
ENVIRONMENTAL POLICY CONSIDERATIONS IN THE GRAIN-LIVESTOCK SUBSECTORS IN CANADA, MEXICO AND THE UNITED STATES

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INTRODUCTION

This paper explores several themes in the relationship between trade liberalization and environmental protection. In recent years, this relationship has become both more controversial and more important. We attempt to build on some ideas that were examined at a workshop of the International Agricultural Trade Research Consortium in Toronto in 1995 (Bredahl et al., eds. 1996) and at the Third Agricultural and Food Policy Systems Information Workshop in Tucson in March 1997 (Loynes et al., eds. 1997). In order to set the context of what follows, we discuss the emerging consensus on the environmental effects of agricultural trade liberalization under both the Uruguay Round Agreement (URA) and under the North American Free Trade Agreement (NAFTA) and we examine the available evidence on the potential effects of domestic environmental regulations on competitiveness and ultimately on trade in agricultural commodities. We then turn our attention to some conceptual and practical issues that will need to be resolved before much more progress can be made in the integration of trade and environmental policies. The general focus of our discussion is on the crop and livestock industries of North American agriculture, but many of the issues that we discuss transcend these sectoral or geographic boundaries.

The purpose of this paper is two-fold. First, we will attempt to lay to final rest some enduring speculation about the effects of trade liberalization in agriculture on environmental quality and about the impediments to trade embodied in national or subnational environmental policies. Our assessment of the growing empirical literature on these questions is that both effects are small when measured at a national level, but that there are important intranational adjustments in production, transportation, trade and consumption that seem to have been underappreciated. Our second

purpose is to stretch the conceptual boundaries that we have in mind when we talk about policy harmonization. Typically, "policy" has meant national governmental policy. But policy is made by subnational levels of government and it is also made by voluntary trade associations, by firms and by individuals. Sometimes policy made in these other contexts contradicts initiatives made at the national level and sometimes it reinforces those decisions. But what has not been adequately recognized, in our judgement, is that policy decisions at the non-national governmental level can be a substitute for national governmental policy. We characterize this as a Coasian perspective, but we are mindful that in so doing, our message may be as misunderstood as was Coase's original paper. The cumbersome process of policy integration at the national governmental level described by Josling (1997) provides the rationale for policy action at other levels and through other means. But it also creates analytical challenges to a discipline that has traditionally conceptualized policy more narrowly.

Trade liberalization and environmental protection continue to enjoy considerable political and intellectual support in Canada and the United States. We do not anticipate that this will fundamentally change any time soon. But the constituencies for the two agendas have, traditionally, not overlapped greatly. With the inclusion of agriculture in the multilateral trade liberalization process under the General Agreement on Tariffs and Trade (GATT) and now the World Trade Organization (WTO), and the efforts of the negotiators of the NAFTA to include agricultural trade in that regional exercise in trade liberalization, it has become increasingly important to build some bridges between these largely disparate constituencies. These bridges are needed to forestall political gridlock that would impede progress on both agendas. We see this as both the rationale for and the terms of reference of the North American Accord on Environmental Cooperation (NAAEC).

The scope of issues covered under environment also requires comment. The natural environment is composed of physical and biological resources, such as air, water, soil, plants and animals. These resources serve production and consumption needs and also are valued for their non-consumptive uses. They may be held as private or several property, they may be owned as common property or as government property, or they may exist in a state of open access where the ownership rights to exclude others are not vested in any individual or organization. In the discussion that follows, we are primarily concerned with the effects of changes in the production, distribution, retailing and consumption of products that originate on farms in response to reforms of agricultural or environmental policies. We limit our discussion to environmental effects in the form of changes in water quality or quantity, the degradation of topsoil, the loss or gain of wildlife habitat, and air quality changes. Often environmental effects are defined to include human health effects, either in the form of operator or third party safety issues or food safety concerns. Humans are part of the biosphere, but consideration of these types of human risks and benefits related to trade liberalization in agriculture is beyond the scope of this paper.

ENVIRONMENTAL EFFECTS OF TRADE LIBERALIZATION

Trade treaties do not occur in a market or policy vacuum. Contemporaneous changes in demand and supply, or in domestic policies, driven by factors that can be largely independent of those that influence the outcome of trade negotiations, have effects on production and consumption that are confounded with the effects of trade policy changes. In the case of Mexico, the URA and the NAFTA are the most recent phases of a process of policy reform that began in the mid-1980s (OECD, 1997). Mexico joined the GATT in 1986. In 1987, Mexico unilaterally exceeded its GATT commitments and reduced its maximum tariff rate to 20 percent. Prior to Mexico's entry into the GATT, its agricultural policy emphasized national self-sufficiency in staple food grains, food subsidies for low income urban consumers and both output price supports and input subsidies for domestic producers. Falling government revenues from oil in the latter half of the 1980s prompted a reform of those policies in the direction of more liberal markets and improved efficiency of resource use in the agricultural sector. Both the URA and the NAFTA effects on Mexican agriculture need to be seen, therefore, in the context of this longer process of policy and institutional reform.

The effects of trade treaties on production, consumption, transportation and trade go beyond the direct effects of tariff reductions and relaxations of quotas on prices. Recent work by Runge and Fox (1998) on the effects of the NAFTA on the North American cattle and beef industry are a case in point, but the effect may also be operating in the hog industry. At one level, the effect of the NAFTA on tariffs and quotas in cattle and hogs between Canada and the United States was trivial¹. But the NAFTA also sent an important signal, not in the form of tariff reductions but rather as a symbol of a "cease-fire", in the trade tensions in red meats that had been acrimonious for at least two decades.

Several presentations at this workshop address the task of quantifying the effects of the URA and the NAFTA on the agricultural economy of North America. While these agreements were being negotiated, several studies attempted to characterize the potential effects of different hypothetical levels of liberalization. The general finding of this literature was that, at least at a national industrial level of aggregation, the effects of removing all tariffs, export subsidies and quantitative restrictions on trade in agricultural commodities would be small. This result rests on the generally inelastic demand and supply relationships that have been estimated using historical data and econometric methods. The limited empirical work that has been conducted in the same vein since the actual terms of the URA and the NAFTA have been available and continue to indicate small effects on world agricultural production and prices².

¹The effect of the NAFTA on the Mexican cattle and beef industries, through decreased tariffs and increased market access, was more substantial (Runge and Fox, USITC, OECD).

²See Tanner (1997) for a synopsis of modeling efforts on the URA.

Environmental Impacts

Our view is that agricultural trade liberalization affects prices of products and inputs through the reduction of tariffs, the relaxation of quantitative restrictions on products or inputs, and the harmonization of technical standards. Compliance with the terms of a trade agreement may also require the modification or even the elimination of programs and policies that influence farm production decisions and actions further down the supply chain. The primary impact of these changes occurs when producers and consumers respond to new market opportunities. It is these changes that, for agriculture, lead to the first round of environmental effects of trade liberalization. These effects may be positive or negative, from an environmental point of view. Second round effects come as these changes in production and consumption translate into changes in transportation and trade. This can create environmental impacts if goods are transported longer or shorter distances or using different means of transportation. Of course, these effects could also be positive or negative.

A third round of environmental impacts of trade liberalization arises through the effect of liberalization on economic growth. The relationship between trade liberalization and environmental quality is complex. This relationship has been examined from several perspectives. Some environmental critics of trade liberalization have argued that if economists are correct in their claim that the dismantling of protectionism raises the average standard of living of citizens of the country whose trade policies have been liberalized, and if higher levels of income translate into greater pressure on global natural resources, then trade liberalization should be rejected on environmental grounds.

The key empirical relationship in this assessment is the one between economic growth and environmental quality. Aggregate evidence presented by Grossman and Krueger (1995) suggests that the relationship between economic development and environmental degradation is not linear. In fact, they suggest that if a correlation exists, the relationship may be an inverse one, at least at higher levels of income per caput. Lucas (1996) also concluded that, while the empirical relationships are far from simple, there is not a monotonic increasing relationship between standards of living and various measures of environmental quality. Arrow et al. (1995) also urge caution in the interpretation of the available empirical evidence on the relationship between economic growth and environmental quality.

We are concerned with the relationship between trade and the environment at a less aggregate level. In particular, we are concerned with the effects of the URA and of the NAFTA on environmental quality through the effects of those treaties on the livestock and grain industries of North American agriculture. Trade liberalization can affect production and consumption decisions for agricultural commodities in numerous ways. These decisions can result in mixed effects on environmental quality. A comprehensive and balanced approach is required to ensure that all of the important positive and negative effects of trade liberalization are considered in any environmental analysis of a trade agreement. Focus on one class of effects at the expense of the other has often lead to avoidable controversy.

The primary focus of trade liberalization³ negotiations has been the reduction of tariffs and, to a lesser extent, quantitative restrictions on imports and exports. The reduction of tariffs has three primary effects. First, consumers face lower prices than they otherwise would. As long as demand for the relevant product is not completely inelastic, we would expect consumption to increase. A second effect of tariff reductions is to reduce the product and input prices received by domestic producers. Unless supply is completely inelastic, we would expect domestic producers to produce less after a reduction in tariffs on outputs and to produce more after a reduction in tariffs on inputs. The net effect of a simultaneous reduction in tariffs on inputs and outputs is therefore ambiguous. The third effect, and this is usually ignored, is the impact on government revenues. Unless a Laffer Curve effect is observed, we would expect a reduction in tariffs to decrease government revenues. Determining the effects of this fiscal impact on resource use in agriculture is clearly a complex undertaking. If revenues lost from tariffs are replaced by income, sales or other domestic taxes, then the effect on economic output depends on the incidence of those taxes relative to the tariffs they replace. Alternatively, lost revenues could lead to reduced government expenditures.

Environmental Implications

The environmental implications of these three effects are complex. A fall in product prices received by domestic producers can have two effects. First, it can lead to a contraction of the extensive margin of production. Economically marginal land that was in production at the artificially high prices sustained by tariff protection will become extramarginal. This extramarginal land will tend to move to its next highest valued use outside agriculture. If that use is forestry, recreation or abandonment, this can lead to an improvement in environmental quality if those activities are more conducive to the maintenance of wildlife habitat and water and air quality than the agriculture that they replace. But this land use conversion may benefit some species that are less well adapted to the modified ecosystem under agriculture and be a setback for those species that did well in that agricultural ecosystem. So even at this basic level, the environmental effects of trade liberalization are equivocal. And agricultural land use may maintain physical infrastructure that slows erosion relative to what would occur should agricultural land be abandoned. In these instances, surface water quality may be degraded by eroded sediment when that infrastructure, in the form of terraces and canals, falls into disrepair.

The reduction of prices received by domestic producers can also have an impact on the intensive margin of production. Falling output prices, often accompanied by increasing input prices as input subsidies are also reduced or abandoned as part of a trade agreement, creates an incentive for domestic producers to apply fewer inputs per unit of land than they otherwise would. To the extent that these inputs have been applied in amounts that exceed the absorptive capacity of the land and the plants which are grown on it, they can be a contributing factor to degradation

³The discussion that follows is based on the conditions that typically prevail in developed country agricultures; that domestic policies favor domestic producers and the expense of consumers and taxpayers.

of ground and surface water quality. Under these circumstances, reduced input intensity can shrink the environmental footprint of agriculture. Of course, reductions in tariffs on inputs would act generally in the opposite direction as reductions in tariffs on outputs⁴.

It is important to remember, however, that the adjustments in resource use in agriculture that occur in response to a trade treaty are the joint products of the terms of that treaty **and** domestic environmental programs such as land set-asides, restrictions on land use and fertilizer applications to protect groundwater or surface water, local zoning regulations that limit the expansion of livestock facilities, domestic pesticide regulations and other resource conservation policies. These measures, at least initially, could constitute constraints on changes in agricultural production in the wake of a trade treaty. Moreover, the existence of a such a treaty can create pressures for policy change in these areas. For example, non-targeted soil conservation payments to producers might attract only limited international attention in the absence of a trade treaty, but they become a potentially contentious issue when the terms of that treaty permit payments to farmers only in the pursuit of a "legitimate" environmental measure by "cost effective" means.

Some environmental critics of trade liberalization have been quick to point out, however, that reduced domestic production and increased domestic consumption lead to increased international trade and that trade must be transported from exporting countries to importers. This transportation consumes resources and releases emissions into the atmosphere and into waterways. This increased pressure on air and water should be acknowledged as part of the consequences of trade liberalization (Gabel, 1994). There are important qualifications to this effect, however. Intranational transportation is not always less environmentally burdensome than international transportation. Canadian trade and transportation policies have been closely linked since the "National Policy" of the MacDonald government shortly after Confederation in 1867. The aim of this policy was to promote east-west transportation and interprovincial trade within the fledgling Canadian confederation of provinces at the expense of north-south trade with the United States. To the extent that this policy was successful, it increased the distance over which goods were transported within Canada and, for that matter, within North America. This example illustrates the possibility that trade liberalization can actually lead to shorter distances traveled by commodities.

Trade liberalization generally has more sweeping implications than the reduction of tariffs and the relaxation of quantitative restrictions of imports and exports. Signatories to a trade treaty may agree to forgo the use of certain classes of policies, for example export subsidies, as well as to reduce tariffs and increase quotas. Or some policies may be abandoned because they become prohibitively expensive under more liberal trade. The NAFTA and the URA also contained provisions to

⁴To complete the taxonomy that we introduced earlier, relaxation of import quotas on outputs or inputs would tend to reduce domestic producer prices. Trade liberalization in agriculture usually also involves the application of a set of criteria that rules certain types of input or output subsidies as "illegal" under the terms of the treaty.

harmonize or otherwise render compatible national technical and environmental regulations. Regulatory harmonization has proven to be one of the most worrisome concerns to environmental critics of GATT and the NAFTA. It was arguably the potential for the so-called "race to the bottom" as the outcome of regulatory competition among Mexico, Canada and the United States that led to the signing of the NAAEC concurrently with the ratification of the NAFTA itself. Lindsey and Bohman, at last year's meeting of this group, clearly laid out the trade economists' case against a Procrustean homogenization of technical standards and environmental regulations among trading partners, particularly among trading partners at disparate levels of economic development. The case, however, continues to be a hard sell outside the confines of the community of trade analysts and negotiators. Later in this paper, we outline reasons that might give economists pause in their criticism of harmonization.

The linkages between the terms of a trade treaty and the effects of those terms on patterns of production and consumption within the domestic economies of the signatories to that treaty and on intra and international trade in commodities affected by that treaty are complex. No less complex are the linkages between those changes in production, consumption, transportation and trade and the various dimensions of environmental quality. The quantitative literature on the effects of the NAFTA or the URA on Agriculture specifically investigating the likely effects of the actual content of those agreements is not voluminous. Many studies⁵ were conducted while the treaty negotiations were in progress.

Different possible levels of liberalization were modeled before it was yet clear how much substantive progress would be made on the liberalization of agricultural trade in either of those agreements. The general finding of this research effort is that the aggregate effect of even a radical, almost complete, liberalization of agricultural trade relations would be modest. Anderson and Strutt (1996) report that the aggregate effect of such a hypothetical liberalization on global grain and livestock production would be negligible. A small⁶ relocation of production away from the most protectionist high income countries to low income countries, for whom trade liberalization would amount to a cessation of punitive trade treatment of their agricultural economies, and to some of the less protectionist developed economies, was anticipated. But describing the regional changes in production in terms of high income and low income countries masks an important effect of this hypothetical radical liberalization. Various results reported by Tyers and Anderson (1992) indicate that agricultural output under radical liberalization would fall by as little as 10 percent to as much as 50 percent in Japan and in the European Community. The environmental importance of this adjustment follows from the fact that the agricultural economies of these regions are currently among the most input intensive in the world. High producer prices have encouraged farmers in these countries to apply

⁵See Anderson and Strutt (1996) for an overview of this literature.

⁶Anderson and Strutt indicate a 5 to 6 percent reduction in production in the industrialized countries, primarily Japan and western Europe, partially offset by increases in North America and Australia and New Zealand, and an increase in production in low income countries on the order of 3 to 8 percent.

more plant nutrients, plant protection products and animal units to each unit of land. In our judgement, it is no coincidence that environmental concerns regarding agricultural emissions are acute in these countries.

So, potentially at least, agricultural trade liberalization could produce an environmental dividend. Decreasing input intensive agricultural production in high income densely populated countries that have been strongly protectionist toward their agricultural industries and increasing more input extensive production in more sparsely populated countries could result in a less environmentally invasive world agriculture. Of course, an important qualification of this generalization is that the net environmental effects of liberalization will also depend on the environmental policies and institutions in place in the countries where production expands that will shape the specific resource use adjustments that take place.

Evidence on Mexico

The actual level of liberalization achieved in agricultural trade relations in the Uruguay Round or in the NAFTA was far from radical. And the less liberalization actually achieved, the smaller will be the environmental dividend gained. Beghin et al. (1997) have recently published the results of a major study of the environmental effects of the NAFTA in Mexican agriculture. They used⁷ a general equilibrium approach in which Mexican agriculture was disaggregated into 22 agricultural and 14 related processing industries. Thirteen categories of agricultural emissions were considered in the model, but only chemical contamination of soils and water and NO₂ and SO₂ were analyzed in the three policy scenarios. Results were obtained for the case of domestic environmental policy reform in Mexico, the case of trade liberalization under the URA and the NAFTA alone, and finally the case of the coordinated domestic environmental policy reform and trade liberalization. An important feature of the model used in this study was its capacity to allow for adjustments in the input mix employed in agriculture in response to changes in either trade or environmental policies, rather than allowing only changes in total output with fixed input-output combinations. Emissions were modeled as a function of inputs used, not output produced. Environmental policy reform was modeled as the application of emission taxes on outputs. The emission taxes modeled in this study were hypothetical because, as far as we know, no such taxes are used in Mexico, Canada, or the United States, or in other OECD countries for agriculture. Taxes were levied on producers in proportion to the inputs used in production and to the emissions assumed to be generated from the use of those inputs. In our view, the model's focus on inputs is essential if modeling is to capture the intranational effects of policy change that are often most important from an environmental point of view.

Studies such as Beghin et al. are useful as preliminary indicators of environmental effects, but a growing body of literature indicates that local variations in climate, topography, geology, hydrology and ecology are critical factors influencing

⁷This analysis employed the OECD's Trade and Equilibrium Analysis (TEQUILA) general equilibrium model of the Mexican economy.

the severity of environmental problems associated with production activities and also the effectiveness of different measures that might be employed to address these problems. Antle, et al. argue that the level of aggregation embodied in most CGE models does not have enough resolution to identify these local effects. Consequently, these models give us little insight about the real environmental effects that will ensue, just aggregate loadings. We agree and suggest that these exercises are most useful for judging general directions of change and orders of magnitude.⁸

Beghin et al. report that the imposition of effluent taxes on Mexican agriculture would reduce aggregate output of the sector by a little less than 5 percent. Much of this reduction is concentrated in the food grains sectors that have traditionally received a high level of protection under Mexican agricultural policy. The trade liberalization scenario is modeled as a gradual elimination of tariffs by the year 2010 coupled with a 10 percent increase in world commodity prices over the same time period, presumably as a consequence of liberalization in the rest of the world. Once again, production of the major food grains crops, maize, beans and sorghum declines under this scenario. Imports of these grains, as well as wheat and livestock, increase. Trade liberalization is accompanied by environmental improvements as the overall level of agricultural output declines, but some paradoxes are observed. For example, hog production falls under trade liberalization, but NO₂ emissions increase, presumably as a result of changes in rations brought about by increased availability of imported feed grains.

To our knowledge, there has not been any empirical analysis of the U.S. or Canadian agricultural economies to parallel the Beghin et al. study. Perhaps this group should coordinate research in this area. This is an ambitious undertaking. Many writers have suggested that more effective integration of trade and environmental policies will turn out to be a central issue in the next round of multilateral trade negotiations. If they are correct, then both the analytical capacity to study the environmental effects of continued trade liberalization in agriculture and improved empirical analysis of the nature and size of those impacts will soon be needed.

Ultimately, the environmental effects of adjustments in production, distribution, processing, retailing and consumption in response to a trade treaty are site specific. Local climate, geology, distribution of biota and hydrology can make resource adjustments that are ecologically benign in one context yet harmful in another. We would hasten to add that this observation in itself should not be used as an excuse to delay efforts at trade liberalization until more complete baseline data and analytical methods are available to enable us to identify site-specific risk factors. Since trade liberalization has the effect of reducing environmental pressure in some places and increasing it in others, delaying the process of liberalization merely prolongs the environmental damage inflicted by agricultural policies that have artificially encouraged agricultural production as the extensive and intensive margins.

⁸On the other hand, the cost of the large number of highly disaggregated studies that would be needed to investigate the local environmental consequences of the NAFTA throughout the North American agricultural economy would be enormous.

By the same token, the uncertainty should not delay putting environmental policies in place to guard against reasonably certain cases of increased environmental pressure, such as along border zones.

EFFECTS OF ENVIRONMENTAL REGULATION

North American farmers fear that environmental programs hurt their ability to compete in global markets in two ways. First, if domestic environmental programs impose strong standards or restrict the use of key inputs in production, their costs will rise. The ultimate effects on trade depend on the size and duration of the cost increase, and any changes in the *ceteris paribus* conditions. Second, if foreign nations guard against perceived environmental risks from imports by requiring certain product or product-related process characteristics, market access will be restricted. An example is a restriction on grain shipments for phytosanitary reasons. The significance of such restrictions depends upon their scope and the firmness of enforcement.

Concern about the trade effects of environmental programs is relatively new to agriculture, but not to other industries (Pearson, 1993). National air, water and land quality programs approved in the 1970s required firms outside production agriculture to reduce pollution, mostly by adopting specified technologies. Government and business leaders voiced fear about maintaining trade competitiveness in the face of added compliance costs. They felt that countries with lower environmental standards would capture a greater share of trade markets, and even attract some domestic firms. By and large, their fears have not materialized. We explain the reasons below, and can learn from them to inform the emergent debate in agriculture.

The issue of whether environmental programs affect trade competitiveness should be posed as "How can a country maximize welfare from its choices of domestic production and consumption, of trade, and of environmental management?" Perhaps Kym Anderson (1996, p. 44, emphasis added) has answered this question most clearly "... the fundamental point remains that free trade is nationally and globally superior to no trade **so long as the optimal pollution tax is in place.**" There are many caveats to this conclusion, but the principle is clear. Both open trade and optimal environmental management are requisite to maximizing national and global economic welfare. If the conclusion that liberalized trade improves welfare is to hold, environmental shadow prices must be included in the decision calculus throughout liberalization (Ervin, 1997). Hence, programs that internalize the external environmental costs and benefits of farming and ranching are needed.

What constitutes an "optimal" pollution control program requires further comment. In theory, we know that such a program will push pollution control to the point where the present value of the stream of benefits from avoided damages just equals the present value of the stream of marginal benefits from avoided damages. However, measuring the benefits of environmental improvement is often difficult or impossible because of missing current market prices, let alone forecasting future values. This relegates the optimal decision rule to the classroom for many environmental management problems. In its place, the choice of an "optimal" approach is

left to the judgement of duly elected politicians or responsible public officials who may consider available economic and other evidence. In practice, this often boils down to establishing physical or biological standards, such as the maximum permissible concentration of water pollution in a stream based on known or suspected health risks, and then finding the most cost-effective approach to achieve those standards. Is this in any sense "optimal"? Perhaps, if we can be assured that the decision-makers weigh all available evidence and accurately represent the public's preferences. These difficulties may explain why Anderson (1996) opts for the requirement of "something approaching an optimal tax" rather than strict optimality. It may also explain why the URA did not impose stronger conditions on the legitimacy of agri-environmental programs explained below.

Studies of other industries have found remarkably little evidence of trade and industrial location effects due to environmental regulations. The main approach has been to analyze the relationships between trade flows and pollution abatement costs (PAC). PAC comprise a small share of an industry's costs (on average less than 2.0 percent), but vary considerably over sectors (OECD, 1993). Moreover, differences in PAC between countries have declined over time. Comprehensive reviews conclude that compliance costs have caused insignificant output reductions on average, and show little if any evidence of any significant trade impacts (Dean, 1992). The lack of significant effects may reflect a host of offsetting influences, e.g., similar environmental programs across competing exporters, exchange rate forces, and management and technology innovations.

If production costs rise sufficiently from environmental regulation, some firms may migrate to countries with lower standards. This is the well known "pollution haven" hypothesis that "dirty" firms will move abroad to avoid heavy compliance costs. Their movement may reflect an intentional economic change because the industry creates large environmental damages. Theoretically, if the countries charge for significant environmental costs and compensate for significant benefits left out of market prices, then such a move can leave both countries better off. But concluding that the shifts improve global economic welfare depends on whether sufficient policies have been implemented at home and abroad. Studies have found scant evidence that PAC have affected industrial location decisions (Leonard, 1988; Dean, 1992). Firms base their location decisions on a variety of factors, including labor productivity, infrastructure, transportation costs, and other factors. If abatement costs are relatively small, then the incentive to reduce these costs by relocating is small as well.

Two important qualifications apply to the conclusion of insignificant trade and relocation effects by environmental regulation. First, some industries spend very different amounts on pollution control and face considerably different degrees of competition. Analyses of aggregate trade flows may miss specific effects on high PAC sectors that become apparent in more detailed studies. High-cost sectors may suffer from unfavorable pairwise differences with their competing exporters. Even small amounts may be important in increasingly competitive international markets under trade liberalization. Second, the studies are backward looking by necessity, and

subsectors that anticipate strengthened environmental requirements require careful monitoring. Given the extensive use of land and water by agriculture and a trend to more direct controls, close scrutiny appears warranted.

Most developed countries pursue a similar set of environmental objectives for agriculture, including reduced water pollution, soil erosion control, wildlife habitat protection, and landscape preservation, albeit with differing priorities and approaches (OTA, 1995). The United States predominantly uses voluntary-payment schemes⁹ The programs often combine education to identify problems, technical assistance to install recommended practices, and cost-sharing to defray a portion of the expense of implementing a practice. Another approach is to make rental payments to retire cropland from production temporarily. No other U.S. industry is offered the wide array of voluntary-payment programs for environmental management that are offered to agriculture.

With the exception of the short-lived Lower Inventories For Tomorrow (LIFT) program in the 1970s, Canada has not used land set-asides as a central instrument of agricultural resource policy. In part, the export orientation of the Canadian grain industry makes this policy approach unattractive. There is no comprehensive national environmental agricultural policy process in Canada. The federal Farm Income Protection Act of 1991 represented a limited step in this direction. The Act required an environmental analysis¹⁰ of all new federal agricultural policies and programs and a periodic environmental review of existing programs. Analyses were conducted for the Gross Revenue Insurance Program (GRIP) and for the Net Income Stabilization Accounts (NISA) (Environmental Management Associates, 1993) as well as for the national crop insurance program (Von Massow and Fox) but we are not aware of any more recent studies. Other Canadian agriculturally related environmental programs have taken the form of cost sharing non-targeted voluntary initiatives. A case in point is the Soil and Water Environmental Enhancement Program (SWEEP). This program consisted of research, demonstration projects, information distribution and producer assistance directed at reducing the rate of sediment and phosphorous deposition from agricultural sources into the Great Lakes, primarily Lake Erie. Mexico possesses the authority to pursue direct controls in agro-environmental management under the 1988 General Ecology Law. While this broad authority exists, it is unclear to what extent the provisions have been implemented.

⁹Payments for environmental management were sanctioned in the Uruguay Round Agreement on Agriculture under two conditions: (1) they are applied as part of a clearly defined government program to fulfill specific conditions, and (2) the payment amount cannot exceed the cost of the management practice of the loss in income associated with program compliance (Annex 2). Known as the "Green Box" conditions, they are part but not all of the requirements to ensure that subsidies do not cause trade distortions. In addition, the subsidies should be provided only in cases where the expected benefits of environmental improvement outweigh the anticipated costs. Also, the subsidies should be structured to stimulate producer and R&D innovations that minimize long-term compliance costs. If the subsidy does not satisfy these conditions, it can attract capital to the industry, enlarge supplies, and may aggravate environmental problems. Agro-environmental subsidies in the U.S. generally have not met the minimum compensation and incentive-compatibility requirements (OTA).

¹⁰The Act did *not* require an environmental assessment, which is a formal quasi-judicial process in Canada. The environmental analysis indicated in the Act is *ad hoc*.

The dominance of voluntary programs implies that North American farmers generally hold *de jure* or *de facto* rights to dispose of wastes into streams and other environmental media (Bromley, 1997). The extensive use of payments reflects that farmers require compensation for any diminution of those rights. Defining cost responsibility in favor of producers likely stems from the special political status given agriculture in developed nations. It also affects the technical difficulty an economic cost of implementing regulations to control diffuse sources of pollution that can not be readily traced to their sources over such a large land base and from millions of diverse production units, *i.e.*, nonpoint pollution.

Some compulsory environmental programs apply to North American agriculture. Not strictly regulation, the United States has compliance schemes that require farmers participating in other agricultural programs to meet minimum conservation standards or risk losing the program payments. Each country regulates the introduction and use of pesticides. Generally, human and environmental risks from pesticides are controlled by registering only those compounds deemed to be without excessive risk from application or through food, water or air exposure. Some programs also regulate the alteration of lands that would cause environmental loss. For example, conversion or drainage of certain wetlands and endangered species habitat in the United States is regulated. Finally, large confined animal facilities generally are subject to permits issued by federal, state and local governments that specify required waste control technologies and/or maximum effluent.

How has this mix of programs affected trade competitiveness? The general hypothesis is clear—the trade effects should be negligible, given the dominance of voluntary-payment programs. The U.S. government spends about \$3.5 billion per year on such programs, most of which goes for land rental payments, cost-sharing, and education/technical assistance (USDA-ERS). These programs do not exert competitiveness drag on **individual** farms and ranches. The effect on industry supply may indeed be significant as discussed below for set aside. The effects of the regulatory programs also appear modest. Assessments have shown that U.S. pesticide regulation has not caused significant economic loss for the farm sector (Osteen and Szmedra, 1989). Deen and Fox as well as Deen and McEwen have argued that while Canadian farmers often lament perceived disadvantages in access to pest control inputs relative to their U.S. counterparts, the actual effects on competitiveness are not large.[†] Comprehensive estimates of the effects of US regulations on confined animal facilities, wetlands alteration, and endangered species protection on competitiveness have not been made. However, a survey of assessments of those programs through the early 1990s suggested that the wetlands and endangered species programs had not affected broad segments of U.S. farms and ranches, and the confined animal facility regulations were unevenly and weakly enforced by states (OTA, 1995, pp. 97-98).

[†] Editor's note: Several surveys have shown that Canadian farm chemical prices are no higher (or lower) than those in the U.S., exchange rate effects included.

Formal tests of the competitiveness hypothesis are fraught with difficulty. Data on pollution control costs are not collected and reported for agriculture, unlike other industries. Statistical analysis also has proven difficult because of missing data on the **net** costs of the programs. Looking at payments as well as costs is important because past programs have made substantial transfers into agriculture in many countries (Paden, 1994). Those subsidies may have boosted production and trade, especially when coupled with production and export subsidies.

Tobey (1991) estimated the potential for different crops to generate pollution and correlated the estimates with the revealed comparative advantage of crops in the world market. He found that the crops that perform well in world markets also have the largest pollution potential. Therefore, stringent programs to control that pollution could affect their trade advantage. He concluded, however, that trade competitiveness losses are likely to be modest for three reasons. First, most competing exporters have introduced similar agro-environmental programs. Second, developing countries do not hold large market shares in most of the commodities, such that uneven environmental requirements will greatly affect trade. Finally, any competitiveness effects will likely be swamped by larger forces such as exchange rates.

Some trends raise the concern that production and trade may be increasingly affected. There is a distinct chance that conservation subsidies may rise in the form of green payments as production and export subsidies are diminished. Environmental subsidies do not necessarily distort trade as explained above. However, in practice, subsidy programs often depart from the optimal conditions. Also, there appears to be a trend toward environmental policies with more cost responsibility for farms and ranches. In the United States, 30 states have passed laws that authorize enforceable measures for farm water pollution, most during the last decade (Ribaud, 1997). The trend is for more direct controls.

The potential for greater effects exists because of the industry's extensive use of land and water. Two programs illustrate that potential. The first is land set-aside for environmental purposes. A 1995 study estimated significant trade gains from downsizing the U.S. Conservation Reserve Program (CRP), and few environmental losses (Abel, Daft, and Earley). Retirement of up to 14.75 million hectares in the CRP was reauthorized by the Federal Agriculture Improvement and Reform (FAIR) Act of 1996. Current enrollment stands at about 12 million hectares. It is unclear at this point how much more land will be retired. The USDA implemented an improved environmental benefits index and rules against paying rents in excess of market rates to help avoid retirements without net benefits. These reforms bring the CRP more in line with the URA requirements for environmental payments. Absent the support programs that previously boosted production, set aside now is more likely to be a binding constraint on production. However, it is possible that some enrollments are simply retiring cropland at the extensive margin that was brought into production under previous programs.[†]

[†]Editor's note: See the discussion of CRP in the Young and Adams paper in this publication.

The second is controls on pesticides. Major reform of U.S. pesticide programs was approved in the 1996 Food Quality Protection Act (FQPA) which will involve the re-registration of most compounds. The potential exists that many current pesticides will lose their registration. Concern by U.S. farmers emerges about maintaining trade competitiveness under the tighter controls. American agriculture is heavily reliant on these inputs. For example in 1995, 324 million pounds of active ingredients (a.i.) of herbicides, 70 million pounds (a.i.) of insecticides, 45 million pounds (a.i.) of fungicides, and 127 million pounds (a.i.) of other pesticides were estimated to be applied on cropland growing major U.S. crops (USDA, ERS, 1997). The total of 566 million pounds of a.i. compares to 215 million pounds in 1964. Herbicide use on corn grew from 26 million pounds (a.i.) in 1964 to 210 million pounds (a.i.) in 1991, and on soybeans from 4 to 70 million pounds (a.i.). Although acute toxicity risk has risen over the period, analysis shows that a chronic toxicity index has declined due to less persistence in the environment of newer compounds (USDA-ERS).

Two tentative findings emerge about the effects of agro-environmental programs on trade. First, current programs mostly cause negligible effects. U.S. set-aside programs are the major exception. Their effects on grain production and trade are likely significant. Their potential to cause welfare losses or gains depends on the rules used to enroll the lands. Second, future agro-environmental programs will enlarge the potential for trade effects. Restrictions on pesticide use and tighter controls on wastes from large confined animal facilities are notable. Any trade distortions from these restrictions depend on the specific programs adopted.

ENVIRONMENTAL TRADE MEASURES (ETMS)

Article XX of the GATT provides for two general exceptions from a country's GATT obligations that permit a country to institute measures related to environmental management:

Article XX(b) provides an exception for measures "necessary to protect human, animal or plant life or health"; and

Article XX(g) provides an exception for measures "relating to the conservation of exhaustible natural resources if such measures are made effective in conjunction with restrictions on domestic production or consumption."

An application of either exception generally comes in the form of a product standard, such as the amount of pesticide residue or the presence of unwanted insects on imported foods. Countries also use product-related process standards, such as the satisfaction of processing sanitary conditions.

Technically, the regulation is on the product, but it relates to the process of production. Controversy surrounds the use of process standards for environmental purposes. The exceptions legitimize country actions to protect their natural resources

from trade-related risks. Nonetheless, fears of a proliferation of environmental non-tariff trade barriers abound (Runge). Article XX actions must avoid unnecessary trade interference, such as unequal treatment of imports and domestic production.

Esty (1994) believes that the exceptions provide an insufficient basis for environmental management. His main reasons are the restrictions on "process" approaches since environmental effects largely derive from the production process rather than products, and the proscription on unilateral actions when multilateral environmental organizations are absent. Despite these concerns, tens of thousands of country actions to protect plant and animal health have been implemented and several international environmental agreements operate, with few GATT challenges to date. The apparent incongruity may be one of "the glass is half-empty, or the glass is half-full". Whether the existing mechanisms are sufficient to address modern environmental transboundary issues is the point of contention.

The URA added two new agreements related to environmental management—Sanitary and Phytosanitary (SPS) Measures and the Technical Barriers to Trade (TBT). SPS issues currently have the larger potential to affect agricultural trade. The SPS agreement sets out conditions under which sanitary and phytosanitary measures can be used to protect human, animal or plant health. Specific examples include inspection, certification and approval procedures, quarantine treatments, and the establishment of pesticide tolerances. The apparent driving forces for passing the new SPS agreement were food safety concerns and avoidance of unscientific measures that restrict food exports. Nonetheless, the SPS measures include animal and plant life and health, and therefore pertain to the natural environment.

How might the SPS Agreement affect the grain-livestock sector? One of the largest environmental risks of liberalized agricultural trade is opening new pathways for the importation of harmful non-indigenous species (HNIS). Over half of the weeds and 40 percent of the insect pests affecting U.S. agriculture and forestry are estimated to be non-indigenous. Prominent examples include the Russian wheat aphid, and 50 to 75 percent of major U.S. weeds that cause extensive damage to public and private lands. Jenkins notes that approximately 80 percent of the harmful new exotics detected from 1980 to 1993 in the United States were unintentional imports through trade. The costs of HNIS in the United States have been significant (OTA, 1993). Cumulative economic damage from 1906 to 1991 caused by 79 NIS organisms or species cases, less than 14 percent of the total, was estimated at \$97 billion (1991\$). Losses due to exotic agricultural weeds could not be included.

The SPS code pertains to HNIS cases. The code sanctions the use of quarantines, for example, to minimize harmful introductions. The United States has invoked this provision on a number of occasions: for example, to ban seed potatoes from Canada. Such actions may be viewed as disguised barriers to trade, and open to challenge under GATT rules. The GATT has rarely been used for such challenges, as noted above. Article XX establishes a nation's right to establish its own rules and regulations regarding human, animal, and plant health (which cover NIS).

Despite abundant fears, there is little evidence to document environmental technical barriers. One survey analyzed the impact of environmental standards on the exports of southern U.S. commodities (Marchant and Ballenger, 1994). Their findings did not reveal extensive trade effects from current domestic or foreign environmental actions, with the exception of the scheduled phase out of methyl bromide. Comprehensive assessment of technical barriers to U.S. agricultural exports is underway (Roberts and DeRemer, 1997). Technical barriers in this analysis encompass all product or product-related process standards that impede U.S. exports regardless of their legality vis-à-vis GATT rules. Therefore, they could include transparent violations of existing SPS and TBT codes, legitimate applications of the codes (e.g., to protect open access resources), or applications of product and process standards that have questionable legitimacy. The authors report an extensive survey of USDA field staff and representatives of producer groups who identified approximately 300 "questionable" measures in 63 foreign markets, and estimated that the technical barriers threatened, constrained, or blocked nearly \$5 billion in 1996 U.S. exports.

The "questionable" barriers were unevenly distributed by value of impact, by region, and by purpose. The estimated trade impact (loss in producer gross sales revenue) was under \$10 million for 70 percent of the barriers. On the other hand, just 20 barriers accounted for over 60 percent of the total impact. East Asian and the Americas countries led other regions in barriers. About 60 percent of the impact was attributable to measures that affected market expansion, followed by market retention, and then market access. Over 90 percent of the issues are SPS applications, and the remainder are other technical barriers. The barriers generally mirrored the broad pattern of trade flows for U.S. agricultural products. Although the survey was only the first step in a larger assessment, it suggests that technical barriers materially affect U.S. agricultural trade. The vast majority of barriers pertain to private natural resources, e.g., orchards, and not to open access environmental resources.

INCORPORATING ENVIRONMENTAL PROVISIONS IN TRADE AGREEMENTS: LESSONS FROM RECENT EXPERIENCE

There is increasing international interest in the integration of agricultural trade and related environmental protection measures¹¹. Calls for integration by trade negotiators and trade policy analysts tend to be animated by concerns that environmental policies might become the next generation of protectionism (Runge). Both the GATT and the NAFTA have come under fire from environmental policy analysts for not having achieved an appropriate level of integration of environmental and trade policy concerns. Calls for integration from environmentalists have primarily been concerned with trade based on a false comparative advantage when production of a traded commodity degrades some environmental value and this cost is not adequately reflected in the price of the traded good¹² (Paden, 1994). As a result of these

¹¹Recent work by the OECD (1993) and the agenda of this workshop are evidence of the growing interest in this topic.

competing perspectives and motivations, it is not always clear what purpose advocates of policy integration have in mind. The process of integration of trade policy and environmental policy is just beginning. There are reasons to believe that the NAFTA represents an improvement over the GATT in this respect, however trilateral support for the Commission for Environmental Cooperation has not been strong, indicating that the practical commitment to integration may not be as strong as some would like it to be. It remains an open question whether policy integration at the international level is best achieved within a multilateral trade organization, like the WTO, or with a parallel independent multilateral environmental organization, a WEO.

Our view is that trade treaties should ensure that trade is taking place under conditions in which the appropriate costs of external effects of production and consumption are internalized (taken into account) by producers, and consumers so that trade is not being distorted by environmental subsidies and that national measures taken to achieve such internalization are not disguised ways of protecting domestic producers from foreign competition. This purpose is clearly easier to state conceptually than operationally. What do we mean by internalization of appropriate costs? The economists concept of externality has been stretched to the point that it cannot help us draw the relevant boundaries. It has come to mean any instance of human action that generates harmful or beneficial effects for someone who is not party to the action or market exchange that originated those effects. Not all such harmful interdependence needs to be internalized before trade could be considered free of environmental subsidies¹³.

Does the requirement that trade not be implicitly supported by environmental subsidy require that "free trade" satisfy the requirements of sustainability (as suggested by Paden and by Common and Perrings) that is, are intergenerational environmental subsidies out of bounds as well as the more commonly considered third party costs associated with air and water pollution? Is it necessary to internalize all third party costs, or only those that are worth doing, in the sense articulated by Demsetz and Dahlman?

Regardless of how these conceptual issues are resolved, several practical resource related issues, in our judgement, are emerging in the trade and environment area that have important implications for the grains and livestock industries of North American agriculture. These include the following.

¹²This is sometimes referred to as an environmental subsidy, implying that some natural or environmental resource is being employed in the production of a traded commodity, but that the opportunity cost of that resource is not accurately reflected in the price at which that good is traded. Trade analysts, however, use the term "environmental subsidy" as we used it earlier, to refer to a payment by government to farmers in exchange for farmers providing some type of environmental service, for example, maintaining endangered species habitat on their land. These are clearly different ideas. This difference is but another illustration of the difficulties involved in building bridges of communication between the constituencies of trade and environmental policies.

¹³In the sense that this term is used by Paden (1996).

Full Cost Pricing of Irrigation Water. Irrigation water is becoming an increasingly scarce resource in Mexico, as well as the western United States and Canada. Farmers have rarely paid the full cost of providing this water. Increasingly, however, the environmental costs of reservoir and canal or pipeline construction and the alternative in situ and consumptive uses, especially urban consumptive uses, are being raised. Determining the level of subsidization of irrigation water costs for farmers is controversial and the stakes are high.

Full Cost Pricing of Grazing on Government Owned Lands. Few issues in agricultural policy in the United States, and to a growing extent in western Canada, are as explosive as grazing fees on federal lands. There are shreds of evidence that grazing fees in the United States and Canada are less than those that would prevail if those lands were privately owned and the fees were negotiated as market exchange prices. But the size of the difference between fees that would prevail under those circumstances and current fees is difficult to determine. And the potential countervail issue is the difference between the differences.

Full Cost Pricing of Transportation Services. Grain transportation off the Prairie provinces in Canada as well as through the combination of rail, truck and barge in the midwestern United States, historically has been fraught with implicit and explicit transportation subsidies. These subsidies have played a pivotal role in the evolution of the development of the continental grain transportation infrastructure. This in turn has influenced the location of production and processing activities. The current environmental footprint of the grain industries, and indirectly through feedgrains of the livestock feeding and finishing industries, reflects this history of subsidization. In Canada, the demise of the Crow Rates and their descendants is already being acknowledged as an important factor in the regional transformation of livestock feeding and meat processing at a national level. In the United States, water transport of grains raises the issue of watershed management, water use, and the full cost pricing of water used in transportation as well as irrigation.

Compensation of Landowners for Regulatory Takings Regarding the Protection of Endangered and Threatened Species. Policies to protect endangered species, wetlands and other natural areas differ substantially between Canada and the United States (Ivy, 1996) and even more so between Mexico and its NAFTA partners. The issue of compensation of land owners for restrictions on land use to preserve wetlands or to protect threatened and endangered species is being raised with increasing frequency in the United States and Canada (Fox, 1998). To the extent that emerging compensation practices differ between the two countries, they could be seen as an unfair competitive advantage.

Reform of U.S. Conservation Reserve Programs. The available evidence indicates that expenditures under various conservation provisions of U.S. farm bill legislation has been, to put it mildly, not closely correlated with the achievement of environmental objectives. It is not easy to define the criteria for targeted environmental programs. But Fox et al. (1995) have argued that there needs to be a clear contribution of erosion to off-site water quality problems before government action is justified. If we

accept this argument, then there is room for considerable improvement in U.S. soil conservation policy. The current level and distribution of expenditures would be hard to justify as a cost effective means of attaining a legitimate environmental objective, making them potentially vulnerable under URA provisions (see footnote 9).

Cross Border Water Pollution Problems, especially on the Mexico/U.S. border. As part of the environmental side-agreement of the NAFTA, the North American Accord for Environmental Cooperation, Mexico and the U.S. agreed to establish a special initiative to reduce water pollution crossing their borders. Early progress on these issues however, has been disappointing.

Domestic Water Quality Problems from Agricultural Emissions. In the developed economies, agriculture is one of the last sectors to have come under legislative and regulatory scrutiny for air and water borne emissions. The exclusion of agriculture from the process of regulatory oversight is usually attributed to agricultural emissions being characterized as "non-point" sources. But this term fails to adequately convey the nature of the problem of mitigating agricultural emissions. All emissions come from somewhere, from some "point". The problem with agricultural emissions can best be explained in terms of the costs of information. National or even regional regulatory agencies face a daunting task in obtaining information about the location of agricultural emission sources. These sources are numerous and are spread out over large areas. And emissions from most agricultural sources are seasonal or episodic. There is not a continuous regular flow of displaced sediment from crop land to adjacent water bodies. Sediment transport occurs contingent on weather events and the extent to which topsoil is exposed during these events. Similarly, livestock manure ends up in streams when storage facilities overflow, when grazing cattle obtain access to stream banks or when manure is misapplied. These are not continuous repetitive processes like many industrial or municipal emission processes. Consequently, it is often more costly to identify the points at which agricultural emissions originate. And this makes it more costly to trace the transport and fate of those emissions.

Perhaps, in light of the relative risks associated with agricultural emissions and the cost of obtaining better information about their origins, transport and fate, it has made sense to leave agricultural emissions until near the end of the regulatory process. In any case, baseline data for agricultural emissions in Canada and the United States have not been readily available. But this is changing rapidly. For example, the Economic Research Service's (1997) *Agricultural Resources and Environmental Indicators* provides a comprehensive empirical overview of the relationship between primarily crop production and environmental quality in the United States. While the available data on sources of agricultural emissions and our understanding of the mechanism that distributes these emissions in the environment are still incomplete, both the completeness and quality of these data and our understanding of the relevant mechanisms have progressed substantially in the last 15 years. While there is currently no Canadian counterpart to the ERS's *Indicators*, important efforts have been made to assess the contribution of agricultural emissions

to the degradation of ground and surface water quality. A major survey of rural groundwater quality was conducted in Ontario in 1992. Harker et al. (1997) reviewed the available evidence on the effects of agricultural activities on water quality in the Prairie Provinces and most recently, Paterson et al. (1998) have reported the findings of a five year study of the impact of agriculture on water quality in the province of Alberta.

Whether these environmental issues will become important in a trade context is difficult to predict. They would only become trade policy issues if they became irritating enough to one of the signatories to the NAFTA for that party to initiate some trade sanction such as a countervailing duty. As mere mortals, we are not in a position to predict that this will happen. We do however, consider each of these areas to be potential trade irritants in the future, and they all represent challenges to more effective integration of trade and environmental policies.

THE ROLES OF INDUSTRY SELF-REGULATION AND INTERNATIONAL AGREEMENTS

Agricultural economists have generally focused on government environmental policy and trade agreements as the primary or even the exclusive means of resolving harmonization and competitiveness issues. An emerging trend in business, however, suggests that the private sector is not waiting for government action to make progress on these complex problems. Apparently, too much is at stake in rapidly expanding global markets. A growing number of private firms are undertaking business-led environmental management programs. Their reasons are diverse, from cost saving by reducing production waste, to avoiding regulatory penalties, to entering lucrative green markets, to ensuring access to global markets; and, their strategies are often aggressive. Most of the early innovators have not been food and fiber production firms. Some agricultural input suppliers have extensive efforts underway, such as Dupont.

Two forces appear to foster business-led environmental management (Batie and Ervin):

- A desire to lower costs and improve profits while achieving or even exceeding environmental compliance standards, i.e., compliance-push forces; and,
- A desire to respond to consumer demands for more environmentally friendly processes and products, i.e., demand pull forces.

A recent example of the "compliance-push" force is the success of the National Pork Producers dialogue on waste management with the U.S. Environmental Protection Agency. The dialogue produced the central strategy for the President's Clean Water Action Plan to control waste emissions from large confined animal operations. An example of the "demand pull" forces is the large growth rate in "natural" foods produced by farms with organic or other sustainable agriculture technologies. The potential of demand-pull actions to solve complex multi-state or cross-border issues,

such as the Gulf of Mexico hypoxia problem, appears limited. Still, the private approach requires a limited government role, such as setting health standards, and grants broad private flexibility.

One approach that many firms involved in global commerce are eyeing to assist their business-led efforts is ISO 14000. This industry initiative is not designed to aid enforcement of environmental laws or inform the public. Rather, the firm undertakes a series of actions that assure a comprehensive environmental monitoring and management system is in place with independent auditing. Basic elements might include waste disposal processes, energy efficiency, water reuse, and treatment of hazardous wastes. Life-cycle analysis plays a central role in the ISO process. The International Standards Organization facilitates the process and assures that the firm's environmental system is credible. The firm is prohibited from using ISO 14000 status in marketing their products. However, it may be a way of assuring access to certain foreign markets, if those governments recognize the ISO process. The key role of transaction costs surfaces again. ISO 14000 may be particularly attractive to multinational firms with production and marketing operations in several countries with divergent environmental systems.

We can think about the trend toward industry self-regulation in terms of a hypothesis advanced by Coase (1960).¹⁴ If, according to Coase, government regulation can be a transaction cost economizing alternative to individual market

¹⁴Coase (1960/1998, 1994) has lamented the effect that his 1960 essay has had on economics. His contention, recently supported by Farber (1997), is that the true message of his 1960 essay has been lost on economists. The exposition of the so-called "Coase Theorem", a phrase that originated with Stigler, not with Coase, was not the aim of the paper. The world without transaction costs that is described in the first five sections of the paper is presented to illustrate a paradox in economic theory. In such a world, uncompensated external costs, monopolies, public good and free rider problems would be negotiated away by those who acted to exploit the latent gains from bilateral or multilateral exchange that deadweight losses represent. The paradox is that the economic theory of 1960, and according to Coase, the economic theory of 1992, had not integrated transaction costs into its conceptual apparatus. It was therefore incapable of providing a coherent explanation of how problems of monopoly, public goods or externalities could persist. Coase, in contrast, had already described the real world as awash in transaction costs in 1937. The description of a world without transaction costs as a "Coasian" world is a fundamental error. Coase's claim is that the world of economic theory is the world without transaction costs.

If there is a real Coase theorem in the 1960 essay, it goes something like this. The world in which we live is one in which transactions are costly. Before we can transact, we need to search for potential partners and then we need to negotiate terms. These activities consume resources. In some circumstances, according to Coase "An alternative solution is direct governmental regulation. Instead of instituting a legal system of rights which can be modified by transactions on the market, the government may impose regulations which state what people must not do and which have to be obeyed." (Coase, 1960/1988, p. 117). This "Coase Theorem", is that, under a given set of institutional and technological conditions, regulation by the state may be a transaction cost economizing alternative to the resolution of problems through market transactions. It becomes an empirical question, therefore, of under what institutional and technological circumstances is this likely to be the case, and how can we tell if those circumstances occur.

The re-emergence of industry self-regulation, motivated by the negative incentives of avoiding potential liability or by the positive incentives of increasing market share, represents a test of this Coasian hypothesis. Have institutional or technological conditions changed recently so that government regulation formerly was a transaction cost economizing means of resolving problems of harmful interdependence, but no longer is? Coase, in sections VI and VIII of his 1960 essay explains that there is no reason to believe that the actual pattern of regulation undertaken by real governments will necessarily be a transaction cost economizing alternative to individual transactions. So another hypothesis is that existing regulations that are being abandoned may be cases of actions that were not really justified, in the Coasian sense, originally.

exchanges under specific institutional or technological conditions, then the observed increase in interest in industry self-regulation could simply be a response to underlying changes in institutions or technology.

A more accurate understanding of Coase's hypothesis also has important implications for the conventional economic analysis of the harmonization of environmental regulations. As Patricia Lindsey and Mary Bohman explained to this workshop last year, differences in environmental comparative advantage, technology, standards of living or preferences would provide a rationale for different regimes of environmental regulations in different countries. But this analysis is incomplete, in that it ignores a potentially important category of transaction costs. The need to adjust product specifications to different national regulatory requirements increases transaction costs. Firms may elect to not sell into as many markets under these circumstances, foregoing potential economies of size, scale or scope. Harmonization of regulations may be an important means of economizing on transaction costs.

Our profession has conducted little analysis of the forces driving this apparent trend and the potential consequences for environmental management in agriculture. Only anecdotal and case study data are available. If the privately-led initiatives offer joint private and public benefits, then strategic public assistance may be used to accelerate and expand the process (Batie and Ervin). We would like to see this group tackle the empirical work necessary to determine if this is true.

Private action generally does not suffice for solving transboundary environmental problems. They require multilateral cooperation, which involves huge transaction costs. The Montreal Protocol to reduce ozone-depleting substances and the Rio Conventions on climate change and biodiversity illustrate such approaches. Although there are more than 1000 separate international environmental agreements (IEAs), their overall effectiveness has not been assessed. The small number, about 20, that use trade measures appear to be effective. Research suggests that cooperative multilateral action with trade sanctions fosters "stronger" environmental standards than unilateral action (Barrett, 1996).

As evolving science reveals new linkages of environmental systems across borders and countries multiply their connections through international commerce, the impetus for structuring new IEAs will grow. This likely development could give two side benefits to lessen trade disputes. First, the IEAs will require some form of agreement on harmonized standards for the issues at hand. Second, appeal to a recognized international environmental agreement seems to be an admissible defense to a NAFTA or GATT challenge.

CONCLUSIONS AND RESEARCH RECOMMENDATIONS

Our digest of the available literature indicates that while there is much that we still do not know about the complex relationship between trade liberalization in agriculture and environmental stewardship, there is at least a preponderance of evidence

accumulating on some aspects of this relationship. For example, there is reason to believe that an environmental dividend is at least possible from the pursuit of trade liberalization in agriculture. We would hasten to add that the realization of that dividend is contingent on an appropriate integration of trade and agricultural policies and environmental policies and institutions. And local variations in ecological, physical and social circumstances play a critical role in shaping the nature and size of that potential dividend. Unfortunately, available models and baseline data are typically too aggregative to facilitate satisfying analysis of the impact of these local variations in conditions. But the costs of undertaking extensively disaggregated environmental analysis of the effects of trade liberalization would be enormous.

In addition, there seems to be at least some shreds of evidence that compliance costs associated with environmental regulations are not likely to play a determinative role in the location of agricultural production, either at the primary or subsequent processing levels, or in the patterns of trade. Of course, further research in this area may contradict the admittedly limited evidence compiled so far, but at least from the perspective of what we know today, the risk of the kind of "race to the bottom" on environmental standards that figured so prominently in the NAFTA debate would seem to be small in the case of agriculture.

If the prognosticators that have suggested environmental issues will figure prominently in the next multilateral round of trade negotiations in the WTO are correct, then our list of potentially controversial agriculturally related resource and environmental issues anticipates a difficult way ahead on the path to further trade liberalization. If the Article XX provisions of the GATT are retained or expanded, then there will be much analytical and empirical work to be done to aid in the more effective targeting of agricultural resource conservation programs and on pricing for water and government land used in agriculture to better reflect the opportunity costs of those resources. This will be much easier to say than to do. But trade policy analysts revel in the challenge of solving problems that have confounded production and natural resource economists.

At a more fundamental level, we would like to suggest that more attention be devoted to clarification of some conceptual issues. For example, calls for better integration of agricultural trade and environmental policies are increasingly common place, both by constituents of trade liberalization and of environmental stewardship. But it is not clear what integration means. And, in our judgement, "policy" has all too often been construed too narrowly. We would argue that integration does *not* mean subservience of one of these agendas to the other. And our professional experience indicates that there are important language, ethical and conceptual issues that divide trade liberalization advocates from their counterparts on the environmental stewardship side.

On the question of the narrowness of the concept of policy, we would like to propose that our collective consciousness be more aware of the role of policy initiatives and institutional changes that arise outside of the realm of interactions among national governments. Subnational governments also have policy functions, as do

private voluntary associations. And legislation is not the only instrument that regulates activities that have environmental consequences. As Elizabeth Brubaker (1995) has shown so effectively, common law remedies against trespass, nuisance and the violation of riparian rights played an important role in the regulation of emissions from production, even from agricultural production, in the United Kingdom, Canada and the United States until the effectiveness of those institutions was undermined by judicial "innovation" or by legislative law. Discussions of the integration of agricultural trade and resource conservation policies need to better reflect the complementarity and the competition among different levels of policy making.

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Section 5

Implications, Research Needs and Future Direction

The objective of the concluding discussion is to summarize “what we have learned”, viewed from the perspective of three countries and several work environments.

