The Greening of the WTO Green Box: A Quantitative Appraisal of Agri-Environmental Policies in OECD Countries

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ABSTRACT

The WTO recognises the need for countries to protect their environment and to conserve natural resources. In response to growing awareness of the effects of agriculture on the environment, agri-environmental policy measures have assumed a more prominent role in agricultural policy in OECD countries over the last two decades. OECD countries address environmental issues in agriculture with a plethora of measures, encompassing economic instruments, direct regulation, technical assistance, research and extension, often in the context of production linked production support. Although agri-environmental policies can reduce environmental degradation and conserve natural resources, they can also alter production and price levels, thereby influencing trade patterns. Land retirement programmes or introduction of more environmentally benign technologies through government cost-share programmes, for example, can drastically affect production. At present a sound evaluation of the trade-offs is not a criterion for inclusion in the "green box".

How important are agri-environmental policies in OECD countries and how have they evolved over the implementation period of the Uruguay Round Agreement on Agriculture? What are the main types of agri-environmental payments used in OECD countries? To what extent are agri-environmental policies production and trade neutral? Are the "green box" criteria sufficient to ensure the economic neutrality of agri-environmental programmes?

This paper attempts to shed some light on these questions. It first provides an overview of the use of agri-environmental measures included in the green box by OECD countries and of their relative importance over the 1995-2000 URAA implementation period. Two econometric analyses are conducted using meta-production function and bilateral-trade (gravity) models to assess the production and trade impacts of agri-environmental policies in OECD countries implementation period. The results suggest that environmental payments are a statistically significant determinant of agricultural production and trade. Finally, the potential problems in the "green box" exemptions for environmental programmes are discussed.

I. Introduction

Since the establishment of the World Trade Organization (WTO) in 1994, trade and environment has been a prominent issue for policy makers and researchers alike. Prior to that, the two issues tended to be dealt with separately. Trade agreements, such as the forerunner of the WTO, GATT, dealt with trade issues, while environmental policy was dealt with either domestically, in the case of local pollution, or in separate multilateral environmental agreements, in the case of transboundary or global pollution. The preamble to the Marrakech Agreement establishing the WTO makes an explicit link between the two issues, stating sustainable development, environmental protection and conservation of scarce resources to be explicit objectives and an

integral part of the multilateral trading system.[2] For agriculture, the domestic support provisions of the Uruguay Round Agreement on Agriculture (URAA) recognize the legitimacy of pursuing domestic policy objectives, including the need to protect the environment and conserve natural resources. Environmental payments are included in the "green box", and thus are exempt from reduction commitments. Environmental concerns also gained more weight in regional trade agreements (e.g. NAFTA) and in the process of ongoing multilateral trade negotiations. The Doha declaration, for the first time in the WTO, includes a significant programme of negotiations on trade and environment covering the relationships between WTO rules and multilateral environmental agreements and the reduction or elimination of trade barriers to environmental goods and services (WTO, 2001).[3] WTO's fundamental philosophy is that trade liberalization and environmental protection are complementary goals, if appropriate environmental policies are in place.

Despite the general consensus within the WTO on these fundamental principles, considerable controversy surrounds the issue of the linkages between agricultural trade and the environment. Agriculture is integrally connected with the environment, being a major user of natural resources, especially land and water; a source of environmental harm, such as water pollution, soil erosion and reduction of biodiversity; and of environmental benefits, such as the provision of landscape features, flood control, biodiversity and carbon sinks. Agricultural production creates positive and negative environmental "externalities" that are not always reflected in market prices. It is widely recognized that when social costs and benefits are not fully reflected in product prices, the market alone cannot lead to an optimal resource allocation. A key policy concern is to distinguish between agri-environmental measures that actually address market failures by internalizing environmental externalities or ensuring the provision of public goods associated with agriculture, from policies that appear to be merely labeled "green" and used as a means of disguised protection. In OECD countries, environmental policies rely on a mix of instruments such as cost-sharing, technical assistance, income safety nets, and conservation research and development (OECD, 2003; Latacz-Lohmann and Hodge, 2003).

Defining whether a measure constitutes environmental protection or trade protection is a contentious issue. By virtue of joint production of agricultural and environmental outputs, agri-environmental policies aimed at internalizing domestic externalities may affect quantities produced, trade flows and may impose burdens on a country's trading partners. A number of commentators have suggested that some countries could use agri-environmental policies to further a protectionist trade agenda or to manipulate the terms of trade in their favour (Ervin, 1999, Vasavada and Warmerdam, 1998). A sound evaluation of the trade-offs should be undertaken to determine eligibility criteria for inclusion in the "green box".

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[2] For a detailed discussion on how trade and environment are being dealt with in the multilateral trading system see Shaw and Schwartz (2002).

[3] It is noteworthy that there are differences in opinions among economists against linking trade and environmental issues. Some economists (Bhagwati and Srinivasan, 1997; Whalley and Zissimos, 2000) argue against linking trade and environment ("trying to kill two birds with one stone is a recipe for missing both birds"). Such critics advocate that environmental externalities should be tackled at their source, usually at the point of production, occasionally at the point of consumption, and rarely at the point of exchange. Other economists advocate the trade-environment linkages. Repetto (2000), for example, makes the point that where the first-best solution of targeted multilateral environmental agreements is not available, the second-best solution may not be to liberalise trade anyway.

Perhaps the three most crucial issues surrounding agricultural trade and the environment, in the context of the WTO, are the following: (i) the impact of international trade and trade liberalization on the environment; ii) whether environmental regulations influence trade patterns problems and farm competitiveness in world markets; and (iii) difficulties associated with the green box exceptions for environmental programmes. The impact of agricultural trade liberalisation on the environment has been the subject of a growing body of literature in recent years (Tsigas, Gray and Hertel, 2002; OECD 2000a; Antle, Lekakis and Zanias, *eds*. 1998, Vasavada and Nimon). Several studies have also addressed the effects of farm regulations on competitiveness (see OECD, 2000b and Toma, 2002 for a brief survey of the available studies). However, there is less empirical evidence of the production and trade effects of agri-environmental programmes.

The main focus of this paper is to shed some light on the extent to which agri-environmental payments in OECD countries included in the green box affect domestic agricultural production and international agricultural trade. This issue is related to the debate on the impacts of agri-environmental standards on farm competitiveness in world markets. The competitiveness debate is primarily concerned with policy measures that aim to reduce environmental pollution from farming activities, while the issue of payments centres on the payments to farmers for the provision of agri-environmental services. The paper is structured as follows. Section II discusses the environmental provisions of the URAA and the relative importance of agri-environmental payments in the green box over the URAA implementation period. Section III provides an overview of the main types of agri-environmental payments used by OECD countries. Section IV outlines the econometric techniques, meta-production and bilateral-trade (gravity) models, used to estimate the production and trade impacts of agri-environmental policies and presents the results. Section V discusses whether the "green box" criteria with respect to agri-environmental programmes are sufficient to ensure their trade neutrality. Finally, Section VI presents some conclusions.

II. Environmental provisions of the Uruguay Round Agreement on Agriculture

The WTO recognises the need for countries to protect their environment and to conserve natural resources. The URAA green box identifies domestic support measures that are exempt from reduction commitments and includes a variety of programmes related directly or indirectly to environmental protection. The green box comprises a wide range of measures such as general services (e.g. research, inspection, training and extension), domestic food aid, decoupled income support, natural disaster relief, insurance and income safety net programmes, environmental programmes, structural adjustment assistance programmes, and regional assistance. As outlined in Annex 2 of the URAA, to be eligible for inclusion in the green box exemption, policies must not act as an effective price support, must "have no, or at most minimal, trade-distorting effects or effects on production," must be financed by the government and must meet other policy-specific criteria that apply to individual programmes.

In addition to these basic criteria for green box exemptions, there are two policy-specific criteria for agri-environmental payments (paragraph 12 of Annex 2 of the URAA): 1) The amount of payment shall be limited to the extra costs or loss of income involved in complying with a government programme, while green box resource retirement programmes must not link remaining land to prices or production and must retire land for a minimum of three years;

2) Eligibility for agri-environmental payments must be determined as part of a clearly-defined government environmental or conservation programme and be dependent on the fulfillment of specific conditions under the programme, including conditions related to production methods or inputs.

Green box exemptions are available to both developed and developing countries, although very few developing countries make use of green box exemptions for environmental policies.[4] Among OECD countries only Mexico, Poland and Turkey (which does not have domestic support reduction commitments) have not notified any environmental payments in their green box exemptions. Of the 19 non-OECD developing countries (as classified in WTO) that submitted supporting tables relating to commitments on domestic support, only four (Argentina, India, Slovenia and South Africa) claimed direct environmental programmes, with those for soil conservation being the most frequently cited.

Green box payments constitute the main category of domestic support in many OECD countries, but their share varies considerably across countries. The European Union, Japan, and the United States are by far the largest providers of green box payments in absolute terms, accounting for almost 80% of the base period total AMS for OECD countries. In Australia, New Zealand, Poland and the United States, green box measures accounted for more than 80% of total domestic support as measured in WTO over the 1995-98 period. While support from policies assumed to have the greatest effects on production and trade has declined in many countries, support by OECD countries from green box policies has increased in the implementation period as compared to the 1986-88 base period (green box expenditures more than doubled in 1995 relative to the 1986-88 level) (OECD, 2001a). Of the 14 OECD countries reporting green box spending both in the base and in the implementation period, all notified an increase in green box expenditures. Most of this increase was concentrated in three countries—the United States, the European Union, and Japan. The 1996, 1997 and 1998 green box expenditure was greater than the totals reported for the AMS.

On average, over the 1995-98 period, most of the expenditures on green box policies by OECD countries, were made for domestic *food aid* and *general services*. Domestic food aid was the single largest category of green support, most of which was spent by the United States. Expenditures on environmental programmes are not the dominant category in any OECD country. However, it should be kept in mind that the level of environmental payments in the green box does not necessarily reflect the importance that governments accord to environmental protection and conservation of natural resources, as other agricultural policies are related directly or indirectly to the environment (e.g. natural disaster, general services, regional assistance, etc.), while the plethora of environmental regulations affecting agriculture is significant in most OECD countries.

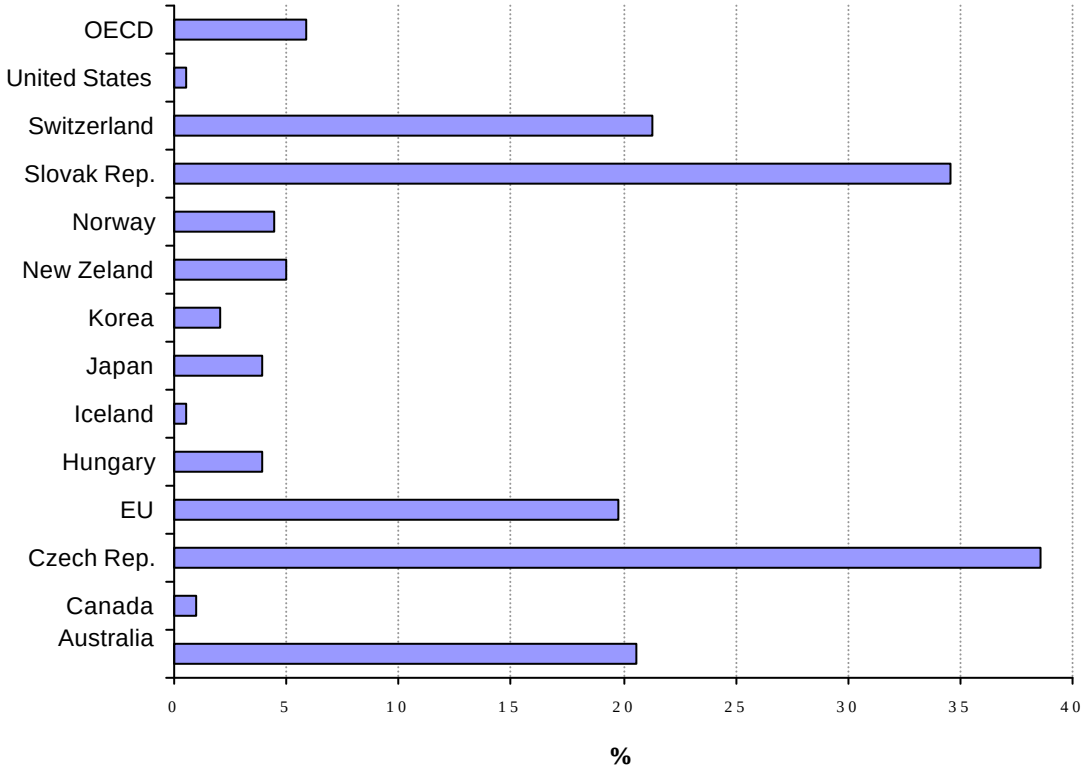
As portrayed in Graph 1, environmental payments accounted for around 6% of OECD green box expenditures over the 1995-98 period of the implementation of the URAA. Expenditures on such programmes, however, have increased rapidly in most OECD countries since the mid-1990s (Graph 2). For example, in Australia the share of environmental programmes in total green box

[4] For most developing countries, it is not possible to determine whether they operate programmes that would qualify under environmental green box exceptions as their notifications do not specify whether the exemptions are based on the green box or on Special and Differential Treatment.

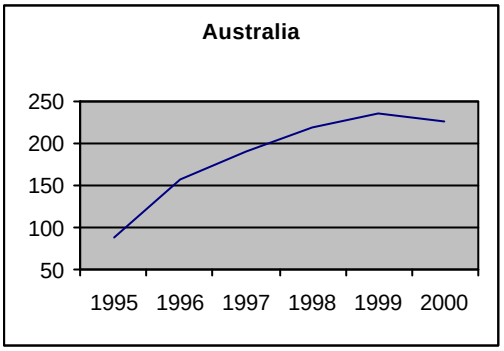
expenditure increased from 13% in 1995 to 30% in 2000, in the EU from 15% in 1995 to 26% in 1998 and for the OECD area as a whole from 4.5% in 1995 to over 7% in 1998. For the United States the share of environmental programmes in total green box expenditure remained constant over the 1995-98 period at around a half percent.

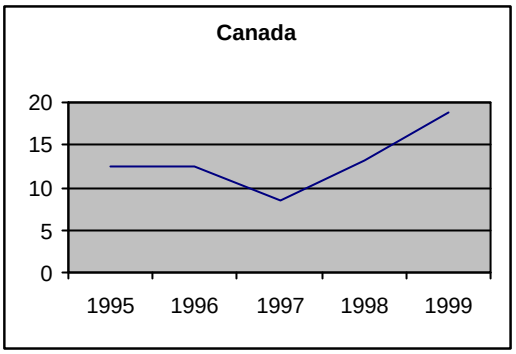
Likewise, environmental payments in the green box represent only a small proportion of the total amount spent on agricultural support. In 1998, total monetary transfers to the agricultural sector as a whole, the total support estimate (TSE), for OECD countries amounted to US$349 billion and the producer support estimate (PSE) amounted to US$262 billion. In comparison, total expenditure on policies notified by OECD countries for the WTO's "green box" amounted to US$104 billion in 1998, of which about 4.5% was due to environmental programmes. In 1998, environmental payments accounted for 5.8% of the PSE in Australia, 8.4% in the Czech Republic, 4.7% in the European Union, 1.9% in Japan, 0.4% in Canada, 0.7% in Korea, 6.6% in New Zealand, 4.9% in Switzerland and 6.2% in the United States.

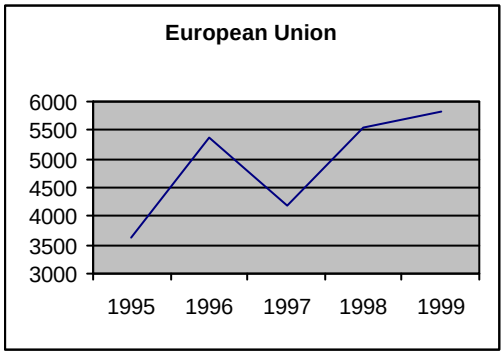
Graph 1. Share of environmental payments in the URAA green box, 1995-98

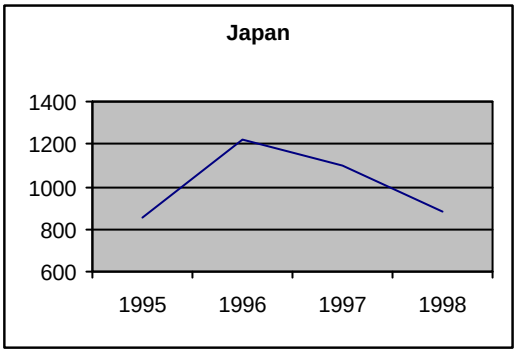


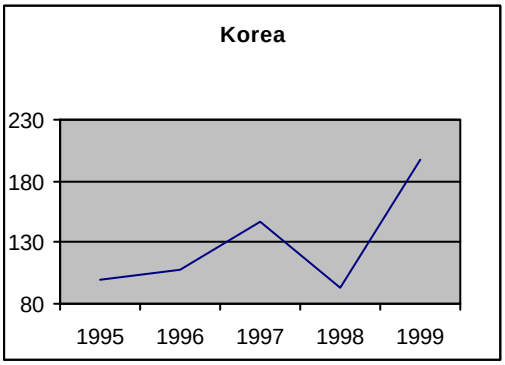
Graph 2. Evolution of environmental payments in the green box (mill. US$)

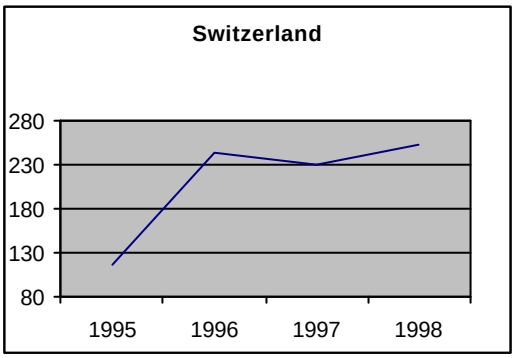


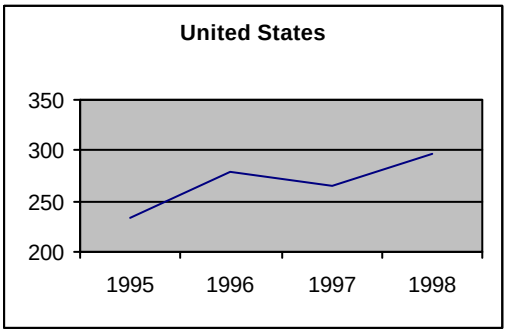


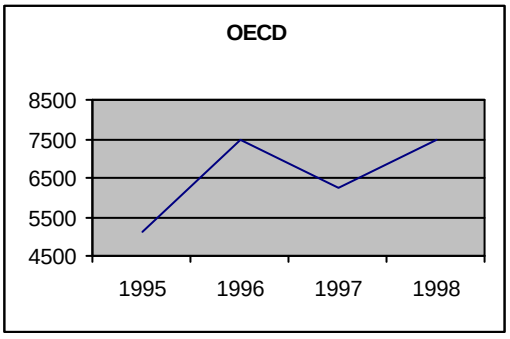












II. What are the main types of agri-environmental payments used in OECD countries?

OECD countries address environmental concerns and promote the provision of environmental amenities with a plethora of measures, encompassing economic instruments, direct regulation, technical assistance and conservation, research and extension. Payments, including implicit transfers such as tax and interest concessions, to farmers, on a voluntary basis, are offered by many OECD countries. However, many payments are provided in the context of production-linked support, which results in environmental effects. *Regulatory requirements* to address the negative effects of agricultural activities on the environment, ranging from outright prohibitions, to input standards and resource-use requirements are imposed by all OECD countries (OECD, 2003). Moreover, *cross-compliance* measures, tying minimum environmental standards to agricultural support are also well established in the United States, Switzerland and a number of EU Member states.

The diversity of programmes across OECD countries and regions is vast. In practice, agri-environmental payments tend to be linked to on-farm practices associated with certain environmental outcomes, land the amount paid tends to be based on area covered or other factors of production. Payments directly based to environmental outputs - such as 'improved landscape' or 'more diversity' - are rare. In particular, many European countries and the United States greatly increased the use of these measures since 1990s. Some notable trends include the growing use of payments to support the adoption of less-intensive farming practices; land retirement payments to promote environmental objectives; and transitional payments to assist farmers in implementing structural changes intended to benefit the environment. By contrast, some countries, including Australia, make available payments administered through *community-based* schemes involving local governments and other community groups. These approaches tend to take advantage of farmers' own interest in environmental conservation and make use of local expertise in solving environmental problems.

The European Union co-finances with EU member states a wide range of payment programmes based on farming practices under a policy first established in 1992 under *Agri-environment Regulation 2078/1992*, and later more broadly encompassed under the *Rural Development Regulation 1257/1999*. These programmes are often established at different administrative levels (national, sub-national, and regional). Switzerland's *Federal Agricultural Law (AP 2002)*, which provides the basic legislative framework governing agricultural policy for the period 2000-03, offers a range of payments based on different standards of agricultural practices: tier one is for specific biotypes, such as extensive grasslands high stem fruit trees, and hedges; tier two supports integrated production with reduced inputs; while tier three is support for organic farming.

Prominent among measures based on farming practices are payments to support farmers adopting low-intensity farming systems, including organic production systems and other less input-intensive forms of production. Two types of payments can be distinguished to promote for organic farming: transitional per hectare payment tailored to any income loss as a result of converting to organic production, and continuing payments based on area and headage to stimulate organic

farming after this transition period. Such payments are particularly important in the European Union, Norway and Switzerland.[5]

In the United States the *Environmental Quality Incentives Program (EQIP)* was established by the *1996 Farm Act* to provide financial and technical assistance to farmers to promote the adoption of environmentally sensitive practices in environmentally sensitive areas. *EQIP* provides assistance to farmers of up to 75% of the investment cost of installing or implement structural changes to promote environmental objectives, with a particular emphasis on addressing environmental problems associated with the livestock sector. Over US$200 million is spent under *EQIP* annually, with contracts running for 5 to 10 years. In addition, the *Conservation Security Programme (CSP)*, introduced by the *2002 FSRI Act*, is to provide several tiers of payments to farmers based on different levels of conservation practices, and is expected to go considerably beyond established programmes such as *EQIP* - it is estimated that around US$2 billion will be spent on this programme over the next ten years. The EQIP, by facilitating the adoption of more environmentally benign techniques can affect relative costs and production levels.[6]

Land retirement programmes to promote environmental objectives are mainly pursued in the European Union, Japan and the United States. These measures are intended to improve the environmental performance of agriculture. They can substantially vary in the way they influence land use and farming practices (i.e. the length of the set-aside period, the type of land to be taken out of production, the rules governing the treatment of idled land, and the possibilities for alternative land use). The payment rates of several of these land diversion schemes are intended to compensate farmers for the cost increases and/or revenue losses associated with abandoning conventional production on part of their land. In practice, however, there is often little or no differentiation in payment rates by type of farm, agri-environmental measure, or region. Total budgetary expenditures on land diversion schemes currently account for only a very small percentage of agricultural support to farmers as measured by the OECD Producer Support Estimate (PSE), but in some countries they are among the fastest growing types of direct payments to farmers.

In the European Union, two *long-term land diversion schemes* were introduced as part of the "accompanying measures" of the CAP reforms.[7] These two schemes are specifically aimed at achieving environmental objectives, but also help to reduce structural commodity surpluses. The first scheme is aimed at protecting land taken out of production and the second is aimed at

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5 Payments in relation to organic farming are included in the OECD PSEs for several countries, either under the heading *Payments based on unlimited area or headage*, or under *Payments based on constraints on a set of inputs*.

6 In the OECD methodology of measuring support, the share of expenditure for technical assistance is included under the PSE category *Payments based on use of on-farm services*, while the share for cost-share payments is included under the category *Payments based on constraints on a set of inputs*.

7 These are in addition to the compulsory set-aside which was introduced by the 1992 CAP reform as a condition for producers receiving area-based compensatory payments for cereals, oilseeds, protein plants and linseed. Further, the proposals for reform of the CAP presented by the European Commission to the Council and the European Parliament in July 2002, in the context of the Mid-Term Review of Agenda 2000, entail, *inter alia*, introduction of compulsory long-term set-aside (10 years) on arable land, as part of the cross-compliance requirements to receive direct payments, equivalent to the amount of land-set-aside under current arrangements.

supporting the development of farm forestry (Reg. 2078/92 and 1257/1999). Under the former regulation, cereal farmers can receive payments for diverting land from production for environmental purposes for a period of at least 20 years. Payments are made on a per hectare basis of the of land set-aside to cereal producers, based on their historical base acreage. The arable land set-aside may either be used for non-food purposes, left fallow, with the possibility of rotation, afforested or used for non-agricultural purposes (e.g. conversion of arable land to grassland, the introduction of grassland buffer strips around watercourses, etc.).[8]

Japan has implemented programmes to divert land from rice production since 1971. The total area diverted has varied considerably over time, ranging from around a quarter of a million hectares in 1975 to almost a million hectares in the late 1990s. Having primarily been conceived as supply control measures, the programmes have increasingly been regarded as supporting environmental objectives as well — basically, precluding any potentially negative environmental effects of withdrawing paddy fields from production. Gradually environmental provisions have been incorporated into successive programmes aiming at avoiding degradation by paying farmers to manage diverted paddy fields in environmentally sound ways through appropriate cropping alternatives and/or maintenance of idle paddy fields. Rice diversion measures have been classified as an environmental measure within the URAA, and are thus not subject to support reduction commitments. According to the notification of domestic support to WTO, payments for conversion from rice production increased from JPY81 (US$0.8) billion in 1995 to JPY133 (US$1.2) billion in 1999.[9]

Land diversion programmes have dominated agricultural conservation expenditures in the United States since the mid-1980s. The major land retirement programme is the *Conservation Reserve Program (CRP)*. The US CRP was established with the Food Security Act of 1985 as a voluntary long-term cropland retirement programme. Farmers who participate in the CRP commit themselves to retire highly erodible or environmentally sensitive cropland from production for 10 to 15 years and to keep it under a permanent cover, such as grass or trees. In exchange, they receive annual rental payments and half the cost of establishing the vegetative land cover. The primary stated goal of the CRP is to reduce soil erosion on highly erodible cropland, although other environmental and non-environmental objectives are also pursued. The 1996 FAIR ACT limits enrolment to 36.4 million acres at any time, while the 2002 Farm Act increased the enrolment limit to 39.2 million acres. In 2000, 8.8% of cropland in the US was idled under the CRP (Vasavada, Warmerdam and Nimon). Although the CRP aims to retire environmentally marginal cropland, it may also generate significant output effects if land that is environmentally marginal is not marginal from the economic viewpoint. Since 1996, CRP rental payments have averaged more than US$1.5 billion a year, or around 96% of the total spent on land retirement by the USDA.[10]

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8 Payments for these types of set-aside programmes are currently included in the OECD PSE under *Payments based on fixed input constraints*.

9 In the OECD PSE classification, rice diversion payments are classified as *Payments based on fixed input constraints*.

10 In the OECD PSE classification, CRP payments, both the annual rental payments and associated cost-share assistance payments, are classified as *Payments based on fixed input constraints*, whereas within the URAA they are claimed in the green box.

In addition to these programmes, the European Union, Norway and Switzerland support the continuation of farming in areas that are considered to be economically marginal because of difficult growing conditions or in danger of becoming depopulated. Although such programmes have often been established with rural development objectives in mind, they are nowadays seen as also contributing to preserving landscape values and preventing the abandonment of extensive farming systems. In the EU, following the Agenda 2000 CAP reform, payments are provided for environmentally sensitive areas. Norway grants annual payments to farmers who graze dairy cattle in *mountainous regions*; under another programme it pays farmers who farm on *steep slopes*.[11] Moreover, acreage payments for grass fodder production in mountainous areas are granted, based on the distance between the farmstead and the fields, Intending to compensate for the higher labour and transportation costs in cases where the fields are removed from the permanent farm residence.[12] Norway has also provided area-based payments with environmental objectives. The *Acreage and Cultural Landscape Scheme,* for example, provides a payment to farmers who fulfil minimum requirements for production of coarse fodder, grains, potatoes, or fruits and vegetables, and proscribes a range of activities that would disturb landscape features such as streams, hummocks and traditional traffic arteries. The payments are divided into two parts: an "acreage" part (differentiated into four field-size classes and four regional zones) and a smaller, "cultural landscape" part (differentiated into two regional zones); an extra area-based payment is given per hectare of root crops.[13]

IV. To what extent are agri-environmental payments production and trade neutral?

This section endeavours to provide an empirical multi-country analysis of the impact of agri-environmental payments on domestic production and foreign trade. Two empirical approaches are used: an aggregate production function model and a gravity model for analysing bilateral agricultural trade flows.

Production model

The approach chosen is based on the meta-production function defined as an envelope of the most efficient points of production for any given industry among countries in the world (Hayami and Ruttan, 1970). Since its introduction by Hayami and Ruttan, many studies have utilised this concept (Kawagoe, Hayami and Ruttan, 1985; Mundlak and Hellinghausen, 1982; Binswanger, et al., 1987, Lau and Yotopoulos, 1989; Diakosavvas, 1990; Frisvold and Lomax, 1991; Boskin and Lawrence, 1992). This approach represents the input-output relationship of a given sector (i.e. agriculture) for all countries and is based on the simple assumption that all countries have access to the same technology but that each may operate on a different portion of the function due to specific country situations. The analysis is based on pooling of cross-section and time-series data for the period 1995-2000 for all OECD countries. The use of inter-country data has the advantage of both capturing a wide variation in observed production and increasing the total number of observations.

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11 Both payments are included in the OECD PSE under the category *Payments based on use of fixed inputs*.

12 These payments are included in the OECD PSE under the category *Payments based on use of variable inputs*.

13 All these area payments are included in the OECD PSE under *Payments based on area and headage* category.

The independent variables include four conventional inputs (labour, land, fertiliser and machinery) and one policy shifter, representing environmental payments. The agricultural employment variable (LABOUR) was measured by the economically active population in agriculture in thousand units, and the agricultural land variable (LAND) by hectares of agricultural land in thousand units.[14] Fertiliser (FERT) is the sum of nitrogen (N), phosphorus (P_2O_5) and potash (K_2O) of all fertilisers used, measured in metric tons of plant nutrients. Machinery is measured by the total number of tractors measured in thousand units. These two inputs are considered proxies for the whole range of modern mechanical and biological technology inputs.[15] Variables capturing the education level of agricultural labour force were not included because data for the educational attainment of farmers across OECD countries are very sketchy and not comparable across countries. Such data are available across countries for the entire population and they involve large observational errors when interpreted as measures of the general education level of the agricultural labour force.[16]

The environmental variable (ENV) was measured by the environmental payments notified by countries in their WTO green box. Unfortunately, some domestic support notifications to WTO are overdue and there are OECD countries which have yet to notify WTO for 1999 and 2000. In these cases, data from the OECD PSE database were used to fill the gaps. Further, as the EU green box reports environmental payments for the EU as a whole, the shares of each EU member in agri-environmental payments published by the European Commission were used to partition the EU environmental payments reported in the green box.

The inter-country production function employed is of the Cobb-Douglas type, i.e:

$$\ln(output)_{it} = \text{int}\,ercept + \alpha \ln(land)_{it} + \beta \ln(fert)_{it} + \gamma \ln(tract)_{it} + \delta \ln(labour)_{it} + \varepsilon \ln(ENV)_{it} + u_{it}$$

The stochastic disturbance term $E[u_{it}] = 0$ is assumed to have mean zero and constant variance, $E[u_{it}^2] = \sigma^2$ and $\alpha + \beta + \gamma + \delta + \varepsilon \leq 1$

The Cobb-Douglas form was used as a framework for gauging the statistical significance of the environmental payments rather than as a means to obtain precise estimates of input elasticities. In contrast to other production functions which are more flexible, such as the transcendental function, the Cobb-Douglas approach requires less parameters to be estimated and interpretation of the results is straightforward.

The Cobb-Douglas production function was estimated both in its simple form (as above) as well as in its "intensive" form. That is to say, the conventional inputs were expressed in terms of labour. The advantage of the "intensive" form of Cobb-Douglas is that it reduces the problems of multicollinearity and heteroscedasticity. The specification based on the "intensive" form is

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14 Also trials with arable land were attempted. The results were not very different.

15 In addition to these proxies for conventional inputs, a number of other variables were tried in the test runs, but failed to yield statistically significant coefficients. The ratio of irrigated land to total land area and the ratio of cropland to pastureland were experimented to adjust for differences in the quality of land input. A possible factor in our lack of success in capturing the effects of irrigation may be the high complementarity between irrigation and intensity of fertiliser use.

16 The data on production and conventional inputs are from FAO, FAOSTAT.

reported here since its statistical fit was found to be slightly better.[17,18] Further, the assumption of constant intercept and slopes was tested with F-test comprising restricted and unrestricted residual sum of squares. It was found that the fixed cross-section effects and fixed time-series effects for the constant term were statistically significant at 1% significance level. Thus, the final model estimated is based on intercept that varies over time and over countries and constant slopes:

$$\ln(y_{it})_{it} = \bar{\beta}_i + \mu_i + \lambda_t + \sum_{k=2}^{K} \beta_k X_{kit} + u_{it} \quad \text{with intercept } \beta_{1it} = \bar{\beta}_1 + \mu_i + \lambda_t$$

$i = 1, \cdots, N$ refers to cross-section unit (countries); $t = 1, \cdots, T$ refers to a given time period. The β_{kit} are unknown parameters or response coefficients, $\sum_{k=2}^{K} \beta_{k1} \leq 1$

y_{it} = the value of the dependent variable (OUTPUT/LABOUR) for country i at time t and X_k is the value of the kth non-stochastic explanatory variable for country i at time t. In our specification k= LAND/LABOUR, FERT/LABOUR, TRACT/LABOUR and ENV.

Trade flow model

For the purpose of this paper the trade flow equation or gravity model is adopted, as developed by Tinbergen (1962) and Linnemann (1966), augmented by agri-environmental payment variables both in the exporter and the importer countries. Such a model is considered appropriate for our purposes because it takes into account bilateral trade flows and therefore is a useful approach to examine how agri-environmental policies between countries influence foreign agricultural trade flows. Such an approach has been used by Van Beers and Van den Bergh (1997) (VBVB) and more recently by Harris, Kónya and Mátyás (2002) (HKM) to estimate the impact of environmental regulations on trade flows in OECD countries. VBVB analysed the impact of environmental regulations on bilateral trade flows for a cross-section of 21 OECD countries in 1992. VBVB found a statistically significant relationship between stringent environmental regulation and trade flows. HKM extended the model used by VBVB by incorporating importing country, exporting country and time-specific effects. This more general model specification, which incorporates the VBVB model as a special case, was estimated for a panel of 24 OECD countries over a sample period of 1990-96. HKM detected significant statistical relationship between environmental regulation and bilateral trade flows in model specifications which do not allow country specific effects. However, when such effects were incorporated into the models no significant relationship was found.

The specific model employed in this paper extends the traditional gravity models used by VBVB (1997) in so far as it allows for both importing and exporting countries, as was done by HKM (2002). It is nonetheless based on a cross-sectional data set (1997) and thus, any unobserved heterogeneity over time, common to all countries, namely the business cycle effects on bilateral

17 The main difference between the two models is that in the simple form the intercept is statistically insignificant.

18 As is well known the "intensive" form of Cobb-Douglas production function requires constant returns to scale. This assumption was tested by a standard F-test and accepted at the 1% level of statistical significance.

trade flows, are blurred. However, inclusion of the time effects is likely to cause problems of multicollinearity as some the independent variables vary across countries, but not over time. [19]

The traditional trade flow equation model has the following form:

$$y_{ij} = \beta_0 Y_i^{b_1} Y_j^{b_2} N_i^{b_3} N_j^{b_4} L_i^{b_5} L_j^{b_6} (ENV)_i^{b_7} (ENV)_j^{b_8} (EU)_{ij}^{b_9} (NAFTA)_{ij}^{b_{10}} (ADJ)_{ij} e^{u_{ij}}$$

with

y_{ij} = Total agricultural exports of country i to country j in million of US$[20];

Y_i = Gross Domestic Product of country i in 1000s of US$;

Y_j = Gross Domestic Product of country j in 1000s of US$;

N_i = Population of country i in 1000s;

N_j = Population of country j in 1000s;

L_i = Agricultural arable land of country i in 1000 hectares;

L_j = Agricultural arable land of country j in 1000 hectares;

EU_{ij} = A dummy variable, equal to 1 if countries i and countries j are both members of the European Union and zero otherwise;

$NAFTA_{ij}$ = A dummy variable, equal to 1 if countries i and countries j are both members of NAFTA and zero otherwise;

ADJ_{ij} = A dummy variable, equal to 1 if countries i and countries j are adjacent (i.e. share a common border) and zero otherwise;

ENV_i = Environmental payments of country i in million US$;

ENV_j = Environmental payments of country j in million US$;

u_{ij} = white noise disturbance term; and $i = 1,...,N$, $j = 1,...,i-1,i+1,...N$

In matrix form the specification of the model used in this paper can be expressed as:

$$y_{ij} = D_N \alpha + D_j \gamma + Z\beta + u_i$$

where:

y_{ij} is the vector of observations of the dependent variable,

$y = [y_{11}, y_{12},...., y_{1j}, y_{21}..., y_{N1},.....y_{Nj}]$;

Z is the matrix of observations of the explanatory variables, including the constant term, organised in a similar way to y; $\alpha = [\alpha_1, \alpha_2,....,\alpha_N]'$, $\gamma = [\gamma_1, \gamma_2,....,\gamma_N]'$, $\beta = [\beta_1, \beta_2,...., \beta_k]'$ are parameter or disturbance vectors; The α permits average propensities to export to differ across countries, while the vector γ permits average propensities to import to differ across

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19 Harris, Kónya and Mátyás (2002) for example dropped the LAND variable as it was perfectly collinear with the á¿ parameters.

20 Bilateral agricultural export data are from GTAP data, Dimaranan, Betina V. and Robert A. McDougall (2002). *Global Trade, Assistance, and Production: The GTAP 5 Data Base*, Center for Global Trade Analysis, Purdue University. Population data from FAO and GDP data from OECD.

countries;[21] k is the number of explanatory variables; and e_{it} is the vector of disturbances. D_N and D_j are dummy variable matrices defined as $D_N = I_N \otimes l_N$ where l_N is a vector of ones. The structure of the $D_j = (N^2 xN)$ matrix is somewhat more complex such that:

$$D_j = \begin{pmatrix} \tilde{I}^{(1)} \\ \vdots \\ \tilde{I}^{(N)} \end{pmatrix} \text{ where:}$$

$I^{(1)} = \begin{pmatrix} 0 & I_N \end{pmatrix}$ and $\tilde{I}^{(1)} = I^{(1)} \otimes l_N$

$I^{(2)} = \begin{pmatrix} 1 & & \\ & 0 & I_{N-1} \end{pmatrix}$ and $\tilde{I}^{(2)} = I^{(2)} \otimes l_N$

$\vdots$

$I^{(N)} = \begin{pmatrix} I_{N-1} & 0 & \\ & & 1 \end{pmatrix}$

The α_i and γ_j specific effects can be treated either as random variables (an error component approach) or fixed parameters (a fixed effects approach). The issue whether to treat them fixed or random, is essentially one of the expected correlations between these specific effects and the included explanatory variables, and also on the objective of the model. Since in our case such correlation is quite likely a fixed effects approach is chosen. To avoid singularity five D_i dummies were dropped ($D_{25,} D_{26,} D_{27,} D_{28,} D_{29}$).

Estimation results

The results of the meta-production function are summarised in Table 1. Considering the aggregate nature of the analysis, the level of statistical significance of the regression coefficients appears very satisfactory. The environmental variable, like the other variables, are significant at the 1% level. As expected, the elasticity for the environmental variable is smaller than that for the conventional inputs. These results support the hypothesis that agri-environmental payments are statistically important determinants of agricultural production in OECD countries.

Table 2 contains the findings for the bilateral trade flows model. In the table, Model A is the sets of results from without specific effects, while Model B provides the results based on the specification which allows for exporting and importing specific effects. In model A, all slope coefficients but two are statistically significant in the expected direction. In particular, both exporting and importing GDPs, POPs, EU membership, environmental payments seem to be positively related to total agricultural bilateral export flows. On the other hand, adjacency exerts an unexpected negative effect, while the land size in exporting country seems not to be an influential factor. The environmental variable in the exporting country and importing country

[21] Factors that might determine the propensity to export and import might include historical factors, composition of domestically produced output, or superior/inferior quality of domestically produced output (HKM, 2002).

Table 1. Estimates of the Meta-production function in OECD countries, 1995-2000

	Estimate	t-value	
Intercept	-9.245	13.86	***
ln(LANDLAB)	0.596	4.65	***
ln(FERTLAB)	0.194	3.79	***
ln(TRACLAB)	0.153	3.03	***
ln(ENV)	0.043	4.41	***
R^2		0.99	***
Test for ìi = ët = 0			
F-test		3990	***

*** = indicates significance at 1%.
LANDLAB = ratio of agricultural land to agricultural labour;
FERTLAB = ratio of fertiliser use to agricultural labour;
TRACTLAB = ratio of tractors to agricultural labour;
ENV = Environmental payments.

have significant positive effects on total agricultural export flows. Although, for the importing county, one would *a priori* expect a negative relationship, a positive effect is also plausible. In many cases agri-environmental policies 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. Moreover, when agri-environmental payments aim at correcting market failures (i.e. the provision of countryside services) they may either tend to reduce or to increase agricultural output and thus trade, depending on the technical relationships between the two categories of output (Hodge, 2000).

Table 2: OLS Estimation Results for Agricultural Bilateral Exports

Variable	Model A		Model B	
Constant	-14.437		2.141	
	(9.27	***	(0.14)	
lnLANDit	0.032		3.391	
	(0.30)		(4.87)	***
lnLANDjt	-0.27		0.228	
	(2.53)	**	(0.96)	
lnGDPit	0.186		-2.187	
	(4.12)	***	(1.43)	
lnGDPjt	0.096		0.063	
	(2.12)	**	(0.63)	
lnPOPit	0.428		-0.596	
	(3.15)	***	(0.53)	
lnPOPjt	1.009		-0.275	
	(7.43)	***	(0.91)	
NAFTAijt	-1.067		1.053	
	(1.20)		(2.61)	***
EUijt	1.554		0.603	
	(5.93)	***	(3.66)	***
ADJij	-3.143		1.865	
	(9.38)	***	(11.22)	***
ENVit	0.001		0.027	
	(2.47)	**	(2.71)	***
ENVjt	0.001		-0.0006	
	(3.08)	***	(0.61)	
Di				1, 2, 10, 11, 12, 13, 14, 17, 18, 23, 24
Dj				All
DF	840		840	
Adj.R^2	0.279		0.88	
F-test $_{(43,776)}$	Model B *vs* Model A		18.1	***

*** and ** indicate significance at the 1% or 5% level, respectively

Di and Dj denote the sets of significance at the 5% level exporter country and importer country dummy variables. The countries are number as: Australia = 1; New Zealand = 2; Japan = 3; Korea = 4; Canada = 5; USA = 6; Mexico = 7; Austria = 8; Belgium/Luxembourg = 9; Denmark = 10; Finland = 11; France = 12; Germany = 13; UK = 14; Greece = 15; Ireland = 16; Italy = 17; Netherlands = 18; Portugal = 19; Spain = 20; Sweden = 21; Switzerland = 22; Iceland = 23; Norway = 24; Hungary = 25; Slovak Rep. = 26; Poland = 27; Czech Rep. = 28; Turkey = 29.

According to the general F-test, it is clear that both the exporting dummy variables and the importing dummy variables are jointly significant, suggesting that Model A is incorrectly specified. These results support the arguments and the results presented by HKM (2002).[22] In Model A, the intercept and some other explanatory variables, most notably, POP, GDP or even ENV, absorb the influence of the missing effects, making them appear significant.

Considering the two model specifications, six notable important differences in the results are apparent. Firstly, judging the quality of both models by the adjusted coefficient of determination, Model B's explanatory power is reasonably satisfactory. Secondly, as both the exporting and importing country effects are taken into consideration, the intercept, the exporting and importing populations and GDPs, and the importing country land variable lose their significance. This is not surprising given the cross-section nature of the analysis. Thirdly, the NAFTA dummy becomes significant and with the expected sign. Fourthly, adjacency remains highly significant but now its sign is changed in the expected direction. Fifthly, the statistical significance of the importing country dummy variables are stronger than that for the exporting country dummy variables. This implies that, as regards individual effects, total bilateral agricultural exports are influenced primarily by importing country effects. Sixthly, the environmental variable in the exporting country turns out to have a strong positive effect on total agricultural exports, while the environmental variable in the importing country becomes negative but insignificant. Taken together, the results from both the production function estimates and the bilateral trade flows model tend to suggest that agri-environmental payments in the green box for OECD countries exert a statistically influential effect on production and trade.

V. Are "green box" criteria sufficient to ensure production and trade neutrality of agri-environmental programmes?

There are several unresolved questions related to the URAA criteria for green box exemption in general, and environmental payments in particular. The fundamental criterion for green box exemptions is that they have "no, or at most, minimal" effects on trade and also "shall not have the effect of providing price support to producers." However, neither the term "trade distortion" nor what constitutes price support is precisely defined. Most of the environmental payments in the green box are linked to area planted, livestock numbers, or input use, and categorised in the PSE classification as such (Table 3). Whether such policies do or do not represent commodity-specific support with similar production incentives as price support needs to be further clarified.

The question of whether agri-environmental payments reported in the green box have no significant production and trade effects warrants closer scrutiny. The total amount of the payment as well as the detailed design of a programme are critical factors for determining the impact of agri-environmental policies on production and trade. The production and trade response depend largely on the extent to which agricultural and environmental outputs are joint products (OECD, 2001c; Latacz-Lohman, 2000). Joint production of agricultural and environmental outputs means that even an optimally designed and targeted agri-environmental policy aimed at internalising domestic externalities may affect trade flows and may impose burdens on a country's

[22] It should be noted that our results are not strictly speaking comparable with those reported by either HKM (2002) or VBVB (1997) as the objective of these studies is to test the effects of environmental regulations, while in our case it is to test the effects of agri-environmental payments on bilateral trade flows.

trading partners. Moreover, like many other policies, agri-environmental payments can indirectly influence production and trade through wealth, liquidity, or income risk effects.[23] Thus the issue is to what extent and under which conditions environmental payments should be allowed in the green box and how they can be evaluated with a view to limiting negative effects on both trade and the environment.

Work at the OECD has identified some of the characteristics that support measures should have in order to keep their production and trade distorted effects to a minimum (1994, 1998, 2001). This work suggests that, in order to avoid creating production incentives, direct payments should either be fixed, or if variable, should be related to a production parameter which is outside the farmer's control. Ideally, this means that payments should not be determined by current or future levels of production or levels of input use. In general, the more carefully a given measure is targeted to an environmental outcome, the greater is the possibility that it will achieve its objective at least overall cost. Effective policies will need clear objectives, should be implemented in targeted ways and should specify the associated costs, benefits, and beneficiaries. If there are multiple policy objectives at stake, an equal number of policy instruments may be needed to deal efficiently with

Table 3: Classification of agri-environmental payments by OECD

	1995		1998		2000	
	Mill. US$	Share (%)	Mill. US$	Share (%)	Mill. US$	Share (%)
Area/headage	363	8	502	7	465	8
Input use	1172	27	1743	26	1755	29
Input constraint	2707	62	4314	63	3665	60
Historical	41	1	89	1	87	1
General Services	74	2	186	3	168	3
Total	4357	100	6835	100	6140	100
Total Support Estimate (TSE)	368587		334440		310820	
Share in TSE (%)	1.2		2.0		2.0	

TSE = Monetary Transfers to the sector as a whole arising from agricultural support policies. Turkey is excluded from the TSE estimates.

Source: Author's calculations based on OECD TSE data and country notifications on domestic support to WTO.

[23] For a detailed discussion of the trade impacts of agro-environmental programmes, see OECD (2000b).

the issues. Trade policy measures 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 and allow for flexibility with respect to the diversity of agricultural situations. Moreover, farmers' compliance should be closely monitored and the effects on farming practices and the environment should be continuously assessed against the stated goals.

As pointed out in the preceding section, there is very wide variation in the extent to which agri-environmental payments in the green box reflect the characteristics and recommendations summarised above. Some measures remain closely linked to production or factors of production while in others a significant degree of production neutrality appears to have been achieved. Indeed, some of the agri-environmental measures included in the green box, although in conformity with the specific-policy criteria set for these programmes, may provide a significant incentive to produce. The trade impact of any particular agri-environmental measure depends largely on the extent to which agricultural and environmental output are joint products, i.e. on the degree of jointness of production. If there is only a weak link between agricultural output and the level of environmental improvement sought then the trade effect will be smaller than otherwise would be the case. Agri-environmental payments for the planting and maintenance of hedgerows and other landscape features or the rebuilding of stonewalls as means of enhancing the aesthetic value of the cultural landscape are examples of a weak link between agricultural and environmental outputs. In contrast, land set-aside programmes or support to organic farm production involve a more direct link between environmental objectives and agricultural output. Land set-aside programmes appear to have the largest effects on production and trade as they remove land from production, thereby directly affecting output. Organic conversion payments are also trade-distorting because they have direct impacts on the quantities supplied in a particular market, i.e. the organic market, which is particularly sensitive to supply shocks. A salient feature of Table 3 and Annex Table 1 is that several agri-environmental policies in the green box are classified in the OECD PSE calculations which are economically distorting. In OECD countries, on average, only 3% of total agri-environmental payments reported in the green box are provided to the sector collectively (i.e. not to individual producers).

There are also several contentious implementation issues that have arisen in the green box exemptions for environmental programmes. The first relates to the term "environmental" which is not defined in the URAA. For instance, an environmental payment that helps prevent soil erosion by retiring fragile land from production could be considered as a valid exception. However, it is unclear whether the environmental exceptions in the green box are also meant to include payments which aim at preserving the amenity value of a "traditional" agricultural landscape.

In the case of agri-environmental programmes, the existence of constraints on production methods and payment-limits based on compliance costs are the two policy specific conditions required. Eligibility for payments depends on "the fulfilment of specific conditions…, including conditions related to production methods or inputs" (paragraph 12 of Annex 2). Different agri-environmental policy measures leading to similar environmental outcomes, have differing impacts on production and trade. The attainment of a specific environmental objective can be efficiently achieved through a wide range of policy instruments providing either incentives or disincentives, but the effects on production, trade and financial transfers depend on how the instruments are designed and implemented. In general, the production and trade effects of voluntary agri-environmental

payment-*cum*-farming-restriction-programmes can be more pronounced than those of mandatory ones, because of indirect liquidity and income effects.

The WTO condition which postulates that compensation payments should be limited to compliance costs or income losses, literally, would mean that only mandatory agri-environmental programmes could be in the "green box". If a programme, for example to maintain low-intensity farming in disadvantaged areas, were indeed voluntary while the financial incentive for farmers were equal or below their compliance costs, no farmer would enrol in the programme. But as there are a number of voluntary environmental programmes in the "green box", this condition seems to have been handled somewhat flexibly in practice.[24]

In the "green box" eligibility criteria is implicitly assumed that all trade effects of agri-environmental programmes are trade-distorting. But environmental policies are often used to correct for pre-existing market failures. In these cases, environmental policies will alter relative prices, production patterns and international trade flows. However, as they have the potential to increase global welfare, they are characterised as trade-correcting (OECD, 2000b).[25] An open question is whether inclusion of such policies in the green box will be permitted.

The evaluation of trade-offs and "synergies" between trade and environmental considerations is difficult. The "least trade-affecting" criterion, that is, 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. A first consideration for evaluating whether an agri-environmental policy might be trade-distorting is to test for potential jointness of commodity and environmental outputs, and on international spill-overs from domestic policy measures. The jointness of many commodity and environmental outputs from agricultural activities is central to the issue of trade effects and distortions associated with agri-environmental policies.

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 mitigated, if these policies are implemented in connection with binding constraints on production practices and compensation payments are sufficiently differentiated according to prevailing production conditions. 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

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24 In some cases, farmers might participate in voluntary agri-environmental programmes, even if they are not fully compensated for their compliance costs. This could, in particular, occur if farmers are also beneficiaries of local externalities or public goods, such as a valued landscape.

25 The sign of the overall welfare effects depends on the type and magnitude of the externality, and the implied elasticities of demand and supply. Using a partial-equilibrium trade analysis, Latacz-Lohmann (2000) attests that only when internalising a negative externality in an exporting country agri-environmental intervention yields an unambiguously gain in global welfare, despite the fact the importing countries will lose due to increased world prices.

their compliance costs (Latacz-Lohmann and van der Hamsvoort, 1998 and 1997). High administrative and transaction costs might, however, thwart the implementation of such schemes.

A number of criteria have been proposed in the literature for designing agri-environmental programmes (OECD, 2001b; Latacz-Lohman, 2001, 2000; Ervin, 1997, 1999; Runge, 1999). They can be summarised as follows:

1. *Assessing evidence of genuine concern*

   Notifying countries should provide concrete evidence that the environmental problem concerned is in fact an issue of genuine concern. Indicators such as rates of soil erosion or pesticide and nitrate concentrations in ground water may be useful yardsticks.

2. *Assessing the "technology" of policies*

   In addition to the two policy criteria relating to agri-environmental policies in the URAA green box, the following criteria may be added:

   - Agri-environmental programmes must be transparent, have clearly defined and, as far as possible, quantifiable objectives;
   - The type of policy instrument used (e.g. tax, subsidy, charge) should take account of existing property rights allocations and conform with internationally agreed principles such as the Polluter Pays Principle or the Beneficiary Pays Principle;
   - Environmental programmes should account for the spatial dimension of agri-environmental problems;
   - Agri-environmental contracts should be offered on a competitive basis;
   - Notifying countries should demonstrate that they have in place an appropriate administrative framework for implementing, monitoring and evaluating programmes;

3. *Probing for less trade-distorting alternatives*

   There should be no alternative policy which is equally effective and yet less trade-distorting. This amounts to ensuring that only "technically efficient" policies are approved, that is policies which represent a movement along the production possibility frontier rather than a step from the frontier to the inside of the production possibility set.

4. *Assessing the distribution of benefits and costs*

   The proposed policy should result in a potential Pareto improvement. As it is intrinsically difficult to apply the Pareto potential criterion in a quantitative manner, a more qualitative assessment of the size and distribution of the costs and benefits of agri-environmental measures may reduce the potential for conflict. If, for example, an environmental measure restricts trade, but imposes a greater burden on foreign competitors than domestic producers, and alternatives exist which would allow the burden to be more equally shared, one may argue in favour of adopting the alternative. Likewise, when environmental policies offer widespread benefits and their costs are borne by few affected parties, domestic policy measures are less likely to become the subject of criticism in the WTO as it is easier to target the affected parties for direct compensation.

Adherence to these guidelines of policy design will ensure that agri-environmental policies do not unduly distort international trade and could also reduce the likelihood of dispute in the WTO. However, how these guidelines can be operationalised and implemented in the WTO context is less obvious. In many instances decisions would most likely have to be made on a case-by-case basis, and it might be difficult in practice to find a generic and practical framework.

VI. Conclusions

In response to increasing public awareness and concerns as of the environmental impacts of farming, agri-environmental measures are assuming a more prominent role in agricultural policy design in most OECD countries. Environmental programmes may either tend to reduce or to increase agricultural production, depending on the nature of the programmes and the technical relationships between agricultural and environmental outputs. The empirical evidence presented in this paper suggests that, although environmental payments are not the dominant category in the WTO green box in any OECD country, they have a statistically significant positive effect on domestic production and international agricultural trade. There are a number of open questions regarding the trade-offs and synergies between environmental protection and trade effects and the legitimacy of domestic policies currently classified in the "green box". A key conclusion is that green box criteria with respect to environmental measures are insufficient to ensure the production and trade neutrality of these programmes. The compatibility of some environmental programmes with WTO provisions could be questioned.

Several refinements of the existing eligibility criteria for environmental policies might have to be addressed in the current Doha Round of multilateral trade negotiations. For example, the notion of "non- or minimally trade-distorting policies" could be operationalised by required that notifying countries have to prove that the proposed policy is the least trade-distorting one among the alternatives that allow them to achieve a certain environmental outcome; the extent to which support linked to production constitutes price support; how voluntary environmental programmes can be integrated in the green box and how trade-correcting policies can be allowed for. Moreover, the distinction between "trade-correcting" and "trade-distorting" environmental policies warrants more careful scrutiny. Correcting for domestic externalities does not always result in net gains in global welfare and the gains/losses are unequally distributed among trading partners. Only trade-correcting environmental policies which are environmentally efficient, cost effective and least-trade distorting should be allowed to continue to enjoy green box exempt status. Disaggregated sectoral empirical case studies could be useful in identifying such policies and analysing the trade effects of achieving environmental targets with different types of policy measures, such as quantitative restrictions on inputs, payments or cross-compliance programmes. International organisations such as the OECD could play a pivotal role in developing and implementing practical guidelines of good agricultural and environmental policy practices.

Annex Table 1. Classification of the main environmental policies in the Green Box and OECD PSE/GSE

Country	Name and description of measures	Year	Amount (mil. US$)	Classification in OECD PSE	Classification in OECD GSSE
Australia		2000			
	National Landcare		47.9		Infrastructure
	Bushcare		52.9		Infrastructure
	National Rivercare Programme		13.6		Infrastructure

	Murray-Darling Basin Initiative		83.1		Infrastructure
	Environmental services for agricultural industries (Western Australia)		14.0		Infrastructure
Canada	Prime Vert; Farm Environmental Stewarship Programm (New Brunswick)	1999	18.9	Payments on constraints on fixed inputs	
Czech Republic	Support for bee keeping	2000	2.1	Payments on unlimited area	
	Support for Ecological Agriculture		2.3	Payments on constraints on variable inputs	
	Maintenance of agricultural land		86.5		
	Support for cattle, sheep, goat and horse farming on permanent grasslands		15.2	Payments on limited area	
European Union	Protection of environment and preservation of the countryside, control of soil erosion, extensification, aid for environmentally sensitive areas; support and protection of organic production by creating conditions of fair competition; aid for forestry measures in agriculture; conservation of genetic resources in agriculture.	1999	5819.5	Payments based on area/headage (7%); payments based on input use (25%); payments based on input constraints (68%)	
Hungary	Assistance to the protection of arable land	1998	7.0	Payments on fixed inputs (50%)	Research (50%)
	Assistance to the establishement of environmentally friendly crop structure		2.1	Payments on constraints on a set of inputs	
Iceland	Environmental programmes; afforestation	1999	2.9	Payments on constraints on fixed inputs	

Annex Table 1. Classification of the main environmental policies in the Green Box and OECD PSE/GSE (cont'd)

Country	Name and description of measures	Year	Amount (mil. US$)	Classification in OECD PSE	Classification in OECD GSSE
Japn	Payments for conversion from rice production: payments for maintaining paddy fields in environmentally good condition through growing any plants other than rice or other appropriate management.	1999	1024.6	Payments on constraints on fixed inputs	
	Support programmes for reduction of environmental burden due to dairy farming: payments to dairy farmers who practice appropriate management to tackle environmental problems		58.8	Payments on fixed inputs	
Korea	Payments for the prevention of soil erosion, soil acidification (soil conservation)	1999	0.07	Payments on variable inputs	
	Management of livestock wastes(purification of livestock excretions for prevention of water pollution)	1999	0.1	Payments on constraints on fixed inputs	
	Direct payments for environmentally friendly farming practices	1999	0.03	Payments based on area or headage	
New Zealand	Soil conservation	2000	4.3	Payments on constraints on fixed inputs (50%)	Inspection (25%); Infrastructure (25%)
Norway	Subsidy to Ecological Production. Subsidy to research on, and to farmers changing to, ecological production methods	2000	4.8		Research
	Subsidy to producers who refrain from field work on areas exposed to erosion in autumn.		17.0	Payments on constraints on a set of inputs	
	Subsidy to Summer Dairy Operations in Mountainous Regions		2.4	Payments on constraints on fixed inputs	
	Subsidy to Production on Steep Areas		4.0	Payments on fixed inputs	
	Fixed Area Support to Ecological Production		1.8	Payments on constraints on a set of inputs	

Annex Table 1. Classification of the main environmental policies in the Green Box and OECD PSE/GSE (cont'd)

Country	Name and description of measures	Year	Amount (mill. US$)	Classification in OECD PSE	Classification in OECD GSSE
Switzerland	Payments for special ecological services	1998	517.2	Payments on constraints on a set of inputs	
	Payments for summer pasturing		46.1	Payments on unlimited area	
	Payments for set aside pasture land and renewable raw materials		12.9	Payments on limited area	
	Payments for extensive cereal production		29.8	Payments on unlimited area	
United States	Agricultural Conservation Program	1998	23.0		
	Emergency Conservation Program		26.0	Payments on fixed inputs	
	Wetland Reserve Program (also see NRCS part)		121.0	Payments on constraints on fixed inputs	
	Wildlife Habitat Incentives Program		5.0	Payments on farm services	
	Conservation Programme Technical Assistance		41.0	Payments on farm services	
	Environnemental Quality Incentives Programme		61.0	Payments on farm services; payments on constraints on a set of inputs	

PSE is the Producer Support Estimate. It measures monetary transfers to farmers arising from agricultural support policies. GSSE refers to General Service Support Estimate. It measures monetary transfers to general services (research, marketing and promotion, infrastructure) provided to agricultural sector collectively.

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