NAFTA, Agricultural Trade, and the Environment

Introduction

Over seven years after its implementation, NAFTA remains unique in that it is the only trade agreement to address environmental concerns explicitly in an accompanying agreement. This accord, known as the North American Agreement on Environmental Cooperation (NAAEC), outlines environmental objectives, such as the promotion of sustainable development, enhancing compliance with and enforcement of environmental laws and regulations, and promoting policies and practices to prevent pollution.

The existing literature about the environment, international trade, and economic development suggests that the economic development fostered by trade liberalization offers the prospect for substantial environmental improvement over the long run, especially for less-developed countries such as Mexico. In the short run, NAFTA is likely to have a combination of positive and negative effects on the environment, as producers select alternative techniques of production, increase or decrease the scale of production, and modify the crop and animal composition of their agricultural activities. In addition, the expansion of trade within North America is associated with increased traffic, congestion, and air pollution along certain transportation corridors. Ongoing investments in infrastructure offer the promise of alleviating these problems.

The Environmental Impact of Trade Liberalization: Theory and Evidence

Economic theory tells us that trade liberalization increases wealth. Moreover, wealthier countries tend to be more willing and able to channel resources into environmental protection and to have higher environmental standards. Thus, a diverse set of environmental standards across countries should be expected to persist due to differences in country-specific attributes such as per capita income (Bhagwati, 1996). As long as per capita incomes vary across countries, diverse environmental preferences are likely to persist.

Higher income countries have greater resources to allocate not just towards consumer goods but also towards pollution abatement. As such, freer trade and differential environmental preferences may result in the export of some pollution problems from developed countries (DC's) to less-developed countries (LDC's), as the latter group specializes in more pollution-intensive industries (Copeland and Taylor, 1994). Nonetheless, trade-induced increases in per capita income should create conditions under which all countries, including the LDC's, freely choose strengthened environmental standards.

Even if trade-induced income growth ultimately strengthens environmental regulations and enforcement, this begs the question of how trade liberalization affects short- and long-run environmental outcomes. In order to understand the economic processes underlying these outcomes, it is useful to decompose the environmental impact of trade liberalization into three general categories — a technique effect, a scale effect, and a composition effect (Cole, Rayner, and Bates, 1998):

> ***Technique Effect.*** All else being equal, increasing per capita income tends to result in calls for increased regulation mandating cleaner technologies. Trade liberalization thus may have a technique effect as producers alter production methods to adopt either cleaner or dirtier production technologies.
>
> ***Scale Effect.*** Empirical evidence has long linked open economies to economic growth (Edwards, 1992; Harrison, 1996). Increased output and scale of production resulting from trade liberalization, however, may generate additional pollution emissions and accelerate the depletion of natural resources.
>
> ***Composition Effect.*** Trade liberalization may also affect the composition of output produced in an economy, as resources formerly devoted to protected inefficient industries will be utilized elsewhere.

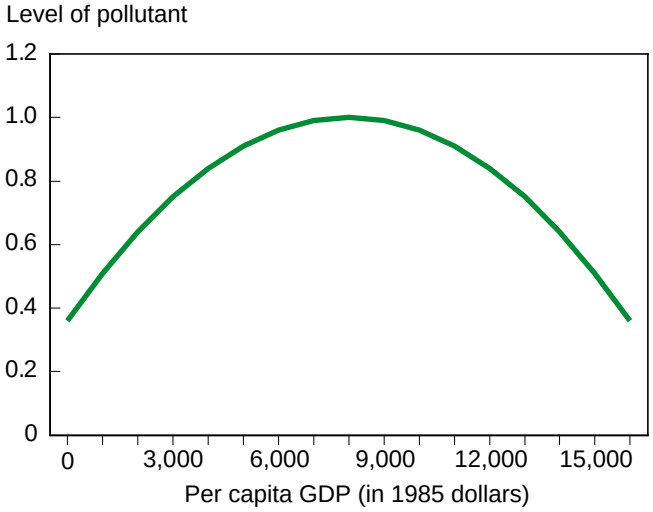
These three effects may interact to create an inverted-U relationship between income and pollution. Named in honor of Simon Kuznets, who proposed a similar relationship between income and income inequality,

this hypothetical relationship is known as the environmental Kuznets curve (EKC) (World Bank, 1999). The argument is that when a country develops from an initially low level of income, the scale effect dominates, as there is increased demand for all inputs, including using the environment as a sink for waste. Rising incomes, however, increase the willingness to pay for environmental amenities. Regulations are enacted, forcing a shift to cleaner production processes, as the technique effect reduces harmful emissions and environmental damage. As resources are shifted out of protected polluting industries and rising incomes shift preferences to cleaner goods, the composition and technique effects eventually dominate the scale effect.

Figure F-1 illustrates this phenomenon in a stylized EKC for NAFTA countries. Although Stern, Common, and Barbier (1996) criticize the estimation and usefulness of the EKC, Grossman and Krueger (1995) provide empirical support of this hypothesis. They find that, for most pollutants, mean air and water concentrations increase as per capita GDP initially increases from a low level of income, but that concentrations begin to decline before per capita GDP reaches $8,000 in 1985 dollars. Expressed in 1985 dollars, Mexican per capita GDP was $3,124 in 1999, while Canadian and U.S. per capita GDP were $14,173 and $22,456, respectively.[1] Given that the per capita GDP's of the NAFTA countries cover a broad range, it is likely that the three countries lie along different points on the EKC.

Figure F-1

Stylized environmental Kuznets curve



Source: Economic Research Service, USDA.

Trade Liberalization and Agriculture: Empirical Evidence

Only a few empirical studies specifically examine the environmental effects of agricultural trade liberalization, and even fewer studies focus on the NAFTA countries. While drawing general conclusions is difficult and speculative, the existing research does provide a few insights.

First, the relative importance of agricultural externalities[2] may differ according to a country's level of per capita income. For example, the prevalence of *extensive* methods of agricultural production, in which output is increased by expanding the area planted, possibly to marginal lands, may be greater in poorer countries. In contrast, higher-income countries may be more likely to employ intensive methods, in which output is increased by expanding the use of inputs other than land.

Extensive and intensive methods are associated with different types of externalities. For example, soil erosion may be a relatively more important externality for extensive agriculture while nutrient and pesticide runoff is relatively more important under intensive agricultural practices. Agricultural trade liberalization may affect the overall level of environmental degradation, but it may also cause shifts between types of effects.

The intensities of fertilizer and tractor utilization are often thought to be indicative of the intensity of agricultural production. Interestingly, fertilizer usage has increased in both Canada and the United States since the implementation of the Canada-U.S. Free Trade Agreement (CFTA) in 1989, which suggests that agriculture is becoming more intensive in these two countries (fig. F-2). In contrast, fertilizer usage in Mexico has changed very little since NAFTA's implementation in 1994, except for a precipitous drop in fertilizer usage in 1995, on the heels of the peso crisis of December 1994. With respect to tractor utilization, there have been no major changes among the three NAFTA countries during the CFTA-NAFTA period (fig. F-3). However,

[1] To express per capita GDP for 1999 in 1985 dollars, GDP data from World Bank (2001) were deflated using the implicit price deflator from U.S. Department of Commerce, Bureau of Economic Analysis (2001).

[2] An externality is a "cost or benefit that falls on third parties and is therefore ignored by the two parties to a market transaction" (McEachern, 1997, p. 523).

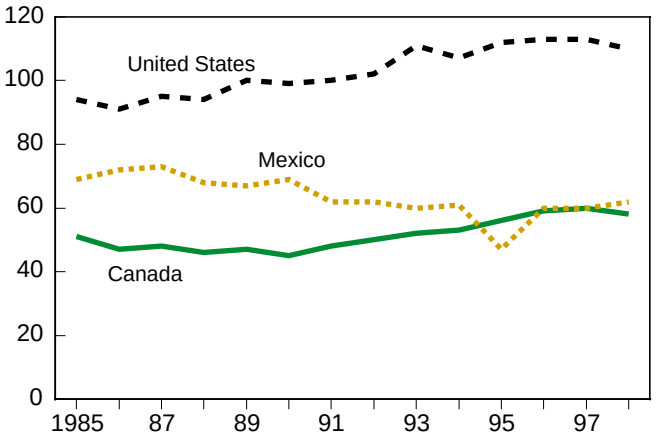
these data do not account for changes in input quality such as tractor size and fertilizer type.

Recent analysis by the OECD (2000) indicates that trade liberalization would cause agricultural prices to decline in countries that historically have pursued chemical-intensive agriculture. Lower output prices decrease the incentive to apply costly inputs, so environmental stress from pesticide runoff and groundwater contamination would be relieved in those countries. Conversely, in countries that are better able to accommodate increased agricultural intensity because pesticide and fertilizer usage historically has been low, there should be increased rates of chemical application. On the other hand, the externalities associated with extensive methods of production may decrease.

Figure F-2

Fertilizer usage in the NAFTA countries, 1985-98

Metric tons of fertilizer per 1,000 hectares

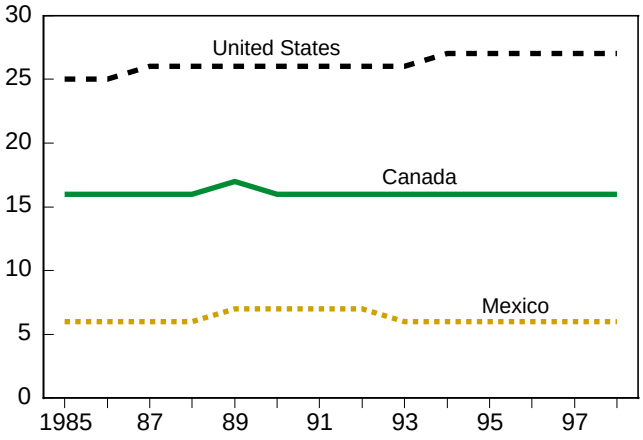


Source: Food and Agriculture Organization of the United Nations (2001). For each country, total fertilizer consumption is divided by the total amount of land devoted to arable and permanent crops.

Figure F-3

Tractor utilization in the NAFTA countries, 1985-98

Number of tractors in use per 1,000 hectares



Source: Food and Agriculture Organization of the United Nations (2001). For each country, tractor utilization is divided by the total amount of land devoted to arable and permanent crops.

A number of researchers have employed sophisticated economic models to predict the environmental consequences of trade liberalization on agriculture in North America. For example, a detailed general equilibrium study of 22 agricultural sub-sectors in Mexico indicates that unilateral trade liberalization by Mexico would decrease both agricultural output and pollution, as measured by 13 indicators of water, air, and soil effluents. Overall Mexican real GDP, however, increases significantly (Beghin, Dessus, Roland-Holst, and van der Mensbrugghe, 1997). Using a partial equilibrium model (a simplified model that presumes no income effects due to price changes) in conjunction with econometric analysis, Williams and Shumway (2000) evaluate the impact of NAFTA, economic growth, research investment, and farm policy. Real farm income is projected to increase in both the United States and Mexico, and dramatically so in the latter. Unlike previous studies, Williams and Shumway's input and output elasticity estimates lead to predictions that U.S. and Mexican fertilizer usage will increase substantially. In addition, their model predicts that U.S. pesticide usage will increase, while Mexico's pesticide usage will fall.

The North American Agreement on Environmental Cooperation

In recognition of the potential benefits from the coordination of trade and environmental policies, the North American Agreement on Environmental Cooperation (NAAEC) was negotiated in 1993 as a side agreement to NAFTA. The NAAEC encourages and facilitates sound domestic environmental policies in conjunction with trade liberalization. In addition, it created the Commission for Environmental Cooperation (CEC), which promotes environmental objectives such as sustainable development and pollution abatement while encouraging “win-win” opportunities for both trade and the environment.

The CEC provides numerous opportunities for environmental organizations and other stakeholders to voice their concerns to policymakers. A recent

example is the symposium entitled "Understanding the Linkages between Trade and Environment," held on October 11-12, 2000 in Washington, D.C.[3] By bringing environmental concerns before policymakers, these gatherings facilitate the coordination of trade and environmental policies and lessen potential conflicts between the two.

In addition to soliciting public input at symposia, the CEC reviews submissions from interested parties who claim that a NAFTA country is failing to enforce its environmental law. Although the CEC has no authority to force compliance, it may develop and publish a factual record if warranted in order to encourage reform. Submissions currently under review include an allegation that Mexico has failed to enforce its environmental laws that would have prevented a shrimp farm from, among other things, introducing a species of shrimp that spread disease to other fishery resources. The NAAEC also permits each NAFTA country to challenge the environmental enforcement effectiveness of any other NAFTA country before an arbitral panel that possesses the authority to impose monetary penalties. However, the actions that may be challenged are restricted to those characterized by a "persistent pattern" of non-enforcement. Furthermore, a member country will not be liable if the non-enforcement results from "bona fide decisions to allocate resources to enforcement in respect of other environmental matters determined to have higher priorities" (NAAEC). Though no suit has yet been brought before the arbitral panel, the NAAEC remains unique among trade agreements in its provision allowing one member country to challenge the effectiveness of another member country's environmental protections. Any assessments that levied would be paid into a fund established in the name of the CEC and expended to improve the environmental quality of the country complained against.

The CEC also conducts original research on the environmental effects of NAFTA. In particular, two of the CEC's three case studies examining the environmental impacts of NAFTA-induced changes in market structure focus on agriculture. By definition, case studies are not comprehensive works, but the topics were chosen because of *a priori* beliefs that these subjects have a strong relationship to NAFTA and the environment.

One agricultural case study examines feedlot production of cattle. It finds that trade liberalization under NAFTA has reinforced existing patterns of comparative advantage and concentrated the feedlot sector into larger operations in Kansas and southern Alberta. Although this concentration has the potential to cause nitrate contamination of groundwater because waste management problems are more severe on larger feedlots, this development may have a positive net environmental outcome. Specifically, there may be economies of scale in waste treatment facilities, and larger, more visible firms are more likely to adopt state-of-the-art technology in anticipation of government inspection and enforcement (Runge and Fox, 1999).

The other agricultural case study concerns Mexican corn production (Nadal, 1999). As corn producers in Mexico adjust to changing price dynamics, their responses could generate important environmental effects. Potential responses include the modernization of production techniques or the substitution of corn for other crops. Modernization involves capital-intensive production technologies such as irrigation, the intensive use of agro-chemicals, and the heavy use of mechanized equipment. Many of these technologies are water-intensive. Thus, their adoption could place increased pressure on water resources. Similarly, soil quality may be affected by more intense tillage practices.

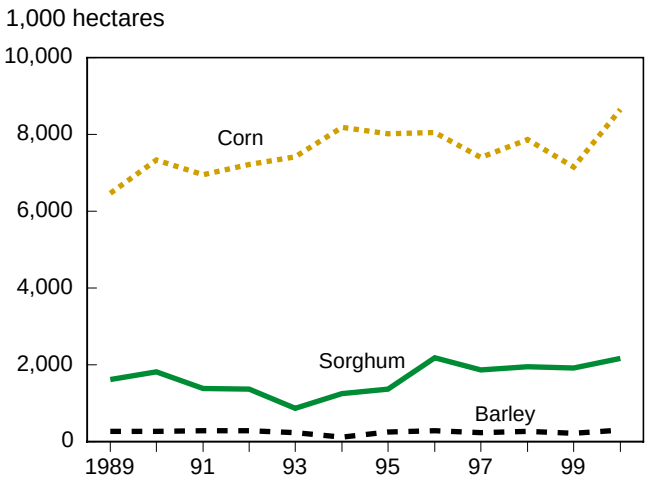
On the other hand, a shift from corn to feed grains such as sorghum or barley may have positive environmental outcomes, as plowing and water usage could decrease. Since the implementation of NAFTA, total area harvested in Mexico has remained fairly stable, but the area devoted to sorghum production has reached record levels and the area devoted to barley has increased slightly (fig. F-4). These increases in feed grains, however, have not come at the expense of corn production, which has fluctuated due to a series of droughts. Trade liberalization undoubtedly reinforces a shift to crops in which a country possesses a comparative advantage, but predicting this shift and its environmental impact poses a significant challenge. In the case of sorghum, the increase in area planted may have been driven by increased livestock production in Mexico.

Modernization may also involve the adoption of biotechnologies that reduce the need for pesticides and thus generate positive environmental outcomes. However, the study indicates some loss of genetic diversity, as farmers shift from local varieties of corn

[3] Materials from the symposium are available at <*http://www.cec.org/symposium/index.cfm*>.

Figure F-4

Area harvested in Mexico of barley, corn, and sorghum, 1989-2000



Source: Food and Agriculture Organization of the United Nations (2001).

to hybrids with higher yields. This loss has been limited by heterogeneous soil qualities, climates, and local pests, which degrade the performance of high-yield hybrids. Although the case study focuses on the environmental impacts of potential responses by Mexican corn producers, the incentives for crop substitution and the intensification of production practices would likely apply to many other crops as well.

Environmental Concerns: The Effects of Trade and NAFTA's Rules

Some environmental groups have argued that NAFTA's rules on investment, as specified in Chapter 11 of the agreement, are flawed. With a few exceptions, Article 1110 of Chapter 11 prohibits each NAFTA country from "directly or indirectly taking any actions that nationalize or expropriate the investment of an investor" from another NAFTA country. Fourteen environmental groups have criticized these rules and argued against the adoption of similar language in other multilateral agreements (Downs, 1999). Their concern is that NAFTA's rules allowing firms to sue member governments for compensation for "expropriation of an investment" limit a country's ability to enact and enforce strict environmental laws. A frequently cited case involves the Canadian government's revocation of restraints imposed on the importation and trade of MMT (methylcyclopentadienyl manganese tricarbonyl), a U.S.-made, allegedly toxic, gas additive. The revocation was made on July 20, 1998, after its manufacturer, Ethyl Corporation, filed a suit against the Canadian government under NAFTA's Chapter 11 provisions on investment (Baker & McKenzie, 1998). Although no Chapter 11 case has directly involved agriculture, the ongoing debate concerning the environmental and health impacts of genetically modified organisms suggests that this possibility is not implausible.

A related concern is that trade liberalization creates an incentive for countries to lure capital by lowering environmental standards, which in turn may cause other countries to respond in kind. In contrast to the static concept of "pollution havens," this dynamic process is commonly referred to as the "race-to-the-bottom" hypothesis. According to the existing (albeit limited) empirical work, NAFTA has not encouraged a general weakening of environmental standards (Fredriksson and Millimet, 2000).

Another concern is that increased agricultural trade among the NAFTA countries may increase the risk of introducing harmful non-indigenous species (HNIS) and diseases to new countries and new geographic areas. An estimated 40 percent of the insect-pest species (e.g. Russian wheat aphids and Asian Gypsy moths) afflicting U.S. agriculture and 50-75 percent of the weed species (e.g. knapweeds and cheatgrass/medusahead) are not indigenous to the United States (U.S. Congress, 1995).

The costs of HNIS are undoubtedly significant, in terms of increased pesticide expenditures and altered if not irrevocably damaged ecosystems. However, the difficulty in measuring these costs makes it extremely challenging to determine what standards should be set for import screening. A standard of "zero entry" would be prohibitively expensive, while standards that are too lax could expose individual agricultural producers and the natural environment to unacceptable risks. Of course, HNIS can be introduced via non-agricultural trade and tourism as well.

To safeguard against HNIS, USDA's Animal and Plant Health Inspection Service (APHIS) operates agricultural quarantine inspections at international airports, seaports, and border stations. The important policy question then is whether current inspection standards and devoted resources are appropriate given the increasing level of trade among the NAFTA countries.

Agricultural trade is a significant component of overall NAFTA trade, and increased international commerce

likely involves increased transportation and fuel usage. Thus, expanded agricultural trade may contribute to increased emissions of pollutants. Economic integration often is concentrated in a few border corridors, resulting in hotspots of localized environmental stress, such as the high traffic areas in and around Laredo, Texas, and Detroit, Michigan (Sierra Club and Holbrook-White, 2000). A recent study of the border corridors of Vancouver-Seattle, Winnipeg-Fargo, Toronto-Detroit, San Antonio-Monterrey, and Tucson-Hermosillo concludes that NAFTA trade "contributes significantly to air pollution" in all five corridors (ICF Consulting, 2001: iv). The study identifies many opportunities to address these problems, including the use of cleaner-burning fuels and the alleviation of delays in border crossings through policy changes and investments in infrastructure.

Conclusion

Agricultural trade liberalization under NAFTA is likely to have affected the environment in a variety of ways, some positive and others negative. As Canada, Mexico, and the United States continue to integrate economically, it is highly probable that there will be further composition effects, as price incentives concentrate industries in areas possessing a comparative advantage. Crop substitution, technological modernization, importation of harmful, non-indigenous species (HNIS), increased use of transportation, and the development of environmentally friendly products are other examples in which the expanded agricultural trade associated with NAFTA could have positive or negative effects on the environment.

Assuming that increased trade contributes to rising future incomes, there is every reason to believe that an increasing willingness to pay for environmental amenities will translate in the long run into increasingly stringent domestic environmental regulations and enforcement. As this process unfolds, the North American Commission for Environmental Cooperation (CEC) provides concerned individuals and organizations with new opportunities to raise environmental issues that policymakers might have otherwise overlooked. These activities facilitate the coordination of domestic environmental polices with trade-induced changes in environmental stress. Equally useful is that the activities organized by the CEC engage civil society in discussions of complicated transboundary issues that require international cooperation. Such cooperation could prove to be crucial in addressing certain issues. For example, agricultural exporters can take actions to reduce the probability that HNIS will be introduced to new areas.

Although real challenges lie ahead, the North American Agreement on Environmental Cooperation (NAAEC) positions NAFTA as the most environmentally sensitive trade agreement to date. Since trade liberalization generally improves allocative efficiency and raises per capita incomes, the long-run prospects for environmental progress in all three NAFTA countries are generally positive.

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