INTERNATIONAL TRADE AND ENVIRONMENTAL CHANGE

Evidence and Implications for Developing Countries

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I. Introduction

This paper discusses four aspects of the relationship between international trade and the natural environment:

- The effect of trade liberalisation on the environment;
- The effect of the unilateral imposition of environmental regulations on trade patterns;
- The use of domestic trade policy as an environmental instrument; and
- The use of trade measures in international environmental agreements.

The paper provides a critical review of the empirical and theoretical economic literature that addresses these four sets of issues. Its objective is to clarify what economic analysis has to say about the relationship between trade and the environment, and to highlight some of the important limitations of the analysis. Particular attention is paid to the evidence and the implications of these issues for developing countries.[1]

II. Trade Liberalisation and Environmental Change

Economic analysis makes a powerful conceptual case for the positive environmental effects of the liberalisation of international trade. The case rests upon the effects of liberalisation in terms of the reallocation of production and in terms of the technological and demand effects. The case related to static reallocation of production will be discussed first.

According to trade theory, a country will tend to specialise in the export of goods which require relatively more intensive use of those factors of production (i.e. labour, capital, materials, etc.) which it possesses in relative abundance. It is argued that the country will have an advantage in such sectors in comparison with other countries, even if *absolute* costs of production in the sector are higher. The theory of environmentally-determined comparative advantage is merely an extension of this, in the sense that the environment is introduced as a factor of production, analogous to the standard factors of production usually incorporated in trade theory. Thus, a country with a relative abundance of natural capital (renewable and non-renewable resources used as direct inputs in production and/or assimilative capacity to absorb waste arising from production) will specialise in the production of goods which are intensive in the use of natural capital. Abundance depends, however, on both 'natural' factors, such as endowments of natural resources, the composition of the soil and the speed and direction of prevailing winds and currents; as well as 'anthropogenic' factors

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[1] The economic analysis of the environmental case for trade liberalisation is discussed on its own ground – this focus is at the expense of arguments which, although important, start from a different analytical framework.

which determine the demand for such resources as clean rivers, virgin forests and unpolluted air. Within such a framework, therefore, environmentally-determined trade is the expression of national supply and demand factors. However, it should be emphasised that the pattern of specialisation arises from relative, and not absolute, levels of environmental endowments and preferences.

The same economic logic which indicates that countries will specialise in the production of those goods which are intensive in the use of resources in which it possesses a relative abundance, also implies that trade liberalisation will encourage the efficient exploitation of such resources across trading nations. Since trade in goods can be understood as trade in embodied factors of production, a given level of global material welfare can be attained with fewer inputs (including environmental inputs) than would be the case if each country attempted to satisfy its own consumption patterns purely through domestic production. Consequently, it is argued that the inhibition of trade flows arising from trade restrictions, whether explicit (tariff barriers and import quotas) or implicit (subsidies and non-tariff barriers), will result in greater levels of resource use and environmental damage being needed to produce the same level of output than would be the case in a free international trading regime. (For theoretical discussions see Siebert *et al* 1991.)

Much of the empirical work which has been undertaken to test this hypothesis is related to the agricultural sector, particularly as it concerns protectionism in North America and Western Europe. Ervin (1996), Runge (1993) and Anderson (1992) assert that trade liberalisation in the agricultural sector will tend to reduce the global environmental-intensity of the sector. In effect, protectionism has resulted in trade patterns which do not reflect natural endowments and assimilative capacity. The removal of such distortions would result in a shift in agricultural production away from regions where energy and chemical inputs are intensive, to regions which are relatively better suited for such production and which require fewer environmentally damaging inputs. Although the regional effects of such shifts in trade patterns may result in increased use of environmental resources in particular areas, the overall global effects will be environmentally preferable.

This conclusion is broadly supported by more aggregate macroeconomic studies, which find that trade liberalisation will tend to reduce the adverse environmental effects of production per unit of aggregate global economic output. (See Beghin *et al* 1995, Perroni and Wigle 1994, Lucas *et al* 1992 and Birdsall and Wheeler 1993.) This is significant, since the net environmental effects of trade liberalisation can only be understood in a multi-sectoral analysis. The reallocation of production following liberalisation will not necessarily result in less environment-intensive production in each individual sector, but only in aggregate.

The static argument related to resource allocation is further supported by a belief that trade liberalisation will generate dynamic technological effects which may have further beneficial consequences for the environment. Thus, from the individual country's perspective, the gains are reflected not only in terms of the *composition* of output across countries, but also in terms of the *technology* of production applied within countries. There are numerous interrelated channels through which economic openness can affect the environment-intensity of technology and technological change:

- By opening domestic markets to foreign technology firms may be able to import technology, which is environmentally less damaging than technology available domestically. This may take the form of capital equipment or material inputs.

- By allowing firms to realise economies of scale through the expansion of the market for their output, trade may enable firms to invest in more efficient production processes. This may be is less environmentally damaging for the reason cited above and/or because clean technology often requires larger average scale of production to be economic.

- By granting firms access to foreign export markets, domestic manufacturers may be subject to foreign patterns of demand. In many instances this may include markets which attach greater importance to the environmental characteristics of production.

Relative to studies which examine the effects of liberalisation on the environment-intensity of production through changes in the composition of output, the environmental effects of liberalisation through technological change has been much less adequately analysed. This is due in large part to data difficulties, since the requirements are much more significant. However, the evidence which does exist tends to support the view that liberalisation has a positive effect on the environmental characteristics of the technology of production. For instance, it has been found that less pollution-intensive thermomechanical technology has been adopted by the pulp and paper sector in countries with relatively more open trading regimes (Wheeler and Martin 1992). Thus it is argued that protection, by distorting trade flows, has encouraged the development of production processes requiring relatively greater environmental through-put.

Furthermore, it is argued that the positive composition and technology effects are reinforced by the effects that trade has on the environment-intensity of production through increased income levels. The argument rests upon a belief in the existence of positive relationships between international trade and economic growth on the one hand, and between economic growth and environmental quality on the other. Although the former relationship is beyond the scope of this paper,[2] the latter requires some discussion. In effect, it is argued that "environmental wear" (pollution emissions and resource exploitation) per unit of output, rises with income levels until a certain point, beyond which it begins to fall, generating an inverse-U relationship.

To some extent, the existence of this relationship has been borne out by empirical studies. (See Lucas, Wheeler and Hettige 1992, Shafik 1994, Grossman and Krueger 1995, and Selden and Song 1994.) However, a number of points are worth emphasising. Firstly, the results vary significantly across measures of environmental quality, with those effects which are most localised (i.e. particulate matter) tending to exhibit the most evident inverted-U relationship, whilst others with effects which are either potentially externalisable (solid waste) or environmentally diffuse (CO_2), not exhibiting such a relationship at all. This reveals the importance of the incidence of environmental effects and demand-side issues.

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[2] For recent evidence see Harrison *et al* (1995) and Goldin and Mensbrugghe (1993).

Secondly, the use of "reduced form" equations in the empirical studies – in which the main causal factors are implicit – means that the practical significance of the studies in policy terms is restricted, since such equations are singularly inadequate in the explanation of causal effects. They do not purport to claim that development *causes* improved environmental quality, but rather that it *accompanies* it. The third issue is related to the pervasiveness of irreversibilities in processes of environmental degradation. Although it may be the case that economic growth eventually generates notional demand for environmental quality and the means to make this demand effective once the 'hump' of the U-curve has been passed, the resource base upon which the economy depends may no longer be able to satisfy this demand if environmental irreversibilities are significant.

In summary, it is important to be clear about what economic analysis of the environmental effects of trade liberalisation does and does not say. The static resource reallocation argument does not state that environmental quality will improve in all countries following trade liberalisation. Even if all externalities are appropriately internalised (i.e. the marginal costs of the use of environmental resources equals the marginal benefits), *aggregate use* of environmental resources may rise (natural resource exploitation increases and pollution emissions rise), in countries which are richly endowed with such resources. Indeed, environmental inputs *per unit of aggregate output* may even rise, as some countries adjust the sectoral composition of their output toward more environment-intensive sectors as a reflection of comparative advantage. This could be true even if all externalities are internalised. Just as labour-rich or capital-rich countries may experience increased use of labour or capital in aggregate terms, or per unit of output following liberalisation, the same could be true of environmental resource use for certain countries.

Therefore, the widespread assertion that environmental quality will improve in individual countries following liberalisation as long as externalities are internalised, is dependent upon dynamic technological and demand effects, and not strictly static resource reallocation and sectoral composition effects. This is significant, since the former are expected to have positive environmental consequences within individual countries, whilst the latter are primarily concerned with effects across a group of countries. Moreover, the results for the two former factors (technology and demand) are rather less robust than for the two latter factors (input reallocation and sectoral composition).

Evidence and Implications for Developing Countries

The effects of liberalisation are potentially significantly important for developing countries, since their environmental endowments and priorities may be very different from OECD countries. As such liberalisation may generate significant changes in the environmental characteristics of production. Although on one level the aggregate global effects may be positive, there may be cases of considerable increases in regional stress in certain developing countries.

One of the only empirical models used to examine the environmental effects of liberalisation systematically, albeit in necessarily simplified form, is that of Perroni and Wigle (1994). Using a static general equilibrium model of the world economy they find that liberalisation results in a 0.7% increase in an aggregate index of "environmental damage" in developing countries.[3] Interestingly this

is lower than in industrialised countries, despite the assumption of greater assimilative capacity in developing countries. This is explained by the fact that the model predicts considerably smaller increases in economic activity in developing countries than elsewhere. Indeed the welfare effects of increased economic activity only just compensate for decreased environmental quality in percentage terms. However, it should be emphasised that the highly abstract nature of general equilibrium modelling means that such results are at best illustrative.

In their TEQUILA model, Begin *et al* (1995) examine the environmental effects of trade liberalisation in Mexico using a dynamic general equilibrium model. Unlike many of the other studies emissions are associated with the use of intermediate inputs and not production of final outputs. As such they can capture some of the effects of technological change insofar as it is reflected in factor substitution. They find that unilateral trade liberalisation generates a significant rise in GDP (3.2%) relative to the base case in 2010, but that most major pollutants increase by a comparable amount (2.5% - 4.8%). Thus, the pollution-intensity remains more or less constant, despite significant changes in the composition of output and some change in the technology of production.

However, there are two issues which are not adequately addressed in the literature, and which may be of particular relevance to developing countries. The first relates to the process of monetisation of output which often accompanies trade liberalisation in poorer countries. Whereas traded goods are necessarily monetised (except the limited cross-border barter which continues to exist), this may not be true of the non-traded good production which may have been displaced following liberalisation. As such, the increase in economic growth following liberalisation may be overestimated, unless considerable care is taken when accounting for displaced subsistence production. In addition, in some cases the adverse environmental consequences of such displacement may be simultaneously underestimated. It is not only the economic function of subsistence modes of production which may not be properly accounted for, but also their potentially positive (or less negative) ecological function relative to traded production. Whether or not monetised and traded production is more or less environmentally damaging than displaced non-monetised and subsistence production is an empirical issue which can only be determined at the level of individual cases. (See Young and Bishop 1995 for a discussion related to agriculture.) However, the potential importance of these two effects is most clearly illustrated by the transformation from subsistence agriculture to cash crops following liberalisation. Depending on the nature of the crop the very process which overstates actual economic growth through increased monetisation of the local economy may simultaneously understate environmental degradation if the ecological function played by the displaced crop was less damaging.

In addition, the cross-sectional and pooled nature of the data used in the income-environment studies cited are such that some of the measured decreases in environmental degradation for higher-income countries may, paradoxically, reflect changes in foreign investment and international trade patterns across countries, and not strictly increased preferences for environmental quality and/or the application of more environmentally benign technology in individual countries. Instead of the causality running from trade through growth to the environment, trade may be masking the true

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[3] Although exceedingly abstract, the environmental damage function, which is convex and constant-elasticity, is consistent with the standard assumptions in the literature.

relationship between growth and the environment. More environment-intensive goods are simply being imported from lower-income countries. Given that such a tendency does not reflect changes in final consumption patterns but merely a geographical displacement of production patterns, this would indicate that there is a limit to the extent to which environment-intensity will continue to fall as income levels rise.[4] As more countries apply stringent environmental regulations this avenue of emission reduction and resource conservation becomes increasingly less readily available.

III. Environmental Regulation and Trade Patterns

The preceding section has been concerned with the environmental consequences of trade liberalisation. In effect, environmental endowments are treated as factors of production, analogous to capital and labour. However, unlike capital and labour, the environment is a public good. As such its price is not an outcome strictly of market forces, but rather of the complex means by which the state mediates economy-environment interactions. The most evident, but not the only, means by which it does so is through regulation. In this section, the consequences of state regulation of environmental externalities with respect to trade patterns will be discussed. More specifically, it is important to determine whether or not international differences in the stringency of environmental regulation affect trade flows.

Most empirical work conducted on these issues is related to the effects of the imposition of carbon/energy taxes. This is hardly surprising since it is one of the few regulations likely to be of sufficient magnitude in terms of costs and sufficient scope in terms of sectors, to have an appreciable effect on trade patterns. Perhaps more importantly, the cost effects of the regulation are much easier to measure than is the case with other forms of environmental policy. Most of the models which have employed general equilibrium methodology (i.e. Pezzey 1992, Perroni and Rutherford 1993, Felder and Rutherford 1992 and Manne and Rutherford 1994) have found appreciable effects in terms of loss of competitiveness in those countries which are assumed to impose carbon and/or energy taxes. A notable exception is the OECD's GREEN model (Oliveira-Martins *et al* 1992), which is considerably more data intensive – this applies more sophisticated econometric techniques and accounts for a number of key structural characteristics in the economy, such as the importance of non-price determinants of trade flows. Significantly, the results in terms of loss of competitiveness are much less pronounced than in the other studies. However, given the long-run nature of global warming all these studies have placed an emphasis on forecasting over long time horizons rather than detailed analysis of the historical record. It is, therefore, worth looking at more detailed studies which have focused explicitly on the statistical importance of environmental regulations in terms of trade flows.

In order to capture differences in pollution regulations Tobey (1990) derived an index of their relative stringency in 23 different countries based on results to a survey questionnaire. The environmental variable is not found to be statistically significant, indicating that environmental regulations are not determinants of trade patterns. Using a larger cross-section of countries an

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[4] See Saint-Paul (1994) for a theoretical discussion of this issue.

"omitted variable test" – wherein all explanatory variables thought to be important are included, except the environmental regulation index – is conducted in order to determine whether or not the residuals incorporate effects which may be related to the excluded variable. Once again, however, the null hypothesis that pollution control measures have no effect on trade patterns can not be rejected. Kalt (1988) regressed net American exports over the period 1967-1977 across 78 industries, using relative compliance costs as an indicator of regulatory stringency. This would capture bilateral trade patterns with all countries, with an implicit assumption that American standards tend to be higher than elsewhere and, perhaps more importantly, that such differences are normally distributed across sectors. His results are mixed, with one specification supporting the hypothesis that environmental regulations affect trade patterns, but another having an unexpected sign and a statistically insignificant coefficient.

Han and Braden (1996) use American panel data for 19 manufacturing sectors for the period 1973-1990 to examine the effects of pollution abatement costs on net exports with the rest of the world. Heckshcher-Ohlin methodology is applied, in which the factor inputs are assumed to be capital, research and development, human capital, labour and the environmental policy variable (abatement costs). An additional variable, wherein abatement costs are multiplied by time, is also included in order to indicate its relative importance across time. They find that the abatement variable is significant and negative (as expected), and that the abatement-time variable is significant and positive. The latter result indicates that the competitiveness effects of US abatement costs have been decreasing over time – which would be consistent with a scenario in which the United States had been the leader in terms of the adoption of environmental regulations, but that its main trading partners have been catching up over time.

And finally, using a "gravity model" in which trade is explained by factors such as GDP, population and distance, van Beers and van den Bergh (1996) examine the bilateral trade flows between 21 OECD countries for 22 sectors in 1992. They find that their derived index of environmental policy – based on factors such as the percentage of petrol which is unleaded and changes in the energy-intensity of production – has ambiguous trade effects. However, if resource-based sectors are excluded from the sub-set of pollution-intensive industries the trade effects are significant and negative. This would indicate that environmental policy is a significant determinant of trade flows for sectors which are not bound by proximity to resource endowments.

Although many of the macroeconomic models cited above reveal that the trade effects of certain types of environmental regulations may be significant, the econometric literature has generally found more ambiguous results. This is usually attributed to two factors: the unimportance of costs attributable to environmental policy relative to costs such as labour; and the difficulty of finding an appropriate measure of such costs[5]. However, it is significant that evidence is rather firmer for

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[5] van Beers and van den Bergh (1996) mention the complications generated by the widespread introduction of compensatory subsidies and/or import controls for sectors which are adversely affected by environmental policies.

studies which apply more sophisticated methodology and data sets. For this reason it is important to examine the potential implications for developing countries.

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It is commonly asserted that the extent to which environmental regulations affect trade patterns, they will systematically result in developing countries specialising in more environment-intensive sectors, since the regulatory regime is less well developed. (See, for example, Chichilnisky 1993 and Copeland and Taylor 1994.) Whether this is due to authentic differences in endowments of natural capital and preferences for environmental quality, or simply to differences in the institutional capacity required to bring these two into equilibrium, is the subject of considerable controversy.

Thus, many environmentalists cite such effects as examples of "eco-dumping", with poorer countries engaging in a competitive struggle to encourage investment and increase exports by reducing environmental restrictions on production. Conversely, many economists assert that such differences may merely be evidence of the rational expression of international differences in supply and demand conditions. Determining which of these two views is a more accurate description of the motivation for actual trade patterns is problematic, since a given country's natural endowment is necessarily defined socially and not exclusively physically. However, two key points emerge from this debate. Firstly, in the event that trade patterns are determined in part by the imperfect internalisation of externalities in certain regions, the case for the positive aggregate welfare effects (including environmental effects) of trade liberalisation can not be accepted uncritically.[6] Secondly, in the event that regulations are harmonised across trading nations with different environmental preferences and natural endowments, trade flows will be distorted.

Some light can be shed on the effect of North-South differences in the stringency of environmental regulations on international trade flows by examining the empirical literature which relates specifically to relevant bilateral relationships. Grossman and Krueger (1992) conducted a cross-sectional econometric analysis of United States-Mexico trade to examine whether or not environmental regulations were significant determinants of comparative advantage. They used the ratio of 1987 American imports from Mexico to total value of shipments as the dependent variable (i.e. the ratio of total abatement costs over total value added as the environmental explanatory variable) along with a number of other explanatory variables which capture the relative-intensity of other factors of production and relevant institutional variables. The results indicate that the stringency of environmental regulations in the United States does not have a statistically significant effect on imports from Mexico.

Looking at another important bilateral trading relationship – Indonesia and Japan – Lee and Roland-Holst (1994) measured the pollution-intensity of trade flows between the two countries using an index of the human toxicity of effluents, which has been developed by the World Bank using

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[6] This finding is part of a more general body of literature known as the "theory of the second best," which states that the removal of one distortion (i.e. trade protectionism) is not necessarily welfare-improving in the presence of another one (i.e. environmental externalities). See Lipsey and Lancaster (1956) for the classic discussion.

American census data. Although the methodology is quite different – only indirectly capturing the effects of environmental regulations on trade and investment patterns and concentrating on those effects which are related to the sectoral composition of output – the results are of considerable interest. They found that the toxicity of exports from Indonesia to Japan relative to the toxicity of imports was approximately twice that which would be expected on the basis of the relative toxicity of aggregate output in the two countries. However, it should be emphasised that the study is useful only insofar as the relative toxicity of production across different sectors is comparable in the two countries.

A more general simulation analysis conducted by Perroni and Wigle (1995) was used to examine the trade effects of the application of more stringent regulations in a sub-set of countries. They found that if North America unilaterally increased the stringency of its regulations, the economic effects would be marginal in terms of displaced trade patterns, although the environmental benefits would be considerable. Although the results can only be interpreted as illustrative, they do indicate that fears of significant "leakage" through increased production of pollution-intensive goods in developing countries are misplaced. One of the only studies to look at the effects of more stringent regulations from the perspective of a developing county is Beghin *et al* (1995). They find that in the case where Mexico introduces taxes which reduce emissions by 25% the trade effects are surprisingly small. However, the abatement functions appear to be quite general in nature.

IV. Trade Restrictions as Environmental Instruments

The use of domestic trade interventions as a means of achieving environmental objectives can be grouped into those measures which are primarily concerned with adverse environmental consequences arising from consumption, and those measures arising from production externalities. Examples of the former are numerous (i.e. restrictions on cars which do not meet specified emissions standards or on pesticides that have not been proven safe) and although they may have significant economic and environmental effects, their application is not particularly contentious as long as domestic producers are subject to similar constraints (Esty 1994).

The use of domestic trade policies to reduce environmental degradation arising from production can be further broken down into two categories: those policies which are concerned with extra-territorial natural resources and environmental damages (i.e. those which do not affect the country imposing the restriction); and those which are concerned with international natural resources and environmental damages (i.e. those which affect the country imposing the restriction). The former, which are usually motivated by fears about the relative importance of the aforementioned "eco-dumping", represent an effort on the part of one state to affect behaviour in another country with respect to environmental degradation which exists within the exporting country. Given the relative importance attached to principles of national sovereignty in international law, the application of trade policy to effect change in the generation of domestic environmental externalities overseas is not usually considered justifiable.

The latter case, involving international externalities, is rather more contentious.[7] It is often argued by economists that since international trade (understood in its strictest sense as a means of exchange and not as an aspect of production) can not be a *cause* of environmental degradation, then as such, restrictions on trade do not address the fundamental determinants of degradation. For this reason trade restrictions may result in significant resource misallocation for little environmental gain. (See Beghin *et al* 1995.) In some cases they may have unexpected and even perverse consequences. In a study of the tropical timber trade, Barbier *et al* (1994) find that the application of trade restrictions on the imports of tropical timber may not reduce the rate of deforestation in exporting countries, and in some circumstances may even increase it.

Conversely, others point out that trade may be the only point at which countries can have an impact upon those production processes elsewhere which have environmental implications for the importing country (i.e. transfrontier pollution or resource migration). Thus, assertions that trade interventions are not a "first-best" policy (even if true) may be irrelevant as long as the fundamental cause of degradation can not be targeted directly. Moreover, even the general proposition that trade restrictions are always less efficient than well-designed domestic standards is not always clear. In a theoretical discussion Baumol and Oates (1988) emphasise that in a "second-best" situation where markets do not operate perfectly, trade restrictions may approximate the optimal outcome. Beghin *et al* (1994) summarise studies which find this to be the case under particular circumstances (i.e. terms of trade effects, illegal disposal, institutional constraints). However, in general, it is the sub-optimality of trade interventions which is emphasised in the economic literature, rather than the qualifications.

Not surprisingly, the GATT/WTO has broadly supported the economic interpretation of the relative legitimacy of alternative motivations for "environmental" trade interventions. Thus, panel decisions (i.e. the United States-Canada tuna case, Mexico-United States tuna/dolphin case, the EU-United States Superfund tax case) indicate that trade restrictions based on environmental degradation arising from consumption are considered legitimate, whereas those based on degradation arising from production processes are not. In addition, in its panel decisions the GATT/WTO has tended to hold the position that it is not legitimate to impose trade restrictions in order to protect natural resources or the environment extra-territorially (see Pearce 1992 and Esty 1994.) However, in general, wherever possible the panels have avoided using environmental criteria to decide such cases, basing their decisions on non-environmental criteria.

For this reason the relevant clauses require clarification. This necessity was reflected in the confusion on the part of member countries in the Uruguay Round about the potential relevance of Article XX to production and process methods, particularly in light of revisions to the 1979 Agreement on Technical Barriers to Trade (Low and Safadi 1992). In addition, since the appeal to transfrontier effects as a justification for trade interventions is dependent upon environmental benefits being proportional to economic costs, there is the potential for cases to arise wherein this is not clear-cut and wherein there may be considerable uncertainty (Pearce 1992). Thus, it is quite likely

[7] International externalities are understood to include all cases of transfrontier pollution (including unidirectional, regional and global externalities) and transborder resource use (including species migration and existence value).

that in the future cases will arise in which the panel will have to decide explicitly on the basis of the international environmental benefits arising from trade interventions based on production and process methods. These issues and others are being addressed in the discussions of the WTO's Committee on Trade and Environment, although there is some fear that the WTO remains wary of including complex environmental issues in the trade regulation framework. Thus, the first panel reports of the case on Venezuela-United States oil refineries continues to argue that restrictions based on production and process methods are not legitimate (IISD 1996).

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Given the general perception in industrialised countries that environmental constraints are relatively less stringent in developing countries, many of the latter fear that trade interventions with apparent environmental motivations are, in fact, merely disguised forms of protectionism. This fear is, to some extent, justified by the fact that the overwhelming majority of environmentally-motivated trade interventions have been introduced by industrialised countries.

The issue can be examined in more detail by looking at the proposed American ban on Mexican tuna imports. The case arose when an environmental NGO in the United States sued the Environmental Protection Agency for not enforcing aspects of the Marine Mammal Protection Act (MMPA), which stated that the number of dolphin deaths per net dropped by foreign fleets could not exceed that of the American fleet, or imports would be restricted. (Esty 1994 and Pearce 1992). The NGO won the case and the government ordered a ban on tuna imports from Mexico. In effect, the Americans were using domestic production practices as a yardstick by which to measure whether or not foreign production processes were environmentally justifiable. The Mexicans took the United States to the GATT and won, with the panel deciding that the US standard, based on dolphin kills in a given year, was inappropriate because it was determined retroactively and its stringency was uncertain in any given year. More substantive issues related to economic efficiency and environmental benefits were not addressed.

The German Packaging Ordinance has also created considerable problems for many developing countries by restricting imports of products which are not packaged in specified ways in order to encourage increased use of recyclable material. In a series of UNCTAD case studies this was found to be significant in countries as diverse as Colombia, Zimbabwe and India (Markandya 1994). Although the economic repercussions may be significant, the environmental benefits may be limited or even perverse. Since the ordinance was originally formulated in order to encourage environmentally sustainable production in Germany itself, it is not clear that it would have similar effects in a country such as India, where the specified materials are not readily available and may have to be imported. Moreover, it is unlikely that such a regulation would be compatible with GATT/WTO principles.

In general, therefore, there is some danger that trade restrictions imposed by developed countries in order to achieve environmental objectives may have adverse economic consequences for developing countries and few positive, and perhaps even perverse, environmental consequences. Unless the transfrontier environmental externality is clear and the imposition of the trade restriction takes

account of international differences in preferences and conditions, the use of trade restrictions for environmental purposes should be discouraged.

V. International Environmental Agreements with Trade Provisions

There are three senses in which international environmental agreements can incorporate international trade provisions: agreements which have trade bans as their primary component; agreements which use trade restrictions as an incentive for accession; and agreements which encourage trade in environmental permits.

An example of the first form of agreement is *The Basel Convention on the Control of Transboundary Movements in Hazardous Wastes and Their Disposal* which was adopted by 42 countries in 1989. In addition to standard notification and manifest requirements it prohibited the export of hazardous waste to countries which have explicitly prohibited the import of such waste, or which are not signatories to the agreement. Signatory states had to ensure that exports are managed in an "environmentally sound manner" and attempt to reduce such exports to the greatest extent possible. It also required the repatriation of illegal shipments (Hilz 1992). Another example of an agreement which restricts trade as its primary objective is *the Convention on Trade in Endangered Species* (CITES). Signed in 1972, the agreement bans the export of species "currently threatened with extinction" (Appendix I species). Exports of those species which "might become threatened by extinction" (Appendix II species) are subject to the discretion of the exporting country. CITES has certainly reduced trade in some Appendix I species – although illegal trade in some cases may still be important. The effect on trade in Appendix II species is limited – unless of course they are upgraded to Appendix I status – except to increase public awareness (Swanson and Barbier 1992).

The Montreal Protocol on Substances that Deplete the Ozone Layer represents an example of an environmental agreement which uses trade restrictions as an incentive for accession. Signed in 1987, the agreement requires reductions in the production and consumption of chlorofluorocarbons (CFCs) by signatories, followed by a ban taking effect from 1996 for developed countries and from 2010 for developing countries. Trade between signatories and non-signatories is restricted in three senses: a ban on imports of controlled substances from non-signatories and a ban on exports from signatories; a ban on imports from non-signatories of products containing controlled substances; and finally, a ban on imports from non-signatories of products manufactured using controlled substances. Although the latter restriction remains controversial, the trade bans appear to have been relatively successful insofar as they have prevented non-signatories from free-riding, thus perhaps increasing accession (see Barrett 1994 and Taylor 1993). However, illegal trade between signatories and non-signatories is alleged to be significant. This illustrates the complexity of international economic and environmental links, since the motivation for such trade would arise from the difficulties faced by manufacturers in importing countries in downstream sectors (i.e. those sectors which use CFCs as inputs in production of other goods) in trying to find cost-effective substitutes for CFCs domestically.

Agreements which actively encourage international trade in environmental permits are rare, but a potentially significant example has arisen out of the *Framework Convention on Climate Change* (FCCC) which allows for pilot projects for "joint implementation" of CO_2 commitments – a cooperative agreement between countries whereby agreed emission reduction commitments of one country are attained through the realisation of abatement in another country.[8] As of late 1995 there were 17 on-going or approved joint implementation projects registered with the Sectretariat of the FCCC. [9] Although joint implementation is not a full-fledged permit system, it does represent an important antecedent that possesses some of the advantages which would be realised in a full permit trading system i.e. international transfers in abatement obligations to encourage equalisation of marginal abatement costs. However, two notable deficiencies should be emphasised. Firstly, the bilateral nature of the negotiations means that the market is very thin, if it can be described as a market at all. And secondly, the rather *ad hoc* nature of the negotiations means that transaction costs are likely to be high. Both of these problems would be obviated through a full international permit system.

Evidence and Implications for Developing Countries

International environmental agreements with trade components possess a number of implications for developing countries. At the most fundamental level this arises from the necessity to accommodate international differences in natural endowments and environmental preferences. If the agreements do not account for these potential differences, whether through the trade components themselves or through associated clauses, the agreements may not be successful.

It is clear that agreements which impose trade bans as their primary means of achieving a given environmental objective must have compensatory mechanisms for adversely affected developing countries if they are to be successful. CITES is illustrative in this regard. With most of the affected species primarily inhabiting developing countries, trade restrictions will necessarily have economic consequences for the South. However, the Convention does not address this issue, providing no support for countries affected by Appendix I bans or, more importantly, assistance in the management and protection of Appendix II species which would serve to avoid their upgrading. Thus, species which are subject to exploitation might be left unmanaged until the point at which a ban is introduced. The result is loss in income for the affected community which may merely accelerate the demise of the species if its ecosystem is converted to other uses (i.e. agriculture) in order to secure compensatory income. (See Swanson and Barbier 1992)

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8 The Montreal Protocol also allows for joint implementation.

9 Two cases are worth mentioning. Under the Global Environmental Facility Norway financed the conversion of part of the Mexican domestic appliance stock to more energy-efficient versions, with the consequent reduction in CO2 emissions attributed to Norway. (Chichilnisky and Heal 1995) In another case the Netherlands financed reforestation projects in the Czech Republic, Malaysia, Ecuador and Indonesia, with the increased absorption deducted from Dutch emissions (UNCTAD 1994). Other cases involve projects in Russia, Poland, Hungary, Belize, Ecuador, Costa Rica and Honduras.

The importance of distributional issues also applies to agreements which use trade restrictions as an incentive for accession. *The Montreal Protocol* illustrates this clearly. India (along with a number of other developing countries) did not accede to the agreement initially. As a significant producer and consumer of CFCs it felt that the relatively less stringent abatement requirements for developing countries – effectively a grace period – were not sufficient to justify its accession despite the loss of trading opportunities. This raised fears amongst environmentalists that India would challenge the agreement in the GATT/WTO on the basis that it was discriminatory. If it had done so it would have almost certainly won since the Montreal Protocol is not GATT/WTO compatible, particularly with respect to restrictions related to the use of CFCs in production processes. However, this did not arise, since once additional funds became available to help developing countries implement the agreement India and other developing countries acceded to the agreement. (See Taylor 1993.)

And finally, distributional issues are also potentially important for environmental agreements which allow for trade in permits directly or trade in obligations through joint implementation. Thus, many observers have stressed the importance of resource transfers via permit allocation in order to encourage accession to the agreement, and/or for reasons of equity. Trade in environmental obligations through joint implementation may also generate transfers. Since the existence of such a project implies the existence of a wedge between costs of abatement in the two countries, the benefits derived from the project relative to unilateral abatement can be distributed between the two countries on a more or less progressive basis.

VI. Conclusions

The links between international trade and the global environment are manifold. This paper has examined the links from an economic perspective, and discussed some of the more important implications for developing countries. The main conclusions can be summarised as follows:

- The theoretical case that trade liberalisation has positive effects on the environment in aggregate terms is strong and is, to some extent, borne out by the empirical literature. However, the environmental repercussions for particular countries may be negative and significant. Moreover, the general conclusion must be qualified in important respects. Some of the qualifications arise from methodological issues associated with the principal studies cited (i.e. the nature of the data, estimation with reduced-form equations, monetisation of output), while other qualifications are more fundamental in nature (i.e. international differences in the degree of internalisation of externalities, the existence of irreversibilities, the displacement of pre-existing ecosystems). Most significantly, the qualifications are of particular relevance to poorer countries and North-South trade.

- Although economic theory and simulation models suggest that international differences in the stringency of environmental regulation are likely to be significant determinants of trade patterns, the empirical evidence is limited. This may, however, be mainly of a reflection of the methodological issues involved and as such concerns such as those associated with "eco-dumping" – particularly from the North to the South – should not be dismissed on the basis of such results.

- Environmentally-motivated trade interventions are only legitimate in instances involving transfrontier pollution emissions or transboundary resource use. However, even in such cases it is clear that successful resolution of such problems will require recognition of international differences in environmental preferences and natural endowments. This is likely to be particularly important in cases involving North-South relations.

- Distributional issues are also important in all three types of international environmental agreement – those which involve trade bans, ones which use trade restrictions as incentives, and those in which trade in environmental permits is actively promoted. They are important, both in order to encourage accession and for reasons of equity.

Thus in general it is clear that economic analysis has a great deal to say about the relationship between trade and the environment. However, the relationship is significantly more complex than simple textbook analysis would imply or that some international organisations have been prepared to admit. As such, policy prescriptions related to the nexus between trade and the environment are dependent upon the specific context concerned, both in terms of the environmental issue to be addressed and in terms of the trading relationships involved. Some general recommendations can, however, be made:

- Given the potentially significant environmental impacts of trade liberalisation, environmental impact assessments should be undertaken before any significant trade agreement is signed. However, such assessments are best understood as a means of determining potential environmental problems and as a guide to introducing appropriate safeguards, rather than strictly as a means of determining whether or not the agreement should be brought into force.

- Since the unilateral imposition of more stringent environmental regulations does not appear to result in significant deterioration in competitiveness, such effects should not be used as a pretext for delays in the application of regulations which are economically justifiable in the absence of such effects. However, for those regulations which may have important trade effects the establishment of cooperative agreements with major trading partners may be required.

- Domestic trade policy interventions to effect changes in production practices elsewhere are only environmentally justifiable in certain circumstances. In such cases, the provision of economic assistance from the affected country to that which is responsible for the damages may be necessary if environmental preferences and natural endowments differ significantly.

- The transfer of economic resources from the North to the South may also be important in international environmental agreements with international trade components. However, it is important to emphasise that these transfers may be economically efficient and not just equitable, or else they may not be politically acceptable in donor countries.

Moreover, a final policy recommendation is that trade and the environment not be treated as separable issues, and that the relationship between the two be understood in the context of North-South relations more generally.

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