CHAPTER 9

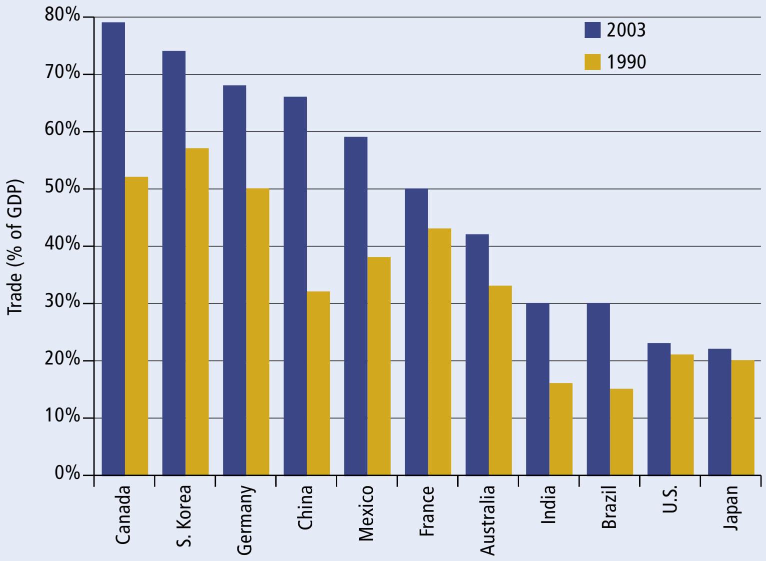
International Trade

Global trade in mining products (such as energy fuels, discussed in Chapter 8), manufactured goods, and agricultural products has increased remarkably over the past few decades. Since 1960, global trade has grown twice as fast as GDP, accounting for about 25 percent of world GDP in 1960 and about 50 percent in 2003.[76] Accordingly, the share of national economies comprised of imports and exports has in most cases increased dramatically over the past few decades. For instance, as of 2003, trade accounted for 66 percent of China's GDP (34 percent exports and 32 percent imports), compared to 32 percent in 1990 and 15 percent in 1980.[77]

Many of the top GHG emitting countries are now highly integrated into the world economy through imports and exports of goods and services (Figure 9.1). Among the most integrated are Canada, South Korea, and Germany, where trade (imports and exports) accounts for 78, 74, and 68 percent of GDP, respectively.[78] The countries in which trade accounts for smaller shares of GDP include Japan, the U.S., Brazil, and India, where trade is between 22 and 30 percent of GDP.[79]

These trends have implications for understanding GHG emissions, given that trade flows include many products that are GHG-intensive. GHGs, discussed throughout this report, are generally measured at the *point of emissions*. Emissions data primarily reflect national production rather than consumption patterns. Certain traded goods—such as motor vehicles and household appliances—contribute to GHG emissions primarily through their use (post-manufacture). For these products, the prevailing GHG accounting system does not pose significant controversy, as the emissions are attributed to the user. On the other hand, some traded products—such as some chemicals—contribute significant GHG emissions during the manufacturing process itself. Products manufactured in China and exported to Japan, for instance, may have "embedded" emissions associated with the manufacturing process. These emissions, under prevailing methodologies, will be attributed to the producer (exporter) country. Thus, emissions may appear misleadingly low for countries that import large quantities of emission-intensive goods, such as chemicals or aluminum. Conversely, for countries that

Figure 9.1. **Trade and National Economies**
Selected countries



Sources & Notes: World Bank, 2005. Trade's share of GDP is the sum of the GDP shares for imports and exports (and therefore could exceed 100%). Data for Canada, Australia, and the U.S. is from 2002.

help satisfy, through exports, the market demand in other countries, emissions may appear unduly high.

Figure 9.2 shows how CO_2 emissions would change, for selected countries, if they were instead assessed in terms of consumption of manufactured goods, using the methodology developed by Ahmad (2003). The largest net outflows of CO_2 come from Russia, China and Canada, where consumption-based accounting reduces emissions by 16, 12, and 11 percent respectively. Emissions also decline in India and Australia. By contrast, Japanese, French, and South Korean emissions would be 17, 15, and 10 percent higher, respectively, when viewed through the lens of consumption rather than production. Emissions in Germany, the U.S., Brazil, and the United Kingdom also increase under this methodology. For industrialized countries as a whole, the results show a net increase in emissions when measured through consumption of about 5 percent.[80] Accordingly, as a whole, emissions from developing countries decline when adjusted for consumption and production.

These figures include only trade in energy-intensive manufactured goods. Similar issues arise for international trade in fossil fuels. As discussed in Chapter 8, cross-border flows of energy fuels are significant, especially for oil. Production-related GHG emissions—such as from gas flaring, gas venting, refining, and other transformation processes—are likewise significant and, under normal GHG accounting practices, are routinely attributed to the exporting rather than importing country. As with manufactured goods, industrialized countries are net energy importers.[81] Although the bulk of energy-related emissions occur in the importing country (through combustion), industrialized countries avoid significant quantities of emissions by importing—compared to the hypothetical scenario where all energy consumption is from domestic sources.[82] It follows that exporting-country emissions are higher due to their role in satisfying demand in other countries.

National-level effects of energy trade can sometimes be significant, as the cases of Norway and Canada illustrate. While 90 percent of Norway's oil and gas production is exported, the emissions associated with these exports constitute 35 percent of Norway's total energy-related emissions.[83] Thus, increased demand

Figure 9.2. **CO_2 Emissions from Production and Consumption**

	Domestic Production	Exports	Imports	Domestic Consumption	Difference (Cons. less Prod.)	
Country	———— $MtCO_2$ ————				**$MtCO_2$**	**%**
United States	5,421	289	552	5,684	263	5
China	3,068	463	102	2,708	-360	-12
Russia	1,440	256	24	1,208	-232	-16
Japan	1,100	102	289	1,287	187	17
Germany	866	193	254	927	61	7
India	672	74	24	623	-49	-7
United Kingdom	536	110	123	549	13	2
Canada	493	155	101	439	-54	-11
South Korea	364	75	113	402	38	10
France	355	86	139	408	53	15
Australia	279	47	31	263	-16	-6
Brazil	258	24	32	266	8	3

Sources & Notes: Ahmad, 2003. Data ranges from 1993 to 1998, and includes only CO_2 from fossil fuels.

in Europe for Norwegian oil and gas has significant impacts on Norway's emissions. Similarly, increases in Canadian exports of oil and gas (which constitute over half of domestic production) put upward pressure on Canada's emissions.[84]

Overall, the degree to which emissions differ under the alternative accounting methodologies depends in significant part on the volume and mix of traded products for individual countries. Additional information about trade flows in particular sectors—such as electricity, steel, aluminum, chemicals, and others—can be found in Part II of this report.

Implications for International Climate Cooperation

There are good reasons, such as clarity and simplicity, for basing GHG accounting on emissions within national borders. It would be practically infeasible to develop, refine, and implement a comprehensive new system of emissions accounting based on consumption rather than production. Such an approach would be complex, controversial, and probably not transparent to the broader policy community and public. Furthermore, a consumption-based system may have its own substantive shortcomings. For example, it is debatable whether producers of GHG-intensive products should be absolved of responsibility for production-related emissions on the grounds that the products were consumed elsewhere.

Nevertheless, examining the role of trade and changes in international markets can enhance the overall understanding of the forces driving national emissions patterns, and may also be relevant for domestic and international policy-making. For instance, production and consumption differences may be an additional factor to be considered in differentiating future emission targets. At the very least, failure to acknowledge the trade effects on emissions may create political challenges for particular policies or proposals that, implicitly or explicitly, attach value judgments to national emissions levels, such as through cross-country comparisons. In some cases, it may be that special treatment is warranted to address inequities arising from the inability of prevailing measurement systems to account for trade-related effects. For example, following the U.S. announcement that it would not become party to the Kyoto Protocol, the government of Canada suggested that its "clean energy exports" to the U.S. ought to merit special consideration under the Protocol's accounting rules.

Other possibilities also exist. Partnerships between importers and exporters, perhaps in particular carbon-intensive sectors or products, could help address the issues raised above. Likewise, policy approaches might be developed that create incentives for producers to consider the downstream effects of the fuels or emissions-intensive products they produce (value-chain analysis).