

CBO

Border Adjustments for Economywide Policies That Impose a Price on Greenhouse Gas Emissions



DECEMBER 2013



Contents

Summary	1
Policies That Impose a Price on Greenhouse Gas Emissions Could Have Unintended Effects on the Competitiveness of Some Industries	1
Border Adjustments Could Offset the Loss of Competitiveness	2
Border Adjustments Would Be Difficult to Implement and to Defend If Challenged	2
Transition Assistance Also Could Offset the Loss of Competitiveness	3
Effects on Firms' Costs of Policies That Impose a Price on Emissions	3
Unintended Effects of Economywide Policies That Impose a Price on Emissions	4
Consequences of the Changes in Competitiveness for Foreign Emissions	5
BOX: THE EFFECTS OF ALTERNATIVE EMISSION-REDUCTION POLICIES ON FIRMS' COSTS	6
Consequences of the Changes in Competitiveness for Employment	9
Preserving Competitiveness With Border Adjustments	12
Practical Difficulties in Implementing Border Adjustments	13
Determining the Greenhouse Gas Emissions Embodied in Imports	13
Modifying Border Adjustments to Reflect Other Countries' Emissions Policies	15
Potential Legal Challenges to Border Adjustments Under the GATT	15
Conflicts With General Provisions of the GATT	16
Possible Defenses	17
Preserving Competitiveness With Transition Assistance	20
Transition Costs and Transition Assistance	20
Implications for Competitiveness	20
Practical Difficulties	20
Constraints of the WTO Agreements	21
About This Document	22
Figures	
1. Carbon Dioxide Emission Intensities, International Trade, and Emissions, by Industry, 2010	8
2. Carbon Dioxide Emission Intensities, International Trade, and Employment, by Industry, 2010	11



Border Adjustments for Economywide Policies That Impose a Price on Greenhouse Gas Emissions

Summary

Human activities around the world are producing increasingly large quantities of greenhouse gases (GHGs), the most abundant of which is carbon dioxide (CO₂). In recent years, concerns about the effects those emissions might have on the climate have prompted the Congress, federal regulators, and others to consider policies to reduce them. This Congressional Budget Office (CBO) report examines the unintended effects on the competitiveness of U.S. firms of an economywide policy, such as a carbon tax or a cap-and-trade program, that would reduce emissions by imposing a price on them. The report also assesses the use of border adjustments, such as import tariffs and export subsidies, and transition assistance to mitigate those unintended effects. Border adjustments could reduce the loss of competitiveness and make the costs of U.S. producers more similar to those of producers in countries that do not impose comparable policies, but such adjustments could be difficult to implement and to defend if challenged as being inconsistent with the General Agreement on Tariffs and Trade (GATT), one of the component agreements of the World Trade Organization (WTO). Transition assistance could also offset the loss of competitiveness and would probably be easier to implement but might engender difficulties under WTO agreements as well.

Policies That Impose a Price on Greenhouse Gas Emissions Could Have Unintended Effects on the Competitiveness of Some Industries

Under a carbon tax or cap-and-trade policy that covers all or almost all GHG emissions, industries' or firms' production costs would increase, causing those industries or firms to raise the prices of the goods they produce. The prices of emission-intensive goods (that is, goods whose production involves the emission of large amounts of greenhouse gases relative to their value) would increase

the most. The higher prices would create incentives for other firms and consumers to purchase fewer of those goods, leading to declines in the production of those goods and the resulting emissions.

The higher prices would also make emission-intensive U.S. products less competitive relative to competing foreign products. Therefore, imports of the competing products would increase, and exports of the domestically produced products would decrease. Those changes in trade would lead to declines in the value of the dollar on foreign-exchange markets, thereby increasing the exports and reducing the imports of the products that are less emission-intensive. As a result, the policy would have little net effect on the U.S. trade balance, but it would have other unintended effects.

Foreign Emissions Would Increase. The displacement of domestically produced emission-intensive goods by products produced in other countries would cause some of the reduction in U.S. emissions to be offset by increases in foreign emissions. The resulting changes in trade in the products of the other industries would reduce foreign emissions, but not by as much as the changes in trade of emission-intensive products would increase them. Hence, the emission reduction achieved by the policy would be partially offset by a net increase in foreign emissions, a phenomenon known as *carbon leakage*. Such leakage would also occur through other mechanisms. In particular, reducing domestic demand for fossil fuels would lower the price of those fuels in other countries, thereby increasing their use in those countries.

The estimates in the literature that CBO reviewed for total leakage (through trade and other mechanisms) under an economywide carbon tax or cap-and-trade policies in the long term fall in a range from 1 percent to

23 percent of the reduction in emissions from domestic sources. Recently, a group of 12 modeling teams examined a policy consisting of a 20 percent reduction in emissions from their level in 2004. The modelers assumed that a large group of industrialized countries that includes the United States would implement the policy. The leakage rates projected by the modeling teams ranged from 5 percent to 19 percent, with a mean of 12 percent for the estimates. Leakage is likely to be lower in the shorter term, and studies of programs in Europe have found no significant leakage in the first few years of those programs.

Some Industries Would Lose Jobs and Profits. The displacement of domestically produced emission-intensive goods would also cause losses in employment and profits in the industries that produce them, such as the chemical and primary metals industries. The resulting changes in trade in the products of other industries would cause increases in employment and profits in those other industries. The initial net effect of all of the changes in trade on employment would probably be small, but some workers in emission-intensive industries who lost their jobs would have to look for work elsewhere.

Border Adjustments Could Offset the Loss of Competitiveness

Border adjustments are one way to offset the decline in competitiveness of U.S. emission-intensive firms and thereby reduce the consequent leakage and lost profits and employment that would otherwise result from an economywide carbon tax or cap-and-trade program. Those adjustments are provisions that would impose the same costs on imports that the emission-reduction policy would impose on domestic production and that would rebate the costs the policy would impose on domestic production that is exported. In the case of a carbon tax, the adjustments might take the form of import tariffs and export subsidies in proportion to the greenhouse gases emitted in the production of traded products. In the case of a cap-and-trade program, they might take the form of a requirement that importers obtain allowances for those emissions and that domestic manufacturers receive a rebate of the allowances required for their products that are exported.

Although border adjustments would help emission-intensive firms by preventing the increases in imports and declines in exports of their products that the policy would otherwise cause, they would harm firms that are not

emission-intensive by preventing the declines in imports and increases in exports of *their* products that would otherwise occur as a result of changes in the exchange rate. Moreover, the adjustments would not reduce leakage occurring through mechanisms other than trade—in particular, leakage that would occur through lower prices for fossil fuels. Nevertheless, the 12-model study found that applying simplified border adjustments to emission-intensive industries with significant foreign competition reduced the mean estimated amount of leakage by roughly one-third.

Border Adjustments Would Be Difficult to Implement and to Defend If Challenged

Implementing border adjustments for an economywide carbon tax or cap-and-trade program would require determining the GHG emissions embodied in imports (that is, the amount of greenhouse gases emitted in producing each imported good and service), which would be extremely difficult if applied to most imports (but not if applied only to imports of fossil fuels). The difficulty could be reduced, but not eliminated, in several ways:

- By assuming that the emissions embodied in products were the same for all firms in a given industry and country;
- By limiting the adjustments to selected imports that embody large quantities of emissions or to primary products (such as steel and other metals) whose production would probably require lesser amounts of intermediate inputs purchased from other firms than would production of goods farther downstream (such as automobiles or other products made from steel); or
- By ignoring the emissions embodied in intermediate inputs.

However, such simplifications would result in adjustments that less accurately offset the effects of the emission-reduction policy on competitiveness.

The use of border adjustments might be challenged in the WTO as being inconsistent with the GATT, an agreement to which all WTO members, including the United States, are signatories. CBO has not independently analyzed the merits of such challenges but instead has reviewed several legal analyses of border adjustments in the literature. Those analyses suggest that the prospects for a successful defense of border

adjustments are uncertain and would depend on the design of those adjustments. For example, an allowance requirement for imports under a cap-and-trade program might be more difficult to defend than would import tariffs and export subsidies under a carbon tax. Certain simplifications—such as assuming that the emissions embodied in products were the same for all firms in a given industry and country—might increase the difficulty of defending the adjustments in the WTO.

Transition Assistance Also Could Offset the Loss of Competitiveness

Transition assistance could also be used to reduce the decline in competitiveness that would result from a broad emission-reduction policy. Transition assistance would be the aid the government provided to compensate firms and their employees for some of the costs incurred while the emission-reduction policy was being phased in. If such assistance was made contingent on firms' levels of output or employment after the policy went into effect, it could offset the decline in competitiveness—and, consequently, some of the leakage and employment losses. In principle, such assistance could be made in an amount sufficient to eliminate the decline in competitiveness. However, doing so would negate the incentive for consumers to reduce their purchases of emission-intensive products—one of the major mechanisms of emission reduction under such policies. Hence, such assistance would result in more emissions under a carbon tax and would increase the cost of meeting the emissions cap in a cap-and-trade program.

Implementing transition assistance could be a substantial undertaking, but it would probably be easier than imposing border adjustments because the necessary data regarding firms' costs and emissions would be more readily available. However, it might engender problems under the Agreement on Subsidies and Countervailing Measures, a component agreement of the WTO.

Effects on Firms' Costs of Policies That Impose a Price on Emissions

Human activities around the world are resulting in the emission of increasingly large quantities of greenhouse gases, the most abundant of which is carbon dioxide. Emissions can occur in a variety of ways. Emissions of CO₂ result directly from the combustion of fossil fuels, as when drivers burn gasoline in their cars or when utilities burn coal to produce electricity. However, many types

of economic activity yield emissions indirectly, as when manufacturers, in the process of fabricating their products, consume electricity that was produced by a coal-fired generator or burn fuels for processes that require heat. Some products (such as metals and chemicals) require a great deal of energy to produce, while others (such as software) do not. Moreover, some energy-intensive products may be produced using electricity generated from nuclear power or renewable fuels, in which case no CO₂ emissions are generated. As a result, some products (such as crude oil or coal) directly contain carbon that will be emitted when the products are consumed, other traded products indirectly "contain" a great deal of carbon if their production is very energy-intensive and the energy used is largely derived from fossil fuels, and still other products are not very carbon-intensive at all.

In recent years, concerns about the effects that GHG emissions might have on the climate have prompted the Congress, federal regulators, and others to consider policies to reduce them. To date, the two main market-based approaches for reducing emissions that have received attention are a carbon tax and a cap-and-trade program:

- A *carbon tax* is a fee levied on the amount of carbon in fossil fuels or on the amount of CO₂ emissions that result when those fuels are burned.¹ Such a tax could be designed to include other greenhouse gases as well.
- Under a *cap-and-trade program*, the government sets gradually tightening limits on emissions, issues rights (or allowances) for firms to emit greenhouse gases consistent with those limits, and then lets firms trade the allowances among themselves.

A carbon tax would directly impose a price on emissions that would be subject to the tax. A cap-and-trade program would also effectively place a price on emissions; the price would be equal to the price of the emission allowances.

By placing a price on GHG emissions, the policies would create incentives for firms and consumers to reduce emissions in two main ways:

1. For additional information, see Congressional Budget Office, *Effects of a Carbon Tax on the Economy and the Environment* (May 2013), www.cbo.gov/publication/44223.

- Firms would be encouraged to reduce the quantities of greenhouse gases they emit during production, thereby lowering the amount they must pay for emissions. Similarly, consumers would be encouraged to reduce their emissions by, for example, setting thermostats lower in the winter and higher in the summer, driving less, and buying cars that are more fuel-efficient.
- Firms would probably raise their product prices to cover the cost imposed by the price on emissions. Consumers, in turn, would buy less of the products whose prices rose substantially because their production required substantial emissions. Instead, they would purchase goods whose prices rose less as a result of the policy because their production was less emission-intensive.

Policymakers have also considered and adopted other types of policies for reducing GHG emissions. Those policies include imposing a cap-and-trade program only for certain activities, such as generating electricity; adopting regulatory standards, such as more stringent standards for vehicle fuel economy; or providing subsidies for certain activities that reduce emissions, such as those for electricity produced from wind. Many of those policies also affect industries' competitiveness (see Box 1) although they are not the focus of this report.

Unintended Effects of Economywide Policies That Impose a Price on Emissions

Imposing an economywide carbon tax or cap-and-trade program would put the U.S. firms most affected—those that are emission-intensive—at a competitive disadvantage relative to their competitors in other countries unless those countries implemented similar policies. Such a policy would impose costs on domestic firms, allowing foreign producers from countries with less stringent policies, or no policy at all, to charge less for their goods than U.S. producers.² As a result, some consumers would switch to competing goods produced in other countries. That switching would unintentionally cause foreign production and thus foreign emissions to increase. Estimates of the increase in foreign emissions for economywide policies range from 1 percent to 23 percent of the reduction in domestic emissions achieved by the policies. Another

unintended effect would be the loss of employment of workers in industries placed at a disadvantage by the policy. The reduction in total employment from such a policy would probably be small; however, finding new work would take some time for the workers losing jobs.

Not all domestic producers would become less competitive under an economywide policy that reduced emissions by imposing a price on them. Some producers would benefit. That benefit would be large enough that the U.S. trade balance (that is, the total value of exports minus the total value of imports) would not be affected much, if at all, in the long term. The reason is that the policy would cause the value of the U.S. dollar to decline in foreign-exchange markets, effectively lowering the foreign-currency price of U.S. exports and raising the dollar price of U.S. imports. The change in the value of the dollar would occur because the increase in imports of emission-intensive products prompted by the policy's effects on costs would require that dollars be used to purchase the foreign currencies needed to buy the products from abroad. Thus, all else being the same, the demand for foreign currencies would increase, driving up the dollar prices of the currencies (or, equivalently, driving down the foreign-currency prices of the dollar). Similarly, the reduction in exports would also drive down the price of the dollar.

The size of the effect on the value of the dollar would depend on the amount of the change in imports. Ultimately, the dollar's value would not decline enough to completely offset the higher costs paid by the producers most seriously affected by the emission-reduction policy—typically the producers that emit large quantities of greenhouse gases relative to the value of their products and cannot easily reduce their emissions. However, the decline in the value of the dollar would more than offset the cost for the producers least affected—typically those that emit only small quantities or that could easily reduce their emissions—and would thereby give them a competitive advantage.

2. Policies that impose a price on GHG emissions would affect the competitiveness of some producers of services as well as some producers of goods. This report focuses on goods, which are generally more emission-intensive than services. In addition, international trade agreements regarding services differ from those involving goods, so the analysis in this report does not fully apply to services.

Consequences of the Changes in Competitiveness for Foreign Emissions

The switch to foreign emission-intensive products by U.S. and foreign consumers would cause foreign production and, consequently, foreign GHG emissions to increase—an example of *carbon leakage*.³ The corresponding switch in demand from less-emission-intensive, foreign-produced goods to the competing U.S.-produced goods would reduce foreign production and thereby offset leakage through the trade of the more emission-intensive goods. However, the offset would only be partial because of the difference in emission intensity, resulting in a net increase in foreign emissions. That increase would offset to some extent the reduction in U.S. emissions achieved by the emission-reduction policy.

Leakage would also occur through mechanisms unrelated to the competitiveness of individual firms and industries. In particular, it would occur through changes in the prices of carbon-based fuels.⁴ Increases in those fuel prices in the United States—and in the prices of goods requiring substantial amounts of such fuels to produce—would reduce U.S. consumption of those fuels. Because the fuels are internationally traded (primarily petroleum and, to a lesser extent, coal), the resulting reduction in demand would cause their prices in other countries to decline relative to what they would be otherwise.⁵ As prices dropped, demand for the fuels in other countries would rise and their emissions would increase. The amount of those changes would depend on the ease with which each fuel is traded and on other factors, such as whether foreign producers of fossil fuels—especially petroleum—react to changes in the United States. In particular, if Saudi

Arabia or the Organization of Petroleum Exporting Countries lowered output to offset reduced consumption of oil in the United States—limiting the decline in the price of oil—leakage through lower fuel prices would be reduced.

The Location of Leakage. Most U.S. GHG emissions are not subject to leakage through trade. Roughly two-thirds of those emissions originate from the residential, commercial, construction, and transportation sectors, which (aside from international air travel) face no significant international competition.⁶ (For that estimate, the emissions of the electricity-generating sector were attributed to each sector of the economy in proportion to its use of electricity.) Emission reductions achieved in those sectors would not be subject to being offset by carbon leakage through trade in their products, although they would be subject to leakage through reductions in the international prices of carbon-based fuels.

Of the remaining one-third of U.S. emissions of greenhouse gases that occur in sectors where leakage is more likely to occur—agriculture, mining, and manufacturing—the amount of leakage that is likely to occur varies from industry to industry, depending on several factors. Particularly important are the following three:

- The industry's emissions;
- The amount of foreign competition, which can be roughly measured by the trade ratio (that is, the ratio of exports plus imports to U.S. market size); and
- The percentage increase in the industry's cost imposed by the policy, which is proportional to the industry's

3. For a more detailed discussion of the issues and findings summarized here, see Bruce Arnold, *International Trade and Carbon Leakage*, Working Paper 2013-08 (Congressional Budget Office, December 2013), www.cbo.gov/publication/44970.

4. Leakage may also occur in connection with reductions in greenhouse gases from activities not subject to limits on emissions. See, for example, Congressional Budget Office, *The Use of Offsets to Reduce Greenhouse Gases* (August 2009), www.cbo.gov/publication/20972, and *Deforestation and Greenhouse Gases* (January 2012), www.cbo.gov/publication/42686.

5. For more information on the ability of U.S. fuel consumption to influence the price of carbon fuels in other countries, see Congressional Budget Office, *Energy Security in the United States* (May 2012), www.cbo.gov/publication/43012.

6. Although the U.S. airline industry has foreign competition on international routes, it would not be put at a competitive disadvantage under a carbon tax or a cap-and-trade program. The reason is that such policies would affect the industry through the price of fuel, and U.S. and foreign airlines would generally purchase their fuel at the same locations and would therefore face the same costs. Hence, no significant carbon leakage would occur in that industry. CBO's calculation is based on estimates of GHG emissions from Environmental Protection Agency, *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2010*, EPA 430-R-12-001 (April 2012), p. 2-19, Table 2-14, <http://go.usa.gov/T8mj>.

Box 1.**The Effects of Alternative Emission-Reduction Policies on Firms' Costs**

Policymakers have considered and, in some instances, adopted policies other than a broad-based carbon tax or cap-and-trade program in order to reduce greenhouse gas (GHG) emissions. Such policies include price-based policies, such as a cap-and-trade program, for particular sectors of the economy; regulatory standards that are specifically designed to reduce GHG emissions; and subsidies for certain activities that result in lower emissions of greenhouse gases than do alternative activities. Each of those approaches would affect the economy or specific markets in different ways, and their impact on firms' costs would depend on how the policies were implemented.

Alternatives That Do Not Cover All of the Economy's Emissions

Rather than covering all or almost all emissions in the economy, a cap-and-trade program could be more narrowly targeted to cover the emissions of particular industries or sectors of the economy. In that case, prices would increase the most for the products of emission-intensive firms or plants in the targeted industries or sectors and for goods made by firms that use those products intensively. For instance, under such a policy that covered the electrical generating industry, the prices of electricity generated in an emission-intensive manner (such as from coal rather

than from nuclear energy or hydropower) would increase the most along with the prices of goods whose production requires intensive use of such electricity. The subset of those firms that face foreign competition would see a decline in their competitiveness. Such a policy would probably result in lower leakage through the prices of fossil fuels than would an economywide policy that would also increase the prices of petroleum—not just the prices of coal and natural gas that would be affected by a policy limited to the electricity sector.

Alternatives That Impose Regulatory Standards

Another approach to reducing emissions would be to impose regulatory standards on certain industries or sectors. Such standards could regulate either production processes or products. Either kind of regulation would increase costs, leading to price increases and reduced sales of certain products—as would occur under a carbon tax or a cap-and-trade program. As in the case of a narrowly targeted cap-and-trade program, the largest price increases would be for products of the targeted industries and those of the industries that use those products intensively in their production; however, there would not necessarily be a direct relation between the cost and price increases and the emission intensity in the targeted industries or sectors.

Continued

- emission intensity—one measure of which is the ratio of its direct emissions to its value added.⁷

Despite the potential for leakage based on those and other factors, the benefits of agglomeration and the fixed location of existing plant and equipment, for example,

tend to reduce the relocation of production to other countries, at least temporarily.⁸

Industries with substantial emissions, high trade ratios, and high emission intensities are the most likely to generate substantial leakage under an economywide carbon tax or cap-and-trade program that includes no provisions to

7. Direct emissions are those attributable to the industry's production and to the production of the electricity it uses but not to the production of intermediate inputs the industry purchased. Value added is the value of the industry's output minus the value of the intermediate inputs it purchased.

8. For more information, see Josh Ederington, Arik Levinson, and Jenny Minier, "Footloose and Pollution-Free," *Review of Economics and Statistics* vol. 87, no. 1 (February 2005), pp. 92–99, www.mitpressjournals.org/toc/rest/87/1.

Box 1.**Continued****The Effects of Alternative Emission-Reduction Policies on Firms' Costs**

Setting minimum requirements for the use of renewable fuels in electrical generating plants is an example of a *process standard*. A binding standard would increase costs by requiring the substitution of more expensive renewable fuels for the fuels the plants would otherwise use, thereby putting upward pressure on the average price of electricity and on the prices of the products of electricity-intensive industries.¹ By increasing the average price of electricity, a renewable-fuels standard would raise the costs—and reduce the competitiveness—of firms whose production processes are electricity-intensive. However, the costs imposed on firms by a process standard would generally be different from those under an economywide carbon tax or cap-and-trade program.

Requirements that automobiles and household appliances meet specified energy-efficiency standards are examples of *product standards*. In particular, the existing fuel-economy standards for automobiles and other light-duty vehicles sold in the United States starting in 2017 require gradual reductions in GHG emissions. Product standards would raise at least some firms' production costs and would probably lead to increases in the products' prices. In those instances, the rise in costs would not necessarily be proportional to the firm's emissions or the effect the

policy would have on those emissions. Moreover, unlike the case for process standards, the cost and price increases resulting from product standards would have little, if any, effect on the competitiveness of U.S.-made products—and, therefore, on trade—because the same standards would apply to a product sold in the United States regardless of whether it was produced domestically or imported from abroad.

Alternatives That Subsidize**Low-Emissions Substitutes**

Still another approach to reducing emissions would be to provide subsidies for alternative technologies that reduce GHG emissions. For instance, under current law, producers of electricity generated from wind power are allowed to take a tax credit for using that renewable source of energy.² Such policies tend to reduce producers' costs rather than increase them, although not necessarily in proportion to the amount of greenhouse gases that are avoided. Those policies would result in lower prices for the products of firms receiving the subsidies and firms that intensively use the products of the firms receiving them. Therefore, they could increase the competitiveness of the most directly affected U.S.-made products.

1. For additional information, see Congressional Budget Office, *The Effects of Renewable or Clean Electricity Standards* (July 2011), www.cbo.gov/publication/41451.

2. For additional information, see the testimony of Terry M. Dinan, Senior Advisor, Congressional Budget Office, before the Subcommittee on Energy of the House Committee on Science, Space, and Technology, *Federal Financial Support for Fuels and Energy Technologies* (March 13, 2013), www.cbo.gov/publication/43993.

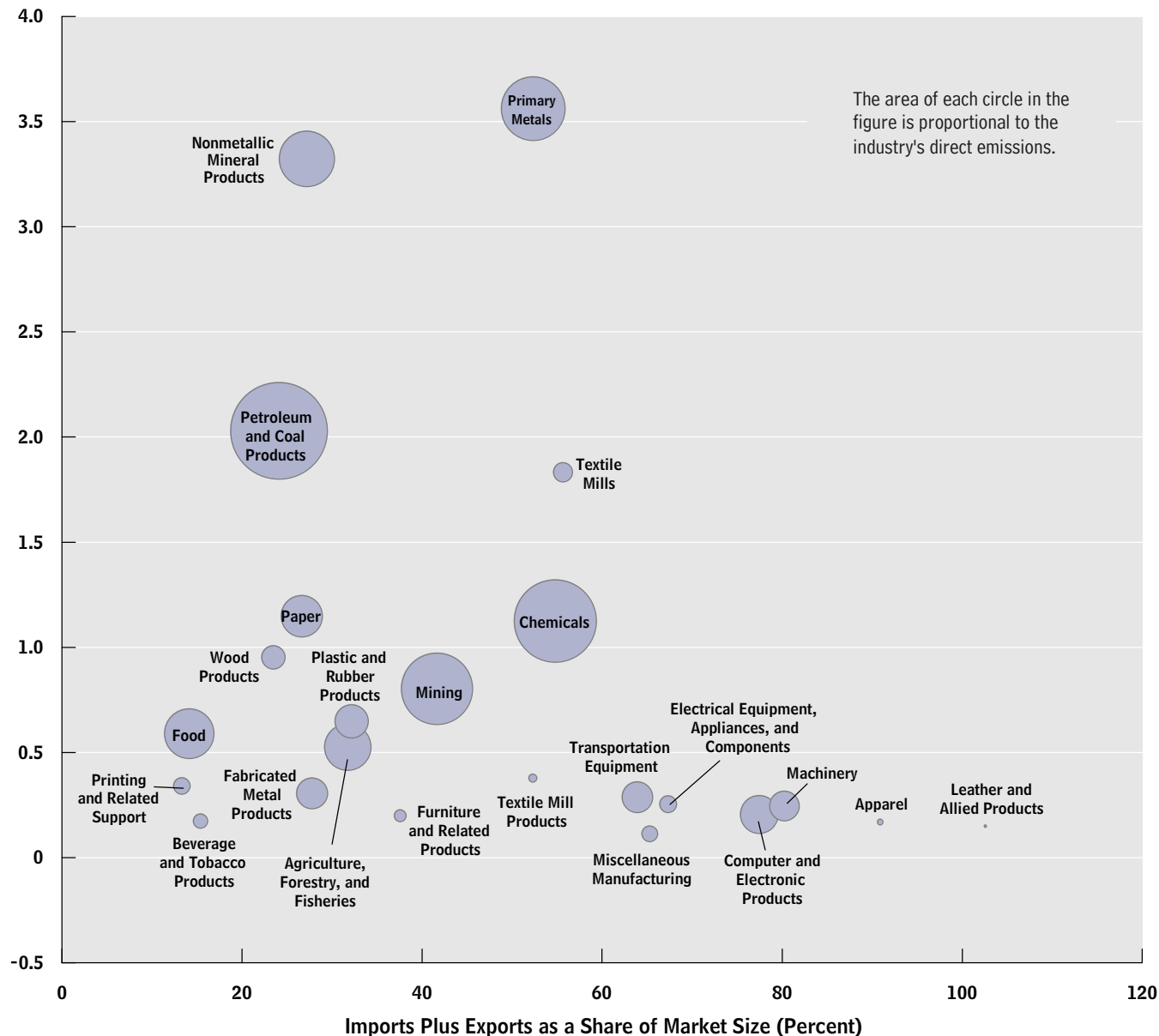
reduce leakage (see Figure 1). The industries that stand out by those criteria are those that produce chemicals, primary metals (such as aluminum and iron and steel), and, to a lesser extent, nonmetallic mineral products (cement, lime, gypsum, and glass) and petroleum and coal products (refining and coke production). If such a policy were to reduce the non-CO₂ emissions of agriculture (particularly, methane and nitrous oxide)—something policies the Congress has considered to date would

not do—and did so in a way that did not offset the cost with subsidies or other compensation, that sector would also probably be a sizable source of leakage.

The Magnitude of Leakage. Estimating leakage is difficult and subject to considerable uncertainty. Analyses of proposals for economywide policies have produced estimates of leakage rates ranging from 1 percent to 23 percent of the total emission reduction the policies would achieve

Figure 1.**Carbon Dioxide Emission Intensities, International Trade, and Emissions, by Industry, 2010**

(Carbon dioxide emission intensity)



Source: Congressional Budget Office.

Notes: The largest amounts of leakage through trade are likely to occur in industries that have sizable emissions of carbon dioxide (CO₂), have high direct emission intensities, and face significant foreign competition as measured by the ratio of an industry's trade—imports plus exports—to the size of the U.S. market. The size of the U.S. market for each industry is measured here by the industry's output plus imports minus exports. As such, the ratio can exceed 100 percent.

Direct CO₂ emissions are the sum of an industry's own emissions and the emissions attributable to the production of the electricity it uses.

The CO₂ emission intensity shown is the direct intensity, which is the ratio of an industry's direct emissions to its value added (that is, to the value of its output minus the value of the intermediate inputs it uses), measured here in metric tons of CO₂ per thousand dollars of value added.

in the countries implementing them.⁹ Recently, a group of 12 modeling teams examined a policy consisting of a 20 percent reduction in emissions from their level in 2004 and assumed that it was implemented by industrialized countries listed in Annex I of the U.N. Framework Convention on Climate Change (including the United States but excluding the Russian Federation).¹⁰ The leakage rates projected by the 12 teams ranged from 5 percent to 19 percent, with a mean of 12 percent for the 12 estimates. Industries that produce goods that are traded internationally are responsible for only a small portion of U.S. emissions (less than 37 percent of greenhouse gases and only 25 percent of CO₂). Hence, the loss of U.S. market share to foreign competitors and consequent percentage rates of leakage through trade could be much higher for some of those industries than for the economy as a whole if the estimates primarily reflect leakage through trade. However, the estimates of 1 percent to 23 percent also include leakage through the prices of

carbon-based fuels. Estimates in the literature generally indicate that leakage through that mechanism may be more than half of total leakage, although such estimates are sensitive to parameters for which estimates are sparse and uncertain.¹¹

Caution must be exercised in using those estimates to draw conclusions about the effects of various proposals, for several reasons. First, the estimates are generally for periods well into the life of a policy; leakage in the initial years would probably be much lower. Second, the reduction in competitiveness of U.S. producers and the consequent amount of leakage would depend on the number of U.S. trading partners that implemented comparable policies at the same time the United States did. Finally, the estimates generally do not account for provisions that could limit leakage by providing border adjustments or transition assistance linked to continuing levels of output or employment.

Some studies have looked back at the effects of policies already implemented in Europe and have found no evidence of significant leakage in the first few years of those policies. One study, which looked at the effects in the United States of changes in energy prices from 1974 through 2001, concluded that some domestically produced goods were displaced by goods produced abroad in the first few years after prices rose. However, the implied magnitude of leakage for an emission-reduction policy is not clear from the results. Regardless of the initial magnitude, leakage would probably increase after the first few years of a policy as transition assistance provided by the government to severely affected industries ended and firms had time to move their production abroad to avoid the higher costs.

Consequences of the Changes in Competitiveness for Employment

The declines in competitiveness of emission-intensive industries are of interest not only because of the resulting leakage but also because they would cause reductions in

9. See Environmental Protection Agency, *EPA Analysis of the Lieberman-Warner Climate Security Act of 2008, S. 2191 in 110th Congress* (March 14, 2008), <http://go.usa.gov/T8VR> (PDF, 4MB) (S. 2191 was reported from the Senate Committee on Environment and Public Works on May 20, 2008, but no further action was taken on the bill); Liwayway Adkins and others, *The Impact on U.S. Industries of Carbon Prices With Output-Based Rebates Over Multiple Time Frames*, RFF DP 10-47 (Resources for the Future, December 2010), <http://tinyurl.com/c8usx6r>; J.P.M. Sijm and others, *Spillovers of Climate Policy: An Assessment of the Incidence of Carbon Leakage and Induced Technological Change Due to CO₂ Abatement Measures*, Report 500036-002 (Netherlands Research Programme on Climate Change, December 2004), pp. 13–14 and 31, <http://www.tinyurl.com/lh3f3pw> (PDF, 1.29 MB); Jean-Marc Burniaux and Joaquim Oliveira Martins, *Carbon Emission Leakages: A General Equilibrium View*, OECD Economics Department Working Paper 242 (Organisation for Economic Co-operation and Development, May 2000), <http://tinyurl.com/p5tzn4c> (PDF, 548 KB); Environmental Protection Agency, *The Effects of H.R. 2454 on International Competitiveness and Emission Leakage in Energy-Intensive Trade-Exposed Industries*, An Interagency Report Responding to a Request From Senators Bayh, Specter, Stabenow, McCaskill, and Brown (December 2, 2009, with corrections on February 23, 2010), <http://go.usa.gov/T8pT> (PDF, 1.8 MB); and ZhongXiang Zhang, *Competitiveness and Leakage Concerns and Border Carbon Adjustments*, Working Papers in English 2012.080 (Fondazione Eni Enrico Mattei, 2012), <http://tinyurl.com/clzqb5z>.

10. Christoph Böhringer, Edward J. Balistreri, and Thomas F. Rutherford, eds., "The Role of Border Carbon Adjustment in Unilateral Climate Policy: Results from EMF 29," *Energy Economics*, vol. 34, Supp. 2 (December 2012), pp. S95–S250, <http://tinyurl.com/c65mott>.

11. See ZhongXiang Zhang, *Competitiveness and Leakage Concerns and Border Carbon Adjustments*, Working Papers in English 2012.080 (Fondazione Eni Enrico Mattei, 2012), p. 3, <http://tinyurl.com/clzqb5z>, which summarizes a number of studies. The estimates in Liwayway Adkins and others, *Carbon Pricing With Output-Based Subsidies: Impact on U.S. Industries Over Multiple Time Frames*, RFF DP 12-27 (Resources for the Future, June 2012), <http://tinyurl.com/lmn2d6s>, are also consistent with that conclusion.

employment in some industries, forcing some workers to find work elsewhere. (Job losses would also arise from reduced total demand for the industries' products caused by consumers switching to other products—domestic or foreign—that are less emission-intensive.)¹² Similarly, the increase in competitiveness of other industries as a result of the decline in the value of the dollar would cause employment in those industries to rise. The initial effect on total employment—that is, the employment losses in industries placed at a disadvantage minus the employment gains in other industries—would probably be small, and even that small effect would subside as wages adjusted to equate the supply of labor with the demand for it. Nevertheless, some workers would be unemployed until they were able to find work in other industries or left the labor force.

Developing an estimate of the employment losses that each industry would incur as a result of the decline in competitiveness would require estimating the amounts by which exports would decrease and imports would increase, which is beyond the scope of this report. The industries most likely to lose large numbers of workers can be ascertained, however, by looking at the industries that have a high trade ratio and a high direct emission intensity and determining which of them has a large workforce.

When only CO₂ emissions—the main greenhouse gas for most industries and the only one for which CBO had emissions data for every industry—are considered, the largest employer in the sectors with a total trade ratio of at least 50 percent and a direct emission intensity of at least 1 metric ton of CO₂ per thousand dollars of value added is the chemical industry (see Figure 2). That industry employs about 1.2 million people. The primary metals and textile mills industries are smaller than the chemical industry, employing about 450,000 people and about 150,000 people, respectively, but they have comparable trade ratios and higher direct emission intensities and therefore are more likely to lose market share to foreign rivals. The nonmetallic mineral products industry and the petroleum and coal products industry are also

smaller, employing about 450,000 people and about 190,000 people, respectively, and also have higher direct emission intensities. However, their trade ratios are lower, making the likelihood of their losing significant market share to foreign rivals a little less clear. In principle, a small loss in competitiveness in an industry with a large workforce could cause a greater loss in employment than would result from a larger loss in competitiveness in an industry with a small workforce. However, such determinations would require estimates of employment losses and therefore are beyond the scope of this report.

When one considers all greenhouse gases (not just CO₂), the largest employer in the agricultural, mining, and manufacturing sectors that also has a significant trade ratio and a high emission intensity is the agriculture, forestry, and fisheries industry, which employs almost 2.2 million people. Although its CO₂ emission intensity ranks moderately low among the industries in question, its GHG emission intensity is more than five times as large and therefore ranks much higher. However, under policies that do not limit or place costs on agriculture's non-CO₂ emissions, including the cap-and-trade programs the Congress has considered to date, that industry is not likely to have a substantial loss of employment.

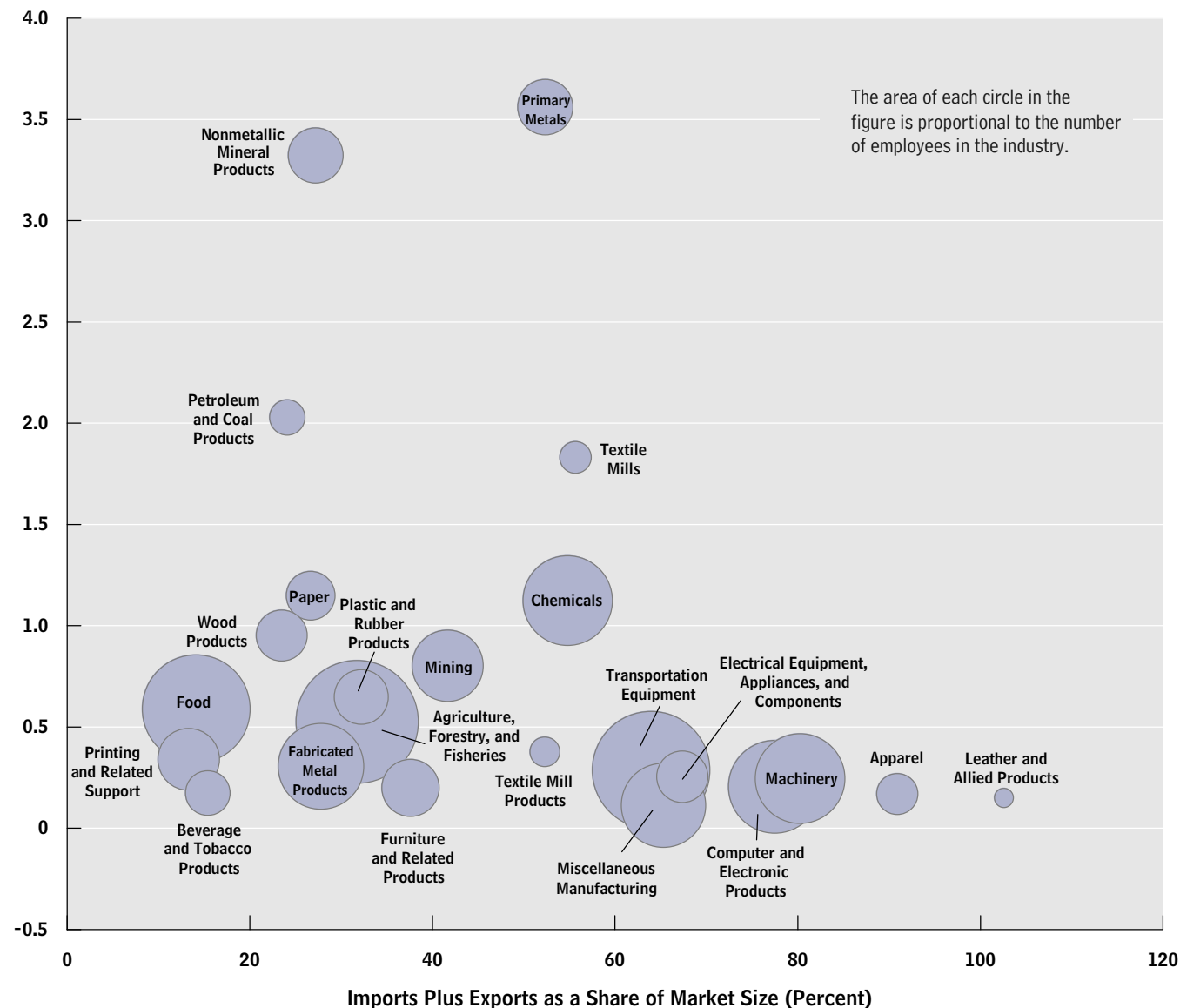
A rough idea of the magnitudes of competitiveness-related employment declines can be ascertained by assuming that such declines would be similar in percentage terms to the competitiveness-related declines in output. One study that examined the effects of fluctuations in energy prices in the United States on net imports over time estimated that imposing a price of \$15 per ton on CO₂ emissions would lead in the first few years to increases in net imports and consequently to competitiveness-related declines in domestic production of the products of emission-intensive industries equal to 1.0 percent to 1.3 percent of domestic production.¹³ That decline is about one-third of the total decline in production in those industries that the study estimated would result from the policy; the other two-thirds results from reduced consumer demand stemming from higher prices. Another study estimated that a cap-and-trade

12. For more information about the effects of emission-reduction policies on employment, see Congressional Budget Office, *How Policies to Reduce Greenhouse Gas Emissions Could Affect Employment* (May 2010), www.cbo.gov/publication/41257.

13. Joseph E. Aldy and William A. Pizer, *The Competitiveness Impacts of Climate Change Mitigation Policies*, Working Paper 17705 (National Bureau of Economic Research, December 2011), www.nber.org/papers/w17705.

Figure 2.**Carbon Dioxide Emission Intensities, International Trade, and Employment, by Industry, 2010**

(Carbon dioxide emission intensity)



Source: Congressional Budget Office.

Notes: The largest employment losses resulting from reductions in international competitiveness are likely to occur in industries that have sizable employment, have high direct emission intensities for carbon dioxide (CO₂), and face significant foreign competition as measured by the ratio of an industry's trade—imports plus exports—to the size of the U.S. market. The size of the U.S. market for each industry is measured here by the industry's output plus imports minus exports. As such, the ratio can exceed 100 percent.

Direct CO₂ emissions are the sum of an industry's own emissions and the emissions attributable to the production of electricity that it uses.

The CO₂ emission intensity shown is the direct intensity, which is the ratio of an industry's direct emissions to its value added (that is, to the value of its output minus the value of the intermediate inputs it uses), measured here in metric tons of CO₂ per thousand dollars of value added.

program with an allowance price of \$20 per ton of CO₂ would, in the medium term, increase net imports of the products of energy-intensive industries that face substantial foreign competition by roughly 1 percent to 2 percent of the domestic production of those industries.¹⁴ Another study estimated that competitiveness-related reductions in output for such industries resulting from a tax of \$15 per ton on CO₂ emissions would average roughly 46 percent of the total reductions in output for those industries in the medium run and 33 percent in the long run.¹⁵

Preserving Competitiveness With Border Adjustments

Border adjustments are one way to offset the decline in competitiveness of U.S. firms and thereby reduce the carbon leakage and lost profits and employment that would otherwise result from an economywide policy to reduce emissions by imposing a price on them.¹⁶ The simplest border adjustments conceptually would be a tax (or tariff) on imports and a subsidy for exports that were proportional to the quantity of greenhouse gases emitted in the production of the good in question. The tax or subsidy might be lowered to reflect any increased costs resulting from an emission-reduction policy in the country from which the good was imported or to which it was exported. (Transition assistance linked to continuing levels of output or employment—a policy that is contained

in some emission-reduction proposals to compensate firms and their employees for costs they would incur while the emission-reduction policy was phased in—could also be used to offset declines in competitiveness, as discussed below.)

Rather than impose a tax on imports, some proposals for a cap-and-trade program would require that importers obtain allowances for the emissions embodied in the goods they import. Such proposals would have separate pools of allowances for imported goods and those produced domestically, and the price of allowances for imported goods generally would be set at or below the market price of the allowances for domestic production and would serve the same function as a tax on imports. Eliminating the requirement for domestic production that is exported, or refunding the cost allowance for exported products, would provide a benefit to exporters of such products.

Border adjustments would prevent the increases in imports and declines in exports that would otherwise occur for emission-intensive goods. However, in doing so they would in turn prevent the decline in the value of the dollar and the resulting declines in imports and increases in exports of other goods. Because an emission-reduction policy would have little long-run effect on the overall trade balance, border adjustments to offset the policy's effects on trade would also have little effect on the overall trade balance. Similarly, the net effect of the adjustments on total employment would probably be small. If effectively implemented, however, the adjustments would reduce or eliminate the leakage that would otherwise occur through trade in emission-intensive goods—although not the leakage that would occur through lower prices of petroleum and other carbon-based fuels in other countries. The group of 12 modeling studies discussed above estimated leakage for the emission-reduction program in question both with and without simplified border adjustments applied to the products of emission-intensive industries that face significant foreign competition. The mean estimated amount of leakage with the border adjustments applied was roughly one-third lower than the mean without the border adjustments.

The border adjustments could also hurt firms that are not emission-intensive—and firms that produce goods that are not traded, whether emission-intensive or not—for another reason: For a given goal for reducing domestic

14. The estimates cited here are for the effect of H.R. 2454, the American Clean Energy and Security Act of 2009, with an allowance price of \$20 per ton but without the provisions of that bill that were designed to offset effects on industry competitiveness. See Environmental Protection Agency, *The Effects of H.R. 2454 on International Competitiveness and Emission Leakage in Energy-Intensive Trade-Exposed Industries*.

15. Liwayway Adkins and others, *Carbon Pricing With Output-Based Subsidies: Impact on U.S. Industries Over Multiple Time Frames*, RFF DP 12-27 (Resources for the Future, June 2012), <http://tinyurl.com/lmn2d6s>. The numbers given here are for what the paper estimates in the case of no output-based subsidies.

16. Besides border adjustments, some papers have examined the possibility of changing the existing tax structure—reducing the corporate income tax rate or lowering the payroll tax rate, for example—to compensate industries whose international competitiveness would be harmed by an emission-reduction program. See, for example, Gilbert E. Metcalf, *Using the Tax System to Address Competition Issues with a Carbon Tax*, RFF DP 13-30 (Resources for the Future, October 2013), <http://tinyurl.com/lrrazve>.

emissions, including border adjustments in an economy-wide carbon tax or cap-and-trade program would mean that less of the reduction would be achieved by industries that are emission-intensive and produce goods that are traded internationally, so more of the goal would have to be achieved by other industries.¹⁷ Specifically, by reducing the loss of market share to foreign producers, the adjustments would increase the domestic output of goods in U.S. emission-intensive industries, and that increased output would increase GHG emissions in the United States. Meeting the goal for reducing domestic emissions would therefore require greater reductions by other producers—those whose goods are less emission-intensive, are not traded, or both—than would be the case for a policy without border adjustments. In a cap-and-trade program, the increased output of emission-intensive industries would raise the demand for emission allowances, causing their price to rise. Those higher prices would increase the incentive for other industries to reduce their emissions.

Practical Difficulties in Implementing Border Adjustments

In practice, implementing a policy to preserve the competitiveness of specific industries that would occur in the absence of the emission-reduction policy would be extremely difficult. Precisely offsetting the effects of the policy on competitiveness would require determining the amount of greenhouse gases that are embodied in imports and adjusting for existing policies to reduce GHG emissions in other countries. Modified versions of the adjustments could ease implementation somewhat but would still be difficult to carry out and would less accurately offset the policy's effects on the competitiveness of specific U.S. industries. Lowering adjustments for imports from countries that have their own emission-reduction policies would be consistent with the rationale for such adjustments but complicated to undertake.

Determining the Greenhouse Gas Emissions Embodied in Imports

Imposing border adjustments that would precisely offset all of the effects of a policy to reduce GHG emissions

would require a lot of information that is not readily available. In particular, it would require knowing the total amount of greenhouse gases emitted in the production of each imported good, including the amounts emitted in the production of intermediate inputs used to make the imported good. Those amounts would not be evident from examining the imports, and determining the amounts would be extremely difficult and costly.¹⁸

Precisely Calculating the Ideal Border Adjustment.

Precisely offsetting all of the effects that a policy that imposes a price on emissions has on competitiveness would require applying border adjustments to all imports and exports. In addition, the adjustment for a given product would have to be calculated separately for each firm (and perhaps for each individual plant) making the product, because the emission intensity of a good imported from one firm might differ from that of the same good imported from another firm. Such separate calculations would require gathering data on emissions from each firm. Moreover, they would require collecting data about the products each firm purchases for use as intermediate goods and from which other firms it purchases them, so that the emissions embodied in those goods could be calculated, which in turn would require collecting data from the companies producing the intermediate inputs about their emissions and purchases from other firms, and so on.

The task of gathering the required data and calculating the border adjustments might be given to a new entity similar to the one in the Department of Commerce's International Trade Administration (ITA) that, in conjunction with the International Trade Commission, enforces the antidumping and countervailing-duty (AD/CVD) laws.¹⁹ When U.S. imports are suspected of being dumped or subsidized, the foreign producers of

17. However, because border adjustments would reduce leakage and therefore foreign emissions, policymakers might be less concerned if the goal for reducing domestic emissions is missed only by the amount of the increase in domestic emissions resulting from the adjustments.

18. For further discussion, see Michael O. Moore, *Implementing Carbon Tariffs: A Fool's Errand?* Working Paper IIEP-WP-2010-2 (George Washington University, Institute for International Economic Policy, June 2010), <http://tinyurl.com/poyrxgn> (PDF, 356 KB).

19. Those laws are in Title VII of the Trade Act, as added July 26, 1979, P.L. 96-39, as amended; codified at 19 U.S.C. §§1671–1677n. The most frequently used antidumping law provides for the imposition of duties on imports that are sold at a price below their cost of production or below the price at which the producer sells the good in its home market. The countervailing-duty law provides for duties on imports that have been subsidized by the producer's home government.

those goods are required to report to the ITA the information it needs to determine whether the imports are being dumped or subsidized and, if so, by how much. Using that information (and information obtained elsewhere), the ITA makes a determination. A similar arrangement might require producers of U.S. imports to report to the ITA or to another U.S. government agency the information needed to calculate the emissions embodied in those imports.

Two differences between enforcing the AD/CVD laws and implementing border adjustments for an emission-reduction policy could cause greater difficulties for the latter, however. First, investigations for AD/CVD law enforcement occur only for imports suspected of being dumped or subsidized, which constitute only a small fraction of all U.S. imports. By contrast, for border adjustments applied to all products, all firms producing U.S. imports and all significant suppliers of intermediate inputs to those firms would have to be investigated to determine the emissions embodied in U.S. imports—a much larger task.

Second, to create an incentive for firms under investigation to cooperate, U.S. AD/CVD laws stipulate that if a firm does not provide the necessary information within specified deadlines, the ITA may use “facts otherwise available” in its place. Such facts could be information supplied by the domestic U.S. industry that filed the AD/CVD case, which has an interest in having duties imposed on the imports with which it competes. Thus, the use of such facts may result in a dumping or subsidy determination that is larger than would be the case if it had been made on correct information supplied by the firm being investigated—which encourages the firm being investigated to provide such information. Provisions of the WTO’s Antidumping and Subsidies Codes explicitly allow governments to collect data from firms for the enforcement of AD/CVD laws, and they explicitly allow the use of facts otherwise available when the firms being investigated do not provide the necessary information.²⁰ However, the WTO agreements do not contain similar language that would apply to collecting

information for border adjustments for an emission-reduction policy.

Approximating the Ideal by Treating All Firms in Each Industry of Each Foreign Country the Same. The implementing authority could simplify its task by assuming that all imports of a given product from a given country embody the same quantity of emissions even if different units of the product were produced by different firms in different locations. Under that assumption, the emissions embodied in imports could be calculated using input-output tables for the economies of the countries producing the imports. Entries in such tables indicate the quantity of inputs that each industry purchases from each other industry.

Using that procedure would entail several problems, however. First, even the most detailed input-output tables available are likely to mix together industries that are distinct in ways that could yield an inaccurate calculation for the purpose at hand. For example, such tables generally lump together electricity produced from nuclear power, which produces no GHG emissions, and electricity produced from the burning of coal, which produces substantial quantities of such emissions. As a result, calculating the emissions of any industry that uses electricity would attribute average emissions per unit of electricity of the whole electricity-generating sector to that industry even if the electricity the industry purchased was produced by a nuclear power plant and therefore embodied no emissions.

Second, some of the intermediate inputs that the foreign producers of imports used in their production would have been purchased from other countries. Therefore, the calculation would require an input-output table not only for each foreign producer’s country but also for each other country from which that producer purchased significant quantities of intermediate inputs. Using input-output tables from several countries for one calculation may be difficult because the tables are likely to divide their respective economies in different ways, with the industry definitions used in a given table overlapping only partially with those used in other tables.

Third, even in industrialized countries like the United States, input-output tables—especially detailed ones—take so long to produce that the most recent ones are likely to be five or more years out of date, possibly leading to inaccurate estimates for rapidly growing

20. Article 6.8 of the Agreement on Implementation of Article VI of the General Agreement on Tariffs and Trade 1994, 1868 U.N.T.S. 201; and Article 12.7 of the Agreement on Subsidies and Countervailing Measures, April 15, 1994, Marrakesh Agreement Establishing the World Trade Organization, Annex 1A, 1867 U.N.T.S. 14.

industries. And finally, the procedure might be successfully challenged in the WTO (as discussed below).

Making Adjustments Only for Selected Products. Another way to simplify the task of determining the emissions embodied in imports would be to impose border adjustments only on selected imports that embody large quantities of emissions. Limiting the adjustments to primary products, such as steel and other metals, might also alleviate problems with making determinations about emissions because many of the firms producing such products would probably purchase fewer intermediate goods than would other firms, many of which use primary products (or products made from them) as intermediate inputs.

Making Adjustments Based on Direct Emissions Only. Still another simplification would be to base the adjustment for each import only on the greenhouse gases emitted directly by the firm that produced the imported good (and perhaps the emissions attributable to the electricity the firm used) and not on the emissions embodied in intermediate inputs. If the adjustment was based on the ratio of direct emissions to the value added by the firm—that is, the value of the product minus the value of intermediate inputs used to produce it—then the adjustment would be either slightly too high or slightly too low, depending on how that ratio compared with the same ratio for the intermediate inputs.

Such an adjustment would also make it easier for firms to take advantage of the system. For example, a firm that previously produced both a final product and its intermediate inputs might rearrange its production so that the intermediate inputs were purchased from a nominally independent firm, whose emissions would not count under the simplified procedure. As a result, the firm would face lower border adjustments.

Modifying Border Adjustments to Reflect Other Countries' Emissions Policies

Provisions in many cap-and-trade proposals have specified that border adjustments be lowered for imports from countries that have their own emission-reduction policies. The adjustments might have to be lowered if they are to be successfully defended from a challenge in the WTO. However, a provision for lowering the adjustments could make them much harder to implement because determining the amount by which the border

adjustments should be reduced for each country to reflect its own emission-reduction policy could be difficult.

For imports from a country that has a carbon tax or a cap-and-trade program covering all industries, determining the appropriate adjustment would not be particularly difficult. It would involve simply subtracting the carbon tax rate or the price of emission allowances in that country from the border adjustments that the United States would otherwise make for imports from the country.

However, determining the adjustment would be more difficult if the country's carbon tax or cap-and-trade program did not apply to all of its industries. Industries that were not directly covered by the emission-reduction policy might still have higher costs because they purchased inputs from the industries to which the program applies; hence, the United States could not simply reduce or eliminate its border adjustments for imports from the industries to which the foreign country's program applied and not do the same for other industries in that country. Instead, the United States would have to track the purchases of intermediate inputs by the various industries and thereby trace the amount by which the country's program raised those industries' costs.

Making the determination would be even more difficult for imports from countries whose emission-reduction programs were neither a carbon tax nor a cap-and-trade program but instead were a program of regulations or standards that were not market based. In almost all such cases, making a reasonably accurate determination would not be possible.

Potential Legal Challenges to Border Adjustments Under the GATT

One or more WTO member countries might view border adjustments as inconsistent with U.S. obligations under the GATT and might therefore challenge the adjustments in the WTO.²¹

21. One of the agreements to which all WTO members are signatories is the General Agreement on Tariffs and Trade 1994, April 15, 1994, Marrakesh Agreement Establishing the World Trade Organization, Annex 1A, 1867 U.N.T.S. 187 (GATT 1994). GATT 1994 consists of the General Agreement on Tariffs and Trade, Oct. 30, 1947, 55 U.N.T.S. 187 (GATT 1947), and various other GATT decisions, waivers, understandings, and provisions as noted in the text of GATT 1994.

One of the WTO agreements, the Dispute Settlement Understanding, lays out the procedures for settling trade disputes.²² The aggrieved country must first consult with the country imposing the offending policy to attempt to resolve the dispute. If the consultations fail, it may then challenge the policy by requesting that the WTO convene a dispute settlement panel. After hearing the arguments by both parties, the panel issues a ruling, which may be appealed to the Appellate Body for a final decision. If the final ruling is in favor of the challenging country, the Appellate Body can grant remedies to that country, such as requiring the defending country to withdraw the offending policy or authorizing the challenging country to retaliate by imposing trade restraints.

A number of years might pass before rulings in challenges of various countries' implementations of border adjustments make clear whether border adjustments for emission-reduction programs are consistent with the GATT and which particulars of such adjustments are consistent with the GATT and which are not.

Given the possibility that border adjustments would be challenged, CBO reviewed several legal analyses of them in the literature.²³ The analyses are based in part on rulings that have been issued in previous disputes. Decisions by dispute settlement panels and the Appellate Body of the GATT and the WTO are made on a case-by-case basis and serve only as rough guides—not as binding law—for how a future dispute settlement panel or the Appellate Body would decide a similar dispute. Therefore, the literature's discussion of past decisions shows only the past treatment of similar GATT provisions; it does not necessarily predict future rulings of a dispute settlement panel or the Appellate Body. Analysis of the text of the WTO agreements and relevant jurisprudence is sufficiently complicated that an in-depth discussion of all of the issues that might arise is not possible in this report; the following discussion merely outlines some of the more likely issues. In addition, the discussion is based solely on the analyses that CBO reviewed and does not reflect any independent legal analysis by CBO.

On the basis of that review, it appears that border adjustments would probably violate a general provision of the

GATT, so they would have to be defended using one of the exceptions to the general provisions. Whether border adjustments could be successfully defended is unclear, and the likelihood of a successful defense of them would depend on their design. For example, border adjustments for a cap-and-trade program could be more difficult to defend than those for a carbon tax. Simplifying implementation in certain ways, such as assuming that the emissions embodied in products were the same for all firms in a given industry and country, might make border adjustments more difficult to defend.

Conflicts With General Provisions of the GATT

Article II:1(b) of the GATT prohibits each member country from imposing import tariffs or other charges that are higher than upper limits (called tariff bindings or bounds) listed in a schedule agreed to by that country and annexed to the agreement.²⁴ Almost all U.S. tariffs are at or near their bindings, so border adjustments in the form of tariffs or other charges on imports would make the total of tariffs and other charges on many U.S. imports higher than the bindings the United States has agreed to and thus would violate Article II:1(b).

22. Understanding on Rules and Procedures Governing the Settlement of Disputes, April 15, 1994, Marrakesh Agreement Establishing the World Trade Organization, Annex 2, 1869 U.N.T.S. 401.

23. See Larry Parker and Jeanne J. Grimmer, *Climate Change: EU and Proposed U.S. Approaches to Carbon Leakage and WTO Implications*, CRS Report for Congress R40914 (Congressional Research Service, April 12, 2010); Joost Pauwelyn, *U.S. Federal Climate Policy and Competitiveness Concerns: The Limits and Options of International Trade Law*, Working Paper NI WP 07-02 (Duke University, April 2007), <http://tinyurl.com/poyrxgn>; Jason E. Bordoff, "International Trade Law and the Economics of Climate Policy: Evaluating the Legality and Effectiveness of Proposals to Address Competitiveness and Leakage Concerns," in Lael Brainard and Isaac Sorkin, eds., *Climate Change, Trade, And Competitiveness: Is a Collision Inevitable?* (Brookings Institution Press, 2009), <http://tinyurl.com/cxwfhf4>; Gary Clyde Hufbauer, Steve Charnovitz, and Jisun Kim, *Global Warming and the World Trading System* (Peterson Institute for International Economics, March 2009), <http://tinyurl.com/bnm3ovd>; Robert Howse and Antonia Eliason, "Domestic and International Strategies to Address Climate Change: An Overview of the WTO Legal Issues," in Thomas Cottier, Olga Nartova, and Sadeq Z. Bigdeli, eds., *International Trade Regulation and the Mitigation of Climate Change* (Cambridge University Press, 2009), Chapter 4, <http://tinyurl.com/p5upkoj>; and Andrew Green, "Climate Change, Regulatory Policy and the WTO: How Constraining Are Trade Rules?" *Journal of International Economic Law*, vol. 8, no. 1 (March 2005), pp. 143–189, <http://jiel.oxfordjournals.org/content/8/1/143>.

24. Unless otherwise specified, "Articles" refer to Articles of GATT 1947, as modified, amended, or interpreted upon integration into GATT 1994.

Cap-and-trade proposals, however, have typically included provisions for border adjustments based on emission allowances. Article XI:1 of the GATT proscribes prohibitions and quantitative restrictions on imports. A prohibition on imports for which the importer does not have emission allowances conceivably could be ruled as a violation of that provision. Alternatively, the requirement could be ruled as not violating that provision because the allowances could be purchased and the imports therefore are not actually prohibited. However, such reasoning might imply that the requirement is effectively a charge on the imports and therefore violates Article II:1(b).²⁵

Possible Defenses

Whether adjustments took the form of tariffs or a requirement of allowances for imports, a general provision of the GATT would probably be violated, so border adjustments would have to be defended using an exception to the general provisions of the GATT. Two exceptions that could be useful in a defense are contained in Article II:2(a) and Article XX.

Article II:2(a) Defense. Notwithstanding the general prohibition in Article II:1(b) on tariffs and charges that are higher than the tariff bindings to which a country has agreed, Article II:2(a) provides that a country that imposes a tax internally on a domestically produced good can impose an equivalent tax on imports of “like” goods. That provision, for example, allows the European Union to impose its value-added tax on imports and to rebate it on exports.

Several issues would be likely to arise when asserting an Article II:2(a) defense of border adjustments for an emission-reduction policy. Foremost is whether the policy and the associated requirement of allowances for imports are “taxes” within the meaning of Article II:2(a). Strictly speaking, a cap-and-trade program and an associated requirement of allowances for imports are not taxes, but their effects are sufficiently similar to those of taxes that they conceivably could be treated as such. One analysis

that CBO reviewed states that “the general definition of a tax is a compulsory contribution imposed by the government for which taxpayers receive nothing identifiable in return.”²⁶ Although the requirement for emission allowances is not a contribution, it resembles one in the sense that firms must spend money to purchase them, which from the firms’ standpoint is like a contribution, and the firms receive nothing in return for the expenditure. Hence, the analysis argues, the requirement might qualify as a tax.

Another issue that would be likely to arise in the case of a cap-and-trade program is whether the program is still a tax if the government distributes some or all of the emission allowances for imports free of charge. If a firm did not have to purchase its required allowances, the requirement would not resemble a compulsory contribution and, therefore, would not appear to be a tax. However, not all firms are likely to be given the allowances they need; some firms would have to purchase at least some of their allowances. Moreover, the effects of a cap-and-trade program on the output and employment decisions of firms are mostly independent of whether the government sells the emission allowances or gives them away. A firm that receives the allowances it needs free of charge incurs a cost in using them for its own production because it thereby forgoes the revenue it could receive from selling them. Thus, the analysis argues, a cap-and-trade program might still be considered a tax even if the government gave the allowances away.

The legal analyses CBO reviewed indicate that, assuming that a dispute settlement panel and the Appellate Body considered an emission-reduction policy and associated border adjustments to be taxes on carbon emissions, several criteria would need to be met to successfully assert an Article II:2(a) defense. Some of the issues the analyses address involve process versus product taxes, the so-called national treatment requirement, and the so-called most-favored-nation requirement.

Is the tax on GHG emissions a process tax or a product tax?

A tax on emissions would seem to be a tax on the production process rather than on the product itself, whereas the phrase “in respect of the like domestic product” in Article II:2(a) would seem to suggest that only product taxes are eligible for that provision. Some analysts interpret the

25. Two analyses discuss the possibility of the allowance requirement for imports being considered as part of an internal regulation applied to all products sold domestically, whether domestically produced or imported, rather than as a tax or import prohibition. Such regulations must be consistent with Article III.4. See Pauwelyn, *U.S. Federal Climate Policy and Competitiveness Concerns*, pp. 23–27; and Parker and Grimmett, *Climate Change*, p. 50.

26. Pauwelyn, *U.S. Federal Climate Policy and Competitiveness Concerns*, pp. 21–22.

relevant jurisprudence as suggesting that taxes on inputs incorporated into a product would be ruled eligible but that taxes on inputs like energy that are consumed during production but not incorporated into the product would probably be ruled ineligible. If so, then a cap-and-trade program would most likely be ruled ineligible for the Article II:2(a) provision allowing an equivalent tax on imports of “like” goods. Other analysts, however, argue that the eligibility of energy taxes for border adjustments is unclear, and they present reasons to think that such taxes might be ruled eligible.²⁷

Do the policy and adjustments give national treatment to imports? That is, is the border tax on each imported good less than or equal to the emissions tax on the “like domestic product” as required by Article III:2 of the GATT?²⁸ The critical issue here is the meaning of like domestic product under WTO jurisprudence. In past cases, like products have been determined by their characteristics, and the processes used to produce them have been considered irrelevant. If that rule was used in assessing the border adjustments for a tax on GHG emissions, the adjustments might be found to violate the national treatment requirement in any case in which larger quantities of those gases were emitted in the production of an imported product than in the production of the like domestic product.²⁹ Such a finding would void a defense under Article II:2(a), which requires that the relevant tax be consistent with Article III.

Do the policy and adjustments adhere to the most-favored-nation requirement of Article I? Article I requires that imports of each product from each WTO member be treated no less favorably than imports of like products from every other member, a requirement commonly referred to as the most-favored-nation requirement. Thus, a country cannot charge one tariff on a product imported from one WTO member and another tariff on a like product imported from a different member.³⁰ Once again, the meaning of “like product” is critical because two otherwise identical products would require different

border adjustments if different amounts of greenhouse gases were emitted in their production. If those otherwise identical products were considered to be like products, then the most-favored-nation requirement would be violated, once again voiding an Article II:2(a) defense.

The requirement also would probably mean that border adjustments could not be reduced for imports from countries that had emission-reduction policies of their own. Countries that had their own carbon tax or cap-and-trade programs and disliked the terms of the U.S. policy would have to rebate their tax on, or the emission allowances required for the production of, the goods they export to the United States.

Article XX Defense. Article XX of the GATT is devoted to general exceptions to the provisions of the GATT. The most relevant exceptions for an emission-reduction policy with border adjustments are those contained in Article XX:(b) and Article XX:(g). The article’s introductory paragraph (also called the *chapeau* or proviso), and the two paragraphs in question, follow:

Subject to the requirement that such measures are not applied in a manner which would constitute a means of arbitrary or unjustifiable discrimination between countries where the same conditions prevail, or a disguised restriction on international trade, nothing in this Agreement shall be construed to prevent the adoption or enforcement by any contracting party of measures: . . .

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

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

Several analyses that CBO reviewed note that “relating to” is a less stringent standard than “necessary to” and therefore is more easily met.³¹ Hence, this discussion

27. See Hufbauer, Charnovitz, and Kim, *Global Warming and the World Trading System*, pp. 39–46, for a discussion of the issue.

28. Article II:2(a) stipulates that any domestic tax imposed at the border on imports must be consistent with Article III:2.

29. However, one analysis presents reasons that border adjustments might be found not to violate national treatment even using that rule for “like products.” See Pauwelyn, *U.S. Federal Climate Policy and Competitiveness Concerns*, p. 30.

30. Various provisions of the GATT contain exceptions to the most-favored-nation requirement. For example, Article XXIV allows for the creation of free-trade areas among WTO members.

31. Parker and Grimmer, *Climate Change*, p. 53; Pauwelyn, *U.S. Federal Climate Policy and Competitiveness Concerns*, p. 34; and Green, “Climate Change, Regulatory Policy and the WTO: How Constraining Are Trade Rules?” p. 44.

focuses on a defense based on Article XX:(g). According to the analyses that CBO reviewed, some issues a panel would be likely to consider in assessing such a defense are as follows:

- *Is the atmosphere an exhaustible natural resource?* Several analyses that CBO reviewed noted that clean air has previously been found to be an exhaustible natural resource.³² One analysis says that for the United States to prevail, the dispute settlement panel would have to find that a “sufficient nexus” exists between CO₂ emissions of the country challenging the border adjustment and consequences for the climate in the United States.³³
- *Are the border adjustments related to the goal of conserving that natural resource (that is, to mitigating warming of the atmosphere)?* According to one legal analysis, WTO panels have interpreted “relating to” to mean “primarily aimed at.”³⁴ That analysis argues that whether border adjustments would satisfy that test is unclear because estimates suggest that the leakage the adjustments address might be small even without them.
- *Does the adjustment comply with the requirement in the introductory paragraph of Article XX that the “measures are not applied in a manner which would constitute a means of arbitrary or unjustifiable discrimination between countries where the same conditions prevail, or a disguised restriction on international trade”?* According to one legal analysis that CBO reviewed, several prominent environmental cases in the WTO have turned on the introductory paragraph.³⁵ Similarly, another analysis says that in all cases for which an Article XX defense has failed before the Appellate

Body, it failed because the policy at issue was ruled to be contrary to that paragraph.³⁶

Several related issues could arise under the introductory paragraph.³⁷ First, the apparent purpose of the border adjustments would have to be a “rational connection” to the conservation goal and not an attempt to “level the playing field” to protect domestic industries.

Second, the United States would probably have to determine the border adjustments for each firm individually rather than for all firms from a given country as a group. Such detailed determinations would be very difficult to make, and simplifications to that task might be found to be unjustifiable. One analysis argues that lack of usable data on foreign emissions may raise questions about whether border adjustments can be applied in a nondiscriminatory fashion.³⁸

Third, the United States could not require that another country have an emission-reduction policy that was the same as or similar to the U.S. policy, or one that used a market mechanism, as a condition for not imposing border adjustments on the imports from the country. It could only require that the other country’s program be “comparable in effectiveness” to the U.S. policy.

Fourth, some legal analyses suggest that border adjustments might have to be reduced for imports from countries that have their own emission-reduction policies and perhaps for imports from some developing countries. Estimating the amount of such reductions would be difficult, especially for emission-reduction programs that consist of regulations or standards and are not market based.

Fifth, according to some analyses, WTO case law indicates that before imposing the adjustment the United States must have “serious, across-the-board negotiations” with countries that would be affected by the adjustments.

32. See, for example, Hufbauer, Charnovitz, and Kim, *Global Warming and the World Trading System*, p. 51, which cites Panel Report, *United States—Standards for Reformulated and Conventional Gasoline*, WT/DS2/R (Jan. 29, 1996), paragraph 6.37.

33. Pauwelyn, *U.S. Federal Climate Policy and Competitiveness Concerns*, p. 35, which cites Appellate Body Report, *United States—Import Prohibition of Certain Shrimp and Shrimp Products*, WT/DS58/RW/AB (Oct. 12, 1998), paragraph 133.

34. Bordoff, “International Trade Law and the Economics of Climate Policy,” p. 50.

35. *Ibid.*, p. 51.

36. Pauwelyn, *U.S. Federal Climate Policy and Competitiveness Concerns*, p. 37.

37. All except the fourth issue are discussed (in the same order) in Bordoff, “International Trade Law and the Economics of Climate Policy,” pp. 51–54. The fourth and fifth issues are mentioned in Pauwelyn, *U.S. Federal Climate Policy and Competitiveness Concerns*, pp. 38–40. The fifth issue is also mentioned in Green, “Climate Change, Regulatory Policy and the WTO,” p. 46.

38. Parker and Grimmett, *Climate Change*, p. 59.

Preserving Competitiveness With Transition Assistance

Instead of using border adjustments to preserve the competitiveness of U.S. firms, policymakers could consider providing transition assistance to reduce the decline in competitiveness that would result from a carbon tax or a cap-and-trade program. Transition assistance would be government aid provided to firms to reduce the costs of complying with an emission-reduction policy. If such aid was made contingent on the firms' levels of output or employment after the policy took effect, it would subsidize production and thereby tend to offset the effects that the policy would have on competitiveness and the consequent leakage and employment loss. It would also, however, cause a greater reduction in the effectiveness of the policy at reducing emissions than would be caused by border adjustments. Such assistance would probably be easier to implement than border adjustments because of differences in availability of the necessary data, but like border adjustments it might engender problems in the WTO.

Transition Costs and Transition Assistance

Even in the absence of trade, an emission-reduction policy would lead to a contraction of some industries or firms and consequent losses to their stockholders and employees. The costs could be high during the transition to the new lower levels of output and consumer demand for certain products. During that period, industries would incur the cost of retooling their factories to reduce their emissions, and their carbon tax payments or costs of purchasing emission allowances would be particularly high until the retooling was complete. Employees who were laid off would probably experience a period of unemployment as they searched for new employment.

To alleviate transition costs, some proposals for economy-wide policies that would impose a price on emissions have contained provisions for transition assistance to firms that would be severely affected. Such assistance might take the form of direct monetary payments or tax credits for retaining certain levels of output or employment (in the case of a carbon tax) or free emission allowances from the government in proportion to the emissions a firm had before the policy went into effect (in the case of a cap-and-trade program).

Implications for Competitiveness

If transition assistance was tied to the level of output or the number of workers that a firm continued to employ

after an emission-reduction policy went into effect, it would offset the negative effects that the policy would have on the international competitiveness of U.S. emission-intensive industries by effectively subsidizing firms' output or employment. Such assistance would aid the stockholders and the employees of emission-intensive firms, and, in principle, could be designed to completely eliminate those negative effects. However, in doing so, it would also eliminate the incentive that the emission-reduction policy would otherwise create for consumers to reduce their purchases of emission-intensive products. Firms would still have an incentive to reduce the emission intensity of their production, but eliminating the incentive for consumers would make the emission-reduction policy less effective. As a result, less emission reduction would be achieved under a carbon tax, and the cost of meeting the emissions cap in a cap-and-trade program would be higher.

If the assistance was not made contingent on continued production or employment levels by the firm or industry, however, it would not affect firms' international competitiveness or help their employees; it would only ameliorate the effects of the policy on the stockholders of the firms receiving the assistance. Specifically, assistance that was not contingent on production or employment levels would not affect firms' decisions concerning how much to produce, how many workers to employ, or the prices to charge for their products. That would be the case for direct payments because such payments would not change the fact that raising the level of production would increase a firm's carbon tax bill. And that would be the case for free emission allowances because such allowances would not change the fact that raising the level of production would increase the revenue a firm would forgo by not being able to sell the corresponding allowances. Thus, firms would face the same cost trade-off in making their production decisions whether they received such transition assistance or not.

Practical Difficulties

The practical difficulties of providing transition assistance would probably be considerably less than those for border adjustments. The reason is that, unlike the case for border adjustments, most of the necessary data generally would be available in the United States, and domestic firms would have an incentive to provide those data. Even so, if such assistance were provided to all firms in proportion to their emissions before the emission-reduction policy went into effect (rather than just to

firms that had substantial emissions), it would be a large and potentially costly undertaking.

Constraints of the WTO Agreements

Direct payments to offset costs resulting from a carbon tax might be considered to be a subsidy. If some or all of the allowances in a domestic cap-and-trade program were given to firms free of charge by the government rather than being sold to them, they also might be considered to be a subsidy, in which case the program would be subject to the provisions of the Agreement on Subsidies and Countervailing Measures (ASCM). One of the legal analyses that CBO reviewed discussed that possibility.³⁹ That study suggested that whether providing allowances free of charge would be considered a subsidy under the terms of the ASCM was unclear and that no directly relevant jurisprudence existed, but that study concluded that free issuance would probably be ruled to be a subsidy. Another analysis similarly argued that if allowances were given out free of charge and were then sold by the recipients for profit, the ASCM would probably be implicated.⁴⁰

If the transition assistance was ruled to be a subsidy, it would be subject to restrictions contained in the ASCM. Article 3 of the ASCM would then prohibit assistance that was contingent on the amounts of producers' exports or on their use of domestically made rather than foreign-made intermediate inputs. Article 5 in Part III of the agreement would prohibit assistance that was specific to particular firms or industries and caused adverse effects to the interests of other members of the WTO. Adverse

effects include injury (such as lost sales) to a domestic industry, nullification or impairment of benefits accruing from the GATT, and serious prejudice.⁴¹ Making the assistance contingent on continued production or employment levels by firms receiving the assistance would create an incentive for increased production and thereby make a finding of adverse effects more likely. Finally, if the assistance was specific to particular firms or industries, Part V of the agreement would allow foreign countries to impose countervailing duties on their imports of the products of those firms if the imports injured or threatened injury to the countries' own industries.

Even so, a country could attempt to defend such subsidies on the grounds that they are intended to address environmental concerns. The ASCM previously contained a provision to allow for certain subsidies based on environmental adaptation. Although that provision has expired, one analyst argued that a country might contend that such an exception is still justified.⁴² The resolution of such a claim could take a long time and would ultimately depend on the WTO dispute resolution process. The length of time involved to resolve a challenge relative to the duration of the transition assistance itself would be a consideration in whether a challenge was likely to be made.

39. Hufbauer, Charnovitz, and Kim, *Global Warming and the World Trading System*, pp. 61–63.

40. Howse and Eliason, "Domestic and International Strategies to Address Climate Change: An Overview of the WTO Legal Issues," p. 56.

41. "Serious prejudice" is defined in Article 6 of the ASCM. The definition concerns effects on international trade, prices, or world market share that result from subsidization at ad valorem rates higher than 5 percent, subsidies to cover operating losses of an industry, subsidies to cover operating losses of an enterprise other than one-time nonrecurrent measures, or direct forgiveness of debt.

42. Bordoff, "International Trade Law and the Economics of Climate Policy," pp. 57–58.

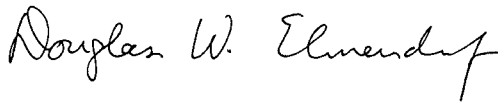
About This Document

This Congressional Budget Office (CBO) report, was prepared at the request of the Chairman of the Senate Committee on Energy and Natural Resources. In keeping with CBO's mandate to provide objective, impartial analysis, the report makes no recommendations.

Bruce Arnold of CBO's Microeconomic Studies Division prepared the report in collaboration with Kevin Perese of CBO's Tax Analysis Division and under the supervision of Joseph Kile and Chad Shirley. Terry Dinan, Mark Hadley, Andrew Stocking, and Rebecca Verreau, all of CBO, provided helpful comments, as did Lindsay Coleman, Juann Hung, and Jennifer Smith, all formerly of CBO.

Joseph Aldy of Harvard University, Rob Johansson of the Department of Agriculture (and formerly of CBO), Ross McKittrick of the University of Guelph, and Richard Morgenstern of Resources for the Future commented on earlier versions of the report. The assistance of external reviewers implies no responsibility for the final product, which rests solely with CBO.

Sherry Snyder (formerly of CBO) edited the report, and Jeanine Rees and Maureen Costantino prepared it for publication. An electronic version is available on CBO's Web site (www.cbo.gov/publications/44971).



Douglas W. Elmendorf
Director

December 2013