



AgEcon SEARCH
RESEARCH IN AGRICULTURAL & APPLIED ECONOMICS

The World's Largest Open Access Agricultural & Applied Economics Digital Library

This document is discoverable and free to researchers across the globe due to the work of AgEcon Search.

Help ensure our sustainability.

Give to AgEcon Search

AgEcon Search
<http://ageconsearch.umn.edu>
aesearch@umn.edu

*Papers downloaded from **AgEcon Search** may be used for non-commercial purposes and personal study only. No other use, including posting to another Internet site, is permitted without permission from the copyright owner (not AgEcon Search), or as allowed under the provisions of Fair Use, U.S. Copyright Act, Title 17 U.S.C.*

MANCHES

WP90/08

Manchester
Working Papers
in Agricultural Economics

FOUNDATION OF
AGRICULTURAL ECONOMICS
LIBRARY

MAY 28 1992

THE ENVIRONMENT AND INTERNATIONAL TRADE

Trevor Young
University of Manchester

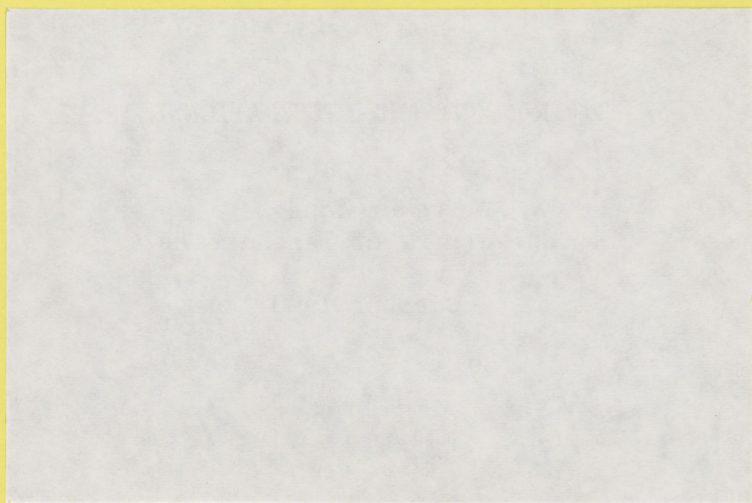
October 1990

WP90/08



**Department of
Agricultural Economics**

Faculty of Economic and Social Studies
University of Manchester,
Manchester U.K.





THE ENVIRONMENT AND INTERNATIONAL TRADE

Trevor Young
University of Manchester

October 1990

WP90/08

THE ENVIRONMENT AND INTERNATIONAL TRADE

In the analysis of externalities in the agricultural sector, relatively little attention has been given to the interaction of international trade and environmental quality. The purpose of this working paper is to provide an overview of some of the issues. Specifically, consideration is given to

- 1) the effect of environmental regulation on international trade, and
- 2) the effects of agricultural trade policies on the environment.

1 Environmental Regulation and International Trade

1.1 Environment as a Determinant of Comparative Advantage

Comparative advantage, which determines location and the trade product mix, is governed by a country's endowment of labour and capital, technical knowledge, tastes, government policy and environmental scarcity. Natural resources and the environment should be seen as productive capital, and hence a production factor determining comparative advantage.

In establishing the country's resource base, account must be taken of

a) the endowment of public consumption goods (e.g. landscape amenity, wildlife). Any restrictions imposed on the use of these goods will influence its foreign trade position, notably of the service sector (tourism).

b) the environmental assimilative capacity of the country, which in turn depends on

- i) the capacity of environmental systems to reduce environmental damage by natural processes
- ii) the tolerable level of environmental damage beyond this- which depends on society's preferences, income, population density, etc.)
- iii) the amount of environmental damage in the form of pollution emissions, soil erosion, deforestation, etc.
- iv) investments to increase assimilative capacity or reduce demand for assimilative services.(Siebert, 1981)

For example, many LDCs are considered to have a comparative advantage with respect to environmental endowment and some have high assimilative capacity, due to a relatively low demand for assimilative services (given a relatively low level of industrialisation), and a different valuation of environmental quality.

1.2 Gains from Trade when Environmental Damage is taken into Account

A standard proposition which emerges from orthodox economic theory is that countries benefit from trade. A question which arises in the present context is: does this proposition still hold if environmental effects are taken into account?

Consider a country with a comparative advantage in an agricultural export crop, the production of which generates some environmental damage, say soil erosion. Consequently, as production increases, environmental quality declines. As Siebert (1977) demonstrates, there will be a trade-off between welfare gains from trade and environmental quality.

To assess whether a country will gain from trade, the net benefit position must be examined. Trade only pays when net welfare rises, i.e. when traditional gains from trade outweigh deterioration of environmental quality. *A priori* it is conceivable that in the case of a strong preference for environmental quality and of a high marginal physical damage due to the side-effects of production,

the welfare loss associated with deterioration of environmental quality may outweigh conventional gains from trade. In this extreme case, the country would be better off by not engaging in trade in the environment-damaging product.

If an appropriate corrective environmental policy is introduced, the social costs of export production will be taken into account by producers. But as production costs rise, the country's comparative advantage in that product is reduced and the correct benefits from trade would be established. In the limiting case it is possible that production costs could increase to such a degree that the country prices itself out of the market, losing its comparative advantage entirely.

Where there are external costs to production, comparative advantage is distorted in the absence of environmental policy. In effect, the sector generating the external costs is receiving a hidden subsidy. Too many resources are used in that sector and there is an excessive degree of environmental damage.

1.3 Effects of Environmental Regulation On Comparative Advantage

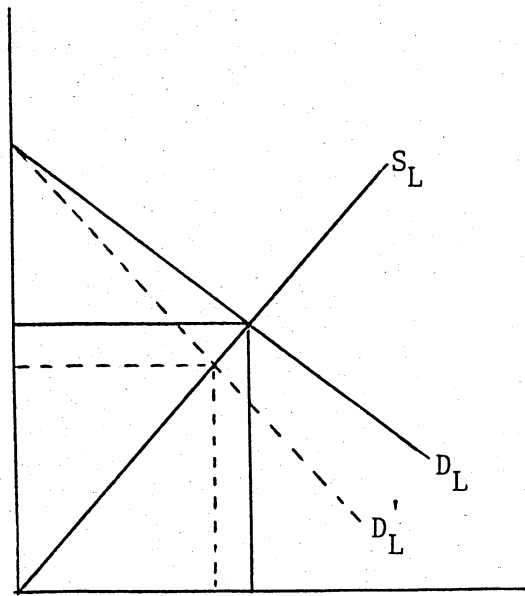
1.3.1 The Nature of Environmental Regulation

To reach a desired level of environmental quality, "the role of government ... is to redefine the conditions of individual activity in such a way that private costs do not differ substantially from the social costs of individual activities." (Siebert, 1981, p.113). The orthodox supply schedule incorporates private marginal costs of production only. Where production has spill-over effects in the form of pollution, soil erosion, deforestation, etc., then these social costs should be taken into account. For a given market price, society would prefer a lower output to that provided in an unfettered private market. The task of environmental policy would be to encourage a re-allocation of resources in that direction and a number of policy instruments can be employed for this purpose, including moral suasion, subsidies, taxes, regulation, and licences.

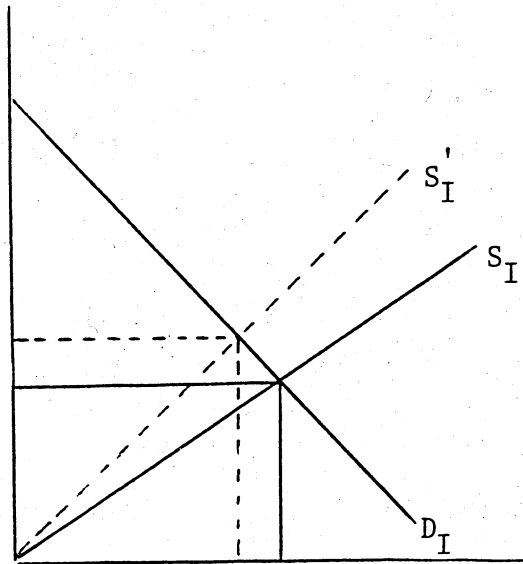
The effects of environmental and natural resource policies on the production costs can be assessed by examining how the marginal cost of production changes as a result of policy intervention. The impact may be neutral if producers can readily switch to alternative production systems but as a general rule, production costs would be expected to rise with the imposition of a tax or direct prohibitions, and to fall if a subsidy is put in place.

Subsidies or more general resource development programmes are used to encourage specific production practices. For example, there has been much interest recently in the use of subsidies to promote the conservation of landscape amenity. The imposition of a tax or prohibition on specific agricultural inputs or practices offers a more certain means of improving environmental quality. Figure 1.1 illustrates the effects of imposing a tax on input use, say on fertiliser. The tax shifts fertiliser supply to S_1' , domestic product supply to S_p' and demand for land to D_L' . The reduced output causes the world price to rise and exports to decrease. There will be an overall welfare gain from environmental policy as long as marginal social costs of producing the good (including environmental costs) are higher than the marginal value of the good in consumption or as long as the tax is lower than the marginal environmental damage.

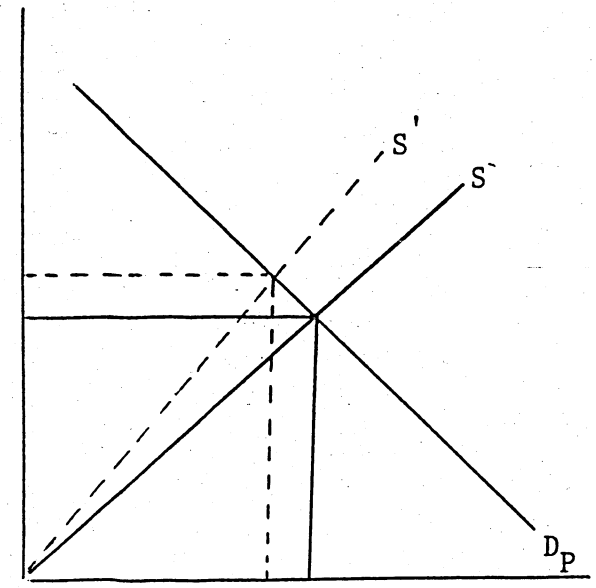
A major consequence of environmental regulation is a shift in property rights. Both regulatory and taxation approaches disadvantage some sub-set of farmers. Paradoxically, regulations which increase costs of production can increase aggregate farm income (if demand is relatively unresponsive to price). Net revenue changes will be greater for some producers than others; those heavily dependent on use



a: Land Market



b: Input Market



c: Domestic Product Market

FIGURE 1.1 Environmental Tax

of regulated input or productive practice will be worse off. As Reichelderfer (1989) notes, according to "polluter pays" principle, this is as it should be. But it can give rise to particular concern if it is the small farmer who suffers most.

1.3.2 Short Run Effects of Environmental Regulation on Trade

Some Generalisations

For the "small" country which must take world prices as given, the introduction of environmental policy will reduce the country's comparative advantage in the environmentally damaging good. As the costs of environmental protection rise progressively, comparative advantage deteriorates progressively with environmental policy. Moreover, the policy will

- a) reduce resource use in unsustainable practices and the output of these activities,
- b) reduce exports and foreign exchange earnings,
- c) increase resource use in abatement and environmental protection,
- d) reduce national income.

It is to be expected that capital will move from countries with environmental regulation in place to those which are relatively regulation-free.

A "large" country which is a net exporter will enjoy an increase in its terms of trade, as world price rises, and can increase its foreign exchange receipts.

Analytical Approaches

The effects of environmental regulation on trade can be analyzed in a number of ways. Here we mention two relatively simple approaches.

A. A Spatial Equilibrium Model

Baumol and Oates (1988) present a simple spatial model of a competitive world market for a single product. The commodity is produced and consumed both in the home country and in the rest of the world. The production of the good, however, generates some social costs through environmental damage. The home country considers unilaterally introducing environmental regulation.

Imposing a tax or a ban on the agricultural practice which causes the environmental damage has the effect of increasing the domestic costs of production (the supply curve shifts to the left). The result will be a higher world price and a reduced world demand for the product. The home country produces less and its exports fall. However, foreign exchange receipts may increase if the rest of the world's demand for imports is inelastic (in which case the rise in price more than compensates for the reduced sales).

Two further points may be noted. In the classic small country case (where the demand for exports is perfectly elastic), foreign exchange receipts will fall as a consequence of environmental regulation. Secondly, if the home country is a net importer, its balance of trade will be worsened by adopting an environmental policy (as unit costs and the price of its imports rise).

Little empirical evidence can be brought to bear on this analysis. Baumol and Oates cite some work by d'Arge and Kneese reported in Kneese et al. (1971), though stressing the imprecise nature of the calculations. Assuming a country were to impose environmental protection measures unilaterally, the effect on gross national income was estimated to vary from a negligible loss of income in some countries to a loss of over 25% in others. However, in virtually all cases the trade balance improved.

B. A Model of a Small, 2-sector Economy

Siebert (1981) and Siebert et al. (1980) explore the effects of environmental regulation in a small, 2-sector economy. Of the two commodities which can be produced, one is intensive in terms of damage inflicted on the environment. In the model, external costs are due to the emission of pollutants but, with respect to short run impacts, the analysis holds equally for other externalities (soil erosion, salination, health and safety risks, etc.). The country exports the "damage-intensive" commodity (good 1) and imports the other commodity (good 2). As a small country it must take the relative price of the two goods as given exogenously on the world market.

It is then supposed that the country introduces an environmental policy, such as a tax, so that production costs fully reflect the external social costs which are incurred. The following conclusions are drawn:

i) resource use in environmental protection (abatement) activities will rise, whereas resource use in the damage-intensive sector (good 1), and also in both production activities taken together, will fall. Resource use in the less damage-intensive sector (good 2) may increase or decrease. Once the (given) relative commodity price and environmental regulation (tax) are fixed, the production point is completely determined. The price of the resource used in production adjusts until the resource market is in equilibrium.

ii) national income will fall. This is the cost of increasing environmental quality. It occurs because less is produced, as resources are withdrawn, whereas the relative commodity price remains fixed.

iii) the level of excess demand is determined by consumer demand, i.e. consumers decide the level of home consumption and hence the level of exports. By assumption the balance of payments is held in equilibrium and this condition, given the relative commodity price, determines the level of imports. If the demand for good 1, the damage-intensive product, is less income elastic than that of good 2, then exports will fall. Since home demand does not fall too strongly (in response to the drop in national income) but production is reduced, exports must be lower. Home demand for good 2 falls if its income elasticity is positive.

These analyses focus on the short run, comparative statics of environmental protection and on the short run costs of improving environmental quality. There are, however, dynamic effects of natural resource management which will be expected to influence long run costs and benefits.

1.3.3 International Repercussions and Long Run Consequences:

When a country takes unilateral action to improve the quality of its environment, comparative advantage in the production of the damage-intensive good moves in favour of its competitors (with a resultant resource degradation in the latter).

Siebert terms this relocation of productive activity a case of "pollute-thy-neighbour-via-trade". He does suggest, however, that there are some factors which mitigate the process. In particular, the home country, if unwilling to incur the full costs, may fall short of adopting the optimal level of environmental regulation; as the costs of environmental protection rise progressively, severe limitations are placed on environmental policy; and competitors can restore the original relative trade position by undertaking their own environmental policy programme.

Nevertheless there are cases of resources shifting from regulated to unregulated countries. Often the flow is from developed countries to low income developing countries which are lax with regard to environmental regulation and which subsequently become the home of the world's "dirty" industries and a ready market for restricted agricultural and industrial chemicals. As Runge (1989) notes, "a kind of 'environmental arbitrage' results, in which profits are gained by exploiting the differential in regulations."

In the longer term this can create problems in the recipient country, as social damage rises with population growth, the extent of environmental damage itself increases, and per caput income rises (and society's valuation of environmental quality changes). In other words, in the long run the country may wish to have a very different product mix. Moreover, where particular agricultural practices (e.g. the use of agricultural chemicals) pose health or safety risks, products carrying these risks from unregulated countries may face non-tariff trade barriers in the regulated countries. Having lost competitive advantage through environmental regulation, producers have an added incentive to resist imports by initiating further environmental or health restrictions on trade from the unregulated markets. In this case environmental regulation can mask protectionism¹.

Finally, it should be noted that, although trade opportunities are reduced in the short run when environmental policy is adopted, future competitiveness of the country undertaking environmental policy measures should be enhanced. In the longer term those countries which do not protect their environment and continue to degrade their resources must ultimately face falling agricultural productivity. On the other hand, a country which chooses to adopt sustainable agricultural practices must benefit in the long run.

1.4 Concluding Remarks

Just as a firm may be reluctant to take unilateral action to protect the environment from fear of losing a competitive price advantage in the marketplace so a government may feel it cannot introduce significant environmental policy because of the impact of its trading position.

However, against the short run losses in terms of output and national income, which environmental policy inflicts, should be set the long run gains in the form of higher agricultural productivity than otherwise would have been achieved. In the long run comparative advantage may be re-gained as competitors who fail to adopt sustainable practices must grapple with declining productivity on a degraded resource base. Nevertheless, in making the adjustment to a more sustainable agriculture, there may be short term hardships and particular groups of farmers may be severely disadvantaged under the new production regimes.

The willingness to adopt introduce environmental regulation may also be muted where significant benefits accrue to non-residents -for example, a reduction in the rate of deforestation in Amazonia would yield global benefits in terms of climatic stability, preservation of species, etc. This suggests that some environmental problems cannot be solved by unilateral action alone. International co-operation, possibly fostered by side-payments or compensation for profits foregone, will be required.

¹ Runge cites as an example fruit and vegetable production in the Caribbean. "While Caribbean farmers are encouraged to use pesticides, herbicides, and fertilisers, regulation against some of these products in North America are rapidly becoming barriers to market access."(p.13)

2 AGRICULTURAL POLICIES AND ENVIRONMENTAL QUALITY

The pattern of agricultural development and its impact on the environment is greatly influenced by government agricultural policy. This section indicates the nature of these policy effects and examines how agricultural policy reform, at both the national and international levels, might affect environmental quality.

2.1 Short Run Effects of Agricultural Policy on Environmental Quality

Agriculture in developed countries is often characterised as an overvalued sector in which price incentives to producers are above optimal levels (see, for example, Schultz, 1978). Input subsidies are also a common feature of agricultural support programmes in many countries. Government intervention of this kind promotes a particular form of intensive farming and encourages the overuse of inputs, in terms of social costs, as natural resources are depleted and the unwanted residues and waste by-products are deposited.

The removal of domestic price distortions would induce farmers to produce less (and to change the product mix), to use less inputs, and ultimately to slow the rate of adoption of new technology. The lower use of inputs (in the form of chemical fertilisers and pesticides) can decrease the spill-over effects of agricultural production on waterways and land quality. But enhanced environmental quality may come from another source. The negative supply response may be through a reduction in the extensive agricultural margin rather than a reduction in intensification through the application of fertilisers, technology, etc. These positive environmental effects would be mitigated to the extent that any reduction in prosperity, which lower prices and higher production costs might bring, discourages investment in resource conservation.

An additional complication is introduced when changes in the product mix are considered. As price incentives alter, so too will the mix of agricultural commodities produced. However, the amount of environmental damage varies markedly by type of crop (Table 1). So in assessing the overall environmental impact, account must be taken of the products which are being encouraged by policy reform and those which are discouraged.

Risk

An important objective of government intervention in agricultural markets is to reduce the riskiness which the vagaries of the weather, depredations of pests and outbreaks of disease inflict on agricultural enterprises. As Reichelderfer (1989) notes, when in the form of disaster payments, subsidised farm credit or, more rarely, subsidised crop insurance, such intervention allows the farmer to invest in soil conservation and experiment with alternative pest management, thus permitting improvements in environmental quality. However, when in the form of price guarantees, it may encourage production, possibly in areas ill-suited for some supported crops. Moreover, where the source of risk is highly variable rainfall or high pest threat, programmes which underwrite risk encourage greater use of agricultural chemicals.

When farmers' perception of the riskiness of agricultural enterprises is influenced by policy intervention, the crop pattern will alter. Without risk-reducing measures production would be distributed by natural comparative advantage, possibly with lower production costs and lower rates of fertiliser, pesticide and soil erosion.

Table 1 : Agricultural Land Uses, Erosion Potential and Chemical-Intensity

Land Use/Production Activity	Relative Erosiveness	Relative Fertilizer Requirements ^a	Relative Pesticide Requirements ^a
Cotton	Most erosive	High	High
Soybeans	Most erosive	Low	Moderate
Maize	Moderately erosive	Highest	High
Grain Sorghum	Moderately erosive	High	Moderate
Wheat	Less erosive	Moderate	Low
Barley	Less erosive	Moderate	Low
Oats	Less erosive	Moderate	Low
Rice	Less erosive	Moderate	High
Grassland	Least erosive	Lowest	Lowest
Range and Pasture	Least erosive	Lowest	Lowest
Forest and Tree Crops	Least erosive	Low	Variable

^a Based on 1987 average, per acre applications of fertilizers (nitrogen and phosphorus) and pesticides (insecticides, herbicides, and fungicides).

Source: Reichelderfer (1989).

2.1.1 Agricultural Export Promotion and Resource Depletion

Agricultural strategies which are seen to promote exports have been a particular source of controversy. In the present context, the concern is that every extra unit of an export crop involves more use of resources and this can result in additional resource depletion, principally in the form of soil erosion. For example, in the USA the export boom of the 1970s was seen as a mixed blessing, with some arguing that the country was "exporting its soil" (Gardner, 1988).

Gardner demonstrates how an expansion of exports accompanied by increased external costs inflicts a net welfare loss on the home country, while the major benefits may be enjoyed by importing nations. Figure 2.1 illustrates the argument. Here the demand for the home country's exports is less than perfectly elastic. In other words, it is assumed that the home country has some market power and its own actions can influence the world price. Domestic demand is represented by the schedule D_d ; the total demand for the domestic product, including overseas demand, is given by D_T . The domestic supply curve, based on marginal private costs is given by S . The notion that production incurs external costs such as soil erosion can be expressed by incorporating marginal social costs into the supply relation, giving S_{sc} .

The appropriate level of output when external costs are taken into account is then Q^* with a market price of P^* . If the external costs of production are ignored, output would be expanded to Q_0 with a market equilibrium price of P_0 .

In moving from Q^* to Q_0 , there is a gain to domestic consumers purchasing more of the product at a lower price (the gain in consumer surplus is represented by area a in the figure). Foreign consumers also benefit from access to lower priced exports (their gain in consumer surplus is given by area $b+c+d$). There is, however, a loss in producer surplus in the home country (area $a+b+c-e$) and additional external costs of production to be borne (area $g+d+e$). Summing these costs and benefits, the increase in exports produces a net welfare loss (area g). Furthermore, the welfare loss to the home country alone is greater (area $g+b+c+d$) -the gains to domestic consumers are outweighed by producer losses and the additional costs in terms of environmental damage. The home country bears the welfare loss of an export expansion which primarily benefits the importers.

For completeness, Figure 2.2 depicts the case of the small country which takes the world price of the product as exogenously determined (the demand for its exports is perfectly elastic). In this case, there are no consumer gains from the expansion in production but there is a producer surplus gain (area e) to be set against the additional external costs of production (area $g+e$). Again there is a net welfare loss to the domestic economy (area g).

This simple analysis illustrates the need to address adequately the problems of natural resource management in the formulation of agricultural policy. This point is reinforced when changes in the product mix which policy encourages, are considered. Specifically, agricultural policies that do not take into account the possible environmental impacts and displacement effects may lead to a sub-optimal allocation of resources. The critical parameters include:

1. Input requirements of different crops.
2. Impact of different crops on erodible soils.
3. The importance of management techniques and agricultural practices. As a generalisation, risks of environmental damage are much greater in mono-cropping than in multi-cropping. Intercropping techniques

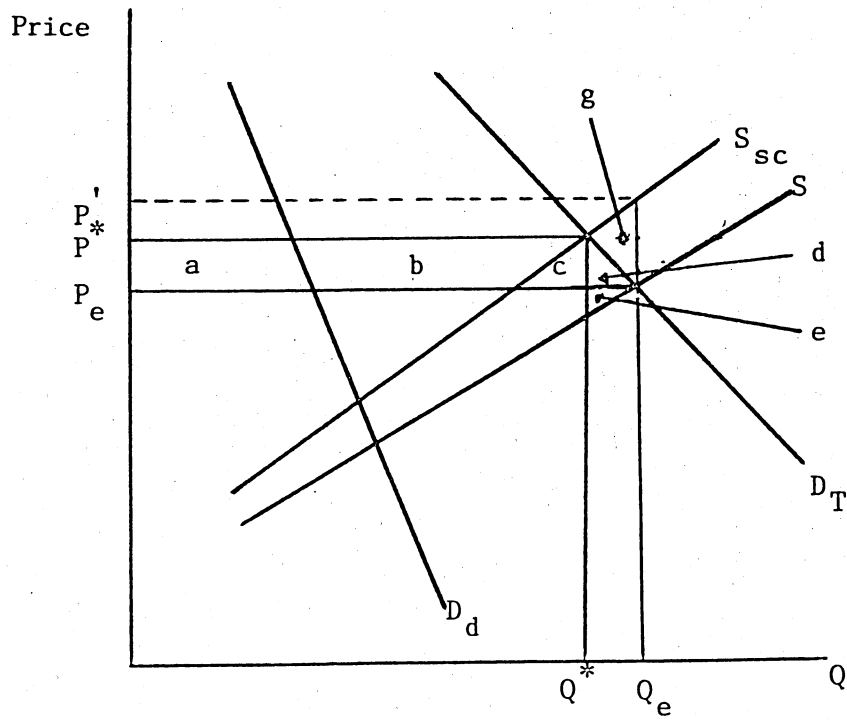


FIGURE 2.1: "Exporting the Soil"; large country

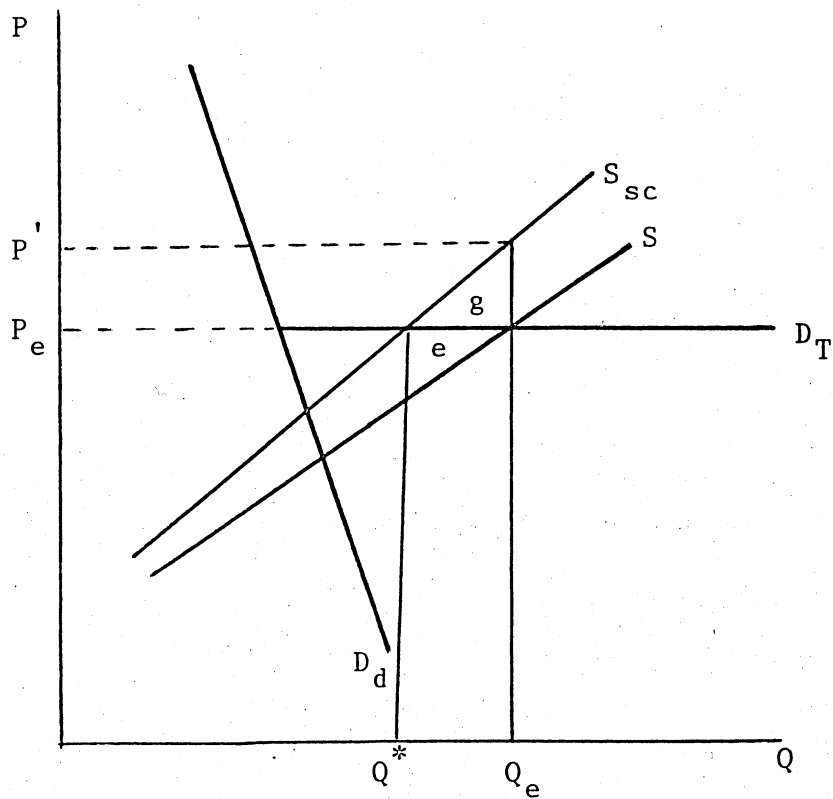


FIGURE 2.2: "Exporting the Soil"; small country

and agroforestry can reduce undesirable environmental impacts. The influence of agricultural policy should again be noted. In many countries, past patterns of commodity specialization is influenced by governments, as initial natural advantage has been reinforced by development of downstream agroprocessing and marketing channels, by public investments in irrigation, and by research focused on these crops by national and international research organisations. As Hazell (1987) claims, this has often led to excessive specialization at the farm level, as less favoured alternative commodities have been pushed out.

More diverse cropping patterns, particularly if integrated with livestock, may have the advantage of providing more sustainable farming systems in terms of their impact on soils and environment. By increasing the importance of crop rotation and livestock in maintaining yields, farmers may also use less fertilisers and pesticides.

The conclusion to be drawn is that it is not the choice of crop *per se* that should give rise to concern but the failure of agricultural policymakers to consider the implications of policy signals for resource use. Moreover, the orthodox crop-by-crop approach is unlikely to address adequately the pressing problems of resource depletion. The focus of attention should shift to the farming system viewed as a whole and to assisting choice of production practices and product mix which are more consistent with ecological conditions as well as the needs of farming households.

2.2 Trade Liberalisation

The Uruguay Round negotiations, with agricultural protectionism as a key issue, have provided the impetus for analytical work on the effects of trade liberalisation. However, attention has focused, almost exclusively, on the implications for trade flows and national welfare. Very little regard has been given to the likely environmental impact of the removal of trade barriers.

2.2.1 Effects of Trade Liberalisation on Agricultural Production and Trade

The contributions to a recent OECD/World Bank symposium on agricultural trade liberalisation and its implications for developing countries (Golden and Knudsen, 1990) represent the "state of the art" of analytical work in this area. In the scenario in which OECD countries alone liberalise their agricultural trade, increases in the world prices of meat, dairy products, and sugar are anticipated in all but one model. For feed grains the results are more ambiguous; the Valdes/Zeitz model and OECD's MTM model suggest that this price would fall.

Although there is broad agreement on the direction of price changes, there is some variation in their magnitude, especially for livestock products and sugar. Some of the difference can be accounted for by choice of base year and the assumed level of support. The participation of the LDCs in the liberalisation process allows international price signals to be more fully transmitted to their farmers, with the result of greater production response and considerably muted price changes.

In most of the empirical work to date whether there are dynamic effects from induced technical change remains an open question. But as a permanent reduction in protectionism would lower domestic food prices in the developed countries and increase food prices in developing countries, agricultural productivity growth in the latter may be boosted, while in developed countries it may be slowed.

The effect of liberalisation on price instability must also be the subject of further research. Although Anderson and Tyers suggest that instability will be reduced, others would argue that too little is known about the true causes of instability in agricultural markets to be so confident of the outcome.

2.2.2 Effect of Trade Liberalisation on Environmental Quality

The effects of trade liberalisation will depend critically on the changes in producer price which are induced, but even in those cases in which the direction and magnitude of price changes can be accurately predicted, the impact on the use of resources and on environmental quality is difficult to assess. The arguments introduced earlier again come into play. A fall in price in the developed countries (compared to current levels of protection) could induce a decrease in the intensity of resource use (a positive environmental impact), a reduction of the extensive margin (again a positive impact) or, by tightening the income constraint, discourage conservation measures (a negative impact). The environmental impact becomes more uncertain because relatively little is known about what the dynamic effects of liberalisation, and the effect on price instability in world markets would be.

A simplified, short run analysis, for a developed country, is illustrated in Figure 2.3. It is assumed that the external costs increase with production: the orthodox supply schedule incorporating private costs of production is denoted S_p , the supply curve including all social costs is given by S_{sc} . The fall in producer price induces a reduction in output (from Q_0 to Q_1). Hence liberalisation brings with it the benefit of a reduction in social costs ($a + b$). However, at the new price level the socially optimal level of production is Q_0 . Liberalisation prompts a shift of resources in the right direction but a further reduction in output is necessary².

Webb and Webb (1989) provide some empirical evidence of the impact of trade liberalisation on land use and production patterns in the USA. They conclude that liberalisation alone is not sufficient to reduce the major soil erosion problem. The latter mainly occurs on land for which a change in cropping patterns or in farming methods will have little effect.

Thus, trade liberalisation cannot be relied upon to significantly improve environmental quality. From the standpoint of economic efficiency, trade liberalisation is the optimal course provided private costs do not differ significantly from social costs or, by environmental policy, the cost structures of private agents reflect the social costs of their actions. The existence of an externality implies a divergence between private and social comparative advantage, and market-determined trade patterns are no longer optimal. (Segerson, 1988).

An additional complication arises where there are international externalities, i.e. some portion of the social costs of agricultural production is borne by non-residents. In this case, national endeavours to internalise the costs of environmental damage will not produce the optimal allocation of resources. Some form of international action is required.

² For a developing country, trade liberalisation can shift resources away from the social optimum.

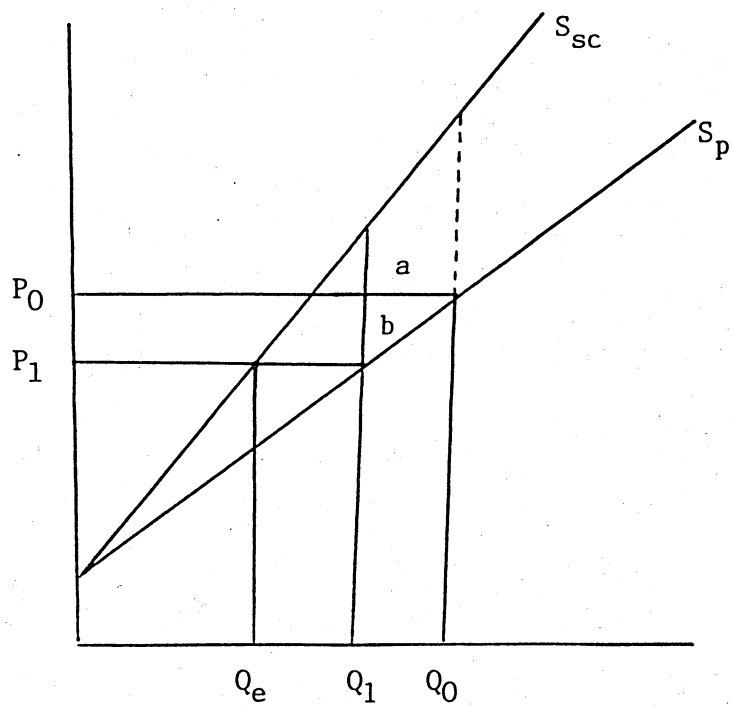


FIGURE 2.3 : Effects of Lower World Price

2.3 International Externalities

Some environmental problems have an obvious international dimension. The atmosphere, the stratosphere and the oceans beyond exclusion zones are open access resources, which are in danger of over-exploitation if national self-interest is left unchecked. To prevent the "tragedy of the commons" international agreements are needed which in effect alter property rights from open access to common property³, i.e. the management of the resource is undertaken by a well-defined group governed by an agreed set of rules.

As Helm and Pearce (1990) point out, there is still a risk of breakdown in these agreements, where maximisation of national welfare is in conflict with maximisation of the collective good⁴. To make the agreement binding, some form of side-payment (an in-kind transfer, cash payment, or transfer of technology) may be required. In essence such side-payments conform to a "victim pays principle"⁵. The victim may have little alternative to offering side-payments, if it does not import the product whose production creates the spillover (and so cannot retaliate with barriers to that trade).

Incentives to co-operate in the management of international externalities may also be necessary in cases where countries are differentially affected, or place a different valuation on the environmental damage, or have different capacities to contribute to the management of the common resource. The latter is of particular topical interest, since many developing countries, beset by international debt problems, cannot meet the costs of improving environmental quality. As in a national setting, a moral hazard is introduced, whereby, in order to elicit payments, the country may threaten to degrade its resources, falsify information on the rate of degradation, etc.

2.3.1 Non-Tariff Barriers

Some environmental problems appear as purely national concerns but take on an international character when international trade effects are considered. As noted above, differential environmental regulation can encourage the international transmission of environmental risks - "pollute-thy-neighbour-via-trade". This in turn often leads to barriers to this trade being introduced, both as a means of maintaining national health and safety standards and as a form of protectionism. However, little attention has been given to this issue. As Runge (1989) notes, one of the few international responses has been FAO's work in developing the "Codex Alimentaris" as a set of rules governing food and agricultural health and safety.

³ An alternative would be nationalisation of the resource. The creation of national property rights, as in the case of the 200-mile exclusion zone of the ocean along coastline, is an example of such an approach.

⁴ The problem may be characterised as the "Prisoner's Dilemma". Each participant stands to gain by not co-operating with the others, but all participants would be better off if they all co-operated.

⁵ As examples of this principle at work, Helm and Pearce cite Sweden's technical assistance to reduce acid emissions from Poland and the currently negotiated technology transfers to China and India with respect to CFCs.

Obtaining agreement on binding environmental and health standards is of course fraught with difficulties, not least in determining the level at which the standards should be set. Differences in national priorities and level of economic development must be allowed for; standards need not be the same for all countries. James (1982, p.260) advocates "intermediate standards" for LDCs. That is to say, whereas there is a need to improve health and environmental regulations in the LDCs, "it does not follow from this that countries of the Third World should adopt either the same number or the same level of standards as developed countries."⁶ In this regard a case could be made for "Special and Differential Treatment" for LDCs under GATT rules. The terms under which it is granted may reduce present regulatory differentials by upgrading LDC norms (Runge, 1989).

An important aspect of non-tariff trade barriers is the imposition of bans on trade in certain species or products, either because of their intrinsic worth, or because the production system from which they have been generated is thought to be unsustainable. It is important to note that these bans do not spring from the same concerns as the 'health and safety' restrictions, where the cause of the ban is (may be) due to the explicit impact of the characteristics of the product on consumption. Rather, the ban is based, not on concern for the qualities of the consumption good itself, but for consumption *per se*. Examples would include the ban on the trade in ivory, and other wildlife products such as fur, and the concern about the source of tropical hardwoods, requiring that it should be produced 'sustainably'. By its actions, the consuming nation (usually a developed country) is trying to express its 'existence' valuation of the resource, even though in an individual country consumption may be negligible.

The question arises as to the efficiency of such bans on achieving the desired objective of resource base management. Banning trade may not enhance the survival of the species. By reducing the economic value of the species, the direct incentives for exploitation may be reduced, but the probability will increase that the resource will be displaced by other economic activity which now generates a higher value.

A standard result from the environmental economics literature is that resources will be mismanaged when their value is not manifest, and the banning of trade is suppressing the expression of one element of the resources value. In many cases the cause of the inefficient management of the resource is the lack of property rights, but to try to correct for the effects of this by undertaking policy action at a different point in the system will (at a theoretical level) be inefficient, and may also lead to perverse results.

An alternative to a total ban on trade is to limit trade to those commodities that are produced in a sustainable manner. This would require some form of labelling system. This has been proposed for tropical timber products, but has been rejected by the producing countries as a form of hidden protectionism for the developed countries' timber industries. The advantage of the system is that it does not reduce the value of the resource to zero, but only that component that is produced in an unsustainable manner. The incentive mechanism then operates in such a way that there is an advantage in converting to sustainable production techniques. The drawback of the scheme is that the identification system is likely to be complex. It also does not preserve forests that are being destroyed for conversion to other uses (such as agriculture) where the wood is seen as a by-product of that process, or where the wood is consumed domestically rather than being traded. It is interesting to note that a similar selective trade ban has been suggested for ivory, with some countries being allowed to re-classify their elephants from Annex

⁶ Cited in Runge (1989).

1 to Annex 2 if they can show that certain management and conservation criteria are being met (Ivory Trade Review Group (ITRG), 1989).

Clearly there is a role for the multinational agencies (WHO, FAO, UN Environment Programme, as well as GATT, the World Bank and IMF) in coordinating international efforts towards a cooperative solution. As a beginning, current discussions on trade, aid and development could be extended to a consideration of environmental and health regulation and its use as a barrier to trade. In addition, one could follow Runge's suggestion of an international accord "to call for the rights, duties, and liabilities that define national regulations." The recent Montreal Protocol on emissions reduction suggests that some progress in this direction is possible.

REFERENCES

- ANDERSON, K. AND R. TYERS (1990), "How Developing Countries could gain from Agricultural Trade Liberalization in the Uruguay Round". Chap. 2 in GOLDIN and KNUDSEN op.loc.
- BAUMOL, W.J. and W.E. OATES (1988), The Theory of Environmental Policy. Cambridge University Press. Second edition.
- DAVIS, T.J. and I.A. SCHIRMER (eds.) (1987), Sustainability Issues in Agricultural Development. Proceedings of the Seventh Agriculture Sector Symposium. The World Bank.
- GARDNER, B. (1988), "Bringing Together International and Resource Economist: Comment." in SUTTON (ed) op. loc.
- GOLDIN, I. and O. KNUDSEN (1990), Agricultural Trade Liberalization. Implications for Developing Countries. OECD; The World Bank.
- HAZELL, P.B.R. (1987), "Economic Policy for Diversification." in DAVIS and SCHIRMER, op. cit.
- HELM, D. and D. PEARCE (1990), "Assessment: Economic Policy towards the Environment." Oxford Review of Economic Policy 6, No.1, pp.1-16.
- IVORY TRADE REVIEW GROUP (1989), The Ivory Trade and the Future of the African Elephant Prepared for the Seventh CITES Conference of the Parties
- JAMES, J. (1982), "Product Standards in Developing Countries,." in F. STEWART and J. JAMES (eds.), The Economics New Technology in Developing Countries. Westview Press.
- KNEESE, A.V. and J.L. SWEENEY (eds.) (1985), Handbook of Natural Resource and Energy Economics. Volume 1. North-Holland.

- KNEESE, A.V., S.E. ROLFE and J.W. HARNED (eds.) (1971), Managing the Environment: International Economic Cooperation for Pollution Control. Praeger Publishers.
- OECD (1989), Agricultural and Environmental Policies. Opportunities for Integration. OECD, Paris
- REICHELDERFER, K. (1989), "Environmental Protection and Agricultural Support: Are Trade-offs Necessary?." National Center for Food and Agricultural Policy, Resources for the Future. Discussion Paper Series FAP89-03
- RUNGE, C.F. (1989), "Trade in Disservices: Environmental Regulation and Agricultural Trade Competitiveness." Paper for the Symposium of the Consortium on Agricultural, Resource, and Environmental Policy Research, Water Quality and Agriculture: International Perspectives on Policy. Mimeo.
- SCHULTZ, T.W. (ed.) (1978), Distortions of Agricultural Incentives. Indiana University Press.
- SCHWARTZ, N.E. and G.E. ROSSMILLER, (1988) "Discussion: Developing a Framework for Analyzing Effects of Resource Policies on Trade." in SUTTON (ed) op.loc.
- SEGERSON, K. (1988), "Natural Resource Concepts in Trade Analysis." in SUTTON (ed) op.loc.
- SIEBERT, H. et al. (1980), Trade and Environment: A Theoretical Enquiry. Studies in Environmental Science 6. Elsevier.
- SIEBERT, H. (1985), "Spatial Aspects of Environmental Economics." Chap.4 in KNEESE and SWEENEY, op.cit.
- SIEBERT, H. (1977), "Environmental Quality and the Gains from Trade." Kyklos 30 pp. 657-673.
- SIEBERT, H. (1981), Economics of the Environment. Lexington Books.
- SUTTON, J.D. (1989), "Resource Policy Subsidies and the GATT Negotiations." USDA, Resources and Technology Division, ERS. Agricultural Economic Report No.616.
- SUTTON, J.D. (ed.) (1988), Agricultural Trade and Natural Resources. Discovering the Critical Linkages. Lynne Rienner Publishers.
- WEBB, S-E.H. and A.J. WEBB (1989), "U.S. Conservation Reserve Programs and the GATT". ERS, USDA. Mimeo.

