain. Whilst it is clear that a firm granted free allowances will be better off financially than one who must pay for them, how this translates into future investment location decisions is less obvious. A firm will be incentivised to invest in a country where it expects to receive free allowances in the future; those it receives before making the investment

will simply improve its balance sheet, making it more likely to invest in new plants but not incentivising one location over another. Whether free allowances are sufficient incentive to change locations depends on a range of economic, political and regulatory factors. The nature of the industry is also important. Capital-intensive industries which require the construction of large plants with long supply chains may be better incentivised by measures which respond directly to investment needs rather than are linked to production.

165. There is little empirical evidence to suggest whether or not free allowances would be effective. Economic theory strongly suggests that they will have little or no impact in the short term. In the longer term, little is known about how effective free allowances would be in encouraging producers to remain in countries with climate change PAMs. There must be a strong suspicion that free allowances, which have the nature of a compensatory payment, will have little impact on competitiveness and leakage. They would thus represent an ineffective use of government resources (Neuhoff, 2008).

4.2 How many free allowances should be given?

166. The answer to this question is not straightforward. It requires:

1. Definition of a compensation level principle. If a country wishes to constrain its GHG emissions, one would expect companies with GHG-intensive processes to see their profits fall (if they do nothing to respond to the new policies and measures). If auctioning were introduced along with a BTA, profits would almost certainly fall in energy-intensive industries as the price of their product increased and demand fell. Calculating the level of free allowances to fully compensate for the expected loss in profit from the imposition of the climate change PAM thus appears over-generous.

2. Certainty as to whether affected industry is already partially compensated. Certain allocation scheme details, particularly those relating to the updating of allocations and closure provisions, tend to dilute the effective carbon cost faced by industries. Flanking measures have also often been associated with the imposition of environmental PAMs in the past. Both of these are forms of (partial) compensation to industry, and should result in a lower level of compensation through free allowances.

3. Analysis of how the specific market works. Section 2.1 discussed the economic principles governing how industry would be affected by GHG PAMs. Of note is the ability of industry to pass on some part of cost increases to consumers. This depends on a range of factors including market structure, product substitutes, transport costs and product differentiation. Lobby groups often make the assumption that no pass-through of costs is possible, but this is unlikely to be the case in the energy-intensive industries around which competitiveness and leakage concerns are focused.

167. It is extremely difficult to arrive at any more than rough estimates for the criteria above. Earlier EU proposals attempting to identify the profit-neutral pass through rate were abandoned in favour of a simpler approach involving cost increase and import intensity indicators. Both the EU and Waxman-Markey Bill appear to run the risk of significantly over-compensating industries. This both represents a lost opportunity cost of government revenue and also is likely to delay restructuring of energy-intensive industry. It would also set a weak precedent for sectors not covered by the ETS, creating the expectation that their efforts can be watered down.

168. It could be concluded that calculating the optimum level of free allowances to grant is not possible with any degree of accuracy and that a gradual phase-out of free allowances over the medium-term is a reasonable strategy to follow.

4.3 Do we have the data we need? Will we?

169. The previous response to how many free allowances should be given highlighted the difficulties of attempting to simulate how markets will change when climate change PAMs are implemented. The range of results which models give, and their sensitivity to a range of drivers, means that models are unlikely to ever be anything more than a useful tool to gain understanding of the key drivers of competitiveness and leakage impacts.

170. As GHG PAMs are implemented a set of empirical data will be generated, notably around changes in trade and the location of production. But it is wrong to assume that it will be possible to pinpoint the impact of GHG PAMs from this data; there are simply too many factors driving production decisions to enable the impacts of any single factor to be ascertained.

171. This analysis leads to the conclusion that options such as granting free allowances which requires estimation of the impacts of GHG PAMs on competitiveness and leakage will always be based on uncertain calculations. The level of uncertainty may be high. Policies such as BTA, which imposes a cost but does not require any understanding of how competitiveness and leakage will be impacted if BTA was not implemented, should thus be favoured under this criterion.[131]

4.4 Are free allowances a subsidy?

172. The issue has not been tested and no clear conclusions can be drawn as yet. WTO rules would definitely be broken if a scheme granted free allowances to domestic producers but required importers to pay a BTA or some other charge, but such proposals do not form part of the EU ETS or proposed schemes in other jurisdictions.

173. The EU ETS is the only scheme to date that has had an operational free allowance scheme, and even this has only been operational for four years. The EU's focus has so far been on preserving its own internal market rather than looking overseas. Given that other countries do not as yet have operational ETSs imposing costs on their producers, challenges between countries on the basis of relative levels of free allowances given to a particular industry have not yet been possible. They are certainly possible in the future, however, and a 'support war' could develop.

174. Section 3.3 referenced Bordoff's (2009) statement that free allowances met the three criteria of what constitutes a subsidy under the WTO's Agreement on Subsidies and Countervailing Measures (ASCM): they are a "financial contribution" by government; confer a "benefit"; and are "specific" to certain industries or sectors. To be disciplined under the ASCM they must also be proven to cause adverse impacts on one or more WTO Members. Free allowances will not be challenged until GHG PAMs are more advanced in more countries. When this is the case, there is a strong possibility that challenges will be made and that adverse impacts will be proven. Although much of the legal attention to date has been focused on whether BCAs would be eligible under the WTO, this does not imply that free allowances are themselves eligible.

[131] It is also important to note that there are other possibilities to deal with competitiveness and leakage concerns: see Section 4.5 for a potential portfolio of tools.

4.5 Would BCAs be an effective alternative?

175. Whether BCAs would be effective in reducing competitiveness and leakage is far from certain. Results from models considering single sectors of the economy (e.g. iron/steel or cement) suggest that imposing differential carbon costs between countries would alter production in the short and long term and would lead to leakage. There is no consensus on how large such leakage would be. Models which take into account the interactions of sectors with the wider economy show results that can be contradictory. They tend to show that leakage is driven principally by the fossil fuel price channel, i.e. that climate policies reduce fuel demand in their countries of application which lowers fuel prices world-wide and thus increases consumption. The models tend to show that BCAs will transfer costs of meeting emissions commitments from energy-intensive sectors to other parts of the economy and will also reduce world welfare.

176. There are 'horses for courses'. Dröge (2009) states that "tool[s] needs to be chosen taking into account the characteristics of an industry, including costs structures, international competition, technological status quo and potentially market structures – all determine the leakage potential". "Moreover, creation of a policy tool portfolio takes time and requires information". She recommends:

- Direct compensation when climate policy results in high indirect costs (e.g. of increased electricity prices to aluminium producers);

- Border adjustment when climate policy results in high impact on direct or operating costs and: the product is homogenous; the product is not from a process which is capital-intensive or incapable of running with plant at part load;

- Output-based allocation when the product is not homogenous but all other conditions are the same as above;

- Direct compensation or free allowances with a new entrant reserve when processes are capital-intensive and/or incapable of running at part load.

177. BCAs do not appear to be a clear option which will respond effectively to competitiveness and leakage across sectors, be easy to implement and fit easily into international climate change and trade agreements.

4.6 Could BCAs be implemented?

178. Whilst much discussed and analysed, there are serious doubts as to whether BCA will ever be enacted. The European Commission's proposals for Phase 3 of the EU ETS (starting in 2013) envisaged a phasing out of free allowances in favour of auctioning, which the EC has always regarded as the preferred allocation methodology. When faced with resistance from industry, the EC chose to move back to granting free allowances rather than implementing a BCA. The US proposals under the Waxman-Markey Bill also see free allowances, with border adjustment added as a further provision from 2020 if, following a review, it can be demonstrated that US producers are operating at a competitive disadvantage. The share of allowances granted for free suggests very strongly that such provisions will not be needed, as the value of the free allowances that US producers in energy-intensive sectors would receive appears large enough to offset any profit losses. Given that BCAs under that regime would prove technically extremely difficult to implement and would almost certainly sour the international trade and climate regimes, it appears likely that the US would continue with a generous free allowance scheme into the foreseeable future.

179. WTO legality requires that measures are non-discriminatory, suggesting that all countries must be treated equally. The principle of allowing special dispensations for least developed countries is widely accepted.

180. A scheme which requires carbon content to be measured for all products would clearly be administratively cumbersome. Ismer and Neuhoff (2007) and others thus recommend a scheme where carbon content is set at the level of the 'best available technology'. The analysis presented in Section 1.2 for cement, steel and aluminium showed the wide range of emissions factors from different production routes. It questioned whether a 'best available technology' factor could be set at anything other than a very low rate (which would render it largely ineffective).

181. It seems that an alternative method is needed whereby carbon content factors are set (perhaps on the basis of the technology route followed by production) with producers able to challenge this factor by providing evidence that their processes emit less. Challenges could be various and multiple: for example, marginal against average production or how a plant's emissions should be disaggregated across its multiple products. There is a clear incentive for exporters to channel their cleanest production to export markets, retaining less clean production for their home markets, thus not reducing a country's GHG emission at all. The borders between these two tranches may be fuzzy at best.

182. A number of technicalities would have to be resolved before a BCA could be implemented. These include setting the boundaries of the system, notably on whether (and how) emissions from electricity generation would be included. Again, there is no easy solution to these issues, which would ideally be resolved by international agreement.

4.7 What account should be taken of alternative policies in other countries?

183. Section 1.1 introduced the idea that countries and regions are likely to have a range of GHG PAMs and that different GHG PAMs result in very different costs and incentives to sectors of the economy. This immediately raises the problem that seeking to compensate domestic producers for less stringent conditions faced by producers in other parts of the world would require an assessment of the combined impacts of a wide range of disparate PAMs.[132] Given that ascertaining the impact of even a single PAM is difficult, the task appears extremely challenging at best.

184. The UNFCCC's "common but differentiated responsibility" (CBDR) principle states that countries should reduce their national emissions in line with their historical responsibility and capacity to act. It implies that similar sectors in different parts of the world would be expected to bear different responsibilities in reducing GHG emissions. This requirement is not in line with BCAs, which seek to level the playing field by equalising costs to producers across the world. BCAs therefore appear to be at odds with the principle of CBDR.

185. The need for international agreement to ascertain what represents "comparable effort" appears clear. International agreement would ideally establish principles and guidelines for:

[132] The Waxman-Markey Bill requires such an assessment to be made when considering what options should be put in place to level the playing field.

- when and how BCAs could be applied;
- how embodied carbon should be measured;[133]
- how comparable effort should be judged and measured.

186. To this list can be added agreements on how free allowances should be granted.[134] The agreement would need to weigh the need to comply with the principle of CBDR against the danger of leakage eroding the environmental effectiveness of the GHG commitments made by developed countries.

187. Such an agreement would represent a very ambitious undertaking, with the best institutional home being the UNFCCC. The support of the WTO would be very beneficial. Without such an agreement there is a danger of unilateral implementation of PAMs and policy being left to the WTO's Dispute Panel by default.

4.8 Concluding Thoughts

188. The economic and environmental impacts of competitiveness and leakage are uncertain and will continue to be so for the foreseeable future. The key reason for responding to these concerns appears to be that without such a response there is a danger that ETSs and other GHG PAMs may not be implemented and global GHG emissions will rise.

189. The experience of the first major mover, the European Union, is instructive. It can be argued that its response is not the most economically efficient, but that it has addressed its own domestic policy framework and has also avoided pushing the problems of climate change policy into the trade arena.

190. It appears clear that international agreement would result in a more effective, more equitable response to competitiveness and leakage concerns than unilateral responses followed by disputes (which are likely to be at the WTO, and thus focused primarily on trade). Such an agreement would be challenging and ambitious, but the benefits would be significant.

191. Further exploration of how an international agreement on the guiding principles for implementing BCAs could be set up, and what that agreement should contain, is indicated.

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[133] Further research is needed in this area to extend the debate beyond rhetoric and perceptions of negative impact on competitiveness that are not backed up with solid data.

[134] Note the relationship with EC desire for a 2015 OECD trading scheme and one in 2025 including major emitters. Harmonisation (or at least linking) of emissions trading schemes would be a more economically efficient method than a political solution around "comparable effort".

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