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Environment and Trade in Developing Economies: A Primer for the World Bank's *Global Economic Prospects 2001*

John C. Beghin

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ENVIRONMENT AND TRADE IN DEVELOPING ECONOMIES: A PRIMER FOR THE WORLD BANK'S *GLOBAL ECONOMIC PROSPECTS 2001*

The interface between development and the environment is intertwined with the trade orientation of a country. Trade negotiations and agreements that have taken place in the last ten years have polarized the environmental concerns of interest groups and the general public. There is concern that a global phenomenal income growth has been accompanied by environmental degradation. The issue has been raised of whether globalization and the opening of trade have contributed to this environmental degradation. Beyond the rhetoric, true environmental problems have been identified, such as unsustainable fishing and water supply in some regions of the globe (Bailey 1995, Nordström and Vaughan 1999).

There was and still is a public perception that pollution-intensive industries are moving wholesale to developing economies. Some of the concerns are legitimate, but setting common rules on so-called beyond-the-border measures, such as environmental standards and competition policy, will prove to be significantly more challenging, if not counterproductive, in a multilateral setting. Countries have different priorities, which are in large part a reflection of different levels of development. In particular, developing countries may perceive a sharper trade-off between development goals and sensible, though perhaps elusive, environmental goals. In many countries, poverty is a key contributor to environmental degradation. Poorer countries are likely to make different choices in facing trade-offs between growth and environmental goals than industrial countries will make. It is important that developing countries retain access to the international trading system, even if their domestic environmental policies are not those that are preferred by richer countries.

Alternative mechanisms already exist and should be the preferred forum in which to discuss environmental goals. Several international institutions, such as the United Nations Environment Programme (UNEP) and international environmental summits, have an

environmental mandate and should be the preferred forum to discuss and agree on environmental goals. Further, donor countries and international agencies can and do make their assistance conditional upon achieving environmental goals, including important aspects of the global commons.

The Interface between Economic Growth, Environmental Protection, and Trade

The interface between the environment and the development process is complex and conditioned by the trade orientation of a country. First, economic growth implies increased economic activity, which, in turn, implies increased pollution, other things being equal. Producing more implies more pollution or more environmental degradation; this is known as the scale effect (Copeland and Taylor 1994). This effect is empirically important, especially for countries that specialize in environment-intensive activities, such as mining, fisheries, and forestry in Chile and industrial chemicals and petroleum in Indonesia (Lee and Roland-Holst 1997). At the same time, the technological improvements that drive growth result in savings on inputs, including energy and environmental amenities. This effect decreases the pollution intensity of growth. Further, higher living standards increase the affordability and desirability of reduced pollution and indirectly lead to better environmental protection.

Typically, economic growth is attained through productivity gains that result from adopting new or newer technology and knowledge. Technological improvements are driven by potential savings on inputs, (such as energy and environmental amenities), which become or are “scarce” in countries experiencing economic growth. This second force is an offsetting element, decreasing the pollution intensity of growth. Capital flows facilitate the transfer of technology and contribute to a cleaner environment.

A third important influence on the environment comes from the division of labor or specialization undertaken by a developing economy. Relative endowments of factors change with economic development. Their relative prices change as well, creating opportunities to become competitive in some new industries, but also challenging established industries to remain competitive or else shrink. Trade liberalization induces a

new specialization in production and consumption, which may or may not exacerbate the environmental degradation occurring in the economy. The latter factor is known as the composition effect. Development also induces a composition effect as rising incomes lead to a more than proportionate rise in consumption of (relatively cleaner) services.

Policy distortions, such as consumption, production, or border taxes, can have a major influence on the relative prices and profitability of sectors in the economy. Policies determine the competitiveness of sectors and their associated use of environmental resources. Some distortions have stronger environmental consequences than others. For example, subsidized energy usually implies a more energy-intensive economy and, therefore, more pollution emissions. Hence, the World Bank's long-term message of getting prices right remains important to insure that distorted price signals do not subsidize environmental degradation. The dramatic decrease in the energy intensity of the gross domestic product (GDP) in the Central and East European Countries (CEECs) and China, following their transition to market economies, illustrates such a policy principle (Vukina et al. 1999, World Bank 1997). For example, energy intensity in China decreased by 30 percent between 1985 and 1997.

All these forces interact simultaneously, and their net effect has to be assessed empirically. The available evidence on the environmental impact of trade policy reform and integration in goods and factors markets does not support the pessimistic conjecture of a wholesale specialization in dirty activities by developing economies. There is convincing evidence that under an import substitution strategy, countries have specialized in pollution-intensive manufacturing activities for which they are not truly competitive. Outward orientation has reduced the pollution intensity of output in several countries through a composition effect (Birdsall and Wheeler 1992). There is also evidence of lower energy intensity brought about by a strong increase in the domestic price of oil following trade liberalization (Vukina et al. 1999).

Similar findings emerge for natural resource use. For example, a recent study has assessed the impact of trade liberalization on agriculture and soil erosion in Sri Lanka (Bandara and Coxhead 1999). This study finds that openness increases the demand for land in tea production, which is a relatively less erosive sector than other crops, and thus

has environmental as well as economic benefits for the Sri Lankan economy. In the long run, an increased demand for land has a positive impact on the emergence of land markets and reduces the uncertainty on the returns to land conservation investment.

However, some countries do show patterns of specialization into dirty activities following trade liberalization: e.g., Indonesia (Lee and Roland-Holst 1997, Strutt and Anderson 1999), China (Dean 1999, Jha et al. 1999, Dessus et al. forthcoming), Costa Rica (Dessus and Bussolo 1998, Abler et al. 1999), and Turkey (Jha et al. 1999). These countries are expanding or specializing in activities that are harmful to the environment.

Both scale and, possibly, specialization induce environmental degradation. There is no definite evidence on which effect is dominant. Evidence reviewed by Beghin and Potier (1997) suggests that the scale effect is the most important. Countries face more domestic pollution following trade liberalization because their aggregate activities have expanded, but not necessarily because they are specializing in dirty activities. However, new numerical evidence from a study by (Ferrantino and Linkins 1999) suggests that specialization is a more important determinant of pollution than scale. These authors provide estimates of the output effects of trade liberalization (the Uruguay Round and a hypothetical liberalization scenario in manufacturing) on toxic emissions using a multicountry, applied general equilibrium model. Liberalization slightly reduces global pollution by rationalizing formerly protected sectors, which are pollution-intensive. Parts of Asia, as well as the economies in transition may become more polluted as a result of liberalization. In short, the jury is still out on the respective contribution of specialization and scale to pollution. Table 1 summarizes this evidence.

The specialization in dirty activities is not by itself evidence of externalities, but there is evidence that the burgeoning, often informal, environmental protection in many countries does not internalize the cost of pollution appropriately (Pargal and Wheeler 1996, Hartman et al. 1997).

Furthermore, resource allocation tends to be more efficient under free trade, because world prices are often closer to social prices than the former distorted domestic prices. The energy content of aggregate manufacturing output tends to decrease with trade liberalization. Capital-intensive dirty production relocates from developing to developed

economies, where it is more resource-efficient and less polluting (Ferrantino and Linkins 1999). Vukina et al. (1999) find a result consistent with that of Ferrantino and Linkins in looking at the impact of market and institutional reforms on pollution emissions and energy use in 12 former centrally planned economies. The energy use per unit of aggregate product declines drastically with market reform, although the decline in energy use may have been caused by the cleaner composition of manufacturing output following trade and price liberalization.

The findings just discussed are consistent with the earlier findings of Lucas et al. (1992). Outward-oriented economies have lower pollution-intensity of aggregate output relative to inward-oriented ones and have been exhibiting declining pollution intensities with outward-oriented growth in the 1980s. However, the robustness of the systematic link between openness and declining pollution intensities of output has been questioned by Rock (1996). Measuring openness and market integration at the margin remains challenging in the context of large panel data of countries and industries.

Policy Responses to the Interface between Growth, the Environment, and Trade

Trade Sanctions for Environmental Protection

Several robust messages arise from economic theory on the use of trade barriers for environmental protection. In general, both consumption and production activities do pollute, and tariffs are usually ineffectual instruments to tackle pollution and environmental degradation. Only when the externality originates in trade are trade taxes a good instrument to address the problem (Subramanian 1992). There is a ranking of instruments to address pollution emissions that follows the targeting principle (Bhagwati and Srinivasan 1997), which in effect says, “the closer the better.” Hence, emission taxes are the best instrument to address pollution emission and minimize distortionary effects elsewhere in the economy. If emission taxes are not feasible, input taxes are preferable to production taxes, which are themselves preferable to tariffs (Beghin et al. 1997, Lloyd 1992, Ulph 1999, and others).

This point has been documented empirically in the case of forestry products (Barbier and Rauscher 1994) and also for the Indonesian economy (Lee and Roland-Holst 1997). Indonesia tends to specialize in resource- and pollution-intensive activities with increasing economic integration. However, pollution emissions at the national level (as opposed to a sector level) cannot be decreased even modestly using tariffs. By contrast, they show that production taxes proportional to the pollution content of output make the abatement feasible at a reasonable cost in terms of foregone growth.

Joint Trade and Environmental Policy Responses

Economic theory also has a set of robust recommendations on piecemeal reforms when both environmental and trade policies are considered. First, trade liberalization undertaken when "optimal" environmental protection is in place increases welfare (Anderson 1992, Bhagwati and Srinivasan 1997). The environmental protection in place internalizes the cost of pollution, which may or may not increase with trade liberalization. Second, when the economy is ridden with both trade and environmental distortions, trade liberalization accompanied by an increase in environmental taxes increases welfare by internalizing the cost of pollution (Copeland 1994, Beghin et al. 1997). The intuition is the standard second-best principle—that reducing one of the two distortions at the time may exacerbate the other distortion and result in welfare losses. Joint reform of environmental and trade policy appears even more crucial when capital is mobile across borders and can exacerbate a country's specialization in dirty activities (Copeland 1994).

Hence, there is a strong economic foundation for a country to tackle both distortions (trade and environmental) simultaneously and with two instruments. More generally, the joint reform principle motivates countries to address economic integration and environmental protection jointly rather than sequentially in the context of a growth strategy. This principle also legitimizes environmental side-agreements within trade agreements to avoid the exacerbation of environmental distortions. These side agreements, such as in the case of the North American Free Trade Agreement (NAFTA), can be based on reciprocal recognition of each country's environmental regulations and do not imply harmonization of environmental standards across countries. They also

achieve a pragmatic objective of putting to rest concerns of environmental regulatory chill.

Feasible Environmental Protection in Developing Economies

Given that free trade and environmental protection should be undertaken jointly, which environmental policies are feasible and desirable in a developing economy? Environmental protection as part of the economic development process can be characterized by a continuum of institutional quality that guides and sustains economic activity. There is a supply and demand side to the quality of institutions protecting the environment, and both are influenced by the trade orientation of an economy.

On the demand side, economic growth implies higher income and increasing demand for environmental protection and standards. This process is a political one because, in most instances, environmental protection cannot be purchased readily on the market by decentralized agents. This demand for environmental protection is multifaceted like the environment. Economic agents care first about their immediate environment (water, air) or about environmental factors that directly affect their health. At much higher levels of income, environmental problems that are more remote in space and time eventually become prominent; this typically occurs after graduation from the developing economy stage. The “global village” is an industrialized-country notion. Free trade reinforces the demand for effective environmental institutions by fostering the income prospects of economic agents through a greater pie and unfettered knowledge flows.

On the supply side, governments in developing economies have scarce amounts of resources and human capital to allocate to the provision of competing institutional functions, including environmental protection. These governments are accumulating policy and institutional experience, and some stylized facts are emerging. Institutional knowledge can be transferred across industries and borders. Hence, the free movement of institutional knowledge reinforces the sustainability of economic development. This is a robust conclusion. Environmental side-agreements to trade agreements could facilitate such knowledge transfer.

Cleaner technology innovation and adoption in industrial countries have been driven by environmental regulation. Transnational firms tend to standardize and replicate the technologies appropriate in the regulated North market, in all markets. Combined with foreign direct investment (FDI) and the use of technology-laden imported inputs, this cleaner technology has been transferred to developing economies. There are at least two well-documented cases of this happening on a global scale: for the paper and pulp industry (Wheeler and Martin 1992), and for the steel industry (Reppelin-Hill 1999). Hence, in the short run, environmental protection "spills over" from the North to the South and mitigates environmental degradation in the South, but falls short of providing full-fledged environmental protection there.

Nevertheless, it is unlikely that all firms will adopt the new and cleaner technology. Indeed, there is a wide range of capital vintage in many industries (e.g., Pargal and Wheeler 1996). Capital stock is dated in mature industries and is more likely to pollute. Lessons can be learned from the experience of industrial countries when thinking about feasible environmental policy in the context of developing economies (O'Connor 1994). It is clear now that environmental protection is relatively inexpensive in terms of foregone growth or of the capital cost of abatement for private firms. This is more obviously true in fast-growing industries. Despite the inefficiency of the command and control approach that most Organization for Economic Cooperation and Development (OECD) countries have used to address pollution, the cost of compliance to industries has been surprisingly small and abatement has been significant (Jaffe et al. 1995). Hence, the debate on the efficiency of environmental policy instruments may be less important than it first appears. Several approaches can be used by countries with developing economies as long as the approaches lead to predictable outcomes for private agents affected by the new policy. The following paragraphs discuss such approaches implemented by developing economies.

What has been the developing countries' experience with various policies and institutions? Market-based instruments have proven effective in tackling environmental problems. A reduction of subsidies on pollution-intensive activities or raising taxes on polluting activities (via discharge, input, or output taxes) decreases pollution and

increases tax revenues. There are instances of such policy changes in Bangladesh, Indonesia, Brazil, and other countries (World Bank 1997). Market-based instruments also provide incentives for countries to save on the taxed resource and become more resource-efficient. The more targeted the instrument, the better. Some countries, such as China and Malaysia, use emissions charges with some success. When the cost of monitoring is not prohibitive, the market instrument can be very targeted. For example, stumpage fees are used successfully in many countries to foster sustainable forest management (World Bank 1997). New evidence from China gathered by Wang and Wheeler (2000) shows that China has been successfully abating pollution for the past 20 years using levies, and that firms do respond rapidly to levies by abating emissions.

Markets can mitigate environmental issues induced by open access and lack of property rights. Markets can be created when they do not exist. The most obvious examples are land and water markets. Better property rights induce pricing of resources that is closer to their social value and that stimulates conservation. Allocation of property rights can be done readily, and the institutional support to define and enforce these rights can be built incrementally (O'Connor 1994). For land markets, for example, titling and simple zoning are important first steps toward better property rights and environmental protection.

Privatization and competition—or incremental reform in this direction—are other effective ways to promote better resource management. Several studies identify state firms as worse polluters than the private sector (Pargal and Wheeler 1996) or state planning as worse than market economies (Vukina et al. 1999). Incentives to economize, combined with increased resources for better management, have improved the performance of public entities in many countries. For example, water user associations have been substituting successfully for the government in the provision of irrigation water in several countries.

Policymakers and private agents in developing economies focus their attention on domestic environmental problems rather than on global ones. Addressing these domestic problems provides the most direct benefits for developing economies. Phasing out leaded gasoline, creating clean water provisions, and decreasing air pollution are achievable

targets that will lead to improvements in health and, indirectly, in human capital. Health benefits from major air pollution abatement are generated by environmental policy. Hence, these environmental policies can pay for themselves, or at least reduce the social cost of pollution abatement, through reduced health expenditure due to reduced morbidity and mortality (Dasgupta et al. 1997, Beghin et al. 1999).

As institutional capacity progresses, more ambitious policies are feasible with political will. Chile and Malaysia offer examples of ambitious pollution control programs that have been successful in abating air and water pollution. Vukina et al. (1999) in a study of 12 former centrally planned countries, found that stronger environmental regulatory regimes reinforced the shift towards less-polluting allocation of resources induced by market and trade reforms. Pollution abatement through environmental protection appears clearly feasible in former centrally planned countries and is strongly related to income levels attained by these countries. The development of environmental protection is a generic problem of institution building in a developing economy under severe scarcity of key inputs (human capital, financial resources, etc.). Inconsistent regulations, lack of enforcement, and weak monitoring are other generic problems faced by many countries (Jha et al. 1999), and not only in the area of environmental protection.

Engaging the public is an essential ingredient in successful environmental protection, thus the political dimension of institution building. This process can be positive by fostering partnerships among the public, firms, and authorities. The government can be a facilitator for private industry by promoting the dissemination of information on new technology and environmental regulations. The process also can be coercive in the sense of fostering disclosure of violation of environmental regulations (e.g., illegal discharges). This principle has been effective in developing economies, such as China (Dasgupta and Wheeler 1997), although complaints tend to be positively associated with higher income and human capital.

Race to the Bottom

Market integration and trade liberalization between countries with different levels of environmental regulation raises concerns of compromising the ability to protect the

environment. The issue is the environmental "race to the bottom." This phenomenon is seen when free movement of capital and goods between countries with different environmental regulations induces developing economies to attract and specialize in dirty industries and become pollution havens. A corollary conjecture is that integration inhibits the objectives of environmental regulatory reforms causing a regulatory chill—because of competitiveness concerns.

The emergence of a race to the bottom is theoretically possible (Wilson 1997, Klevorick 1997), particularly in political and regulatory environments that are not transparent and that are vulnerable to capture by dirty-industry interests. (However, capture by "green" interests also is possible, where environmental protection may exceed public preferences.) Constraints on tax instruments, capital mobility, the lack of transparency and disclosure in the regulatory process, and the lack of mobility and representation of the population in the political process all foster the emergence of a race to the bottom. A race to the top is more likely to emerge with capital mobility and a "green" capture of the political process. At the moment, there is little evidence that either a race to the bottom or to the top has emerged, with the exception of the not-in-my-back yard (NIMBY) attitude prevalent in the United States in the management of interstate hazardous waste shipments (Levinson 1997b). Table 2 summarizes the investigations supporting this lack of evidence, which is also discussed later.

Several recent studies have used the cross-sectional Heckscher-Ohlin (H-O) model, which explains specialization based on environmental abundance, to indirectly examine the effects of environmental regulation on international competitiveness (Han 1996, Kalt 1988, Valluru and Peterson 1997, Tobey 1990, Diakosauvas 1994, Xu 1999). This model examines the relationship that exists between the trade of a good and the factor intensities used to produce it, expressed as the amount of each production factor used in a unit of production of that good. Kalt (1988) examines the impact of domestic U.S. environmental regulatory costs on both inter-industry and aggregate trade performance using 1977 data. Using pollution abatement as a proxy for absorptive capacity, Kalt finds that his measure of regulation had a significantly negative effect on net exports of U.S.

manufacturing goods; i.e., tougher regulation led to a decline in international competitiveness.

Tobey (1990) examines the impact of environmental regulation on world trade patterns in “dirty” commodities based on 1975 data. His study incorporates 11 factor inputs in the model as well as a United Nations Conference on Trade and Development (UNCTAD)-based qualitative variable that measures environmental stringency. The results provide no evidence that increased regulation has affected output in these pollution-intensive industries. Han (1996) uses panel data (industries and over time) to empirically test the environmental H-O model and actual expenditure data on pollution abatement as a measure of the environmental input. His study finds that increases in environmental regulation have a significantly negative effect on competitiveness, but this effect has been decreasing over time. The effects of increased domestic regulation were significant in the past, but with regulation tightening in foreign countries, these effects have become much less significant. In addition, abatement costs also have been dropping, with new capital vintages, learning by doing, and new technologies.

Valluru and Peterson (1997) and Diakosauvas (1994) assess the impact of environmental regulation on agricultural trade. The evidence suggests little support for a significant negative regulatory effect, except for the most polluting crops, such as cotton and tobacco. Finally, Xu (1999) examines the impact of stringent environmental standards on the international competitiveness of environmentally sensitive industries, using a similar approach. He finds that the export performance of these goods for most of the 34 countries included in his data set was unchanged between the 1960s and the 1990s, despite the emergence of environmental standards in most developed countries since 1970.

The evidence on Foreign Direct Investment (FDI) and potential pollution havens is consistent with the small amount of evidence coming from the empirical H-O model. For example, the evidence suggests that the United States is importing pollution-intensive industries more than it is exporting them and that dirty industries are no more likely to invest abroad than other industries (Albrecht cited in Nordström and Vaughan 1999, Eskeland and Harrison 1997). Eskeland and Harrison look at French and U.S. FDI flows

going into manufacturing industries in the Ivory Coast, Morocco, Mexico, and Venezuela. They find no evidence of pollution-intensive bias in the allocation of the FDI among industries. Nevertheless, Xing and Kolstad (1995) find that U.S. FDI in chemical industries seems influenced by weak environmental regulations proxied by SO_2 emissions. The same authors find that the FDI of other, cleaner industries were not influenced by environmental stringency.

The plant location approach to assess the impact of environmental regulation on competitiveness and production location is a richer approach than the trade flow approach, and it is probably the closest to a true empirical test of the race to the bottom. There is limited evidence supporting the industrial flight conjecture, however. Firm surveys investigating relocation decisions provide some information. An UNCTAD survey on relocation of transnational corporations (UNCTAD 1993) appears to give credence to the race to the bottom argument. Runge (1994) also refers to a firm survey in the context of NAFTA. Surveys tend to be less reliable than actual data because they report what is said rather than what is done (Levinson 1997a).

Levinson uses establishment-level manufacturing data and the Survey of Pollution Abatement Costs and Expenditures to examine the effect of differences in the stringency of state environmental regulations on establishment location choice. Levinson investigates the link between site choice and environmental regulations for many industries and measures of stringency, using limited dependent variables, as in previous studies by Bartik (1989) and others. Interstate differences in environmental regulations do not systematically affect the location choices of most manufacturing plants in the United States.

Using a similar approach, Mani et al. (1997) look at the same location issue for manufacturing firms in India. India has environmental controls at both the federal and state levels. Although regulations are set at the federal level, the states implement and enforce these regulations. Differences between states' attitudes towards environmental policy may influence firm location. The authors use industry-level data to examine the location decisions of new manufacturing plants for a wide range of manufacturing industries and also for the smaller subset of pollution-intensive industries. They find an

unexpected positive correlation between manufacturing location and their second proxy for stringency, which is the state budget share spent on environmental programs. It is possible that the latter variable measures state efficiency, which induces firms to locate in states with higher environmental expenditure—in short, the antithesis of the race to the bottom, or in other words, a race to the top as a proxy for efficient public good provision.

Several other studies have looked at the impact of environmental regulation in agriculture, but mostly in OECD countries. Metcalfe (2000) provides a thorough investigation of the hog industry in the United States and selected foreign countries. He finds little evidence of stringency having an impact on location of hog production in the United States in a panel data of hog production across states, farm size, and over time. The only notable impact is the negative impact of regulatory stringency on small operators. There is no impact on large, modern confinement livestock producers. Data constraints exclude such systematic analysis at the international level. This result is consistent with a recent report by Hettige et al. (1996) who find evidence of economies of scale in environmental compliance for many other industries in several countries. These two studies suggest that in a developing economy with a larger range of firm size and technology vintage, environmental protection may affect smaller and older firms and precipitate their decline, but that this effect would probably be modest in aggregate given the small share of environmental compliance cost in the total cost of production.

A last insight on competitiveness, specialization, and environmental regulation comes from the positive link found between environmental performance and profitability of firms in the United States (Repetto 1995, Cohen and Fenn 1997). Although environmental compliance is not free, it creates new market opportunities and may induce further efficiency gains that may partly offset the small cost of compliance. Environmental performance appears to be systematically associated with higher profitability.

In sum, looking at the four approaches (trade patterns for goods, FDI patterns, plant location studies, and environmental performance), there is little evidence in support of pessimistic conjectures regarding environmental regulation and competitiveness.

The Cost of Environmental Protection in Developing Economies

There is a convergence in the evidence coming from various but complementary approaches used to look at the cost of environmental regulation in developing economies. This important stylized fact helps explain the non-emergence of pollution havens. Detailed qualitative case studies of individual industries undertaken by UNCTAD (Jha et al. 1999) corroborate the stylized findings obtained with numerical applied general equilibrium (AGE) models (Beghin et al. forthcoming). In the latter study, the cost of abatement appears modest for most types of emissions when it is expressed in terms of the foregone GDP growth induced by pollution abatement. Further health benefits appear substantial for air pollution abatement in the case of Chile. This finding of feasible pollution abatement was a recurrent stylized fact for Chile, Indonesia, Mexico, Costa Rica, China, Vietnam, and Morocco, using two AGE models differing in their assumptions on abatement possibilities and for 13 pollution types. Bio-accumulative toxic release in water is the only pollution type that is expensive to abate.

The cost of environmental protection is moderate and does not compromise competitiveness. Findings pertaining to the developing world are consistent with the extensive literature investigating the impact of environmental regulation on competitiveness in the United States (Jaffe et al. 1995, Levinson 1997a). For example, Malaysia is an interesting case of specialization in environment-intensive activities accompanied by environmental protection (Jha et al. 1999). In Malaysia, two rather rapidly expanding major export industries, the palm oil complex and electronics, have been facing substantial environmental regulations that were implemented rapidly. The palm oil industry faced a loss of profit but has adapted well to the new regulations and taxes. Compliance is high and exports have not decreased, despite the limited opportunities to pass on to consumers the cost increase of crude and refined palm oil in world markets. These markets are very competitive, and many substitutes exist for these goods. State-funded research has helped to develop commercial by-products from the palm meal, which reduced the cost of compliance by generating revenues from the by-products instead of treating or dumping them and paying penalties. The bulk of the program's cost was passed on to palm growers, who lost suffered permanent losses

through lower prices for fresh palm fruits (Jha et al. 1999, Khalid and Braden 1993). A similar successful adjustment occurred for the Malaysian electronics industry, which is highly compliant and competitive. Because of a strong FDI presence in Malaysia, the electronic industry has leap frogged to modern technology (Jha et al. 1999).

Regional and Transboundary Policy Approaches

Regional, rather than global, approaches to environmental standards also may prove to be a positive and more feasible step, particularly on issues with a clear regional component—such as transboundary emissions and shared water resources—and for countries with similar development levels or with strong prospects of rapid income convergence. To date, global environmental concerns have been dealt with outside the context of the trading system, with some success. In some cases, trade sanctions have been built in as an enforcement mechanism. But, the compatibility of these sanctions with the World Trade Organization/General Agreement on Tariffs and Trade (WTO/GATT) has yet to be tested and their effectiveness has yet to be scrutinized. Trade sanctions are typically untargeted and may induce large deadweight losses to consumers.

A regional approach does not imply uniform standards, either in the broad sense of environmental protection (e.g., Bhagwati and Hudec 1997) or in the narrow sense of standards referring to pollution per unit of output in value or physical unit. The case against harmonization of policies is overwhelming in most settings. The major reason for such a strong presumption resides in different levels of marginal damage of pollution across countries or, in other words, in different levels of the valuation of the marginal benefits of environmental protection.

When departing from the competitive market paradigm, the case against harmonization remains strong, although coordination of policies between two countries may make sense. Coordination between countries is a better choice than the subsidiary principle—each country deciding autonomously its policy level—when “eco-dumping” could arise if governments are constrained in their choice of policy instruments and face incentives to lower environmental policies below their optimum levels.

Finally, some product standards constitute non-excludable attributes by providing a definition of goods and their quality. They reduce information asymmetries, like labels do, and reduce transaction costs. They are endogenous and change with income and trade policy, if the latter affects income (Casella 1997). Harmonization or a move toward harmonization may arise only if income levels between trading partners converge. These standards may become common to several countries if coalitions supporting these standards cross borders. Hence, one could conceive of "harmonized" standards generated by political economy with a coalition of firms spanning several countries within one industry.

Evidence of Trade Disputes Induced by Environmental Standards and Labels

Have questionable technical barriers been used for environmental protection and led to trade disputes or impediments? Whalley and Hamilton (1996) report a limited number of instances for the 1982–1996 period. An examination of the WTO's "Overview of the State-of-Play of WTO Disputes" reveals less than a handful of disputes based on technical barriers linked to environmental objectives since 1995. Only 2 out of the 43 requests from developing countries involve an environmental objective (the case of reformulated U.S. gasoline and the U.S. ban on seafood products). Hence, although it is a concern, the frequency of actual trade disputes based on environmental protection is minimal.

Roberts (1998) reports on U.S. agricultural exports that have actually been faced with questionable technical barriers in global export markets. The study shows that out of 300 occurrences of such trade impediments, valued at close to $5 billion, only one was motivated for environmental reasons. Most of the measures involved food safety and protection of crops and livestock from pest and disease. Hence, phytosanitary and sanitary measures seem much more prevalent than purely environmental ones. The United States trades with many industrialized countries, and it is fair to assume that Roberts's study reflects general market conditions beyond the narrow U.S. focus of her investigation.

Eco-labeling schemes provide information to consumers on environmental standards met by final consumption goods. Eco-labels are another potential source of trade friction. These labels increase the cost of production by imposing fees and standards. Eco-labeling schemes, such as in textiles, require multiple production standards for dyes, fibers, and bleaching chemicals (OECD 1997). These standards increase the cost of production, but cost data are scarce. The eco-labeled market remains a niche market in many OECD countries. Fees are imposed in most schemes. For example, Canada's Environmental Choice Program imposes a 0.5 percent charge based on the price of the good on sales up to Canadian $1,000,000. Fixed costs arise from the application and site inspection involved in the certification process.

Certification is another potential source of trade friction (Jha et al. 1999, Jha and Zarrilli 1994, OECD 1997, Zarsky 1994). Developing countries have voiced their concern that certification with industrialized labeling schemes may be virtually impossible for them. For example, based on the European Union (EU) Commission’s list of companies that have obtained the EU eco-label, there is a pattern consistent with this concern. Forty-eight licenses have been granted covering 219 products. None were granted to a developing economy firm, but it is not even clear that any applied. A surprising fact is the small number of licenses granted, which is consistent with a niche market situation and a lack of interest with the EU eco-label program (Nimon and Beghin 1999).

Eco-label schemes can be discriminatory, especially in markets such as textiles that are dominated by developing economies’ producers. Eco-label schemes could be construed as targeting the foreign production of these goods. Domestic industries have more say in the definition of these standards than foreign competitors (OECD 1997, Jha and Zarrilli 1994). Abstracting from political economy considerations, the standards are likely to address technologies that are feasible in industrialized countries but perhaps attach less weight to the input mix and technology set of developing countries. Further, the difference in their respective marginal utility of income implies different tolerance levels for pollution. Local eco-labels are emerging in developing countries, especially in

timber-based products but also in textiles, to promote better practice and preempt discriminatory labeling in industrialized countries.

Malaysia supports eco-labels and standards that are seen as a marketing tool and insists on the following principles: labeling must be applied to all types of timber and should be based on internationally agreed-upon standards, not merely on standards developed by one or a few countries (Jha et al. 1999). This is consistent with the stylized findings of Nimon and Beghin (1999). One unresolved issue in Malaysia's eco-labeling is the cost of certification involved with labeling and international standards. Malaysia has an experimental program, associated with the ISO-14000 series and environmental management system, that assesses their costs and benefits to the private firms. The cost and feasibility of certification remains a major hurdle in many developing economies.

Conclusions

Economic theory provides strong support for joint trade and environmental policy design and implementation within one country. A joint reduction of both trade and environmental distortions is welfare improving for any country. Free trade, carried out jointly with reduced environmental degradation, is the relevant approach to sustain economic development.

Attempts to coordinate these policies among countries in a context of multilateral agreements call for free trade among the countries, but not for harmonized environmental protection. The case against harmonization of environmental protection is overwhelming. Public policy measures other than trade sanctions will prove more effective in improving environmental standards.

Common standards for environmental protection make sense in the limited context of the definition of quality of goods that consumers care about. Economies of scale may arise in having a common standard to define goods across boundaries, and consumers may exhibit a higher willingness to pay for greener goods, such as for eco-labeled goods. Developing economies may find it beneficial to have their own green label programs if industrialized countries use their own label as a protectionist device.

Nevertheless, actual cases of trade disputes based on environmental policy are rare, relative to other cases brought by developing economies. Concerns of developing economies related to such disputes may be exaggerated. Even in the case of eco-labels, the markets involved are limited relative to their conventional counterparts (e.g., textiles). A caveat may be that the cost of litigation is higher than the benefits brought by the dispute settlement mechanism, which is reflected in the small number of disputes.

Policy and institutional arrangements to address pollution are in an experimental stage in developing economies. However, stylized facts have already emerged. Consumers care about and value environmental protection, even at low income levels. Further, simple measures can be highly effective in reducing pollution and increasing welfare. Such measures include the reduction of subsidies on polluting activities, public disclosure of violations and discharge levels, plant inspection and adoption of environmental management plans of the ISO-14000 type, titling and zoning, and user fees. As countries increase their institutional capacity, they can take on more ambitious programs.

The cost of abatement is expected to be moderate for firms, based on the long-term OECD country experience and on the emerging experience of developing economies. In fact, the cost could be lower for developing countries because they can benefit from the experience of industrial countries. The cost of building public institutions for environmental protection is little known. It would be interesting to assess countries' public expenditure on various public efforts for environmental protection in order to get a better understanding of the full cost of environmental protection.

Table 1. Scale, composition, and technique effects of trade liberalization on pollution

Economywide Studies

Counties	Shock	Scale	Composition	Technique	Total Pollution
Mexico[1]	Trade liberalization	+	-	na	small decrease
USA[1]	with NAFTA	+	+	na	increase
Canada[1]		+	+	na	increase
Mexico[1]	Trade liberalization	+	+	na	increase
USA[1]	with NAFTA +	+	+	na	increase
Canada[1]	investment liberalization	+	+	na	increase
Mexico[2]	Trade liberalization better terms of trade with U.S. and Canada	+2.8 to 3.7%	-4.3 to 2.6%	-.7 to 3.5%	-.2 to 6.4%
Costa Rica[3]	Trade liberalization	9.4%	5.6 to 10.6%	+ but small	15 to 20%
Vietnam[4]	Trade liberalization	5 to 8.8%	-6.3 to 8%	1.1 to 7.5%	0.8 to 23.1%
Indonesia[5]	Trade liberalization with Japan	0.8%	-.36 to 2.86%	na	0.51 to 3.73%
Japan[6]	Trade liberalization with Indonesia	0.0%	-.09 to -.02%	na	-.09 to -.02%
OECD[10]	Multilateral liberalization	na	na	-0.02 to -0.0%	-4.32 to -0%

Panel Data

Composition effect (pollution intensity of GDP or aggregated manufacturing output) and outward orientation

Rock[7]	na	+ to ambiguous	na	na
Lucas et al.[8]	na	negative	na	na
Vukina et al.[9]	na	negative, robust	na	na

1. Grossman and Krueger. Percentages not available.
2. Beghin, Roland-Holst and van der Mensbrugghe (1995). The scale effect range refers to production and absorption. The ranges for composition and technique effects refer to 13 measures of pollution emissions.
3. Dessus and Bussolo. The scale effect is the increase in output. Composition is the difference between total and scale effects.
4. Dessus, Roland-Holst, and van der Mensbrugghe.
5. Lee and Roland-Holst. The range of composition effects refers to 10 pollutant types. They also report a human toxicity index.
6. Lee and Roland-Holst. The range of composition effects refers to 10 pollutant types. They also report a human toxicity index.
7. Rock uses four measures of outward orientation (Dollar index, dummy variable (closed/open) and rate of growth of exports and export shares).
8. Lucas et al. use the Dollar index to measure outward orientation.
9. Vukina et al. use EBRD scores of trade policy reform in CEE countries.
10. Ferrantino and Linkins, Tables 7 and 9. Scale and composition figures are not disaggregated.
1 to 9 are reproduced from Beghin and Potier.

Table 2. Evidence on international competitiveness and environmental regulation approach

Approach	Study	Conclusion
Cross-sectional Heckscher-Ohlin (HO) model	Kalt	U.S. manufacturing exports negatively impacted by environmental regulation
	Tobey	World trade in dirty commodities not affected by environmental regulation
	Han	Small negative impact of regulation but decreasing over time
	Valluru and Peterson	Grain trade not impacted by environmental regulation
	Diakosauvas	Exports of the five most polluting crops negatively impacted by regulation
	Xu	Environmentally-sensitive exports of 34 countries not influenced by regulation
FDI flows investigations	Albrecht	United States imports pollution-intensive industries more than it exports them
	Eskeland and Harrison	No pollution-intensive bias in French and U.S. FDI in developing economies
	Xing and Kolstad	U.S. FDI influenced by weak regulation only in chemical industries
Plant location-firm surveys	UNCTAD	Environmental policy negatively influences location
	Levinson (1997a) summary	Marginal impact of compliance cost except for self-declared U.S. dirty industries
Plant location-econometric approach	Levinson (1997a)	No effect
	Bartik	Small and negative effect
	Mani et al.	Positive effect of one measure of environmental stringency on plant location
	Metcalfe	Negative impact of regulatory stringency on small U.S. livestock operators

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