

# Border Adjustments for Carbon Taxes and the Cost of Emissions Permits: Economic, Administrative, and Legal Issues

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## I. Introduction

Under the Kyoto Protocol, most advanced countries other than the US committed to reduce emissions of CO<sub>2</sub> occurring within their boundaries, on average, to 95 percent of their 1990 levels between 2008 and 2012. By comparison, the protocol exempted developing countries from the requirement to reduce CO<sub>2</sub> emissions. Although the Protocol does not prescribe the means to be employed to achieve this target, it is anticipated that either carbon taxes or cap and trade systems – hereinafter referred to as carbon pricing – will play an important role. The first carbon pricing systems to be implemented rely on what, in the tax literature, would be called *origin-based* systems for pricing carbon embedded in internationally traded products.<sup>1</sup>

For example, under the European Union’s Emissions Trading System (ETS), by far the most important extant system for pricing carbon, emissions permits are required to engage in *production* in a Member State that entails *emissions* of CO<sub>2</sub>. Exports are not exempt from the requirement to hold permits, and the cost of permits for carbon emissions embedded in the cost of exports is not rebated when products are exported. Conversely, it is not necessary to hold CO<sub>2</sub> emissions permits of EU members of destination to import into the EU products that would be subject to the requirement for emissions permits if produced within the EU. The first column of Table 1 describes the treatment of international trade under an origin-based system, for both carbon taxes and a cap and trade system.

The origin- (or production/emissions-) based system for pricing carbon has adverse consequences that are now well-recognized, in part because not all nations “participate” in the Kyoto Protocol coalition, in the sense of agreeing to price carbon.<sup>2</sup> The list of non-participating nations includes the United States, which refused to ratify the Kyoto treaty, as well as China, India, and other developing countries. First, firms that produce in participating countries are

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<sup>1</sup>Two conventions are followed here, as in much other literature. In both cases, meaning should be clear from context. First, because of the technological relationship between the amount of carbon consumed in combustion and the quantity of CO<sub>2</sub> emitted, “carbon” and “CO<sub>2</sub>” are sometimes used interchangeably. Second, some of the carbon that causes global warming is said to be “embedded” in products, although it is emitted as part of the emission of CO<sub>2</sub>. It is the *cost* of carbon that is embedded in the *cost* or price of products.

<sup>2</sup>Strictly speaking developing countries that signed the Kyoto Protocol participate in the Protocol. The term “participating” is used here to refer only to countries in the Kyoto coalition that have undertaken commitments to reduce emissions. Other countries are treated as not participating.

placed at a competitive disadvantage, in both domestic and export markets, relative to those that produce in non-participating countries.<sup>3</sup>

Second, there is an incentive for nations to be “free-riders,” by not participating in the Kyoto coalition, in order to retain a competitive advantage for their producers. Since global warming involves transnational externalities, these nations enjoy the benefits of preventing it.

Third, partial coverage can lead to “carbon leakage,” as production, including that associated with new investments, shifts from participating countries to non-participating countries, impeding the reduction of global emissions.<sup>4</sup> Even if the United States decides to participate, as long as China and India do not curtail emissions, there is little hope of meeting global targets for stabilizing the concentration of CO<sub>2</sub> in the atmosphere at a level that many believe is necessary to avoid serious risk of irreversible and potentially catastrophic global warming.

Fourth, even if the Kyoto targets were to be realized, if some countries of origin impose a price on emissions and some do not, worldwide economic efficiency suffers, because the reduction of emissions does not occur where it is cheapest. The first column of Table 2 summarizes these four problems. (The table also describes other key characteristics of several systems of pricing carbon described below.)

This origin/production/emissions- based system for pricing carbon stands in marked contrast to the way value-added taxes (VATs) are commonly levied. In the standard *destination-based* VAT, imports are subject to the same tax as domestic products, and exports enter world markets tax-free. In short, the tax applies to *consumption*, rather than to production. The application of VAT to imports and the exemption from and rebate of tax on exports required to achieve this are commonly called border tax adjustments (BTAs).

Not surprisingly, the outcomes under a destination-based tax are very different from those under an origin-based tax.<sup>5</sup> There is no competitive advantage to producing in a country that does

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<sup>3</sup>As stressed in other literature, competitiveness should be defined at the sectoral or perhaps firm level.

<sup>4</sup>It is important to distinguish two types of carbon leakage. In what follows the term “leakage” is reserved for a drop in domestic production of CO<sub>2</sub> that exceeds the fall in domestic consumption of embedded CO<sub>2</sub> resulting from pricing carbon. It occurs because of the change in the relative cost of using carbon-based energy in participating and non-participating countries induced by carbon pricing. Computer models reveal that a quantitatively more important form of leakage occurs because carbon pricing depresses the demand for energy in countries adopting such policies. As a result, the price of energy falls and more of it is used, especially in non-participating countries. See, for example, McKibben and Wilcoxon (2009).

<sup>5</sup>An old theorem says that taxes that apply to all production or to all consumption are equivalent in their economic effects, because differences will wash out in movements in exchange rates or price levels. This theorem has limited applicability to real-world VATs, which are not levied on all consumption and presumably would not be levied on all production, if the origin principle were chosen. See Feldstein and Krugman (1990).

not have such a tax, the tax does not distort choices of where to produce, and free-riding is not an issue.

The same reasoning applies to destination-based systems for pricing carbon.<sup>6</sup> Unlike origin-based pricing, destination- (or consumption-) based carbon prices would not affect competition between producers in countries that do and do not price carbon. Moreover, policy-induced leakages of carbon emissions would take a different and less pernicious form, and incentives for countries to be free riders by eschewing such prices would be muted. In particular, if the community of nations decided to impose a destination-based price on carbon, some countries might choose not to do so, to avoid burdening their *consumers*. The mitigation of emissions would be less than if carbon pricing were universal, and these countries could be described as free riders in the effort to reduce global warming. But the environmental and free-rider effects would be less harmful than under an origin-based system, in which free-riding countries avoid burdening their *producers*. The second column of Table 2 summarizes these benefits (and other characteristics and effects) of a destination-based carbon tax. (The results for a cap and trade system, with obvious reinterpretations, are the same, except that administrative requirements differ and revenue accrues to the country issuing permits. The latter, in turn, is determined by the international allocation of authority to issue permits.)

As with a VAT, implementation of a destination-based system of pricing carbon would require “border adjustments” or BAs. (The term “border adjustments” is equally applicable to carbon taxes and cap and trade systems. “BTAs” is reserved here for border adjustments for taxes.) In the case of a carbon tax, taxes would be levied on carbon embedded in imports, exports would be exempt, and embedded carbon tax paid before the export stage would be rebated. Under a cap and trade system, permits (or the payment of a tax) would be required for imports, based on their embedded carbon content, but not for exports, and the embedded cost of permits incurred before the export stage would be rebated. The second column of Table 1 describes a destination-based system for pricing carbon.

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<sup>6</sup>The theorem cited in the previous footnote has even less relevance to carbon prices, which have quite different impacts on different sectors, than to real-world VATs. Thus Hufbauer and Kim, 2009, p. 3, notes 3 and 4) write the following in successive paragraphs:

When the profile of VAT across traded sectors is jagged—some very high rates, some very low rates—the similarity begins to fade between the impact of origin and destination BTAs. Origin BTAs will not adequately shield the highly taxed sectors from foreign competition, even after the exchange rate adjusts.

For a different view, see Lockwood and Whalley (2008) and Whalley (2009), which emphasize the possibility that carbon prices might be reflected in wage rates and returns to other factors that are sector-specific, rather than affecting product prices. While labor and other factors may be specific to certain sectors in the short run, specificity is much less in the long run. More to the point, it is precisely the short-run impacts on specific sectors and factors employed therein that motivate much of the concern about competitiveness.

Responding to concerns about competitiveness, carbon leakage, and free-rider problems, a number of public officials in the EU have suggested that imports from nations that do not participate in the Kyoto Protocol (most notably the US) should be subject to border adjustments, and draft legislation for carbon taxes and cap and trade systems introduced in the US Congress includes such provisions.<sup>7</sup> Proposals for border adjustments on exports to non-participating countries are less common, presumably because unfair competition in domestic markets is seen to be a greater threat than unfair competition in export markets. Most examinations of border adjustments for carbon prices envisage grafting destination-based features onto what is fundamentally an origin-based system, rather than creating a conceptually coherent, universally applicable destination-based system. Thus border adjustments might be applied only to trade with countries that do not have “comparable” origin-based programs to curtail emissions, creating what Section III calls a “mixed” system.<sup>8</sup>

Despite the advantages described earlier, the case for destination-based carbon pricing is easily overstated. First, implementing such a scheme must overcome daunting technological and administrative challenges. Second, there may be legal barriers to implementing a destination-based system for pricing carbon, especially a mixed system, under the rules that govern international trade, principally the General Agreement on Tariffs and Trade (GATT) and the Agreement on Subsidies and Countervailing Measures (ASCM). Third, whether it makes sense to attempt to implement destination-based pricing depends on the magnitude and nature of the distortions, effects on competitiveness, carbon leakages, and incentives for free riding that would occur if some countries do not price carbon. Finally, because of the strong opposition by developing countries to the use of BAs by developed countries, there is widespread concern that unilateral introduction BAs could set off trade wars, given especially the uncertainty of the legality of such measures under the international trade rules, an issue discussed in Section V. This hangs like a dark cloud over the Copenhagen negotiations that began in early December 2009. It would, in principle, be both possible and desirable to revise those rules to allow explicitly for border adjustments for carbon prices, but revision would not occur quickly – and it might never occur – because of political resistance to revision.

This next section describes the equivalence of three comprehensive harmonized systems of pricing carbon and criteria for choosing among them. Section III considers, at a conceptual level, alternative ways of achieving the benefits of destination-based pricing of carbon in a world of origin-based carbon pricing, including a zero price for carbon set by countries not participating in the Kyoto Protocol. Section IV examines technological and administrative issues related to introduction of BAs, and Section V summarizes the discussion of the GATT-legality of BAs for carbon taxes and the cost of emissions permits. Section VI summarizes and concludes.

In order to concentrate on the issues at hand, several limitations are placed on the analysis. First, CO<sub>2</sub> is the only greenhouse gas considered. But much of what is said here would, with some modifications, be applicable to a more comprehensive scheme that included pricing of

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<sup>7</sup>See McLure (2009) for references.

<sup>8</sup>See, for example, Aldy, Orszag, and Stiglitz (2001), Biermann and Brohm (2005a), and Metcalf and Weisbach (2009).

other greenhouse gases. Second, only emissions of CO<sub>2</sub> arising from the combustion of fossil fuels are considered explicitly. Thus, for example, CO<sub>2</sub> released in the burning of forests is not considered. But the same reasoning could be applied to some other emission-intensive activities, including the production of cement. Third, the paper generally does not consider the need to make allowances for the embodiment of carbon in some products (for example, in chemicals, steel, and asphalt). Fourth, there is no attempt to compare the efficacy of BAs and other proposed ways to deal with competitiveness and leakage, such as free allowances and output-based rebates. Finally, this analysis pertains specifically to trade between nations. The international trade rules are, of course, of no relevance for determining the legality of border adjustments on interstate trade.

## **II. The First-best Solution: Globally Comprehensive Harmonized Carbon Pricing**

From an economic point of view, the ideal way to price carbon is via a harmonized system that achieves “carbon price equivalency” – the same price for carbon, wherever carbon combustion or consumption of embedded carbon occurs. With a uniform price for carbon, mitigation of emissions would occur where most cost-effective, because the marginal cost of reducing emissions would equal the uniform price for carbon in all countries, and penalties for emitting CO<sub>2</sub> would not depend on where products that embody CO<sub>2</sub> are produced or consumed. There would be no carbon leakages and no competitive advantages and disadvantages in a harmonized global system. By assumption, there would be no free riders.

The simplest such system to understand, and perhaps and to implement, would be a globally uniform carbon tax. But a cap and trade system with international trading of emission permits could, in theory, also produce a globally uniform price for carbon. (In the absence of international trading, there is no reason to expect carbon price equivalency.)

This section describes three prototypical (or stylized) ways to achieve carbon price equivalency, examines criteria for choosing among them, and discusses the effects of non-participation, including exemptions for developing countries, under origin-and destination-based systems.

### **A. Three Globally Comprehensive Harmonized Systems for Pricing Carbon**

In the three prototypical systems for pricing carbon, the price is imposed on the *severance* of fossil fuels, the *emission* of CO<sub>2</sub>, or the *consumption* of embedded carbon. (The same country could, of course, be the source of fuel, the origin of omissions, and/or the destination of embedded carbon.) For reasons described below, the community of nations is not likely to choose the first and it may not be cost-effective to implement either of the others – and especially a destination-based system – in their pure forms.

- In a *severance-based system*, countries where fossil fuels come out of the ground (i.e., where coal mines and gas and oil wells are located) would require payment of taxes or royalties for permission to extract the fuels. This is inherently an origin-based system, but one based on the *origin of fuels*, not the origin of emissions.

- In an *origin- (or emissions-) based system*, jurisdictions where CO<sub>2</sub> is emitted would impose a price on all combustion of carbon or on all emissions occurring on their territory. Since imported fuel would be subject to tax (or permits), but exported fuel would not be, it could be said that such fuels are subject to border adjustments. Even so, for present purposes, it seems better to refer to this as an origin-based system for pricing carbon, as in the first section of this paper.
- In a *destination- (or consumption-) based system*, jurisdictions where households consume embedded carbon (including electricity, residential heating oil, and motor fuel, as well as manufactured products) would levy taxes on (or require permits for) the consumption of embedded carbon occurring within their borders. Thus BAs would be allowed for carbon embedded in imports and exports, as well as for imports and exports of fossil fuels.

Table 3 describes the crucial structural differences between these three systems.

## **B. Choosing among Globally Comprehensive Harmonized Systems**

In thinking about the choice between the three systems described above, it will be useful to distinguish between considerations that are invalid or irrelevant in the present context, those that are likely to be controlling, and others that should be kept in mind. The discussion of the first two sets of considerations assumes that the systems would be implemented as described, in particular, that there would be full participation and no cheating by countries.

### **1. Invalid or irrelevant considerations**

Several arguments that may be offered in favor of the origin or the destination principle are either invalid or irrelevant in the present context of establishing a globally comprehensive harmonized system for pricing carbon. (They will be reexamined below, in a context where they are both valid and relevant.) For now the fact that revenues would be distributed very differently are ignored.

*Economic effects.* Some may think that effects on production, employment, consumption, prices, mitigation of emissions, carbon leakage, or economic efficiency would be different under the three systems. This is, however, clearly wrong. Since the three approaches have identical impacts on the price of carbon, *the economic and environmental effects of a global harmonized system of pricing carbon do not depend on which approach is employed.*

*Incidence.* There may also be a tendency to think that the three ways of pricing carbon would have different effects on the distribution of income among people (commonly called “incidence” in the tax literature) – for example, that consumers would bear relatively more of the burden of a destination-based system and producers more of the burden of an origin-based

system.<sup>9</sup> Again, this is false. Since the three systems affect prices identically, their incidence would be identical.

*The “polluter pays” principle.* Finally, some may believe that the “polluter pays” principle points toward origin-based taxation, because the firm that emits carbon is the one doing the polluting and thus should pay. By comparison, others may believe that the principle dictates destination-based pricing, because pollution occurs on behalf of consumers of embedded carbon. In fact, the principle offers no guidance; no matter whether the tax is severance-, origin-, or destination-based, the same people ultimately “pay.”

## **2. Controlling considerations**

The origin/emission-based system clearly dominates both the severance and consumption-based systems, but for quite different reasons.

*Distribution of revenues.* The distribution of revenues from carbon taxes (or the sale of emission permits) among nations would be markedly different under the three alternatives. Under a severance-based system, revenues would flow to the members of OPEC, non-OPEC producers of oil and gas, and nations where coal is mined. Although included for completeness, this alternative does not seem to be relevant, as a practical matter. It is not likely that the community of nations would choose to encourage and facilitate the expansion and strengthening of the OPEC cartel as a way to slow global warming. The discussion in the remainder of this paper thus focuses on origin- and destination-based systems, including systems that are not comprehensive or pure.

The choice between these two systems also has implications for the distribution of revenues. Under a destination-based carbon *tax*, the distribution of revenues among nations is determined by the distribution of consumption, under an origin-based system by the distribution of emissions.<sup>10</sup> Since developed countries are responsible for more consumption of carbon than for carbon emissions, more of the revenues would flow to them under a destination-based system than under origin-based system.

By comparison, under a *cap and trade* system with international trading of permits, the distribution of revenues would be determined by the distribution of authority to issue permits, but it would probably resemble the distribution of tax revenues. In any event, the distribution of revenues is likely to be a secondary consideration in the choice between comprehensive harmonized origin- and destination-based systems, compared to differences in costs of compliance and administration.

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<sup>9</sup>For expositional convenience, the (invalid) comparison in the text is limited to these two systems. Like other economic effects, the incidence of a severance-based tax would, of course, be the same as that of the other two systems. As emphasized below, the distribution of revenues is quite different under the three systems.

<sup>10</sup>In principle, international revenue sharing, side payments, or even a supranational taxing (or cap and trade) authority could exist. Those possibilities are not considered here, as they are secondary to the present purpose of examining international trade regimes for pricing carbon. See, however, Seidman and Lewis (2009).

*Costs of compliance and administration.* Of the three prototypical systems for pricing carbon, the severance-based system would almost certainly be the simplest to implement. Countries where fuels originate could impose a price on the carbon content of fossil fuels as they come out of the ground (e.g., at the wellhead in the case of oil and gas and the mine mouth in the case of coal) or at various “choke points” (e.g. gas processing plants). See Metcalf and Weisbach (2009, pp. 522-27). Even so, this system is unlikely to be chosen.

The origin-based system would require monitoring of either combustion of carbon (most easily achieved by monitoring domestic production, imports, and exports of fossil fuels) or the amount of CO<sub>2</sub> emissions. It would be the next easiest to implement, especially if imposed upstream, rather than on the emission of CO<sub>2</sub>.<sup>11</sup> An origin-based system that relies on measuring emissions underlies the ETS.

Implementation would be particularly difficult in the case of a globally comprehensive destination-based system. In addition to the administrative and compliance requirements of an origin-based system, destination-based carbon pricing would require knowing the embedded carbon content of all non-fuel exports and imports, in order to calculate the appropriate border adjustments. As explained in Section IV, this would be an overwhelming task. It would be senseless to incur these costs, since the same environmental effects could be achieved under an origin-based system. (Moreover, it might be necessary to renegotiate the rules of international trade, but that would presumably occur if there were an international consensus to adopt this approach.)

To reduce costs of compliance and administration and thereby increase cost-effectiveness, it is virtually certain that carbon pricing would be subject to limits, even if imposed on a globally comprehensive and harmonized manner. This is especially true under a destination-based system. For example, carbon pricing might be limited to certain sectors and not extend beyond certain points in the production-distribution chain. Moreover, BAs would probably be limited to carbon- and trade-intensive products. See Section IV.

### **3. Other considerations**

As in many cases where globally comprehensive harmonized systems are preferable from the viewpoint of society, there would be incentives not to participate in the systems described and to cheat. The incentives would be different under the various systems.

*Incentives for non-participation.* The benefit of not participating in an origin-based system – the world of the Kyoto Protocol – are increased competitiveness for domestic firms in energy-intensive sectors. The cost of non-participation that is internalized by the non-participating country (in contrast to the unfair competition that is experienced elsewhere and the damage to the environment associated with carbon leakage) would be the loss of revenues from

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<sup>11</sup>Emissions could not be measured by the amount of fuel purchased in those instances in which CO<sub>2</sub> is captured and sequestered or in which carbon is incorporated in products, as in the case of chemicals, rubber, plastic, steel and asphalt. Given the variation of the carbon content of fuels, especially coal, it may be easier and cheaper, for a given level of accuracy, to measure emissions than to measure the carbon content of fuel inputs used by particular installations. But it may be easier and cheaper still to measure the carbon content of fuels upstream.

taxation or the sale of permits. But non-participation could generate substantially increased income tax receipts. The tradeoff between costs and benefits would depend on the shapes of the supply and demand curves for products that embody carbon. Given that the demand curve for the output of a single country is likely to be highly elastic, the net incentives for non-participation may be substantial – a conclusion that is borne out by experience in negotiating the Kyoto Protocol.

Non-participation in a destination-based system reduces the prices consumers in non-participating countries pay for carbon-intensive products. As with an origin-based system, weighing against tendencies not to participate (or to cheat) is the possibility that pricing carbon may be the most attractive means for a country, especially a developing one, to raise revenue. But implementing a destination-based system is likely to be especially difficult for developing countries. Perhaps the strongest motivation for non-participation in a destination-based system is the desire maintain the status quo.

*Incentives to cheat.* There would also be incentives for countries (as well as for firms) to cheat under all three systems; indeed, these incentives and their effects would resemble those for non-participation. Under origin- and destination- based systems, cheating would take the form of lax administration – undercharging for the emission or consumption of CO<sub>2</sub>.<sup>12</sup>

Like undercharging under an origin-based system, excessive border adjustments under a destination-based system (i.e., excessive charges for carbon embedded in imports and excessive rebates for carbon embedded in exports) would artificially increase the competitiveness of producers in the cheating nation and induce carbon leakage into the cheating nation. This is one of the concerns that have been expressed about allowing border adjustments for carbon prices.

### **C. Effects of Non-Participation in a Destination-based System**

In negotiations leading up to the Kyoto Protocol, developing countries argued successfully that they should not be required to reduce emissions, since it is developed countries that are responsible for the vast majority of the current overhang of CO<sub>2</sub> in the atmosphere and because reducing CO<sub>2</sub> emission would seriously undermine their opportunities to develop and achieve a higher standard of living. Moreover, the United States refused to sign the Protocol, because of the fear of loss of competitiveness to exempted developing countries. This subsection discusses the implications of non-participation in a destination-based system, focusing on the exemption of developing countries.

The implications of exemptions for developing countries under a globally harmonized destination-based system of pricing carbon are quite different from those under an origin-based system. (In this context, “exemption” is interpreted to mean the developed countries would not be required to price carbon embedded in production or in imports. It does not mean that

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<sup>12</sup>A problem related to cheating is the provision of subsidies, including tax exemptions, that offset the intended effects of carbon pricing, for example, in an origin-based system imposed by countries where emissions occur. Given the plethora of taxes and subsidies that impinge on the production and combustion of carbon and the consumption of carbon embedded in non-fuel products, it may be difficult to agree on the baseline for the measurement of compliance with an agreed-upon system.

developed countries would not apply border adjustments to imports from developing countries. In short, consumption in developing countries would benefit from the exemption, but production would not. ) China, India, and other developing countries would not be able to emit CO<sub>2</sub> with impunity, without fear of undermining the competitiveness of their industries, as their exports to developed countries would be subject to border adjustments. On the other hand, their imports from developed countries would not be burdened with carbon prices, as they would under either a comprehensive destination-based system or an origin-based system.

Table 4 shows the results of exemptions for developing countries under origin- and destination-based systems. The first and third columns show that if there are no exemptions for developing countries, consumption of carbon is priced in both developed and developing countries under both origin-and destination-based pricing systems; the only issue (assuming a harmonized price) is whether the country of origin or of destination receives the revenues. In an origin-based system in which developing countries are exempt from the requirement to curb emissions, as in the second column, consumption of carbon is priced in developed countries if it is imbedded in domestic products or imports from other developed countries, but not (as indicated in bold) if it is imbedded in imports from developing countries. On the other hand, carbon is priced in developing countries if it is embedded in imports from developed countries, but not if it is embedded in domestic products or imports from other developed countries (also indicated in bold). This column illustrates the competitiveness concerns and the potential for carbon leakage inherent in this system. Finally, the fourth column shows that exemption of developing countries under a destination-based system does not distort the choice of where to produce, as all carbon embedded in consumption in a given country is treated the same, whether in a developed country (where it is taxed) or in a developing country (exempt, shown in bold), whether production occurs domestically, in other developing countries, or in developed countries.

Much has been made of the role that border adjustments, the topic of this paper, might play in leveling the competitive playing field, preventing carbon leakage, and reducing the incentive for free riding. But Table 4 helps to highlight a glaring limitation that is inherent in an attempt to use border adjustments to achieve the more ambitious and arguably much more important goal of reducing global emissions of CO<sub>2</sub>. Under either origin- or destination-based pricing of carbon, combustion of fossil fuels or emission of CO<sub>2</sub> related to production for domestic consumption would be taxed or subject to permits in developing countries, as long as such countries are not exempt. On the other hand, if these countries are exempt, carbon combusted or released in production for domestic markets would not be priced, regardless of which system is chosen. Given the relative importance of production for domestic consumption in even the most export-driven developing country, this suggests that border adjustments are not likely to be very effective in reducing global emissions. Either developing countries must not be exempted or alternative techniques must be found to induce them to reduce emissions of CO<sub>2</sub>. Examining the efficacy of such techniques is well beyond the scope of this paper.

#### **D. Economic Efficiency, Incidence, and “Polluter Pays” Reconsidered**

Once it is recognized that participation may not be universal, it is necessary to reconsider

incidence, economic efficiency, and the “polluter pays” principle, issues that were argued above to be irrelevant under a globally comprehensive harmonized system. Indeed, the first two issues have already been considered implicitly in the discussions of non-participation and exemptions for developing countries and need not be discussed much further, beyond the following observations.

*Economic efficiency.* Destination-based pricing of carbon has clear advantages over origin-based pricing from the point of economic efficiency in a world of less than universal participation. This consideration is, however, likely to be outweighed by the difficulties of implementing a destination-based system.

*Incidence.* If an origin-based system for pricing carbon is not universally applied, whether producers of products containing embedded carbon can recover the cost of carbon pricing from customers depends on conditions of supply and demand, especially the elasticity of demand. Since demand for the products of a particular country is generally likely to be rather elastic, the possibilities of shifting the cost of carbon forward are limited. Thus owners, employees, and suppliers of the polluting firm, and not those who consume imbedded carbon, are likely to bear the burden of a geographically limited origin-based carbon-pricing system.

The situation is quite different in the case of a geographically limited destination-based system for pricing carbon. Because the supply curve facing consumers in a given country tends to be quite flat, the burden of a destination-based system is likely to be borne by those who consume the embedded carbon. Even if the aggregate burden on residents of a participating country is as great under a destination-based system as under an origin-based system, burdens are less concentrated. Fear of concentrated burdens under origin-based carbon pricing underlies concerns about lost competitiveness.

*“Polluter pays” principle.* The “polluter pays” principle is not meaningless in the context of carbon pricing that is not globally comprehensive. But whether it implies origin- or destination-based pricing of carbon seems to boil down to a matter of philosophy and interpretation: Is it those who emit carbon or those who consume imbedded carbon who should pay?

To gain insight, it may be useful to quote Principle 16 of the Rio Declaration on Environment and Development, which states, regarding Internalization of Environmental Costs:

National authorities should endeavour to promote the internalization of environmental costs and the use of economic instruments, taking into account the approach that the polluter should, in principle, bear the cost of pollution, with due regard to the public interest and *without distorting international trade and investment.* (emphasis added)

The first part of this statement seems consistent with either origin-or destination-based charging, as both internalize environmental costs of carbon emissions. But only destination-based charging satisfies the italicized requirement.

## **E. Summary Appraisal of Options**

Because of the concentration of revenues in nations where fossil fuels are produced, severance-based pricing of carbon does not deserve – and is not likely to receive – serious consideration. Of the remaining two options, if participation is not universal, destination-based pricing seems preferable to origin-based pricing on economic grounds. It avoids adverse effects on competitiveness and economic efficiency, it is arguably better suited to implement the “polluter pays” principle, it is likely less vulnerable to cheating and non-participation, it better tolerates exemptions for developing countries, and carbon leakage and incentives for free-riding are less pernicious. It does, however, raise crucial – and perhaps controlling – questions of implementation and compatibility with international trade law. Sections IV and V consider these questions.

### **III. Achieving Destination-based Carbon Pricing in an Origin-based World**

Origin- and destination-based systems of pricing carbon differ enormously in their complexity. The next section shows that the border adjustments required to implement the destination principle accurately on all a participating country’s trade would be extremely difficult, if not impossible, to calculate. It thus seems appropriate, as well as likely, that origin-based carbon prices will be the primary market-based instruments of choice in the battle against greenhouse gases. But it is neither appropriate nor likely that countries that adopt origin-based systems will eschew measures to combat what they see as unfair competition from, carbon leakage to, and free riding by, countries that do not take measures to reduce carbon emissions. This section describes two ways countries concerned with competitiveness, carbon leakage, or free riding – or merely seeking negotiating leverage – could implement destination-based charging in a world of origin-based charges. (For expositional convenience carbon pricing is the only means of controlling carbon that is considered. It is assumed initially that the carbon intensity of production is the same in all countries and that all participating countries impose the same price on carbon. Given this simplifying assumption, the only question is whether carbon pricing is imposed by the country of origin or that of destination.)

#### **A. A “Mixed” Origin/Destination System**

Under the mixed system, trade with countries that have “comparable” systems for pricing carbon would be origin-based and thus not subject to border adjustments. By comparison, imports from other countries would be destination-based, and thus subject to adjustments. Exports to these countries would also be subject to border adjustments under the symmetrical mixed system described below, but not under an asymmetrical system. Of course carbon embedded in trade between countries that do not price carbon would go unpriced. (It is assumed for now that trade falls neatly into these boxes – that it does not contain components originating in both countries that price carbon and those that do not. This issue is discussed further in the next section.)

This system could be applied broadly or narrowly, to only specific carbon-intensive products. The Waxman-Markey bill contains a list of covered industries. Moreover, a country might be treated differently for different products. Thus border adjustments would presumably apply only if the trading partner did not apply carbon pricing to the sector in question. Similarly, if the US were to adopt a system with broader coverage than the ETS, only US imports from the

EU that are subject to carbon pricing under ETS would be exempt from border adjustments in the US.<sup>13</sup> Of course, border adjustments would not be made for products containing embedded carbon not subject to pricing.

The third column of both Tables 1 and 2 describes a “mixed” system from the perspective of a particular country that prices carbon,<sup>14</sup> differentiating between a “symmetrical” system and an “asymmetrical” system. (To save space, Table 2 considers only carbon taxes. The analogous implications of a cap and trade system are obvious.)

### **1. Symmetrical and asymmetrical border adjustments**

There are several reasons to distinguish between symmetrical and asymmetrical mixed systems. First, as a practical matter, most attention in public policy debates has focused on imports. Second, many believe that border adjustments for carbon prices would fail to pass muster under the basic rules of the GATT, that adjustments for imports could be saved, if at all, under one of the general exceptions provided under Article XX of the GATT, and that adjustments for exports could not be salvaged in this way. (See Section V.) In short, an asymmetrical mixed system might be GATT-legal, but a symmetrical system would not be. Third, border adjustments for exports would impede the achievement of several of the policy objectives behind carbon pricing. This last argument is worth examining at the outset.

In the case of the VAT, the economic argument for BTAs for exports is as strong as that for import BTAs; both are needed to implement the destination principle and assure that VAT is applied to all consumption (including imports), and not to production for export. If importing countries choose not to impose a VAT, no issues of global public policy arise. This reasoning arguably does not carry over to border adjustments for carbon taxes.

Application of a BAs to carbon embedded in imports from non-participating countries has the benefits posited. But, except for competitiveness benefits, the analogous conclusion does not hold for BAs on carbon embedded in exports to non-participating countries – essentially allowing exports to occur free of carbon prices. Border adjustments for imports prevents competitive effects, and thus carbon leakage, by leveling the playing field so that the same carbon price must be paid for imports as for domestic products. By comparison, allowing border adjustments for exports to non-participating countries levels the playing field by eliminating the carbon price embedded in exports. While there may be no incentive for carbon leakage, there is also no

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<sup>13</sup>In the first stage, the ETS caps on emissions apply only to energy activities (electric power, oil refineries, coke ovens), production and processing of ferrous metals (metal ore and steel), mineral industry (cement kilns, glass, ceramics), and industrial plants that produce paper and pulp.

<sup>14</sup>Border adjustments should, of course, be allowed for trade with countries that employ destination-based systems to price carbon; otherwise carbon embedded in exports to such countries would be priced twice, and import from them would not be priced. It is thus assumed in what follows that border adjustments under a mixed systems would be applied to such trade, as well as to trade with countries that do not price carbon. Since pure destination-based systems do not exist – and are not likely to be created, this qualification may be of little practical importance.

incentive for exporting sectors to reduce domestic emissions of CO<sub>2</sub>. Rather than reducing the incentive to be a free rider, border adjustments for exports increase such incentives, by putting competitive pressures on those producing for the domestic market in importing countries that do not price carbon. Finally, economic neutrality suffers, as exports are favored over production for the domestic market of the country that prices carbon. For all these reasons, it make sense to concentrate on border adjustments for imports. The last column of Table 2 describes the effects of symmetrical and asymmetrical BAs in a mixed system.

## **2. What is a comparable system?**

If there is a uniform worldwide tax on carbon or international trading of emission permits, in which a country either participates or does not, it is clear whether the country has a comparable system for pricing carbon. Otherwise, it may be difficult to know in particular instances whether a country's system for pricing carbon is "comparable" to another's. How similar must carbon prices be for systems to be deemed comparable? Moreover, carbon pricing is not the only way to meet targets for emissions reductions; inter alia, regulations could be used. Examination of how comparability might be defined is beyond the scope of this paper. It should be noted, however, that application of BAs to trade with countries that use effective non-price methods to reduce emissions are unlikely to pass muster under Article XX, discussed below.

## **B. Border Adjustments with Credit for Origin-based Carbon Prices**

The fourth column of Tables 1 and 2 shows another option. Under it the importing country would apply border adjustments to all imports, but allow credits on imports for taxes or the cost of permits incurred in the exporting country, up to the level of border adjustment in the importing country.<sup>15</sup> (Exports could be either subject to BAs or not.) Exporting countries would have an incentive to impose origin-based carbon prices up to the level of carbon prices imposed by importing countries in order not to lose the revenue that would otherwise go to the importing country. Like the mixed system, this system could be applied broadly or narrowly.

This approach seems markedly inferior to the mixed system described above, because it is significantly more complicated. It would require calculation of the amount of carbon imbedded in all imports (needed to calculate both the before-credit border adjustment on imports and the credit for the carbon price paid in the exporting country). By comparison, in the first instance, the mixed system described earlier would require only a determination of whether a particular trading partner has a comparable system for charging for CO<sub>2</sub> emissions related to a particular product. If so, the imports or exports in question are not subject to border adjustment, and the investigation goes no further. Only in the case of trade (in a particular product) with a country that does not price carbon is it necessary to calculate and apply border adjustments. Although the burden of compliance and administration under the mixed system should not be underestimated, it would be far smaller than under a destination-based system with credits for origin-based carbon prices embedded in imports. This alternative deserves no further consideration.

## **IV. Technical and Administrative Issues**

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<sup>15</sup>The analogy to the operation of foreign tax credits for income taxes should be obvious.

At best, the technical and administrative challenges involved in implementing border adjustments for carbon prices would be daunting, as it would be necessary to determine the carbon content embedded in the cost of exports (so that carbon taxes or the cost of emissions permits could be rebated) and – even more challenging – of imports (so that carbon taxes or permit fees could be collected). These problems would be alleviated to the extent that the pricing of carbon is limited to a small number of energy-intensive sectors or that BAs are limited to carbon- and trade-intensive products.

This section uses a simple numerical example to contrast the simplicity of BTAs under a VAT and the difficulty of making accurate BTAs under either a turnover tax (called a prior stage cumulative indirect tax in the GATT) or a carbon tax. The analysis is equally applicable to a cap and trade system. Table 5 provides the basic transactions data assumed to underlie the example. It considers five productive activities: sales of refined fossil fuel, transportation, generation of electric power, production of aluminum, and automotive manufacturing, which can be considered a proxy for all manufactured goods that are either bought by households or exported. Several extreme assumptions are made to simplify the analysis and allow concentration on key issues. First, it is assumed that each sector makes sales only to purchasers listed below it in the table. Second, it is assumed that there are no exemptions under the VAT and the turnover tax (except for exports, in the latter case). Third, only the automotive sector makes sales to consumers and only it and the aluminum sector export. Fourth, all refined fuel is assumed to be imported. Fifth, imports of fuel are not subject to VAT at the border; while this assumption is generally unrealistic, it has no ultimate effect and is made to simplify the presentation. By comparison, imported fuel is assumed to be subject to the turnover tax. Finally, it is assumed that units of carbon and the carbon tax rate are chosen so that the amount of carbon combusted in each sector and the tax thereon both equal the monetary value of fuels purchased by that sector. It should be emphasized that the numbers used in the example are not intended to reflect accurately the energy-intensity of various activities or the importance of inputs to the various sectors.

*Value-added tax.* Table 6 describes the calculation of value added tax in each sector, BTAs for VAT, turnover tax, and embedded carbon. The first three columns describe each sector's total sales, gross tax liabilities under a 10 percent VAT, and liabilities under a 2 percent turnover tax; the two taxes are assumed to be paid only on domestic sales, as under the destination principle. (These two tax rates would not necessarily yield the same amount of revenue; indeed, whether they would do so depends on the assumptions regarding BTAs for the turnover tax. That is not important for present purposes, which is to understand the mechanics of BTAs.) Significantly, no tax is collected directly on exports of aluminum and automotive goods, which are zero-rated. Figures in the column for turnover tax will be discussed below.

Column (4) shows total purchases subject to VAT and the breakdown thereof, according to the sector making the sales. The first entry reflects the assumption that the 250 of imports of fuel are not subject to VAT at the border. Column (5) shows the total amount of credit allowed for VAT on purchased inputs. The next two columns show value added, as calculated under the destination principle and subtraction method (the difference between domestic sales and purchases) and net VAT liability, as calculated under the credit method (the difference between tax on domestic sales and tax on purchases). Since exports of aluminum and automotive goods are zero-rated, credit is allowed for VAT on all purchased inputs. In the former case, since tax

paid on purchases exceeds tax due on domestic sales, net VAT liability is negative, implying refund of some of the VAT paid on inputs. The entries for consumers and exports, enclosed in brackets to indicate that they are different in kind from the other numbers in the table, indicate that VAT paid by consumers exactly equals the VAT on domestic automotive sales – the only sales to households – and that no net VAT is paid on exports.

Significantly, because of the way the input credit system works, it does not matter that fuel imports are assumed not to be taxed at the border; since there is no tax on purchases, there is no input credit, and all products sold to households for which fuel is an input bear the full 10 percent tax.<sup>16</sup> Of course, it is common for imports to be subject to tax – the import BTA, which is eligible for input credit.

*Turnover tax.* It is extremely difficult to calculate accurate BTAs for a turnover tax, which is applied to gross receipts from domestic sales (including imports, but not exports) every time a product is sold, or “turns over.” Tax paid by consumers includes turnover tax paid at earlier stages and embedded in the prices of automotive products – what are called “*taxes occultes*” (hidden taxes) in the literature on BTAs under the GATT – as well as the tax levied directly on those products. Accurate BTAs for imports of consumer goods would ideally reflect the cascading of turnover tax on domestic products. (Note that, in contrast to the situation with regard to carbon taxes, there is no reason that BTAs on imports should differ from the amount of turnover tax paid on domestic products to reflect a different degree of foreign cascading.) But, this is not something that is readily known, although in this simple example it could be calculated from the information provided in Table 5.

Of course, cascading is not limited to products sold to consumers; turnover tax is also embedded in the prices of goods destined for export. It is thus not enough simply to exempt exports of aluminum and automotive products, as that would result in no compensation for turnover tax paid at prior stages of the production-distribution process – in this example, the tax on domestic sales of fuel, transport services, electricity, and aluminum. Nor is it sufficient to allow automotive producers BTAs only for turnover tax paid directly on purchases of aluminum, the only input that is physically incorporated in automotive products, as that would leave the tax embedded in the cost of inputs uncompensated. Given the importance of electricity used to produce aluminum, it would be desirable at least to allow for turnover tax paid on electricity in calculating BTAs for exports of both aluminum and automotive products made from aluminum. But this would leave uncompensated the turnover tax paid on imports of fossil fuels and transportation. Unless BTAs reflect all embedded turnover taxes, exports will not occur tax-free.

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<sup>16</sup>It is worth noting that, in theory, it would be possible to implement a sales tax as a retail sales tax (RST) – one levied only on sales to households. Thus, a 10 percent tax on the 300 of sales of automotive goods to households would yield the same amount of revenue as the 10 percent VAT. BTAs would not be necessary under an RST (except in the case of imports made directly by consumers, not considered here), because both imports and exports occurs before the tax is levied at the retail stage. In fact, the RST is administratively inferior to the VAT, because of the need for retailers to distinguish between exempt sales to registered traders and taxable sales to households.

The relative ease of tracing embedded turnover taxes through to sales to consumers and to exports in this simple example belies the difficulty of calculating BTAs that would exactly eliminate the tax embedded in exports and impose on imports the same burden borne by domestic products. Not only would the calculation be rendered substantially more difficult by the inclusion of more sectors selling taxed inputs and more stages in the production-distribution process. The real world does not obey the simplifying assumption that sales are made only to purchasers further down the list in Table 5, which implies, inter alia that the transportation sector does not purchase any of the output of the automotive sector, that the electric power sector does not purchase anything made of aluminum, etc. Of course, at the level of aggregation in this example, this complication could be handled by the straightforward application of input-output analysis. But in the real world, BTAs are not applied to sectors; they are applied to individual products (e.g., to automobiles, trucks, and various types of spare parts, rather than “automotive” products) – a level of disaggregation well beyond even the most sophisticated input-output analysis. The difficulty of calculating accurate BTAs is one of the reasons that the six Member States of the European Common Market, the forerunner of the EU, decided in the early 1960s to shift to the VAT.

*Carbon tax.* Table 7 illustrates the difficulty of calculating accurate BTAs for a carbon tax, which resembles in some ways that of calculating BTAs for turnover taxes and stands in sharp contrast to the ease of BTAs under the VAT (and the fact that BTAs are not required under an RST). As noted earlier, it is assumed that the amount of carbon combusted in each sector (shown in the first column) and the tax thereon both equal the monetary value of fuels purchased by that sector (shown in the first column of Table 5) In this example it does not matter whether carbon pricing is achieved through a tax paid on (the carbon content of) imports of fuel (as long as it is stated separately in the domestic price of fuel), on purchases of fuel, or on CO<sub>2</sub> emissions. Moreover, the same analysis would also be applicable to the cost of emissions permits.

As with the turnover tax, the cost of the carbon tax paid initially by the transport and electricity sectors are embedded in the cost of aluminum, and the tax embedded in the costs of those three sectors are embedded in the cost of the automotive sector. The problem, then, is to calculate BTAs for exports of aluminum and automotive products that would relieve exports of the cost of carbon taxes, including those embedded in the cost of inputs. As with the turnover tax, it is not adequate to allow BTAs only for carbon taxes paid directly, to the neglect of embedded taxes.

The “direct” costs of the carbon tax on fuel are shown in the first column. “Indirect” costs of the tax are embedded in the prices of non-fuel products and total (direct and indirect costs) are shown in the remainder of the table. (The preceding terminology is based on the assumption that the carbon tax is imposed on the purchase or combustion of fuel or on emissions of CO<sub>2</sub>; if, instead, the tax were paid at import it would be embedded in the cost of fuel.) Thus the second set of columns allocates the “first-level indirect costs” of carbon tax initially borne by each sector among the other sectors buying its products, consumers, and exports. Of course, as shown in the third set of columns, except where the tax is embedded in sales to consumers and exports, there are “second-level indirect costs” of the tax; for example, the cost to the tax on fuel used to produce electric power is embedded in the cost of aluminum, which is either sold to the automotive industry or exported. By the same token there are third and fourth-level indirect costs.

(In the latter case the chain of embedded costs is from fuel to transportation, to aluminum, to automotive, to consumer sales and exports.) (The last column of Table 6 summarizes these calculations, with prior indirect effects being consolidated and traced through to the point that they are embedded in the cost of the sectors listed.)

The bottom three entries in the “total” column indicate the ultimate allocation of direct and indirect costs among consumer sales and exports. The objective of export BTAs is to rebate the entire amount of carbon tax embedded in the price of exports. But, as with turnover taxes, calculating the appropriate rebate is a formidable task. Not only are many of the same problems encountered; there are additional ones. (But at least it is not necessary to take account of the degree of cascading, as cascading does not occur under a well-structured carbon tax.) For example, if (contrary to assumptions underlying this example) electricity is produced using both carbon-intensive and “clean” technologies, but sold at a uniform price, producers of aluminum have an incentive to use (or claim that they use) electricity generated in the carbon-intensive manner to produce exports, in order to maximize export rebates. Of course, under the asymmetrical system described earlier, which does not include export BTAs, these problems would not arise.

The calculation of import BTAs would be even more problematic, as it should it reflect the carbon content of production in the exporting country. Obtaining the requisite information may be extremely difficult, especially in developing countries. Compounding the difficulty is the fact that imports, including those from countries that price carbon, may contain components produced in several countries, including the importing country. It would be necessary to have rules of origin and methodologies for calculating the appropriate BTAs in such cases.<sup>17</sup> (No similar issues arise under the VAT, as BTAs do not depend on the taxation in the country of origin.) Similar problems would occur on the export side. Finally, the two methodologies for calculating import BTAs discussed in the next section that are assumed to be legally “fail-safe,” predominant method of production in the importing country and best available technology, would presumably need to be applied at each stage of the production-distribution process to calculate the acceptable level of import BTAs, further greatly complicating the calculation.

*Limiting BAs.* The difficulty of making accurate BAs suggests that, as a practical matter, the effort to do so is likely to be limited in several ways. First, BAs are likely to be applied only in the most energy-intensive sectors, e.g., aluminum, iron and steel products, pulp and paper, and chemicals.<sup>18</sup> This might be called the “sectoral breadth” of BAs. Second, combustion of carbon

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<sup>17</sup>Ismer and Neuhoff (2007, p. 152) raise the specter of re-export by countries that price carbon of products originating in countries that do not, perhaps after enough modification to satisfy rules of origin, and the need for anti-abuse rules. Cosbey (2008, p. 5) provides examples of possible diversion of trade through countries that price carbon.

<sup>18</sup>The Waxman-Markey bill foresees the possibility that importers of energy-intensive and trade-sensitive goods such as chemicals, iron and steel, cement, glass, lime, some pulp and paper products, and non-ferrous metals such as aluminum and copper might be required to purchase “international reserve allowances.” The earlier Warner-Lieberman bill contained similar provisions.

directly related to production would almost certainly be considered in calculating BAs, but energy combusted for most other purposes probably would not be. This could be described as limiting the “intra-sectoral breadth” of BAs. Third, while some indirect effects (most prominently, the pricing of carbon combusted in generating power used by the aluminum industry), as well as direct effects, might be considered, it seems highly unlikely that compensation for higher order indirect effects – which would involve an expansion of the sectoral breadth of BAs – would be attempted. This could be described as a limit on the “vertical depth” of BAs. It is illustrated by the question of whether to consider energy used in transporting inputs and outputs of the trading sector, including energy itself, versus energy used to transport inputs of suppliers of that sector.

The upshot of such limitations is that BAs are likely to fall short of those theoretically needed to maintain competitive balance and prevent carbon leakage. How important this is, as a practical matter, depends on the coverage of the carbon pricing for which BAs are sought, as well as the breadth and depth of BAs. If carbon taxes (or their equivalents) are imposed only on the same sectors for which BAs are allowed and BAs are allowed for a high percentage of the total direct and indirect costs of carbon pricing in those sectors, these differences would be relatively insignificant. If, on the other hand, the application of carbon taxes were substantially broader than that of BAs or if BAs were allowed for only a relatively small share of total costs of carbon pricing in the sectors where applied, the effects would be more serious.

## **V. The GATT-Legality of BAs**

Under the General Agreement on Tariffs and Trade (GATT) and the Agreement on Subsidies and Countervailing Measures (ASCM) – the multilateral treaties that specify the rules for international trade of most relevance for present purposes – border adjustments are allowed for only certain types of taxes. The WTO oversees compliance with the GATT and the ASCM. Even if the WTO finds that a measure contravenes the basic or substantive trade rules, it may find that it qualifies for one of the general exceptions provided by Article XX of the GATT. Unfortunately, as the OECD (2006, p. 92) has stated, and many others have confirmed, “The application of BTAs to energy taxes under the GATT/WHO rules is clouded with uncertainty.” Whether the WTO would allow border adjustments for the cost of emission permits is even less certain, especially if permits are distributed free of charge or bought on the secondary market.<sup>19</sup>

This section examines the GATT-legality of BAs for both carbon taxes and the cost of emission permits under a cap and trade system. Since the GATT rules were formulated to deal with border *tax* adjustments – albeit not with BTAs for carbon (or other environmental) taxes, BTAs for carbon taxes are examined first, and in greatest detail.

There are many subsidiary questions within the overarching question that is the focus of this section. Among them are whether the same rules apply to BAs for imports and exports; whether carbon taxes are direct taxes; whether carbon taxes are “prior-stage cumulative indirect taxes,” a concept to be explained below; whether carbon taxes are levied on *products*; whether

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<sup>19</sup>The discussion of this section is based on McLure (2009), which provides a much more detailed and nuanced discussion, as well as references to much of the voluminous literature on this topic. See also, *inter alia*, Hufbauer, Charnowitz, and Kim (2009).

they are levied on *like* products; whether BTAs for carbon taxes would qualify for one of the general exceptions of GATT Article XX, even if found to violate the basic GATT/ASCM rules – a question that has still further questions nested within it; whether the legality of BAs for the cost of auctioned emissions permits can be deduced from conclusions regarding the legality of BTAs for carbon taxes; and whether BAs would be allowed for entities that have not purchased permits from a government.

### **A. Rules for Imports and for Exports**

While economists may think of border adjustments as a package that should be applied symmetrically to imports and exports, as they commonly are in the case of the VAT, that is not the way they are treated in WTO law and the literature thereon. Moreover, and perhaps of vital importance, it seems unlikely that an Article XX exception would be available for export BAs, even if one is available for import BAs.

The basic GATT rules that determine the GATT-legality of BAs for imports are those that specify national treatment and most favored nation treatment. Under the first, imports cannot be taxed more heavily than like domestic products; under the second, discriminatory treatment of imports from different GATT signatories is outlawed. The rules that are relevant for exports are primarily those in the GATT and the ASCM pertaining to subsidies, which treat exemption and rebate of taxes in excess of those borne by like products as an export subsidy. Demaret and Stewardson (1994, p. 30) summarize the situation: “GATT contains different provisions, formulated differently, in respect of imports and exports, and no explicit statement as to whether those respective provisions should be implemented in symmetric fashion.”

One of the keys to gaining an exception under GATT Article XX is that a trade measure must either be necessary to the protection of health or relate to the conservation of exhaustible natural resources. As explained below, given the likely economic effects of BAs for exports described earlier, it seems unlikely that an exception for export BAs would be forthcoming. This compounds the case for treating BAs for imports and exports differently and is one of the reasons for considering asymmetrical BAs under the mixed system examined earlier.

### **B. The Nature of Carbon Taxes**

Before turning to the crucial question of whether carbon taxes are levied on “like products,” for which the answer is unclear and controversial, it will be useful to dispose of two others that arguably have clear answers. First, are carbon taxes direct taxes, for which BTAs are per se not allowed? If not, are they “prior-stage cumulative indirect taxes” (PSCI taxes), for which the GATT explicitly allows BTAs?

The GATT does not provide a satisfactory answer to the first question. It merely states that BTAs are allowed for taxes “in respect to like domestic products,” leaving to be inferred the type of taxes for which BTAs are not allowed. By comparison, the ASCM states explicitly that BTAs are allowed for indirect taxes, but not for direct taxes and includes a definition of direct taxes that most tax experts would recognize (“... taxes on wages, profits ... and other forms of income ...”). Although the view is not unanimous, the preponderance of opinion seems to be that carbon taxes are not direct taxes and that BTAs for them are thus not per se illegal.

The ASCM provides specifically that BTAs are allowed for PSCI taxes on inputs consumed in production, including explicitly energy, fuels and oils. Some believe that this means that BTAs would be allowed for carbon taxes, but this view seems to be based on a misunderstanding of the nature of PSCI taxes. Coined at a time that countries were beginning to adopt VATs, for which BTAs were explicitly allowed, the term “prior-stage cumulative indirect taxes” was intended to describe the turnover (gross receipts) taxes that still existed in some countries. The rule regarding the legality of PSCI taxes thus seems to be irrelevant in the present context.

### **C. Are Carbon Taxes Levied on “Like Products?”**

Whether carbon taxes are levied on “like products” involves three interrelated issues: whether such taxes are levied on products, rather than on “process and production methods” (PPMs); whether taxes based on PPMs are adjustable; and whether differences in carbon intensity make products unlike, so that BTAs on imports can exceed the carbon tax paid on production of otherwise identical products for the domestic market.

*Products vs. PPMs.* The GATT refers to taxes that are “applied, directly or indirectly, to like domestic products.” Carbon taxes levied directly on fossil fuels are thus clearly adjustable, as are taxes on inputs that are physically incorporated in traded goods. But what about carbon taxes embedded in the prices of products? Carbon that is emitted is clearly not incorporated in products. In earlier discussions of the legality of BTAs indirect taxes not levied directly on products or inputs physically incorporated therein were called “*taxes occultes*” (hidden taxes). Now they are commonly described as relating to PPMs, rather than being levied on products.

*BTAs based on PPMs.* Although opinions on the adjustability of taxes related to PPMs are divided, the WTO website has (at least until recently) contained the following categorical statement:

Under existing GATT rules and jurisprudence, “product” taxes and charges can be adjusted at the border (i.e. when products are imported or exported), but “process” taxes and charges by and large cannot. For example, ... tax on the energy consumed in producing a ton of steel (a tax on the production process) cannot be applied to imported steel, even if it is charged on domestically produced steel ... .<sup>20</sup>

Whether this view would prevail if BTAs for a carbon tax were challenged is unclear. In the *Superfund* case, a WTO panel sustained the legality of BTAs for imported chemicals intended to compensate for the domestic US tax on feedstocks used in the domestic production of such chemicals. Unfortunately, the panel did not indicate whether the feedstocks were physically incorporated in the domestically produced chemicals or whether it mattered – issues that could be

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<sup>20</sup>This statement is taken from “CTE on: how environmental taxes and other requirements fit in,” which was available on the WTO website on July 13, 2009 at: [http://intranet.corpei.ec/carpetas/cic/OMC/WTOCD/WTO%20Website/SnapshotOfWTOWebsit eInEnglish/english/tratop\\_e/envir\\_e/cte03\\_e.htm](http://intranet.corpei.ec/carpetas/cic/OMC/WTOCD/WTO%20Website/SnapshotOfWTOWebsit eInEnglish/english/tratop_e/envir_e/cte03_e.htm). The author has been unable to access this page since September 4, 2009.

crucial for the appraisal of the legality of BTAs for carbon taxes. (If the feedstocks were not physically incorporated, it could be argued that the domestic US tax for which the BTAs compensated was based on PPMs.)

The BTAs that accompanied the US tax on ozone depleting chemicals (ODCs) was clearly based on PPMs, as they were imposed on products manufactured with ODCs, but not containing them, as well as imports of ODCs and products incorporating them. That these BTAs have never been challenged before the WTO leads some to believe that BTAs for PPMs would be found GATT-legal, but there is no way of knowing how the WTO would have ruled, had it been asked to decide the legality of the BTAs for the ODC tax.

What many believe to be the most relevant WTO case did not even involve taxes. In the *Shrimp-Turtle* case, the WTO Appellate Body ruled that the US could restrict imports of shrimp caught using nets that lacked turtle-exclusion devices. Although this case involved an Article XX exception, it has been interpreted as suggesting that the WTO might sustain a tax based on PPMs under the basic GATT rules, as well as under Article XX.

*Energy-intensity and “like products.”* If BTAs for carbon taxes are to level the playing field between imports and domestic goods, they must reflect the energy-intensity of imports. But BTAs cannot exceed the tax on “like” domestic products. This raises the question of whether physically identical products are “like,” if they differ in energy intensity. If they are “like,” BTAs cannot be based on the energy intensity of imports.

“Likeness” involves the competitive relationship between products. Since identical products generally are competitive, they seem likely to be found to be “like.” Although the WTO Appellate Body has found that likeness may depend on consumers’ tastes and habits, as well as the product’s end-use, properties, nature, quality, and tariff classification, this qualification is not likely to matter much for the industrial inputs that figure most prominently in the debate over BTAs for carbon prices, including steel, aluminum, wood and paper, and chemicals.

While this conclusion would almost certainly be important for appraising the GATT legality of BTAs under the basic rules (national treatment and most favored nation treatment), it is unclear whether it would be dispositive with regards to an Article XX exception.

#### **D. Mixed Systems and Most-favored Nation Treatment**

Whether BTAs would pass muster under the national treatment and subsidy provisions of the GATT and the ASCM, is unclear. On the other hand, it seems virtually certain that a mixed system that applied BTAs only to imports from countries not pricing carbon (and perhaps exports to such countries) would be found to violate the most-favored nation clause of the GATT.

#### **E. The Article XX Exceptions**

Assuming the above analysis to be correct, could BTAs for carbon taxes, including those under a mixed system, be rescued by the general exceptions of Article XX, which come into play only if the basic rules are violated? The answer involves passing a two-tier test to be applied sequentially: first, consistency with one of the general exceptions and then acceptability under the *chapeau* (headnote), which is concerned with how a measure is applied and is intended to balance the rights and duties of those seeking the exception and of those protesting the measure in question.

The exceptions that are most relevant are those for measures:

(b) necessary to protect human, animal or plant life or health; or

(g) relating to the conservation of exhaustible natural resources if such measures are made effective in conjunction with restrictions on domestic production or consumption.

Although some believe that BTAs for carbon taxes would qualify under paragraph (b), the more common belief is that qualification under paragraph (g) is more likely.

Based on the decision of the WTO Appellate Body (AB) in the *Shrimp-Turtle* case, it is reasonable to believe that BTAs for imports would be found to satisfy paragraph (g), as they relate directly to conservation of the atmosphere, which the Appellate Body has previously determined to be an exhaustible natural resource, and would be implemented in conjunction with a domestic carbon tax. Significantly, the AB stated that the words “conservation of exhaustible natural resources” must be read “in light of contemporary concerns of the community of nations about the protection and conservation of the environment.” By comparison, it seems difficult to argue that BTAs for exports would relate to conservation of clean air, as they effectively remove a disincentive for emission of CO<sub>2</sub>. It is thus assumed in what follows that export BTAs for carbon taxes would not be allowed.

It is not enough for a measure to satisfy paragraph (b) or (g); it must also satisfy the chapeau, which requires that the measure in question not be “... 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...”

BTAs on imports from countries employing origin-based carbon taxes (or other means to reduce emissions) arguably would not be allowed, as that would entail double taxation (or its functional equivalent). On the other hand, developed countries might well be allowed to impose BTAs on imports from “renegade” developed countries that do not adopt such policies (e.g., the United States), as in the mixed system. Qualifying this conclusion is the need to have engaged in good-faith negotiations (such as those preceding and following the adoption of the Kyoto Protocol) and respect for due process and fairness.

The legality of BTAs imposed on imports from developing countries seems to be less certain. Developed countries would contend that BTAs should be allowed because the same conditions – the lack of carbon pricing, as well as the state of development– do not prevail in developing countries. Perhaps more important, developing countries could note the logical inconsistency of exempting them from the requirement to reduce emissions and then imposing BTAs on their exports. Although the US could counter that it had not ratified the Kyoto Protocol, it was a party to the United Nations Framework Convention on Climate Change (UNFCCC), which acknowledged that nations have “common but differentiated responsibilities and respective capabilities” in addressing climate change.

## **E. Calculating BTAs**

If BTAs are found to be GATT-legal, but physically identical products are found to be “like,” BTAs for imports could not exceed the tax on carbon embedded in like domestic products. The WTO, in the *Superfund* case, condoned use of the “predominant method of production” (PMP) in the importing country in calculating the maximum BTA that could be applied to imports of chemicals. (The same method was used to calculate BTAs for the tax on ODCs.) It is presumed that the same methodology could be employed to calculate the maximum allowable BTAs for carbon taxes. If, however, a foreign producer could demonstrate that its products were less carbon-intensive than domestic products, it could pay BTAs based on actual carbon content. The Superfund and ODC legislation also provided this option. By comparison, it is presumed that BTAs for exports, if allowed, would reflect the actual carbon content of exports.

Another method for calculating BTAs on imports that has been suggested is “best available technology” (BAT), which its primary proponents define as “for example, the most effective and advanced stage in the development of activities and their methods of operations which indicate the practical suitability for providing in principle the basis for emission limit values designed to prevent and, where that is not practicable, generally to reduce emission and the impact on the environment as a whole...” (“Ismer and Neuhoff, 2007, p. 147) While these authors say that implementing BAT would be “relatively simple,” they have identified (p. 154-58) a number of issues that would need to be resolved, including the definition of product classes, variations of energy-intensity within product classes, identifying the technology that should be labeled BAT, and the choice of fuel used to calculate the carbon content of traded goods – an especially troubling issue in the case of electricity, since the options range from zero-emissions alternatives (wind, hydro, and nuclear) to medium carbon-intensity alternatives (oil and gas) to high-carbon intensity coal-fired generation. See also the discussion of technical and administrative issues in the previous section.

Use of either PMP or BAT would not level the playing field between highly energy-intensive imports and less energy-intensive domestic products. That would require basing BTAs on the actual carbon content of imports, which, of course, would be GATT-legal only if identical products were not found to be “like” – or if this methodology were approved in response to a request for an Article XX exception. Implementing this approach would be especially daunting, as it would require knowledge of the carbon content of imports. Estimates of carbon content must pertain to particular products produced by specific firms (or perhaps even specific plants); they could not be based on country or sectoral averages, provided, for example, by the use of input-output analysis. Leaving aside problems of calculating carbon content, especially in developing countries, verification would pose an enormous challenge. Also, if a firm uses technologies that differ in energy intensity, they can be expected to export (or say they export) products made using the technology with the highest carbon intensity, in order to maximize BTAs applied to their exports. This issue could be addressed by basing BTAs on the average energy-intensity of a firm’s products, but it is not clear that that approach would be GATT-legal.

#### **F. BAs for the Cost of Emission Permits**

The GATT-legality of BAs for the cost of emission permits must be inferred from provisions originally written to deal with other issues, namely those dealing with BTAs for taxes and other charges and perhaps those dealing with regulations, a possibility that is not considered

here. Thus the uncertainty of the GATT-legality of BTAs for carbon taxes is compounded by uncertainty as to how those provisions would be applied to the cost of permits.

The OECD has defined taxes as “compulsory, unrequited payments to general government.”<sup>21</sup> It seems reasonable to see the cost of permits bought from governments as a compulsory, unrequited payment, in which case the GATT-legality of BTAs for such costs should logically be governed by the same considerations as the GATT-legality of BTAs for carbon taxes. But there is no way of knowing whether the WTO would share that view.

It may be important, moreover, that permits are not only acquired by making payments to governments. In particular, they may be distributed free of charge and they may be bought on the secondary market. To overcome the problems of competitiveness, carbon leakage, and free-riding identified earlier, it is necessary to allow BTAs for the cost of permits acquired in these ways. The reasoning is simple. The free allocation of permits can best be seen as a lump-sum transfer. Permits have value, and thus an opportunity cost, whether bought from a government, received free of charge, or purchased on the secondary market. These opportunity costs will be reflected in prices – at least if the agencies regulating electric utilities allow it. Unless they are also reflected in BTAs, they will reduce competitiveness and induce carbon leakage and free-riding.<sup>22</sup> While this reasoning may be logically impeccable to economists – and may actually describe how things play out in the real world – it may not be persuasive to the WTO, especially in the case of freely allocated permits. After all, it implies that BTAs should be allowed for costs not actually incurred, in direct contrast to the wording of the GATT and the ASCM. There seems to be general agreement that BTAs would be limited to the fraction of permits that are not allocated freely.

Whether the cost of acquiring auctioned permits on the secondary market would be considered a tax for which adjustments would be appropriate would seem to depend on where one placed the emphasis in the OECD definition of a tax as a “compulsory, unrequited payments to general government.” The holding of permits for emissions would be compulsory and arguably unrequited, but payment would not be made to a government, at least not directly. Acquisition on the secondary market of permits originally granted without charge compounds the uncertainty.

## **VI. Summary and Conclusions**

The threat that border adjustments for carbon taxes and the cost of emissions permits will be introduced raises serious economic, administrative, and legal issues, as well as threatening to inflame protectionist tendencies. BTAs are likely to be grafted onto what is – and should be – essentially origin-based systems for pricing carbon and applied only to trade with countries that do not have comparable systems of pricing carbon, in order to ameliorate competitive disadvantages for energy-intensive industries and carbon leakage and to induce carbon pricing. They are thus almost certain to be found to violate the most-favored treatment provision of the GATT; being imposed on PPMs rather than products, they may also be found to violate the

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<sup>21</sup>OECD, “Note on the Definition of Taxes by the Chairman of the Negotiating Group on the Multilateral Agreement on Investment (MAI)” (DAFFE/MAI/EG2(96)3, 19 April 1996), at 1, visited September 3, 2009, cited in de Cendra (2006, p. 135, n. 44).

<sup>22</sup>See, for example, Frankel (2008, p. 14).

requirement of national treatment. It seems quite possible that import BAs would be granted an exception under GATT Article XX, but unlikely that export BAs would be. Whether import BAs could be based on the carbon content of imports, as would be required to level the playing field between imports and domestic products, rather than on that of production of comparable products in the importing country or on best available technology is uncertain. In any event, calculating the appropriate BAs would be extremely complicated, and it is likely that BAs would be limited in both breadth and scope – that they would be applied to only a relatively small number of energy-intensive products, would compensate only for direct and indirect (embedded) carbon prices incurred in production, and would not reach very far upstream in their inclusion of indirect carbon prices, as it would probably not be cost-effective to go beyond that. While BAs are thus unlikely to compensate fully for all carbon prices embedded in international trade, they will compensate for the most important costs.

**Table 1: Alternative Trade Regimes for Carbon Taxes and Cap and Trade Systems**

	Trade Regime			
	Global participation		Non-participation/exemption for developing countries	
	Pure origin (No BAs)  (1)	Pure destination (BAs on all imports and exports)  (2)	Mixed <i>Symmetrical</i> : origin for trade with “white list” countries; BAs for other trade <i>Asymmetrical</i> : origin for imports from “white list” countries and for exports; BAs for other imports  (3)	Import BAs, with credit for origin-country tax or cost of permits  (4)
Border adjustments for Carbon Taxes				
Imports	Exempt	Taxed	From “white list” countries: exempt From other countries: BAs	BAs, with credit
Exports	Taxed	Exempt, with rebate of embedded tax	<i>Symmetrical</i> To “white list” countries: taxed To other countries: exempt, with rebate of embedded prior-stage tax <i>Asymmetrical</i> : taxed	Taxed
Border adjustments for Cap and Trade Systems				
Imports	Permits not required	Permits required	From “white list” countries: permits not required From other countries: permits required	Permits required; credit for embedded cost of origin-country permits
Exports	Permits required	Permits not required, with rebate of embedded cost of prior-stage permits	<i>Symmetrical</i> To “white list” countries: permits required To other countries: permits not required, with rebate of embedded cost of prior-stage permits <i>Asymmetrical</i> : permits required	Permits required

**Table 2: Implications of Alternative Trade Regimes for a Carbon Tax**

Features compared	Trade Regime		
	Global participation		Non-participation/developing country exemption
	Pure origin (No BAs)	Pure destination (BAs on all imports and exports)	Mixed <i>Symmetrical</i> : origin for “white list” trade; BAs for other trade <i>Asymmetrical</i> : origin for “white list” imports and for exports; BAs for other imports
<b>General Descriptive Features</b>			
Marginal tax rate on traded goods	Origin	Destination	White list trade: origin Asymmetrical: Imports from non-participants: destination Exports to non-participants: 0
Country receiving revenues	Origin	Destination	White list trade: origin Asymmetrical: Imports from non-participants: destination Exports to non-participants: none
Carbon leakage?	Yes	No	Symmetrical: No Asymmetrical: Yes
Free-rider problem	Yes: Aids producers	Yes: Aids consumer	Symmetrical: No Asymmetrical: Yes
Economic efficiency?	No	Yes (if carbon price is uniform)	Symmetrical: Yes (if uniform carbon price) Asymmetrical: No
Additional administrative requirements	Baseline: no	Institute BAs	BTAs for trade with countries not on “white list” Definition of “white list”
Implied meaning of “polluter pays”	Where CO <sub>2</sub> is emitted	Where embedded CO <sub>2</sub> is consumed	Logically consistent interpretation is difficult
<b>Perspective of a Developed Country Choosing the Regime</b>			
Competitiveness problem	Yes	No	Symmetrical: No Asymmetrical: Imports: No Exports: Yes

**Table 3: Comprehensive Harmonized Systems for Pricing Carbon, Based on the Severance of Fossil Fuels, the Origin of CO<sub>2</sub> Emissions, and the Consumption of Embedded Carbon**

Economic activity	Harmonized tax base		
	Severance of fuel	Emissions of CO <sub>2</sub> / combustion of fuel (Origin/emissions)	Consumption of “carbon” (fuel and embedded carbon) (Destination/consumption)
Description of tax base			
Severance of fuels	Taxed	Not applicable; taxed by source country	
Emission of CO <sub>2</sub> / combustion of fuel	Not applicable	Taxed, without BTAs for embedded carbon; see below	Taxed, with BTAs for embedded carbon; see below
Treatment of international trade			
Import of fossil fuel	Not applicable	Taxed	
Export of fossil fuel	Not taxed as such; taxed at severance	Not taxed; rebates if taxed upon import	
BTAs for import of embedded carbon	Not applicable	No	Yes
BTAs for export of embedded carbon		No	Yes

**Table 4: Pricing of Consumption of Carbon, under Origin- and Destination-based Treatment of International Trade, with and without Exemptions for Developing Countries**

	Origin-based System		Destination-based System	
Exemptions for Developing Countries?	No (1)	Yes (2)	No (3)	Yes (4)
Pricing of carbon embedded in consumption in developed countries				
Domestic products	Yes	Yes	Yes	Yes
Imports from other developed countries	Yes: X	Yes: X	Yes: M	Yes: M
Imports from developing countries	Yes: X	<b>No</b>	Yes: M	Yes: M
Pricing of carbon embedded in consumption in developing countries				
Domestic products	Yes	<b>No</b>	Yes	<b>No</b>
Imports from developed countries	Yes: X	Yes: X	Yes: M	<b>No</b>
Imports from other developing countries	Yes: X	<b>No</b>	Yes: M	<b>No</b>

“Yes: M” and “Yes: X” mean that embedded carbon is priced in the importing or exporting country, respectively.

**Table 5: Transactions Assumed in Illustration of BTAs for VAT and turnover Tax**

Purchasing sector	Selling sector					
	Fuel	Transport	Electricity	Aluminum	Automotive	Total
Fuel						
Transport	50					50
Electricity	100	50				150
Aluminum	50	50	200			300
Automotive	50	50		150		250
Consumers					300	300
Exports				200	100	300
Total	250	150	200	350	400	1350

**Table 6: Illustration of Calculation of Value-added tax, BTAs for VAT, and Embedded Carbon**

Sector making sales	Sales; Taxes			Purchases; VAT credit		Value added; Net VAT		Carbon embedded in sales
	Sales (1)	VAT on domestic sales (2)	Turnover tax on domestic sales (3)	Taxed purchases (4)	VAT input credit (5)	Value added (6)	Net VAT (7)	
Fossil fuel	250	25	5	0	0	250	25	
Transport	150	15	3	50 (fuel)	5	100	10	50 (fuel)
Electricity	200	20	4	150 100 (fuel) 50 (trans)	15	50	5	117 100 (fuel) 17 (trans)
Aluminum	350	15	3	300 50 (fuel) 200 (elect) 50 (trans)	30	-150	-15	183 50 (fuel) 117 (elect) 17 (trans)
Automotive	400	30	6	250 50 (fuel) 50 (trans) 150 (alum)	25	50	5	145 50 (fuel) 17 (trans) 78 (alum)
Consumers				300 (auto)			[30]	109 (auto)
Exports				300 200 (alum) 100 (auto)			[ 0]	141 105 (alum) 36 (auto)
Total	1350	105			75	300	30	250

**Table 7: Illustration of Calculation of Embedded Carbon**

	Direct	Indirect effects of carbon tax embedded in costs of products													Total
		First level: Tax on combusted fuel embedded in cost of:				Second level: First-level indirect cost of carbon tax embedded in:			Third level: Second-level indirect cost of fuel embedded in:			Fourth level			
		Tran	Elec	Alum	Auto	Elec	Alum	Auto	Alum	Auto	Alum	Auto	Auto	Auto	
Trans	50														50
Elect	100	16.7													116.7
Alum	50	16.7	100			16.7									183.3
Auto	50	16.7		21.4			7.1		42.9		7.1				145.2
Cons					37.5			12.5		16.1		5.4	32.1	5.4	108.9
Exp				<b>28.6</b>	12.5		<b>9.5</b>	4.2	<b>57.1</b>	5.4	<b>9.5</b>	1.8	10.7	1.8	141.1
Total	250	50	100	50	<b>50</b>	16.7	16.7	<b>16.7</b>	100	<b>21.4</b>	<b>16.7</b>	<b>7.1</b>	<b>42.9</b>	7.1	<b>250</b>

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