Could globalization trigger an environmental “race to the bottom” in which competition for investment and jobs relentlessly degrades environmental standards? Because billions of people subsist on less than U.S. $2 a day, it would be cavalier to dismiss this threat lightly. Indeed, the race-to-the-bottom model provokes widespread concern because its underlying assumptions have an air of plausibility.¹ In the race-to-the-
bottom world, decent environmental standards impose high costs on polluters in high-income economies. To remain competitive, these firms relocate to low-income countries whose people are desperate for jobs and income. Local governments ignore regulations in order to promote investment and economic growth, allowing businesses to minimize costs by polluting with impunity. Driven by shareholders to maximize profits, international firms follow suit. Rising capital outflows force governments in high-income countries to begin relaxing environmental standards, but this proves fruitless because the poorest countries have no environmental standards at all. As the ensuing race to the bottom accelerates, all countries converge to the hellish pollution levels that afflict the poorest.

Proponents of this catastrophe model have a straightforward preventive recommendation: high, globally uniform environmental standards and, for countries that are unwilling or unable to enforce them, tariffs or other restrictions on imports of their pollution-intensive products that neutralize their cost advantage as pollution havens. Proponents of free trade naturally view these prescriptions as anathema, arguing that their main impact would be the denial of jobs and income to the world’s poorest people.

**Testing the Race-to-the-Bottom Model**

What does the evidence suggest? Pollution control does use scarce resources, so polluting activities in high-income economies have higher regulatory costs than in developing countries (Jaffe, Peterson, Portney, & Stavins, 1995; Mani & Wheeler, 1998). This creates a source of “comparative advantage” for the latter that might induce some highly polluting industries to relocate. Empirically, the question turns on whether differences in pollution control costs outweigh other locational considerations and whether internationally mobile activities actually pollute more in developing countries. Numerous studies have suggested that pollution control costs are not major determinants of relocation (Albrecht, 1998; Eskeland & Harrison, 1997; Janicke, Binder, & Monch, 1997; Levinson, 1997; Tobey, 1990; Van Beers & Van den Bergh, 1997) and that most Organisation for Economic Co-operation and Development (OECD)–
based multinationals maintain near-uniform environmental standards in their national and international plants (Dowell, Hart, & Yeung, 2000). However, the evidence also suggests that pollution havens can emerge in extreme cases (Xing & Kolstad, 1995). During the 1970s, for example, environmental regulation tightened dramatically in the OECD economies with no countervailing change in developing countries. The regulatory cost differential was apparently sufficient to generate a significant surge in production and exports of pollution-intensive products from developing countries. Since then, however, regulatory changes in the latter have narrowed the gap and apparently stopped the net migration of polluting industries. In the present, relatively stable situation, developing countries’ imports from high-income economies remain more pollution intensive than their exports to those economies (Albrecht, 1998; Mani & Wheeler, 1998).

A simpler, more direct test of the race-to-the-bottom model is also possible because the model yields such a simple, robust prediction: After decades of increasing capital mobility and economic liberalization, the race to the bottom should be under way, and pollution should be increasing everywhere. It should be rising in poor countries because they are pollution havens and in high-income economies because they are relaxing standards to remain cost competitive. Trends in available pollution data provide a reasonable basis for testing these propositions.

Climatic and economic factors cause pollution to vary considerably from year to year, so trend analysis requires an extended series of monitoring data. For comparison of environmental conditions in large urban regions, air pollution measures are generally more reliable and comparable than water pollution data. Among widely measured air pollutants, the international health community currently believes the most damaging to be suspended particulate matter (SPM; dust). Numerous health studies in low- and high-income countries have associated high concentrations of suspended particulates with higher than normal rates of death and illness from cardiopulmonary problems. Over time, health research has narrowed its focus from all SPM to particles less than 10 microns in diameter (PM-10) and, most recently, to particles whose diameters are less than 2.5 microns (PM-2.5). Atmospheric monitoring is adjusting to these findings, but PM-2.5 readings remain scarce in low-income countries. Because all particulate concentration measures are correlated, however, even SPM measures provide useful information about pollution that severely damages human health.

Air quality monitoring is routine in high-income countries, but it remains uneven in the developing world. China, Mexico, and Brazil provide notable exceptions. During the past two decades, these three rapidly industrializing countries have begun monitoring and reporting SPM, PM-10, and other forms of air pollution in a number of industrial centers. In addition, they had the top three shares of foreign direct
investment (FDI) among developing countries throughout the 1990s. China’s average share was 28%, and the averages for Mexico and Brazil were 9% and 7%, respectively. As Figure 1 shows, their combined share of FDI was nearly 60% of the total for developing countries in 1998. If the race-to-the-bottom model is correct, urban SPM and PM-10 levels should be rising in all three countries. In the United States, proponents of the race-to-the-bottom model have been particularly vocal about more liberal trade agreements with Mexico and China. It would seem reasonable to trace this concern to deteriorating air quality in U.S. cities because U.S. industrial imports from all three countries have been expanding for decades.

To test the race-to-the-bottom prediction, Figures 2 to 4 present SPM and PM-10 monitoring data along with FDI statistics for China, Mexico, and São Paulo State, which is Brazil’s dominant industrial region. For comparison, Figure 5 displays PM-10 monitoring data from five U.S. metropolitan areas (Los Angeles, Houston, Chicago, Atlanta, and New York). The Chinese series is the average annual SPM reading for more than 50 cities, reflecting the extensive coverage of China’s air monitoring network. The Mexican data reflect SPM readings in Mexico City, and the Brazilian data are drawn from PM-10 measures for the industrial region of Cubatão in São Paulo State. Mexico City is by far the largest industrial center in Mexico, and Cubatão has traditionally been a center for pollution-intensive industry in São Paulo. These two regions, along with Los
Angeles, suffer from geographic and climatic conditions that make them natural traps for air pollution.

The foreign investment data in Figures 1 to 4 provide a compelling picture of expansion in China, Mexico, and Brazil during the past two decades. However, Figures 2 to 5 show no sign of a race to the bottom; trends in particulate pollution are downward in all four countries. Despite China’s poverty and rapid industrialization, its major urban areas have experienced significant declines in SPM. During the period from 1987 to 1995, the average concentration fell from nearly 500 \( \mu g/m^3 \) to somewhat more than 300 \( \mu g/m^3 \). After rising in the early 1990s, Mexico City’s percentage of SPM readings above standards fell to historical lows in the latter part of the decade (the period during which NAFTA was implemented). In Cubatão, Brazil, the average PM-10 concentration fell from 155 \( \mu g/m^3 \) in 1984 to approximately 80 \( \mu g/m^3 \) in 1998. In the United States, PM-10 concentrations declined in all five metropolitan


3. Comparable PM-10 data for the São Paulo metropolitan area are not available. However, air quality reports from Companhia de Tecnologia de Saneamento Ambiental, São Paulo State’s Environmental Sanitation Agency, show that average SPM levels in São Paulo fell by 52% during the period from 1980 to 1995.
areas during the period from 1988 to 1997. The sharpest reduction (32%) was recorded in Los Angeles, the largest U.S. urban-industrial area in the region most affected by NAFTA.

These results strongly contradict the race-to-the-bottom model. Instead of racing toward the bottom, major urban areas in China, Brazil, Mexico, and the United States have all experienced significant improve-
ments in air quality. The improvements in Los Angeles and Mexico City are particularly noteworthy because they are the dominant industrial centers in the region most strongly affected by NAFTA.

Problems With the Race-to-the-Bottom Model

The race-to-the-bottom model’s basic assumptions must be flawed, because its predictions are inconsistent with urban air pollution trends in three of the developing world’s major industrial powers. In fact, empirical research has undermined all of these assumptions.

Pollution control is not a critical cost factor for most private firms. Research in both high- and low-income countries suggests that pollution control does not impose high costs on business firms. Jaffe et al. (1995) and others have shown that compliance costs for OECD industries are surprisingly small, despite the use of command-and-control regulations that are economically inefficient. These results suggest that differential pollution control costs do not provide OECD firms with strong incentives to move offshore. Firms in developing countries frequently have even lower costs because the labor and materials used for pollution control are less costly than in the OECD economies. Big polluters also have...
lower average control costs per unit of pollution because abatement is subject to scale economies. Figure 6 displays recent econometric estimates of control costs for sulfur dioxide (SO₂) air pollution in large Chinese factories (Dasgupta, Wang, & Wheeler, 1997). For non-state-owned enterprises, costs of a few dollars per ton are typical until control rates rise above 70%. As Figure 6 shows, state-owned enterprises have much higher costs because they are operated less efficiently. The average cost of pollution control has therefore declined as China has moved away from state ownership during the era of liberalization. In Colombia, a new pollution charge program has sharply reduced organic water pollution by large factories. Colombian factory managers have found that cleaning up is cheaper than paying charges, even when they are set at relatively low levels. No participating factory seems to have experienced financial difficulties in the process (Wheeler, 1999). Similar conclusions have emerged from studies of regulation and control costs in Malaysia (Jha, Markandya, & Vossenaar, 1999; Khalid & Braden, 1993).

4. Xu, Gao, Dockery, and Chen (1994) have shown that atmospheric SO₂ concentrations are highly correlated with damage from respiratory disease in China. SO₂ and other oxides of sulfur combine with oxygen to form sulfates and with water vapor to form aerosols of sulfurous and sulfuric acid. Much of the health damage from SO₂ seems to come from fine particulates (PM-2.5) in the form of sulfates.
Where formal regulators are present, communities use the political process to influence the strictness of enforcement. Where regulators are absent or ineffective, nongovernmental organizations (NGOs) and community groups (including religious institutions, social organizations, citizens’ movements, and politicians) pursue informal regulation based on convincing polluters to conform to social norms. Although these groups vary from region to region, the pattern everywhere is similar: Factories negotiate directly with local actors in response to threats of social, political, or physical sanctions if they fail to compensate the community or reduce emissions.

Indeed, communities sometimes resort to extreme measures when sufficiently provoked. In the *Asian Survey*, Robert Cribb (1990) recounted an Indonesian incident “reported from Banjaran near Jakarta in 1980 when local farmers burned a government-owned chemical factory that had been polluting their irrigation channels.” In a similar vein, Mark Clifford (1990) reported in the *Far Eastern Economic Review* that community action prevented the opening of a chemical complex in South Korea until appropriate pollution control equipment was installed.

When factories respond directly to communities, the results may bear little resemblance to the dictates of formal regulation. For example, Cribb (1990) also cited the case of a cement factory in Jakarta, Indonesia, that, without admitting liability for the dust it generates, “compenses local people with an ex gratia payment of Rp. 5,000 and a tin of evaporated milk every month.” Agarwal, Chopra, and Sharma (1982) described a situation in India where, confronted by community complaints, an Indian paper mill installed pollution abatement equipment, and to compensate residents for remaining damage, the mill also constructed a Hindu temple. If all else fails, community action can also trigger the physical removal of the problem. In Rio de Janeiro, Brazil, for example, a neighborhood association protest against a polluting tannery led managers to relocate it to the city’s outskirts (Stotz, 1991).

*Rising income strengthens regulation.* Countries regulate pollution more strictly as they get wealthier for three main reasons. First, pollution damage gets higher priority after rising wealth has financed basic investments in health and education. Second, higher income societies have stronger regulatory institutions because technical personnel are more plentiful, and budgets for monitoring and enforcement activities are more generous. Third, higher income and education empower local communities to enforce higher environmental standards, whatever stance is taken by the national government (Dasgupta & Wheeler, 1996; Pargal & Wheeler, 1996). The result is a very close relationship between
national pollution regulation and per capita income, as illustrated in Figure 7.  

Of course, regulation is only one determinant of pollution, which is the focus of this article. Numerous theoretical articles have explored the overall relationship between economic development and environmental quality (Gruver, 1976; John & Pecchenino, 1994; John, Pecchenino, Schimmelpfennig, & Schreft, 1995; Lopez, 1994; McConnell, 1997; Selden & Song, 1995). This theoretical work has focused particularly on establishing conditions for the existence of an environmental Kuznets curve (EKC) or "inverted-U" relationship between environmental quality and economic development. In the first stage of industrialization, pollution in the EKC world grows rapidly because regulation is weak, communities are too poor to pay for abatement, and people are far more interested in jobs and income than clean air and water. The balance

5. The measure of regulation in Figure 7 was developed from an analysis of country reports on environmental management submitted to the United Nations. For a detailed discussion, see Dasgupta, Mody, Roy, & Wheeler (2001).
shifts as income rises because leading sectors become cleaner, people value the environment more highly, and regulatory institutions become more effective and responsive to a greater demand for environmental quality. Along the curve, pollution levels off in the middle-income range and then falls toward preindustrial levels in wealthy societies. Numerous empirical studies have tested the EKC model by regressing cross-country measures of ambient air and water quality on various polynomial specifications of per capita income (Cole, Rayner, & Bates, 1997; Grossman & Krueger, 1995; Hettige, Lucas, & Wheeler, 1992; Holtz-Eakin & Selden, 1995; Horvath, 1997; Panayotou, 1993, 1995; Rock, 1996; Selden & Song, 1995; Shafik, 1994; Shafik & Bandyopadhyay, 1992; Stern, Auld, Common, & Sanyal, 1998). The regressions, typically fitted to cross-sectional observations, suggest turning points in the range of U.S. $5,000 to U.S. $8,000 for several air and water pollutants.

These EKC estimates contrast sharply with the implications of the race-to-the-bottom model as well as the findings reported in this article. The race-to-the-bottom model implies that existing EKC estimates are too optimistic because they suggest that developing countries will eventually reduce pollution by raising income. If a race to the bottom has begun, the conventional EKC is simply a snapshot of a dynamic process that will raise the income-pollution relationship to a horizontal line at the pollution level of the poorest, least regulated country.

In contrast, the results reported in this article suggest that conventional EKC estimates are too pessimistic. For example, the average urban pollution index for China cited in Figure 2 comes from a more detailed study cited in Wheeler (1999), which shows that particulate pollution has declined since 1987 in both the coastal cities (the main recipients of foreign investment) and the interior cities of the country’s northern region. According to recent World Bank data (expressed in constant 1995 U.S. dollars), China’s gross national product (GNP) per capita grew from U.S. $259 in 1985 to U.S. $711 in 1998. China’s apparent “turning point” for pollution (approximately U.S. $300) contrasts sharply with conventional EKC estimates in the range of U.S. $5,000 to U.S. $8,000. During the same period, the GNPs per capita of Brazil and Mexico have been in a range near U.S. $4,000. During a period of rapid reduction in urban air pollution, both countries have experienced modest income growth to a level that remains below the EKC’s conventional turning point range.

Local businesses control pollution because abatement reduces costs. Although public spirit moves a notable minority of firms to control pollution, most managers are bound by pressures from markets and shareholders. Through a variety of channels, regulatory and market forces induce managers to reduce costs by controlling pollution. Where formal

regulation is well developed, financial penalties for excessive pollution can include charges, fines, and revenue losses from plant closures. Where formal regulation is not present, local communities can exact penalties through political, social, and economic channels. Market agents can also play an important role. Bankers may refuse to extend credit because they are worried about liability; consumers may avoid the products of firms that are known to be heavy polluters. In response to these factors, cost-minimizing managers will reduce pollution to the point at which the marginal cost of abatement equals the marginal penalty for polluting.

Polluting emissions also reflect managers’ technology decisions. Pollutants are unmarketed production residuals whose disposal creates environmental damage. Improved technologies that waste fewer raw materials therefore have an environmental advantage that complements their cost advantage. In the OECD countries, innovations induced by stricter regulations have generated significantly cleaner technologies that are available at incremental cost to producers in developing countries. Even in weakly regulated economies, many firms have adopted cleaner technologies simply because they are more profitable. Empirical studies have shown that firms in relatively open developing economies adopt such technologies more quickly (Birdsall & Wheeler, 1993; Huq, Martin, & Wheeler, 1993).

Large multinational firms generally adhere to OECD environmental standards in their developing-country operations. Multinational firms operate under close scrutiny from consumers and environmental NGOs in the OECD economies. Although the influence of these groups is well known, recent research has suggested that investors also play an important role in encouraging clean production. Heavy emissions may signal to investors that a firm’s production techniques are inefficient. Investors also weigh potential financial losses from regulatory penalties and liability settlements. Several studies have confirmed that the U.S. and Canadian stock markets react significantly to environmental news, generating gains from good news and losses from bad news in the range of 1% to 2% (see Hamilton, 1995; Klassen & McLaughlin, 1996; Lanoie & Laplante, 1994; Lanoie, Laplante, & Roy, 1997; Muoghalu, Robison, & Glascock, 1990).

According to a recent study of toxic polluters (Konar & Cohen, 1997), firms whose bad press has the greatest impact on stock prices subsequently reduce emissions the most. Similar effects have been identified by recent research on new stock markets in Argentina, Chile, Mexico, and the Philippines (Dasgupta, Laplante, & Mamingi, 1997). In fact, the responses are much larger than those reported for U.S. and Canadian firms: Gains average 20% in response to good news and losses range from 4% to 15% in the wake of bad news.
Multinationals have responded to such factors. A recent study of 89 U.S.-based manufacturing and mining multinationals with branches in developing countries found that nearly 60% adhere to a stringent internal standard that reflects OECD norms, and the others enforce local standards (Dowell et al., 2000). Controlling for other factors (e.g., physical assets, capital structure), the study found that firms with uniform internal standards had an average market value U.S. $10.4 billion higher than their counterparts. To illustrate the implications for local environmental quality, Figure 8 reports results from a careful audit of Indonesian factories undertaken in 1995 (Afsah & Vincent, 1997). Almost 70% of domestic plants failed to comply with Indonesian water pollution regulations, whereas approximately 80% of the multinational plants were fully compliant.

**Implications of the Evidence**

A large body of evidence suggests that the predictions of the race-to-the-bottom model are inaccurate because its assumptions are not realistic. Although pollution control costs matter to factory owners and managers, they are generally not a critical factor in location decisions. In addition, emissions are strongly affected by the increased availability of clean technologies and the ubiquity of penalties for polluting. Even where formal regulation is weak or absent, local communities use numerous informal channels to penalize polluters when they suffer...
from severe environmental damage. At the national level, governments display a remarkably consistent tendency to tighten regulation as incomes grow. Within countries, regional differences in income and education also produce variations in community-based enforcement of environmental norms. Among multinationals, scrutiny from customers and investors has led the majority of firms to standardize their environmental performance on OECD norms. The rest subscribe to local norms, which rise over time with income.

In this more realistic view of the world, an environmental race to the bottom appears extremely unlikely. In fact, the converse appears to occur as “the bottom” rises with economic growth. The poorest societies persistently improve their environmental quality as investment increases employment and income. Mutually reinforcing feedback mechanisms at the local, national, and international levels produces increasing pressures for pollution control as societies develop.

Although the evidence suggests that globalization has been generally compatible with pollution reduction, several caveats are in order. First, to invert Keynes’s maxim, “in the short run, a lot of us might be dead.” Under rapid liberalization, a sudden increase of industrial investment could create pockets of severe pollution before national governments or local communities could respond effectively. This could occur even if “clean” multinationals expanded locally because domestic firms would also be attracted by increased production and export opportunities. Second, the findings on particulate pollution in this article may not hold for other damaging pollutants. Comparable monitoring data on water pollution, pollution from heavy metals, and other contaminants are still very scarce in developing countries. Recent research also suggests that the situation may be quite different for global pollutants such as carbon dioxide (CO₂) that have no direct impact on the emitting society. They may escape the regulatory forces whose effects on local pollution are described in this article. For example, the results of de Bruyn (1997) suggest that CO₂ emissions are positively affected by economic growth.

Third, the apparent absence of a race to the bottom in particulate pollution does not imply that globalization has not had a chilling effect on regulation. PM-10 readings have declined in U.S. cities since 1985, but they might have fallen more quickly in the absence of concerns about investment and jobs. Similarly, air quality improvements in China, Brazil, and Mexico might have been more rapid if policy makers had not been concerned about pollution abatement costs.7 These possibilities cannot be tested directly because they involve a counterfactual condition. Nevertheless, regulatory chill may well have retarded environmental progress.

7. My thanks to an anonymous referee for raising this issue.
Fourth, communities’ capacities to control pollution formally or informally depend on the quality of available information about emissions sources and damages. Some dangerous pollutants can be seen or smelled, but others cannot be detected without specialized equipment. So, information gaps may well lead to much higher levels of contamination than local communities would tolerate if they were better informed.

Fifth, globalization is almost certain to produce an increase in average pollution intensity (emissions/output) as developing countries increase their shares of world industrial production. High-income countries have stricter formal and informal regulations than low-income countries, so production in the latter has higher pollution intensity (on average; exceptions were noted in the previous section). To illustrate, Figure 9 summarizes a recent econometric result from a cross-country analysis of organic water pollution: Relative to the highest income countries, the poorest countries have an approximately tenfold differential in pollution intensity. The biggest improvements come relatively early in the growth process, as countries grow from approximately U.S. $500 per capita to U.S. $3,000 per capita. After that, the marginal improvements level off considerably (Mani & Wheeler, 1998). By implication, shifting a unit of production from a high-income country to a poor economy will substantially increase the pollution intensity of that unit.

The air monitoring data in Figures 2 to 5 reveal the consequences of differential pollution intensity. In the late 1990s, Cubatão’s PM-10 concentration was approximately 80 μg/m³, whereas PM-10 concentrations in most U.S. cities were below 30 μg/m³. After a decade of decline, China’s urban SPM readings were still approximately 300 μg/m³ in

Figure 9: Industrial Pollution Intensity and Economic Development
1995, far higher than readings in OECD cities. This differential may have created the mistaken view that globalization is creating a race to the bottom, even though air quality seems to be improving in countries at all income levels. If current trends continue, the bottom will continue to rise, and international average pollution intensities will begin to fall at some point in the future. The critical point for the globalization debate is that cities in developing countries have actually improved their environmental quality during a period of rapid liberalization and industrial growth.

**Conclusions and Policy Implications**

A large body of evidence suggests that for locally damaging air pollution at least, there will be no environmental race to the bottom for two main reasons. First, communities in developing countries are neither passive agents nor focused exclusively on material gain. Empowered with good information about the benefits and costs of environmental protection, they will act to protect their own interests. As their incomes and education levels improve, they will control pollution more strictly. Second, consumers and investors assign significant value to environmental performance, and if they are well informed, their market decisions will provide powerful incentives to reduce pollution. On both counts, the most plausible long-run forecast is for rising, not falling, environmental quality in both high- and low-income economies. A significant gap may remain, but pollution damage should decline in poor countries as they develop.

Although this news is good for the global environment in the long run, adjustment to a cleaner world is not likely to be smooth. Countries whose economic policies induce a rapid expansion of income and employment may also experience severe environmental damage unless direct measures are taken to accelerate regulation’s positive long-run response to income growth. On the macropolicy front, the persistence of a regulatory gap between rich and poor countries may lead to continuing controversy over trade policy and international assistance strategy. OECD interest groups that support protectionist measures for other reasons may continue to invoke the race-to-the-bottom model, relying on a common misperception that the regulatory gap automatically implies a race to the bottom. Despite clear evidence to the contrary, they may continue to argue that a race to the bottom can only be avoided through the enforcement of uniform environmental standards in all countries. Lacking any direct means of creating such a regime, interest groups may argue for trade restrictions and aid cutbacks until poor countries close
the gap. The available evidence suggests that such measures will retard, not advance, the day when the gap actually disappears.

In summary, the basic assumptions of the race-to-the-bottom model are contradicted by a large body of empirical research. Its flaws invalidate its main conclusion (the inevitability of the race to the bottom) and its main policy prescription (uniform standards enforced by any means necessary). Abandoning this theory, however, does not imply that poor countries must resign themselves to bad environmental quality for an extended period. Several recent benefit-cost analyses have made persuasive cases for stricter pollution control, even in very low-income economies. In China, for example, a recent study has shown that the economic returns to pollution abatement would justify significant tightening of regulation (Dasgupta et al., 1997). Similar studies in Indonesia (Calkins, 1993) and Brazil (Von Amsberg, 1997) have produced similar conclusions.

How can environmental quality improvement be accelerated in the era of globalization? Recent international experience has identified four keys to rapid progress:

1. Sustained support for programs that provide public, easily accessible information about polluters, pollution damages, local environmental quality, and the cost of pollution abatement. Such programs significantly improve the abilities of local communities to protect themselves, national regulators to enforce decent environmental standards, and market agents to reward clean firms and punish heavy polluters. International institutions such as the World Bank have begun supporting this idea in collaborative programs with environmental agencies in Indonesia, the Philippines, China, Thailand, Vietnam, Mexico, Colombia, Brazil, and elsewhere.

2. Sustained support for development of stronger regulatory institutions and cost-effective measures to reduce pollution. Sustained support is critical because institutional development takes time. Although private sector clean-production initiatives can play a valuable role, only public sector institutions can protect society's general interest in a cleaner environment.

3. Rejection of trade and aid sanctions as levers to force closure of the regulatory gap between low- and high-income countries. First, such sanctions are unjust because they fail to discriminate between clean and dirty firms in the affected countries. Numerous studies have shown that factories with world-class standards are operating even in the poorest countries (Afshah & Vincent, 1997; Hartman et al., 1997; Huq & Wheeler, 1992; Wheeler et al., 1999). Second, such blunt instruments will inevitably penalize workers in poor countries by reducing opportunities for jobs and higher wages. Finally, they will not work anyway. As noted in previous sections of this article, poor countries have weaker regulations and higher pollution intensities for a host of reasons. Governments of low-income countries

8. For more information about these programs, see New Ideas in Pollution Regulation (2001).
could not deliver on promises of OECD-level regulation, even if they were willing to make them.

4. **Willingness by the World Bank, the International Monetary Fund, and other institutions to take explicit account of environmental risks in the design and implementation of adjustment operations and other economic reform programs.** Rapid structural change could inflict severe pollution damage on some localities unless public environmental information and regulation keep pace with changing conditions. Willingness to recognize and compensate for this risk with targeted programs will greatly strengthen the credibility of international institutions that support continued economic liberalization in the name of sustainable development.

Manuscript submitted November 14, 2000; revised manuscript accepted for publication March 19, 2001.

**References**


Horvath, R. J. (1997). Energy consumption and the environmental Kuznets curve debate. Sydney, Australia: University of Sydney, Department of Geography.


David Wheeler is lead economist in the Infrastructure/Environment Unit of the World Bank’s Development Research Group. He received his undergraduate degree from Princeton University (1968) and his Ph.D. in economics from the Massachusetts Institute of Technology (MIT) (1974). Before joining the World Bank in 1990, Wheeler was a tenured associate professor of economics at Boston University (1976 to 1990). He has also been a visiting professor at MIT’s Department of Urban Studies and Planning (1978 to 1979) and the National University of Zaire (1973 to 1975); director of the Development Studies Project in Jakarta, Indonesia (1987 to 1989); and cofounder of the Boston Institute for Developing Economies. After joining the World Bank, Wheeler was asked to establish the Environment Unit in the Development Research Group. As lead economist, he directs a team that works on environmental policy and research issues in collaboration with policy makers and academics in Brazil, Colombia, Mexico, China, India, Indonesia, the Philippines, and other developing countries. He has published numerous books and articles on issues related to development and the environment.