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**PRODUCTION EFFECTS OF AGRI-ENVIRONMENTAL POLICY  
MEASURES: RECONCILING TRADE AND ENVIRONMENTAL OBJECTIVES**

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RECONCILING TRADE AND ENVIRONMENTAL OBJECTIVES**

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## **Foreword**

This study discusses linkages between agri-environmental policies and trade with a view to inform the policy debates on the impacts of agri-environmental standards on farm competitiveness and the effects of agri-environmental programmes and payments on international agricultural trade. The issues involved are closely related, as the first debate is primarily concerned with policy measures that aim to reduce environmental pollution from farming activities, while the second centres around remuneration payments to farmers for the provision of agri-environmental services. The discussion in the paper is based on economic welfare analysis that is complemented by issue-specific conceptual and empirical investigations.

The analysis has been undertaken by the Joint Working Party of the Agricultural Committee and the Environment Policy Committee. It was carried out in the Policies and Environment Division of the Directorate for Food, Agriculture and Fisheries under the general supervision of Wilfrid Legg. While the study was prepared as part of the collaborative process in the OECD, the principal author of the report was Peter Walkenhorst.

The Secretary-General has agreed to declassify this document under his responsibility.

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**PRODUCTION EFFECTS OF AGRI-ENVIRONMENTAL POLICIES:  
RECONCILING TRADE AND ENVIRONMENTAL OBJECTIVES**

**1. Introduction**

In addition to generating commodity outputs, agricultural production activities affect water, air, and soil quality, influence eco-systems and biodiversity, and shape rural landscapes. Many of these environmental effects exhibit the characteristics of negative or positive externalities or public goods, for which private markets do not exist or are poorly functioning. OECD countries implement a variety of agri-environmental policy measures with the aim of addressing the environmental effects associated with agricultural production.<sup>1</sup> Policy measures include regulations and taxes to contain or prevent environmental harm, information and training programmes to promote environmentally friendly farming practices, and payments that remunerate farmers for environmental services they provide. Over the past 10-15 years, the scope and complexity of agri-environmental policies has increased, not least because of growing concerns of society for the state of the environment.

In parallel to the rising importance of agri-environmental considerations, agricultural trade policy reforms, in particular through policy changes following the Uruguay Round Agreement on Agriculture, have gradually opened domestic agricultural markets to international competition. Trade barriers, export subsidies, and domestic support have been bound and are being scaled down. In this context of greater international interdependence, there are two related policy debates on the possible impact of environmental standards, programmes, and payments on agricultural production and trade. The first is concerned with the impact of differences of agri-environmental regulations among countries on agricultural production costs and farm competitiveness (Box 1.1), and the second with the issue whether and to what extent domestic agri-environmental policies influence international trade (Box 1.2). The two policy debates do not have the same prominence in all OECD countries, and in some countries the underlying issues are seen to be of no relevance at all. Yet, the discussions have the potential to influence negotiations on agricultural trade and the environment at the international level.

Both debates centre on the question of how agri-environmental regulations in combination with freer agricultural trade affect societal welfare at the national and international level. The two underlying policy issues are indeed complementary in the sense that the discussion about farm competitiveness is mainly concerned with the effects of measures to internalise *negative externalities* from agriculture on farmers' production costs and welfare, while the debate on trade effects focuses largely on the impacts that payments for the internalisation of *positive externalities* or the provision of *public goods* have on world market prices and welfare of producers and consumers in other countries.

Earlier work in the JWP reasoned that current agri-environmental policies did not greatly affect trade, but that impacts could be aggravated in the future (Ervin, 1997). For example, increasing reliance on regulations to restrict contamination of surface- and groundwater through agro-chemicals might increase farming costs, reduce domestic production, and increase imports (or reduce exports). On the other hand, the further development of minimum standards for products and production processes to safeguard against

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1 . In this document, agri-environmental policy measures are taken to be all environmental policies that affect agricultural producers, even though some of them might not be directed specifically towards agriculture.

damage to the environment or human health or the introduction of new agri-environmental programmes to remunerate farmers for environmental outputs that are jointly produced with agricultural commodities could affect trade by reducing imports or increasing exports.

This paper aims to examine several related questions: What are the effects of agri-environmental policy measures on agricultural trade? To what extent do agri-environmental regulations influence farming costs and international competitiveness? Would an international harmonisation of agri-environmental policies increase welfare? Which characteristics might policy measures have to possess in order to be considered minimally trade distorting?

Section 2 provides a brief discussion of the welfare economics relating to agricultural trade and the environment. In Section 3, the impact of agri-environmental regulations on farm competitiveness is discussed both in a conceptual and empirical context, and the benefits and drawbacks of a potential international harmonisation of agri-environmental standards are evaluated. Next, Section 4 develops guidelines for policies that are least trade distorting. Finally, Section 5 summarises the main results of the study.

**Box 1.1. The policy debate on competitiveness**

In the debate on competitiveness, one line of argument has been that the adoption of strict environmental standards in a country leaves domestic producers at a competitive disadvantage compared to foreign suppliers by putting restrictions on production methods and increasing the costs of production inputs. Higher production costs (that are not offset through compensation payments) could translate into lost sales, reduced profits, and scaled-down investments, and might eventually trigger a shift of production to countries with less strict environmental standards. According to some analysts, the differences in the stringency of environmental regulations may indeed induce an environmentally destructive “race-to-the-bottom” in the regulatory system (for overviews of the discussion see: Wilson, 1996; Esty/Geradin, 1998). Governments in countries with relatively high environmental standards might come under pressure to deregulate and lower their standards in order to preserve or enhance the existing base of production and employment. Moreover, public authorities might refrain from raising environmental standards, because they are concerned about losing established industries, even though the relocation-threat might only be hypothetical (Perrez, 1998). Under these circumstances, policies would converge towards a situation where only a minimum of protection for the environment would be provided. To counter such developments, some observers have argued for trade restrictions or an international harmonisation of environmental standards in order to “level the playing field” and preserve the quality of the environment.

Critics of the race-to-the-bottom theory have instead pointed to the benefits of regulatory variety (Bhagwati, 1996). Differences in regulatory approaches are needed, it is argued, to reflect the diversity of natural conditions in different countries, as well as differences in societies’ preferences for commodity and environmental outputs. Indeed, such differences are seen as being among the most important sources of benefits from trade between countries. Specialisation according to comparative advantage will tend to favour the production of goods that are intensive in their use of environmental resources in countries which are relatively rich in these resources or whose population values other goods more highly than environmental benefits and amenities. Conversely, countries which are relatively less abundant in environmental resources or whose citizens place a high value on environmental protection and hence support strict environmental regulations will tend to specialise in the production of goods and services that place less of a burden on the environment. Trade between countries then presents a means to organise production in a way that goods and services are provided at the lowest possible opportunity costs in terms of agricultural production factors and environmental quality. In this context, a harmonisation of agri-environmental standards across countries that is not based on a convergence of economic conditions and societal preferences would not be desirable.

A third group of analysts sees differences in environmental regulations across countries as allowing for a “push-to-the-top”, if consumers are able to distinguish between products from high-and low-standard countries (Kirton/Rugman, 1998). Freer trade might allow countries with low environmental standards to export their products to countries with higher standards. But consumers in the latter might only buy the imports if the foreign producers show that they satisfy certain minimum standards of environmental protection (“eco-labelling”). This provides direct incentives for the exporters to upgrade their environmental performance, raises the consciousness about environmental issues in low-standard countries, and could trigger the establishment of new institutions for monitoring environmental protection, as well as the implementation of tighter environmental regulations.

### **Box 1.2. The policy debate on trade impacts from agri-environmental policy measures**

Some commentators in the debate have argued that governments need to use policy measures to internalise agri-environmental externalities and encourage the provision of public goods associated with agricultural production, as efficiently functioning markets do not exist for many of these outputs. In countries with high agricultural production costs, the profitability of commodity sales might not be sufficient to maintain agricultural production at levels that ensure the desired supply of positive externalities and public goods from agriculture, so that governments would have to provide financial incentives to foster the generation of agri-environmental outputs and eliminate any “under-supply” of agri-environmental services (Lindland, 1998). These agri-environmental policies might have effects on agricultural production and trade, in cases where environmental and commodity outputs are produced jointly. But it is argued that as trade and environmental policy objectives have the same legitimacy, the international discussion on linkages and trade-offs between the two objectives should not be dominated by the notion to minimise impacts on agricultural trade, but also give equal consideration to the environmental dimension.

Another group sees the danger that some agri-environmental policy measures, in particular if they take the form of market price support and production-linked budgetary payments to farmers, are merely disguised forms of protection. Society’s demand for agri-environmental outputs is difficult to determine, so that there is considerable uncertainty about the appropriate agri-environmental policy measures, with the possibility that governments encourage an “over-supply” of agri-environmental services. Also, where commodity and environmental outputs are separable from each other, farmers might not be the group best placed to provide the environmental outputs society wants. In this context of ambiguity over society’s demand for agri-environmental outputs and over the jointness of agricultural and environmental outputs, transparent policy measures have the potential to ensure that agri-environmental payments are appropriately linked to environmental requirements, and to avoid their use as a means to support farm incomes and maintain commodity outputs beyond the levels that should result from international reduction-commitments for agricultural tariffs, export subsidies, and production-linked budgetary support. Higher domestic production levels would reduce imports (or increase exports) and depress world market prices with adverse effects on agricultural producers in other countries, including those that have a comparative advantage in agricultural production. It is argued that such adverse impacts on agricultural trade should be minimised by pursuing domestic agri-environmental objectives through policies that are as far as possible decoupled from commodity production and clearly targeted towards the environmental outcomes (ABARE, 1999).

## **2. Trade effects from agri-environmental policies**

Governments pursue a variety of economic policy objectives, which can be broadly grouped into efforts to promote efficiency (and economic growth), equity, stability, and sustainability. These objectives can be mutually reinforcing, such that measures to correct a policy or market failure, for example, contribute also to a more equitable income distribution, increased economic stability, and more sustainable development. But often there are trade-offs to be made such that an improvement in economic efficiency could lead to adverse distributional impacts, more pronounced fluctuations in economic activity, or adverse long-term effects on physical, natural, and social resources. Trade-offs can also exist between policy objectives relating to trade and the environment, which are the focus of this study. For example, possible gains in environmental quality due to stricter standards will have to be weighted against losses in incomes as a result of higher production costs for domestic producers and loss of international market share.



Governments that aim to maximise the welfare of citizens in their own countries do not necessarily give similar consideration to the welfare of people beyond their borders. Such conduct does not create any problems in as far as the effects of policies are confined to individual countries. However, where policies have transboundary impacts, for example by influencing international trade flows, welfare maximisation in one country might conflict with the wellbeing of people in other countries and indeed reduce global welfare. Whether this is indeed the case or whether objectives concerning domestic and global welfare maximisation are non-conflictual is an empirical question.

National governments have long recognised this interdependence and have pledged to take the transnational impacts into account when designing domestic policy measures. For example, Principle 12 of the Rio Declaration provides that "...Trade policy measures for environmental purposes should not constitute a means of arbitrary or unjustifiable discrimination or a disguised restriction on international trade..." and Principle 16 states that "National authorities should endeavour to promote the internalisation of environmental costs and the use of economic instruments, 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."<sup>2</sup>

There is no international agency to pursue global welfare maximisation, but co-ordinated policy making by national authorities that takes the international repercussions of national policies into account could in principle promote similar outcomes. Governments would have an incentive to refrain from implementing policies that would increase national but reduce global welfare, if other countries' governments are committed to do likewise. However, it is difficult to monitor and enforce countries' pledges for international co-operation on a global scale. International agreements, such as the Uruguay Round Agreement on trade in agricultural products, the Kyoto Protocol on greenhouse gas emissions, and the United Nations Convention on Biological Diversity, can mitigate these implementation problems by defining individual country's commitments more precisely, establishing rules-based approaches for assessment based on country circumstances and the nature of the transboundary issues, and creating institutions that facilitate information exchange and dispute resolution.

## **2.1 *Global welfare maximisation***

The paradigm of global welfare maximisation, which comprises financial, environmental, and social elements of human well-being and sustainable development, can be helpful for analysing policy issues at the interface of environmental quality and international trade.<sup>3</sup> Many agri-environmental policies will have effects on agricultural production and trade.<sup>4</sup> These effects can be direct, if a policy measure

2. Corresponding pledges have been made with respect to domestic policy impacts on the global commons and environmental quality in other countries. For example, Principle 2 of the Rio Declaration proclaims that "States have, ..., the sovereign right to exploit their own resources pursuant to their own environmental and developmental policies, and the responsibility to ensure that activities within their jurisdiction or control do not cause damage to the environment of other States or of areas beyond the limits of national jurisdiction."
3. The concept of global welfare maximisation allows the offsetting of welfare losses in some countries by welfare gains in others. Yet, as policies that improve global resource allocation have positive-sum outcomes, it would in principle be possible for countries that are net-beneficiaries to compensate those that are net-losers, and thereby make all countries equally well or better off as in the situation before the policy change (potential "Pareto optimum"). The necessary welfare transfers between countries, however, could often be difficult to implement on a global scale.
4. Similarly, agricultural trade policies will have effects on the environment, and further agricultural trade liberalisation might have to be accompanied by environmental policies to safeguard against potentially adverse impacts on the environment. See OECD (2000a) for a detailed discussion.

influences farmers' revenues or costs, or indirect, if policies impact on farmers' wealth, liquidity, or income risk and thereby affect his production and investment decisions (OECD, 2000a). The extent of the production response will depend on whether there is jointness between agricultural and environmental outputs and its degree, as well as the particular incentives or disincentives that the policy measures provide.

Domestic agri-environmental policies can enhance global welfare, if the benefits from increases in environmental quality due to the internalisation of negative and positive environmental externalities or provision of public goods are accompanied by benefits from a more efficient international specialisation of production or more than outweigh welfare losses that result from higher international production costs or less efficient production patterns. On the other hand, agri-environmental policies could have adverse production and trade effects, in cases where the domestic and international welfare losses from the diversion of trade flows exceed the benefits from higher environmental quality. Hence, global welfare is reduced.

Welfare is intrinsically difficult to quantify and aggregate across countries. But some general principles can be derived through economic analysis that might help to establish under which conditions the trade effects of agri-environmental measures are likely to have a beneficial or adverse impact on the international economic system. Developing these principles requires defining the point of reference for welfare comparisons, establishing distinctions between, independently and jointly produced agricultural and environmental outputs, and differentiating between national production and international trade effects of agri-environmental policies.

## 2.2 *Reference points for welfare comparisons*

Policies can be evaluated as to whether they enhance human welfare compared to the *status quo* policy-mix, or contribute to reaching the state of highest possible welfare, i.e. the "first-best" optimum (Box 1.3). The assessment using either of these two points of reference will in many cases lead to the same results. But as some market or policy failures might not be appropriately addressed in the *status quo* situation, so that decision makers act in a "second-best" context, the evaluation of policy measures can result in a different outcome from the one that would be obtained when using a "first-best" policy optimum as the point of reference (Lipse and Lancaster, 1956).

### **Box 1.3. Alternative definitions of the concept "trade distortion"**

Although frequently used in policy discussions, no generally accepted definition of *trade distortion* exists. There are a number of alternative sets of characteristics associated with the term, and alternative concepts differ, for example, according to whether they are based on national or international welfare considerations, or whether they use "first-best" or "second-best" situations as the "benchmark" for evaluation. A reference point based on a hypothetical "first-best" situation would have the advantage of allowing the consideration of both positive and negative environmental effects of existing policies, including trade and farm income support policies. But welfare comparisons based on "first-best" situation benchmarks are in practice difficult to undertake, so that comparisons with the *status-quo* (the "second-best") might turn out to be a more pragmatic method.

There is no agreement about which definition of the term *trade distortion* is the most appropriate for evaluating trade-offs between trade and environmental objectives, but it is important that those involved in the policy debate are aware of the differences between alternative characterisations and approaches. The main requirement is that the underlying assumptions should be transparent in order to allow for a constructive debate.

For example, in the context of high tariffs on grain imports that increase domestic price levels and generate additional market revenues for farmers but also provide incentives to produce more input-intensively, a fertiliser tax to reduce nutrient use and associated leaching into the surface or groundwater might be assessed as being welfare enhancing for the country concerned. The same fertiliser tax, however, might turn out to be welfare reducing for that country, if evaluated against a background of “first-best” trade and income policies. Moreover, although the tax might be welfare-enhancing in the “second-best” situation, it could make it subsequently politically more difficult to reach the “first-best” outcome, as there would now be two policy instruments in place (the tariff and the fertiliser tax) that would have to be reformed as a policy-package in order to reach the overall optimum.

### **2.3 *Jointness of agricultural and environmental outputs***

The jointness of many commodity and positive and negative environmental outputs from agricultural activities is central to the issue of trade effects from agri-environmental policies. If the commodity and environmental outputs can be provided independently from each other, the standard policy approach would be to let market demand and supply determine the output of private goods, and to use targeted and decoupled policy measures to ensure the supply of environmental outputs by farmers and non-agricultural producers according to societal preferences. This approach is the predominant policy practice in some OECD countries. Agri-environmental policies then have merely *indirect* effects on the production of agricultural products, through their impact on wealth, liquidity, and income risk. Such indirect influences of policies, which would, of course, not only result from agri-environmental but also from other economic and social policy measures, seem difficult to avoid entirely.

In the case of jointness, i.e. if technical interdependencies or shared production factors make it impossible to separate the commodity from the positive or negative environmental outputs, the impact of agri-environmental policies on agricultural markets is more profound. Policies aimed at influencing the level or composition of environmental outputs will *directly* affect the level of commodity production. The extent of the production response will depend on the degree of jointness. In cases where producers are able to switch to a different production system and adjust the mix of commodity and environmental outputs according to new combinations of market and non-market incentives, the production impact will be less pronounced than in cases of technically fixed output-proportions. Detailed analysis of the potential jointness of commodity and positive and negative environmental outputs has been carried out in connection with the work on multifunctionality and sustainability of agriculture (see OECD, 2001c, 2001f, 2001a).

Jointness of commodity and positive and negative environmental outputs does not necessarily imply market failure. For example, in a case of fixed proportions between a commodity and a positive environmental output, some level of the environmental good or service will be provided with the commodity production of low-cost farmers, even without any policy intervention. If this level of environmental output satisfies society’s demand, there is no inefficiency in resource allocation and hence no market failure (OECD, 2001c).

### **2.4 *International transmission of national production effects***

Agri-environmental policies will only influence the wellbeing of people in other countries, if they have transboundary impacts. A domestic production effect from agri-environmental measures will not translate into a direct trade impact, if the particular agricultural products, such as some speciality meats (e.g. kangaroo, frogs’ legs, dog meat), are only produced and consumed locally. In these cases, the only

impact on other countries would be through indirect effects, including those occurring through markets for product substitutes or complements.

Moreover, in many cases agri-environmental programmes use a combination of measures to improve environmental quality, while trying to contain the impact on production. For example, a programme might provide payments to farmers in order for them to maintain agricultural activities and associated landscape benefits in marginal production areas, but at the same time impose constraints on the use of pesticides or livestock densities that reduce the risk of surface and groundwater pollution and mitigate, offset, or reverse the incentive to increase agricultural output. The payment and the constraint will individually have a production and trade impact, but as these effects work in opposite directions, the combination of the two measures can result in an outcome that is largely production and trade neutral.<sup>5</sup> Hence, in order to fully capture the trade effect of complex policy programmes, the production and trade impacts of measures that are implemented jointly have to be assessed for the entire bundle, rather than for the individual measures.

Most *individual* policy measures to address agri-environmental issues have effects on international trade. In contrast, the environmental effects of most agri-environmental policies will be locally or regionally confined, so that there is generally an asymmetry between the geographical scope of environmental and production/trade effects. This asymmetry between domestic benefits in terms of environmental quality and international costs in the form of reduced production efficiency can lead national governments that primarily aim for domestic welfare maximisation to “overpursue” agri-environmental policies, for example by fostering the provision of domestic agri-environmental services, while tolerating adverse impacts on international trade partners. This risk does not exist and is in some sense reversed where the environmental impacts related to agricultural production are transboundary, such as with respect to greenhouse gas emissions, biodiversity preservation, or nutrient and pesticide pollution of rivers that flow across borders. In these cases, the environmental *benefits* of domestic policies are shared among citizens of different countries, while the *costs* of achieving the environmental improvement will largely fall on producers, consumers, and taxpayers in the country that pursues the environmental policy, although producers and consumers in other countries might to some extent also be affected through changes in trade flows. Hence, governments have an incentive to “underpursue” policies that address transboundary environmental effects, unless multilateral agreements on joint policy efforts are reached and implemented.

In addition to physical linkages (*via* agricultural and environmental outputs) between domestic and international spheres, there can be non-physical international impacts from changes in domestic environmental quality *via* option values. People sometimes attach values to environmental preservation in places distant from their home, even if they do not directly experience those outcomes. Such option values are rooted in general preferences and ethical attitudes that consider the global protection of valuable biodiversity, habitats, or landscapes as preserving the natural heritage of mankind. As in the case of transboundary environmental effects that are of a physical nature, multilateral environmental agreements might be the most appropriate channel to address those international concerns, in particular where they concern irreversible changes in environmental quality.

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5. If there are other policies, including potentially trade-distorting ones, in place, the production constraint associated with the agri-environmental policy would not ensure trade-neutrality (compared to a first-best situation).

## 2.5 *Possibility of policy failure*

The existence of negative and positive externalities and the under-provision of public goods may provide a rationale for corrective action by governments. However, when governments intervene in a market to correct a market failure, there is a risk that the intervention fails and results in welfare losses even compared to the situation in which the market failure is not addressed. Such government failure could be caused by an agency's lack of information and analysis to design an appropriate intervention, or by deliberate action aimed at rewarding particular groups for their political support, even though the intervention might be costly for the community at large (Anderson, 1998).

Moreover, whether a possible market failure justifies policy intervention is a question that depends also on the magnitude of welfare losses from an economic, social, and environmental perspective. There are numerous negative and positive externalities that are considered of minor importance and on which governments do not take action. Indeed, addressing minor market failures might carry a substantial risk of policy failure, as programmes would be relatively costly to administer and lead to the possibility of rent-seeking by special interest groups.

## 3. **Agri-environmental policies, agricultural competitiveness, and harmonisation of standards**

The earlier discussion showed that the overall welfare impact of agri-environmental standards on farmers' production costs relative to those of their competitors in other countries depend on whether and to which degree there is jointness between agricultural and environmental outputs, whether there are effects from agri-environmental measures on international trade, and whether there is policy failure. Yet, in order to derive operational policy recommendations, further conceptual and empirical investigation on the linkages between agri-environmental policies and farm competitiveness, and the magnitude of the effects seems necessary.

### 3.1 *Conceptual and empirical issues regarding farm competitiveness*

The term "competitiveness" is often used loosely, without providing a clear definition, and some analysts have dismissed the concept altogether because of lack of a sound foundation in economic theory (Krugman, 1994). Nevertheless, the term is frequently used in the policy debate and has thereby acquired a certain legitimacy. One definition provided by the United States' Competitiveness Policy Council (1992) takes competitiveness as the ability of a nation's producers to meet the demands of the international marketplace while ensuring that its citizens have a sustainable standard of living that rises in the long run.

There are two different types of environmental standards that affect farmer's production costs. *Product* standards describe the characteristics of a product, such as its physical and chemical properties or its packaging and presentation. They are often aimed at protecting consumers' health, but can also concern environmental issues. In contrast, *process* standards, which often aim to protect the environment (as well as animal welfare, and producers' health), regulate the way a product is made.

The adoption of particular *product* standards will not necessarily affect the competitive position of domestic farmers, as foreign producers would have similarly to meet the required standard if they wanted to supply the domestic market. Some foreign suppliers might indeed not be able to continue exporting to the high-standard country, should the standards turn out to be too costly to meet. This might in particular happen if standards are set in line with current domestic practices and differ considerably across countries. In some such cases, environmental product standards could turn into technical barriers of trade. The WTO's Sanitary and Phytosanitary Agreement, which was part of the outcome of the Uruguay Round trade negotiations, allows governments to restrict trade in order to protect human, animal, and plant

health. However, the trade restrictions have to be transparent, consistent, based on international standards or scientific risk assessment, ensure equal treatment between all imports and domestic products, and be least trade distorting.

In general, it is differences in *process* standards, which often represent differing natural conditions and societal preferences, that are at the core of competitiveness concerns. Farmers in countries applying strict environmental (or animal welfare) process requirements will tend to incur higher marginal and total production costs than in countries where standards are less stringent. Other things being equal, these higher costs might compromise their ability to compete with foreign suppliers in both domestic and international markets.<sup>6</sup> However, in the longer term the increased pressure on farmers could in some cases stimulate adjustments in production methods and structures that lead to higher productivity and thereby counteract the initial impact of regulation induced cost increases on farm profits and competitiveness.

Where strict regulations of farming practices, such as limits on the use of certain pesticides or ceilings on livestock densities, impose costs on farmers, the impact on agricultural production and trade will depend on the *incidence* of these compliance costs, i.e. the question which proportion of regulatory costs that are borne by farmers *versus* those borne by other economic agents. For example, if a country is a major producer and exporter of a commodity, domestic commodity producers might be able to pass regulation-induced cost increases partly on to consumers in the form of higher prices (Bohman/Lindsey, 1997). Moreover, in some cases the adoption of stricter environmental standards could allow the opening up of new markets, if consumers can distinguish between products by production method, for example through labels, and are willing to pay price-premiums for high-standard produce (e.g. organic foods).

Another aspect of competitiveness concerns the *relative importance* of agri-environmental compliance costs. Differences between countries in agricultural support levels and non-environmental regulation, including those concerning taxes, public services, or transport, also affect agricultural production and trade. So, while farmers in a particular country might face relatively high production costs due to stringent agri-environmental regulations, they might at the same time benefit more than their competitors in other countries from producer support, tax concession, additional public services, or better infrastructure. Hence, a competitive disadvantage with respect to environmental standards might be partly or entirely offset through advantages from other policy measures. On the other hand, there is also the possibility that competitive disadvantages to domestic producers from strict agri-environmental regulation might be reinforced by relative disadvantages in other policy areas.

### 3.2 *Quantifying the impact of environmental regulations on agricultural production costs*

A majority of studies of pollution abatement costs in industrial sectors have found that these costs tend to be relatively low and influence the competitiveness of producers only to a limited extent (Tobey, 1990; Low, 1992; Jaffe *et al.*, 1995; Levinson, 1996). With respect to agriculture, there are a limited number of studies that have evaluated the impact of agri-environmental policies on farming costs. These cross-country comparisons are generally undertaken in the context of the *status-quo* of existing agricultural, agri-environmental, and other policies. The results of the investigations show that the impact of environmental regulations on agricultural production costs have been modest relative to the differences in production costs across countries (Gardner, 1996, Vallaru/Peterson, 1997). These results are overall confirmed by three recent studies, which are summarised below.

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6. Differences in process standards do not necessarily imply corresponding differences in environmental quality. Natural conditions, prevailing farming practices, and population densities vary considerably across countries, so that a certain outcome in terms of environmental quality can be achieved with different process standards.

Research by the *United Kingdom's* National Farmers' Union (Wilkinson, 1998) found that the vast majority of the 224 regulations aimed specifically at agriculture in the UK was intended to prevent or control crop and livestock diseases (55 per cent of all sector-specific regulations), to ensure food safety (26 per cent), to protect the environment (7 per cent), to enhance animal welfare (6 per cent), and to achieve other policy objectives (7 per cent), such as seed quality and integrity. More than 80 per cent of the regulations applied to livestock operations, while about a quarter concerned arable farming or horticulture (some regulations were relevant for both livestock and crops). Furthermore, the study estimated the impact of environmental regulations on farming costs, based on information from parliamentary compliance cost assessments. The results showed that individual regulations, such as the Crop Residues Burning Regulation or the EU Nitrate Directive, impose costs on affected farmers of 1.2 per cent (Crop Residues Burning) to 2 per cent (Nitrate Directive for dairy farmers) of their value of output. However, the impact was found to be much less pronounced at the national level, as not all farmers are affected to the same extent by particular regulations. For example, the Nitrate Directive restricts emissions of nitrates in designated nitrate vulnerable zones, but does not impose similar constraints on farming practices outside these zones. Hence, farmers in different regions are affected by the agri-environmental policy measure to a varying extent.

A study by Grote *et al.* (2000) analysed the impact of agri-environmental standards on the international competitiveness of farmers and agro-processors in *Germany* compared to competitors in Brazil and Indonesia during 1998/99. The investigation was based on production-level data collected by experts in the study-countries. The researchers found that in Germany, more stringent technical security and environmental standards than in Brazil and Indonesia added 0.3 to 4.4 per cent to the total production costs for typical rapeseed and grain producers. The typical German poultry producer faced 2.7 per cent higher production costs due to relatively more demanding environmental and animal welfare regulations. In the oilseed processing industry, environmental compliance costs amounted to 5 per cent of total production costs in Germany, 0.5 to 1 per cent in Brazil, and 0.4 to 1.1 per cent in Indonesia.

The cross-country differences in environmental compliance costs at the farm and processing level were found to be considerably smaller than the differences in total production costs, suggesting that other factors, including producer support, wage levels, land rents, and capital costs, are more important determinants of overall production costs and international competitiveness. Also, the study revealed that many of the cost-increasing environmental standards in Germany, for example with respect to building codes, are of little relevance in Brazil and Indonesia, because of differing climatic conditions and resource endowments. However, the results of Grote *et al.* should be interpreted with care, as their analysis was based on a relatively small sample of agricultural products and processing facilities.

A survey by Brouwer *et al.* (2000) compared a broad spectrum of environmental and human health-related issues associated with agricultural production in the *EU* with those in *Australia*, *Canada*, *New Zealand*, and the *United States*. The analysts found that the relatively large density of regulations and standards in the EU reflects environmental and human-health related problems that result in part from biophysical and agricultural conditions, such as the existence of important farming activities in close proximity to residential areas, the relatively input-intensive nature of the farming operations, and societal perceptions and choices concerning issues like animal welfare, genetically modified organisms, and farming technology.

Local and regional regulations were evident alongside national standards in the EU as well as the other countries, and voluntary, private sector-led approaches seem to be gaining in importance. In agricultural exporting countries, such as Australia and New Zealand, agri-environmental practices seem at times to have been adjusted to meet EU standards in order to maintain confidence by European consumers. The study reached only preliminary conclusions with respect to the effect of agri-environmental and health regulations on farming costs, drawing on country analysis that was seen as being not directly comparable.

It appeared that the costs of complying with environmental and health regulations were generally relatively small, although higher in livestock production than in crop farming.

### 3.3 *The potential for harmonisation of agri-environmental standards*

In light of the considerable diversity in environmental conditions and societal preferences and the results from the studies that agri-environmental standards impose additional costs on farmers by reducing the productivity of commodity production, but that these costs are generally small relative to overall production costs, it seems questionable whether a large-scale international harmonisation of agri-environmental standards would be necessary or even desirable.<sup>7</sup> Yet, there are several forms and degrees of harmonisation, and their effects on economic welfare could differ considerably.

*Procedural harmonisation* refers to the fostering of transparency and sound environmental management in order to achieve convergence around a core set of environmental practices and thereby mitigate competitiveness-related tensions between countries. It generally involves voluntary approaches. The concept comprises issues such as information exchange through international fora, system harmonisation with respect to environmental auditing and reporting, and eco-labelling, which allows consumers to distinguish products according to the way they were produced. Since these approaches would generally not involve regulations that would be uniformly enforced by public authorities, producers could refrain from participating in the harmonisation process if they feel that the costs of adjustment exceed the benefits of moving to a common practice.

While different forms of procedural harmonisation might contribute to raising environmental standards in a voluntary and indirect way, *substantive harmonisation* aims to either directly reduce cross-country differences in ambient or effluent standards or to alter the rules that govern production processes and methods (PPM). According to the first method of substantive harmonisation, governments in participating countries would agree to enact and enforce certain standards of environmental quality that all domestic producers have to comply with. In case of the second form, producers in different countries would face the same, or at least comparable, environmental regulation, so that concerns over competitiveness and “unfair” trade would not arise.

In the case where environmental effects of a regulation are not confined to a particular country, but are transboundary in nature (or concern transnational option values), a harmonisation of PPM-standards might indeed be necessary to safeguard against environmental degradation (Nordhaus, 1994). A higher standard in one country would tend to result in higher production costs and lower profits for domestic producers, but would improve environmental quality for the domestic population only to a limited extent, as the state of the environment is determined collectively by production output in several countries. Hence, a single country is not able to improve environmental quality significantly on its own, and indeed has an incentive to lower its standards with respect to international environmental aspects in order to benefit its producers, while shifting environmental costs to other countries. Multilateral co-operation, possibly in the form of an harmonisation of environmental standards agreed to in multilateral agreements, could be a policy option to overcome the resulting environmental problems and maintain or improve international environmental quality, although the distribution of benefits will tend to vary across countries (Escapa/Gutierrez, 1997).

For example, the Montreal Protocol provided for a harmonisation of the use of ozone-layer-depleting substances, including the insecticide methyl-bromide (United Nations, 1987). In particular,

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7. Small cost impacts can nevertheless have significant production and trade effects, if the demand for the respective inputs is very elastic (OECD, 1999).



governments reached agreement on a two-tiered production ban of all chlorofluorocarbons (CFCs). Developed countries are committed to phase out their production and consumption by 2005, while developing countries have until 2015 to stop producing and using CFCs. Other examples include the possible harmonisation of energy taxes to curb greenhouse gas emissions, or the harmonisation of pollution standards with respect to international waterways.

If the benefits of agri-environmental policies are regionally confined, there is a risk that substantive harmonisation of standards could prove welfare reducing. This risk varies with the diversity in socio-economic conditions and agri-environmental standards in the countries involved. In cases where a group of countries has similar agricultural production conditions, comparable public preferences for environmental quality, and only small differences in agri-environmental standards, moving to a harmonised system of standards might not create any major problems, but could indeed help to ease political tensions over competitiveness.

On the other hand, if the countries concerned are highly diverse, a harmonisation of agri-environmental standards might lead to substantial welfare losses. A single standard across countries does not allow governments to tailor agri-environmental policies to local needs, resource endowments, and preferences. Agri-environmental effects are often site-specific, and agricultural production methods and compliance costs can differ considerably across countries. Moreover, an agri-environmental issue that might be highly policy-relevant in one region or country, might be irrelevant in others. For example, in densely populated areas there might be strong demand for strict regulations on noxious odours from livestock operations, while no emission standards might be necessary if the livestock facilities were far removed from any residential area.

Hence, in cases where substantive harmonisation would require countries to raise their environmental standards considerably, the gain in environmental quality might not compensate for the loss of producer profits. Conversely, in countries where standards would be revised downwards, the loss in societal welfare from environmental outputs might exceed the gains accruing to producers. A multi-tiered approach to harmonisation, whereby the stringency of agri-environmental standards varies with respect to the countries' level of development or natural resource endowment might mitigate the welfare losses (Mendelsohn, 1986), but is in principle subject to the same problems.

#### **4. Characteristics of agri-environmental policies that are least trade-distorting**

The summary of respective studies in the preceding section suggests that agri-environmental standards, most of which are designed to address negative externalities associated with agricultural production, have only a modest impact on farm competitiveness, and that the resulting effects on international trade are unlikely to warrant substantive harmonisation of agri-environmental standards on a broad international scale. Payments to compensate farmers for the provision of environmental services or public goods are similarly only of relatively minor importance compared to overall transfers to the agricultural sector. The total support estimate (TSE) for OECD countries amounted to USD 383 billion in 1995 (and to USD 361 billion in 1999; OECD, 2000b). In comparison, total expenditure on policies notified by OECD countries for the WTO's "green box" amounted to USD 118 billion in 1995, of which about 5 per cent was due to agri-environmental programmes. This share of environmental expenditure in total "green box" expenditure has increased since the mid-1990s in several countries (OECD, 2001d), but still only accounts for a minor portion of overall "green box" expenditure. Nevertheless, developing guidelines for agri-environmental policies that are least trade-distorting seems to be warranted as they could also be of relevance for other "green box" policies.

The “green box” provisions in the Uruguay Round Agreement establish several eligibility criteria for policies that are non or at most minimally trade-distorting (Box 4.1). The Agreement does not provide a definition of the term “trade distortion”, but lists policy-specific conditions for different programme areas. A general condition that applies to agri-environmental and other policies in the “green box” is that policy measures should be financed through government programmes and not provide price support to producers. In the case of agri-environmental programmes, dependence on the fulfilment of specific conditions under a government programme and payment-limits based on compliance costs are the two specific eligibility conditions applied. These “green box” requirements are intended to allow those domestic policies that address “non-trade concerns”, while maintaining an operational, rules-based approach, based on the correct notification of domestic policies by governments. Yet, there are a number of unresolved or unclear issues (Vasavada/Warmerdam, 1998)). A key concern in policy analysis is to distinguish between agri-environmental measures that are shown to address market failures by internalising environmental externalities or ensuring the provision of public goods associated with agriculture, from policies that appear to be merely labelled to serve environmental purposes, while being used as means to support domestic farmers and protect them from international competition.

**Box 4.1. WTO “Green Box” specifications for agri-environmental measures**

The Uruguay Round Agreement (Article 6 in connection with Annex 2) exempted certain policies from commitments to reduce domestic support. These include certain direct payments under production-limiting programmes (“blue box”), domestic support that is of minimal importance relative to production value (“*de minimis* clause”), and policy measures with no or at most minimally trade-distorting effects (“green box”). There are two general conditions for policies to be eligible for the “green box” (Annex 2, paragraph 1), namely that they are financed from government budgets and do not support prices or increase consumer costs. In addition, eligible environmental programmes have to satisfy two specific conditions: “Eligibility for such payments shall be determined as part of a clearly-defined governmental environmental or conservation programme and be dependent on the fulfilment of specific conditions under the government programme, including conditions related to production methods or inputs (Annex 2, paragraph 12a);” and “The amount of payment shall be limited to the extra costs or loss of income involved in complying with the government programme (12b).”

According to the *due restraint* provisions of the Uruguay Round Agreement (Article 13), domestic policy measures in the “green box” can not be subject to countervailing duty action under the “Subsidies Agreement”, other subsidy actions under GATT and the “Subsidies Agreement”, and nullification or impairment actions under GATT. This “peace clause” expires at the end of 2003. For the time afterwards, the status of “green box” measures is unclear.

At the domestic level, agri-environmental objectives can generally be met through different policy approaches, with differing consequences for production and trade, government budgets, and farmers’ income. Some programmes have more pronounced effects on production and trade than others, and several authors have aimed to categorise policies according to their prospective impacts on international trade (Miner/Hathaway, 1988; IATRC, 1990; Rude, 2000a). Agri-environmental measures that are targeted directly to environmental outcomes and decoupled from commodity production have the potential to lead to best outcomes in terms of environmental and production impacts. But in cases where there might be jointness between agricultural and positive and/or negative environmental outputs it will be difficult to achieve complete production neutrality.

As discussed in section 2.4, production effects from agri-environmental policies, including those that involve compensation of farmers for compliance costs or remuneration for the provision of agri-environmental services, can be neutralised, if these policies are implemented in connection with binding constraints on production practices. In order to tailor the magnitude of potential compensation payments to

farmers' individual costs of supplying agri-environmental outputs, some analysts have recommended that governments organise regional auctions, in which farmers would bid for participation in agri-environmental programmes and thereby implicitly reveal information about their compliance costs (Latacz-Lohmann/van der Hamsvoort, 1997). High administrative and transaction costs might, however, inhibit the implementation of such schemes.

Another aspect of production neutrality is the question whether a farmer can anticipate the effects of an agri-environmental programme prior to making his production decision (Rude, 2000b). For example, in cases where agri-environmental payments are not associated with sufficiently binding production constraints, the anticipation of the programme's introduction can induce a farmer to change his production decisions in order to take maximum advantage of the economic and policy situation. In this case, the programme might not be entirely production-neutral.

One principle of welfare economics requires that only a policy that is not inferior compared to a feasible alternative in terms of both trade and environmental objectives can be efficient. In other words, if an agri-environmental objective can be met by a policy measure that has less of an effect on trade, then the first one is not efficient and its stronger impact on trade will tend to be trade-distorting. The "excessive" effect on trade could be avoided by implementing the alternative policy measure. For practical purposes, it would be important that any alternatives be empirically feasible, and not wholly hypothetical. Feasibility implies that these alternatives could be financed from the existing budget and be capable of execution. If particular policy alternatives are already implemented, a demonstration of feasibility and hypothetical judgements on their costs and effects could be avoided. Where such empirical experience with policies does not exist, evidence would need to be gathered showing that the alternatives are affordable and can be implemented in principle.

The "least trade-affecting" criterion (i.e. having the same environmental outcome, but with a smaller trade effect) is based on a minimisation of trade impacts. But this principle does not mean that trade objectives would be given preference over environmental considerations, as the minimisation of trade effects would be subject to fulfilling the environmental outcome requirements. So, while domestic agri-environmental objectives would be satisfied in any case, the measure with the least trade-effect among the feasible policy alternatives should be applied.

Allowing for policies with production-increasing impacts might require the verification of the legitimacy of claims that a policy is enhancing environmental quality and hence a quantification of the policy-related benefits and costs. Such analysis requires comprehensive knowledge of production processes and socio-political preferences, which is rarely available. In particular, it is often difficult to determine or verify the public demand for agri-environmental amenities or reductions in environmental impairments and to assign monetary values to changes in environmental quality, since for many agri-environmental outputs no well functioning markets exist. The development of rules and guidelines for policy evaluation still needs to be significantly advanced in order to become operational in a policy context.

Runge (1999) suggested to also take distributional considerations into account in order to capture that different environmental measures may impose different patterns of trade burdens (costs) in relation to their environmental advantages (benefits). For example, if an environmental measure restricts trade, but imposes more of a burden on foreign competitors than domestic producers, and alternatives exist in which the burden would be more equally shared, one may argue in favour of replacing the initially proposed or implemented measure with this alternative. Also, when environmental policies offer widespread benefits, and their costs are borne narrowly by affected parties (such as a sector or firm), it might be easier to target this group for direct compensation, whilst retaining the widespread advantages of environmental protection. However, decisions would likely have to be made on a case-by-case basis, and it might be

difficult in practice to find a general framework for judging the appropriateness of different distributions of costs and benefits, unless one policy measure is dominated by another in terms of distributional impacts.

Ervin (1999) has proposed a broad set of guidelines to “GATT-proof” agri-environmental measures in the form of a “Code of Good Process.” In addition to “least trade-affecting”, these principles include: (i) specifying clear environmental objectives for the programmes; (ii) clarifying property rights in environmental resources to establish the applicability of payments, charges, and subsidies; (iii) establishing scientific linkage between the environmental objective and the policy instrument; (iv) implementing monitoring and evaluation programmes to document policy/programme efficacy; (v) applying equal treatment for domestic products and imports; and (vi) ensuring the transparency of agri-environmental measures. These guidelines correspond to principles of good policy practice, but it seems not entirely clear how they could be implemented and verified in the WTO context.

## **5. Conclusions and policy implications**

This paper discussed linkages between agri-environmental policies and trade with a view to inform the policy debates on the impacts of agri-environmental standards on farm competitiveness and the effects of agri-environmental programmes and payments on international agricultural trade. The two debates are closely related, as the first one is primarily concerned with policy measures that aim to reduce environmental pollution from farming activities, while the second centres around remuneration payments to farmers for the provision of agri-environmental services. The discussion in the paper is based on general economic welfare analysis that is complemented by issue-specific conceptual and empirical investigations. A number of policy-relevant issues were addressed, as outlined below.

### *Effects of agri-environmental policy measures on agricultural trade*

Like many other policies, agri-environmental policies have direct and indirect effects on farmers’ production decisions. Indirect effects concern impacts not immediately related to commodity production, such as those on farmers’ wealth, liquidity, and income risk. Such indirect influences of policies can not be entirely avoided, even though the extent to which different parameters (wealth, liquidity, risk) are affected will vary across policy measures.

Direct effects are due to changes in farmers’ production costs or revenues that trigger adjustments in the level of commodity output. Such effects will tend to occur when agri-environmental policies are implemented to influence the level of environmental outputs, while the latter are produced jointly with commodity outputs. However, in many cases agri-environmental policies and payments are implemented in connection with particular constraints on farming practices that mitigate, offset, or reverse the production incentives provided through the agri-environmental policy. In fact, compliance with restrictions on farming practices might often result in reductions of agricultural output.

If any direct production incentive from agri-environmental policies is neutralised through production constraints, agricultural trade flows will not be affected by the policy. Similarly, if a product is not traded internationally, there is naturally no direct impact of changes in domestic production on international trade. Otherwise, production impacts from agri-environmental policies will affect the level of net-trade of the country that implements the policy and thereby influence the welfare of producers and consumers in other countries.

Not every effect from agri-environmental policies on trade will be distortive. A policy to internalise previously unaddressed externalities, for example, will increase environmental quality and possibly overall societal welfare. On the other hand, if there is policy failure, the production and trade

effects from agri-environmental policies can be welfare-reducing. It should be noted that a *trade effect* from an agri-environmental policy is necessary but not sufficient for a *trade distortion* to occur.

Some general results from economic policy analysis, as established in earlier work in the OECD (1994, 1998), can provide guidelines for agri-environmental policy design and reduce the risk of policy failure: Effective policies will need identifiable objectives and specify the associated costs, benefits, and beneficiaries. When addressing market inefficiencies, low-cost policy measures will tend to be the ones that target the particular concern directly and affect related markets to the least possible extent. If there are multiple policy objectives at stake, an equal number of policy instruments will typically be needed to deal efficiently with the issues. In some cases, policy targeting might be associated with high transactions costs, so that less direct instruments might have lower overall costs. Trade policy measures, however, are rarely efficient tools to address agri-environmental concerns, not least because they influence not only the incentive structure of producers, but also that of consumers. Any agri-environmental payments or charges should be tailored to farmers' compliance costs, allow for flexibility with respect to the diversity of agricultural situations, and take their distributional impact into account.

#### *Influence of agri-environmental regulations on farming costs and international competitiveness*

Agri-environmental regulations impose costs on farmers, and differences in process standards across countries are at the core of competitiveness concerns. However, the incidence of agri-environmental policies does not necessarily fall entirely on agricultural producers, because farmers might be able to pass parts of any cost increase due to stricter environmental regulation on to consumers, for example by establishing new markets for premium-priced, high-standard produce. Moreover, differences in agri-environmental standards will likely not be the only regulatory differences between countries. Disadvantages for domestic agricultural producers due to strict agri-environmental regulations might be mitigated or offset through advantages with respect to agricultural support, taxation, public services, or infrastructure. On the other hand, disadvantages for domestic producers from strict agri-environmental regulation could also be reinforced by relative disadvantages in other policy areas.

Evidence from a limited number of empirical studies suggests that the impact of agri-environmental standards on farming costs is relatively small, accounting generally for less than 5 per cent of total production costs. The cost-increases because of additional environmental compliance costs are thereby lower than the overall differences in agricultural production costs among countries, suggesting that other factors, including wage rates, land rents, and capital costs, are more important determinants of international competitiveness than differences in agri-environmental standards. Moreover, some standards that inflated production costs considerably in some sub-sectors (e.g. livestock production), regions, or countries were found to be of little relevance in others.

#### *Welfare implications of an international harmonisation of agri-environmental policies*

Given the considerable diversity of natural conditions and societal preferences and the relatively minor importance of agri-environmental standards for agricultural production costs, it seems questionable whether a global harmonisation of standards would be necessary and desirable. A substantive harmonisation of standards (i.e. the adoption of identical limits on effluents and effluents) that concern domestic environmental effects has the disadvantage that a single standard across countries does not allow governments to tailor agri-environmental policy to local needs, resource endowments, and preferences. Thus, harmonisation will tend to lead to a reduction in economic efficiency and societal welfare.

Yet, there are cases where an international harmonisation of agri-environmental standards could be beneficial. If harmonisation, for example concerning production and marketing procedures, occurs on a

voluntary, private-sector led basis, such as through information exchange, system harmonisation, or eco-labelling, the adoption of common standards would only proceed if producers see it as being beneficial for them. Also, substantive harmonisation could be desirable for a group of countries with similar agri-environmental standards, agricultural production conditions, and public environmental preferences in order to reduce political tensions over competitiveness.

Furthermore, in the case of transboundary environmental effects, substantive harmonisation will tend to be welfare-improving. A higher standard in one country would tend to result in higher production costs and lower profits for its domestic producers, but would improve environmental quality for the domestic population only to a limited extent, as the state of the environment is determined collectively by production output in several countries. Hence, multilateral co-operation, possibly in the form of a harmonisation of environmental standards agreed to in multilateral agreements, might be necessary to overcome possible free-rider problems and maintain or improve international environmental quality.

#### *Characteristics of policy measures that are minimally trade-distorting*

In the Uruguay Round Agreement on Agriculture, a considerable number of policy measures were exempted from reduction commitments for domestic support, because they were deemed non- or only minimally trade-distorting. The Agreement did not provide a definition for what constitutes a trade distortion, but specifies criteria that eligible policies have to satisfy. In order to qualify for the WTO “green box”, policies are supposed to be financed entirely from the government budget and not to provide price support to producers. In addition, specific conditions applied to agri-environmental policies require that any payments do not exceed the compliance costs or income losses of farmers and be dependent on the fulfilment of specific conditions under a government programme.

As a general guideline for least-trade effecting agri-environmental policies, policy measures should as far as possible be targeted directly to environmental outcomes and be decoupled from commodity production. Yet, if there is jointness between agricultural and positive and negative environmental outputs, complete production neutrality might not be feasible. In this case, implementing those policy alternatives that achieve the given environmental objective with the least impact on production and trade would be desirable. Also, programmes might best be designed in ways that do not allow farmers to anticipate the programme’s introduction and adjust their production decisions prior to the programme’s launch merely to reap financial benefits that participation in the programme might entail.

#### *Issues for further analysis*

There are several possible areas for further research concerning the impact of agri-environmental policy measures on environmental quality, farming costs/revenues, and international trade:

- Some studies have found that the impact of agri-environmental measures on farming costs is more pronounced in livestock production than in crop farming. This issue of potential distortions in international livestock trade could be more extensively explored by drawing on empirical work in OECD countries.

- The principle of “least trade-affecting policies” could be further developed and illustrated by modelling and analysing the trade implications of achieving environmental targets (e.g. specific reductions in input use or soil erosion) with different types of policy measures, such as quantitative restrictions on inputs, taxes, payments, or cross-compliance programmes.
- Rules and guidelines for the evaluation of agri-environmental policies could be developed, and the possibility of clarifying and refining existing criteria for agri-environmental policies that are least trade-distorting could be examined.

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