

Trade and the Environment

by

Ramón López and Asif Islam

WP 08-14

Department of Agricultural and Resource Economics
The University of Maryland, College Park

November 12, 2007

Trade and the Environment

Ramón López

University of Maryland at College Park
3125 Symons Hall
College Park, MD 20742
(301)-405-1281
rlopez@arec.umd.edu

Asif Islam

University of Maryland at College Park
3108 Symons Hall
College Park, MD 20742
aislam@arec.umd.edu

This paper was submitted as a chapter for the Princeton Encyclopedia of the World Economy

Copyright © 2008 by Ramón López and Asif Islam.

All rights reserved. Readers may make verbatim copies of this document for non-commercial purposes by any means, provided that this copyright notice appears on all such copies.

Trade and the Environment

Trade, the exchange of goods and services across countries, is often viewed as an engine of economic growth. Benefits of liberalized trade include access to a larger variety of goods and services to consumers, easier access to foreign technologies, access to larger markets for producers, and increased efficiency in resource allocation. The impact of trade on the environment, however, is a contentious issue; air and water pollution, the degradation of natural habitats and loss of species, and global pollutants, particularly carbon dioxide emissions, are major concerns.

Recent Trends

In the late 20th and early 21st centuries international trade has rapidly increased worldwide, while average tariffs and quantitative restrictions to trade (import and export quotas) have fallen steadily. Export growth has outpaced growth in gross domestic product (GDP) (World Bank 2006). With respect to the environment, there are persistent and widespread improvements in most *local* urban pollutants, mainly airborne pollutants (e.g., sulfur dioxide, nitrogen dioxide, carbon monoxide, air particles, and lead). An important exception is local ozone, a highly dangerous local pollutant that has increased over time in most cities, in part as a consequence of measures taken to reduce some other air pollutants. There are also less clear but perceptible trends to improve some indicators of water quality (United Nations 2006). In contrast, there is a clear worsening of the *global* pollutants (e.g., carbon dioxide) as well as of the rural or “green” environment (i.e., the natural forests and other important natural habitats). The latter

phenomenon is causing a precipitous loss of species and has contributed to increase global warming through the emissions of carbon dioxide due to massive forest burning.

Thus while trade has rapidly expanded, the environmental trends show a sharp dichotomy: the local urban environment improves but the green or rural environments continuously deteriorate. One reason for this may be that local urban pollution is directly felt by large concentrations of population able to exert strong pressures on politicians to control it, while the rural environment affects directly a smaller fraction of the population which, due to its geographical dispersion, is less able to pressure governments. Rural environmental degradation and global pollution are less visible to the majority of the population than local urban pollution, which might explain the generally more lax response by governments to rural than urban environmental problems and to global than local pollutants.

The central issue is whether opening up to trade has magnified the trends described above or has instead mitigated some of them. The effects of trade on the environment can be broken down into scale, technique, composition, and growth effects (Antweiler, Copeland, and Taylor 2001; López, Galinato, and Islam 2007).

Effects of Trade on the Environment

Scale effect. Most forms of pollution are a by-product of a production process. Increased trade openness often implies an increase in economic activity. The scale effect, holding constant production techniques and the mix of goods produced, is likely to cause an increase in the level of local and global pollution and also faster degradation of natural resources. For example, expanding agricultural exports may increase agricultural

activities, which may result in water pollution from extensive fertilizer use and deforestation from increased demand for agriculture. The scale effect may also include trade related direct increases in pollution emissions through increase in air and road transportation. Empirical studies usually employ gross domestic product (GDP) per square kilometer as a proxy for the scale effect. López (1997), for example, found that in Ghana trade liberalization induced a faster rate of deforestation. Given the more lenient attitude of governments toward rural environmental degradation and global pollutants than to urban local pollution, the negative impact of the scale effect is likely to be worse for the green-global environment than for the urban environment.

Technique (wealth) effect. The technique effect refers to reductions in emission intensity per unit of output. If trade raises income, emission intensity may fall if environmental quality is a normal good. A normal good is one for which as incomes rise, individuals would prefer more of. Higher income may lead to stricter environmental regulation, under the assumption that country governments are responsive to the citizens' demands. A trade-induced rise in incomes would thus make higher environmental quality desirable. Empirical studies often use per capita GDP as a proxy for income. A more accurate measure is per capita household consumption expenditure, which is more directly related to permanent income or wealth than per capita GDP (López, Galinato and Islam 2007). The technique effect of trade has been found to reduce certain pollutants, particularly air pollutants, but the effects on other environmental factors is less significant. The strength of the technique effect is weaker for the green and global environment than for the local urban environment because the citizens' demands for

environmental quality are likely to be feebler in the rural areas and for global pollutants than for the control of local urban pollutants.

Composition effect. Trade may also alter the composition of the economy's output. If the economy's comparative advantages favor clean industries, increasing trade openness may switch from pollution-intensive "dirty" goods to less polluting, or "clean," goods and services. The general assumption is that production of dirty goods is more intensive in physical capital and natural resource while clean goods production is more intensive in human capital. Holding the scale of production and other factors constant, an economy that shifts its production toward physical capital-intensive goods will pollute more, and conversely, an economy that shifts its production away from physical capital-intensive goods will pollute less. Countries that have large endowments of natural resources are likely to relatively specialize in resource-intensive industries and thus increase the extraction of natural resources when they open to trade. In countries where property rights on resources are poorly defined or where environmental regulations are not properly enforced, increased trade is likely to result in more resource degradation and deforestation.

Even more seriously, lack of property rights on resources may lead countries to specialize in natural resource-intensive activities and hence to further environmental degradation even if they are not richly endowed in resources. That is, the institutional and regulatory failures may lead to false comparative advantages, in which case trade may reduce rather than raise income as is normally assumed (this is behind the *pollution haven hypothesis* as discussed later). In this perverse case the technique effect discussed earlier (which assumed that income increases with trade) would be reversed. Also, once again,

the weight of the composition effect may be felt on the green-global environment because environmental control institutions and regulatory policies are less developed for the rural-global resources than for urban pollutants.

Growth rate effect. Trade openness may cause a number of dynamic forces that promote not only a once-and-for-all effect on the income level but also a faster pace of economic growth over time. For example, trade openness may cause an economy to adopt new technologies at a faster rate due to the fact that many new technologies are generated abroad. A faster pace of economic growth may cause lower environmental quality than a country growing at a slower rate (López, Galinato and Islam 2007). The issue here is that environmental institutions and policies need time to be adapted. An economy growing at a fast rate will find it much more difficult to timely adapt their policies and institutions to properly respond to increasing pollution than an economy growing at a more moderate pace. This trade-induced growth rate effect may result in a decline in environmental quality.

The net effect. Empirical studies seem to corroborate the hypothesis that the positive-technique effect dominates the other effects for certain local urban pollutants resulting in trade being good for the urban environment (Copeland and Taylor 2003). However, the few empirical studies of the impact of trade on the rural environment, particularly the impact on wetlands and natural forests, suggest that the net effect of trade is negative (López 1997). This is consistent with the earlier conceptual discussion regarding the relative strength of the various partial effects on the urban and rural environments. The net effect of trade is also likely to be negative for global pollutants

because the technique effect may be weak for such pollutants as people care less for pollutants that do not affect them directly.

Pollution Haven Hypothesis

According to this hypothesis the direction of trade between two countries may be dominated by differences in environmental regulatory strengths. Developed economies tend to have better environmental institutions and more efficient regulation than poorer countries. The pollution haven hypothesis states that rich countries may export their dirty industries to poorer countries due to the differences in regulation. Freer trade thus results in declining environmental quality in poorer economies and improving environmental quality in richer ones (Chichilnisky 1994). There are two main assumptions behind the pollution haven hypothesis: first, that pollution regulation differences are a key determinant of industry location, and second, that environment is a normal good and thus differences in regulation are due to income differences. A further implication of this hypothesis is that global environmental quality may deteriorate and the income of the poorer economies may fall. As polluting industries migrate to regions with less stringent pollution policy, overall global pollution will increase. The available empirical evidence generally rejects the pollution haven hypothesis, but this does not mean that environmental regulation plays no role in affecting trade (Copeland and Gulati 2006). The evidence simply says that environmental regulatory differences do not necessarily dominate the direction of trade as the pollution haven hypothesis suggests.

Factor Endowment Hypothesis

The factor endowment hypothesis deviates from the pollution haven hypothesis by postulating that factor endowments, and not just differences in environmental regulations, are the main motivation for trade patterns. Economies engaging in trade will specialize in production where comparative advantage is exhibited. If the most developed countries are relatively abundant in factors (usually capital) used in pollution-intensive industries, then they may have a comparative advantage in dirty industries, and thus will specialize in them. Consequently, dirty goods production may shift from developing to developed economies. Developed economies have better environmental regulation and institutions, and thus the consequence of trade would be an overall decline in pollution. Proponents of this hypothesis point to the fact that Europe and United States have the most stringent pollution policies yet export manufactured goods that are highly pollution intensive. If developing countries have an abundance of the factor needed by pollution-intensive production, the predictions of the factor endowment hypothesis would be consistent with the pollution haven hypothesis. Furthermore, developed countries will lose their comparative advantage in dirty industries if stringency in pollution policy is increased. Thus there are two forces at play, pollution policy differences and factor endowments.

Trade Openness and the Environmental Kuznets Curve

Part of the empirical environmental literature has been on the relationship between income and pollution, otherwise known as the Environmental Kuznets Curve (EKC) (Shafik and Bandyopadhyay 1992; Grossman and Krueger 1995). The EKC is an inverted U-shaped relationship: as income increases, pollution first increases until it reaches a

turning point and then declines. The first empirical estimation of the EKC for air and water pollutants was carried out by Grossman and Krueger (1995). Estimation of the EKC has also been carried out for natural resources such as forests (López and Galinato 2005). There is much debate with regards to the empirical estimates, data accuracy, robustness, and theoretical underpinnings of the EKC (Harbaugh, Levinson, and Wilson 2000; Deacon and Norman 2007).

Trade plays an important role in some of the conceptual explanations of the EKC. The income effect theory identifies environmental policy response as the main reason for the EKC. As an economy grows, at first the benefits of increasing output are so large that they dominate the increased demands for environmental quality caused by a higher income and thus the scale effect dominates (the curve is upward-sloping in this segment). Beyond a certain level of income, the marginal preference for more consumption declines and the preference for clean environment increases until the turning point occurs. Pollution declines as income increases beyond this point. What trade does is to enhance the process of economic growth and thus has an indirect effect on the EKC.

Another story focuses on the composition effect. In the early stages, countries grow through physical capital accumulation and expansion of industries intensive in physical capital, which are generally dirty; in the latter stages, a country grows through human capital and knowledge accumulation and thus cleaner industries emerge, yielding an EKC relationship. Trade liberalization may assist in the switch from dirty to clean industries by allowing the growing economy to increasingly specialize in clean industries. Without trade the assumptions required for an EKC process are much more stringent than with trade.

The Resource Curse

Countries with larger endowments of natural resources apparently tend to grow less than resource-poor countries (Sachs and Warner 1999). There are several explanations for such a phenomenon (Barbier 2005). One of the most credible explanations is directly linked with trade, the so-called Dutch disease effect. As a natural resource-dependent economy booms, resources are allocated from other sectors to the natural resource sector. Furthermore, the currency of the economy appreciates, which renders other sectors in the economy uncompetitive in international markets. This results in further dependency on the natural resource sector. Hence the economy is more vulnerable to the price fluctuations inherent to primary commodities. Examples of the resource curse can be seen in oil-producing countries that are resource rich but are growing slowly.

The Role of Government

Environmental quality is a public good; thus by definition the market will underprovide it. Although much emphasis has been placed on government efficiency and the provision of public goods such as environmental quality, there has been less emphasis placed on the efficiency of government subsidies. Governments that provide trade and other subsidies do so at the expense of underproviding public goods, given a fixed budget constraint. Public good investments by the government can complement private investments and alleviate market failures, thus resulting in economic growth (López and Miller 2007; López and Galinato 2007). Furthermore, government subsidies, including trade subsidies, would promote activities that would be more demanding for the environment as opposed

to public good expenditures, which may compensate for credit market failures and promote human capital accumulation. A study by López, Galinato and Islam (2007) finds that increasing the share of public goods in total government expenditures reduces SO₂, NO₂, and lead pollution.

Empirical and conceptual analyses suggest that trade has contributed to economic growth and has accelerated trends to ameliorate local air pollutants. This is particularly true of most local air pollutants affecting cities. Trade does not seem to mitigate the ever-increasing emission of global pollutants, particularly carbon dioxide. The few studies focused on the links between trade and the green environment suggest that increased trade appears to exacerbate the losses of natural forests and other natural habitats, thus aggravating the trends toward global climate change and loss of biodiversity.

See also Basel Convention; Convention on Biological Diversity; Convention on International Trade in Endangered Species (CITES); Global Environment Facility; multilateral environmental agreements; pollution haven hypothesis

Further Reading

Andreoni, J., and A. Levinson. 2001. "The Simple Analytics of the Environmental Kuznets Curve." *Journal of Public Economics* 80: 269–86. A theoretical and empirical analysis of the role of economies of scale of abatement technology on the Environmental Kuznets Curve.

- Antweiler, W., B. R. Copeland., and M. S. Taylor. 2001. "Is Free Trade Good for the Environment?" *American Economic Review* 91 (4): 877–908. A rigorous theoretical and empirical examination of the relationship between trade and the environment.
- Barbier, E. 2005. *Natural Resources and Economic Development*. Cambridge: Cambridge University Press. A thorough review and exploration of the relationship between natural resources and development.
- Chichilnisky, G. 1994. "North-South Trade and the Global Environment." *American Economic Review* 84: 851–74. An important theoretical paper on the relationship between trade and property rights.
- Copeland, B., and S. Gulati. 2006. "Trade and the Environment in Developing Countries." In *Economic Development and Environmental Sustainability*, edited by R. López and M. Toman. Oxford: Oxford University Press, 178-216. An exploration of the relationship among capital mobility, international trade, and environmental quality from a developing country perspective.
- Copeland B. R., and M. S. Taylor. 2003. *Trade and the Environment*. Princeton, NJ: Princeton University Press. A comprehensive theoretical and empirical exploration of several aspects of the relationship between trade and the environment.
- Deacon, Robert T., and C. Norman. 2007. "Is the Environmental Kuznets Curve an Empirical Regularity?" In *Frontiers of Environmental and Natural Resource Economics*, edited by R. Halvorsen and D. Layton. UK: Edward Elgar. An empirical analysis of the robustness of the Environmental Kuznets Curve.

- Grossman, Gene M., and Alan B. Krueger. 1995. "Economic Growth and the Environment." *Quarterly Journal of Economics* 112 (2): 353–78. One of the earliest examinations of the Environmental Kuznets Curve for a wide range of environmental indicators.
- Harbaugh, W., A. Levinson, and D. Wilson. 2000. "Reexamining the Empirical Evidence for an Environmental Kuznets Curve." *Review of Economics and Statistics* 84 (3): 541–51. An empirical analysis update of the Environmental Kuznets Curve using revised data subject to various specification alterations.
- López, R. 1997. "Environmental Externalities in Traditional Agriculture and the Impact of Trade Liberalization: The Case of Ghana." *Journal of Development Economics* 53 (1): 17–39. A theoretical and empirical examination of the impact of trade policies on environmental resource in Ghana.
- Lopez, R., and G. Galinato. 2007. "Should Governments Stop Subsidies to Private Goods? Evidence from Rural Latin America." *Journal of Public Economics* 91 (5–6): 1071–94. An important analysis of the impact of government subsidies on per capita income, poverty, and environment in rural Latin America.
- López, R., G. Galinato, and A. Islam. 2007. "Government Expenditures and Air Pollution." University of Maryland at College Park Working Paper. An empirical analysis of the relationship between the share of government expenditures in public goods and air pollution.
- Lopez, R. and G. I. Galinato. 2005. "Deforestation and Forest-Induced Carbon Dioxide Emissions in Tropical Countries: How Do Governance and Trade Openness

- Affect the Forest-Income Relationship?" *The Journal of Environment & Development*, 14: 73-100.
- López, R., and S. Miller. 2007. "The Structure of Public Expenditure: A Robust Predictor of Economic Development?" University of Maryland at College Park Working Paper . A thorough cross-country analysis of the impact of the share of government expenditures in public goods on economic growth.
- Sachs, Jeffrey D., and A. W. Warner. 1999. "The Big Rush, Natural Resource Booms and Growth." *Journal of Development Economics* 59: 43–76. A theoretical and empirical examination of the relationship between natural resource booms and economic growth for Latin American countries.
- Shafik, N., and S. Bandyopadhyay. 1992. "Economic Growth and Environmental Quality: Time Series and Cross-Country Evidence." Policy Research Working Paper No. WPS 904. Washington, DC: World Bank. One of the earliest studies on the relationship between economic growth and environmental quality, later to be dubbed the Environmental Kuznets Curve.
- United Nations. 2006. *Trends in Sustainable Development*. New York: UN Department of Economic and Social Affairs. An overview of global trends in sustainable development indicators.
- World Bank. 2006. *Assessing World Bank Support for Trade, 1987–2004: An IEG Evaluation*. Washington, DC: World Bank. An evaluation of the World Bank's involvement and support for international trade.