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Environmental and Food Safety Standards in the Context of Trade Liberalization: Issues and Options

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Abstract

The current debate on trade liberalization is accompanied by an increased concern about environmental and food safety issues leading to frictions of different country groups under the World Trade Organization (WTO). This discussion paper aims at shedding more light on some of the issues in the "trade and environment" debate. It describes the complex process of setting standards, the relevant WTO agreements dealing with technical as well as sanitary and phytosanitary standards and potential outcomes of setting environmental standards—outcomes for the environment, for international trade relations and the competitiveness of countries. The theoretical part shows that under certain assumptions, not only protectionist but also environmental concerns may lead to a political decision for suboptimal standards. Finally, the paper offers a list of alternative policy responses and strategies to tackle environmental issues in the context of international trade. This includes the polluter-pays principle, eco-labeling and other labeling schemes, reducing in- and output subsidies, stronger enforcement of given standards, technical assistance, harmonization and mutual recognition of equivalent standards, and multilateral environmental agreements (MEAs). It is concluded that while no individual strategy proves to be the optimal solution, a mixture of different approaches is needed and care has to be taken to avoid the misuse of environmental standards for protectionist reasons. The participation of developing countries should be increased when setting standards at international level, defining criteria for eco-labels or negotiating MEAs.

Kurzfassung

Die aktuelle Debatte zur Handelsliberalisierung wird begleitet von wachsenden Bedenken zur Umwelt und Lebensmittelsicherheit, wodurch es zu Reibungen zwischen verschiedenen Ländergruppen innerhalb der Welthandelsorganisation (WTO) kommt. Diese Studie zielt darauf ab, die Streitpunkte in der Diskussion um „Handel und Umwelt" näher zu beleuchten. Sie beschreibt den komplexen Prozess der Entwicklung von Standards, die relevanten Abkommen der WTO, welche sowohl technische, als auch sanitäre und phytosanitäre Standards betreffen, und potenzielle Ergebnisse der Umweltstandardsetzung - Ergebnisse für die Umwelt, für internationale Handelsbeziehungen und die Wettbewerbsfähigkeit einzelner Länder. Der theoretische Teil zeigt, dass unter gewissen Voraussetzungen nicht nur protektionistische, sondern auch Umweltanliegen zu einer politischen Entscheidung für suboptimale Standards führen können. Zum Abschluss bietet der Beitrag eine Übersicht alternativer Instrumente für die Politik und Strategien zur Lösung von Umweltproblemen im internationalen Handel. Dies beinhaltet das 'Verschmutzer-zahlt-Prinzip', Öko-Labeling und andere Kennzeichnungsmaßnahmen, reduzierte Faktor- und Produktsubventionen, stärkere Durchsetzung von Standards, Harmonisierung und

gegenseitige Anerkennung äquivalenter Standards und multilaterale Umweltabkommen. Schlussfolgernd wird festgestellt, dass keine einzelne Strategie sich als optimal erweist, sondern dass eine Mischung verschiedener Einzelstrategien und Konzepte benötigt wird. Es sollte darauf geachtet werden, dass Umweltstandards nicht für protektionistische Zwecke missbraucht werden. Wenn Standards international festgelegt, Kriterien für Ökolabels definiert oder multilaterale Umweltabkommen verhandelt werden, sollte die Partizipation von Entwicklungsländern erhöht werden.

1 Introduction

Since the Rio Declaration in 1992 and the establishment of WTO in 1995, sustainable development has become an important concern of trade liberalization and thus, more attention is paid to local environmental problems caused by certain production and processing methods up to global problems like climate change or loss of biodiversity. The globalization process which is characterized by a reduction of tariffs, was accompanied by a rising importance of non-tariff trade barriers like environmental standards. At the same time, conflicts on environmental issues within the context of the World Trade Organization (WTO) have increased and may jeopardize the entire process of trade liberalization.

There are many open questions which need to be tackled by WTO and other closely related international organizations. These include the impact of environmental policy on trade and the impact of trade liberalization on the environment, the consideration of production and process measures (PPMs) to protect the environment, the relationship of WTO to multilateral environmental agreements (MEAs), or the role of alternative environmental policy approaches including the elimination of subsidies.

This paper sheds some light on the international debate on environmental standards in the context of WTO, and examines how the development and enforcement of national and international standards could be improved to avoid that standards may advance to non-tariff barriers. It has been structured as follows: In the second part, an overview of the definition, development and effects of standards is given. The third part specifies the implications and effects of environmental standard setting by presenting a theoretical model of the choice of environmental standards. The fourth part focuses on the Technical Barriers to Trade (TBT) and Sanitary and Phytosanitary (SPS) Agreements which have been established under GATT/WTO, and analyzes them in the light of ongoing disputes. Part four suggests a number of different policy approaches and strategies and partly investigates their relation to WTO obligations. The final chapter summarizes the major conclusions.

2 Environmental standard setting and its effects

2.1 Definition of environmental standards

The Organization of Economic Cooperation and Development (OECD, 1994) suggests a differentiation between the following two groups of environmental standards: 1) Product standards, and 2) Production and Process Methods (PPMs). A product standard relates to the technical characteristics of the product (i.e. performance, quality, safety). PPMs, however, are production and process related standards referring to the life cycle of a product and strongly depending on natural, climatic, technical or economic factors (Stevens, 1994). They have been classified into product-related and non product-related PPMs. The product-related PPMs change the characteristics of the final product so that its use or consumption may pollute or degrade the environment or may harm the health of the consumer ("consumption externality"). In case of non-product-related PPMs, the product itself does not transmit any environmental damage. Instead, the environmental damage is caused at an earlier stage of the life cycle through the production process, and thus takes the form of a "production externality" (OECD, 1994). Examples include high levels of dangerous and toxic emissions during production, the use of certain inputs or methods like the use of fire as a land clearing method.

2.2 Motivations for developing standards

The interests and motivations for developing standards are driven to different extents by economic, environmental and value-based concerns. Motivations for standards often purely aim at achieving an internalization of external environmental costs to achieve that the polluter covers the costs for avoiding or removing its own potential environmental damage at local, regional or global level (polluter pays principle) (OECD, 1998). However, type and scope of the environmental impacts and thus the motivation for setting product standards and PPMs can differ. Following the categorization suggested by the OECD (1994), there are different types of environmental degradation to be identified which justify the development and enforcement of standards:

1. Local environmental impact: The consumption or production of a local product may lead to environmental degradation which is limited to a country or a region within the country. It includes local air, water and land pollution or loss of biodiversity. Most environmental problems are local, meaning that their effects are not transferred through the product to the environment of the importing country.

2. Regional environmental impact: Environmental degradation may occur to air, water or land in a physically-adjacent country or in a shared geographical region, i.e. pollution of a shared river, depletion of fisheries or danger to migratory species or other "production externalities" with spillover effects.
3. Global environmental impact: An environmental degradation may occur to global assets or resources which are common to all countries, e.g. depletion of ozone layer, climate change, endangerment of species, and loss of biodiversity.

In reality, there is also a mixture of environmental impacts likely to occur in international trade. If one country does not take into account its environmental costs caused through its chosen PPM, the following environmental outcomes may occur:

1. Production and/or consumption of own products cause local environmental damage.
2. Consumption of exported products causes local environmental damage in the importing country.
3. Production and/or consumption of the products cause regional pollution like polluted river water which travels across borders.
4. Production and/or consumption of the products causes global environmental damage like global warming.

These impacts in terms of domestic and transnational externalities also determine the level of environmental standards chosen by a country, as will be shown in the theoretical model in chapter 3. In addition, the affected countries may even try to enforce environmental standards in the polluting country by imposing trade sanctions on them. Enforcing product standards or product-related PPMs will address the consumption externalities by allowing the importing country to refuse the import of the goods at the border. The enforcement of non-product-related PPM standards, however, which would tackle all four categories of environmental problems, is questioned under WTO (OECD, 1994)—due to valid reasons which will be mentioned later on. Alternative ways of addressing these environmental impacts need to be found on an international basis.

Motivations may be mainly driven by changed preferences (with raising income and a more densely populated world), and better information and communication about production and consumption externalities.

But not only environmental goals, also employee protection and animal welfare protection may motivate the setting of standards. Similarly, environmental measures may be taken on a moral basis, rather than to solve a specific environmental problem. Motivations for setting trade-restricting standards based on values and preferences usually aim at the production

process in exporting countries and may e.g. include the imports of cosmetics which are tested on animals or other goods which damage the environment in any way.

Economic motivations are generally based on achieving increased transparency, reduced transaction costs and food safety. The economic debate often focuses on compliance cost and competitiveness effects of standards. On the one hand, it is feared that the introduction of costly environmental standards puts the producers and the country as a whole into a disadvantaged competitive situation. On the other hand, there are concerns that environmental standards are motivated by reasons of protectionism to reduce market access for potential competitors.

2.3 The process of setting standards

Industry size and concentration of market share, dominance of buyers, technology intensity and degree of public welfare concern all affect standard development patterns and outcomes. Depending on these factors, there are mandatory, voluntary consensus or de facto standards (Wilson, 1995):

- Mandatory regulatory standards are enforced by the government and are set for safety, health, and partly environmental or related reasons. Very often, these standards had been voluntary standards established by the private sector and then adopted by the government as mandatory.
- Voluntary consensus standards arise from a formal coordinated process in which key participants in a market or sector seek consensus. Thus, the International Standardization Organisation (ISO) for example has developed close to 7,000 voluntary standards at the global level. Many voluntary standards like for eco-labeling are also introduced as a response to consumer requests.
- De facto standards are developed from an uncoordinated process on the competitive market. If producers complying with de facto standards have a relatively high market share, competitors often have to adopt the standard if they wish to compete successfully. Some of the ISO standards (ISO 9000; ISO 14000) have become de facto requirements for producers as their world-wide importance has significantly increased over time.

The trend towards standards and restrictive trade measures is mostly driven by developed countries which are characterized by a growing environmental awareness and food safety concerns of better-off consumers. The result includes standards which can be easily enforced in industrialized countries but not necessarily in developing countries.

In addition, the more advanced economies have established institutional structures for developing appropriate environmental policies (Anderson, 1995). Fundamental differences in the

legal framework for protecting consumers from health hazards actually provide some justification for diverging conceptions on the role of government in setting standards. The legal systems of Latin American countries, for example, give a predominance to *ex ante* regulation, and impose relatively few economic sanctions to offenders, compared to the US legal system. In the US, *ex pos*t liability is a major incentive for ensuring food safety, and because of this, many firms, which risk both their reputation and a high cost in case of legal action, set up standards that exceed those required for passing government approval process.

Similarly, standards can be set in an extremely strict manner but still have minimal effect if monitoring and enforcement are lax. The existence of standards alone is often insufficient to assure that products comply with standards. In many countries, there is a lack of capacity building to develop, implement and enforce standards. In Taiwan or the People's Republic of China, e.g. the Government takes over the responsibilities for the development, implementation, including accreditation, consulting and certification, and enforcement of standards. In contrast, in the United States, there are over 750 public organizations in co-operation with private organizations that develop and implement national standards. Developing and enforcing regulations through fines is basically in the hand of the Environmental Protection Agency (EPA) which is a strong command-and-control system. Only since 1995, the EU has a similar institution, namely the European Committee for Standardization (CEN) which uses the Eco-Management and Audit Scheme (EMAS) to address this need. In many developing countries, the existence of such an institution is missing. Also, certification granted in some countries is not as highly valued as in others which can lead to discrimination of countries again. The lack of bilateral and regional acceptance of certification is evident.

The process of setting standards in a country, especially the level of standards in terms of their stringency, also depends on the level of standards in other countries. This interdependent process and its outcome are analyzed from a theoretical perspective in chapter 3.

2.4 Harmonizing standards

Producing according to harmonized standards may increase the economies of scale of a company or country because it does not have to adjust to diverse requirements in different countries, and it may also decrease the transaction costs in trade. However, harmonizing standards is not always an easy task and might not be desirable in every case. Product standards and PPMs across nations widely vary depending on many different factors:

- Environmental conditions: Adjustment to different climate, and factor and resource endowments, like water availability, is needed, and differences in the capacity of absorbing pollution in various countries exist leading to different cost and benefit structures for alleviating environmental damage.

- Economic conditions: Different levels of development and per capita incomes determine the development, implementation and enforcement of standards. People's willingness to pay for environment and quality differs from country to country and within countries. Costs and availability of environmental techniques differ as well.
- Political conditions: Different standards across nations reflect the choice of environmental policy and the perceptions of optimal environmental policy. Also other policies like trade policy impact on the environment.
- Social and cultural conditions: The prevailing standards depend on preferences of the population for environmental goods or knowledge about the environmental effects of certain activities. The concept of product quality itself is multidimensional (Hooker and Caswell, 1995). Among the many attributes that define quality, the perception of which ones are important, differs across countries for historical or cultural reasons.
- Institutional conditions: The role and capacity of institutions also reflects the differences in standards across countries. This refers not only to the setting of standards but, even more importantly, to the enforcement of the standards.

From an economic point of view, it is not considered optimal and desirable that countries adopt similar standards. Global harmonization does not allow countries to adjust standards to local requirements, conditions or preferences. Therefore, a global adjustment of environmental standards would lead to a renunciation of welfare gains of trade assuming that the international production structure is based on comparative cost advantages (Anderson, 1995). However, adjusting standards can also lead to positive scale effects. If exporters are confronted with different, possibly contradictory product standards, this may turn out trade restrictive (Henson, 1998).

2.5 Effects of environmental standards

Effects on trade and competitiveness

Environmental standards may easily develop into non-tariff trade barriers affecting trade flows and export opportunities of countries. If the motivation of protectionism prevails, there is a risk of setting standards in such a way that foreign suppliers are systematically disadvantaged. For example, the use of certain ingredients may be prohibited, not because they are actually bad for one's health or ecologically harmful, but because they are used by foreign competitors and not by domestic suppliers. Even if standards are not set for discriminating purposes, they may turn out trade restrictive if exporters find themselves confronted with different, possibly contradictory product standards. The simultaneous adjustment to different demands often leads to the loss of positive scale effects in production (Henson, 1998).

For about a quarter of a century, since the development of environmental legislation and its enforcement in industrial nations, there is opposition of a group of producers or policy-makers who fear that, because of higher environmental costs, the competitiveness of the own company, sector or country diminishes. Also, a public opinion poll conducted in the USA in 1990 by the Wall Street Journal confirmed that one third of those asked thought that their job was at risk because of higher environmental standards, compared with the less than 0.1 % employees who actually became unemployed between 1987 and 1990 as a result of higher environmental costs (Goodstein, 1995).

Past studies about assessing competitiveness in the scope of increasing environmental standards are based on very different methods, time periods and countries (Nordström and Vaughan, 1999; Helm 1995). A cost approach was used in many studies that investigated the effect of environmental standards on production and trade. These studies generally choose a group of potentially ecologically harmful industries and analyze trends in the settlement of production sites, of international trade or of investments in order to find out whether increasing environmental standards in an industrialized country lead to a transfer of the production sites or to decreasing competitiveness. These studies refer to the hypothesis of "pollution havens", which says that polluting industries move from industrialized countries to developing countries to avoid environmental costs arising from the compliance with higher standards.

The results from these studies differ significantly. Tobey (1990, 1993) tested whether world trade suffers from the imposition of environmental policy, but found little empirical evidence for it. Based on water-pollution data from China, Dean (1999) analyzed the impact of trade liberalization on emission growth. She found that while increased trade openness in China directly aggravates environmental damage by inducing an expansion of polluting sectors, income growth indirectly decreases emissions. Mani and Wheeler (1999) found that 'pollution-haven' effects meaning that lower trade barriers will not result in developing countries specializing in pollution-intensive industries, are insignificant because production is primarily for the domestic market, not for export. The increase in the developing countries' share of dirty-sector production is attributable to a highly income-elastic demand for basic industrial products. As income levels have increased, this elasticity has declined, and the stringency of environmental regulations has been raised. In some studies, it was found that the export share of polluting products of industrialized nations tended to decrease—in comparison to developing nations in which the share increased (Low and Yeats, 1992; Sorsa, 1994; UNCTAD, 1994). Other studies showed that imports of environmentally-intensive products from the USA and Japan increased relatively more than exports (Kalt, 1988; Sorsa, 1994; Lee and Roland-Holst, 1994). For Europe, little evidence of a general loss of competitiveness has been found for environmentally-intensive industries (Jenkins, 1999). In general, countries with relatively high environmental standards are still the most important producers and exporters of the most environmentally-sensitive products and, at the same time, have the highest standards of living (OECD, 1997a).

In spite of these empirically proven negative effects of environmental standards on competitiveness, authors are very careful about their interpretation. Different other factors are considered to have a substantially stronger effect on international competitiveness than environmental costs and legal framework conditions. These include the wage level, education level, political and economic stability or the vicinity and size of markets as well as the infrastructure.

Effects on costs

Compared with total cost differences, the compliance costs deriving from environmental standards are relatively small and insignificant for the international competitiveness. According to the OECD (1997b), direct environmental costs are estimated to make up only 1-5% of the production costs in industry. Also, in previous studies, Dean (1992) and Jaffe et al. (1995) pointed out that for most producers environmental costs make up only a small part of the total costs. In the USA, for example, it was found that production costs for steel amount to about US$ 513 per ton, US$ 15 of which are ascribed to environmental costs. In Mexico, production costs only amount to about US$ 415 per ton. Even if the USA did not have to raise environmental costs, their costs would still be higher by US$ 83 or little less than 20 % than in Mexico (OECD, 1997b). According to Tobey (1990, 1993), the costs of pollution control have not been very large in pollution-intensive industries and countries with stringent pollution control policies. In the USA, estimates suggest that control costs amount to about 2-2.5% of total costs in most heavily polluting industries. In the agricultural sector, low costs of compliance for meeting environmental standards (up to 4 %) have been found in an international comparison study for the production of selected agricultural products. Total cost differences between Brazil, Germany and Indonesia were mainly based on differences with respect to the wage level, prices for land, machines, buildings and equipment. With respect to processing, the results, however, were ambiguous (Grote, Deblitz and Stegmann, 2000; Grote et al., 2001).

However, some further recent studies found out that environmental compliance costs have systematically been underestimated in previous analyses due to data or the narrow definitions of environmental costs (Esty und Geradin, 1998). They point out that opportunity costs that arise from administration expenses, insecurities and time delays have not been considered (Chapman, Agras and Suri, 1995). Another recent study points out that environmental costs due to governmental subsidies were estimated lower than they actually are (van Beers und van den Bergh, 1997).

Innovation effects

An innovative approach assumes that increasing competition pressure and relatively higher environmental standards may positively affect companies` innovative power (Porter-Hypothesis). These companies search for new ways of increasing their productivity by trying to reduce environmental pollution or by saving on input factors through cheaper material or through

the reduction of losses. The international company DuPont, for example, tried to develop substitutes for ozone destroying CFCs and to put them on the market at an early stage. Because of that, the company gained substantial competitive advantages (Porter, 1991). Alternatively, companies attempt to transform their produced waste into salable goods to earn an additional income (Porter and van der Linde, 1996). Within the scope of eco-labeling, there is a tendency towards the production of environmentally-friendlier products in order to fill a gap in the market and to gain price advantages (Grote and Basu, 1999).

Higher environmental standards have set the basis for gaining pioneering profits and for achieving a competitive advantage not only for individual companies, but also for individual countries. Germany, for example, which is considered pioneer country for relatively high environmental standards, managed to successfully take up the export of environmentally-friendly technologies and thus gained a strong position in the world market.

The European Commission (EC, 1992) and the World Bank (1992) support the opinion that the innovative approach leads to so-called `win-win` solutions which means that two objectives—e.g. an environmental objective and an efficiency objective—are reached at the same time. Can new technologies simultaneously reduce emissions and costs? An extensive study about environment-efficiency relations was carried out by Repetto (1995). He looked at financial and environmental data of nearly 2000 processing sites in the USA and found no general tendency for industries that attach great importance to the environment being less profitable.

Summary

In summary, no clear conclusions can be drawn from existing studies about the effect of environmental standards on the competitiveness of companies and industrial branches. The ambiguous empirical results, the industry-level aggregation of many studies, and the focus on U.S. data all contribute to a continuing debate about these aspects. Some considerations on standard setting and its potential effects will be analyzed more in detail in a theoretical framework in the following chapter. Still, the WTO (Nordström and Vaughan, 1999) states in summary that concerns about the competitiveness are highly overrated in the public debate. An assessment of the competitiveness effects of environmental standards also depends on their cost and innovation effects. On the one hand, according to previous studies, costs of environmental standards make up only a small part of the production costs. On the other hand, factors such as wages, taxes, payments of duty on previous achievements as well as the innovation effects of standards have a considerably stronger effect on the international competitiveness of a country than the costs of environmental standards. Moreover, harmonizing standards is not always an easy task and might not be desirable in every case. Product standards and PPMs across nations widely vary depending on environmental, economic, political, social and cultural and/or institutional conditions, and may even constitute comparative advantages.

3 A formal model of the choice of environmental standards

In this section, we present a formal model which illustrates some of the aspects involved in the choice of environmental standards discussed in the literature. Moreover, the model points to some additional considerations that have received little attention so far: potential environmental reasons for suboptimal standards and the role of international coordination in standard setting. The model addresses the issue of optimal standard setting by governments in different types of countries and analyzes whether the outcomes could be improved through international cooperation. As any theoretical model, the one presented below is based on strong assumptions and is used to illustrate various issues rather than to represent all aspects of reality. It should also be noted upfront that international cooperation here is different from a harmonization of standards as discussed in the literature summarized before. While harmonization usually refers to a process where countries' different environmental standards become more similar, cooperation here is seen as a process where different countries coordinate their standard-setting activities. The latter does not necessarily imply that standards will be more similar. As the model illustrates, cooperation can be of particular benefit in the presence of a transnational externality.

Assumptions

Consider a simple model where there are only two producing countries: a developed country (DC) and a less developed country (LDC). DC produces a good, which causes local environmental damage and these damages are internalized through national environmental policy. A substitute for the good is produced in LDC where its production causes both local pollution and transnational pollution. The product is consumed elsewhere.

Throughout the model capital letters are used for DC and lower-case letters for LDC. Let X and x denote DC's and IDC's production of the good, respectively. Demand for the good is given by the inverse demand function

$$P = a - b\,(X+x). \qquad (A1)$$

There is a single firm in each country and the two firms engage in Cournot competition. DC's cost function is CSX, where C is a parameter and S denotes the country's environmental standard. Thus, costs are increasing in production and in the level of the environmental standard and marginal costs are constant and equal to CS. Similarly, LDC's cost function is csx, where c is a parameter and s denotes LDC's environmental standard.

DC production of the good causes local environmental damages equal to $M(\bar{S} - S)X$, where M is a parameter and $\bar{S}$ is the highest possible environmental standard.[1] Thus, damages are decreasing in the level of the environmental standard and increasing in the quantity produced.

LDC production of the good causes not only local environmental damages, but also transnational damages, i.e., damages to an aspect of environmental quality valued by DC. Local damages in LDC are given by $m(\bar{s} - s)x$, where m is a parameter and $\bar{s}$ denotes the highest possible environmental standard in LDC. Transnational damages are given by $G(\bar{s} - s)x$, where G is a parameter.

Firms' production choices

Firms are assumed to take environmental standards as given and engage in Cournot competition. That is, each firm chooses its quantity produced to maximize its profits taking the other firm's production quantity as given. For example, DC firm's problem is to

$$\max_X [a - b(X + x)]X - CSX$$

The first order condition for an interior solution is

$$a - b(2X + x) - CS = 0$$

Similarly, LDC firm's problem is to

$$\max_x [a - b(X + x)]x - csx$$

Its first order condition is

$$a - b(X + 2x) - cs = 0$$

Solving both first-order conditions simultaneously for X and x yields the equilibrium quantities

$$X(S, s) = \frac{1}{3b}(a - 2CS + cs) \quad (1)$$

and $$x(S, s) = \frac{1}{3b}(a - 2cs + CS). \quad (2)$$

The first derivatives of the production quantities with respect to the level of environmental standards in both countries are

$$X_S = -\frac{2}{3b}C < 0, \quad (3)$$

$$X_s = \frac{1}{3b}c > 0, \quad (4)$$

$$x_s = -\frac{2}{3b}c < 0, \quad (5)$$

[1] The highest possible environmental standard refers to the level of standard which corresponds to a level of zero environmental impacts.

$$x_S = \frac{1}{3b} C > 0 . \tag{6}$$

These results are intuitive. An increase in a country's own standard increases production costs and reduces own production. This decrease in own production increases the world price of the good, leading the other country to produce more. Therefore, each country's production is increasing in the other country's environmental standard and decreasing in its own standard. Thus, the model formalizes the idea that higher environmental standards lead to higher production costs and reduced output within the country. In addition, it raises the issue that if the market share of the country raising a standard is large enough, the fall in output levels could result in an output expansion elsewhere, potentially at the cost of the environment.

Moreover, in this model total production decreases when one of the two countries raises its environmental standard because

$$X_S + x_S = -\frac{1}{3b} C < 0, \; and \quad X_s + x_s = -\frac{1}{3b} c < 0 . \tag{7}$$

Firm's profits

Let us now consider the effect of environmental standards on firms' profits in our model. DC firm's profits are given by

$$\Pi(S,s) \equiv P\big(X(S,s) + x(S,s)\big)X(S,s) - CSX(S,s),$$

and LDC firm's profits by

$$\boldsymbol{p}(S,s) \equiv P\big(X(S,s) + x(S,s)\big)x(S,s) - csx(S,s).$$

The change in firms' profits in response to a change in the country's own environmental standard is given by

$$\Pi_S = P'\big[X_S + x_S\big]X + PX_S - CX - CSX_S, \tag{8}$$

and

$$\boldsymbol{p}_s = P'\big[X_S + x_S\big]x + Px_s - cx - csx, \tag{9}$$

where P' is the first derivative of the price function. The first term in equations (8) and (9) is positive and represents the fact that a higher standard decreases total world output (from (7)) and therefore increases the world price of the good and firms' profits. The second term in equations (8) and (9) is negative and shows the fall in firms' revenues due to their own decrease in production. The third term is negative, representing the direct increase in production costs due to the higher standard, while the last term shows the cost reduction due to decreased production levels. Substituting from (A1) and (1) through (6) and collecting terms we get

$$\Pi_S = \frac{1}{9b} C\big[-4a + 8CS - 4cs\big] = -\frac{4}{3} CX < 0, \tag{10}$$

and

$$\boldsymbol{p}_s = \frac{1}{9b} c\big[-4a + 8cs - 4CS\big] = -\frac{4}{3} cx < 0. \tag{11}$$

Thus, the total effect of a country's increase in environmental standards on own firm profits is negative. The model presents one possible formalization of the expected protectionist argument against higher standards.

Similarly, the effect of an increase in environmental standards abroad on firm's profits is given by

$$\Pi_s = P'[X_s + x_s]X + (P - CS)X_s, \tag{12}$$

and $$\pi_S = P'[X_S + x_S]x + (P - cs)x_S. \tag{13}$$

The first term in (12) and (13) is positive as before. The second term is positive as well and shows the increase in net revenues due to the fact that the firm produces more when the other country's environmental standards are raised. Substituting from (A1) and (1)-(6), we get

$$\Pi_s = \frac{1}{9b}c[2a - 4CS + 2cs] = \frac{2}{3}cX > 0, \tag{14}$$

and $$\pi_S = \frac{1}{9b}C[2a - 4cs + 2CS] = \frac{2}{3}Cx > 0. \tag{15}$$

Thus, firms benefit from an increase in environmental standards abroad. This result is similar to the pollution haven hypothesis described in section 2.3 of this paper, although the model does not allow for firms to move to another country. It also presents a potential explanation why we observe some countries pushing for higher standards abroad.

Government's non-cooperative choice of standards

Let us now consider governments' choice of environmental standards in the absence of cooperation. It is assumed that each country's government chooses its level of standard to maximize the value of its own firm's profits minus environmental damages. In doing so, we assume that governments' take the other country's level of environmental standards as given, but do take into account how an increase in the own standard affects production decisions worldwide.[2] DC government's problem is thus to

$$\max_S \Pi(S, s) - M[\bar{S} - S]X(S, s) - G[\bar{s} - s]x(S, s),$$

which yields the first-order condition

$$\hat{\Pi}_S + M\hat{X} - M[\bar{S} - \hat{S}]\hat{X}_S - G[\bar{s} - \hat{s}]\hat{x}_S,$$

or $$M\hat{X} - M[\bar{S} - \hat{S}]\hat{X}_S = -\hat{\Pi}_S + G[\bar{s} - \hat{s}]\hat{x}_S, \tag{16}$$

[2] Note that this does not imply that the choice of standard does not depend on the level of the standard in the other country. In fact, equations (16) and (17) show that it does. The solution discussed here is a Nash equilibrium, which can be obtained by solving the two equations simultaneously.

where $\hat{S}$ and $\hat{s}$ denote the optimal standards when chosen non-cooperatively and hats over the profit and output functions and their derivatives denote that these functions are evaluated at $\hat{S}$ and $\hat{s}$. The left-hand side of condition (16) shows the marginal benefit to DC of raising its environmental standard while the right-hand side shows the marginal costs. The benefits are due to a reduction in DC's local environmental damages caused by both a decrease in marginal damages (term *MX*) and a fall in local production (term $-M[\bar{S}-S]X_S$). DC's marginal costs from a higher environmental standard has two components. First, a higher standard decreases own firm's profits (term $-\Pi_S$), the standard protectionist argument against higher standards. Second, a higher DC standard increases production abroad, thereby increasing transnational environmental damages. Thus, there is an additional, environmentalist argument against higher standards. DC's optimal choice of environmental standard is lower than it would be in absence or ignorance of the transnational externality. Both of these considerations exist in the model despite the fact that the government is assumed to act as a welfare-maximizing social planner.[3] We would expect that political-economy considerations would work in favor of even lower standards.

Similarly, the LDC government chooses its level of environmental standard to

$$\max_s \boldsymbol{p}(S,s) - m[\bar{s}-s]x(S,s),$$

and the first-order condition for an interior solution is

$$\hat{\boldsymbol{p}}_s + m\hat{x} - m[\bar{s}-\hat{s}]\hat{x}_s,$$

or
$$m\hat{x} - m[\bar{s}-\hat{s}]\hat{x}_s = -\hat{\boldsymbol{p}}_s. \qquad (17)$$

Again, the right-hand side of (17) shows the marginal benefits of a higher standard to LDC and the left-hand side shows the marginal costs. The interpretation is exactly as above. The only difference between the LDC and DC problem is that LDC does not value the environmental damages from DC production. If, in addition, LDC did not consider its own local environmental impacts, it would choose the standard as low as possible to simply maximize its own profits.

The Nash equilibrium level of standards in both countries is obtained by solving equations (16) and (17) simultaneously.

[3] If the country was assumed to also consume the good, the government would consider the trade-off between protecting its firm and the impact on consumers from the resulting price increase.

Bilaterally optimal standards

We have analyzed how governments would optimally choose the level of environmental standards when acting in a noncooperative manner. Could governments gain from a coordination of their standard setting? To address this issue, let us consider the bilaterally optimal level of environmental standards. This can be found by maximizing the sum of both countries' welfare:

$$\max_{S,s} \Pi(S,s) + \boldsymbol{p}(S,s) - M\left[\overline{S} - S\right]X(S,s) - G[\overline{s} - s]x(S,s) - m[\overline{s} - s]x(S,s).$$

The first-order conditions for an interior solution to this problem are, for S and s, respectively:

$$MX - M\left[\overline{S} - S^*\right]X_S + \boldsymbol{p}_S = -\Pi_S + G[\overline{s} - s^*]x_S + m[\overline{s} - s^*]x_S, \qquad (18)$$

and

$$mx - m[\overline{s} - s^*]x_s + \Pi_s - G[\overline{s} - s^*]x_s + Gx = -\boldsymbol{p}_s + M\left[\overline{S} - S^*\right]X_s. \qquad (19)$$

where S^* and s^* denote the optimal standards when chosen noncooperatively and asterixes over the profit and output functions and their derivatives denote that these functions are evaluated at S^* and s^*.

Comparing conditions (16) and (18) we see that from a bilateral point of view there is an additional cost and an additional benefit to an increase in DC's environmental standard. The additional benefit is due to the fact that by increasing the standard LDC profits increase (term $\boldsymbol{p}_S$). The additional cost is caused by the local environmental damages from increased production in LDC (term $m[\overline{s} - s]x_S$). Let us now analyze whether the sum of these terms is positive or negative when evaluated at the non-cooperative levels of standard. If the additional net benefit of a higher standard is positive (negative) at the non-cooperative levels of $\hat{s}$ and $\hat{S}$, then the bilaterally optimal level of standard, S^*, should be higher (lower) than the non-cooperative level. The additional net benefit of a higher DC standard to be considered when chosen bilaterally rather than non-cooperatively is $\boldsymbol{p}_S - m[\overline{s} - s]x_S$. Evaluating this term at $\hat{s}$ and $\hat{S}$, and using equations (5), (6), (13) and (15), we get

$$\hat{\boldsymbol{p}}_S - m[\overline{s} - \hat{s}]\hat{x}_S = -\frac{C}{2c}[\hat{\boldsymbol{p}}_s - m[\overline{s} - \hat{s}]\hat{x}_s] = \frac{C}{2c}mx > 0,$$

where the last equality follows from condition (17). Hence, the additional net benefit to be considered when choosing the DC standard cooperatively is positive. Therefore, the bilaterally optimal level of DC standard is higher than the non-cooperative level. At the non-cooperative level of DC environmental standards, the benefit from a higher DC standard to LDC in form of higher profits always exceeds the local damages from increased production there. Thus, from a bilateral point of view the total welfare of both countries can be increased if DC standards were raised above non-cooperative levels.

Similarly, a comparison of conditions (17) and (19) shows that an increase in LDC standards has additional costs and benefits not taken into account by LDC. A higher LDC standard raises DC profits (term Π_s). A further benefit from a higher LDC standard is the reduction in transnational environmental damages due to both lower marginal damages of LDC production (term $Gx.$) and a fall in LDC production (term $-G[\bar{s}-s]x_s$). On the other hand, an increase in LDC's standard increases DC production, causing additional local environmental damages in DC (term $M[\bar{S}-S]X_s$) due to an increase in production there. Again, if the additional net benefit of a higher LDC standard is positive at the non-cooperative levels of $\hat{s}$ and $\hat{S}$, then the bilaterally optimal level of standard, s^*, should be higher than the non-cooperative level. The additional net benefit of a higher LDC standard is given by $\Pi_s - M[\bar{S}-S]X_s - G[\bar{s}-s]x_s + Gx.$ Evaluating this term at $\hat{s}$ and $\hat{S}$, and using equations (3) through (6), (10), and (14), we get

$$\begin{aligned}\hat{\Pi}_s - M[\bar{S}-\hat{S}]\hat{X}_s - G[\bar{s}-\hat{s}]\hat{x}_s + G\hat{x} &= -\frac{c}{2C}\left[\hat{\Pi}_S - M[\bar{S}-\hat{S}]\hat{X}_S\right] + \frac{2c}{C}G[\bar{s}-\hat{s}]\hat{x}_S + G\hat{x} \\ &= \frac{c}{2C}\left[M\hat{X} - G[\bar{s}-\hat{s}]\hat{x}_S\right] + \frac{2c}{C}G[\bar{s}-\hat{s}]\hat{x}_S + G\hat{x} \\ &= \frac{c}{2C}M\hat{X} + G\hat{x} + \frac{3c}{2C}G[\bar{s}-\hat{s}]\hat{x}_S > 0,\end{aligned}$$

where the second equality follows from condition (16). Therefore, the bilaterally optimal level of LDC standard is higher than the non-cooperative level. The benefits from higher DC profits and lower transnational damages outweigh the increase in DC local damages. Thus, from a bilateral point of view the total welfare of both countries can be increased if LDC standards were raised above non-cooperative levels as well.

Conclusions

The following conclusions can be drawn from the model:

- First, an increase in a country's own standard reduces own production and profits. The reduced output in developed countries may increase the world market prices, thus giving an incentive to developing countries to produce more. If the environmental policy in the latter countries does not fully consider local or global environmental impacts, higher standards in developed countries can in that sense lead to negative environmental impacts. It can be seen from the model that this result depends on the assumption that the level of environmental standard affects production cost. If the cost increase from higher environmental standards is small[4], this will also lead to a smaller effect on outputs and prices. It is also important to note that the model does not consider the issue of price premia for environmentally-friendly products or

[4] In that case, the environmental standard would not enter into the cost function.

dynamic innovation effects which have been mentioned in the literature as potential counteracting factors. Similarly, if the country raising its standards has only a small market share for the product, the price effect and resulting expansion of output abroad would be negligible.[5]

- Second, the model shows that in the presence of a transnational externality, the developed country will choose lower environmental standards than in the absence of such an externality. The externality provides an environmentalist reason, in addition to the common protectionist reason, for a lowering of environmental standards which may result in a degradation of standards ("race to the bottom"). Again, it should be noted that this additional reason is justified only if production costs are affected by the environmental standard and the country has a significant market share.

- Finally, both countries' standards, when chosen non-cooperatively, are below the bilaterally optimal levels. Thus, total welfare of the two countries could be increased if a cooperative agreement was reached where both countries raise their environmental standards. The intuition behind this result is two-fold. The first reason is a protectionist one. By jointly raising environmental standards, the countries can exercise some monopolistic power. The second reason lies in the transnational externality. In the absence of cooperation, the country affected by the externality uses a lowering of its own standard as a second-best measure to reduce environmental impacts from production abroad. This is—again—due to the cost and price effects. By coordinating each others' standard setting, this second-best measure is substituted for by a rise in the standard of the country causing the externality, which directly addresses the source of the problem. It should be noted that in reality, cooperation between countries can be difficult to achieve (see Kirchhoff (1999) for a review of the economics literature on international cooperation).

[5] See Kirchhoff (1998b, 2000) for models of firms voluntarily overcomplying with environmental standards and even lobbying for higher standards, motivated by considerations of price premia and reputation effects.

4 Standards in the context of trade liberalization

4.1 Standards under the GATT/WTO system

The GATT is designed as a flexible agreement to adapt to a continuously changing international trading system and is aimed at reducing tariffs and other trade barriers and abolishing of discriminating behaviors in international trade. Introducing the objective of sustainable development into the WTO preamble led to an increasingly intense debate on the linkages between trade policy and environmental policy since the end of the Uruguay round. The increase of the product coverage under WTO is responsible for the standards issue to gain increasing attention. Under the GATT, mainly manufactures were covered, while the WTO encompasses all goods including agricultural products, services, partly capital and even ideas in form of intellectual property (Anderson, 1998).

The heart of the GATT is based on the *most favored nation requirement* (Article I GATT) and the *National treatment requirement* (Article III GATT). According to the most favored nation requirement, each member country which grants market access to another member country, has to grant the same rights also to all other member countries. According to Article III, a country may require that imported products ("like products") comply with the same product regulations as domestic products. Discriminating between imported "like products" offends against GATT principle. Since two products produced in different countries can never be completely identical, it needs to be decided according to which criteria two products are alike in the sense of Article III GATT. For example, a mandatory label on tropical timber was criticized as being inconsistent with GATT rules, as the regulations applied only to tropical timber and not to other types of wood or "like products". The GATT Agreement itself does not define the term „like product". The determination of what constitutes a "like product" is done case by case. In general, not only the tariff classification, but also the nature of the product, its use or value and substitutability should be considered (Vossenaar and Jha, 1994).

The GATT does not envisage to incorporate non-product-related PPM requirements into its rules. Therefore, domestic environmental degrading effects caused by the production of a tradable good in the producing country cannot be addressed by the use of PPM-based trade measures through another country. The use of trade measures to enforce such PPM standards risks an extraterritorial imposition of the PPM standards of the importing country on its trading partners. This is not agreeable with the fundamental principles underlying the international trading system and would interfere with the principle of international law that protect the sovereign right of countries to exploit their own resources and set their own standards and rules

for activities within their borders. In addition, the risk of protectionism caused by the use of PPMs is considered as particularly high. Many producing countries, especially in the developing world, will face difficulties in complying with PPM-related standards. In addition, inspecting and certifying the environmental quality of the PPMs is very costly and time-consuming and could be abused for protectionist reasons (Sampson and Chambers, 1999; Esty, 1994). However, pressures for PPM-related trade restrictions on developing countries increase and are based on competitiveness concerns and an international responsibility for global natural resources.

Many scientists are opposed to an increasing consideration of PPMs in WTO context. It is assumed that a "tin of the pandora full of protectionism" would be opened (Bhagwati, 1994). Instead, Bhagwati (1996) argues in favor of preserving a diversity of PPMs. He also suggests that allowing general objections to PPMs based on value judgments could lead to serious trouble for international trade. However, according to him, pernicious practices could be outlawed based upon international consensus.

Exceptions from the prohibition to use trade measures are included in the Article XX of GATT. Article XX (b) allows trade restrictions necessary to protect human, animal or plant life or health, while Article XX (g) allows restrictions relating to the conservation of exhaustible natural resources if such measures are made effective in conjunction with restrictions on domestic production or consumption. However, such restrictions are not allowed to be applied in a manner which would constitute a means of arbitrary or unjustifiable discrimination, or a disguised restriction on international trade. In general, the use of GATT Article XX for exceptions to the general trade agreement on the grounds of environmental justifications will be subject to continued, substantial, multilateral debates.

Based on Article XX GATT, international trade agreements like the Technical Barriers to Trade (TBT) Agreement and the Sanitary and Phytosanitary (SPS) Agreement have stipulated rules restricting the use of food quality and technical standards as non-tariff barriers.

4.2 The Agreement on Technical Barriers to Trade

In 1979, the TBT Agreement or Standards Code has been adopted to clarify the treatment of product standards and technical regulations under the GATT, and to ensure that these do not create unnecessary barriers to trade (Bruno, 1997). The TBT Agreement covers agricultural and industrial products. In addition to product standards and technical regulations, also product-related PPMs, meaning standards and technical regulations which impact on the final characteristics of the good or affect its quality or performance, have been covered under GATT (Chakarian, 1994). If an imported product does not comply with a binding technical regulation, it will not be allowed on the market. However, a product which does not fulfill the requirements of a voluntary standard, will be still imported (Altmann, 1994).

The Agreement lays down the rules for preparing, adopting and applying technical regulations, standards and conformity assessment procedures. The food standards e.g. refer to quality provisions, nutritional requirements, labeling and methods of analysis. It also includes a number of measures designed to protect the consumer against fraud (WTO, 1998). Conformity assessment procedures include technical procedures like testing, verification, inspection and certification which can constitute technical barriers to trade if there is no mutual recognition of the procedures or if they differ in terms of bureaucratic requirements.

Like most WTO Agreements, the TBT Agreement is based on the Most Favoured Nation (MFN) and national treatment obligations. That means that products imported from any Member country should be accorded treatment no less favorable than that accorded to like products of domestic origin and to like products originating from any other country. Further, it allows individual countries to set own technical and environmental standards, including packaging and labeling regulations (Anderson, 1995). It has established a notification system to ensure transparency and the opportunity for commenting on the draft legislation from potentially affected trading partners (Chakarian, 1994). Countries are obliged to inform other countries about the introduction and use of technical regulations, (1) if some considerable trade effects are expected, or (2) whenever a relevant international standard does not exist, or the technical content of the proposed regulation or procedure differs from that of the international standard.

The TBT Agreement also encourages countries to base their domestic standards and technical regulations on internationally-agreed ones to prevent that the standards create unnecessary barriers to trade. International TBT-standards are developed by the ISO, the International Electronic Commission (IEC) and the International Telecommunication Union (ITU). For example, ISO is an international non-governmental organization which brings together national standard setting organizations. ISO's involvement in establishing internationally agreed environmental standards started in 1991, and it has developed almost 10,000 standards (Knight, 1994).

The TBT Agreement is also based on the principle of equivalency. Let us assume that a country A wishes to protect its environment from high vehicle emissions and thus requires that vehicles are equipped with catalytic converters. Country B also wants to protect its environment but has introduced a regulation on the use of diesel engines to achieve this, instead. As a result, the two countries can agree on the equivalency of their technical regulations, thus allowing car exporters from country A to export cars with converters to country B, although not fulfilling the requirement of having diesel engines, and vice versa (WTO, 1998). This principle of equivalency is also highly relevant for the recognition of each others conformity assessment activities like registration, inspection, laboratory accreditation, independent audit and quality system registration schemes. Duplicative testing etc. creating additional costs in both, export and import countries could be avoided if the conformity assessment procedures would be recognized as equivalent. However, the implementation of this principle is only limited so far, and countries seem to look more for ‘sameness’ instead of equivalency (Zarrilli, 1999).

Similarly, the principle of mutual recognition has been introduced. A Mutual Recognition Agreement (MRA) includes for example that two or more countries agree to accept the results of one another's conformity assessment procedures, despite the fact that these procedures might be different. MRAs might therefore facilitate trade liberalization. An MRA for shellfish for example, as it has been introduced in 1995 within APEC details sanitation practices and administrative controls necessary in the exporting nation as well as responsibilities of importers in maintaining shellfish safe. Thus, it even includes PPMs to assure importing countries that shellfish produced under terms of an MRA are safe and comply with food standards of the importing country (Wilson, 1995).

The TBT Agreement failed to adequately address several disputes involving PPMs like in the case of the hormone beef case between Europe and the United States. Therefore, during the Uruguay Round negotiations, the SPS Agreement has been established.

4.3 The Sanitary and Phytosanitary Agreement

The SPS Agreement has been set up complementary to the Agreement of Agriculture to avoid that the reduction of tariff and non-tariff agricultural measures would be circumvented by disguised protectionist measures in the form of sanitary and phytosanitary measures. The SPS Agreement thus tries to close the potential loophole in the GATT, Article XX (b) which allows trade restrictions "necessary to protect human, animal or plant life or health". The objectives are described in the following (WTO, 1998).

Table 1: Objectives of the SPS Agreement

SPS Agreement	
Objectives	**Examples**
Protection of animal or plant life or health within the territory of the Member from risks arising from the entry, establishment or spread of pests, diseases, disease carrying organisms or disease–causing organisms	Import ban or restrictions on live cattle from herds infected with Bovine tuberculosis; certain fruit from areas plagued by the fruit fly
Protection of animal or plant life or health within the territory of the Member from risks arising from additives, contaminants, toxins or disease-causing organisms in food, beverages or foodstuffs	Maximum level of pesticide residues on oranges; regulations on salmonella for poultry; veterinary drugs given to farm animals; hygiene standards for slaughterhouses
Protection of human life or health within the territory of the Member from risks arising from diseases carried by animals, plants or products thereof, or from the entry, establishment or spread of pests	Restrictions on imports to avoid spread of rabies; bans on meat from foot-and-mouth disease regions
Preventing or limiting other damage within the territory of the Member from the entry, establishment or spread of pests.	Measure to prevent spread of certain weeds

Source: WTO, 1998.

The SPS Agreement includes the protection of fish and wild fauna, forests and wild flora, however, not the protection of the environment and animal welfare. The sanitary and phytosanitary measures which are suggested include imposing specific product or process criteria, quarantine regulations, certification or inspection procedures, sampling and testing requirements, or health-related labeling measures. Thus, labeling related to food safety are usually SPS measures, while labeling requirements related to the nutrition characteristics or the product quality are covered by the TBT Agreement (Zarrilli, 1999).

Non-product-related PPMs are not covered by the SPS Agreement which is based on the recognition that very often the quality of products cannot be separated from the quality of the production process. Thus, the GATT distinction between product and process standards is blurred in the case of the SPS Agreement. The importing country is eligible to inspect the production process in the exporting country (Chahoud, 1998). For example, Canada but also the EU sets PPMs on imports of meat and drugs which implies that sanitary conditions of production processes in exporting countries are controlled and certified before import licenses for meat are issued (Thomas and Tereposky, 1993; Wiemann et al., 1994).

A country has the right to impose higher food standards than the international ones. Other WTO Member countries, however, can request scientific proof justifying the necessity of a standard if they feel being discriminated. If the arguments are considered as not being sufficient, the case can be challenged at the WTO. Since January 1995, several complaints with respect to sanitary and phytosanitary measures have been raised in the WTO, including inspection procedures for fresh fruits; shelf-life regulations for processed meat products; bottled water requirements or restrictions on poultry processing methods. Bans have been put e.g. on imported salmon and on the use of growth-enhancing hormones in meat production (WTO, 1998). Both, developing as well as developed countries accounted for a total of 220 notifications based on the SPS Agreement in 1995 which increased to about 440 in 1999. From the developing world, Latin America has the highest share with Mexico having submitted 100 notifications in 1995. This is to be seen in relation to the establishment of the two regional trade agreements Mercosur and NAFTA. Asia's contribution to notifications has been modest, while Africa and the Middle East submissions have been rather small. The notifications submitted by the developed countries has also increased mainly due to the grown world food trade and the increased awareness about food, animal and plant safety (Wilson, 2000).

As in the TBT Agreement, a harmonization of SPS standards is tried to be achieved. The standard-setting organizations are the FAO/WHO Codex Alimentarius Commission which exists since 1962, the International Office of Epizootics (OIE) and the international and regional organizations of the International Plant Protection Commission (IPPC) (Bruno, 1997). The Codex e.g. evaluates food-borne hazards and sets non-health related technical food standards like nutrition, composition, and quality standards. It also develops scientific methodologies, concepts and standards to be used for food additives, microbiological contaminants, veterinary drug and pesticide residues. The development of international Codex standards is based on sound scientific analysis and evidence to ensure the quality and safety of food. It also considers other legitimate factors relevant for public health protection and for the promotion of fair practices in food trade like religion or culture. The role of food labeling is generally seen as important in achieving these two objectives. Codex standards, guidelines and recommendations are tried to be established on the basis of an evaluation of the actual risk involved. In detail, the risk analysis and assessment takes into account

- available scientific evidence, relevant production and process methods, inspection, sampling and testing measures, the prevalence of specific diseases or pests, and treatments;
- the relative cost-effectiveness of alternative approaches to limit risks;
- the aim of minimizing negative trade effects; and
- the need to ensure that the same level of protection cannot be achieved by alternative, less trade-restrictive measures (Bruno, 1997).

However, as the hormone beef case has shown, the decision of Codex bodies does not always reflect the results and attitudes of other recognized bodies leading to conflicts. Already back in 1988, the EU prohibited the use of six hormones commonly used to promote muscle growth in cattle, due to human health concerns, and at the same time, imposed an import ban on the hormone-treated beef. In 1996, the United States and Canada brought the case to the WTO, contending that the ban was an unjustifiable trade barrier. In February 1998, the Appellate Body decided that the ban violated the SPS Agreement, and that the EU had to deliver a scientific risk assessment showing that residues of the six hormones in meat posed a health risk to consumers by May 1999, or otherwise the EU would have to lift the import ban. The time restriction could not be met by the EU, and in addition, a joint WHO/FAO Scientific Expert Panel reconfirmed its earlier opinion that residues of the hormones were not harmful to human health if administered to cattle according to good veterinary practice. As a consequence, the United States and Canada imposed penal duties on selected European products. Finally, in May 2000, an interim report released by the EU's Scientific Committee on Veterinary Measures showed that one of the hormones can indeed be hazardous to health by exerting tumor producing effects. As a result, the EU proposed a revision of the EU directive 66/22/EG according to which the import ban for the one hormone will be definite, while the preliminary ban for the other five hormones will continue to exist until respective risk assessments can be delivered.

A similar example is Bovine somatotropin (BST) which is a synthetic growth hormone widely used to boost milk production in dairy cows. The EU prohibited its use in 1993 and Canada banned its sale last January after scientific studies showed that BST use negatively affected the health of dairy cows. While restrictions on its use on animal health grounds are not likely to be challenged, a WTO Member may face dispute settlement procedures if it decides to prohibit imports of dairy products from animals treated with the substance. The Joint WHO/FAO Expert Committee on Food Additives has concluded that residues of BST in milk represent no human health risks, but the Codex Committee on Residues Veterinary Drugs in Foods and the Committee on Residues are divided on whether other legitimate factors than scientific studies, including environmental or consumer concerns, should be taken into account in conducting risk assessment. If Codex adopts a standard indicating, that BST residues represent no human health risk, any import restriction on dairy products could be open to a WTO challenge much the same way as happened in the beef hormone case (ICTSD, 04/99).

A further potential dispute case refers to the use of antibiotics. As of 1 July 1999, the EU bans the use of four antibiotics in animal feed. The EU decided to prohibit the antibiotics in response to concerns that they would make bacteria resistant to antibiotics employed to treat human diseases through overexposure in agricultural uses such as animal growth promotion or crop protection. The EU is also considering banning the import of meat from animals fed with the prohibited antibiotics, which are widely used on the United States and Canada. If Codex would be called and again finds no risk to human health for animal-to-human transfers of antibiotic-resistant bacteria, also this case would be open to another WTO challenge (ICTSD, 04/99).

The SPS Agreement allows countries to take precautionary measures in cases of emergency and when sufficient scientific evidence does not yet exist to support definitive measures. This was for example the case when several emergency bans were introduced in 1996 in Europe to prevent that the mad cow disease BSE spreads to other countries. Also the EU position in the hormone beef case is based on the precautionary principle. However, the immense time requirements for testing the effects of hormones on human health has diminished the credibility of the EU to the challenging parties and increases the pressure on the EU.

As a result, the EU pushes for better acceptance of the precautionary principle and 'other legitimate factors' than science in conducting risk assessment by the Codex Alimentarius Commission. Many consumers consider the dispute as a fight between food safety and global trade rules, pitching the precautionary principle and concern for public health against questionable science in support of free trade.

The SPS Agreement is also based on the principles of equivalency and mutual recognition, meaning that Member countries shall accept the SPS measures of others whenever the same level of human, animal or plant health protection is achieved. The importing countries should have access to inspection, testing etc. of the product. Similarly as in the TBT Agreement, the SPS Agreement therefore calls for assistance to developing Member countries, either bilaterally or through international organizations. Technical and financial assistance is needed in the area of production and processing technologies, research including the procurement of equipment or in form of training and technical advice.

Both, the TBT and the SPS Agreements are bound to be invoked more often in the future as the number of process-based in contrast to product-based standards and regulations increases. Considering the increasing number and the complexity of cases about food safety issues and environmental concerns that are expected to come up in the future, the question about alternative policy responses and strategies to tackle these issues arise and will be investigated in the following.

5 Linking standards to policy considerations

Various types of political measures are being used or proposed to address environmental issues in the context of international trade and to raise the level of national or international environmental standards. In the following, an overview and critical assessment of some major policy options is given. As will be seen, a number of different strategies exists to tackle environmental problems. While no individual strategy proves to be the optimal solution, a mixture of different approaches is often needed.

5.1 Trade policy measures

The demand for unilateral use of trade policy to pursue environmental goals has grown. A major attraction of trade measures is that they can be used effectively as stick or carrot because they are relatively easy to use and are immediate in their impact. While the carrot stands for technical and financial assistance, the stick refers to the threat or use of restrictive trade measures in case of non-compliance with standards. Already the threat of trade sanctions is expected to have a rapid and persuasive effect in encouraging a country to abide to standards. In addition, there have been proposals to use trade sanctions against unrelated products (e.g. threats to ban textile markets unless logging is curtailed or managed sustainably) to persuade developing countries to adopt stricter environmental standards.

Import bans have been used in the case of tropical timber. In the developed countries, growing concern for the consequences of deforestation has led to a demand for decreased importation of tropical timber. The import bans have reduced exports which resulted in lower prices. Lower timber prices make the forest less profitable in relation to other ways of using the land, so that people might have even greater incentives to convert the forest into agricultural land. A ban on imports could therefore lead to increased deforestation, contrary to the original purpose of the ban.

The desire for trade barriers comes from a lack of alternative measures which would directly address the source of the problem, and the belief that trade barriers induce the producing country to change its behavior. But the use of trade measures to enforce standards on the production and process methods risks an extraterritorial imposition of the PPM standards of the importing country on its trading partners. As has been seen in the "dolphin-tuna" dispute case, GATT has declared process-related trade bans as inconsistent with its principles. It also interferes with the principle of international law that protect the sovereign right of countries to exploit their own resources and set their own standards and rules for activities within their borders.

The effectiveness of PPM-based trade measures depends on a range of political and economic factors: (1) the relative market power of a country or the export dependence of the target country decides on the effectiveness of a PPM-based trade measure. A country with a large market upon which the targeted export country depends has the power to influence the use of PPMs in other countries. Small countries would not consider imposing trade measures on large countries who are their export markets; (2) the kind of instrument (if a country exports only small amounts of the good which was produced on the cost of the environment, then a trade sanction targeting other products from that country would be more appropriate); and (3) in general, the effectiveness of a trade measure differs with the country, as countries respond to different types of incentives (Stevens, 1994).

It can be summarized that trade policy is not the first-best instrument for achieving environmental objectives. Trade sanctions or the threat of trade sanctions do not directly affect the root cause of the environmental problem. Their use only reduces unnecessarily the level and growth of global economic welfare especially in developing countries, and may even add to rather than reduce global environmental degradation and resource depletion[6]. Developing countries perceive the entwining of environmental standards with trade policy as a threat to both their sovereignty and their economies. The fact that discriminatory trade measures are increasingly used to achieve environmental goals of rich countries, without regard to legitimate economic development concerns of poorer countries, increase the likelihood of environment-related trade disputes. Unless compensated, firms in developing countries will oppose the raising of domestic standards (Anderson, 1995).

5.2 Environmental policy measures

Environmental policy measures offer alternatives to control PPMs by which pollution is created. In principle, many environmental problems could be solved if polluters would respect the "polluter pays principle" (PPP). The OECD has developed the PPP which has been first published in 1972 in the OECD's "Recommendations on guiding principles concerning the international aspect of environmental policies". In mid-1993, the OECD published its new set of "Procedural guidelines on integrating trade and environmental policy". These guidelines emphasize the need for the transparency of standards, the obligation to consult and to cooperate internationally, and arbitration to resolve (Altmann, 1994). However, the process towards an internalization of environmental costs is still in its infancy. Moreover, the 'polluter pays principle' is controversial in North-South debates because developing countries argue that developed countries have degraded the environment in the past without paying for the consequences. Instead, in many countries, establishing review and monitoring systems for controlling resource use, waste and pollution and institutional reforms could contribute significantly to environmental problems. Economic policy approaches also include fines and other legal enforcement to counter environmental degradation. However, an enforcement

through command-and-control measures is in many cases insufficient (Andersson et al., 1995). Instead, there is a trend towards market-based mechanisms like credit subsidies, reform of property rights, or tax relief. Also instruments like deposit-refund schemes, waste fees, pollution charges, tradable permits or eco-labeling make producers bear the costs for the prevention or removal of potential or caused damage to the environment needs to be considered. However, monitoring and enforcement can present a constraint to the implementation of these options.

The trend towards market-based instruments also includes eliminating distortions by reducing subsidies. This can have a major impact on the environment and on market access, and can directly result in win-win solutions in specific sectors. However, also political will and hard work is needed to achieve win-win-situations (Schorr, 1999). Famous examples refer to the fisheries sector where subsidies are very common, thus promoting overfishing and thus undermining the sustainability of fishing. In the agricultural sector, output and input subsidization has led to intensified land use, expansion of agriculture to marginal areas, intensive animal production with the effect of overgrazing, or the degradation of natural resources or the loss of biodiversity (Sampson, 1999). Environmental benefits could result from reducing subsidies for in- and outputs. It is estimated that the environmental costs of these distortions amount to over US$ 50 billion of fishing subsidies, over US$ 300 billion of energy subsidies and over US$ 350 billion of agricultural subsidies (Töpfer, 1999).

Attention should not only be paid to the kind of subsidies in use, but also to the specific products that are causing environmental damage when produced or processed. In addition, the removal of subsidies for specific products can also have a major impact on the market access for products from developing countries. Fish, meat and clothing have been identified as particularly interesting product categories to remove subsidies; they would promise major benefits and effects with respect to efficiency, the environment, income and development. A lower impact on the environment, but still beneficial for the development of especially developing countries is expected from cocoa, coffee and tea, fruits and flowers or forestry products for example (Page, 1999).

5.3 Eco-labeling

Eco-labeling programs can provide effective incentives for producers to reduce negative environmental impacts (Kirchhoff, 1998a, 1998b, 2000). National eco-labeling programs are now operating in most OECD countries and also in many non-OECD countries like the People's Republic of China, India, Indonesia, Thailand or Zimbabwe. There is a tendency for a number of developing countries to set up their own alternative eco-labeling programs to redress their competitive disadvantage (Kirchhoff, 1998a). Some eco-labeling programs are governmental (i.e. Blue Angel), some are private (i.e. Swedish Environmental Choice; Green Seal), or governmental delivered through the private sector (i.e. Canadian Environmental Choice). It can

[6] A similar result has been found with respect to the effects of trade sanctions on social standards. See: Grote, Basu

be voluntary or mandatory. Mandatory eco-labels may function as a trade measure. Voluntary eco-labels, however, are considered as a market-based alternative for addressing domestic environmental problems, as consumers decide whether they purchase environmentally-friendly products or not.

Eco-labeling is generally acknowledged by WTO as being an effective instrument of environmental policy as long as it does not discriminate between goods. It promotes the consumption and production of environmentally-friendly products, and provides consumers with information about their relative environmental impacts. This also includes reducing the amount of energy and materials contained in products, minimizing waste, eliminating hazardous substances, promoting reuse and recyclability, and prolonging the time of usage of the product. As has been shown, labeling is in fact an effective device to reduce the supply of eco-unfriendly products (Grote and Basu, 1999). However, there is also the danger that labeling programs will be misused as non-tariff trade barriers towards exports from developing countries. There is also a continuous expansion and ongoing multiplication process with respect to eco-labels. As a result, the transparency of the market decreases, information costs increase and the credibility of eco-labeling schemes to the consumers is reduced (Shams, 1995).

There is some evidence that eco-labeling programs have adversely impacted foreign producers and suppliers of input materials in developing countries, especially in pulp and paper, footwear, textiles and timber markets. For example, the label on fine paper in Norway affected Brazil's exports, and additional effects are expected from the EU eco-label on tissue paper. It is further expected that T-shirts which have been earmarked for eco-labeling in the EU, will negatively affect Bangladesh, Maldives and Laos which are the main exporters of T-shirts to the EU (UNCTAD, 1995). Conformance with the selected eco-labeling criteria, the certification process and even the eco-labels themselves may be costlier for foreign producers, especially from developing countries (Ewing and Tarasofsky, 1997). Financial and technical support is needed to help developing countries, and particularly their small and medium enterprises, to overcome this cost barrier.

An empirical study from Colombia shows that in some sectors, the costs of eco-labeling had significantly affected market access for Colombian exports. In particular, the costs of compliance include the use of specific chemicals and other raw materials, capital investment, as well as testing and verification expenses or license fees (UNCTAD, 1995).

Eco-labeling, however, may also increase the international competitiveness of products from developing countries and safeguard national environmental and economic interests in accordance with international trade practices. An example is the establishment of the niche market for jute being largely supplied by less developed countries. In India, e.g., eco-labeling has also achieved considerable success with respect to the environmental impact of leather tanning (UNCTAD, 1995).

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and Weinhold, 1998.

The environmental effects of eco-labeling depend on the relevance and significance of the selected criteria. Eco-labeling criteria tend to be based on emission or technology standards which are rather inflexible. Country-specific differences in terms of absorption capacities and availability of environmental resources are often not reflected. Therefore, where the criteria overlook environmentally acceptable PPMs in the country of production or are inappropriate or irrelevant in the context of local conditions in the producing country, eco-labels fail to provide relevant information to the consumer and can discriminate against imports (Markandya, 1997; Ewing and Tarasofsky, 1997).

Ongoing discussions in the WTO Committee on Trade and Environment concentrate on the relationship between eco-labeling and the TBT-Agreement, and on how the use of criteria based on PPMs should be treated. National governments have to make sure that all voluntary standards comply with the "Code of Good Practice for the Preparation, Adoption and Application of voluntary standards" (Annex 3, TBT Agreement) but there is no agreement on the extent to which the TBT Agreement applies to life-cycle approaches based on eco-labels or other process-related standards and non product-related PPMs. This opens possibilities for interpretation under GATT/WTO (Neitzel, 1996). Numerous issues have already arisen, and some more disputes can be expected.

5.4 Other labeling schemes

Labeling schemes are increasingly used not only to protect the environment but also to ensure the security of food products. Examples include the labeling of processed foods containing genetically-modified organisms (GMOs) and hormone beef—cases where it is difficult or even impossible to provide scientific evidence to any health threat. In the case of GMOs, many countries are currently developing their own labeling schemes for genetically modified foods. An existing EU regulation requiring labeling of foods that contain traceable amounts of DNA from genetically modified soya or corn has been challenged in the TBT Committee: The United States, Canada and Argentina expressed their concern about the rise of mandatory labeling measures and question the feasibility and the need for the EU regulation. However, consumers' organizations in Europe and elsewhere strongly support labeling, mainly based on ethical reasons and the mistrust of consumers towards GMO-food play a major role. The debate on GMO-labeling includes therefore a high potential for future conflicts.

The Codex Alimentarius Commission (CAC) is charged with devising standards, guidelines, and other principles for foods derived from biotechnology by the year 2003. Discussions of international standards for the labeling of genetically modified (GM) foods stalled during the latest round of talks of the CAC on Food Labeling held in May 2000. Representatives from some 165 countries failed to reach agreement on a GM labeling scheme. A variety of labeling options were considered during the meeting. One option, supported by the United States, requires labeling only for GM foods that the government deems to be no longer

equivalent or differing significantly from conventional foods. Other options require mandatory labeling of all GM foods, recognizing that there is an inherent difference between conventional and GM foods. These options were supported by the European Commission, India, Norway and other countries.

5.5 Technical assistance and technology transfer

Developing countries are also eligible to technical assistance under the TBT and the SPS Agreements. This ranges from technical and financial support in the preparation, implementation and enforcement of standards to the establishment of national standardizing bodies or national enquiry points. The latter must be set up by each WTO member. The national enquiry point act as a focal point where other WTO Member countries can request and get information on the country's technical regulations, standards and conformity assessment procedures.

Dialogue and technical assistance may help raise standards over time through increased emphasis on enforcement of food safety provisions and increased information transfer between developed and developing countries (Wilson, 1995). In addition, technology transfer might help to prevent pollution or at least to implement end-of-pipe solutions. A number of international organizations like FAO, the World Bank, UNCTAD or UNEP but also the private sector, have set up different programs to support developing countries in the implementation of the Uruguay Round Agreements. Further research is needed with respect to (1) the kind or method of technical assistance, (2) the implementation and sustainability of technology transfer and (3) the funding of the technical assistance.

5.6 Multilateral Environmental Agreements (MEAs)

Cooperation between sovereign States has proven to be a successful approach of achieving environmental objectives. As was illustrated n the theoretical model in chapter 3, this is especially important in case of transboundary pollution or degradation of global commons. Co-operative solutions with additional compensation payments have been suggested and do exist. In fact, in developing countries where priority is given to economic development and investments into social capital rather than the improvement of the environment, a subsidization by developed countries is needed and does help to achieve a better outcome in terms of enforcement of standards.

There are about 200 MEAs of which about 20 contain restrictive measures of trade in order to achieve environmental objectives more effectively through bans, quotas and notifications. Examples are the Basel Convention on the Transboundary Movement of Hazardous Waste, the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), the Montreal Protocol on Substances that Deplete the Ozone Layer, or the Convention on Biodiversity (UNEP and IISD, 2000).

The trade measures used in the MEAs aim at the following objectives (Stilwell and Turk, 1999):

(i) reducing the demand and thus the incentive to exploit resources. This is of special importance for the protection of resources which are mainly consumed in states where they are not found. An example is the agreement on trade with endangered animal and plant species (CITES) which are often found in developing countries, but with their products (ebony, ivory) mainly consumed in industrialized countries;

(ii) protecting the environment of the importing country from environmentally damaging goods (Basel Convention);

(iii) sanction mechanism for enforcing regulations of the agreement. The Montreal Protocol for the protection of the ozone layer includes, for example, imposing trade sanctions on signatory states that do not fulfill their obligations to which they are committed to in the protocol;

(iv) incentive for non-members to join the environmental agreement. An example is again the Montreal Protocol that prohibits its signatories to trade with ozone harming substances from non-member countries; and

(v) regulatory framework that prescribes how to deal with potentially dangerous substances. Examples include the Prior Informed Consent (PIC) Agreement on the export of particular dangerous chemicals and the Advanced Informed Agreement (AIA) in the Biosafety Protocol.

It should be noted that MEAs also consider non-product-related PPMs—contrary to GATT/WTO trade agreements. A key goal of the Basel convention e.g. is to alter upstream processes and production methods by which wastes are generated. It aims at a reduction of wastes before they occur. In the Biodiversity Convention, there are three very general PPM requirements, like the conservation of biological diversity, the obligation of parties to manage biological resources in a sustainable manner, and the obligation of parties to build an equitable distribution of the benefits arising from the economic use of genetic resources. (Vaughan, 1994).

To date, no GATT contracting party has formally objected to the use of trade policy to achieve environmental problems in MEAs. Nor have they to the bans on trade in ivory and rhino horn and tiger products that are part of the Convention on International Trade in Endangered Species (CITES), or to the trade provisions in the Basel Convention on trade in hazardous wastes (Anderson, 1995). However, the inconsistency of measures applied under certain MEAs with WTO is still an unresolved issue, and there is concern about potential conflicts between MEAs and WTO rules and obligations (Sampson, 1999).

5.7 Harmonization and mutual recognition of standards

As shown in chapter 2.3, harmonizing standards is not an easy task and might not be desirable in many cases. There is a concern with respect to the process of harmonization to agree on relatively lower standards than what would be optimal, resulting in a degradation or even collapse of environmental standards (race to the bottom). The attempt to push for a higher level of environmental protection may make the negotiations between low- and high-income countries extremely difficult. As a result, provisions are usually made for low-income countries. These provisions and exceptions can easily become the rule (Altmann, 1994). As stated before, there is also evidence, that governments often choose not to lift the environmental standards out of concerns of loosing international competitiveness (Esty and Geradin, 1998).

One alternative to uniform standards are for example minimum standards. They force individual countries to consider a baseline level of environmental protection so that the environment cannot be completely neglected and that a race to the bottom can be prevented. At the same time, minimum standards still allow individual countries to develop their own higher standards according to their local requirements. However, even the establishment and implementation of minimum environmental standards at the international level is not considered as an easy task, and does require international environmental governance that does not yet exist. In addition, the minimum requirements would also not solve environmental degradation problems.

Multi-tier harmonization is a further alternative form of harmonization. It establishes different sets of standards across regional groups according to the region's local conditions and the level of economic development. Such a system would still allow for economies of scale within each region, and the countries could also graduate into higher level of standards as they develop. For example, the Montreal Protocol is based on two sets of standards and allows for this gradual adjustment. (Esty and Geradin, 1998).

When harmonization of standards is not desirable or not feasible, the concepts of mutual recognition and equivalency, as described in section 4.2, can provide an alternative. These approaches have the advantage that countries enjoy flexibility in the choice of measures they adopt to achieve a particular level of environmental protection or food safety.

6 Conclusions

Trade liberalization and an increased concern about environmental and food safety issues are accompanied by a rising importance of environmental and food safety standards. As has been shown, the process of standard setting is very complex being determined by diverse motivations and objectives. The outcomes are normally diverse country-specific standards which lead to decreased transparency and increased transaction costs in the context of international trade.

No clear conclusions can be drawn from existing empirical studies about the effect of environmental standards on the competitiveness of companies and industrial branches. The ambiguous results, the aggregation level of many studies on industrial level and the focus on US-data all contribute to a continuing debate about these aspects. Still, the WTO states that concerns about the competitiveness are highly overrated in the public debate. An assessment of the competitiveness impacts of environmental standards also depends on their cost and innovation effects. On the one hand, according to previous studies, costs of environmental standards make up only a small part of the production costs. On the other hand, factors such as wages, taxes, payments of duty on previous achievements as well as the innovation effects of standards have a considerably stronger effect on the international competitiveness of a country than the costs of environmental standards.

In a simple theoretical model it has been shown that competitiveness concerns are not the only reason why countries might opt for standards below the optimal level: Increased standards to reduce local pollution in one country may encourage more extensive production in other countries. If the country implementing the higher standards values the resulting deterioration of the environment abroad it may choose suboptimal levels of standards not only for protectionist but also for environmentalist reasons. However, from a global perspective it would be preferable in these cases to achieve a cooperative agreement with both countries raising their standards.

The TBT and SPS Agreements are bound to be invoked more often in the future as the importance of process-based standards and regulation increases. Considering the increasing number and complexity of cases about food safety issues and environmental concerns that can be observed in the recent past, the question about alternative policy responses and strategies to tackle these issues in the context of international trade arise.

To enforce environmental standards, countries ask for trade sanctions to be imposed on other countries that produce on the cost of the environment. Trade policy has been identified as not being the first best instrument for achieving environmental objectives because trade sanctions or the threat of them are not directly affecting the root cause of the environmental problem. Their use may even have the opposite effect of unnecessarily reducing the level and

growth of global economic welfare especially in developing countries, and thus even adding to rather than reducing global environmental degradation and resource depletion.

Many market-based environmental policy measures offer alternatives to enforce and raise environmental standards in the context of international trade. In principle, many environmental problems could be solved if countries would respect the 'polluter pays principle'. Also eliminating distortions by reducing subsidies alone can already have a major impact on the environment and on market access. It can directly result in win-win solutions in specific sectors. However, monitoring and enforcement can present a constraint to the implementation of these market-based options in many countries. Moreover, the 'polluter pays principle' is controversial in North-South debates because developing countries argue that developed countries have degraded the environment in the past without paying for the consequences.

Eco-labeling is generally acknowledged by WTO as being an effective instrument of environmental policy, as long as it does not discriminate between products and countries. It promotes the consumption and production of environmentally-friendly products and provides consumers with information about their relative environmental impacts. On the one hand, concerns have been raised especially by developing countries about their possible negative trade effects. On the other hand, the comparative trade position, also of developing countries, has been strengthened through participation in labeling schemes. It is important to ensure the transparency of programs and the development of labeling criteria which are suitable to different country-specific environments. Developing countries should be more involved in this process.

Dialogue and technical assistance may help raise standards over time through increased emphasis on enforcement of food safety provisions and increased information transfer between developed and developing countries.

Harmonization can be a useful approach especially when applied with respect to minimum standards or at a regional level. However, valid differences in preferences and endowments across countries should not be ignored, and active participation of developing countries should be ensured. When harmonization of standards is not desirable or not feasible, the concepts of mutual recognition and equivalency can provide an alternative. These approaches have the advantage that countries enjoy flexibility in the choice of measures they adopt to achieve a particular level of environmental protection or food safety.

Product standards and PPMs with transboundary and global environmental impacts are harmonized within MEAs. They are based on cooperative action between countries, and enforced by the threat of trade restrictions imposed on countries that neglect their environment. The inconsistency of trade measures, as used in the MEAs, with WTO principle may lead to conflicts between MEAs and WTO rules and obligations in the future.

It can be concluded that a number of different strategies and concepts (e.g. polluter pays principle, labeling, reducing subsidies, stronger enforcement of given standards, technical assistance, MEAs) exist to tackle environmental problems. While no individual strategy or concept proves to be the optimal solution, a mixture of different approaches is needed and care has to be taken to avoid the misuse of environmental standards for protectionist reasons.

References

ALTMANN, J. (1994): International Environmental Standards: Considerations on Principles and Procedures. In: INTERECONOMICS, July/August 1994, p.176-183.

ANDERSON, K. (1998): The Future of the WTO. CIES Discussion Paper, 98/01, Adelaide.

ANDERSON, K. (1995): The Entwining of Trade Policy with Environmental and Labour Standards. In: Martin, W. and L.A. Winters (eds.) (1995): The Uruguay Round and the Developing Economies. World Bank, Washington D.C.

ANDERSSON, T., FOLKE, C. AND S. NYSTRÖM (1995): Trading with the Environment. London.

BHAGWATI, J. (1996): Trade and Environment: Exploring the Critical Linkages. In: Brehdal, M.E., Ballenger, N., Dunmore, J.C. and T.L. Roe, Agriculture, Trade and the Environment: Discovering and Measuring the Critical Linkages, Westview Press.

BHAGWATI, J. (1994): Ein Plädoyer for freien Handel. In: Spektrum der Wissenschaft. Januar.

BRUNO, A. (1997): Sanitary and Phytosanitary Measures and Technical Barriers to Trade. In: The Uruguay Round and Agriculture in Southern Africa—Implications and policy responses. FAO, Rome.

CHAHOUD, T. (1998): Handel und Umwelt: Förderung umweltfreundlicher Prozeß- und Produktionsverfahren in Entwicklungsländern. Deutsches Institut für Entwicklungspolitik, Berlin.

CHAKARIAN, J. (1994): PPMs and the GATT. In: OECD, Trade and Environment: Processes and Production Methods. OECD Documents, Paris.

CHAPMAN, D., AGRAS, J. AND V. SURI (1995): International Law, Industrial Location and Pollution, 3 Indiana Journal of Global Legal Studies 5.

DEAN, J.M. (1999) Testing the Impact of Trade Liberalization on the Environment: Theory and evidence. In: Fredriksson, P.G. (ed.) (1999) *Trade, Global Policy, and the Environment*. World Bank, World Bank Discussion Paper No. 402, Washington D.C., pp. 55-64.

DEAN, J.M. (1992): Trade and the Environment: A Survey of the Literature. In: Low, P., International Trade and the Environment. World Bank Discussion Papers No.159, Washington D.C.

ESTY, D.C. (1994): Greening the GATT: Trade, Environment, and the Future. Institute for International Economics, Washington D.C.

ESTY, D.C. AND D. GERADIN (1998): Environmental Protection and International Competitiveness. A Conceptual Framework. In: Journal of World Trade 1998, Vol.32, No.3.

EUROPEAN COMMISSION (EC) (1992): Towards Sustainability: A European Community Programme of Policy and Action in relation to the Environment and Sustainable Development. Brussels.

EWING, K.E. AND R.G. TARASOFSKY (1997): The "Trade & Environment" Agenda: Survey of Major Issues and Proposals. From Marrakesh to Singapore, IUCN Environmental Law Centre, Bonn.

GOODSTEIN, E. (1995): Jobs or the Environment? No Trade-off. In: Challenge, Jan.-Feb., pp.41-45.

GROTE, U., DEBLITZ, C., REICHERT, T. AND S. STEGMANN (2001): Umweltstandards und internationale Wettbewerbsfähigkeit. Analyse und Bedeutung im Rahmen der WTO. Vauk publisher, Kiel.

GROTE, U., DEBLITZ, C. AND S. STEGMANN (2000): Environmental Standards in the Agricultural Sector in Brazil, Germany and Indonesia: The Impact on International Competitiveness, In: Quarterly Journal of International Agriculture, Sept. edition.

GROTE, U., A.K. BASU AND CHAU, N.H. (1999) The International Debate and Economic Consequences of Eco-Labeling. Center for Development Research, ZEF Discussion Papers on Development Policy No.18, Bonn.

GROTE, U., BASU, A.K. AND D. WEINHOLD (1998): Child Labor and the International Policy Debate. The Education/Child Labor Trade-Off and the Consequences of Trade Sanctions. ZEF-Discussion Papers in Development Policy No.1, Bonn.

HELM, C. (1995): Sind Freihandel und Umweltschutz vereinbar? Berlin.

HENSON, S. (1998): Regulating the trade effects of national food safety standards: Discussion of some issues, OECD COM/AGR/CA/TD/TC/WS(98)123

ICTSD (04/99): Bridges between trade and sustainable development: Dispute settlement Corner. Year 3, No.3, April 1999.

JAFFE, A., PETERSON, S., PORTNEY, P. AND R. STAVINS (1995): Environmental Regulations and the Competitiveness of US Manufacturing: What does the evidence tell us? In: Journal of Economic Literature, Vol.XXXIII, March.

JENKINS, R. (1999): Environmental Regulation and International Competitiveness – A Framework for Analysis. Conference paper, University of East Anglia.

KALT, J. (1988): The Impact of Domestic Environmental Regulatory Policies on US International Competitiveness. In: International Competitiveness. Cambridge, Mass., Harper and Row.

KIRCHHOFF, S. (2000): Green Business and Blue Angels: A Model of Voluntary Overcompliance with Asymmetric Information. *Environmental and Resource Economics* 15(4): 403-20.

KIRCHHOFF, S. (1999): Higher environmental standards in LDCs through bilateral cooperation. Mimeo. Center for Development Research, Bonn.

KIRCHHOFF, S. (1998a): Achieving Environmental Goals in a World of Trade and Hidden Action: The Role of Trade Policies and Eco-Labelling. University of Maryland Working paper No. 98-26.

KIRCHHOFF, S. (1998b): Overcompliance, Labeling and Lobbying: The Case of Credence Goods. University of Maryland Working paper No. 98-25.

KNIGHT, A., (1994): International standards for environmental management: the work of ISO/TC 207. In: Industry and Environment, Vol. 17, No.3.

LEE, H. AND D. ROLAND-HOLST (1994): International Trade and the Transfer of Environment Cost and Benefits. In: Francois, J., K. Reinerts (eds.): Applied Trade Policy Modelling. Cambridge University Press.

LOW, P. AND A. YEATS (1992): Do "Dirty" Industries Migrate? in. Low, P. (ed.): International Trade and the Environment. World Bank Discussion Paper 159. Washington, pp. 89-103.

MANI, M. AND D. WHEELER (1999) In Search of Pollution Havens? Dirty industry in the world economy, 1960-1995. In: Fredriksson, P.G. (ed.) (1999) *Trade, Global Policy, and the Environment*. World Bank, World Bank Discussion Paper No. 402, pp. 115-128.

MARKANDYA, A., (1997): Eco-labelling: An introduction and a review. In: Zarilli, S., Jha, V. and R. Vossenaar, (1997): Eco-Labelling and International Trade, Geneva.

NEITZEL, H. (1996): Applying Non Product-Related Criteria in Eco-Labelling. In: Gate No.2.

NORDSTRÖM, H. AND S. VAUGHAN (1999): Trade and Environment. WTO, Geneva.

OECD (1998): *Agriculture and the Environment. Issues and Policies*, OECD, Paris.

OECD (1997a): Eco-Labelling: Actual Effects of Selected Programmes, Paris.

OECD (1997b): *The Effects of Government Environmental Policy on Costs and Competitiveness: Iron and Steel Sector*, DSTI/SI/SC(97)46, OECD, Paris.

OECD (1994): Trade and Environment: Processes and Production Methods. OECD Documents, Paris.

PAGE, S. (1999): Environment benefits from removing trade restrictions and distortions: background for WTO negotiations. ODI, London.

PORTER, M. AND C. VAN DER LINDE (1996): Green and Competitive: Ending the Stalemate. In: Welford, R., R. Starkey (eds.): The Earthscan Reader in Business and the Environment. London.

PORTER, M. (1991): America's Green strategy. In: Scientific American, April, p.68.

REPETTO, R. (1995): Jobs, Competitiveness, and Environmental Regulation. WRI. Washington D.C.

SAMPSON, G.P. (1999): Trade, Environment, and the WTO: A Framework for Moving Forward. ODC Policy Paper, Washington D.C., February.

SAMPSON, G.P. AND W.B. Chambers (1999) (eds.): Trade, Environment, and the Millennium. United Nations University Press, Tokyo, New York, Paris.

SCHORR, D. (1999): Statement at the WTO High Level Symposium on Trade and Environment, 15-16 March. Geneva.

SHAMS, R. (1995): Eco-Labelling and Environmental Policy Efforts in Developing Countries. In: Intereconomics, May/June.

SORSA, P. (1994): Competitiveness and Environmental Standards: Some Explanatory Results. World Bank Policy Research Paper 1249. Washington D.C.

STEVENS, C. (1994): Trade and Environment: PPM Issues. In: OECD, Trade and Environment: Processes and Production Methods. OECD Documents, Paris.

STILWELL, M. AND E. TURK (1999): Trade Measures and Multilateral Environmental Agreements: Resolving uncertainty and removing the WTO chill factor. World Wildlife Fund, WWF Discussion paper, November, Gland.

THOMAS, C. AND G.A. TEREPOSKY (1993): The Evolving Relationship between Trade and Environmental Regulation. In: Journal of World Trade, Vol.27, No.4, pp.23-45.

TOBEY, J. (1990) *The Effects of Domestic Environmental Policies on Patterns of World Trade: An Empirical Test*. Kyklos, 43, pp.191-209.

TOBEY, J. (1993) The Impact of Domestic Environmental Policies on International Trade. In: OECD, *Environmental Policies and Industrial Competitiveness*. OECD, OECD Documents, Paris, pp.48-54.

TÖPFER, K. (1999): Statement at the WTO High Level Symposium on Trade and Environment, 15-16 March. Geneva.

UNITED NATIONS CONFERENCE ON TRADE AND DEVELOPMENT (UNCTAD, 1995): Trade, Environment and Development Aspects of Establishing and Operating Eco-Labelling Programmes, TD/B/WG.6/5, Geneva.

UNITED NATIONS CONFERENCE ON TRADE AND DEVELOPMENT (UNCTAD, 1995): Trade, Environment and Development Aspects of Establishing and Operating Eco-Labelling Programmes, TD/B/WG.6/5, Geneva.

UNCTAD (1994): Sustainable Development. Trade and Environment – The Impact of Environment-related Policies on Export Competitiveness and Market Access. Geneva, UNCTAD, TD/B/41 (1)/4.

UNITED NATIONS ENVIRONMENTAL PROGRAMME (UNEP) AND INTERNATIONAL INSTITUTE FOR SUSTAINABLE DEVELOPMENT (IISD) (2000): Environment and Trade. Manitoba.

VAN BEERS, C. UND C.J.M. VAN DEN BERGH (1997): An Empirical Multi-Country Analysis of the Impact of Environmental Regulations on Trade Flows, 50 Kyklos, 1.

VAUGHAN, S. (1994): PPMs and International Environmental Agreements. In: OECD, Trade and Environment: Processes and Production Methods. OECD Documents, Paris.

VOSSENAAR, R. AND V. JHA (1994): PPMs and Developing Countries. In: OECD, Trade and Environment: Processes and Production Methods. OECD Documents, Paris.

WIEMANN, J., BÜNNING, T., DANNE, G., HAGENMAIER, C., KÖLLING, F., SILLER, R. AND A. WENDER (1994): Ecological Product Standards and Requirements as a New Challenge for Developing Countries' Industries and Exports. German Development Institute, Berlin.

WILSON, J.S. (2000): The Development Challenge in Trade: Sanitary and Phytosanitary Standards. The World Bank, Washington D.C.

WILSON, J.S. (1995): Standards and APEC: An Action Agenda. Institute for International Economics, Policy Analyses in international Economics No.42, Washington D.C.

WORLD BANK (1992): World Development Report 1992. Oxford University Press.

WORLD TRADE ORGANIZATION (WTO), (1998); Goods: rules on NTMs. Geneva.

ZARRILLI, S. (1999), WTO Sanitary and Phytosanitary Agreement: Issues for Developing Countries. South Centre, Trade-Related Agenda, Development and Equity (T.R.A.D.E.) Working Papers, No. 3, Geneva.