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Chapter 6

The Conflict Between Trade Policy and Environmental Policy in Agriculture

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Introduction

The agricultural sector is increasingly regarded as one of the most visible contributors to nonpoint source pollution. Concerns about environmental degradation have contributed to a growing consensus that environmental pollution caused by agriculture must be monitored and controlled. Environmental policies affect trade flows, and trade policy will likely affect the environment. This explains the recent interest in the "greening" of agricultural trade (Anderson and Blackhurst, 1992).

Although agricultural policy in a few affluent countries has responded to environmental concerns, most countries have failed to integrate agricultural and environmental policy. This predicament may partially be explained by conflicting policy goals. For example, achieving self-sufficiency through increased domestic production, independent of associated environmental damage, may be a preeminent policy goal for many developing countries. A country exporting an agricultural product may, similarly, hesitate to impose production or input use restrictions because such moves can erode its competitive position in export markets.

This chapter analyzes some consequences of agricultural trade policy when agricultural production or "bad" input use adversely affects the

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environment. A negative externality may occur in either the domestic production sector or in the foreign production sector. Policies seeking to promote exports or to restrict imports can have deleterious environmental effects if they stimulate production of damage-causing outputs or use of damage-causing inputs. This situation generates a conflict between trade and environmental policy goals in agriculture.

Input- and Output-Related Externalities in Agriculture

The hypothesis that agricultural production practices cause environmental damage is well documented (National Research Council, 1989; CAEFMS, 1990). For trade policy analysis, a distinction between output-related and input-related externalities is important (Bhagwati and Srinivasan, 1983). Environmental damage caused by input use implies an input-related externality. In a parallel fashion, when environmental damage depends on output, but cannot be traced to use of a specific input, it is an output-related externality.

From an economic standpoint, a negative production externality, be it output- or input-related, drives a wedge between private and social costs. For an input-related externality, this divergence results in overutilization of the polluting input. An output-related externality similarly causes overproduction.

Examples of input-related externalities in agriculture are abundant. Rachel Carson's early work, *Silent Spring* (1962), drew attention to damage caused by pesticide use. Since that time, this literature has grown exponentially, fueled mainly by a realization that the pesticide pollution problem is even greater than previously believed. Pesticides and fertilizers also contaminate surface and ground water sources (Canter, 1986; Nielsen and Lee, 1987).

Livestock production is an example of an output-related externality in agriculture. Production of livestock wastes causes eutrophication of water sources, fish kills, nitrate contamination of soil and ground water, and breeding of insect pests. Because externality can be reduced by regulating livestock production, it is an output-related externality.

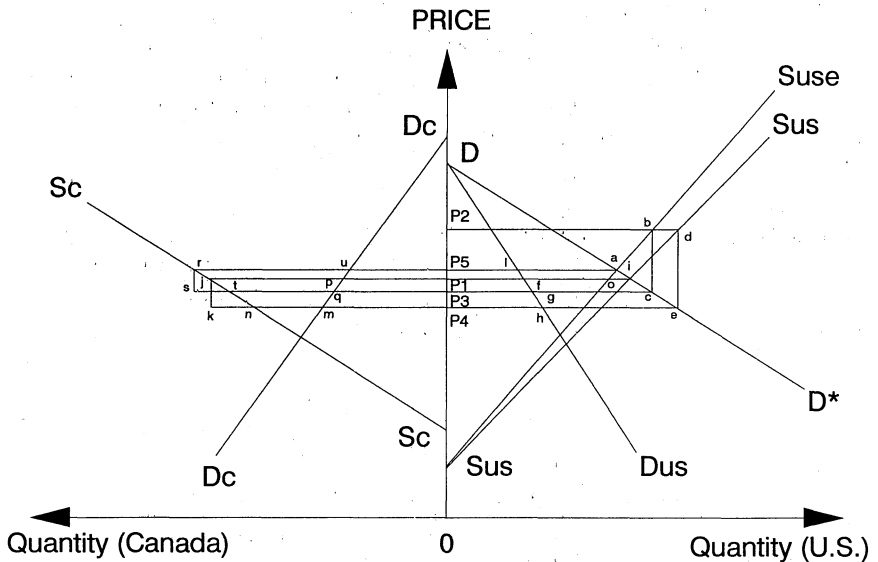
The broader consequences of production externalities in an open economy were recently analyzed (Kurtilla, 1991; Markusen and

Schweinberger, 1990). The model considered below uses a partial equilibrium framework to illustrate potential conflicts between the goals of trade and environmental policy in agriculture. First, the environmental cost of an unlimited production subsidy is evaluated. This case was previously adopted by other researchers (USDA, 1986; Schmitz and others, 1988).

The Environmental Cost of a U.S. Deficiency Payments Program

Consider a large country (say, the United States), and a price-taking competitor (say, Canada). In figure 1, DD_{us} is the domestic U.S. demand curve and DD^* is the total demand curve, including domestic demand. Sus_{us} and Sus_{use} are respectively the private and social marginal cost curves. The vertical distance between these curves measures the environmental cost for that production unit. Similarly, Dc_{ca} is the domestic demand curve in Canada; Sc_{ca} and Sc_{ce} are the Canadian private and social marginal cost curves.

Figure 1 - Deficiency payments and trade: large country case.



When social costs are ignored, world price is P_1 . Suppose that a deficiency payments program is introduced by setting the target price P_2 above the world price. This program causes a net loss of $fhed$ comprised of a deadweight loss edi and a net transfer to importers equal to region $fhei$. The latter arises because the program depresses world prices from P_1 to P_4 allowing importers to purchase greater quantities at lower prices. In addition, an environmental loss is generated in the United States due to increased production.

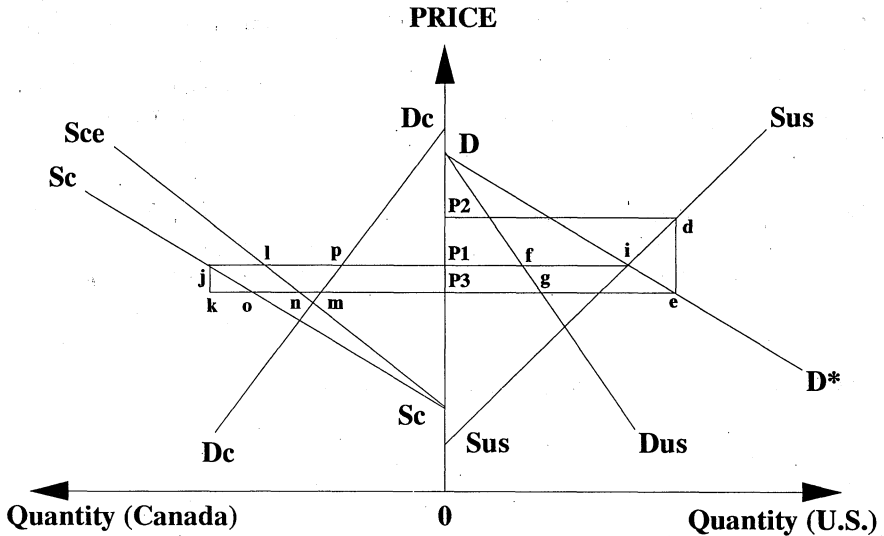
For the competing exporter (Canada), this program increases consumers' surplus by pmP_4P_1 and reduces producers' surplus by jnP_4P_1 . If Canada chooses to support producer income by introducing a deficiency payments program, the deadweight loss of such a program will be jkn . Suppose that the United States uses $SusSuse$ to determine prices instead of pricing with the marginal private cost curve. In this case, the net loss in the United States due to a deficiency payments program is $lgcba$. Both the deadweight loss (acb) and the net transfer to importers ($lgca$) are smaller. Canadian exports are reduced from ru to tp and the deadweight loss due to a Canadian deficiency payments program is rst .

This analysis suggests that, when private and social costs diverge in the U.S. production sector, there is an additional environmental cost of a deficiency payments program. Now suppose that the environmental externality is in the production sector of the competing exporter (fig. 2).

As before, the target price is P_2 so that the effective government subsidy is P_2P_3 per unit. U.S. exports increase from if to eg , domestic production rises from iP_1 to dP_2 , and domestic consumption increases from fP_1 to gP_3 . The net loss in the United States includes two components, $fgei$ which is the transfer to foreign consumers in the form of a price reduction, and eid which is the deadweight loss.

The U.S. subsidy displaces the Canadian domestic demand curve from $Dcpj$ to $Dcmk$. The price reduction causes a loss to producers (joP_3P_1) and a gain to consumers (pmP_3P_1) in Canada. The net loss is $jpmo$ when social costs are excluded from consideration. A U.S. deficiency payments program, by reducing Canadian production from jP_1 to oP_3 , reduces the net environmental loss by depressing Canadian production. If Canada compensates farmers and restores price P_1 with a Canadian deficiency payments program, then the net loss will also include an environmental

Figure 2 - Deficiency payments and trade: small country case.



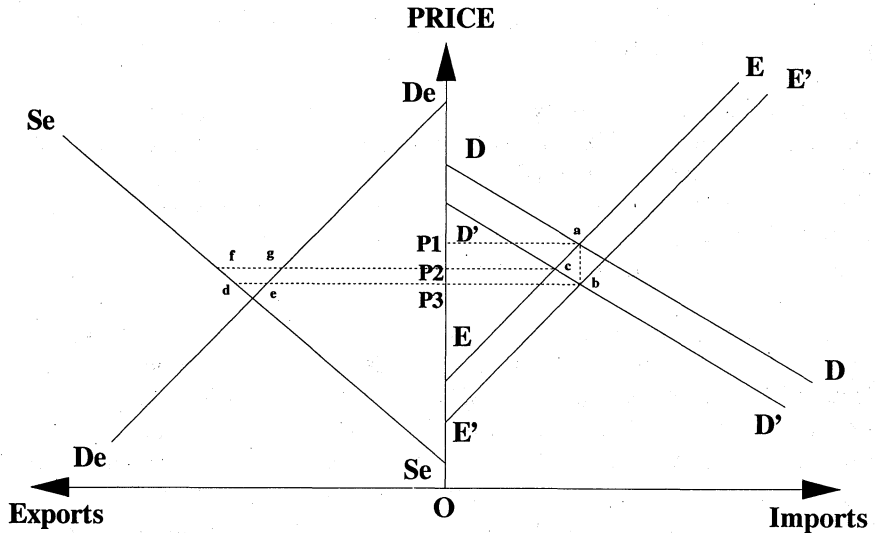
cost component. Even when the deadweight loss component is small due to inelastic Canadian supply response (Schmitz and others, 1988), a Canadian deficiency payments program will have an environmental cost.

These analyses, together, suggest that an unlimited U.S. production subsidy has an additional environmental cost when the externality occurs in the U.S. production sector. This subsidy reduces the environmental cost of a price-taking competing exporter when the production sector of the competing exporter has the externality.

The Environmental Cost of an Import Restriction

The previous analysis assumed that the large price-setting exporter set world price while the competing exporter was a price-taker. Within this framework, any policy reducing world price (such as an unlimited production subsidy) benefits an importing country when negative externalities are present in its production sector. Such a policy reduces production in the importing country. The graphical analysis of a price-taking importer qualitatively mimics the case of a price-taking competing exporter and, for this reason, is not repeated here.

Figure 4 - Subsidies and trade with importer externalities



exporter's social costs exceed private costs, the true export supply curve is EE' . If exporting countries offered EE' , the price would have been $P2$, and $bP2$ would have been imported instead of $aP1$.

Now suppose that the importer imposes a tariff equal to bc for each unit imported. This tariff restricts imports to $bP2$ and restores the exporting country to the solution that would obtain if the correct export supply curve were used. Both countries could benefit from this tariff. The importing country benefits from the tariff because the additional tariff revenue, $cdP1P3$, exceeds the deadweight loss, bda . The exporting country suffers a loss of producers' surplus equal to $eP3P1$ and a gain in consumers surplus' of $gP3P1$. The net loss $eP3P1$ may be less than the ensuing reduction in environmental damage. In the absence of the

externality, an exporting nation will lose when the importer imposes a tariff. Both domestic and foreign nations can gain from a tariff in the presence of externalities.

For the case of an externality in the importing country, this analysis can be modified (fig. 4). $D'D'$ is the original import demand curve, and DD is the import demand curve when social costs are taken into account. Excluding social costs shifts the import demand curve downward. Including domestic social costs causes imports to rise from $cP2$ to $aP1$ and world price increases from $P2$ to $P1$.

Suppose that the importer ignores social costs but gives a per unit subsidy equal to ab . The effective domestic price is $P3$ although the world price is now $P1$. This consumption subsidy corrects the phenomenon of underimportation. A second distortion, again, corrects the first distortion. The problem of importing too little cannot be corrected by an export subsidy because a price-taking exporter cannot influence world price. For a price-taking exporter with domestic demand curve $DeDe$ and domestic supply curve $SeSe$, this consumption subsidy stimulates exports from an initial value of ed to fg .

Conclusions and Policy Implications

The previous analysis suggests several conclusions. First, a negative externality in the exporting country causes excessive exports. Second, an externality in the importing country causes too little to be imported. The appropriate policy response here is a substitution of domestic production with imports. Third, import restriction policies will take a nation further from the social optimum, when social costs exceed private costs in the importing country. Finally, export promotion policies will hurt an exporting country, when social costs exceed private costs in the exporting country.

Agricultural policy seeking to increase export market share, by encouraging domestic production, also imposes an environmental cost. Import restricting policies similarly stimulate production in the importing country and thereby induce an environmental cost. This situation poses a conflict as policymakers balance the dual goals of maintaining farm income and reducing environmental degradation.

The appropriate policy response also depends on the type of externality (Bhagwati, 1971; Bhagwati and Srinivasan, 1983). When a negative production externality is input-related, as with pesticides and fertilizers, then a revenue neutral factor tax subsidy is the first-best policy. This policy corrects a distortion at the source. For an output-related externality, a revenue-neutral production tax subsidy is the first-best policy. Since neither policy raises new revenues, no further distortions follow from these taxes.

When a first-best policy instrument is unavailable, trade taxes or subsidies can ameliorate the environmental problem. However, these policies are less efficient than policies correcting a distortion at the source, unless the externality is trade-related. Furthermore, use of trade taxes may be infeasible in some cases. For example, the U.S. constitution forbids using an export tax.

A demand expansion program pursued by a large exporter may reduce environmental degradation for competing exporters and importers. A tariff imposed by a large importer can also benefit other importers and exporters when a negative production externality is present in their agricultural sectors. These conclusions suggest that further analysis of how trade policies affect the environment and how environmental taxes or subsidies affect trade is a fruitful area for agricultural trade research.

References

- Anderson, K., and R. Blackhurst. (1992) *The Greening of World Trade Issues*. London: Harvester Wheatsheaf.
- Bhagwati, J. (1971) "The Generalized Theory of Distortions and Welfare," *Trade, Balance of Payments, and Growth*. J. Bhagwati (ed.). Amsterdam: North Holland.
- Bhagwati, J., and T.N. Srinivasan. (1983) *Lectures on International Trade*. Cambridge, MA: The MIT Press.
- Brander, J.A., and B.J. Spencer. (1981) "Tariffs and the Extraction of Foreign Monopoly Rents under Potential Entry," *Canadian Journal of Economics*, 14 (3): 371-89.
- Canter, L. (1986) *Environmental Impacts of Agricultural Production Activities*. Chelsea, MI: Lewis Publishing Inc.
- Canadian Agriculture Economic Farm Management Society. (1990) "Agriculture and the Environment: Economic Dimensions of Sustainable Agriculture." Report submitted to the Agricultural Institute of Canada.
- Carson, Rachel. (1962) *Silent Spring*. Boston MA: Houghton Mifflin.
- Kurtilla, Kerry. (1991) "Environmental Regulation in an Open Economy," *Journal of Environmental Economics and Management*, 20: 127-42.
- Markusen, J.R., and A.G. Schweinberger. (1990) "The Positive Theory of Production Externalities Under Perfect Competition," *Journal of International Economics*, 29: 69-91.
- National Research Council. (1989) *Alternative Agriculture*. Washington DC: National Academy Press.
- Nielsen, E., and L. Lee, (1987) *The Magnitude and Costs of Groundwater Contamination from Agricultural Chemicals: A National Perspective*. Staff Report AGES870318. U.S. Dept. Agr., Econ. Res. Serv.

Schmitz, A., G.C. Van Kooten, and W. Hartley Furtan. (1988) "Issues in Commodity Trade: Implications for Natural Resources," *Agricultural Trade and Natural Resources: Discovering the Critical Linkages*. J. Sutton (ed.). Boulder, CO: Lynne Reiner.

U.S. Department of Agriculture, Economic Research Service. (1986) *Embargoes, Surplus Disposal, and U.S. Agriculture*. AER-564.