

Special Issue

Integration of Agricultural and Environmental Policies

**INTERNATIONAL EVIDENCE FOR THE
TRADE-ENVIRONMENT RELATIONSHIP***

LIM SONG-SOO**

Key words: trade, environment, market failure

ABSTRACT

The purpose of this paper is to assess the interface between trade and the environment. Reviews of empirical studies show mixed results over the environmental Kuznets curve and the pollution heavens hypothesis. Apart from controversies over the methodological issues, they highlight complex aspects of the environment. A case study under the NAFTA illustrates the importance of social organization in shaping environmental outcomes. Trade measures embedded in the Multilateral Environmental Agreements (MEAs) imply no automatic mechanism flowing from trade liberalization to environmental gains. Finally, with respect to policy implications, it suggests that the WTO should remedy market failure by adopting both the polluter-pays-principle and the provider-gets-principle, address standards harmonization by incorporating differences in environmental problems, and allow the system approach.

* This paper was presented at the International Seminar on Integration of Agricultural and Environmental Policies in an Environmental Age, Seoul, Korea, August 20-25, 2001. The seminar was co-organized by Korea Rural Economic Institute (KREI) and Food & Fertilizer Technology Center for the Asian and Pacific Region (FFTC-ASPAC).

** Research Associate, Korea Rural Economic Institute, Seoul, Korea.

I. Introduction

The relationship between trade liberalization and environmental protection used to be discussed within separate frameworks. But, as trade liberalization further progresses and a policy objective of sustainable development gains momentum, many countries as well as international fora have devoted increasing attention developing a complementary relationship between trade and the environment. In particular, the World Trade Organization(WTO) established the Committee on Trade and Environment(CTE) which has dealt extensively with a variety of trade-related environmental issues(Choi and Lim 1996a; Lim, Choi and Kim 1998).

In relation to agriculture, the CTE has largely focused upon environmental benefits arising from the elimination of trade barriers or distortions over the last six years. During the course of the meetings, some have argued that government subsidies stimulate intensive agricultural production and cause production surpluses with subsequent trade restrictions and distortions. Others have pointed out that public intervention in markets is legitimate. The legitimacy refers to market failure arising from provision of public goods, the so-called multifunctionality or non-trade concerns(Lim 1998).

A challenging task is therefore to explore the underlying trade-offs or complementarities between trade liberalization and environmental protection. Then the results can be analyzed with a view to designing and implementing win-win strategies, ensuring sustainable development.

II . The Environment-Trade Relationship in International Frameworks

The World Trade Organization(WTO) promulgates its objectives as raising standards of living, ensuring full employment, expanding production and trade, and allowing optimal use of the world's resources(WTO 1998a). In addition, the WTO Preamble

states the objective of sustainable development and recognizes efforts to protect and preserve the environment.

Nevertheless, the claimed link between freer trade and environmental benefits is vulnerable to fierce challenges. In addition to the debates on the environmental Kuznet's curve(EKC), it has been argued that free trade will not be able to allocate natural resources efficiently in the presence of environmental externalities(Cole 2000). This rationale or suspicion of probable environmental gains has been increasingly incorporated into the regional free trade agreements(FTAs) and multilateral environmental agreements(MEAs).

The NAFTA and the Environment

The fear about FTAs(in the case of the NAFTA) is represented by the presumptions of 'the pollution havens' and 'the race-to-the-bottom' in the regulatory system. Positive trade-environmental links are also postulated by accelerated transfer of environmentally sound technologies and foreign direct investment on domestic environmental quality.

The pollution havens hypothesis states that stricter environmental regulations in one country tend to force domestic production facilities to move to countries with less stringent environmental regulations. Accordingly, the differences in the stringency of environmental regulations may indeed induce the country which operates higher environmental standards to deregulate or lower its standards so as to maintain relative competitiveness. Even without the relocation countries may be unwilling to raise environmental standards since they have concerns about probable shifts in production facilities.

Empirical studies find mixed evidence for the theories(OECD 2000; Jaffe et al. 1995; Janicke et al. 1997; Birdsall and Wheeler 1993; Esty 1994). But, specific case studies undertaken by the Commission for Environmental Cooperation(CEC) and the World Wildlife Fund(WWF) could be more useful in understanding the trade-environment relationship under the context of the NAFTA(CEC 1999; Perrin 2000). These studies

assessed the social and environmental effects of trade liberalization in Mexico's corn sector following implementation of the NAFTA.¹

Both studies examined the different social and environmental implications for three categories of corn producers and their responses to trade liberalization. They are referred to as modernization of corn production or high profitability producers,

TABLE 1. Matrix of Changes in Productive Strategies and Linkages to the Environment

Responses	Environmental Consequences			
	Soils	Water	Agrochemicals	Genetic Resources
Modernization of Corn Production	More intense tillage in sloping land can increase erosion. Conservation techniques available (no tillage, vegetative techniques)	Increased water use but also potential for more efficient use of water (drip irrigation, higher end use efficiency)	Greater use of agro-chemical inputs in modern technologies. Negative effects on workers health. Accumulation of residues. No tillage implies greater use of pesticides, IPM a possibility	Some genetic erosion(GE) possible, but most GE due to hybrids/open-pollinated improved varieties(OPVs) already has taken place.
Persistence of Corn Production with Traditional Methods	Extensive use of low quality or marginal lands encourages erosion. Most of this production in regions with greater precipitation.	Most of this type of corn production is rain fed. Under economic pressure little or no resources devoted to improved water use.	Some use of fertilizers and pesticides. Reduction of rates of use as prices increase.	Greatest potential for GE if group of poor producers disappears or continues to function under economic stress. Loss of genetic resources has begun.
Crop Substitution (Horticulture, Other Grains)	Risk of erosion may increase where crops require more intense tillage and harrowing particularly on sloping land.	Most horticulture crops are more water-intensive. Some grain (sorghum) are less water-intensive. In capital-intensive processes some potential for more efficient use of water resources exists.	Most horticulture crops are more intensive in agrochemicals. Risks of residue accumulation. Negative effects on workers health serious risk.	In some regions GE may occur but probably most of GE of this type has already taken place.

Source: CEC(1999).

¹ See Parrin(2000) for the basic arrangement underlying NAFTA's agricultural chapter and the ex-ante assessment.

crop substitution or intermediate producers and persistence of corn production or subsistence farming (Table 1). Focusing on soil erosion and genetic erosion these studies commonly highlighted that trade liberalization is not the primary cause of generating erosion but forces unleashed by the NAFTA have contributed to accelerating the trends.

Although there remain some grey areas between trade liberalization and the environment, implications can be drawn from the above environmental assessment. First, it is clearly indicated that the linkages between trade liberalization and the environment are not unilateral but multifaceted. Lower corn prices due to the NAFTA failed to curtail production levels against a priori supposition. While modern farms adopted more intensive use of inputs and thus generated greater environmental risks, small and poor producers responded to falling prices by expanding production to compensate for income loss. Moreover, such production expansion fueled by relative changes in prices favored for corn over alternatives (e.g. sorghum or wheat). Hence neither a composition effect nor a technique effect occurred in the agricultural sector.²

Second, simultaneity is of relevance to a certain extent. It is reported that expansion in corn production into marginal land brought about reduction in yields over the period of 1990-95 (CEC 1999). The expanded cultivation associated with lower productivity could promote environmental degradation, which then would exacerbate farm incomes. This suggests the other causal link from the environment to income.

Third, social effects could render significant environmental implications. This points to interdependent nature of production processes, technologies and social organization. Increased pressures on migration and social dislocation caused by trade

² The composition effect refers the change in industrial composition that is likely to occur following changes in comparative advantage. The technique effect points to the changes in production methods in response to stringent environmental regulations and greater access to environmentally benign technologies.

liberalization could accelerate environmental risks. Migration may contribute to deterioration of social institutions and support systems of agricultural production in the rural areas. Social dislocation could have direct impacts on the loss of traditional knowledge about corn seeds, thereby generating genetic erosion. It is noted that rich varieties of corns in Mexico play an important role in the development of modern improved varieties of corn that support world food supply. Genetic erosion may threaten the production strategies mainly adopted by subsistence farms that sow different varieties of corn. Because of heterogeneous conditions of soil, water and climate in the regions, the production strategies are vital to ensure stable production and in fact beat the performance of high-yield varieties. Weakened social organization in the rural areas could therefore endanger maintenance of the traditional knowledge and information.

Finally, trade liberalization may not be 'a trigger' of environmental impacts per se. Instead, trade liberalization can be seen as 'an accelerator' in many cases. Since the changes in the corn sector and its processes have been underway even before the NAFTA regime, the NAFTA should be responsible for all the negative environmental effects. Given the lack of methodologies and mutually dependent nature of cause-and-effect relationships, it is virtually impossible to measure net effects of trade on the environment in an accurate term. Hence, the interpretation of trade-related changes should be carefully scrutinized and treated with caution.

The MEAs and the Environment

Few multilateral environmental agreements (MEAs) contain trade measures. The use of trade-related provisions in the MEAs is to address a wide array of environmental objectives. Most of all, trade measures are aimed at preventing a potential damage from trade. Importers may trigger preventive actions against uncertainty or lack of sufficient information on traded products. Ranging from complete bans to information requirements trade measures are

legitimate when specific conditions are met. From a broad perspective, trade measures can be grouped by category depending on the situations they intend to address<Table 2>. But, trade measures appear to play a limited role as sanctions for non-compliance by members. It is because the MEAs do not have cross-sectoral application of punitive trade sanctions unlike in the WTO.

TABLE 2. Trade Measures in Selected MEAs

Trade Measure Objective	Labeling	Reporting	Notification and PIC	Export permit or license	Import permit or license	Selective intra-party export ban	Selective intra-party import ban	Party/non- party trade ban
Monitoring and data collection		Basel CITES MP	Basel	CITES MP	CITES MP			
Promote participation in regime								Basel CITES MP
Promote environmental control of trade or compliance with treaty		Basel CITES MP	Basel CITES	CITES MP	CITES MP	MP		
Punish non-compliance						CITES MP	CITES MP	
Assist by others enforcement	Basel CITES MP		Basel CITES	MP	CITES MP	Basel MP		
Generate environmental information	Basel CITES MP		Basel CITES	CITES				
Prevent trade diversion								Basel CITES MP
Prevent free-riding								CITES MP
Prevent industrial relocation								Basel MP

Note: Basel=Basel Convention; MP=Montreal Protocol
 Source: OECD(1999)

Some common policy approaches laid out in the MEAs include the precautionary principle, differentiated responsibilities, cooperative non-compliance mechanisms, and the principle of prior informed consent(PIC). There are also common difficulties of implementation such as inadequate resources for effective implementation and enforcement, illegal trade, and common issues with respect to the multilateral trading system(OECD 1999).

Trade measures embedded in the MEAs can shed light on the trade and environment interface. First, legal trade provisions in the MEAs highlight the fact that trade liberalization cannot secure environmental benefits by itself. The use of trade-related provisions could be justified by the presence of potential harmful effects of trade on the environment. They also recognize the complex processes of eco-systems and entwined interdependence among economic, social, and environmental elements.

Second, recent development of the Biosafety Protocol indicates that environmental targets are expanding and the associated implementation tools are becoming more specific and enforceable. The Protocol is the most direct and explicit MEA that addresses trade of the living modified organisms(LMOs). The Protocol sets out procedures and rules concerning the transboundary movement, transit, handling and use of most LMOs. Two striking provisions of the Protocol are adoption of the precautionary approach and use of Advance Informed Agreements(AIAs).

Being regarded as a way to take into account the option value of avoiding or at least delaying irreversible environmental impacts, the precautionary principle applies in cases of a lack of scientific certainty. The AIAs procedure requires that exporters seek a priori consent from importers and be subject to stringent procedures in light of risk assessment, risk management, and documentation.

Finally, trade measures in the MEAs contribute to the comprehensiveness of a set of policy responses to complex problems. It is argued that governmental approaches to the environment should reflect public concerns and then establish relevant policy parameters.

The WTO and the Environment

The WTO Agreements are designed to ensure fair and equal competition for market access in all traded goods and services. While restricting measures that impede free trade, these agreements underline the importance of environmental issues. For example, the Preamble to the Marrakesh Agreement establishing the WTO specifies that environmental protection is one of its objectives. Food safety is also addressed by several agreements. The WTO Agreements that have explicit trade measures for environmental protection are the General Agreement on Tariffs and Trade(GATT), the Agreement on Technical Barriers to Trade(TBT), and the Agreement on the Application of Sanitary and Phytosanitary(SPS) measures.³

First, trade measures under the GATT must meet the general principles such as most favored nation(Article I), national treatment(Article III), ban on quantitative restrictions(Article XI), and not being a means of arbitrary or unjustifiable discrimination between countries where the same conditions prevail or a disguised restriction on international trade. In addition, the WTO CTE endorses focusing on final products and not processes and production methods(PPMs). But, Article XX sets out the common exemption of environmental and natural resources upon which countries are allowed to adopt relevant measures.

Second, the TBT Agreement is to ensure that technical regulations and standards do not create unnecessary obstacles to international trade. Since protection of the environment belongs to such a legitimate objective countries are allowed to apply technical regulations for the environment under specified requirements.

³ Other WTO Agreements are also regarded as encompassing environmental objective. They include the Agreement on Agriculture(Annex 2 paragraph 12), the Agreement on Subsidies and Countervailing Measures(Article 8.2(c)), the General Agreement on Trade in Services(GATS; Article XIV(b)), and the Agreement on Trade-Related Aspects of Intellectual Property Rights(TRIPs; Article 27.2).

Third, the SPS Agreement recognizes the right of Members to adopt sanitary and phytosanitary measures for the protection of human, animal or plant life or health. The SPS measures must be based on scientific principles(Article 2.2) and are not a disguised restriction on international trade(Article 2.3). Article 5 obliges Members to take the SPS measures on the basis of an assessment of the risk to humans, animal or plant life or health and provides details for risk assessment procedures. But, Article 5.7 provides exceptions to the applications of scientific principles.

Among the above three WTO Agreements, the SPS Agreement is the only one which allows for using measures in cases of uncertainty. This is because the lack of specifications for the measures or a causal link between threat and damage under the GATT and the TBT Agreement. The GATT and the TBT Agreement are relatively general to justify trade measures such that it is not clear if a trade measure can be considered as 'necessary'. Furthermore, both agreements allow other rules than scientific principles. In the TBT Agreement the elements of risk assessment are not only scientific and technical information but related processing technology or intended end-use of products. The GATT is silent on what the exceptions would be based. This implies the potential efficacy of the SPS provisions in linking trade measures to uncertainty or precautionary principles.

The WTO Environmental Database(EDB) shows environment-related measures or provisions that WTO Members notified to the WTO(WTO 2000).⁴ The EDB can be useful to derive what measures Members are actually adopting and practicing for environmental protection. In 1999, WTO Members submitted 2,427 notifications under the various WTO Agreements. The notifications are categorized by either directly environment-related or contained environmental reference.

Under the TBT Agreement, 669 notifications were made in 1999 of which 84 percent contain environment-related objectives

⁴ The EDB was established in 1998 for the Secretariat to compile and update annually all environment-related notifications to the WTO.

TABLE 3. TBT Notifications under Environmental Objectives

Year	Environment-related notifications(A)	Total notifications (B)	A/B (%)
1980-90	211	2,687	7.8
1995	41	3,928	10.6
1996	53	460	11.5
1997	89	794	11.2
1998	98	648	15.1
1999	84	669	12.5
1980-99	723	6,749	10.7

Source: WTO(2000)

<Table 3>. As for the SPS Agreement, 450 notifications were issued in 1999. Since all SPS measures are related to the safety and protection of human, animal and plant health it is a matter of judgment in sorting out which measures refer to environment objectives. Nevertheless, 12 notifications were found to be relevant for environmental protection.

As measures or issues pursuant to environmental protection are increasingly entering into WTO jurisprudence, the likelihood of formal disputes in an international forum could increase. So far, no direct conflict between the WTO and the MEAs obligations has led to a formal dispute in either system. Besides, growing concerns regulating biotechnology tend to materialize into international rule making. It is *inter alia* important to clarify how GATT Article XX(g) would be applied in a dispute settlement case.⁵ A challenge lying ahead is to defuse any ambiguity in the relationship between measures abiding by the MEAs and the WTO rules.

⁵ It is a matter of how to interpret 'exhaustible natural resources' in Article XX(g).

III. Policy Issues under the WTO Framework

Previous discussions on the trade and environment interface lead to several policy implications especially under the WTO framework. The implications may arise from linking economic and environmental outcomes through trades, identifications and responses to public concerns on the environmental impacts of trade, environmental assessment for the FTAs, the relationships between the MEAs and the WTO Agreements. Some of the emerging issues and related debates can be analyzed as follows.

Externalities

Environmental externalities are divided by consumption and production externalities. A consumption externality occurs when consumption of certain goods has environmental impacts. A production externality refers to environmental consequences arising from production of certain goods. The WTO rules appear to allow only consumption externalities as a legitimate reason for trade restriction. According to Article XX, any legitimate trade restriction must meet the following four tests(Runge 1999).

The first is the 'necessary' test as written in Article XX(b). This test is to confirm that there could no alternative to remove externality. A second test assesses whether the trade restriction is 'primarily aimed at' conservation and does not play as a protecting measure of domestic markets(Article XX(g)). Based upon the TBT Agreement, a third test requires the trade restriction be 'proportional' to the benefits arising from the elimination of externality. A fourth test is to ensure that the trade restriction should not be 'a disguised restriction on international trade'. Theses tests opt to weigh environmental benefits accruing from the removal of externality with harmful effects by the trade restriction.

Unlike the case of a consumption externality, the WTO does not allow the imposition of trade restrictions against a production externality. This stems from the nucleus of the WTO

rules. The most-favored nation provision(Article I) points out that a country needs to treat imported products from another member country no less favorably than 'like products' imported from another country. The national treatment provision(Article III) states that imported products should be treated no less favorably than domestically produced like products. The tariffication provision(Article XI) obligates that all trade barriers be converted into tariffs.

These rules make it illegal to treat like products differently. The WTO's focus is the final product, not PPMs. The PPMs refer to the way in which products are produced or processed and natural resources are extracted and harvested. In principle, the WTO rules bar trade measures against imported like products that are physically similar to domestically produced products no matter how damaging PPMs adopted.

Moreover, the WTO rules do not allow extrajurisdictionality. The term of extrajurisdictionality may indicate attempts to regulate behavior abroad through controls on transactions at the border(Esty 1994). In the 1991s tuna-dolphin case, the GATT panel found that the US trade ban on Mexican tuna could not be justified under GATT Article XX(b) or Article XX(g) and condemned the unilateral extrajurisdictional application of the exceptions. In the shrimp-turtle dispute in 1998, the Appellate Body also concluded that the US ban on imports of shrimps caught in a manner which may harm sea turtles constituted arbitrary and unjustifiable discrimination, contrary to the requirements of the Chapeau of Article XX(WTO 1998b). Nevertheless, this decision did recognize the legitimacy of the US measure as specified in Article XX(g), the conservation of exhaustible natural resources.⁶

In this connection, claims have been made that the WTO

⁶ Since Article XX does not mention the word environment and only refers to conservation of exhaustible natural resources, some argue that this provision fails to cover other important natural resources including the atmosphere, the oceans, the ozone layer and other elements of the global commons(Esty 1994).

rules should be amended to allow the ban against extraterritorial behavior and the distinction between like products which results from differences in the PPMs (Esty 1994; Cole 2000). On the contrary, the fear of the proliferation of trade-related environmental measures has been raised from the perspectives of developing countries (Verbruggen 1999). Developing countries concern that stringent environmental standards in developed countries will induce the South to bear greater compliance and transaction costs, thereby thwarting market access.

It is not clear how the WTO could address the nexus of trade and the environment in the future round. It appears that this agenda is unlikely to be taken into the WTO negotiations as an explicit and independent agenda. The CTE may play an advisory role and give recommendations to negotiators to a certain extent. Even so, many developing countries would oppose the CTE's monitoring and advisory roles in the negotiations.

Standards Harmonization

With regard to the harmonization of environmental standards, the WTO rules state that Members should comply with common or international standards. Among others, environmentalists express a feeling of concern over a loss of sovereignty to control domestic environmental regulations and standards. Another claim is that the harmonization is against comparative advantage. Differences in environmental stringency across countries may reflect different natural resource endowments or assimilative capacity of the environment and the societies preferences over environmental goods. Thus, trade makes the countries to specialize production of goods and services that has comparative advantage in terms of economic factors and assimilative capacity of the environment.

The environmental harmonization can be also assessed by characteristics of environmental problems (Cole 2000). Environmental policies designed to deal with global environmental problems should be harmonized across countries. A rationale behind this approach rests on the premise that global environmental damage is caused by traded goods and thus countries have the same

marginal benefit curves while the marginal abatement costs vary. The same level of emission tax or standards could equate countries marginal benefit and marginal cost, leading to an equilibrium. On the other hand, since both marginal benefits and marginal costs are different for local environmental problems, economic efficiency is attained by setting different levels of tax or standards for each country. Consequently, environmental policies to address local environmental harms should not be harmonized.

As for transboundary pollutants such as nitrogen oxides and sulphur dioxide that cause acid rain, a different approach is suggested. Since they are neither pure global nor local externalities, multilateral commitment would be a suitable option. The EU's efforts to reduce sulphur dioxide and nitrogen oxides by setting common targets and control programs by the United States to reduce emissions of sulphur dioxide have proved effective.

However, the TBT Agreement does not make any distinction between standards which deal with global, transboundary or local environmental issues. Since the Agreement promotes the harmonization of 'all' standards, goals of economic efficiency and environmental protection could be unattainable. It is thus recommended that the TBT Agreement should concentrate on the harmonization of global environmental standards and leave out the standards of transboundary and local pollution(Cole 2000). In the harmonization process, it is also suggested that proper procedures should be developed in which member countries are able to participate in the harmonization efforts while maintaining democratic accountability(Trachtman 2000).

A different argument is that environmental standards harmonization(and eventually policy convergence) should focus on minimum standards(Esty 1994). To address environmental quality levels, the emphasis must be on the development of environmental performance standards that could be defined by human pollutant exposures or ambient levels. These standards are not intended to equalize environmental compliance costs but

accommodate differences in diverse environmental conditions and assimilative capacity. It is thus argued that the WTO is not able to deal with the development of environmental performance requirements or set or harmonize standards (Esty 1994; Stevens 1993). In this context, creation of a Global Environmental Organization (GEO) is proposed (Esty 1994; Charnovitz 1996; Cole 2000).

A challenge before the WTO is to augment technical expertise and to develop flexible and proper procedures with which it could take up internalization of externalities and standard harmonizations in more accurate and transparent ways.

Subsidies

Agricultural subsidies have dominated the debates in the CTE. Especially, advocates of trade liberalization have accused subsidies of the most trade distorting policy instrument. Its logic is that government subsidies in the agricultural sector send wrong market signals to producers, thereby bringing about distortions in prices, production and then trade. It is subsequently argued that market failure should be corrected by eliminating the 'bad' subsidies and making efforts to internalize negative externalities according to the polluter-pays-principle.

In contrast, others posit that agricultural subsidies are not all bad. Since agriculture produces not only food and fiber but other non-commodities which are often characterized as public goods, agricultural subsidies must be regarded as compensatory payments or legitimate public intervention against existing market failure (Lindland 1998).

The core of the debates rest on two points (Lim 2000). The first is whether the agricultural sector provides society with net environmental or other multifunctional benefits for which markets do not fully account. But, this net benefit test may not be technically up for grabs. Quantifying agricultural multifunctionality is largely limited because of complex linkages between agriculture and the ecosystem, site-specific nature of agricultural production and the lack of empirical methodologies arising from

environmental valuation, measurement of heterogeneous demands and data constraints. A recent OECD workshop put forward difficulties in measuring multifunctionality(OECD 2001).

The second is to directly explore the causal link between trade liberalization and reduction in agricultural subsidies, and the effects of environmental benefits. Answers to this question further require recognition of a common fact that agricultural production cannot be a sole determinant of environmental effects. Environmental effects largely depend upon farm inputs, relative prices of products, controls of input use, climate and natural conditions, farming technique and intensity, and product varieties. Interestingly enough, a study points out that there is no systematic correlation between specific changes in agricultural production and subsidy levels(OECD 1998a).

A review of country cases is illustrative, too. In Australia, it is known that soil erosion and salinization is an imminent threat to agriculture production. The land size of the country in the world accounts for approximately 5 percent while the share of soil erosion is about 19 percent(OECD 1998b). This is attributable to the mix of country specific soil landscape, farming methods, and types of commodities. It is apparent that agricultural subsidies have nothing to do with such environmental risks, at least in this case.⁷ As for the United States, the estimated damage from soil erosion reaches about 10 percent of the total agricultural production (that is, 10 billion dollars) per year(WTO 1999).

In sum, few suggestions could be made with respect to the WTO discussion. First, it should acknowledge that distortion in relation to market failure is a double-edged sword. In principle, since market failure comes not only from policy failure (that is government subsidies) but also from the existence of externalities

⁷ In reality, agricultural subsidies may partly affect the decision of farming technique and the types of production. For example, subsidies favored toward irrigation could promote rice cultivation in the Riverina Plain(Choi and Lim 1996b).

and public goods associated with agricultural production, measures against the market distortions must address both types of market failure. To tackle market failure, it needs to discern the types of market failure and subsequently design proper market instruments and policy tools. In this process, market failure can be corrected by the application of the polluter-pays-principle and the provider-gets-principle. The former is for net negative environmental effects while the latter applies to net positive environment effects.

Second, a prima facie effect on the environment interwoven with agricultural subsidies should be re-examined in a comprehensive manner, especially encompassing site specific natural conditions, ecosystems and socio-economic aspects. As seen in the Mexican corn sector under the NAFTA, causal factors to the environmental impact could be diverse and mingled with many non-policy elements. It is therefore necessary to scrutinize the relationship between agricultural subsidies and environmental consequences in a broader context.

Third, more attention must be paid to the environmental impacts of production shifts. More efficient resource allocation through trade liberalization is presumed to yield a shift of agriculture production from highly subsidized countries to less subsidized ones by which overall environmental stress would be reduced. Although this premise contains a rationale, concerns remain.

At countries levels, production shifts may aggravate local environmental conditions in a country whose scale of production increases or farming intensity increases. If the country is already suffering from specific environmental degradation (e.g., soil erosion) or facing with potential environmental harms, more intensive production would threaten its environmental health. An opposite case could be picked up, too. A country that has to give up agricultural production could experience irreversible environmental degradation and has to bear with less provision of multifunctionality, jointly produced with agricultural activities. Since environmental responses to external forces are mostly

asymmetric and non-linear, a greater emphasis must be given to diversities and whole systems.

Finally, the environmental impacts of government policies must be understood in the context of systems, not individual components. Apart from transaction cost-related debates, many policy instruments are designed and directed to address the whole system. System thinking considers entities and the system approach endeavor to grasp the system properties by synthesizing detailed knowledge about the system (Jørgensen 2000). As a correcting action against market failure, government intervention contributes to sustainability of the system in rural areas. This system may consist of agriculture, the environment, rural viability and socio-cultural components. It is so unfortunate that the WTO institution is incapable of incorporating the system approaches.

IV. Conclusion

A traditional approach claims that trade liberalization stimulates economic growth and helps promote environmental improvement. Under the linkages between trade and the environment, a proposed win-win strategy includes promotion of trade liberalization as a necessary condition and adoption of sound domestic environmental policies as a sufficient condition. The international trade rules facilitate the former, and governments, civil societies and the MEAs address the latter.

A critical issue in domestic policies is to remedy market failure. Market failure arises since externalities and public goods prevent markets from functioning properly. Thus, public intervention focuses on ways to enhance internalization. The internalization process requires identifying and quantifying externalities and public goods. However, limits in methodologies and data, the complex nature of the ecosystem and numerous interwoven components make it much more difficult to obtain accurate measurements or evaluations.

Once the net environmental effects are identified, internalization requires the introduction of suitable policy

instruments. As for net environmental effects, governments may provide subsidies to remedy market failure unless other market instruments (e.g. market creation) are operational. If net environmental effects turn out to be negative, the governments may control them by applying the polluter-pays-principle. Therefore, justification of policy instruments depends upon the nature of market failure, that is, net environmental effects of agents' behavior.

Another point is that since the environmental responses to driving forces are so asymmetric and non-linear, and interact with others in systems, it is not easy to draw a simple causal relationship between the environment and driving forces. In addition to economic factors, many forces such as social organization, communities preferences, natural conditions and culture convey environmental implications. As a result, a system approach is preferred to a partial approach in assessing environmental impacts. It is so unfortunate that the system approach is beyond the WTO domain.

REFERENCES

- Birdsall, N. and D. Wheeler. 1993. Trade Policy and Industrial Pollution in Latin America: Where are the Pollution Havens? *Journal of Environment and Development* 2(1): 137-49.
- Charnovitz, Steve. 1996. "Competitiveness, Harmonization, and the Global Economy." Bredahl, M., N. Ballenger, J. Dunmore and T. Roe (eds.). *Agriculture, Trade and the Environment: Discovering and Measuring the Critical Linkages*. Oxford: Westview Press.
- Choi, J.S. and Lim S.S. 1996a. *The Linkages between Trade and the Environment and Agricultural Measures*. (in Korean). R357. Korea Rural Economic Institute.
- _____. 1996b. *Wheat, Rice and Beef Industries in Australia*. (in Korean). D117, Korea Rural Economic Institute.

- Cole, M. 2000. *Trade Liberalisation, Economic Growth and the Environment*. Gheltenham, U.K.: Edward Elgar Publishing Limited.
- CEC (Commission for Environmental Cooperation). 1999. *Assessing Environmental Effects of the North American Free Trade Agreement (NAFTA): An Analytic Framework (Phase II) and Issue Studies*. Environment and Trade Series. Montreal.
- Esty, D. 1994. *Greening the GATT: Trade, Environment and the Future*. Washington D.C.: Institute for International Economics.
- Jaffe, A., S. Peterson, P. Portney, and R. Stavins. 1995. "Environmental Regulation and the Competitiveness of US Manufacturing: What Does the Evidence Tell Us?" *Journal of Economic Literature* 33:132-163.
- Janicke, M., M. Binder and H. Monch. 1997. "Dirty Industries: Patterns of Change in Industrial Countries." *Environmental and Resource Economics* 9:467-91.
- Jørgensen, Sven. 2000. "A System Approach to Environmental Management." Jørgensen (ed.). *A Systems Approach to the Environmental Analysis of Pollution Minimization*. Boca Raton, Florida: Lewis Publishers.
- Lim, S.S. 1998. *Analysis on the Relationship between Trade and the Environment*. (in Korean). P32. Korea Rural Economic Institute.
- _____. 2000. "International Debates on Agriculture and the Environment, and Policy Options." (in Korean). Paper presented in Annual Symposium on Agricultural Responses to Food Safety and Environmental Issues, Forum for Agricultural and Rural Policy, Seoul.
- Lim, S.S, Choi J.S. and Kim Y.S. 1998. *The Linkages between Trade and the Environment and Agri-Environment Policies*. (in Korean). R379. Korea Rural Economic Institute.
- Lindland, Jostein. 1998. "Non-trade Concerns in a Multifunctional Agriculture: Implications for Agricultural Policy and the Multilateral Trading System." Paper presented in the OECD Workshop on Emerging Trade Issues in Agriculture. Paris: OECD.

- OECD. 2001. Main Issues for Discussion. Presented in the Workshop on Multifunctionality: Applying the OECD Framework: Guiding Policy Design, 2-3 July 2001, Paris.
- _____. 2000. *Assessing the Environmental Effects of Trade Liberalisation Agreements: Methodologies*. Paris.
- _____. 1999. *Trade Measures in Multilateral Environmental Agreements*. Paris.
- _____. 1998a. *Agri-Environmental Indicators: Stocktaking Report*. Document COM/AGR/CA/ENV/EPOC(98)52, Paris.
- _____. 1998b. *Environmental Performance Reviews: Australia*. Paris.
- Perrin, Mireille. 2000. "Sustainability Assessment of Trade Liberalization Agreements." in OECD *Assessing the Environmental Effects of Trade Liberalisation Agreements: Methodologies*. Paris.
- Runge, C. Ford. 1999. *Beyond the Green Box: A Conceptual Framework for Agricultural Trade and the Environment*. Working Paper WP99-1. the University of Minnesota.
- Stevens, C. 1993. "Harmonization, Trade and the Environment." *International Environmental Affairs* 5(1):42-49.
- Trachtman, Joel. 2000. "Assessing the Effects of Trade Liberalisation on Domestic Environmental Regulation: Towards Trade-Environment Policy Integration." in OECD *Assessing the Environmental Effects of Trade Liberalisation Agreements: Methodologies*. Paris.
- Verbruggen, Harmen. 1999. "Environment, International Trade and Development." Jeroen, C. and van den Bergh (eds.). *Handbook of Environmental and Resource Economics*. Cheltenham, U.K.: Edward Elgar Publishing Limited.
- WTO (World Trade Organization). 2000. "Environmental Database for 1999: Note by the Secretariat." Document WT/CTE/W/143, Geneva.
- _____. 1999. "Environmental Effects of Trade Liberalization in the Agricultural Sector: Submission by Norway." Document WT/CTE/W/100. Geneva: Committee on Trade and Environment.
- _____. 1998a. *Guide to the Uruguay Round Agreements*. Geneva.
- _____. 1998b. "United States-Import Prohibition of Certain Shrimp and Shrimp Products." Document WT/DS58/AB/R.