

Grossman and Krueger found this inverted U in a number of countries. Economic historians remind us that in the heyday of industrialization, northern England suffered from serious air pollution. Some of you may recall the description of air pollution in nineteenth-century English novels such as Elizabeth Gaskell's *North and South*.

If environmental pollution eventually declines as growth brings rising per-capita incomes, why should we be worried? First, as Grossman and Krueger point out, the inverted U represents historical experience, but it is not inevitable. In particular, if public opinion moves governments and the economy at large toward technologies that reduce pollution, this requires an empowered populace and a responsive government. Here too we see the importance of institutions in growth. A second issue arises in cases in which high levels of current emissions produce irreversible outcomes. Some would argue that by the time nations such as China and Vietnam develop enough to reduce their emissions, it will be too late. Many believe that global warming is such an example.

Another important problem comes from pollution sources that move across country boundaries. Carbon emissions associated with global warming are one such by-product of increased industrialization. Other air pollution problems move across national borders as well. In the heyday of industrialization by the Soviet Union, prevailing winds blew much of the Soviet-produced pollution to Finland. Choices that countries make about levels of growth and levels of environmental control affect the well-being of other countries' populations. Nor is it easy for countries at different levels of GDP per capita to agree on common standards of environmental control. As we suggested previously, demand for clean air increases with income, when needs for food and shelter are better met. It should surprise no one who has studied economics that there are debates between developing countries and developed countries about optimal levels of environmental control. These debates are further complicated when we recognize the gains that consumers in developed economies reap from economic activity in the developing world. Much of the increased carbon emitted by Chinese businesses, for example, is associated with goods that are transported and traded to Europe and the United States. These consumers thus share the benefits of this air pollution through the cheaper goods they consume.

Much of Southeast Asia has fueled its growth through export-led manufacturing. For countries that have based their growth on resource extraction, there is another set of potential sustainability issues. Many of the African nations are in this category. Nigeria relies heavily on oil; South Africa and the Congo are large producers of diamonds and other gems. Extraction methods, of course, may carry environmental problems. Many people also question whether growth based on extraction is economically sustainable: What happens when the oil or minerals run out? The answer is quite complicated and depends in some measure on how the profits from the extraction process are used. Because extraction can be accomplished without a well-educated labor force, whereas other forms of development are more dependent on a skilled-labor base, public investment in infrastructure is especially important. To the extent that countries use the revenues from extraction to invest in infrastructure such as roads and schools and to increase the education and health of their populace, the basis for growth can be shifted over time. With weak institutions, these proceeds may be expropriated by corrupt governments or invested outside the country, and long-run sustainable growth will not result.

The question of whether the natural resource base imposes strong natural limits on growth has been debated since the time of Malthus. Malthus as early as the 18th century worried that population growth in England would outstrip the ability of the land to provide. In that period, technology provided an answer, facilitating output growth.

In 1972, the Club of Rome, a group of "concerned citizens," contracted with a group at MIT to do a study titled *The Limits to Growth*.³ The book-length final report presented the results of computer simulations that assumed present growth rates of population, food, industrial output, and resource exhaustion. According to these data, sometime after the year 2000 the limits will be reached and the entire world economy will come crashing down:

Collapse occurs because of nonrenewable resource depletion. The industrial capital stock grows to a level that requires an enormous input of resources. In the very process of that growth, it depletes a large fraction of the resource reserves available. As resource prices

³Donella H. Meadows et al., *The Limits to Growth* (Washington, D.C.: Potomac Associates, 1972).

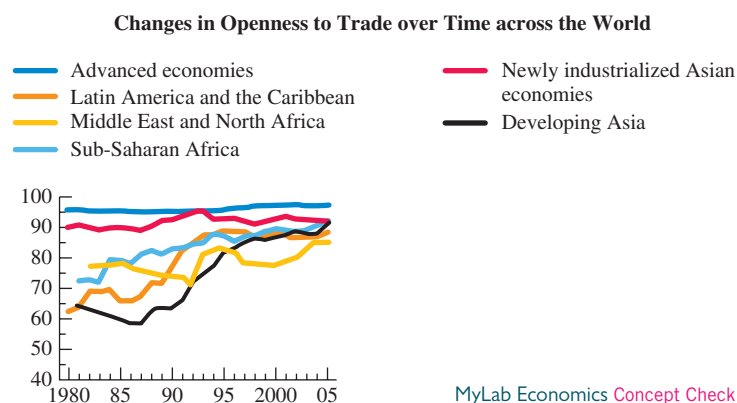
Nevertheless, the concern with global climate change has stimulated new thinking in this area. A study by the Tyndall Centre for Climate Change Research in Britain found that in 2004, 23 percent of the greenhouse gas emissions produced by China were created in the production of exports. In other words, these emissions come not as a result of goods that China's population is enjoying as its income rises, but as a consequence of the consumption of the United States and Europe, where most of these goods are going. In a world in which the effects of carbon emissions are global and all countries are not willing to sign binding global agreements to control emissions, trade with China may be a way for developed nations to avoid their commitments to pollution reduction. Some have argued that penalties could be imposed on high-polluting products produced in countries that have not signed international climate control treaties as a way to ensure that the prices of goods imported this way reflect the harm that those products cause the environment.³ Implementing these policies is, however, likely to be complex, and some have argued that it is a mistake to bundle trade and environmental issues. As with other areas covered in this book, there is still disagreement among economists as to the right answer.

Protection Safeguards Infant Industries Young industries in a given country may have a difficult time competing with established industries in other countries. In a dynamic world, a protected **infant industry** might mature into a strong industry worldwide because of an acquired, but real, comparative advantage. If such an industry is undercut and driven out of world markets at the beginning of its life, that comparative advantage might never develop.

infant industry A young industry that may need temporary protection from competition from the established industries of other countries to develop an acquired comparative advantage.

Yet efforts to protect infant industries can backfire. In July 1991, the U.S. government imposed a 62.67 percent tariff on imports of active-matrix liquid crystal display screens (also referred to as “flat-panel displays” used primarily for laptop computers) from Japan. The Commerce Department and the International Trade Commission agreed that Japanese producers were selling their screens in the U.S. market at a price below cost and that this dumping threatened the survival of domestic laptop screen producers. The tariff was meant to protect the infant U.S. industry until it could compete head-on with the Japanese.

Unfortunately for U.S. producers of laptop computers and for consumers who purchase them, the tariff had an unintended (although predictable) effect on the industry. Because U.S. laptop screens were generally recognized to be of lower quality than their Japanese counterparts, imposition of the tariff left U.S. computer manufacturers with three options: (1) They could use the screens available from U.S. producers and watch sales of their final product decline in the face of *higher-quality* competition from abroad, (2) they could pay the tariff for the higher-quality screens and watch sales of their final product decline in the face of *lower-priced* competition from abroad, or (3) they could do what was most profitable for them to do—move their production facilities abroad to avoid the tariff completely. The last option is what Apple and IBM did. In the end, not only were the laptop industry and its consumers hurt by the imposition of the tariff (due to higher costs of production and to higher laptop computer prices), but the U.S. screen industry was hurt as well (due to its loss of buyers for its product) by a policy specifically designed to help it.



▲ **FIGURE 18.5** Trade Openness across the World (Index is 100 minus the average effective tariff rate in the region.)

³Judith Chevalier, “A Carbon Cap That Starts in Washington,” *New York Times*, December 16, 2007.