

The Polluter-Pays Principle in the Context of Agriculture and the Environment

James A. Tobey and Henri Smets

1. INTRODUCTION

THE Polluter-Pays Principle (PPP) has become an important component of environmental policy at both the national and international level since its adoption by the Organisation for Economic Cooperation and Development (OECD) in 1972 as one of the guiding principles concerning international aspects of environmental policies.¹ The Principle is recognised worldwide and is referred to in national legislation, as well as in many regional and international declarations and agreements (Smets, 1993 and 1994a). The Polluter-Pays Principle was introduced in 1987 in the Single European Act.² Prior to this, the Principle was quoted in a number of OECD Recommendations and in Directives of the European Community. The Maastricht Treaty in 1992 confirmed the adoption of this Principle by the twelve European Union Member States. The 1992 Porto Agreement creating a European Economic Area established that all contracting states will implement the PPP.³ The Principle was also adopted by the Contracting Parties to the 1992 Convention for the Prevention of Marine

JAMES A. TOBEY and HENRI SMETS are from the Organisation for Economic Co-operation and Development, Paris. The views expressed in this paper are the authors' own and do not necessarily reflect the views of the OECD.

¹ See OECD (1992a) for a review of the PPP as interpreted by the OECD and for reference to OECD Council Acts and Recommendations concerning the Principle.

² Article 130r, para. 2, of the Single European Act (see Commission of the European Community, 1987) states that:

Action by the Community relating to the environment shall be based on the principles that preventive action should be taken, that environmental damage should as a priority be rectified at source, and that the polluter should pay.

³ Article 73.2 of the 1992 Porto Agreement states that: 'Action by the Contracting Parties relating to the environment shall be based on the principles that . . . the polluter should pay'.

Pollution in the North-East Atlantic.⁴ Finally, the PPP is one of the principles included in the Rio Declaration adopted at the 1992 United Nations Conference on Environment and Development.

The Polluter-Pays Principle is usually interpreted as both a principle of cost allocation and a principle of cost internalisation. As a principle of cost allocation, the PPP addresses the question of 'who pays' for pollution prevention and control. The PPP instructs that those responsible for causing pollution are required to bear the costs of pollution prevention and control measures. Governments should not as a general rule give the polluter assistance of any kind for pollution prevention and control. In this way, the Principle seeks to avoid potential international trade and investment distortions from environmental subsidies to polluting sectors. As a principle of cost internalisation, the PPP seeks to improve economic efficiency by internalising external environmental costs of production and consumption into market prices. This raises the question of what environmental costs and 'how much' should be paid.

When the PPP was discussed within the OECD, it was mainly directed at the industrial sector, and there was little discussion of the application of the PPP to agriculture and other nonpoint pollution sources (such as transportation and consumption-related pollution). This is now changing and the application of the PPP to agriculture is receiving increasing attention. For example, the application of the PPP to agriculture is presently being considered in the OECD Joint Working Party of the Committee on Agriculture and the Environment Policy Committee. This interest stems from heightened concern over agricultural pollution problems. The trend of increasing intensity of agricultural production systems in industrial countries over the last 20 years has contributed to the contamination of surface and ground water, the eutrophication of lakes and rivers, and the disappearance of species of flora and fauna. In some industrial countries, such as the United States, nonpoint source pollution (especially agricultural) is the principal source of remaining water quality problems (USEPA, 1994). At the same time, rising incomes and populations in industrial countries have increased the demand for environmental quality and recreation services. Environmental policies are being introduced to address these supply-side and demand-side pressures on the environment, raising the question of how far the PPP can go in guiding such policies. The OECD Secretariat (1989, p. 60) has concluded that the PPP 'should apply to all agriculture policies and programmes which are designed to prevent, control or reduce both point and nonpoint sources of pollution'. Similarly, the European Commission has stated that the PPP 'must of course apply to agricultural activity as it does elsewhere' (Commission of the European Community, 1988). However, these strong policy

⁴ See Article 2.2b of the Convention for the Protection of the Marine Environment of the North-East Atlantic, Paris, September 1992.

statements are usually not backed up by actions.

This paper examines the Polluter-Pays Principle with a focus on its consequences for the agricultural sector, trade and international relations. It is found that the application of the PPP to agriculture is not straightforward. Complexities of managing nonpoint pollution sources, and institutional arrangements that in industrial countries endow agricultural producers with wide-ranging rights to pollute, complicate the application of the PPP to agriculture. As a result, the level of cost internalisation in the agricultural sectors of most industrial countries is still insignificant, and the use of environmental subsidy schemes to reduce agricultural nonpoint source pollution is widespread and growing. Against this background, there is real concern that recent progress in reducing agricultural subsidies in industrial countries (for example, as part of the agricultural agreement of the Uruguay Round of multilateral trade negotiations) will be lost as old production-oriented subsidies are replaced by new disguised production-enhancing support in the form of 'green' payments. The agricultural agreement of the Uruguay Round GATT agreement, for example, departs from the PPP in allowing for environmental subsidies up to the full cost of compliance with environmental measures. Similarly, wide-ranging environmental protection subsidies were adopted by the European Union (EU) as part of the 1992 reform of its Common Agricultural Policy (Commission of the European Community, 1992b). As some countries increasingly turn to such agri-environmental subsidies, there is the possibility that their competitiveness in world agricultural markets would be improved *vis-à-vis* other countries that rely more heavily on a polluter-pays approach.

2. COST INTERNALISATION IN AGRICULTURE

The goal of internalisation of environmental costs is a widely-held principle of environmental management and sustainable development. According to the OECD, 'a sustainable and economically efficient management of environmental resources requires, inter alia, the internalisation of pollution prevention, control, and damage costs' (OECD, 1991). Similarly, Principle 16 of the 1992 Rio Declaration states that: 'National authorities should endeavour to promote the internalisation of environmental costs . . . taking into account the approach that the polluter should, in principle, bear the cost of pollution, with due regard to the public interest and without distorting international trade and investment'.

Views on precisely what external environmental costs the Polluter-Pays Principle should be concerned with vary. There has always been agreement that the PPP deals at a minimum with the costs of pollution prevention and control associated with environmental measures introduced by public authorities to ensure that the environment is in an acceptable state. In some cases,

administrative costs and residual damage costs are also included as environmental costs that polluters must bear. Administrative costs refer to the costs of analyses and monitoring that environmental authorities undertake in the course of controlling pollution problems. In some instances, these costs can be assigned directly to specific polluting activities (Smets, 1993).

A 1991 OECD Council Recommendation on the use of economic instruments noted that sustainable and economically efficient management of environmental resources requires the internalisation of pollution prevention, control and damage costs (OECD, 1991). At a global level there has also, on occasion, been recognition that polluters should bear damage costs. For example, the Rio Declaration is in favour of the full internalisation of environmental costs, including damage costs.

In most interpretations of the PPP, the appropriate level of internalisation of external environmental costs is left for public authorities to decide domestically. According to the OECD (1972): 'differing national environmental policies, for example with regard to the tolerable amount of pollution and to quality and emission standards, are justified by a variety of factors including among other things different pollution assimilative capacities of the environment in its present state, different social objectives and priorities attached to environmental protection and different degrees of industrialisation and population density'. Thus, the PPP does not necessarily provide guidance on what the acceptable level of pollution should be, on what is an appropriate level of pollution prevention and control, or 'how much' polluters should in effect pay.⁵ This means that weak environmental protection measures are not necessarily inconsistent with the PPP (as long as environmental standards are not set artificially low, as this could affect trade competitiveness by acting as an 'implicit' subsidy).

b. Environmental Concerns and Control Costs in Agriculture

There are many types of environmental costs and impacts associated with agricultural production.⁶ Effects on ground and surface water, soil resources and natural systems are the major categories of impact in terms of environmental

⁵ Stevens (1994) observes that in the context of current 'trade and environment' debates, some environmental groups would like to use the PPP as a mechanism for judging the stringency of domestic public policies for pollution prevention and control. In particular, one view argues that there should be some minimum environmental regulations upon which the extent of the polluters' responsibility for environmental damages should be based. These minimum standards would be linked with the precautionary principle and the achievement of sustainable development. Smets (1994a) notes that there is a problem with this interpretation of the PPP. Specifically, if current pollution prevention and control measures adopted by public authorities through a democratic political process are thought to be inadequate, then under what procedure or methodology are 'optimal' measures to be determined? And what public body should be responsible for deciding upon and implementing the 'optimal' stringency of environmental measures?

⁶ Agricultural production in this paper refers to primary agriculture and not the agri-food industry.

media. Most, but not all, of these environmental costs are related to pollution flows (for example, of nutrients, sediments, pesticides, salts and trace elements). The variety of environmental impacts does not in principle create difficulties in terms of the PPP. Experience shows that pollution prevention and control has been interpreted broadly, covering most forms of environmental protection. The original OECD guidelines on the PPP refer to the rational use of scarce 'environmental resources' (OECD, 1972). Similarly, the Rio principle clearly refers not only to the 'cost of pollution', but also to more broadly defined 'environmental costs'.

The main categories of agricultural environmental costs include:⁷

- human health effects of pesticides, fertilisers, heavy metals and feed supplements through the contamination of food products, drinking water, the food chain and farm workers;
- erosion of soil resources and consequent sedimentation of coastal and surface water, resulting in infrastructure and property damages, increased risk of flooding and increased costs of navigation, water storage and treatment;
- degradation of air quality from dust and agricultural burning;
- on-site soil productivity losses from salinisation, compaction, waterlogging and chemical pollution;
- loss of wildlife, biological diversity and damage to ecosystem functioning, and resilience due to degradation of soil; contamination of coastal, surface and ground waters from chemical fertilisers, pesticides and animal manure; and conversion of forest, wetland and other natural features (such as streams) to farmland uses;
- nuisances (odour, for example, from intensive livestock production or sugar beet processing; visual disamenities from unsightly farm buildings; and noise);
- contribution of agriculture to global warming through emissions of greenhouse gases (such as methane); and
- acid deposition from ammonia emissions from livestock and fertiliser.

Monetary estimates of environmental damages due to agricultural production are scanty, but some empirical estimates are available for the United States. They

⁷ The PPP concerns external environmental costs (and not benefits). Payments to farmers to compensate activities that generate external environmental benefits (such as landscape preservation or conservation of biological diversity) are not necessarily considered as departures from the PPP. In practice, the positive and negative environmental externalities of agriculture are tightly interlinked, making the distinction difficult. For example, agriculture is both a major cause of biodiversity loss (a negative externality) and a source of habitat for certain species (a positive externality); similarly, a farm practice that reduces negative externalities can, at the same time, produce positive environmental externalities (creation of buffer strips along watercourses reduces water pollution, and can also create positive wildlife and flood control benefits).

show that the social costs of negative environmental externalities from agriculture are substantial. For example, Ribaudo (1989) estimates that surface water damages alone from soil erosion and associated runoff of agricultural chemicals are of the order of \$9 billion annually. Smith (1992) has taken these soil erosion damage estimates and added wetland conversion losses and ground water contamination damages associated with agriculture; he finds that the environmental damages from agriculture in most regions of the United States correspond to five to ten per cent of the total value of crops produced.

Examples of compulsory environmental measures in industrial countries that address agri-environmental problems and that impose the costs of pollution prevent and control on the farm operator include: penalties for the conversion or disruption of wetland on farmland;⁸ controls on ploughing permanent grassland; restrictions on fertiliser and pesticide use, and application practices; chemical charges; required plans for land disturbance; enforceable codes of agricultural practice; operating permits or restrictions on activities that may cause soil erosion; restrictions on straw burning; and mandatory green cover in autumn.

Even in industrial countries where concern over the environmental impacts of agriculture are running high, the costs imposed on agriculture associated with conforming with these and other environmental protection measures appear to be relatively small. Baldock and Bennett (1991) report on detailed case studies of environmental protection measures in agriculture in six European countries (Belgium, Denmark, France, Germany, the Netherlands and the United Kingdom) and find that the costs of environmental protection on the agriculture sector are insignificant relevant to production costs. In the Netherlands, where environmental controls are among the most stringent of industrial countries, total costs of environmental protection measures borne by the farm sector in 1988 are estimated at \$76 million, or just 0.79 per cent of 1988 agricultural GDP (Dutch Central Bureau of Statistics, in Baldock and Bennett, 1991; and OECD, 1992b). More recent statistics indicate that environmental protection costs have risen rapidly in the Netherlands since 1988, largely as a result of the cost of required manure storage facilities. It is estimated that the total cost of measures taken to reduce the environmental impact of agriculture (an important sector in the Netherlands in terms of the country's overall pollution problems) amount to around five per cent of value added in 1994 (Netherlands Ministry of Housing, Spatial Planning and the Environment, 1994, p. 212). In the United States, it is estimated that nonpoint source water pollution control cost \$779 million in 1987 (USEPA, 1990). Only part of this amount was for agricultural nonpoint source

⁸ The constitutional legitimacy of so-called regulatory 'takings' associated with regulations that restrict the rights of property owners with wetland on their property is being debated in the United States.

TABLE 1
Pollution Abatement Costs as a Percentage of Total Production Costs: US

<i>I-O Industry</i>	<i>Direct Pollution Abatement Costs (as % of total costs)</i>	<i>Direct and Indirect Pollution Abatement Costs (as % of total costs)</i>
Livestock and other products	0.09	0.72
Other agricultural products	0.00	0.62
Iron, ferroalloy mining	0.95	2.03
Nonferrous mining	1.06	1.92
Paper and allied products	1.33	2.40
Chemicals	1.73	2.89
Petroleum refining	0.96	1.78
Primary iron, steel	1.28	2.38
Primary nonferrous metals	0.72	2.05

Source: Kalt (1985, p. 10).

water pollution control, yet even this entire value represents just 0.88 per cent of agricultural GDP (OECD, 1992b).

Tables 1 and 2 provide further information on pollution abatement costs in manufacturing sectors (including food products) in the United States, Germany and the Netherlands. The first column of Table 1 shows the direct pollution abatement expenditures as a percentage of total costs in the United States. The second column shows the total (direct and indirect) pollution abatement expenditures as a percentage of total costs. Indirect pollution abatement costs take into account the abatement costs embodied in intermediate goods purchases. Table 2 shows the direct pollution abatement expenditures as a percentage of total costs in Germany and the Netherlands. Tables 1 and 2 illustrate two points. First, pollution abatement expenditures relative to production costs are small even in pollution-intensive industries. Second, pollution abatement costs relative to production costs are small in the food sector (less than one per cent of total

TABLE 2
Pollution Abatement Costs as a Percentage of Total Production Costs: Netherlands, Germany

<i>Industry</i>	<i>Netherlands (1990)¹</i>	<i>Germany (1989)²</i>
Food, beverage and tobacco	0.40	0.35
Textiles and leather	0.50	0.26
Wood and wood products		0.46
Pulp and paper	0.8	1.2
Chemicals	1.8	1.7
Non-metallic mineral products	0.3	0.8
Iron and steel	2.4	0.84
Machinery		0.28

Source: ¹Netherlands Central Bureau of Statistics (1993), p. 268.

²OECD (1993c and 1992b).

agricultural value added) compared with pollution-intensive industries. In sum, while agricultural pollution problems in many industrial countries are serious, the stringency of pollution control measures in most industrial countries appears to be weak.

Little analysis has been undertaken on the potential competitiveness and trade effects of environmental policy changes in agriculture (an early exception is Tobey, 1991), but the spectre of lost competitive advantage is often raised. It is sometimes argued (see, for example, Baldock and Bennett, 1991) that these effects are a particular concern in the agricultural sector because it is a competitive sector in the sense that it is composed of a large number of small producers, none of whom affect producer prices. Since pollution abatement costs cannot be passed on to consumers, such costs, it is argued, could have an important effect on competitiveness.⁹

The premise that competitiveness and trade would suffer from the imposition of environmental policy has a strong element of *a priori* plausibility, but has little empirical support. In the manufacturing sector where environmental regulations are stronger than in agriculture, empirical and case study evidence show that the often touted effect of environmental regulations on patterns of trade and competitiveness has not materialised, even in those manufacturing sectors where pollution standards are the most stringent (see, for example, Tobey, 1990; Leonard, 1988; and OECD, 1994). The main reason is simply that the magnitude of environmental expenditures in countries with stringent environmental policies are not sufficiently large to cause a noticeable effect. In addition, losses in comparative advantage have been small because most industrial countries have introduced environmental regulations at roughly the same time and at approximately the same levels of stringency.

Although the economic effect of regulating pollution due to agricultural production has not been shown to affect domestic competitiveness, when modelling against a benchmark of perfectly competitive international trade, or under assumptions of drastic curtailment of chemical inputs, the impacts of regulations can be significant. For example, a controversial 1990 study of the United States found that a complete ban of all fertiliser and chemical inputs to crop production would reduce yields by as much as 30–50 per cent (Knutson et al., 1990).

b. Reasons for Limited Cost Internalisation in Agriculture

Environmental management in most industrial countries was focused principally at large industrial and municipal point sources of emissions in the 1970s. Some 20 years later, with considerable success in cleaning up these

⁹ That the concern over competitiveness is real might be seen in Austria and Finland's recent abandonment of their nitrogen fertiliser tax as they prepare to join the European Union.

pollution sources, the focus has changed. The most worrisome pollution sources are now more complex, difficult and, in some cases, costly to control. These more difficult to control pollution sources have been termed 'second generation' pollution problems (Braden and Segerson, 1993). The fact that we do not observe far-reaching pollution prevention and control measures in the agriculture sector is certainly related to the fact that agricultural pollution is a second generation pollution problem, and that there are particular environmental management difficulties in this sector. Some of these differences are technical, others are related to existing perceptions of private property rights arrangements, and economic and political considerations. These special circumstances of agricultural pollution control provide the context for the so far limited degree of cost internalisation in agriculture. They also have consequences for the cost allocation rule of the PPP, trade and international relations.

(i) Monitoring and technical difficulties It is useful to decompose agricultural sources of pollution into two classes: 'point' and 'nonpoint' pollution sources. Livestock feedlots are an example of one class of primary agricultural activities that are point sources of pollution. For these activities, it is possible to link polluters and polluting practices with pollution emissions, making the task of environmental management easier. But most agricultural activities are nonpoint sources of pollution. The nonpoint nature of agricultural pollution typically makes it difficult to determine precisely who and what activities are responsible for which proportion of the total pollution load. The indisputable identification of polluters is difficult in most situations because agricultural pollution is normally diffuse. Emissions occur over a dispersed area, rather than fixed, identifiable points, and are therefore unobservable.

Furthermore, it is difficult to estimate the relationship between farms and environmental damages because, in most cases, the pollution is closely associated with farm-operator input choices and management practices whose observation would require continual monitoring which is impractical. For example, pollution resulting from a given quantity of pesticide or fertiliser will depend not only on the total quantity applied but also on the care with which it is prepared, the timing of application, types of crop sown, methods of cultivation used and where it is applied (e.g. proximity to streambanks).

Ecosystem complexity complicates the proper identification of polluters and polluting practices. Differences in endowments of key environmental factors (e.g. soil type, geology, hydrology) mean a practice that is polluting in one place may not be polluting in another. Some agricultural pollutants have complex and uncertain environmental fates.¹⁰ Pollution loadings further depend in part on

¹⁰ To illustrate this point, there is often a temporal discontinuity between a polluting activity on the farm and its impact on environmental quality. The downward transit time for some farm chemicals to reach aquifers may be as much as decades.

random natural variables such as wind, rainfall and temperature. In most situations, nonpoint source pollution is directly tied to the occurrence of a natural event (usually rainfall). This complicates the analysis of and prescription for nonpoint source pollution. It means that pollution loadings can be 'lumpy' with much more serious effects on human health and ecosystems than would be the case if the same pollution was released gradually over time.

(ii) *Agricultural pollution and private property rights* The socially mandated level of internalisation of external environmental costs is in most cases determined in part by legal and constitutional history, in particular regarding the allocation of property rights in natural resources. In agriculture, most of the natural resource degradation problems are closely associated with the use of privately-owned land.¹¹ Existing private property rights arrangements embodied in legislation in most industrial countries do not generally permit extensive interference in landowners' uses of privately-owned land.¹² In the present context, this would include environmental measures that limit private property rights without compensation.

Of course, private property rights are not immutable and a wide range of economic and social forces influence political attitudes towards the rights and duties associated with land use. For example, increased demand for environmental quality and the increased impact of modern technology on the environment can challenge the historical allocation of private property rights with respect to agriculture.

(iii) *Economic and political considerations* Two economic and political considerations may have inhibited the implementation of more stringent and costly pollution prevention and control measures in the agricultural sector. The first consideration concerns the scale of agricultural production. It has been argued that because agriculture is composed of a large number of small units, many of them family farms, it cannot be treated in the same way as bigger enterprises when it comes to environmental compliance (Baldock and Bennett, 1991). The small family farm may face special difficulties in adapting to changing environmental requirements and financing pollution control practices. But the size and composition of farms are changing, and the relative importance of large farm enterprises has greatly increased over the past decade. Moreover, there are other economic sectors and productive activities that are also small and

¹¹ Note that agricultural land is usually, but not always, privately owned. For example, public land in some countries is used for the grazing of livestock.

¹² In the United States, an Executive Order calls for the consideration of property rights issues when writing federal regulation. Recently, a property rights bill (S. 2006) has been introduced in the US Senate that would require a property rights impact statement for every federal regulation that may require the government to impose restrictions on uses of private property.

TABLE 3
Net Percentage Producer Subsidy Equivalents (PSE) in Agriculture

	<i>Average 1981–1984 (% PSE)</i>	<i>Average 1989–1992 (% PSE)</i>
Australia	11	12
Austria	28	47
Canada	30	45
European Community ¹	32	46
Finland	55	71
Japan	63	68
New Zealand	26	4
Norway	69	75
Sweden	38	57
Switzerland	65	77
United States	27	27
OECD	33	43

Note: 'EC-10: 1981–1985; EC-12: 1986–1992, including eastern Germany as from 1990.

Source: OECD, *Agricultural Policies, Markets and Trade: Monitoring and Outlook* (various years).

numerous, and that are treated similar to larger firms with respect to compliance with environmental legislation (e.g. metal plating, textiles, laundry and cleaning services).

The second and by far the most important consideration is related to the economic and political status of agriculture. The political status of the agricultural sector in most industrial countries has meant a reluctance to impose costs on agriculture which might adversely affect farmers' income, the level of production and the agricultural workforce. To achieve agricultural objectives, substantial levels of assistance continue to be an important feature of policy in most, but not all, industrial countries.¹³ Table 3 shows the level of agricultural assistance in selected industrial countries. The average 1989–92 level of agricultural assistance for the OECD as a whole is equivalent to about 43 per cent of the value of total agricultural production.

3. AGRICULTURE AND THE NON-SUBSIDISATION RULE

According to the OECD (1972) the Polluter-Pays Principle means that the polluter should bear the expenses of carrying out pollution prevention and control measures decided by public authorities to ensure that the environment is in an

¹³ Australia and New Zealand are the exceptions with 1993 levels of agricultural assistance equivalent, respectively, to only nine and three per cent of the value of total agricultural production (OECD, 1993b).

acceptable state.¹⁴ Such measures should not be accompanied by subsidies (such as grants, subsidies or tax allowances for pollution abatement equipment, and below-cost charges for public services) that would create significant distortions in international trade and investment. As such, the PPP is a non-subsidisation principle. The rationale for the idea that the polluter should pay for pollution abatement originated from a trade context. The main international concern at the time the PPP was introduced by the OECD involved the potential trade advantages that polluting sectors, in particular industries, might realise in countries that subsidise pollution prevention and control costs.

a. Environmental Subsidies in Agriculture

Contrary to the non-subsidisation rule, an array of environmental subsidies are used in the agricultural sector in most industrial countries to reduce agricultural point and nonpoint source pollution (OECD, 1989; and Russell and Shogren, 1993). Easter (1993) observes that these approaches are popular because they rely on a network of existing agricultural extension agencies, have little or no enforcement costs and have farmer support, all of which lower the transaction costs of this set of alternatives. A number of broad categories of environmental subsidies can be identified.

First, publicly provided education and extension services with some environmental element are common to most industrial countries. This includes, for example, subsidised demonstration projects to illustrate opportunities to reduce agricultural pollution. A second category is composed of subsidies for environmental investments, such as for investments to upgrade manure storage facilities; to construct manure reprocessing plants and facilities to dispose of livestock wastes; for seeding or tree planting; for wetland enhancement; and for the installation of embankments, improvements to water courses and other landscape changes to reduce soil erosion, contamination of water and loss of biological diversity.

A third category, often closely linked with categories one and two, are payments to farmers for the use of farm management practices that reduce agricultural pollution flows or ecological damages to particular landscapes. Most

¹⁴ To implement the cost allocation principle, the 'polluter' must be clearly identified. Identification of the 'polluter' is not always self-evident when there are more than one party directly or indirectly responsible for the pollution (e.g. who is the polluter in relation to airport noise: the airline companies, the passengers, the airport authority, or the government department in charge of airport location?). This point was virtually ignored in the early OECD texts. The language of OECD Council Recommendations consistently refers to the 'polluter' as the person whose activity gives rise to the pollution and not the party 'responsible' or 'liable' for the pollution. In the European Union, the polluter was defined in 1975 as the person who directly or indirectly causes deterioration of the environment or establishes conditions leading to its deterioration (Commission of the European Community, 1975a).

payment schemes involve uniform payments for each agri-environmental practice listed in a menu of possible practices outlined by the government authority. All farmers thus receive the same price for undertaking a given management practice. For example, under the Environmentally Sensitive Areas Programme in the United Kingdom, flat rate payments per hectare are linked to management prescriptions that reduce the flow of nitrates off the farm.

Fourth, many industrial countries have introduced environmental measures that provide financial incentives (usually annual payments) to limit or stop farming activities on environmentally sensitive land, with the goal of reducing potential environmental damages. For example, under the Conservation Reserve Program (CRP) in the United States, farmers have been paid to take out of production some 14.4 million hectares of 'highly erodible' cropland (covering some eight per cent of US cropland).

Finally, there are examples of so-called redistributive charging systems and tax-cum-subsidy schemes. Examples of redistributive charging and tax-cum-subsidy schemes include surplus manure charges which are used in some industrial countries (Belgium and the Netherlands) to help finance manure transport, storage and processing; fertiliser and/or pesticide charges (Denmark, Norway and Sweden) which are used to help finance environmental programmes in agriculture and forestry; and water user charges that are used to compensate farmers for environmentally beneficial changes in farm practices (OECD, 1993a).

b. Magnitude of Environmental Subsidies and Potential Trade Effects

To evaluate these types of environmental subsidies in terms of the PPP we need to first identify and quantify them, and then assess their potential distorting effect on competitiveness and trade. Information on the magnitude of environmental subsidies in agriculture and their trade effects is fragmentary, but suggests that the magnitude is not large. In the United Kingdom, where payments for nitrate reductions are a key environmental management tool in areas identified as environmentally sensitive (comprising 15 per cent of total agricultural area), it is estimated that the value of environmental subsidies will reach \$92 million by 1996,¹⁵ or just 0.86 per cent of 1990 agricultural GDP (OECD, 1992b). In the Netherlands, the value of agricultural subsidies for environmental protection in the agriculture sector is estimated at \$82 million for 1994, or about 0.75 per cent of agricultural GDP (Netherlands Ministry of Housing, Spatial Planning and the Environment, 1994). In the United States, government expenditures for agricultural conservation are estimated at \$3.4 billion in 1993 (USDA, 1993), or

¹⁵ Statement made by Mr Murphy, Assistant Under-Secretary, Ministry of Agriculture, Fisheries and Food, United Kingdom, at a 1994 OECD meeting of the Committee for Agriculture.

about 3.8 per cent of 1993 agricultural GDP (OECD, 1995). This value includes conservation expenditures for technical assistance and extension; cost sharing and payments for the use of conservation practices and for conservation activities; conservation data and research; and land rental and easement payments for conservation purposes (of which CRP rental payments account for \$1.7 billion).

The exact magnitude of environmental subsidies that represents a 'trade distortion' is not specified in the OECD or other contexts in which the PPP is introduced. However, in the final act of the Uruguay Round of multilateral GATT negotiations, a subsidy in excess of five per cent of the value of production is considered to cause 'serious prejudice' (Agreement on Subsidies and Countervailing Measures, Article 6.1). The magnitude of current environmental subsidies in agriculture in selected industrial countries presented above is less than five per cent of the value of production.

In the United States, the magnitude of environmental subsidies approaches four per cent of the value of production, but much of this is for costly land rental and easement payments for conservation purposes. Government incentive payments for farm land retirement can certainly affect agricultural production and trade, but are not necessarily a source of 'prejudice' to the competitive position of other nations. Most of the 14.4 million hectares of land enrolled in the CRP would otherwise have been in production. It is estimated that the impact on US production and trade of retiring this amount of cropland is significant, reducing production of some crops by up to ten per cent and reducing exports by up to five per cent (USDA, 1990). By removing large chunks of cropland from production land, set-aside schemes can increase world agricultural commodity prices, boost agricultural income, reduce domestic exports and provide an incentive for competing countries to expand exports.

With the exception of the CRP in the United States, it is unlikely that existing environmental subsidies in agriculture have had noticeable effects on relative competitiveness, production and international agricultural trade. Their effect is likely to be swamped by other (non-environmental) agricultural assistance measures and economic variables (e.g. swings in exchange rates, energy, labour and other input costs). Moreover, even if the magnitude of environmental subsidies in agriculture were large in industrial countries, their effect on the structure of relative costs and the level of the agricultural 'playing field' would likely be minimal unless there was significant variation in the use of such subsidies across countries (in particular, across industrial countries who are the main world agricultural competitors, accounting for 73 per cent of world agricultural exports; FAO, 1994). So far, there is little concrete evidence of such variation.

It has also been the finding in the manufacturing sector that the level of environmental subsidies is low and evidence of trade distortions has not

manifested itself (OECD, 1990). But this should not be surprising. Pollution abatement costs in industrial countries (including public sector environmental subsidies) are in the order of one to two per cent of GDP (OECD, 1993c; and Commission of the European Community, 1994). Thus, even if environmental subsidies in some manufacturing sectors were a large percentage of total pollution abatement costs, they would still be very small relative to production costs, and would be unlikely to have a major impact on international trade and investment (Smets, 1994b). An OECD investigation of financial aid to the private sector in member countries for pollution control found that during the years 1980 to 1986 the level of aid ranged between 0.06 and 0.10 per cent of GNP for those countries that acknowledged some assistance and for which the statistic could be calculated (OECD, 1990).

c. Exceptions to the Non-Subsidisation Rule

Not all environmental subsidies are necessarily inconsistent with the PPP. When it was agreed (by the OECD) that the polluter should bear the compliance costs of pollution prevention and control measures, it was also agreed that there were valid exceptions to the PPP. In other words, the PPP and its exceptions were adopted as a single package. Since 1972, this approach has been consistently supported. For example, exceptions are foreseen in the Rio Declaration, since it is stated that 'the polluter should, *in principle*, bear the cost of pollution' (Principle 16).

Acts of the European Community, and the practice of individual Member States of the European Union and the OECD, show that, under certain conditions, subsidies for environmental purposes can be in line with the PPP. As these conditions can be quite liberal, and as the number of allowed exceptions is very broad, mechanisms have been created to prevent any abuse. In the OECD context, any government who considers that a pollution control subsidy provided by another member country might introduce a significant distortion in international trade and investment may request that a consultation be initiated to examine whether this assistance is in conformity with OECD guidelines. To date, no request for consultation has ever been submitted to the OECD. In the European Union, the Commission examines whether a proposed subsidy is in conformity with Article 92 of the Treaty of Rome and other relevant texts originating from the Commission, and issues specific guidelines to which States must conform. In a few cases, the Commission has declined to authorise proposed subsidies.

(i) *The OECD and the exceptions to the PPP* The 1972 OECD Recommendation states that 'there may be exceptions or special arrangements, particularly for transitional periods' to the non-subsidisation rule (OECD, 1972).

The OECD provides some guidance by specifying the situations where governments could give subsidies to polluters to help them comply with environmental measures (OECD, 1974a). Government assistance for pollution prevention and control might be given:

- to simulate the development of new pollution control technologies and abatement equipment;
- to ease transition periods when especially stringent environmental protection regimes are being implemented; and
- in the context of measures to achieve specific socio-economic objectives, such as the reduction of serious interregional imbalances.

To avoid abuse of the latter two exceptions, it was further specified that any assistance granted under the OECD exceptions should be selective and restricted to those parts of the economy where severe difficulties would otherwise occur; limited to well-defined transitional periods, laid down in advance; and should not create significant distortions in international trade and investment.

A 1991 OECD Council Recommendation further specified that financial assistance may be applied in the framework of appropriately designed redistributive charging systems (OECD, 1991). Redistributive charging systems refer to the case in which pollution charges imposed on a group of polluters are redistributed back to the same group of polluters (so-called self-financing environmental management schemes). This might include, for example, manure charges that are redistributed back to polluters in the form of subsidies for manure disposal facilities.

All of the above exceptions to the PPP (which apply to all polluting activities, not just agriculture) are general enough to open up a wide array of opportunities for subsidising polluters' costs of meeting pollution prevention and control measures. Strict guidance in the interpretation of the allowed exceptions for specific sectors and activities is not provided in the OECD context. This opens the door to many possible differences in interpretation. For example, because pollution control technology is continually evolving, the 'technology' exception that allows subsidies to stimulate the development of new pollution control technologies and abatement equipment could arguably be exploited indefinitely. In addition, the definition of transition periods is unclear and may be interpreted very differently by different governments.

(ii) *The European Union and exceptions to the PPP* The European Union issued a Recommendation on the PPP in 1975 and laid out even more specific and legally binding guidelines on conditions under which environmental subsidies are acceptable. In agriculture, more detailed guidance is provided by two relatively recent Council Regulations (see Commission of the European Community, 1994). First, Regulation No. 2328/91 specifies that for environmental

investments in agricultural structures, the maximum aid level is, for most cases, 35 per cent.¹⁶

Second, Council Regulation No. 2078/92 (the 'agri-environment regulation') specifies a wide array of agri-environmental measures for which financial assistance may be given (Commission of the European Community, 1992b). The agri-environment regulation was introduced as part of the 1992 reform of the Common Agricultural Policy of the EU and includes subsidies for: reduction in the use of fertilisers and plant health products; extensive agricultural techniques; reduction in the number of bovine animals or sheep, or the increase in acreage per animal; use of more environmentally-sound production methods, as well as the maintenance of nature and landscapes; maintenance of practices which are already compatible with the environment; protection of waters; organic farming; conversion of arable production to extensive grassland; land set-asides with a view to using the area for environmental purposes (biotopes and natural parks); training of farmers in environmentally-sound techniques, as well as for courses and demonstration programmes. Such subsidies are not necessarily in conformity with other national and international government organisations' interpretations of the PPP, such as that of the OECD.

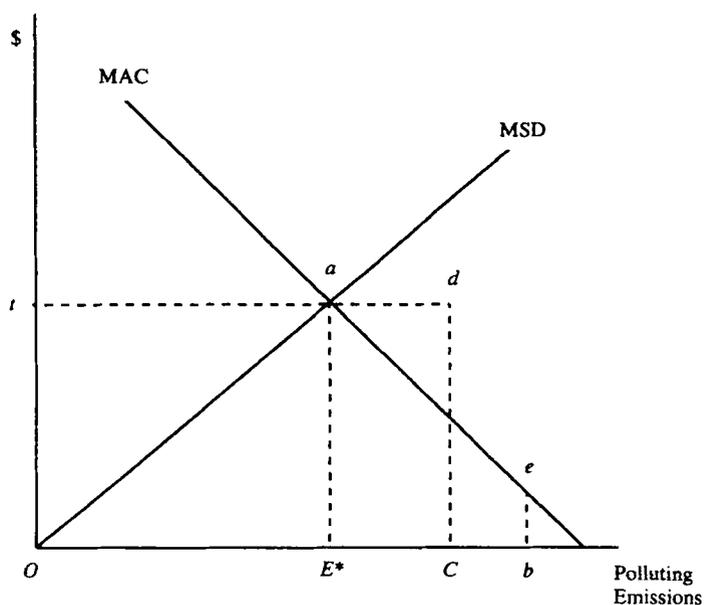
The maximum annual amount of aid for the introduction of these measures and activities varies with the land class and productive activity, and ranges from about \$120–\$550 per hectare. This level of aid is large relative to other agricultural assistance in the form of direct payments and market support (total government assistance to EU agriculture in 1992 is estimated at \$690 per hectare; OECD 1993b). But environmental assistance will not be provided on all agricultural acreage in the European Union, either because it is not necessary or because of limited financial resources. The original proposal for the agri-environment regulation suggested a budget of around \$1.6 billion over the first five-year period ending in 1997 (Baldock et al., 1993). With total agricultural assistance equal to \$52 billion in 1993 (OECD, 1993b), the magnitude of environmental assistance planned over the first five-year period is likely to represent well less than one per cent of total agricultural assistance over the same period.

d. A 'Weak' Polluter-Pays Principle

Many governments consider the types of environmental subsidies in agriculture covered by the EU agri-environment regulation to be consistent with the PPP

¹⁶ EU Council Regulation No. 2328/91 of 15 July, 1991, on improving efficiency of agricultural structures. A 1992 decision of the EU Commission concerning aid in the Netherlands for environmentally-sound disposal of manure showed that limited financial aid may also be granted for investments in facilities for the disposal and reprocessing of surplus manure (Commission of the European Community, 1992a).

FIGURE 1
The Polluter-Pays Principle



because they are for environmental improvements that purportedly go 'above and beyond' environmental performance standards required by government, where such environmental performance standards are often defined by 'good' or 'sustainable' farming practices. Because desired levels of environmental quality are not necessarily met even under full conformity with government mandated environmental performance standards, financial incentives are provided to farmers to go beyond what is required with the ultimate aim to improve environmental quality without introducing a large cost burden on the farm sector. Most of the agri-environmental payments allowed under the EU agri-environment regulation can be seen in this context.

Payments to achieve environmental improvements above and beyond environmental performance standards adopted by government are not unique to the agricultural sector. For example, water pollution sources in French water basins can receive a subsidy for pollution reduction in excess of what is required; and in the EU, purchasers of vehicles with catalytic converters installed in advance of the date that they became required (in 1992) could benefit from a financial incentive.

Payments to farmers for the introduction of pollution prevention and control that produce new and additional environmental benefits beyond what is required are considered by many industrial countries to be consistent with the PPP, and might be termed a 'weak' version of the PPP. The 'weak' PPP and other versions of the PPP can be illustrated using a simple cost-benefit diagram. Figure 1

shows the farm's marginal abatement cost curve (MAC) and the marginal social damage curve (MSD). The marginal abatement cost curve represents the incremental costs to the farm for reducing pollution flows. The marginal social damage curve represents the incremental environmental costs of the farm's polluting emissions. The cost to the farmer of reducing its polluting emissions from point b down to E^* (which corresponds to the desired level of environmental quality) is given by the area E^*aeb . This outcome can be termed the 'standard' PPP. The 'extended' PPP requires farmers to pay in addition the residual damages given by the area E^*Oa . In the 'weak' version of the PPP, the level of pollution abatement required by the government is given by point C . The level of environmental performance imposed on farmers by government in this case does not achieve desired pollution abatement goals. Polluters are required to pay for pollution abatement up to point C , but may receive compensation for the introduction of pollution abatement beyond point C and up to the social optimum (E^*) since such abatement activity is not mandatory. An exceptional right to pollute is, in effect, transferred to polluters. Net pollution abatement costs are equal to the area E^*aeb (abatement costs), less the area E^*adC (compensation).

If the 'weak' PPP is accepted, an implication is that clear guidance on 'good' agricultural practice or sustainable agriculture is needed to determine what represents a valid subsidy for pollution abatement beyond what is required. But such guidance, when it exists, is usually general. Further, such guidance must be interpreted and adapted according to regional or even local conditions. A further question is whether, under the 'weak' PPP, payments should be made to farmers who are already operating at a level beyond what is required. In practice, where payment schemes involve uniform payments for each environmental improvement listed in a menu of possible improvements, it will be difficult for the implementing agency to know what was a 'change' in agricultural practice and what was an 'existing' practice.

4. URUGUAY ROUND OF GATT AND THE PPP

The Uruguay Round (UR) of multilateral GATT negotiations has implications for both the cost internalisation and cost allocation rule of the PPP. In one sense, the UR of GATT negotiations is consistent with the PPP in that a long-term objective of the Agreement on Agriculture of the final act on the UR is to provide for substantial progressive reductions in agricultural support and protection. Although the PPP concerns itself with environmental subsidies, it is widely viewed that agricultural subsidies in general can work at cross-purposes to the intention of the PPP. The 1993 level of agricultural assistance for the OECD as a whole is equivalent to about 42 per cent of the value of total agricultural production, or \$163 billion (OECD, 1993b). This level of support creates major

distortions in agricultural price relations, affecting production and natural resource use with potentially negative effects on the environment.¹⁷ Economic distortions resulting from agricultural assistance can affect environmental quality and natural resources by, for example, encouraging reduced crop diversity, the over-production of crops that are highly erosive, the cultivation of marginal lands that tend to be more subject to soil erosion and moisture deficiencies, and the conversion of wetland and forestland to agricultural production. High and stable prices for agricultural commodities also influence tillage practices, the use of fertilisers and pesticides, the amount of excess manure and the intensity of land use. High levels of agricultural assistance are thus inconsistent with the idea that users of natural resources should internalise the costs of resulting environmental degradation and, further, undermine the effectiveness of agri-environmental policy in internalising external environmental costs. In terms of Figure 1, agricultural support increases the level of polluting emissions and, consequently, the cost to society of achieving the desired level of environmental quality (point *E**) is greater than it would be in the absence of high levels of agricultural support. Environmental protection measures will be more expensive and less effective because they will have to offset the allocational distortions of agricultural support.

Under the UR Agreement on Agriculture, budget outlays of OECD countries for agricultural export subsidies are to be cut by 36 per cent; tariffs are to be reduced by 36 per cent on average; and the total aggregate measure of domestic support to farmers is to be reduced by 20 per cent from the 1986–88 level on average. These and other changes should address to some extent many of the basic causes of agricultural market distortions and, in aggregate, improve environmental performance in the agricultural sector. However, some forms of direct payments have been excluded from reduction requirements (so-called 'green box' measures), which can have production and environmental effects, and the nature and extent of agricultural policy reinstrumentation as a result of the Uruguay Round is uncertain but important in terms of impact on the environment.

In contrast, the UR departs from the PPP by allowing for environmental subsidies in the agriculture sector up to the full cost of compliance. The agreement states that 'the amount of payment shall be limited to the extra costs or loss of income involved in complying with the government programme' (GATT, 1993). This allowance is unique to agriculture. In the manufacturing sector, the UR agreement is quite strict in terms of allowed environmental subsidies and, in fact, appears to represent a tighter discipline on environmental subsidies than does OECD guidelines on the PPP. The agreement establishes as non-actionable

¹⁷ See Anderson and Strutt (1994) for a survey of work in this field.

(i.e. not subject to countervailing duties) only the following specific forms of assistance in manufactures:¹⁸

- assistance to promote adaption of existing facilities to new environmental requirements imposed by law and/or regulations which result in greater constraints and financial burden on firms;
- assistance for research activities;
- assistance to disadvantaged regions.

The UR agreement also stipulates that subsidies to both agriculture and manufacturing, when applied, should have no or at most minimal trade distortion effects on production. In this respect, at least, the provision in the GATT on agricultural subsidies is consistent with the PPP. This also, in principle, places a cap on the use of such subsidies since, as already stated, under the UR GATT agreement subsidies are defined as causing 'serious prejudice' to the interests of another member when the subsidies exceed five per cent of total production costs.

Looking into the future, there is nevertheless a concern among many industrial countries that environmental subsidies for agricultural pollution control, or 'green' payments, could be increasingly used as disguised aid to the farm sector and might act during a period of agricultural policy reform as a cover to prop up the farm sector, affecting farm competitiveness and patterns of international trade. It will be difficult to evaluate the legitimacy of this concern because of the often difficult-to-make distinction between agricultural subsidies related to environmental objectives and subsidies for different purposes. Many measures have multiple objectives, of which controlling impacts on the environment is just one. For example, land set-aside and extensification schemes in the United States, Canada and the European Union aim at both reducing output of surplus commodities and at achieving environmental improvements. Untangling the environmental from the production component of agricultural subsidies will be difficult.

As the use of 'green' payments rises, the issue of policy transparency will become more important. Transparency in the present context means that the environmental objective of environmental policies should be clearly stated and that environmental policies should be targeted to the environmental problem that they seek to address. If policies are transparent and targeted, it is much easier to separate out agricultural policies designed to achieve environmental objectives and policies designed to achieve other objectives (e.g. income and rural development objectives).¹⁹

¹⁸ Additionally, the agreement permits all subsidies that are not 'specific' (that is, targeted to particular firms or industries), such as investment tax credits.

¹⁹ Ideally, income support and environmental protection measures should be distinct. This simply follows from the well-known fact that for every policy objective there should be a separate policy instrument.

5. CONCLUSIONS

After more than two decades, the Polluter-Pays Principle remains extremely popular as a theoretical guide to environmental policy and international trade relations. This paper has considered some of the key issues in the application of the PPP to agriculture. The PPP is described as a cost allocation (non-subsidisation) and cost internalisation rule. In the agriculture sector, it is argued that neither of these rules are widely followed.

In terms of cost internalisation, we find that despite the fact that agricultural activities often result in serious environmental and resource impacts, governments of industrial countries have in the past been hesitant to impose stringent and costly environmental policies on agricultural producers. With a few possible exceptions (e.g. the Netherlands), environmental controls do not appear to be a large cost burden on the farm sector. The most important policy signal in industrial countries that the agricultural sector continues to respond to is not related to environmental protection, but rather agricultural production and assistance. With over 40 per cent of agricultural value added in OECD countries deriving from government policy, this remains a very powerful signal. The Uruguay Round of multilateral GATT negotiations represents an important step in the direction of reduced agricultural support and protection.

In terms of cost allocation, we find that the use of environmental subsidies in agriculture is widespread and is a primary approach for managing pollution and resource degradation in the agricultural sector. But, a preliminary examination of the evidence suggests that the magnitude of environmental subsidies (as a percentage of total production costs) to farmers for achieving environmental objectives is not large, and some of these subsidies might be considered as valid exceptions to the PPP. While the impact on international trade would appear to be small or negligible overall, the available data are sketchy and incomplete. A major problem involves the difficulty in distinguishing between subsidies related to environmental objectives and subsidies for different purposes when aid schemes have multiple objectives.

While the magnitude of environmental subsidies appears to be small to date, their use is growing. OECD exceptions to the PPP are wide-ranging, and the European Union agri-environment regulation introduced as part of the 1992 reform of the Common Agricultural Policy and the agriculture agreement of the Uruguay Round of multilateral GATT negotiations allow extensive use of environmental subsidies in the agriculture sector. As a result, there is concern that such subsidies could in the future become of sufficient magnitude to affect domestic resource allocation and international trade. An implication is that it will become increasingly important for industrial countries to develop comparable systems of identification, quantitative measurement and periodic monitoring of environmental subsidies in agriculture. Such systems of measurement would help

to evaluate the extent that environmental subsidies might affect international competitiveness and patterns of international trade. At present, procedures for monitoring environmental subsidies are poor, and there is a lack of data on how much assistance governments are actually extending to the farm sector for environmental purposes.

REFERENCES

- Anderson, K. and A. Strutt (1994), 'On Measuring the Environmental Impacts of Agricultural Trade Liberalization', Seminar Paper 94-06 (Australia: Centre for International Economic Studies, University of Adelaide, July).
- Baldock, D. and G. Bennett (1991), *Agriculture and the Polluter-Pays Principle* (London: Institute for European Environmental Policy).
- Baldock, D., G. Beaufoy, G. Bennett and J. Clark (1993), *Nature Conservation and New Directions in the Common Agricultural Policy* (London: Institute for European Environmental Policy), 155.
- Braden, J. and K. Segerson (1993), 'Information Problems in the Design of Nonpoint Source Pollution Policy', in C. Russell and J. Shogren (eds.), *Theory, Modelling and Experience in the Management of Nonpoint-Source Pollution* (Kluwer Academic Publishers), 1–36.
- Commission of the European Community (1975a), 'Communication from the Commission to the Council Regarding Cost Allocation and Action by Public Authorities on Environmental Matters. Principles and Modalities', *Official Journal of the European Community*, L 194/2-4 (25 July).
- Commission of the European Community (1975b), 'On the Assignment of Costs and the Imposition of Public Policies in the Area of the Environment', Council Recommendation 75/436 (3 March).
- Commission of the European Community (1987), 'Single European Act', *Official Journal of the European Community*, L 169/1-29 (26 June).
- Commission of the European Community (1988), *Environment and Agriculture*, COM(88)338 final.
- Commission of the European Community (1992a), 'Commission Decisions of 11 March 1992 Concerning Aid Envisaged by the Netherlands Government in Favour of an Environmentally-sound Disposal of Manure', *Official Journal of the European Communities*, L 170/34-39 (25 June).
- Commission of the European Community (1992b), 'Agricultural Production Methods Compatible with the Requirement of the Protection of the Environment and the Maintenance of the Countryside', *Official Journal of the European Community*, L 215/85 (30 July).
- Commission of the European Community (1994), 'Community Guidelines on State Aid for Environmental Protection', *Official Journal of the European Communities*, C 72/3-9 (10 March).
- Easter, W. (1993), 'Differences in the Transaction Costs of Strategies to Control Agricultural Offsite and Undersite Damages', in C. Russell and J. Shogren (eds.), *Theory, Modelling and Experience in the Management of Nonpoint-Source Pollution* (Kluwer Academic Publishers), 37–68.
- Food and Agriculture Organization (1994), *Trade Yearbook* (Rome: United Nations).
- GATT Trade Negotiations Committee (1993), 'Final Act Embodying the Results of the Uruguay Round of Multilateral Trade Negotiations', Document MTN/FA (Geneva, 15 December).
- Kalt, J. (1985), *The Impact of Domestic Environmental Regulatory Policies on US International Competitiveness* (Energy and Environmental Policy Center, Discussion Paper Series, John F. Kennedy School of Government, Harvard University).
- Knutson, R., C. Taylor, J. Penson and E. Smith (1990), 'Economic Impacts of Reduced Chemical

- Use', *Choices* (Fourth Quarter), 27–31.
- Leonard, H. (1988), *Pollution and the Struggle for World Product* (Cambridge: Cambridge University Press).
- Netherlands Central Bureau of Statistics (1993), *Environmental Statistics of the Netherlands* (The Hague, Netherlands).
- Netherlands Ministry of Housing, Spatial Planning and the Environment (1994), *The Netherlands Environmental Programme, 1994–1997* (The Hague, Netherlands).
- OECD (1972), Recommendation on Guiding Principles Concerning International Economic Aspects of Environmental Policies, C(72)128 (Paris: OECD).
- OECD (1974a), Recommendation on the Implementation of the Polluter-Pays Principle, C(74)223 (Paris: OECD).
- OECD (1989), *Agricultural and Environmental Policies: Opportunities for Integration* (Paris: OECD).
- OECD (1990), *Financial Assistance Systems for Pollution Prevention and Control in OECD Countries*, Environment Directorate, Monograph No. 33 (Paris: OECD).
- OECD (1991), Recommendation on the Use of Economic Instruments in Environmental Policy, in OECD, *Environmental Policy: How to Apply Economic Instruments* (Paris: OECD), 111–115.
- OECD (1992a), *The Polluter-Pays Principle*, Environment Directorate, Monograph No. GD(92)81 (Paris: OECD).
- OECD (1992b), *National Accounts, Detailed Tables, Volume II, 1978–1990* (Paris: OECD).
- OECD (1993a), *Environmental Taxes in OECD Countries: A Survey*, Environment Directorate, Monograph No. 71 (Paris: OECD).
- OECD (1993b), *Agricultural Policies, Markets and Trade: Monitoring and Outlook* (Paris: OECD), 183.
- OECD (1993c), *Pollution Abatement and Control Expenditure in OECD Countries*, Environment Directorate, Monograph No. 75 (Paris: OECD).
- OECD (1994), *Environmental Policies and Industrial Competitiveness* (Paris: OECD).
- OECD (1995), *Economic Accounts for Agriculture* (Paris: OECD).
- Ribaud, M. (1989), *Water Quality Benefits from the Conservation Reserve Program*, Agricultural Economic Report No. 606 (Washington, DC: Economic Research Service, United States Department of Agriculture).
- Russell, C. and J. Shogren (eds.) (1993), *Theory, Modelling and Experience in the Management of Nonpoint-Source Pollution* (Kluwer Academic Publishers).
- Smets, H. (1993), 'Le Principe Pollueur Payeur: Un Principe Economique Erigé en Principe de Droit de l'Environnement?' *Revue Générale de Droit International Public*, Numéro 2 (Avril–Juin), 339–364.
- Smets, H. (1994a), 'The Polluter-Pays Principle in the Early Nineties', in L. Campiglio et al. (eds.), *The Environment After Rio: International Law and Economics* (UK: Graham and Trotman), 131–147.
- Smets, H. (1994b), 'Les Exceptions Admises au Principe Pollueur Payeur', *Revue Droit et Pratique du Commerce International*, 20, 211–237.
- Smith, K. (1992), 'Environmental Costing for Agriculture: Will it be Standard Fare in the Farm Bill of 2000?' *American Journal of Agricultural Economics*, 74, 1076–1088.
- Stevens, C. (1994), 'Interpreting the Polluter-Pays Principle in the Trade and Environment Context', *Cornell International Law Journal* (forthcoming).
- Tobey, J. (1990), 'The Effects of Domestic Environmental Policies on Patterns of World Trade: An Empirical Test', *Kyklos*, 43, 191–209.
- Tobey, J. (1991), 'The Effects of Environmental Policy Towards Agriculture on Trade', *Food Policy* (April), 90–94.
- United States Department of Agriculture (1990), *The Conservation Reserve Program: An Economic Assessment*, Agricultural Economics Report No. 623 (Washington, DC: Economic Research Service).
- United States Department of Agriculture (1993), *Agricultural Resources, Situation and Outlook Report*, AR-30 (Washington, DC: Economic Research Service, May).

United States Environmental Protection Agency (1990), *Environmental Investments: The Cost of a Clean Environment*, EPA 230-12-90-084 (Washington, DC, December).

United States Environmental Protection Agency (1994), *National Water Quality Inventory: 1992 Report to Congress* (Washington, DC).