



Economic Development and the Risk of Global Climate Change

Since the industrial revolution, **economic development** has been accompanied by growth in the consumption of **fossil fuels**, with more and more coal, oil, and natural gas being burned by factories and electric power plants, motor vehicles, and households. The resulting carbon dioxide (CO₂) emissions have turned into the largest source of **greenhouse gases**—gases that trap the infrared radiation from the earth within its atmosphere and create the risk of global warming. Because the earth's environmental systems are so complex, the exact timing and extent to which human economic activities will change the planet's climate are still unclear. But many scientists believe that the changes are already observable.

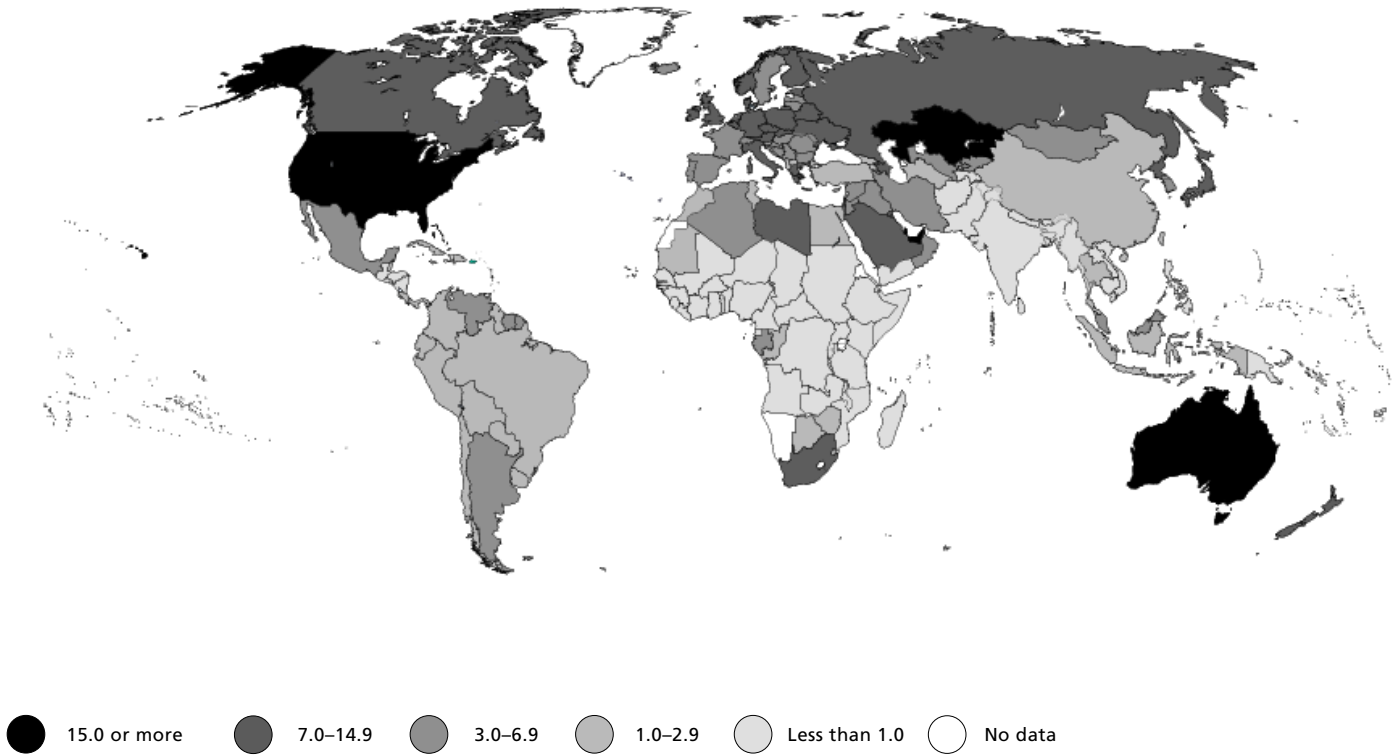
According to the 1995 report of the Intergovernmental Panel on Climate Change, by 2100 the mean global temperature could increase by 1.0–3.5 degrees Celsius and the global sea level could rise by 15–95 centimeters if current trends in greenhouse gas emissions continue. Though these may seem like minor changes, they could have multiple adverse consequences, along with some uncertain benefits. Forests and other ecosystems, unable to adapt to changing temperatures and precipitation patterns, may be damaged. People are also likely

to suffer—and those in poor countries may suffer the most, being less prepared to cope with the changes.

Many developing countries in arid and semiarid regions may see their access to safe water worsen. (As things stand today, more than 1 billion people lack access to safe water.) Tropical diseases may spread farther to the North, and flooding will likely become a bigger problem in temperate and humid regions. While food production could become easier in middle and high latitudes, in the tropics and subtropics yields will likely fall. Large numbers of people could be displaced by a rise in the sea level—including tens of millions in Bangladesh alone, as well as entire nations inhabiting low-lying islands such as those in the Caribbean.

The amount of carbon dioxide a country emits into the atmosphere depends mainly on the size of its economy, the level of its **industrialization**, and the **efficiency** of its energy use. Even though **developing countries** contain most of the world's population, their industrial production and energy consumption per capita are relatively low. Thus until recently there has been little doubt that the primary responsibility for creating

Map 15.1 Carbon dioxide emissions per capita, 1992 (metric tons)



the risk of global warming lies with **developed countries** (Map 15.1; Figures 15.1 and 15.2).

The United States is the largest contributor to global warming. Although it contains just 4 percent of the world’s population, it produces almost 25 percent of global carbon dioxide emissions. *Russia was recently replaced by China as the second largest emitter, but on a per capita basis it is still far ahead of China (see Figures 15.1 and 15.2). Russia’s high per capita carbon dioxide emissions are explained not only by its high level of*

*industrialization: it is also because many Russian enterprises use technologies that are older and “dirtier” than those normally used in developed countries. Extremely inefficient energy use is also one of the Russia’s biggest economic problems. Measured in terms of **gross domestic product (GDP)** per unit of energy use, energy efficiency in Russia is more than 5 times lower than in the United States and more than 12 times lower than in Japan. Only four countries are less energy efficient than Russia—and all are former members of the Soviet Union (see Data Table 4).*

Figure 15.1 Commercial energy use and carbon dioxide emissions per capita, early 1990s

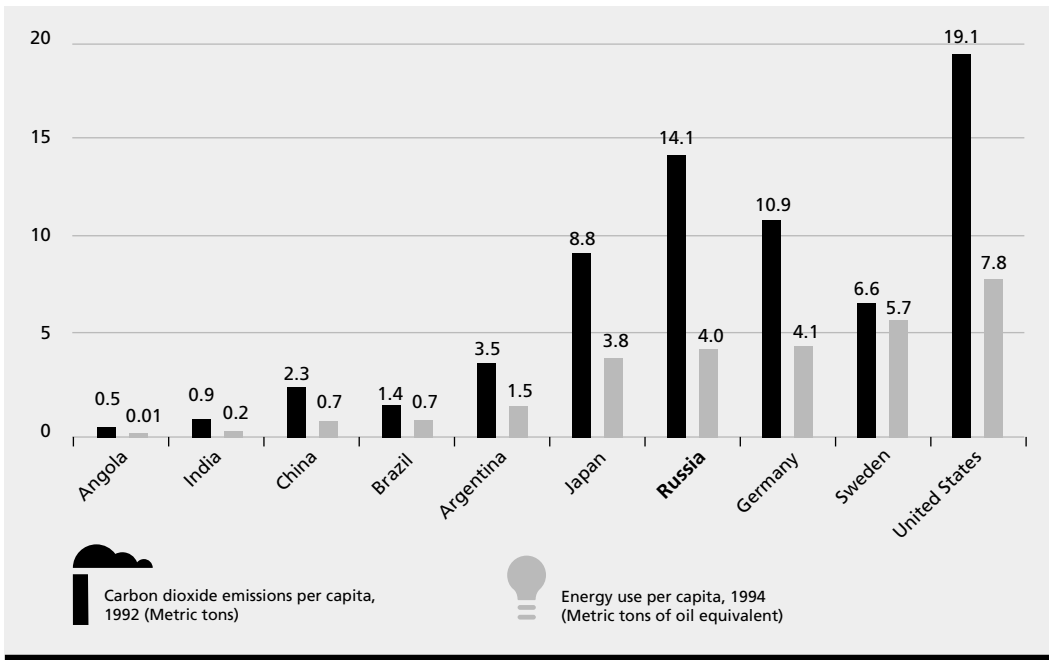
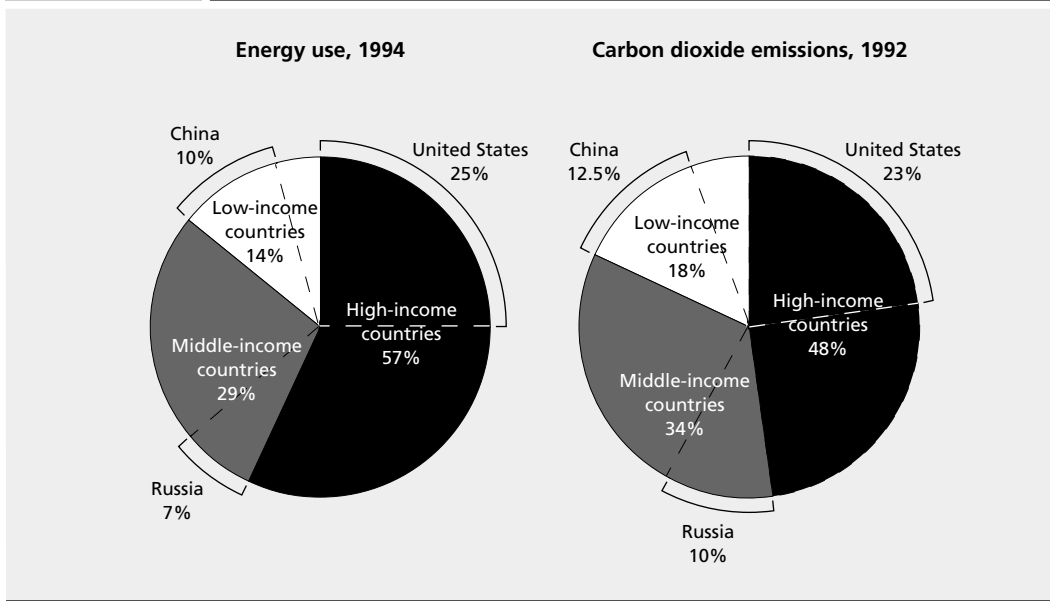


Figure 15.2 Shares of world energy use and carbon dioxide emissions by country income group, early 1990s



The link between **economic growth** and increased energy consumption—accompanied by increased carbon diox-

ide emissions—is direct and positive for **low- and middle-income countries**. But at high income levels, there are signs

of lower per capita energy consumption and pollution despite economic growth (see Data Table 4). This occurs because energy use becomes more efficient and environmentally cleaner technologies are introduced. In addition, a higher-income economy usually includes a proportionately larger service sector, which is less energy-intensive than industry (see Chapter 9).

Germany sets the example for other developed countries in this regard: between 1980 and 1992 its per capita energy use has dropped 11 percent and its per capita carbon dioxide emissions almost 20 percent. In the United States during the same period, per capita energy consumption was stable and per capita carbon dioxide emissions fell about 6 percent. But these changes were not sufficient to stop the growth of carbon dioxide emissions by **high-income countries** or to slow the growth of global emissions (see Data Table 4). To prevent global climate change, concerted efforts are needed from the governments of most countries.

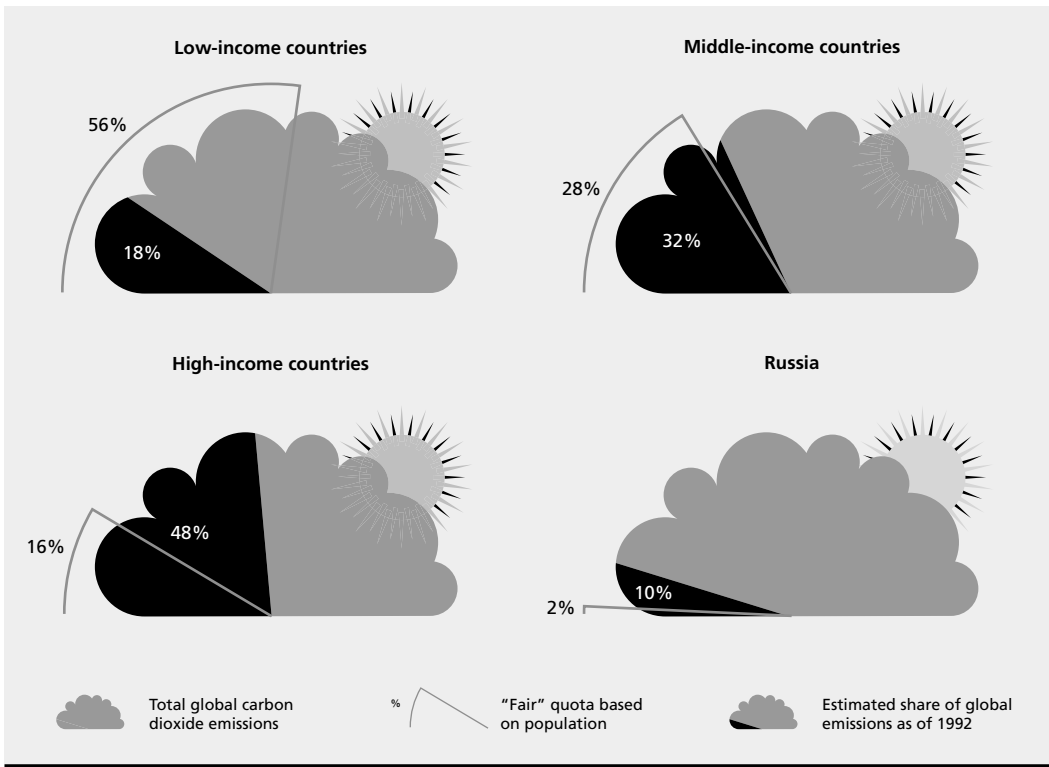
At the 1992 Earth Summit in Rio de Janeiro (Brazil), developed nations agreed to work toward stabilizing their greenhouse gas emissions at 1990 levels by 2000. By the time representatives of 165 countries had gathered in Kyoto (Japan) for the United Nations Conference on Climate Change in 1997, it was clear that many—including the

United States—were falling short of that target. The Kyoto Protocol, adopted at the conference, is meant to be legally binding and calls on all wealthy nations to reduce greenhouse gas emissions by 6–8 percent below 1990 levels by 2012.

This agreement is considered the most ambitious global environmental undertaking in history—even though developing countries' participation in it was postponed. Most developing countries refuse to commit to reducing greenhouse gas emissions, arguing that these commitments would undermine their economic development and impede poverty alleviation. *At the same time, a number of countries with transition economies have joined in the efforts of developed countries. For example, Russia and Ukraine have vowed not to exceed their greenhouse gas emissions of 1990, while Hungary and Poland have promised to go 6 percent below these levels.*

Developed countries are expected to take the lead in preventing global climate change even though in less than 20 years developing countries will likely surpass them as the main emitters of carbon dioxide. But it will take much longer than 20 years for per capita energy consumption in developing countries to become comparable to that in today's developed countries. So, in terms of fairness, today's poor countries have every right to continue polluting the atmosphere. But is it wise for them to follow a

Figure 15.3 What if the right to emit carbon dioxide were based on population size?



model of development that has already proven unsustainable? And is it true that environmental concerns cannot be addressed without impeding poor countries' economic growth? Many analysts believe that the sooner these countries take advantage of cleaner production technologies and more efficient ways of generating and using energy, the better it will be for their long-term development prospects.

Assume, for the sake of fairness, that every person on earth has an equal right

to the atmosphere as a resource. In that case carbon dioxide emission quotas for countries would be determined by population size. Low-income countries would not yet have reached their quotas and would have the right to continue emitting carbon dioxide. But middle- and high-income countries would already have exceeded their quotas (compare Figures 2.2 and 15.3). *And Russia would be among the worst violators: with just 2 percent of the world's population, it produces 10 percent of the world's carbon dioxide emissions.*