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CLIMATE CHANGE TRADE MEASURES

Estimating Industry Effects

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GAO-09-875T

Mr. Chairman and Members of the Committee:

Thank you for the opportunity to appear again before the Committee to provide insights from GAO's work on issues related to important international issues. Changes in the earth's climate attributable to increased concentrations of greenhouse gases may have significant environmental and economic impacts in the United States and internationally. To mitigate climate change effects, countries are taking or considering varying approaches to reducing greenhouse gas emissions, such as carbon dioxide, which is the most important greenhouse gas due to its significant volume. Between 2007 and 2009, Congress introduced a number of climate change bills, many of which contained proposals for a domestic emissions pricing system, such as a cap-and-trade system or a carbon tax. However, imposing costs on energy-intensive industries in the United States could potentially place them at a disadvantage to foreign competitors. In addition, emissions pricing could have negative environmental consequences, such as "carbon leakage," whereby emissions reductions in the United States are replaced by increases in production and emissions in less-regulated countries. As the Congress considers the design of a domestic emissions pricing system, a key challenge will be balancing the need to reduce greenhouse gas emissions with the need to address the competitiveness of U.S. industries.

In my testimony today, my comments are based on a report that we are issuing today to the Senate Committee on Finance.[1] In particular, I will briefly describe some of the key challenges associated with estimating the industry effects from climate change measures, and provide illustrations of key characteristics for potentially vulnerable industries.

To address these objectives, we interviewed officials and reviewed climate change literature and documents from U.S. agencies, international organizations, policy institutes, and professional organizations; reviewed and analyzed a selection of climate change legislation introduced between 2007 and 2009 and congressional hearing records; analyzed data from the Census Bureau and Departments of Energy and Commerce, among others; reviewed and presented

[1] GAO, CLIMATE CHANGE TRADE MEASURES: Considerations for U.S. Policymakers, GAO-09-724R, (Washington, D.C.: July 8, 2009).

summary results for studies attempting to quantify the potential international competitiveness effects on domestic industries from emissions pricing. We conducted our work from October 2008 to July 2009 in accordance with all sections of GAO's Quality Assurance Framework that were relevant to our objectives. We believe that the information and data obtained, and the analysis conducted, provide a reasonable basis for any findings and conclusions in this product.

Summary

Estimating the potential effects of domestic emissions pricing for industries in the United States is complex. If the United States were to regulate greenhouse gas emissions, production costs could rise for certain industries and could cause output, profits, or employment to fall. Within these industries, some of these adverse effects could arise through an increase in imports, a decrease in exports, or both. Estimates of adverse competitiveness effects are generally larger for industries that are both relatively energy and trade intensive. In 2007, these industries accounted for about 4.5 percent of domestic output. Estimates of the effects vary because of key assumptions required by economic models. For example, models generally assume a price for U.S. carbon emissions, but do not assume a similar price by other nations. In addition, the models generally do not incorporate all policy provisions, such as legislative proposals related to trade measures and rebates that are based on levels of production.

Proposed legislation suggests that industries vulnerable to competitiveness effects should be considered differently. Industries for which competitiveness measures would apply are identified on the basis of their energy and trade intensity. Most of the industries that meet these criteria are in primary metals, non-metallic minerals, paper, and chemicals, though significant variation exists for product groups (sub-industries) within each industry. Additional variation arises on the basis of the type of energy used and the extent to which foreign competitors' greenhouse gas emissions are regulated. To illustrate variability in characteristics that make industries vulnerable to competitiveness effects, we include illustrations of sub-industries within primary metals that meet both the energy and trade intensity criteria, examples that met only one criterion, and examples that met neither, but had significant imports from countries without greenhouse-gas pricing.

Background

Countries can take varying approaches to reducing greenhouse gas emissions. Since energy use is a significant source of greenhouse gas emissions, policies designed to increase energy efficiency or induce a switch to less greenhouse gas-intensive fuels, such as from coal to natural gas, can reduce emissions in the short term. In the long term, however, major technology changes will be needed to establish a less carbon-intensive energy infrastructure. To that end, a U.S. policy to mitigate climate change may require facilities to achieve specified reductions or employ a market-based mechanism, such as establishing a price on emissions. Several bills to implement emissions pricing in the United States have been introduced in the 110th and the 111th Congresses. These bills have included both cap-and-trade and carbon tax proposals. Some of the proposed legislation also include measures intended to limit potentially adverse impacts on the international competitiveness of domestic firms.

Estimating Competitiveness Effects

Estimating the effects of domestic emissions pricing for industries in the United States is complex. For example, if the United States were to regulate greenhouse gas emissions, production costs could rise for many industries and could cause output, profits, or employment to fall. However, the magnitude of these potential effects is likely to depend on the greenhouse gas intensity of industry output and on the domestic emissions price, which is not yet known, among other factors. Additionally, if U.S. climate policy were more stringent than in other countries, some domestic industries could experience a loss in international competitiveness. Within these industries, adverse competitiveness effects could arise through an increase in imports, a decrease in exports, or both.

For regulated sources, greenhouse gas emissions pricing would increase the cost of releasing greenhouse gases. As a result, it would encourage some of these sources to reduce their emissions, compared with business-as-usual. Under domestic emissions pricing, production costs for regulated sources could rise as they either take action to reduce their emissions or pay for the greenhouse gases they release. Cost increases are likely to be larger for production that is

relatively greenhouse gas intensive, where greenhouse gas intensity refers to emissions per unit of output. Cost increases may reduce industry profits, or they may be passed on to consumers in the form of higher prices. To the extent that cost increases are passed on to consumers, they could demand fewer goods, and industry output could fall.

While emissions pricing would likely cause production costs to rise for certain industries, the extent of this rise and the resulting impact on industry output are less certain due to a number of factors. For example, the U.S. emissions price and the emissions price in other countries are key variables that will help to determine the impact of emissions pricing on domestic industries. However, future emission prices are currently unknown. Additionally, to the extent that emissions pricing encourages technological change that reduces greenhouse gas intensity, potential adverse effects of emissions pricing on profits or output could be mitigated for U.S. industries.

Several studies by U.S. agencies and experts have used models of the economy to simulate the effects of emissions pricing policy on output and related economic outcomes. These models generally find that emissions pricing will cause output, profits or employment to decline in sectors that are described as energy-intensive, compared with business-as-usual. In general, these studies conclude that these declines are likely to be greater for these industries, as compared to other sectors in the economy. Some research suggests that not every industry is likely to suffer adverse effects from emissions pricing, however. For example, a long-run model estimated by Ho, Morgenstern, and Shih (2008) predicts that some U.S. sectors, such as services, may experience growth in the long run as a result of domestic emissions pricing.[2] This growth would likely be due to changes in consumption patterns in favor of goods and services that are relatively less greenhouse gas-intensive.

Potential international competitiveness effects depend in part on the stringency of U.S. climate policy relative to other countries. For example, if domestic greenhouse gas emissions pricing

[2] Ho, Mun S., Richard Morgenstern, and Jhih-Shyang Shih. (November, 2008) "Impact of Carbon Price Policies on U.S. Industry." RFF Discussion Paper No. 08-37, Resources for the Future, Washington, D.C.

were to make emissions more expensive in the United States than in other countries, production costs for domestic industries would likely increase relative to their international competitors, potentially disadvantaging industries in the United States. As a result, some domestic production could shift abroad, through changes in consumption or investment patterns, to countries where greenhouse gas emissions are less stringently regulated. For example, consumers may substitute some goods made in other countries for some goods made domestically. Similarly, investment patterns could shift more strongly in favor of new capacity in countries where greenhouse gas emissions are regulated less stringently than in the United States.

Stakeholders and experts have identified two criteria, among others, that are important in determining potential vulnerability to adverse competitiveness effects: trade intensity and energy intensity. Trade intensity is important because international competitiveness effects arise from changes in trade patterns. For example, if climate policy in the United States were more stringent than in other countries, international competition could limit the ability of domestic firms to pass increases in costs through to consumers. Energy intensity is important because the combustion of fossil fuels for energy is a significant source of greenhouse gas emissions, which may increase production costs under emissions pricing.

Legislation passed in June 2009 by the House of Representatives, H.R. 2454, 111th Cong. (2009), uses the criteria of trade intensity and energy intensity or greenhouse gas intensity, among others, to determine eligibility for the Emission Allowance Rebate Program that is part of the legislation.[3] H.R. 2454 specifies how to calculate the two criteria. Trade intensity is defined as the ratio of the sum of the value of imports and exports within an industry to the sum of the value of shipments[4] and imports within the industry. Energy intensity is defined as the industry's cost of purchased electricity and fuel costs, or energy expenditures, divided by the value of shipments of the industry.

[3] Proposed legislation specifies that, in addition to trade intensity, either energy intensity or greenhouse gas intensity should be considered. Since data on greenhouse gas intensity are less complete, we focus our analysis on industry energy intensity.

[4] An industry's value of shipments represents its value of output.

Reducing carbon emissions in the United States could result in carbon leakage through two potential mechanisms. First, if domestic production were to shift abroad to countries where greenhouse gas emissions are not regulated, emissions in these countries could grow faster than expected otherwise. Through this mechanism, some of the expected benefits of reducing emissions domestically could be offset by faster growth in emissions elsewhere, according to Aldy and Pizer (2009).[5]

Second, carbon leakage may also arise from changes in world prices that are brought about by domestic emissions pricing. For example, U.S. emissions pricing could cause domestic demand for oil to fall. Because the United States is a relatively large consumer of oil worldwide, the world price of oil could fall when the U.S. demand for oil drops. The quantity of oil consumed by other countries would rise in response, increasing greenhouse gas emissions from the rest of the world. These price effects may be a more important source of carbon leakage than the trade effects described above.

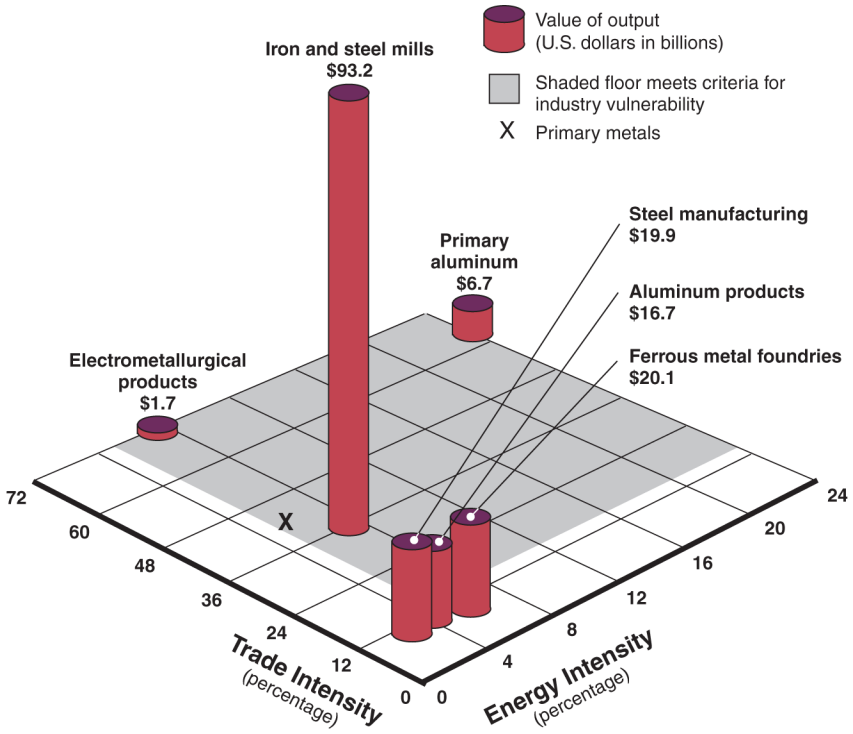
Potentially Vulnerable Industries

Two key indicators of potential vulnerability to adverse competitiveness effects are an industry's energy intensity and trade intensity. Proposed U.S. legislation specifies that: (a) either an energy intensity or greenhouse gas intensity of 5 percent or greater; and (b) a trade intensity of 15 percent or greater be used as criteria to identify industries for which trade measures or rebates would apply. Since data on greenhouse gas intensity is less complete, we focus our analysis on industry energy intensity. Most of the industries that meet these criteria are in primary metals, nonmetallic minerals, paper, and chemicals, yet there is significant variation in specified vulnerability characteristics among different product groups ("sub-industries").

[5] Aldy, Joseph E. and Pizer, William A. (May, 2009) "The Competitiveness Impacts of Climate Change Policies." Pew Center on Global Climate Change, Arlington, VA.

Although our report examined four industry categories, the following pages illustrate the variation among different sub-industries within the primary metals industry, as well as information on the type of energy used and location of import and export markets.[6] Data shown are for the latest year available.

Figure 1: Energy and Trade Intensity Indicators for Primary Metals Sub-Industry Categories



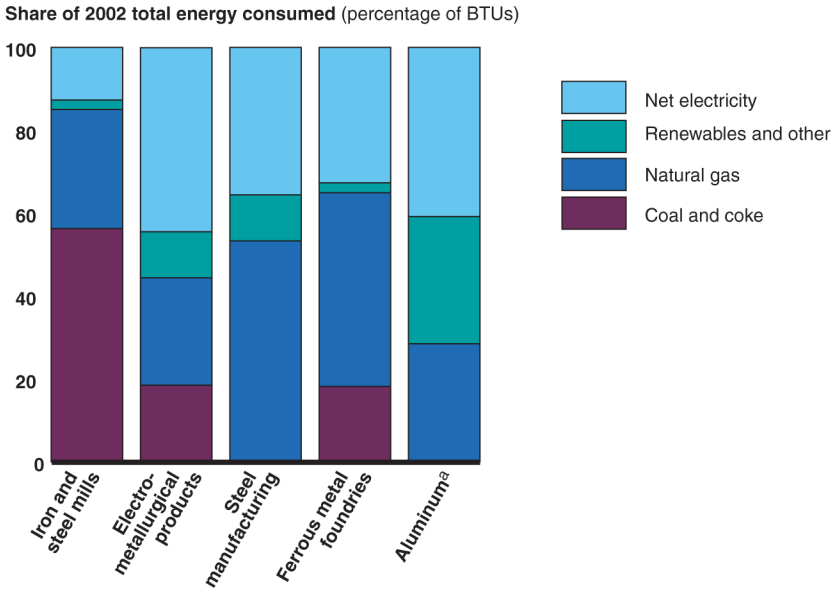
Source: GAO analysis of Department of Commerce energy data for 2006 and trade data for 2007.

As shown by sub-industry examples in figure 1, energy and trade intensities differ within primary metals. For example, primary aluminum meets the vulnerability criteria with an energy intensity of 24 percent and trade intensity of 62 percent. Ferrous metal foundries meets the energy intensity criteria, but not the trade intensity criteria. Steel manufacturing—products made from purchased steel— and aluminum products fall short of both vulnerability criteria. Iron and steel mills has an energy intensity of 7 percent and a trade intensity of 35 percent and is by far

[6] For examples in nonmetallic minerals, paper, and chemicals, as well as further information on data sources and our methodology, see GAO-09-724R.

the largest sub-industry example, with a 2007 value of output of over $93 billion. The energy and trade intensity for all primary metal products is denoted by the "x".

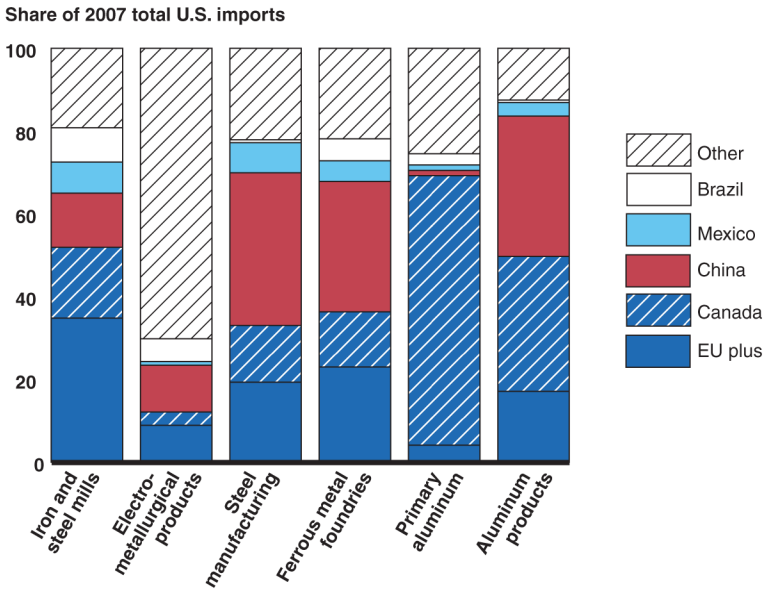
Figure 2: Type of Energy Used by Primary Metals Sub-Industry Categories



Source: GAO analysis of data from the Department of Energy.

Among the primary metals sub-industry examples shown in figure 2, types of energy used also vary. Iron and steel mills use the greatest share of coal and coke, and steel manufacturing and ferrous metal foundries use the greatest proportion of natural gas. Since coal is more carbon intensive than natural gas, sub-industries that rely more heavily on coal could also be more vulnerable to competitiveness effects. The carbon intensity of electricity, used heavily in the production of aluminum, will also vary on the basis of the source of energy used to generate it and the market conditions where it is sold. Data shown for "aluminum" include primary aluminum and aluminum products and net electricity is the sum of net transfers plus purchases and generation minus quantities sold.

Figure 3: Source of Imports for Primary Metals Sub-Industry Categories

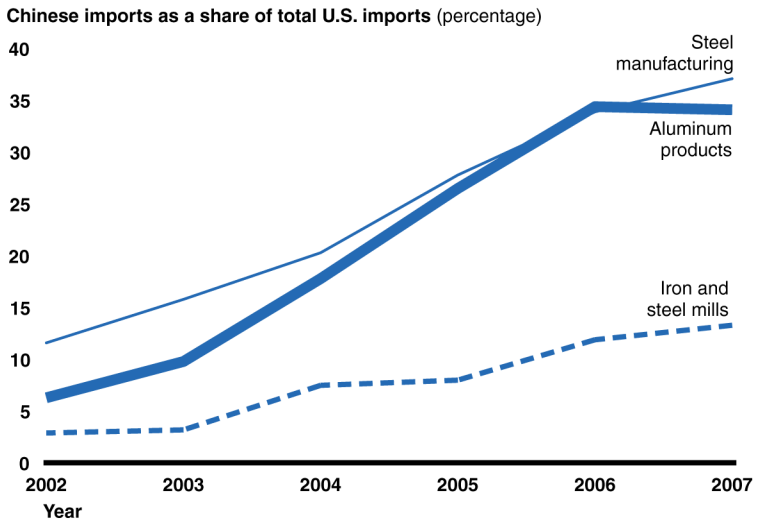


Source: GAO analysis of data from the Department of Commerce.

Industry vulnerability may further vary depending on the share of trade with countries that do not have carbon pricing. To illustrate this variability, figure 3 provides data on the share of imports by source, since imports exceed exports in each of the primary metals examples. As shown, while primary aluminum is among the most trade intensive, the majority of imports are from Canada, an Annex I country with agreed emission reduction targets.[7] For iron and steel mills, over one third of imports are from the European Union and other Annex I countries, not including Canada ("EU plus"). However, for iron and steel mills, almost 30 percent of imports are also from the non-Annex I countries of China, Mexico, and Brazil. While less trade intensive, steel manufacturing and aluminum products each has greater than one third of imports from China alone.

[7] Annex I countries are parties to the United Nations Framework Convention on Climate Change (UNFCCC) that are industrialized countries and were members of the Organization for Economic Cooperation and Development (OECD) in 1992 plus countries characterized as economies in transition.

Figure 4: Chinese Imports as Share of Primary Metals Sub-Industry Categories



Total U.S. imports by value (U.S. dollars in millions)						
Year	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**
Iron and steel mills	$12,558	10,808	23,355	25,131	33,060	30,445
Steel manufacturing	$1,110	1,184	1,792	1,884	1,916	1,822
Aluminum products	$498	549	718	913	1,209	1,183

Source: GAO analysis of data from the Department of Commerce.

As shown in figure 4, adverse competitiveness effects from emissions pricing could increase the already growing share of Chinese imports that exists in some of the sub-industries. Among the examples, iron and steel mills, steel manufacturing, and aluminum products exhibit a growing trade reliance on Chinese imports since 2002. This trend has largely been driven by lower labor and capital costs in China and, according to representatives from the steel industry, China has recently been producing 50 percent of the world's steel.

Conclusion

Mr. Chairman, this concludes my prepared statement. Thank you for the opportunity to testify before the Committee on some of the issues addressed in our report on the subject of Climate Change Trade Measures. I would be happy to answer any questions from you or other members of the Committee.