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Impact of Trade Liberalisation on the Environmental Sustainability of Agriculture in the Countries Applicants to EU Accession

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Introduction

The paper aims to analyse the environmental and agricultural trade policies in the Central Eastern European countries (CEECs) in the process of legislative and institutional harmonisation with the European Union (EU). The analysis focuses on the policy linkages between environment and agricultural trade in view of the CEECs - EU environmental and trade agreements.

Environmental policy framework in the CEECs has been defined based on a weak analytical background. There has been done very little in the field of environmental economics in the CEECs, due mainly to the fact that before 1989 data on pollution were kept confidential, and after that the main concern has been the development and modernisation of the environmental monitoring activity, and much less other issues (e.g. environmental performance of firms, cost-benefit analysis of introducing abatement pollution equipment, mechanisms of incentives and penalties). CEECs have started only during the last decade to adopt policy approaches towards sustainability based on the integration of the environment into sectoral policies and the reshaping of social and economic behaviour through the use of a broader range of instruments and by promoting the principle of shared responsibility. Environmental parameters, analytical methods and monitoring procedures need considerable improvement.

As associated countries, CEECs have paid increased attention to trade agreements with the EU. Still, the linkages between trade and environment have only started to be considered by researchers and policy makers. The most tackled related issue has been the harmonisation of the part of acquis communautaire within agricultural sector that is closely linked with environment, mainly the acquis related to sanitary-veterinary, plant health, animal nutrition and agricultural markets legislation.

Analysing the relationship between environmental policies and agricultural trade might benefit the CEECs by increasing their competitiveness and enhancing their agreements with the EU on

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environmental and trade issues. The convergence of agri-environmental policies and the approximation of the agri-environment legislation are essential components of the integration of CEECs' markets into the European single market. The agri-environmental policies in the CEECs should be shaped based on their current framework, on the EU agri-environmental policy instruments, on the EU enlargement policy and the agricultural trade relationship between the CEECs and the EU.

The paper is structured in two main parts: firstly, we introduce the state-of-art of agri-environmental policies in the CEECs; secondly, we conduct an analysis of the main methodologies applied to assess the linkages between environment and agricultural trade and we discuss their appropriateness in the case of the accession countries.

The CEECs agricultural trade and environmental policies in the context of EU enlargement

Brief account on the EU enlargement process

Enlarging the European Union from 15 to 28 countries will bring with it at least a further 170 million inhabitants, a 58% increase in land area, a 7% increase in the GDP and a unique set of environmental problems and assets.

The Copenhagen European Council of 1993 set the political and economic criteria for accession to the EU. Accession negotiations have been formally launched with Bulgaria, Cyprus, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Romania, the Slovak Republic, and Slovenia; although Turkey's candidacy was recognised in 1999, negotiations have not begun.

The first step towards future EU enlargement involved the negotiation of Europe Agreements (EAs). They form the institutional framework for trade integration between the CEECs and the EU and govern economic aid and political co-operation between the EU and the applicant countries.

The trade provisions of the EAs, called the Interim Agreements (IAs), have been implemented in each of the CEECs. The main objectives of these agreements are the creation of bilateral free trade areas for non-agricultural products within a period of ten years, providing also for some liberalisation of agricultural trade, close compatibility of economic laws and practice, and the development of a framework for political dialogue and economic co-operation. The basic liberalisation principles embodied in the EAs are preferential treatment, asymmetric reductions in tariffs and the respect of rules of origin.

Protocols on reciprocal tariff concessions on agricultural products entered into force on 1 July 2000 with Bulgaria, Estonia, Hungary, the Czech Republic, Latvia, Lithuania, Romania, the Slovak Republic, and Slovenia, and on 1 January 2001 with Poland. These protocols have raised the share of CEEC duty-free agricultural exports to the EU to 75%, and have raised the share of EU duty-free exports of agricultural products to the CEEC to 61%. Further negotiations are in progress.

The negotiations concern the 31 chapters of the *acquis communautaire* and include requests by the candidate country for transitional periods for certain laws and rules; reports on progress to date were last issued in October 2002.

The negotiations in the environment chapter were opened with most of the candidate countries during 2000 and 2001. By the end of 2001, the negotiations were provisionally closed with nine countries: Cyprus, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Slovakia and Slovenia. During 2002, the environment chapter has been closed with Malta and substantive progress has been made in the negotiations with Bulgaria (chapter opened to negotiations under the Belgian Presidency) and Romania (chapter opened to negotiations under the Spanish Presidency). In addition to provisionally closing the environment chapter, it is also important to integrate and involve the candidate countries in the development of EU environmental policy already before they

become members. Most candidate countries have already joined the European Environment Agency (EEA) and have, in practice, started the co-operation in 2002.

The negotiations so far cover the environment legislation that was in force at the end of 1999; legislation adopted after that date still has to be negotiated. As EU environmental legislation consists of almost 300 pieces of law and has impact on several other policy areas, it is an important part of the 'acquis'. EU environmental rules and standards will apply to the new members in the same way as they do to current members. There will be no lowering of standards – a basic principle that applies to all aspects of the enlargement process. Environmental dumping, competitive advantage of lower environmental regulation when selling goods to the Internal Market, will not be allowed.

The principle is that the candidate countries should be able to take on board and implement all EU environmental legislation by the time they become members. However, at the same time the EU has acknowledged the specific problems the candidate countries are facing. Some of the EU laws require heavy investments, and thus transition periods will be needed to implement them. For financial or practical reasons it can be impossible to make these investments, for example build required wastewater treatment plants, in a very short period of time. There are certain pieces of environmental legislation for which no transition periods have been, or will be, accepted because of their particular importance. These include framework directives on water and air, as well as directives on nature protection, access to information and environmental impact assessment.

The candidate countries need to strengthen the capacity of their environmental administrations to be able to implement and enforce the EU legislation. In order to assist the countries the Commission has developed an action plan for each negotiating country to identify the next steps needed to achieve an adequate level of administrative capacity by accession. The EU's main tool in providing technical support is the Twinning system, part of Phare programme. It helps the candidate countries develop modern and efficient administrations with the structures, human resources and management skills needed to implement the EU legislation to the same standards as in the current Member States.

The EU pre-accession support to the candidate countries and other external assistance will meet part of the total investments needs. However, candidate countries will also have to consider other sources of funding. These include loans from international financial institutions, such as World Bank or European Bank for Reconstruction and Development (EBRD), bilateral grants and credit schemes or foreign direct investments.

Agri-environmental policies in the CEECs

The issues discussed in this section (e.g., availability of data needed to analyse the effects of various policy instruments) constitute the main reasons for the lack of applied methodologies to measure trade-environment linkages in the CEECs discussed in the second part of the paper. As data on trade between the CEECs, EU and third countries rises few availability issues, reliable environmental data is still highly missing for most of the CEECs. There are potentially a large number of indicators that could be developed to help quantify the various components and linkages in the agri-environmental framework. In the case of most CEECs, a more or less complete database exists and allows to calculate some indicators, nevertheless problems of data definitions, quality, the regularity of data collection and methods of indicator measurement remain obstacles to progressing the work on most of agri-environmental indicators (see Annex. Agri-environmental data constraints).

Intensive agriculture has negatively affected the fertility and quality of soil, has accelerated its erosion, and has disturbed the ecological equilibrium of the rural landscape. Pressures on the environment from agricultural production decreased during the transition due to lower consumption of inputs (mainly fertilisers and pesticides), contraction of large-scale operations created under the previous regime (livestock complexes) and due to a less intensive agricultural land use structure. At

the same time, due to the reduction of government funds for support of irrigation, land amelioration and lack of producers' own funds to finance these activities, soil quality declined. The recent improvements in the environmental situation are the side effects of transition, and, other things constant, they are not sustainable over the longer term as economic pressures on producers decrease, providing more production incentives and enabling increased use of inputs.

Monitoring of air, water, and soil is still inadequate. Moreover, analytical methods are sometimes incompatible; there is a general lack of comprehensive quantitative information about pollution levels. Still, existing information is sufficient enough to identify *hot spots* that most deserve immediate response, although improved monitoring is necessary to formulate the most cost-effective solutions. While toxic emissions and discharges, which are a known risk to health should be dealt with on an immediate basis, a gradual approach should be adopted to enforcing environmental standards. In the coming years, the need to comply with more severe environmental standards and compliance with international conventions would demand the introduction of the state-of-art technologies in the CEECs for pollution abatement.

The significance of nonpoint source (NPS) type pollution in the CEECs is shown by degradation of several lakes and reservoirs due to eutrophication, agricultural run-off entering water bodies, forestry drainage due to inadequate use of pesticides, accelerated sedimentation due to improper farming practices on fragile soils and steep slopes, acidification of aquatic systems from nitrous oxides and sulphur dioxide emissions occurred due to acid rain and through leaching from affected land.

NPS pollution problems refer mainly to emissions by small sources (e.g. farms) and include nutrient pollution, pesticide pollution, sedimentation, and hazardous and solid waste. Monitoring individual emissions associated with farming activities and responsible for environmental degradation is not possible due to the number of sources, the diffuse character of pollution and stochastic elements (e.g., weather). Therefore, the environmental regulator who seeks to implement a given environmental policy can measure the ambient pollution at specific 'receptor points', but cannot assign any specific part of the pollutant's concentration to a specific polluter in case of more than one polluter of the same pollutant.

Braden and Segerson (1993) refer to problems characterising NPS pollution as regards the lack of information (we choose this classification among the several existing ones, due to its relevance to the CEECs situation):

- problems related to monitoring and measurement. These are due mainly to factors such as regulator's equipment and personnel limitations. Also to inability to enter the polluter's premises, separate damages across farms and subsequently assign liability. The large number of farms contributing to the problem also decreases the possibility of farms co-operating to reduce pollution levels and the likelihood that an individual firm, whose contributions are small relative to the total, will ignore/ deny the impacts of its practices on resource quality (Tomasi, Segerson and Braden, 1994) and

- problems related to natural variability (associated to weather or topographical conditions) that result in stochastic pollution processes.

These problems explain the still modest control of NPS in the CEECs, and in particular, actions to regulate pollution from agricultural sources. Policy-makers in these countries face difficulties in updating traditional pollution control strategies and regulatory approaches in order to address NPS problems. In the case of agricultural NPS pollution, due to the high cost of monitoring individual pollutant discharges, transaction costs (research, information gathering and analysis; enactment of enabling legislation including lobbying costs; design and implementation of the policy; support and administration of on-going programs; monitoring/ detection; and prosecution/ inducement costs) (McCann and Easter, 1999) associated with regulatory policies are particularly high.

Besides, in the CEECs, economic activities that are responsible for NPS pollution problems, agriculture in particular, have substantially been, and are still, although to a lesser extent, exonerated from mandatory regulation, and have not been confronted by effective economic incentives aimed at internalising the social costs of pollution. On the contrary, rather than addressing market failures and promoting a more sustainable use of natural resources, agricultural policies in transition countries have often added further distortions, and by so doing, have often worsened the misuse of resources.

Designing policies to achieve efficiency (first-best outcome) is often impossible because the relationship between economic damages and nonpoint pollution is seldom known. Instead, policies can be designed to achieve specific environmental goals (such as reducing ambient pollution levels or reducing fertiliser applications in a region) at least cost, given the policy instruments available to a resource management agency, relevant policy transactions costs, and any other political, legal, or informational constraints that may exist (second-best outcome).

There are difficulties associated with each of these aspects due to the problems mentioned above. NPS problems must be addressed by preventing the generation of the residuals at their source rather than attempting to control the delivery of the pollutant between its source and final delivery as can be considered with point-source pollution problems.

The type of environmental policy action required in any sector is influenced by the marginal costs and benefits of reducing pollutant levels. The inability to assess the costs of the environmental damages stemming from agriculture makes it difficult to determine the level of abatement effort necessary and the potential acceptability of the instruments attempting to achieve that effort.

Political acceptability of any environmental policy in agriculture is also influenced by the composition of the polluters. In the CEECs, for instance, environmental problems arising from agricultural production are caused by a large number of farms, the majority of which are family-owned operations with low financial means. Given the general need to continue to support these farms and the influence of the farm sector to get such support, any potential policy instrument will need to consider such political realities. Still, small-scale farming in the CEECs pollute least compared to agricultural associations and state farms, as they usually use lower quantities of potentially polluting inputs. Nevertheless, NPS pollution does not depend only on the quantity of agricultural inputs used, but on farm location, inputs' application timing, technological practices, all corroborated with stochastic factors, which show that, after all, size of pollution source is necessary, but not sufficient in explaining environmental impacts.

The nonpoint nature of most agricultural externalities limits the applicability of conventional policies used to combat point-source externalities. NPS pollution problem requires the use of others than standard instruments of environmental policy (Pigouvian taxes, tradeable emission permits, emission standards) as incentives for dischargers to follow socially-desirable policies (see Griffin and Bromley, 1982).

We give a brief review of policy instruments aimed at controlling pollution from agricultural diffuse sources and their applicability in the CEECs, focusing on the instruments introduced through the reforms of the Common Agricultural Policy (CAP), reforms aimed, inter alia, at integrating environmental protection into agricultural and rural development policies.

Regulatory approaches can be classified according to the reference basis adopted for setting policy measures, namely estimated individual pollutant discharges (*indirect regulatory approach*) or observable total discharges (*direct regulatory approach*).
Policy instruments consistent with the *direct regulatory approach* typically take on the form of

- *ambient tax/subsidy policy schemes*[2] that, broadly speaking, depend on deviations between measured and desired ambient pollutant concentrations. Each polluter pays a tax that varies

[2] Segerson (1988), Cabe and Herriges (1992), Xepapadeas (1991).

proportionally with changes in the ambient concentration. Only information about the pollutant at the receptor site is required rather than emission levels of each polluter and, in addition to the reduced data needs, the mechanism is also budget balancing. This approach is less politically acceptable, however, given the separation between behaviour and penalty and this constraint applies mostly everywhere, not only in the CEECs case.

The *indirect regulatory approach*[3] includes the following instruments:

- *estimated emission charges and standards*[4]. There are no models applied in the CEECs that could provide accurate estimates of the complex fate and transport of most agricultural pollutants and accurate proxies are necessary if this indirect approach is to receive political legitimacy. Even if the estimates were accurate, the costs of regularly applying these complex models, particularly in terms of data collection, would be so large as to outweigh any gains.

- *marketable emissions permit systems*[5]. The diffuse nature of agricultural pollution makes the use of conventional tradable permits infeasible, therefore they have been modified to a tradable permit system on polluting inputs and a point/non-point source trading scheme. Neither of them can be applied in the CEECs due to data constraints.

- *input and output- oriented policy measures*[6]. These include input and output levies, mandatory restrictions on input use, codes of good agricultural practice, reforms of agricultural policies, contingent subsidies (cross-compliance measures), and compensation for abandonment of potentially polluting activities (set-aside). Some of these instruments are going to be applied in the CEECs after accession as they are common instruments applied in the EU.

Codes of good agricultural practice and vulnerable zones. In EC legislation, the term "good agricultural practice" is more commonly applied to the regulation of nitrate pollution from diffuse sources, and in this context, it can be seen as being an application to agriculture of the concept of best environmental practice that is applied in industry (Nitrate Directive (91/ 676/ EEC).

Reforming agricultural policies: the EC 1992 agri-environmental programme. As noticed by Brouwer (2000), it is difficult to assess to what extent CAP has affected the course of agricultural development and, in particular, structural changes such as intensification, specialisation, and concentration which are commonly believed to be responsible for observed negative externalities. The agri-environmental programme foresees compensations for farmers who undertake to reduce input use, to change to other more extensive crop patterns and more environmentally friendly production methods, or set aside farmland for at least 20 years with a view to protecting hydrological systems. More than 20% of the total European Union's farmland has been affected by Regulation 2078/92.

Reforming agricultural policies: Cross-compliance measures. Cross-compliance measures require that a producer engages in, or refrains from, specified activities in order to be eligible for other government programs, such as income support programs. The link between farming support and farmers' environmental performance can be implemented in different ways, with various levels of environmental effectiveness. Batie and Sappington (1986) identify two general approaches: the red ticket approach, where eligibility for certain benefits is made contingent upon the farmer attaining a given environmental standard or set of standards, and the green ticket approach, where farmers become eligible for higher levels of support if they comply with or exceed a given environmental standard. EC introduced cross-compliance measures through Agenda 2000, as a Member States' policy option. Cross-compliance is stated by the European Commission as one of the elements which has made the CAP truly green. Attaching environmental conditions to farmers' support

[3] See seminal papers of Griffin and Bromley (1982) and Shortle & Dunn (1986).
[4] Shortle and Dunn 1986; Dosi and Moretto 1993; Shortle and Abler 1994.
[5] Taylor et al., 2001.
[6] Dosi and Zeitouni, 2000.

payments is a way of improving their environmental performance. This approach is given new emphasis following the recent changes in the CAP. Cross-compliance may be seen as a means of addressing concerns such as the protection of water, soil and air, landscape change and the conservation of wildlife.

Land retirement (set-aside). Land set-aside, is one of the options available for reducing agricultural harmful impacts upon groundwater. European Union introduced a voluntary environmentally oriented set-aside program within the agri- environmental program established through Regulation 2078/ 1992. The environmental effectiveness of set-aside programs depends on the degree of correlation between farmland productivity and farmland environmental sensitivity, as well as on the foreseen compensation for land retirement.

No single economic instrument emerges as the ideal choice for reducing pollutants from agricultural production. Each are appropriate under certain circumstances but none by itself adequately addresses the informational and uncertainty problems associated with diffuse-source pollution prevalent in agriculture. For such problems, the costs of monitoring and enforcing a given policy are generally inversely related to its effectiveness in meeting the environmental target at minimum total abatement costs. Performance-based instruments such as emission and ambient charges are targeted directly at environmental quality but suffer from measurement problems, while design-based instruments such as input taxes can be implemented more easily but suffer from the indirect relationship between the chosen design base and environmental damage.

Current CEECs' policies have started to adopt an approach towards sustainability based on the integration of the environment into sectoral policies and the reshaping of social and economic behaviour through the use of a broader range of instruments and by promoting the principle of shared responsibility. The process of increasing environmental awareness has started and has been linked to the EU pre-accession process and CEECs' being part of world conventions on environmental issues. The CEECs' institutions and legislation in the agri-environmental field have been harmonised gradually according to the current EU framework and the process is to continue in the long term.

Trade and environment linkages

General framework

The second part of the paper deals with the policy linkages between environment (component analysed in the first part) and agricultural trade.

The relationship between international trade and environment has received increased attention in recent years, partly due to the stimulus of recent international negotiations on both environmental institutions and trade agreements.

In the past, the two issues, environment and trade have tended to be dealt with separately. Trade agreements, such as the General Agreement on Tariffs on Trade (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). Many economists (such as Bhagwati and Srinivasan, 1996) have argued that this was both efficient and prudent. Efficiency follows from the policy targeting literature, which demonstrates that trade problems are best dealt with using trade policy instruments, and environmental problems with environmental policy instruments. And prudence follows from concerns that linkage may slow down trade negotiations or create new avenues through which special interest groups can block imports to protect their profits at the expense of consumers.

One of the earliest manifestations of trade and environment linkages was the introduction of environmental issues into the GATT context. It was accepted that there was a need to examine the

links between trade and environment and to establish appropriate procedures for this examination. Although trade considerations were predominant, one of the main aims was expected to help eliminate possible contradictions between trade policies and domestic, as well as international environmental policies, and make them mutually supportive. Trade and environment links have been formally under examination at the GATT (and later, World Trade Organisation, WTO) since 1991.

A new era for the acknowledgement of the relationship between trade and environment started with the creation of the World Trade Organisation (WTO) in 1994. In the preamble of the new constitution, the Marrakech Agreement establishing the World Trade Organisation, an explicit link between the two issues has been made, stating sustainable development, environmental protection and conservation of scarce resources as explicit objectives and an integral part of the multilateral trading system. The WTO's Committee on Trade and Environment (CTE) has been established. Environmental concerns gained also more weight in the process of trade negotiations. At the Fourth Ministerial Conference, which took place in Doha, November 2001, ministers adopted a declaration that includes several aspects of trade and environment. The commitment to the objective of sustainable development has been reaffirmed, pointing at the requirement that "the protection of the environment and the promotion of sustainable development can and must be mutually supportive" (Doha Ministerial Declaration). Moreover, within the work programme identified at Doha, the mutual supportiveness of trade and environment is emphasised as a key target and the CTE is given the task of pursuing the necessary work in order to have sustainable development appropriately reflected. However, concrete actions still have to be negotiated.

There has been a very strong movement towards increased linkage between international trade and environment in the EU as the distinction between purely domestic and international policy has gradually eroded. This view applies consequently to the CEECs trade relationships with the EU and carries an increasing weight.

European Commission (EC) opinion presented at WTO Meeting on Trade and Multilateral Environmental Agreements (2000) considers that unilateral measures to deal with global and transboundary environmental issues should be avoided. Also, it firmly subscribes to the fundamental principle that environmental measures should not be abused as disguised restrictions on trade ("eco-protectionism"). The EU, like many WTO Members, believes that Multilateral Environmental Agreements (MEAs) are the most effective way of tackling international environmental problems. Given the growing interface between MEAs and WTO rules, uncertainty over the relationship between the two sets of rules is increasingly affecting MEA negotiations. EC considers that WTO rules and MEAs are separate but equal bodies of international law and that, accordingly, MEAs are not subordinate to WTO rules and vice versa. Trade measures within MEAs have tended to become more nuanced over time as environmental and economic contexts have been better understood, as confidence in international legal regimes has grown, and as sustainable development has come to be a more central guiding concept. In general, trade measures can be an appropriate policy measure to use in multilateral environmental agreements, when the international community has agreed to tackle and manage collectively international trade as a part of the environmental problem; when trade controls are required to make regulatory systems comprehensive in their coverage; to discourage free-riding which can often be a barrier to effective international co-operation; and to ensure compliance with the MEA.

There are opinions against linking trade and environmental issues. Bhagwati (2000) makes the very important point that if there are "social" issues connected with trade liberalisation that require global co-ordination, then the solution may not be to burden the WTO ("burdening trade treaties and negotiations with social agendas"), but to reinforce the intergovernmental organisations set up to address these issues, United Nations Environment Programme (UNEP) amongst them. Comparing policy instruments to stones, he says that "trying to kill two birds with one stone is a recipe for missing both birds". He proposes "fashioning new stones", e.g. in the form of a possible World Environmental Organisation (WEO). Bhagwati's arguments against linkage are questioned

in a number of ways. Few have difficulty with the proposition that local environmental problems should be addressed locally but, as Cooper (2000) points out, the problem lies with transboundary environmental externalities (spillovers) and the provision of international environmental public goods. For these issues the case against linkage is argued to be much less clear cut.

Griffin (2000) considers that "it is almost never optimal to use trade policy instruments to protect the environment. […] Indeed the imposition of trade sanctions to correct environmental externalities is more likely to lower well being than to raise it". He states 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. Where environmental externalities cross state boundaries or affect the entire globe, supra- national institutions of governance will be necessary, like the UNEP, which should be used as a forum for global negotiations on environmental issues in preference to the WTO.

Newell, Whalley, and Zissimos (2000) propose the establishment of an entirely new organisation, a World Environment Organisation. They argue that it should have the capacity to internalise global environmental externalities by setting up markets for trading environmental goods. There would certainly be an advantage in a mechanism for co-ordinating both the MEAs and their interface with other multilateral agreements, e.g. trade ones.

Other economists are advocating the trade-environment linkages. Repetto (2000) makes the point that where the first- best solution to these problems- targeted multilateral environmental agreements is not available, the second- best solution may not be to liberalise trade anyway. In these cases linkage can help.

Xepapadeas (2000) notes that where countries are asymmetric in terms of their fundamentals there exist strong incentives not to cooperate, and considers whether trade policy can help with the design and enforcement of multilateral environmental agreements. He suggests that one way of dealing with this problem would indeed be to connect multilateral trade and environmental negotiation.

Zagonari (2000) goes further to indicate the conditions in which welfare will be enhanced by bringing environmental issues directly into trade negotiation.

Runge (1998) states four principles for the conduct of more sustainable trade policies. These have in view the maximisation of the complementarity between trade reform and environmental sustainability; the identification, reduction and, most desirable, internalisation of environmental damages through the polluter-pays-principle or other policy reform for pollution prevention; the uncertainty upon economic and environmental indicators in agriculture implying a proactive set of agricultural trade and environmental policies; clearer definition of property rights in agriculture, respecting not only desirable outputs, but also undesirable outputs including environmental pollution.

There are two ways of analysing agricultural trade and environment policy linkages, as they both may impact on each other.

On one side, agricultural trade liberalisation has led to adjustments in production and consumption patterns and these changes may affect the environment. Agricultural production is dependent on the use of natural resources and modern agricultural systems rely on a wide range of industrial outputs such as fertilisers and pesticides that can affect environmental quality.

The effects of agricultural trade liberalisation on the environment were discussed during the Uruguay Round negotiations. Advocates of liberalisation asserted that environmental quality would improve as a side benefit. For example, some argued that the discipline of the market would cause farmers who formerly received crop subsidies to use less fertiliser, resulting in less water pollution. In contrast, critics of the agricultural trade liberalisation alleged that predominant reliance on market signals would cause environmental degradation. The abandonment of crop and livestock

production on farmlands that provided biological and landscape values has been a frequently cited risk.

These two opposite views appear to be competing hypotheses, but the outcomes are more complex and not mutually exclusive. There can be diverse environmental effects given the different trading regimes, agricultural systems, natural environments, and environmental management programs across countries. There is insufficient information to test either hypothesis for the CEECs. No methodologies measuring the impact of agricultural trade liberalisation on the environmental sustainability of agriculture have been applied (as to my knowledge) in the CEECs.

On the other side, joint production of agricultural and environmental outputs means that agri-environmental policies aimed at internalising domestic externalities may affect quantities produced, trade flows and world prices and may impose burdens on trading partners. A number of conditions have to be met to prove that agri-environmental measures do not distort trade unnecessarily. We mention the following main ones:

- *Legitimising the incentive mechanism used*. Payments for the provision of environmental goods and services - at which point are they distorting trade by giving domestic farmers a competitive advantage over foreign competitors? 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.

- *Probing for less trade-distorting alternatives*. The trade impact of any particular agri-environmental measure depends largely on the extent to which agricultural and environmental outputs are joint products. The jointness of agricultural commodities 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. Agri-environmental policies then have merely *indirect* effects on the production of agricultural products, through their impact on wealth, liquidity, and income risk. 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.

As agri-environmental issues have only a recent history in the CEECs and they have only started to deal with internalising domestic externalities, there is no way that CEECs environmental policies burden their trading relations. And, as the most likely outcome of the accession process is EU integration, harmonisation of EU trade and environmental policies (briefly described in the first part of the paper) will insure that agri-environmental measures are not going to be used by the CEECs as trade barriers after accession. On the other side, there is no reliable information dealing with the issue of the CEECs' being persecuted by means of environmentally-related trade barriers by any of their trading partners.

Agricultural trade effects on environment

The methodological work on environmental effects of agricultural trade introduces a taxonomy of the main types of national trade measures or instruments with potential impact on environment (OECD, 1994):

Tariffs and Related Measures. Tariffs can have environmental effects in discouraging imports of environmentally-beneficial products, technologies and services by raising their prices. Tariffs, particularly when used as one instrument of a policy to protect domestic industries, can distort production and consumption away from environmentally- sustainable patterns. Tariff escalation, where higher tariffs are charged on processed goods than on raw materials, can have environmental effects in their impacts on resource exploitation.

Non-Tariff Measures. Non-tariff measures include quantitative restrictions (such as quotas) on imports; they also include laws, regulations, administrative procedures, purchasing requirements and standards that individually or in combination can affect imported goods. For example, bans on environmentally- damaging goods affect imported goods and have environmentally- beneficial effects. However, non- tariff measures are often less transparent than tariffs and can also discourage imports of environmentally- beneficial goods and distort trade patterns by protecting domestic industries with related environmental implications.

Trade-Related Subsidies. The risk involved with production subsidies is that they can support uncompetitive production on world markets leading to trade and environmental distortions in importing and exporting countries. Export subsidies, which are specifically targeted to promoting exports of domestically- produced goods, can support the export of beneficial or harmful environmental technologies or goods.

TRIPs. Trade-Related Intellectual Property Rights (TRIPs) are government legal regimes and procedures which influence trade flows through their effects on the legal protection given to such measures as patents, copyrights and trademarks. TRIPs can modify trade in products that enhance or harm the environment and influence patterns of foreign investment and transfer of environmental technologies. TRIPs can also affect the conservation of domestic varieties of plants and animals and other environmental and biological assets.

TRIMs. Trade-Related Investment Measures (TRIMs) are government measures which influence trade flows through their effects on foreign investment. They include rules regarding local content requirements, export performance, technology transfer, and research and development by foreign firms. TRIMs can affect the use or transfer of environmental products and technologies through foreign investment and the environmental performance of foreign firms.

The OECD (1994, 1999) and others (Runge, 1994, Abler and Shortle, 1998) have developed frameworks to decompose the effects of agricultural trade liberalisation on the environment into component parts: scale effects, mix effects, externalities feedback effects, policy effects and technology effects.

Scale effects arise from the total amount of economic activity, holding constant the mix of agricultural and non- agricultural goods. The theoretical basis for this type of effects is that changes in trade that expand national and world output draw down the stock of environmental capital, ceteris paribus. For most countries, analyses of trade liberalisation estimate very small changes in the total scale of economic activity, usually in the 1- 2% range (Schott, 1994). The concept has contradictory outcomes: environmental systems are analysed at local level and afterwards aggregated into policy-relevant areas, neglecting the heterogeneity of the natural resource base and the diversity of production systems, but capturing all significant direct and indirect effects at national or global level.

Mix effects arise from changes in the mix of agricultural and non-agricultural goods produced and consumed, holding constant the scale of economic activity, e. g., a decrease in the share of food production and land in production, and an increase in manufacturing. Trade liberalisation is considered to remove preferences for agriculture over other industries, and any effects on farm product mix, i.e., decoupled payments from specific crops. If the products that increase after liberalisation have different environmental effects than those that decrease, environmental quality may change. To model this, one must have reliable estimates of the elasticities of substitution

between agricultural and non-agricultural goods. The models are usually computable general equilibrium or large scale econometric models of global agricultural markets (Ervin, 1999). The output of these models are generally too aggregate to decompose the effects back to nations and meaningful environmental levels of analysis.

Externalities feedback effects. This category captures the feedback effects on production or consumption of environmental externalities (e. g., run-off of fertilisers and pesticides from farms to watercourses) or other externalities induced by trade liberalisation, holding constant the influences of scale, mix, and other categories. The most frequently modelled trade-induced externalities in agriculture are changes in fertiliser and pesticide use. Most studies do not capture the full set of environmental externalities arising from liberalised agricultural trade. The likely reason for this deficiency derives from missing data.

Policy effects caused by changes in environmental or other policies, e. g., regulations on animal manure disposal by confined animal facilities. This category includes shifts in environmental policies induced by trade liberalisation. Trade changes income or the environmental capital stock, either of which can induce changes in environmental or other policies. Trade may also affect other policies that have environmental consequences. Environmental policy responds to shifts in the supply of and demand for environmental quality. Several studies on developed countries concluded that for every 10 percent increase in income, there is approximately a 4% rise in the demand for environmental quality (Kristom, 1995). The increased demand can exert pressure on the policy process to tighten environmental standards. Ervin, 1997 and Runge (1998) and Kolstad (2000) state that there is no clear evidence on the growth-income-environmental quality relationship, as income gains from trade are necessary, but not sufficient to improve environmental quality.

Technology effects induced by the development and adoption of new products, new production processes, and new pollution abatement or environmental service technologies, e. g., lower irrigation needs due to drought- tolerant plants. This category includes the effects of trade on the environment caused by the development and adoption of new products, new production processes, or new pollution abatement technologies that cause both environmental benefits and costs. The introduction of hybrid seed, chemical fertilisers, synthetic pesticides, animal antibiotics, precision farming systems, and biotechnology illustrate the broad class of effects.

Ervin (1999) makes a methodical taxonomy of methodologies used to estimate the environmental effects of agricultural trade liberalisation. The choice of approach depends on the motivating research questions, the geographical setting, and often on available data.

Partial equilibrium models – use econometric (static) supply and demand functions for agricultural commodities to estimate changes in inputs (e. g., chemicals, land, water), outputs, and prices; generally infer changes in environmental loadings with coarse geographic resolution.

General equilibrium models – construct large- scale, static econometric models of the agricultural and non- agricultural sectors that incorporate the horizontal relationships between the sectors and the vertical relationships with input supply and processing; estimate market- clearing price and quantity adjustments; use input and output effects to infer environmental changes; aggregate levels of geographic resolution.

Mathematical programming models – develop static models of agricultural production and resource use for major regions or a nation that allocate resources based on satisfying an objective function (e. g., profit maximisation) subject to a set of constraints, such as amounts of land in various classes; prices and costs generally determined outside the model; few if any horizontal or vertical economic linkages included; environmental effects often imputed from estimated input and output shifts.

Economic- environmental simulation models – develop econometric models of production input and output choices based on farmer behaviour; prices and costs determined external to model; few horizontal or vertical economic linkages; economic model is linked to environmental process

models that estimate changes in loadings and ambient environmental conditions; can include risk dimensions and static and dynamic environmental feedback effects on production and consumption.

Studies on agricultural trade effects on environment have been targeted at global, national, regional and local levels.

Bhagwati (2000) proposes that the linkage between trade and environment should be analysed based on a taxonomy built around two sets of distinctions: whether the environmental damage or pollution is 'domestic' or 'international' and whether the country addressing it follows egotistical (i. e., its own advantage) or altruistic (i. e., others' advantage) objectives.

Some authors consider that the *global level* is too aggregative to assess environmental effects. Antle et al, (1994) state "will the movement towards trade and domestic policy liberalisation in agriculture lead to environmental degradation? The location- specific nature of the interactions between agricultural production and the environment, and the changes in the intensity and location of production brought about by policy liberalisation, suggest that the answer to this question is to be found in careful empirical research, not in stylised generalities".

Large- scale modelling analyses do not capture the diversity of adjustments necessary to forecast environmental changes. For example, analyses that project the production impacts of URA implementation in the full European Union are of limited use. The heterogeneity of production adjustments and natural resource conditions across EU countries requires more disaggregation to anticipate environmental effects.

Attempts to aggregate the local analyses for policy relevance usually suffer serious data problems. Ervin (1997) suggests that the global modelling studies might be used as a filter to identify the countries/ regions where pressure is likely to be heaviest. Then, local analyses can be conducted using programming or simulation models to estimate the environmental effects with the benefit of the aggregate economic parameters.

Some of the most prominent studies of the global production and environmental effects of agricultural trade liberalisation have been done by Kym Anderson. Anderson and Strutt (1997) use estimated production changes for major countries and regions from a partial equilibrium econometric model of world food markets. The estimates are for an admittedly extreme policy scenario, multilateral reform consisting of the removal of farmer support policies in all industrialised countries and US land set asides in 1990, and full adjustment in that year. Hence, the effects should be interpreted as extreme values of possible adjustments. The findings from this analysis lend support to the notion that the global production effects will be small.

The authors argue that the environmental gains from contractions in chemical and livestock intensive systems in the developed countries are likely to outweigh the losses from expansions in the sparsely populated developing countries.

Partial equilibrium models applied at global level have limitations, including the absence of linkages to non- agricultural sectors for feedback effects induced by trade liberalisation. They also have advantages, including the use of supply and demand elasticities that are more reliable than elasticities of substitution and transformation that are used in general equilibrium models (Ervin, 1999).

There is one type of environmental effect from increases in economic scale for which aggregate models seem indispensable, namely if the environmental resource is truly global in scope, for example the earth's climate, then aggregate models are needed to capture the shifts in total pressure, such as greenhouse gas accumulations (Whalley, 1996). Still, regional and local analyses would still be needed to understand how the global pressure plays out in different areas. These types of global environmental processes are likely to be affected little by agricultural trade liberalisation.

Among the studies done at *national level*, the study of Beghin, Dessus, Roland- Holst, and van der Mensbrugghe (1997) is leading. They use a general equilibrium approach to examine the linkages

between growth, trade and the environment in Mexican agriculture. Their analysis decomposes the changes in pollution emissions induced by changes in the sectoral mix of production, in the effects of technology on emission intensity, and aggregate scale effects. A possible drawback of the model is that the environmental policy change is performed as the imposition of excise/ emission taxes, but such taxes are rarely observed in practice (also, a hypothetical case in the paper). Their conclusion is that implementing trade liberalisation in countries with weak or ineffective environmental policies or technology development programs could easily lead to cases of serious degradation.

A recent study has assessed the impact of trade liberalisation on agriculture and soil erosion in Sri Lanka (Bandara and Coxhead 1999). This study finds that openness increases the demand for land in tea production, which is a relatively less erosive sector than other crops, and thus has environmental as well as economic benefits for the Sri Lankan economy. In the long run, an increased demand for land has a positive impact on the emergence of land markets and reduces the uncertainty on the returns to land conservation investment.

Lopez (2000) uses a general equilibrium model for the analysis of the impact of trade reform on welfare and the environment in Côte d'Ivoire. He explicitly considers externalities affecting biomass, which is shown to be an important factor determining agricultural productivity. The simulation general equilibrium analysis shows that the agricultural output composition effect dominates the agricultural expansion effect for the case of complete trade liberalisation. Thus, in this case trade liberalisation causes a significant improvement in the rural biomass stock by cutting land area cultivated, increases agricultural productivity, and induces dramatic welfare gains. That is, trade liberalisation is a win–win type of policy in this case. However, partial trade liberalisation that only reduces protection to non-agricultural goods (and does not reduce tariffs to agricultural import substitutes and does not reduce export taxes) causes a further deterioration of the biomass resources and reduces welfare.

The accuracy and integrity of environmental analyses generally improves by moving down to smaller, more homogeneous, regions. Ervin (1997) reviews studies done at *regional level* that show positive and negative, and site-specific environmental effects of agricultural trade.

Analysing environmental effects at *local level* is consistent with environmental scientists point of view, while it is not favoured by economists that consider local analysis less useful for national legislation or international trade agreements. Studies by Antle et al (1996, 1998) develop methodologies for conducting linked economic and environmental analyses at the local level that can be aggregated to regional or national scales. They develop a static spatial model of agriculture-environment interactions, with environment in dual roles of providing inputs (soil nutrients), and of receiving the residuals of agricultural production (pesticide and fertiliser residuals). They consider the local environmental effects (water pollution) and use integrated economic- environment- health simulation models to estimate the trade-off functions for Eucadoran potato- pasture production and U. S. (Montana) wheat- other small grain case studies. The estimated relationships can be used for policy decisions if the relevant political unit corresponds to the meaningful environmental unit. In most situations, this correspondence does not occur and some aggregation is necessary, for example from watersheds to state governments in the US. Aggregation often presents a major obstacle due to missing or incomplete data, and has not been taken for major trade-environment issues. Policy decision- makers can compare the loss or gain in crop output with changes in the environmental variable of interest. Their relative preferences for the two outputs and their risk aversion coefficients are necessary for choosing a socially desired combination. This kind of approaches require detailed production and environmental databases necessary for aggregation and still does not solve the problems raised by aggregating very diverse environmental effects into a meaningful policy decision framework.

Copeland (2000) develops a model to investigate the linkages between trade and environmental policy at both local and global level. In the case of purely local pollution, trade liberalisation without constraints on environmental policy induces a non- co-operative game between countries in

pollution policy. Without any agreement on environmental policy, trade negotiations are unlikely to lead to a point on the Pareto frontier. When pollution is global, countries may be expected to disagree on linkages between trade agreements and environmental agreements. Countries importing pollution- intensive goods have an incentive to try to link trade agreements with environmental agreements, while countries exporting pollution- intensive goods have an incentive to try to obtain a binding commitment to free trade prior to negotiations over global pollution.

Empirical analyses of the agri-environmental changes that accompany trade liberalisation are restricted to those questions for which there is reliable data. For agriculture, that has meant most attention has focused on changes in land cultivation, and shifts in fertiliser and pesticide use. This restricted focus is understandable in the short term. However, when it is clear that shifts in production and trading patterns that derive from liberalisation will induce a broader range of environmental effects, additional analysis is necessary. Often, these added issues do not fit easily into existing analytical frameworks. Researchers will need to include a broader range of these effects in future analyses.

The role of environmental policy in shaping the environmental effects of agricultural trade liberalisation is significant, still not considered by most of the models presented above. Difficulties in modelling the dominant approach of voluntary and compensatory approaches have contributed to this deficiency. A first step to remedy this deficiency is to inventory agri-environmental policies and assess their strengths and limitations in various settings and select the lowest cost ways to protect environment while participating fully in global trade.

Agri-environmental policies effects on trade

As regards to methodological work dealing with the environmental impact on agricultural trade, the environmental policy instruments with potential distorting effects on agricultural trade include regulatory instruments (such as product or process restrictions or bans, technical regulations, resource use quotas), economic instruments (such as environmental taxes and charges, environmental subsidies, deposit-refund systems) and voluntary schemes (such as eco- labelling schemes).

Main studies in this field have been done by Jha et al. (1999), Van Beers and Van den Bergh (1997), Lueck and Haley (1997). So far empirical studies have not provided strong support for the hypothesis that relatively high environmental standards lead to the loss of competitiveness, and to the consequent decrease of exports and increase of agricultural imports. In fact, apart from a few exceptions (Walter (1974) and Van Beers and Van den Bergh (1997)), most studies conclude that environmental costs relative to total production costs are still marginal and have hardly any effect on comparative advantage patterns and therefore on foreign trade (Tobey, 1990 and Vallaru and Peterson, 1997). Lueck and Haley (1997) simulate livestock production changes due to the Nitrate Directive and trade effects. They consider the opposing effects of CAP reform, which stimulate livestock production through lower feed cost, and nitrate limitations which decrease production. The authors estimate that the Nitrate Directive coupled with CAP reform implies possible reductions from 1% for sheep to 12% for pigs and estimates EU losses in livestock trade. One of the drawbacks of the paper is that it does not analyse how alternative nitrate control measures could mediate the trade losses. Some authors speculate that present trends in agri-environmental programmes could be a major factor in distorting agricultural trade by raising production costs and providing justification for restrictive policies abroad (Gardner, 1996). Still, the absolute rise in a country's agri-environmental compliance costs is not sufficient to judge competitiveness effects. That depends upon comparable actions taken by competing exporters world-wide.

We do not develop this part as the CEECs have relatively weak environmental policies that are in no way hindering their trading relations.

EU agricultural trade liberalisation and environmental issues with a view on enlargement

To give a brief classification of agricultural trade models and of related resource and environmental modelling used for analysing the European Union, we use the reviews made by Anania (2001) and van Tongeren and van Meijl (1999). Another analysis of the differences in the different types of models most frequently used today is found in Francois and Reinert (1997).

The Anania paper reviews the models used in the past decade to analyse the expected effects of liberalising agricultural trade with specific reference to the implications for agriculture and agricultural policies in the European Union.

Within a project financed by the EU (FAIR6 CT 98-4148), van Tongeren and van Meijl carried out a study of the main simulation models of international agricultural markets and of the linkages between them and national policy interventions (van Tongeren and van Meijl, 1999; van Tongeren et al., 2001). Under the same project, a series of contributions recently made available analyse models using GTAP to study the expected effects of the CAP reform process (El Mekki et al., 2000), of the enlargement of the EU to include Eastern and Central European countries (Pohl Nielsen and Staehr, 2000) and of the multilateral process of liberalising policies and trade (Francois and Rombout, 2000).

The simulation models utilised in the 1990s to analyse the implications of a trade liberalisation for EU agriculture, all differ in more than one respect; consequently, there are a number of axes along which one could define their taxonomy.

The most important distinction is that between *partial equilibrium* and *general equilibrium* models, the first ones being justified (Anania, 2001) only in cases when the particular product, or group of products, analysed represents such a small share of the overall economic system that a variation in its level of production or use can be assumed to cause no significant variations in other markets. As in industrial countries agriculture accounts for only a small share of GNP, the strength of the linkages of agriculture with other sectors is typically not very strong at the level of aggregation that general equilibrium models tend to employ. An exception may be those linkages than run through markets for natural resources, especially land. In contrast, CEECs witness a relatively high share of agriculture in economic activity. There are, therefore, significant second-round effects to be expected from policies that pave the ground towards the EU enlargement process, and general equilibrium models seem to provide the most coherent way to analyse these.

Both reviews discuss the strengths and weaknesses of the main partial equilibrium models used to analyse the EU agriculture: the EC ones (SPEL/EU-MFSS, SPEL TRADE), Bonn University (WATSIM), INRA (MISS), FAPRI (FAPRI-GOLD), OECD (AGLINK, MTM), FAO (WFM), USDA (SWOPSIM), and several others. Among the general equilibrium models, they mention ECAM, CAPMAT, RUNS, GTEM, GTAP, WTO housemodel, G-cubed that were used and adjusted by several economists to consider specific issues (mainly GTAP, which is the most popular).

Among the main weaknesses of some of the above models, Anania (2001) mentions the flaws lying with some *hypotheses* (EU treated as a “small” country; the way competition and market structure are treated in some models; product homogeneity issue - Armington approach followed most often by general equilibrium models-; indirect representation of trade policies through the use of “equivalent tariffs”; the issue of representing trade policies through explicit modelling - which is, in authors’ opinion, the only effective way to conduct simulations of EU agricultural policies, by modelling the CAP instruments explicitly, one at a time) and the ways of dealing with the *1994 GATT Agreement commitments* (reduction in domestic support; increasing market access; reduction of subsidised exports).

We consider in more detail the models dealing with the EU enlargement. Assessments of the likely impacts of extending CAP to the CEECs have been a popular subject of research and investigations.

The methodology applied varies from using the back of an envelope to computable general equilibrium models. All studies indicate that it would be quite costly for the EU's budget to extend the present CAP to the CEECs.

Which are the best models for simulating the effects of a regional, rather than global, trade liberalisation, as the enlargement of the EU to Central and Eastern European countries? Anania (2001) analyses the weaknesses of some of the models constructed with the specific objective of evaluating EU enlargement. Not being "spatial", most models are structurally incapable of simulating the effects of "discriminatory" trade policies, such as preferential trade policies, the creation of a customs union or the enlargement of an existing one. That said, "non-spatial" models are used to predict the effects of discriminatory trade policies –including the enlargement of the EU to CEECs - by assuming imperfect substitution according to the country of origin of the product. In all cases where discriminatory trade policies cannot be ignored - either because they are themselves the focus of the simulation, or because they are relevant for the markets considered - the model ought, according to Anania (2001), to be a genuinely "spatial" model, i.e. its structure ought to be able to reproduce trade flows between each pair of countries without having to resort to additional hypotheses.

Clearly, spatial modelling provides a richer and more detailed picture of the market, but requires much more data, parameters, bookkeeping and computational effort. Whether the additional effort is justified by additional relevant information is dependent on the kind of problems a model has to tackle. Many policy disputes and policy instruments are bilateral in nature, and international economic relations should be modelled at the same level.

An example is ESIM, where a single region, "rest of the world", is added to seven Eastern and Central European candidate countries and the current EU member states; this "rest of the world" is treated as completely exogenous and is assumed to be unaffected by the enlargement and the associated policy changes.

Using a non-spatial multi-product partial equilibrium model (CEASIM, Central European Agricultural Simulation Model), Frohberg et al. (1998) analyse the entry of Eastern and Central European countries into the EU. CEASIM models eight candidate member countries separately, but considers all the others - EU countries included - as a single unit, and assumes that the equilibrium price in this aggregate is exogenous for the Eastern and Central European countries considered. The analysis is conducted considering the likely effects of different price levels and the introduction of production quotas for milk and sugar in the new member states. The structure of the model, however, does not allow either for changes in trade policies in these countries as a result of enlargement (it is not possible to consider the elimination of trade barriers with the other members, nor the aligning of tariffs and export subsidies), or for border price adjustments following enlargement. Moreover, these are the same regardless of the fact that the exports (imports) of the new members are directed towards (coming from) the EU or towards (from) non-member states. All this renders the hypotheses problematic and considerably reduces the credibility of the results.

Gehlhar (1998) simulated the effects of EU enlargement to CEECs making the tariffs on imports from third countries uniform and eliminating the tariffs on trade between the new Central and Eastern European members and the countries of the EU-15, but left unchanged both domestic support for farmers and export subsidies in the new member countries.

Liapis and Tsigas (1998) unify border protection policies of the new members and EU-15, eliminating trade barriers between them, making support to domestic farmers uniform, but leaving export subsidies unchanged.

GTAP makes the assumption of imperfect substitutability in consumption according to their country of origin, therefore simulations of regional trade liberalisation processes appear linked to implicit assumptions on the homogeneity, or lack of it, of products, which is not always easily justifiable. When GTAP is used to simulate the enlargement of the EU (considered as a single country) to

Central and Eastern European countries, in the best of cases this happens eliminating barriers to trade and exports subsidies between these and the EU, and bringing domestic and trade policies of the new members into line with the policies of the EU (in the latter case totally or only partly, depending on the assumptions made regarding the reform process of the CAP before the enlargement). The simulation will assume that after the enlargement goods produced by the original EU member countries will remain imperfect substitutes of those produced in the new members. However, since these goods are going to be produced within the same market and subject to the same rules and regulations, this hypothesis is hard to justify. Moreover, it can lead to serious distortions in the simulation results. Anania (2001) considers as more reasonable to assume perfect substitutability after the enlargement between goods produced by old and new member countries, or, at least, to introduce a discernible change of the parameters of the model in this direction.

Paarlberg et all (2001) examines five critical aspects of EU enlargement and whether they can be addressed in general equilibrium Ricardo-Viner models of transition economies. Some aspects of EU enlargement fit well into the modelling framework. By design the models are intended to examine the impact of commodity policy changes like introduction of the Common Agricultural Policy. Nevertheless, decisions on how to treat EU direct payments or the magnitude of price changes are not clear, but control the magnitude and pattern of results. Labour market adjustments can also be modelled using this framework, but the assumed closure rule largely determines the direction of impacts. Other issues do not fit well into the modelling framework. For example, while the model can indicate how the land rent changes due to output price changes, it is more difficult to analyse the impact of allowing foreign land ownership. Structural fund expenditures that alter product quality cannot be analysed satisfactorily because goods are treated as homogeneous.

Another attempt to model EU enlargement was made by a group of Danish researchers, using the GTAP modelling framework (Frandsen, Bach and Stephensen, 1996). The authors constructed a baseline scenario of the CAP 2010 as a base for comparison, rather than using the present situation. Looking at the impact on economic welfare, the results indicate that extension of CAP leads to income losses in both the CEECs and the EU as a result of higher taxes in the EU to finance extra costs, as well as due to the loss of efficiency caused by the less than optimal allocation of the factors of production and the patterns of consumption in both regions. In the CEECs, in particular, agriculture expands on the account of industry. The CEECs obtain, however, a significant term of trade gain as well as an income transfer. The overall result is a net loss for the EU and a net gain for the CEEC, the gain exceeding the loss.

Although the models used could be adjusted to take into consideration the environmental dimension, none of the above EU enlargement models tackle the issue. This is mainly related to data availability problem discussed in the first part of the paper.

Analysing agricultural trade liberalisation impact on environment in the CEECs

Before 1990 and at the beginning of the transition period, the CEECs have been affected by two types of distortions: agricultural trade policy distortions and environmental distortions. Trade distortions consist in taxing agricultural exports and protecting manufactures and agricultural import substitutes through import tariffs and/or quantitative restrictions on imports. Environmental distortions arise from the lack of internalisation of the full social value of natural resources due to inadequate institutions and difficulties for implementing and enforcing policies that could off-set such institutional inefficiencies.

During the transition period, the CEECs have been in the process of significantly liberalising their trade regimes by gradually reducing export taxation, eliminating import quantitative restrictions and significantly reducing import tariffs. These reforms have been implemented mostly because of pressures and financial support from international organisations in the context of broad-based

programs of economic liberalisation usually referred to as “structural adjustment” (World Bank, International Monetary Fund) and due to membership application to the European Union.

These structural adjustment programs have much less dealt with the environmental distortions and, chronologically, environmental distortions have started to be analysed much after trade liberalisation issues. Tackling environmental distortions require a much more sophisticated and effective government and legal system that has just started to be built as part of the EU integration process and promises to continue on the medium and long term.

Thus, considering the gap between tackling the two different type of distortions, we have a classical second-best problem: in a world of multiple distortions, one cannot a priori determine whether eliminating some of them will be welfare-increasing. Moreover, the elimination of one type of distortions (the trade ones) has a theoretically ambiguous effect on the environmental stocks. In fact, this ambiguity is the reason why the removal of only the trade distortions may or may not be desirable. The environmental distortion implies income losses due to a lower environmental stocks than what is optimal. If the trade reform reduces the wedge between actual and optimal environmental stocks then the trade reform is necessarily desirable, e.g., trade liberalisation is "win-win". If the environmental stocks fall, thus increasing the wedge between actual and optimal stocks, the trade reform may, but not necessarily, be perverse. In this case the welfare losses of the worsening of the environment would have to be weighted against the conventional efficiency gains of bringing domestic prices closer to world prices.

The issue may apply to CEECs case during their transition period in adopting the environmental legislative and institutional *acquis communautaire*, period different from one country to another and, would more likely affect the candidates to be integrated the last.

Whether, in practice, agricultural trade liberalisation will positively or negatively affect the quality of environment in the CEECs, cannot be ascertained before empirical analysis was undertaken. If we consider the opinion of the advocates of trade liberalisation, the trade effects on environment during transition will be not significant. Anderson (1998) makes clear that there is much more likelihood of agricultural trade liberalisation having a positive net effect on the environment than is often admitted by environmental groups, and that, where the environmental effect is negative, the extra damage caused by trade reform is only a insignificant fraction of that which would occur as a result of normal economic growth, the adverse welfare effects of which are likely to be far more than offset by the welfare gains from trade reform. Moreover, if the trade reform were to be accompanied by reform to environmental policies that brought them closer to optimal regulations, the likelihood of an even better outcome would be enhanced, as Beghin et al. (1997) demonstrate quantitatively in a case study of Mexico. The CEECs environmental policy is gradually reforming anyway, just more slowly than the trade reform pace.

Moreover, several specific factors are to be taken into consideration in the case of the CEECs (e.g., low agricultural inputs use, land ownership fragmentation, rationale of supporting subsistence farming, agricultural research funding, etc). Each of these might enhance the impact trade could have on environment and should be included in any modelling approach on trade-environment linkages.

Having in view the diversity of environmental problems occurring in the CEECs, once the data availability problem would be solved (long-term issue due to financial constraints), a mix of methodologies will be most indicated to measure the environmental impact of agricultural trade liberalisation. Instead of trying to adapt a model to measure effects that it is not designed for, it would be far more useful to use different models jointly, each one reproducing part of the mechanism which will yield the final result, by exploiting its specific strengths.

Several researchers have already applied mixed methodologies to simulate the EU enlargement, although most of them not considering the environmental effects. Van Tongeren, van Meijl and Veenendaal (2000) used two different kinds of general equilibrium models jointly; Munch (2000)

and Munch and Banse (1999) used partial equilibrium model combined with single country general equilibrium models; CAPRI Project (Heckeley and Britz, 1999) produced a model in which roughly 200 mathematical programming regional models, which simulate aggregate decisions at the level of individual farms, were employed using prices generated by a spatial equilibrium model (derived from WATSIM), which, based on the results from the first models, calculated the equilibrium price in each country; a similar approach was adopted by the EUROTOOLS Project (2000) where University of Reading's Land Use Allocation Model (LUAM) was extended to the European Union and expanded in order to determine consumption, prices and the net trade position of each country endogenously; Serrão (1998) vertically integrated an econometric model (evaluating the effects of the CAP reform on different sectors) and an input-output model, using the results obtained relating to land allocations and input uses to calculate indicators of the environmental impact of the CAP reform.

As partial and general equilibrium models are already popular in dealing with the EU enlargement, it might appear to be technically and financially easier to invest in environmental data collection needed to adjust these models as to include the agri-environmental component than to apply other methodologies available mostly at a theoretical level. Besides, equilibrium models are more feasible than mathematical programming models from the data requirements point of view.

Nevertheless, the selection of most appropriate methodologies should be based on their being able to answer the questions they are posed. Namely, just adjusting existing models might not be accurate to deal with the CEECs special case, in which case, new models should be created and applied, as the higher costs related to data collection and methodology creation and implementation would be lower than those implied by inaccurate adjustment of existing modelling approaches.

We base this on the findings of Anania (2001) who states that, besides the models which are reliable both on account of their structure and for the quality of the data they use, there are others, for one reason or another, with a large question mark over their ability to supply adequate answers on the effects of the changes in domestic and trade agricultural policies. "The most important thing is that greater care and attention must be paid in tailoring models to answer the specific questions addressed, and abandoning once for all the claim that, once it has been set up, a model can be used to simulate any change in the policy scenario whatsoever" (Anania, 2001).

The models should describe the most important policy instruments used explicitly, one by one, in order to allow researchers to simulate variations in the use of each of the instruments. As Anania (2001) states, EU enlargement simulation models should be carried out with a genuinely "spatial" general equilibrium model, which is capable of simulating both the direct market effects in the new member countries, and the indirect macroeconomic feed back from these effects on agricultural markets in all countries in terms of variations in the demand for agricultural products and the allocation of resources.

Besides coping with reliable databases availability issue, CEECs should invest in training researchers to use these methodologies and the software packages attached. The two issues are inseparable in reaching accurate methodological outcomes: well-designed models need good quality data. Data requirements are very demanding (in volume and consistency) for multi-regional models of international trade. The amount of data is determined by the level of disaggregation (countries/ regions, activities/ commodities) and the theoretical structure (homogeneous/ heterogeneous goods, bilateral/ pooled markets). As data on trade between the CEECs, EU and third countries rises few availability issues, reliable environmental data is still highly missing for most of the CEECs. The parameters used in behavioural equations determine the response to policy changes, and are therefore a basic element in each modelling exercise. Key parameters are: price and income elasticities and budget shares in demand systems; substitution elasticities and input cost shares in supply systems; Armington (substitution) elasticities in import demand; if economies of scale are included, parameters that capture the degree of exhaustion of returns to scale (cost-disadvantage ratio). The values of these parameters must be determined in consistency with data and theory. A

promising approach to overcome the environmental data availability has been introduced by Dessus, Roland-Holst and van der Mensbrugghe (1994). Environmental appraisals of trade reforms can be undertaken on the basis of simulated changes in the use of polluting intermediate inputs for which data is more readily available than emissions data.

Conclusions

Current CEECs' policies have started to adopt an approach towards sustainability based on the integration of the environment into sectoral policies and the reshaping of social and economic behaviour through the use of a broader range of instruments and by promoting the principle of shared responsibility. The process of increasing environmental awareness has started and has been linked to the EU pre-accession process and CEECs' being part of world conventions on environmental issues. The CEECs' institutions and legislation in the agri-environmental field have been harmonised gradually according to the current EU framework and the process is to continue in the long term.

As associated countries, CEECs have paid increased attention to trade agreements with the EU. Still, the linkages between trade and environment have only started to be considered by researchers and policy makers.

There are no empirical attempts to measure the impact of agricultural trade liberalisation on environment in the CEECs (as to my knowledge). Although the existing models used to simulate the EU enlargement could be adjusted to take into consideration the environmental dimension, none of them tackle the issue. This is mainly related to data availability problem discussed in the first part of the paper.

Having in view the diversity of environmental problems occurring in the CEECs, once the data availability problem would be solved (long-term issue due to financial constraints), a mix of methodologies will be most indicated to measure the environmental impact of agricultural trade liberalisation. The selection of most appropriate methodologies should be based on their being able to answer the questions they are posed.

Besides coping with reliable databases availability issue, CEECs should invest in training researchers to use these methodologies and the software packages attached. The two issues are inseparable in reaching accurate methodological outcomes: well-designed models need good quality data.

Applying methodologies to measure the impact of agricultural trade on environment would provide policy makers in the CEECs with better feedback on the impact of their trade decisions on agri-environmental issues, a field that has recently started to be of critical interest in the CEECs, mainly as a result of the EU harmonisation process. The policy makers in environmental field are confronted by the need of setting up a coherent framework for the decision making process.

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Annex. Agri-environmental data constraints

Much of the basic data required to derive *nutrient balances*, such as on farm fertiliser use, livestock manure, numbers and composition of live-stock, and crop production, are widely available and regularly updated for the CEECs. The availability of coefficients to determine the quantity of livestock manure produced by livestock and its nutrient content, and the uptake of nitrogen by crops and pasture, however, is more limited at a regional level, although standardised coefficients have been developed.

Data on *pesticide use* is available, although the time series is not fully complete. A problem is identifying pesticide use for specific crops. CEECs have data series on the area of land to which pesticides are applied but spatially referenced data are limited. The development of a pesticide risk classification system is not complete and it has not allocated quantities of pesticides used into different risk categories.

The major issue to be considered in response to developing *agricultural water use* indicators is the extent to which the use of water resources can be linked to agriculture. Data are available on overall water withdrawal rates and major users in the CEECs economies are identified. The major agricultural use of water supply is for irrigation. Nevertheless, data on irrigation abstraction rates, combined with information collected in relation to farm management indicators, particularly irrigation management indicators do not exist. This data would help to reflect linkages between agricultural water usage and problems of water depletion.

Data on changes in national *land use* patterns, both between agriculture and other land uses and within agriculture, are also available for most of the CEECs. However, definitions of land use types, such as “permanent grassland” vary widely when compared to other countries. The data required to measure indicators that address the issue of land conservation are only beginning to be collected. However, given the close links between agricultural land use, land conservation and other issues – for example, water use, soil and water quality, farm management, wildlife habitats, agricultural landscape, and socio-cultural issues – there may be considerable scope to utilise this wider range of indicators and related basic data.

The CEECs have data on different types of *soil degradation* at national level. The methodology to measure the “risk” of potential soil quality deterioration is still in the development stage, although, at least for soil erosion, the Universal Soil Loss Equation has been used to estimate soil erosion rates, which can then be reported in „risk” classes.

Water quality. The major difficulty is to identifying agricultural sources of pollution, as these are often diffuse and may have effects with a long time lag. Determining the contribution of diffuse pollution sources, such as nutrient run-off from fields, to a given environmental impact is much more difficult than for point sources. Also, water is not always an appropriate sampling medium for many farm contaminants which are stored in sediment or may bio-accumulate. Most of the CEECs have no data on different types of water pollutants specific to agriculture, although more general data are available.

The „risk” approach uses data related to nutrient balances, pesticide use and soil characteristics, for example, and thus incorporates much information addressed by other agri-environmental indicators. Most of the CEECs have not yet developed risk-based methods to measure water quality, especially as these can be directly linked to agriculture. Such approaches may provide early warning of potential problems and are not costly to monitor for national administrations.

All methods for calculating *greenhouse gases* are subject to uncertainty, due to the error margins that are involved with the assessment of emissions and sinks related to agriculture. In the CEECs, as in most countries, while the sources and sinks of agriculture are reasonably well known, their magnitude is more uncertain depending on factors relating to soil, climate and management.

The CEECs have just started to address the issue of *biodiversity* in relation to agriculture, at both the conceptual and empirical level. This work is exploring a number of indicators to measure biodiversity, including for example the extent of diversity of varieties of crops and livestock breeds in agricultural production, and whether production is taking place on a narrow genetic base. Most CEECs have monitored changes in „key indicator" wildlife species (plants, insects and animals) in general, and not specifically in their relation to agriculture (e.g., by monitoring the changes of wildlife species that reside in or are in close proximity to agro-ecosystems). Work is underway to establish information on wildlife habitats by use of satellite based remote sensing in conjunction with analysing this information by the use of geographic information systems.