

What do We Know About the Interactions Between Trade and the Environment? A Survey of the Literature

Savas Alpay*
Department of Economics
Bilkent University
Bilkent, 06533 Ankara, Turkey

Abstract

Does trade liberalization increase (global) environmental degradation? Do environmental regulations hinder the competitiveness of domestic industries against their foreign rivals? Can trade policies be used as an enforcement tool for the international environmental agreements to protect the global environment? We present a survey of the trade and the environment literature from these perspectives. Mainstream economic argument- that free trade is beneficial to every participant- has been questioned by many authors who formally consider environmental consequences of trade liberalization in their studies. Secondly, the supposedly adverse effects of environmental policies on international competitiveness have not been supported by empirical studies. Finally, it has been shown that free riding on the contribution to global environmental protection of other countries becomes less likely when the countries are trade partners to each other.

Keywords: Trade, Environment, Competitiveness, Free-riding.

*Correspondence Address: Department of Economics, Bilkent University, Bilkent, 06533 Ankara, Turkey. Fax: +90-312-266-5140. E-mail: salpay@bilkent.edu.tr

1 Introduction

With the recent emergence of global environmental issues such as ozone-layer depletion, climate change, global warming and acid rain, the role of economics both in the causes of these problems and in the development of policy options are being examined thoroughly. A particular branch of these studies analyzes the two-way interaction between trade and the environment. It may seem that the work on trade and environment is very recent as a result of the increased public awareness of actual and potential threats to global environment; nevertheless, the pioneers of this literature published their work as early as the beginning of 1970's (see, for example, Baumol 1971, Magee and Ford 1972, and Walter 1973).

An overview of the methodological approaches for investigating the diverse and multi-faceted relationship between international trade and environmental externalities has been presented by van Beers and van den Bergh (1996). Lee (1996) analyzed 79 categorical case studies in trade and the environment and his findings suggest that the data mirror 'general beliefs' about trade and environment with respect to types of problems, actors involved, and remedies. Earlier, Dean (1992), Beghin, Roland-Holst, and van der Mensbrugge (1994), and Ulph (1994) surveyed the literature on trade and the environment. Ekins, Folke and Costanza (1994) edited a special issue on trade and the environment for *Ecological Economics*. Referring to these studies and taking recent developments into consideration, we can collect the multidimensional links between trade and environment under the following headings: The impact of trade liberalization on environment; the impact of environmental regulations on the international competitiveness of the domestic firms; the interactions among trade, global environmental protection and free riding; the migration of "dirty" industries to developing countries (pollution haven hypothesis); trade in hazardous substances; environmental standards as non-tariff barriers; the implications of trade and exchange rate reforms on natural resource use. In this

survey, we will concentrate on the first three, which makes up a very large portion of this literature.

The interest on trade and environment goes beyond the academics. The international community started to address these issues with the Stockholm Conference in 1972. In 1980s, the world witnessed a very successful international environmental agreement: The Montreal Protocol on the Substances that Deplete the Ozone Layer; this protocol with its trade provisions as enforcement tool made a prominent example for other global problems such as climate change and global warming. The Uruguay Round of the GATT in 1992 included heated debates between developing and developed countries on the environmental issues; however, there were no significant action plans except for the establishment of Trade and Environment Commission under the World Trade Organization. Most recently, UN organized a conference on climate change in Kyoto in December 1997. As opposed to earlier UN conferences on environment, this conference can be considered a successful one as countries agreed to sign the Kyoto Protocol, which, for the first time, set legally binding numerical targets aiming at limitations and reductions of greenhouse gases emissions for the developed countries.

Our survey shows that the immediate impact of trade liberalization on environment will be negative. The literature is divided into two camps on what happens over time. Some authors suggest that trade liberalization will generate more economic growth and higher income, and that will increase demand for environmental quality. Others question this view, and argue that higher growth without environmental provisions will increase environmental degradation even more, especially in developing countries. Transformation of the GATT into GATE (General Agreement on Trade and the Environment) emerges as the suggested policy in this part of the literature.

In case of the impact of environmental regulations on the competitiveness of the

domestic firms, neither the theoretical nor the empirical works present clear-cut conclusions. The conventional school argues that environmental regulations will lower the competitiveness of the firms subject to those regulations; revisionist school rejects this argument on the grounds that new regulations will induce innovation which may generate a decline in the cost of production and thus may increase competitiveness. More research is required in this area with an emphasis on empirical work.

The results of the last section of our survey where free-riding incentives on global environmental protection are considered together with international trade connections, are encouraging. The available studies demonstrate that the free-riding incentives will be reduced and may sometimes be eliminated when the countries negotiating for contributions to global environmental protection are also trade partners to each other. The discussion here is that whether strategic trade policies should be allowed as an enforcement tool for international environmental agreements or not.

The organization of this survey is as follows: Section 2 summarizes the connections between trade liberalization and environmental degradation; section 3 introduces the literature on international competitiveness and environmental regulation; the impact of international trade on free-riding incentives on global protection is presented in section 4. Concluding remarks are gathered in section 5.

2 Trade Liberalization and the Environment

One of the standard- for some economist, the deepest and most beautiful- results of international trade is that free trade will benefit all participants. As environmental issues were not a big concern at the time when gains from trade arguments were introduced, the welfare changes associated with trade liberalization did not include the impact on the

environment. With the recent emergence of environmental consciousness, the gains from trade argument is being questioned deeply. Almost unanimously, the immediate effect of trade liberalization on the environment is thought to be negative; however, there are two contrasting views on what happens over time. Let us now introduce these two views.

According to the first view, free trade will generate positive environmental consequences over time. The impact of trade liberalization can be decomposed into three parts: The scale effect, which represents the changes in the size of the economic activities; the composition effect, showing the changes in the bundle of goods being produced; and the technique effect, representing the changes in the production technology. Scale effect tends to increase the amount of environmental degradation; however, a change in the composition of production from dirtier goods towards cleaner ones, as well as an adoption of cleaner technology can improve overall environmental conditions after trade liberalization.

Bhagwati (1993), Selden and Song (1994), Grossman and Krueger (1995), and Dean (1997) suggest that the positive impact of composition and technique effects will exceed that of the scale effect for income levels greater than a threshold level. This inverted-U hypothesis, also known as the environmental Kuznets curve, states that higher incomes (which will be generated by trade liberalization) eventually result in lower levels of environmental damage. Lopez (1994) obtains a similar result conditional on the elasticity of substitution in production between conventional factors and pollution and on the relative degree of curvature of utility in income when the preferences are non-homothetic.

The theory discussed above has been tested by quite a few empirical papers. Grossman and Krueger (1993), in their assessment of NAFTA on environmental grounds, obtain an inverted-U type relationship between growth and effluents through an examination of air quality measures in a cross-section of countries. Nevertheless, Grossman and Krueger (1993) states that inverted-U relationship needs to be taken very carefully since it depends

on the type of the polluting particle; increase, for example, in solid waste, and ground water contamination in developed countries continues with economic growth. Similar warnings have also been made by Hettige et.al. (1992), and World Bank (1992).

Lucas, Wheeler and Hettige (1992) find that countries with faster rates of GDP growth had lower rates of increase in toxic intensity and that for fast growing low and middle income countries, low levels of trade distortion reduced the growth of toxic intensity further. Lucas et.al. (1992) also show a positive relationship between trade distortions and the toxic intensity of output. A similar study carried out by Anderson (1992) on world food and coal industry shows that liberalizing global trade in coal and food products would likely reduce the global pollution associated with these products.

Birdsall and Wheeler (1992) look at the subject from a different angle. In their empirical study on Latin American countries, they try to determine whether greater openness, defined in terms of trade regimes and foreign investment, has been associated with the development of pollution-intensive industries or not. They show that with trade liberalization (through the elimination of barriers to importation of new technology and foreign capital) higher environmental standards of industrialized countries are imported to developing countries: more open-economy countries experienced faster growth in clean industries.

More recently, Dean (1997) develops a simultaneous-equation model which incorporates the static and dynamic interaction between trade and environment. Estimation of this model using Chinese provincial data on water pollution shows that there is indeed both a direct and indirect effect of trade liberalization on emissions growth, and that these effects are of opposite sign. Improvements in the domestic terms of trade lead to increased emissions growth. Hence, the direct impact of trade liberalization would be to aggravate environmental damage. However, increased openness significantly raises the

growth of income, and the growth of income has a negative and significant effect on emissions growth. Thus, the indirect effect of trade liberalization is to mitigate environmental damage.

Not all authors agree with these views. A theoretical study by Copeland and Taylor (1994) analyzes the scale, composition, and technique effects of international trade on pollution in a North-South model, and demonstrate (i) free trade lowers the pollution level in the North, but increases the pollution level in the South, and increases worldwide pollution; (ii) an increase in the rich North's production possibilities increases pollution while similar growth in the poor South lowers pollution; and (iii) unilateral transfers from North to South reduce worldwide pollution.

Another theoretical study by Chichilnisky (1994) identifies the impact of freer trade on the use of natural resources when countries lack clearly defined property rights. Two regions with identical technologies, endowments and preferences will trade if one has ill-defined property rights on environmental resources. It is very likely that tax policies designed to lower overuse of resources can actually increase the extraction of environmental resources, due to the negative effect of taxes on the income of the subsistence laborers. Chichilnisky (1994) concludes "the international market transmits and enlarges the externalities of the global commons. No policy that ignores this connection can work."

Daly (1993), Esty (1994), Dua and Esty (1997), and Esty and Geradin (1997) state that as a result of global trade liberalization countries are likely to compete with each other by relaxing domestic standards for environmental quality in order to increase (or maintain) "competitiveness" (a "race to the bottom"), or even discourage the enactment of environmental policies altogether (a "regulatory chill"). Others show that "ecological dumping", where environmental policies are set lower than implied by the marginal damage, may occur for strategic reasons (see, for example, Barrett 1994b, Kennedy 1994, and

Rauscher 1994). Esty and Geradin (1997) argue that industry and union interests join the environmentalists in their fear that economic integration will create “Pollution Havens” with low stringency of environmental regulations and high competitiveness. Fears have given rise to calls for harmonization of environmental policies in the free trade areas, e.g., across the EU or NAFTA members.

Those claims need the support of empirical papers. The only such paper, to our knowledge, is by Eliste and Fredriksson (1998a). They consider the impact of trade liberalization and strategic behavior by export competing countries on the determination of environmental regulations. In their empirical work on the agricultural sector, they find no evidence of “race to the bottom”. This may be due to some specific features of the agricultural sector, like food safety standards and its being resource based, and therefore more empirical research is required on this subject.

Ropke (1994) argues that the trading system is not something inherently good, and especially, the developing countries’ benefits from trade have been very dubious. Ropke states that the trading system has contributed to environmental problems in several ways, e.g., generating undervaluation of natural resources, stimulating economic growth with environmental deterioration as a consequence, and “magnifying” and creating externalities; this paper makes a case for reducing trade. Similar arguments are made by Daly and Goodland (1994). According to Daly and Goodland (1994), many environmental problems can not be resolved equitably, efficiently, or sustainably by unregulated markets (and so by free trade).

A collection of papers that are constructively critical of the gains from trade argument from an environmental perspective has been edited by Ekins, Folke, and Costanza (1994). Their most significant arguments include (i) the additional resources that are generated with economic growth as a result of trade liberalization are not devoted to

environmental protection as proposed; (ii) even if they are directed to environmental protection, nothing can be done about irreversible (or not repairable) damages to environment associated with economic growth, and (iii) the increase in the volume of transportation necessary for trade will contribute substantially to energy-related environmental damage.

A general observation is that developing countries are specializing in dirty industries (Hettige et. al. 1992, Low and Yeats 1992); developing country exports are in relatively polluting products and developed countries are exporting clean products (Lee and Roland-Holst 1994). The statistics on deforestation in Brazil, and Amazon areas, for producing goods for international markets, the deterioration in the environment of outward oriented countries like South Korea, Taiwan, provide further evidences. More recent empirical evidence is provided by Lopez (1997). He shows that a deepening of trade liberalization is likely to induce further losses of biomass and deforestation by studying the case of Ghana.

In brief, the links between trade liberalization and environment are complex. It is mostly expected that (i) trade liberalization affects the environment negatively in the short term, and (ii) dirty industries expand more in developing countries. Many researchers claim that trade liberalization policies without any environmental provisions will not be beneficial to every participant. It is vital to develop policies that will not sacrifice environment for trade and trade for environment. It is time that we should transform GATT into GATE (General Agreement on Trade and the Environment) as suggested by DeBellvue and et. al. (1994).

Now, we reverse the direction of causality: what will be the impact of environmental regulations on international competitiveness and so, on the pattern of international trade?

3 Environmental Regulations and Competitiveness

There are two main school-of-thought on this subject. Conventional school argues that higher environmental standards at home will lower competitiveness of domestic firms; it may even be the case that environmental benefits associated with stricter regulation might be overcome by the loss of markets to foreigners. Revisionist school claims that stricter regulation can increase international competitiveness of regulated firms under the conditions that the regulated firms engage in innovation and that the environmental regulation is incentive-based¹. Note that this assessment does not include the benefits associated with environmental improvement and only considers the competitiveness of the firms.

On the theory side, conventional school seems to be more attractive; one can see the works of Pethig (1976), Siebert (1977), Yohe (1979), McGuire (1982), Palmer, Oates and Portney (1995), Simpson and Bradford (1996) for theoretical evidences for conventional school. The main argument is briefly as follows: New environmental regulations introduce essentially new constraints in the profit maximization problem of the firms; the same optimization problem with more constraints must result in the same or lower profits. Simpson and Bradford (1996) state that the impact of stricter environmental regulation on the performance of the industries being regulated would likely differ across sectors and be impossible to predict with any precision for any, and that it is difficult to construct examples in which tougher regulation should be enacted to enhance the long-run competitiveness of domestic industry even if they innovate; thus, “tightening regulation to induce advantage may be extremely dubious as practical policy advice.”

Revisionist view was brought to our attention by Porter (1991). As summarized by Porter and van der Linde (1995), the trade-off between environmental stringency and international competitiveness comes from the “static” approach to the problem. In fact,

¹Like effluent fees, and tradable permits, but not technology specification.

if the analysis is carried through a “dynamic” framework, which mainly encompasses possibilities of innovation in technology, product, and processes, then there is room for improvement in international competitiveness as a result of stringent environmental regulation. It is true that environmental regulation increases the number of constraints the firms are facing; however, it may motivate the firm towards innovation, which may offset the costs associated with stricter regulation.

More recent theoretical support for the revisionist school comes from Eliste and Fredriksson (1998b). They develop a model that shows that an increase in the demand for environmental quality may give simultaneous increases in two policy variables; a pollution tax and a production subsidy. Polluters, through lobbying, may receive compensation for the expenditures incurred as a result of environmental regulations. In such a case, Eliste and Frederiksson (1998b) show that an increase in the demand for environmental quality may result in an increase in exports and a decrease in imports because of the associated changes in both the tax and subsidy policies.

There are at least 100 empirical studies that investigated the impact of environmental regulations on competitiveness. Some papers approached the problem by studying the impact of *environmental control costs*, henceforth ECC, on industry price and output, and on trade balance: Magee and Ford (1972), Walter (1973), (1982), D’Arge (1974), Richardson and Mutti (1977), OECD (1978), Ugelow (1982), Pasurka (1985), and Robinson (1988). The methodologies adopted in these papers are quite varied; however, they have some common results: estimates of total ECC by industry tend to be very low; abatement costs do not make up a significant portion of industry costs on average; reductions in output as a result of ECC are very small with the exception of some individual sectors.

The changes in the location of foreign direct investment (FDI) also gives valuable information on the impact of environmental policies on trade. It is heuristical to think

that places with lax environmental conditions will attract most of FDI's in the world. In particular, one would like to see whether the ECC differentials have led to industrial flight toward LDCs (Less Developed Countries) where environmental regulation is more lenient. Walter (1982) looks at trends in foreign direct investment by firms from Western Europe, Japan, and the United States for the period 1970-1978. Although there exists a large amount of overseas production in pollution-intensive industries, there is little evidence that it has been influenced by differing ECC. A study by Knodgen (1979) related to West German FDI finds no evidence of widespread relocation of German industries to places with lax environmental standards. Duerksen and Leonard (1980) find out that host countries that received the most overseas investment in pollution-intensive chemicals, paper, metals and petroleum refining were other industrial countries (not LDCs)².

Some other papers look at the effects of environmental regulations on domestic plant location decisions: Bartik (1988), Friedman et. al. (1992), and Levinson (1992) studied mostly manufacturing industries but could not obtain a significant relationship between environmental regulation and plant location decision. Bartik (1989) detected a significant negative impact of environmental regulation, but the coefficient was substantively small.

Tobey (1990) provides an empirical test of the hypothesis that stringent environmental policy has caused trade patterns to deviate in goods produced by polluting industries in a Heckscher-Ohlin-Vanek model. His findings support that environmental policy did not impact trade patterns. In a Heckscher-Ohlin model of international trade, Kalt (1988) finds a statistically insignificant inverse relationship between net exports and environmental compliance costs across 78 US industrial categories between 1967 and 1977. When his sample is restricted to only manufacturing industries, the predicted negative

²These results, however, should be taken with caution because of the many other factors that influence foreign direct investment. It is usually the case that lower environmental standards are in those countries with low degrees of political stability, and less favorable business environment. These factors may be dominant to lenient environmental regulation.

effect of compliance costs on net exports becomes significant; however, it is troubling to note that the magnitude and significance of this effect increases with the removal of chemical industry, which has relatively high environmental compliance costs, from the sample. Grossman and Krueger (1993) obtain a similar finding, i.e., a quantitatively small and statistically insignificant effect of environmental costs on the pattern of trade in the case of Mexico and USA. A very recent study by van Beers and van den Bergh (1997) found that the impact of stricter regulations on exports of non-resource-based (footloose) sectors was statistically significant and negative by using a cross-country data set of OECD countries for 1992.

The Revisionist school presents empirical support for its claims usually through case studies on individual firms. Subject to new environmental standards, Ciba-Geigy's dyestuff plant in New Jersey reexamined its wastewater streams, which resulted in two changes in the production process that brought annual cost savings of \$740,000 (Dorfman, Muir, and Miller 1992). An environmental research organization, INFORM, investigated activities to prevent waste generation at 29 chemical plants. Out of 181 source-reduction activities they investigated, only one resulted in net cost increase; 68 out of 70 cases which had changes in product yield, was found to have yield increases (see Porter and van der Linde 1995 for more examples). It is possible to extend this list of individual cases, but, the implications at the aggregate level are not so clear.

Revisionists have suggested that induced innovation (with the imposition of stricter regulation) can generate lasting comparative advantage for regulated firms, if other countries eventually apply stricter regulations and if there are strong "first-mover" advantages conferred upon the first firms to enter the markets for control equipment (see, for example, Gardiner 1994).

What can we infer from these empirical studies? Do changes in environmental stringency affect competitiveness adversely or positively? How significant are the results?

A recent comprehensive literature survey by Jaffe et. al. (1995) concludes that there is not enough evidence to single out either conventional or revisionist view:

International differences in environmental regulatory stringency pose insufficient threats to U.S. industrial competitiveness to justify substantial cutbacks in domestic environmental regulations. Nor does the evidence recommend enactment of stricter domestic environmental regulations in order to stimulate economic competitiveness.

One final interesting side of the regulation–competitiveness debate is the impact of the *type* of the regulation and the *structure* of the market being regulated. Sartzetakis and Constantatos (1995) investigates how a country’s choice of environmental policy tool affects international competitiveness of its firms. They show that total market share of regulated firms will be higher in case of tradable emission permits than in case of command and control due to better allocation of total abatement among the firms in the former. On the other hand, Ulph (1990) demonstrates that if trade is modelled as a one-shot Cournot equilibrium, countries do not have preference over the type of environmental policy, and if trade is modelled as a Stackelberg equilibrium, then both countries are better-off (in terms of producer surplus) if the follower uses standards (i.e. command and control).

We now turn our attention to interactions among global environmental protection, free-riding and international trade.

4 Environmental Protection, Free-Riding and Trade

Given that not many instruments are available for encouraging (still better enforcing) global agreements among countries to solve transfrontier or global environmental problems, trade policies can be used in ‘motivating’ countries to contribute to global environmental protection. A well-known standard result in economics is that policy tools should be tailored to the problem at hand (Tinbergen 1952). Thus, trade measures should be

used only in response to trade problems; however, in the absence of a powerful inter-governmental organization, transfrontier problems do not seem to fall in the realm of above result, and thus, such function of trade policies should not be ignored. Moreover, it has been shown that trade connections among countries, even without any strategic trade policies, like tariffs and subsidies, can help to decrease free-riding incentives on the environmental protection of others.

Earlier, Demsetz (1967) presented some very sharp views on this issue, shared by many others. He states that users of a communally owned resource will fail to come to an agreement on managing the use of the resource even though it is in the interest of all users to cooperate and reduce the amount of the resource they use. This is so because, even if this superior situation is attained, every user will obtain even higher returns by free-riding on the cooperative behaviour of the others. The only solution according to Demsetz (1967) is some kind of state intervention. Taking these concerns raised by Demsetz (1967) as a starting point, Barrett (1990) states that the theoretical arguments for supposing that cooperation will not develop are compelling; but, they can not be complete as cooperation (in some form) does take place and is codified in international agreements (whether effective or not). He then goes on to explore the reasons why international cooperation might develop. His conclusion is that agreements on global environmental protection between countries must be self enforcing, otherwise they will always be subject to free-riding.

More recently, conditions for viable cooperation that avoids free riding has been studied. It is possible that at some instances global protection can be obtained non-cooperatively, and in some other cases, effective protection can be achieved through partial cooperation and self-financed transfers to attract non-participants. Carraro and Siniscalco (1993) studied free-riding in this context in their model where countries bargain over emission control of a specific pollutant that causes transfrontier pollution. Petrakis and

Xepapadeas (1996) carry out this analysis in an incomplete information framework, when the individual emissions are costly to monitor. A mechanism that detects free-riding in this incomplete information model has also been shown. Barrett (1994a, 1997b) states that cooperative agreements between countries must be individually and collectively rational, meaning they should not be vulnerable to renegotiation.

Given the connections among countries in the international markets for private goods, it is of interest to determine the impact of international trade on incentives to free ride on global environmental protection. The decisions pertaining to participation to any international initiative on environmental problems depend on many factors other than free-riding on the benefit side. Factors like production substitution across countries, terms of trade changes arising from the international connections among countries play significant roles in the final decision; acting only on free-riding incentives will be a short-sighted move. One of the first studies along these lines is done by Piggott, Whalley, and Wigle (1991) where they present empirical evidences for these arguments in their model on carbon emission reductions³. A study by Blackhurst and Subramanian (1992) on multilateral cooperation on environmental issues, sets out the obstacles in the path to cooperation (free-riding being the main component), and then they state that trade policies generate incentives for countries to participate in multilateral efforts to deal with environmental problems.

Barrett (1997a) develops a stylized model of international trade and environmental cooperation in which the threat to impose trade sanctions emerges as an equilibrium. His model shows that there will not be any trade restriction in equilibrium; however, if the threat to impose trade sanctions is prohibited, for example due to GATT regulations, international cooperation could only sustain a collectively inferior outcome. Barrett (1998) discusses the conditions under which trade sanctions can be used as a means of enforcing international environmental agreements. For sanctions to succeed in deterring free-riding

³For an earlier theoretical study, see Merrifield 1988.

every country must be better off as a signatory than as non-signatory when sanctions are imposed against free riders.

Hung and Richelle (1997) investigates the impact of trade liberalization on the provision of the public goods and on the welfare of the countries in a two-country Ricardian model. They show that the opening of trade increases the opportunity cost of producing the public good in both countries, and thus, reduces the total supply of the public good as compared to the autarky level. They also demonstrate that, under complete specialization, the aggregate production of the public good will be smaller when terms of trade effects are evacuated than when terms of trade effects are taken into account by both countries.

In a similar model, Alpay (1998) shows that countries are not always reluctant to contribute to global environmental protection. Even if there is no self-financed transfers between countries, when the terms of trade changes associated with environmental protection are taken into consideration, countries may choose to contribute to global protection instead of free riding on others' contribution. This non-cooperative contribution, contrary to the conventional results (and also contrary to the findings in Hung and Richelle 1997), may exceed the contribution corresponding to the case where countries cooperate with each other on global protection. As a policy implication, he concludes that the assessment of government policies on global environmental protection in a partial equilibrium framework (by ignoring the possible trade connections) may very well be misleading.

In brief, this branch of the literature presents evidence that global environmental protection is more likely to be successful when the countries involved are also trade partners to each other. Sometimes, these trade connections themselves reinforce contributions to global protection (through the terms of trade changes associated with these contributions), and sometimes, the threat of trade sanctions deters the free-riders, and thus, increases the number of contributors. Nevertheless, the use of trade sanctions for

this purpose is still debated by the GATT Secretariat⁴ and more research on this subject seem to be useful.

5 Conclusion

We survey the trade and the environment literature from three main perspectives: the impact of trade liberalization on the environment; the impact of environmental regulations on international competitiveness of the firms subject to those policies; and finally, the interactions among trade, global environmental protection and free riding.

Our survey shows that the impact of trade liberalization on environment casts doubt on the well-known gains from trade argument. The literature is divided into two schools with opposite views on the long-run impact of trade liberalization on the environment with a common point that the immediate (or short-run) effect will be negative. Some authors suggest that trade liberalization will generate more economic growth and higher income, and that will increase demand for environmental quality. Others question this view, and argue that higher growth without environmental provisions will increase environmental degradation even more, especially in developing countries. Transformation of the GATT into GATE (General Agreement on Trade and the Environment) emerges as the suggested policy in this part of the literature.

In case of the impact of environmental regulations on the competitiveness of the domestic firms, neither the theoretical nor the empirical works present clear-cut conclusions. The conventional school argues that environmental regulations will lower the competitiveness of the firms subject to those regulations; revisionist school rejects this argument on the grounds that new regulations will induce innovation which may generate a decline in

⁴For example, the GATT Secretariat has argued that in the Montreal Protocol, the trade restrictions against non-signatories was unnecessary.

the cost of production, and thus, may increase competitiveness. More research is required in this area with an emphasis on empirical work.

The results of the last section of our survey where free-riding incentives on global environmental protection are considered together with international trade connections, are encouraging. The available studies demonstrate that the free-riding incentives will be reduced and may sometimes be eliminated when the countries negotiating for contributions to global environmental protection are also trade partners to each other. The discussion here is that whether strategic trade policies should be allowed as an enforcement tool for international environmental agreements or not.

The studies on trade and environment is very valuable as both trade and environment are essential components of modern life. As stated very nicely in Ekins, Folke and Costanza (1994), "If the world's trading system were to collapse, doubtless much hardship and suffering would result. But, if the global environment were to collapse, the result would be much worse." Thus, we need policies that will not sacrifice environment for trade and trade for environment. It is very vital to develop the institutions and the framework for environmentally sustainable trade, and research towards this goal should be given priority and support.

References

- Alpay, S., 1998, Does Free Trade Always Harm the Global Environment? A Case for Positive Interaction, *Oxford Economic Papers*, forthcoming.
- Anderson, K., and R. Blackhurst, 1992, The Greening of World Trade Issues, Ann Arbor: University of Michigan Press.
- Anderson, K., 1992, Effects on the Environment and Welfare of Liberalizing World Trade: The Cases of Coal and Food, *in* The Greening of World Trade Issues, (K. Anderson, and R. Blackhurst eds.), Ann Arbor: University of Michigan Press.
- Barrett, S., 1990, The Problem of Global Environmental Protection, *Oxford Review of Economic Policy*, 6(1), 68-79.
- Barrett, S., 1994a, Self-Enforcing International Environmental Agreements, *Oxford Economic Papers*, 46, 878-94.
- Barrett, S., 1994b, Strategic Environmental Policy and International Trade, *Journal of Public Economics*, 54, 325-38.
- Barrett, S., 1997a, The Strategy of Trade Sanctions in International Environmental Agreements, *Resource and Energy Economics*, 19, 345-61.
- Barrett, S., 1997b, Collective Rationality in the Theory of International Cooperation, mimeo, London Business School
- Barrett, S., 1998, The Credibility of Trade Sanctions in International Environmental Agreements, mimeo, London Business School.
- Bartik, T.J., 1988, The Effects of Environmental Regulation on Business Location in the United States, *Growth and Change*, 19(3), 22-44.
- Bartik, T.J., 1989, Small Business Start-Ups in the United States: Estimates of the Effects of Characteristics of States, *Southern Economic Journal*, 55(4), 1004-18.
- Baumol, W.J., 1971, Environmental Protection, International Spillovers, and Trade, Stockholm: Almqvist and Wixell.
- Baumol, W.J., and W.E. Oates, 1988, The Theory of Environmental Policy, Cambridge: Cambridge U. Press.
- Beghin, J., D. Roland-Holst, and D. van-der-Mensbrughe, 1994, A Survey of the Trade and Environment Nexus: Global Dimensions, *OECD-Economic-Studies*, Winter 1994, 167-92.
- Bhagwati, J., 1993, The Case For Free Trade, *Scientific American*, November, 18-23.
- Birdsall, N., and D. Wheeler, 1992, Trade Policy and Industrial Pollution in Latin America: Where are the Pollution Havens?, *in* International Trade and the Environment, (P. Low, ed.), Washington, DC: World Bank.
- Blackhurst, R., and A. Subramanian, 1992, Promoting Multilateral Cooperation on the Environment, *in* The Greening of World Trade Issues, (K. Anderson, and R. Blackhurst eds.), Ann Arbor: University of Michigan Press.

- Brown, L.R., C. Flavin, and H. French, 1997, *State of the World: 1997*, New York: W.W. Norton & Company.
- Carraro, C., and D. Siniscalco, 1993, Strategies for the International Protection of the Environment, *Journal of Public Economics*, 52, 309-328.
- Chichilnisky, G., 1994, Global Environment and North South Trade, *American Economic Review*, 84, 851-874.
- Copeland, B.R., and M. S. Taylor, 1994, North-South Trade and the Environment, *Quarterly Journal of Economics*, 109, 755-787.
- Daly, H., 1993, Debate: Does Free Trade Harm the Environment?, *Scientific American*, November, 17-29.
- Daly, H., and R. Goodland, 1994, An Ecological Assessment of Deregulation of International Commerce under GATT, *Ecological Economics*, 9(1), 73-92.
- D'arge, R., 1974, International Trade, Domestic Income, and Environmental Controls, in *Managing the Environment*, (A. Kneese ed.), New York: Praeger.
- Dean, J., 1992, Trade and the Environment: A Survey of the Literature, in *International Trade and the Environment*, (P. Low ed.), Washington, DC: World Bank.
- Dean, J., 1997, Testing the Impact of Trade Liberalization on the Environment: Theory and Evidence, mimeo, The Johns Hopkins University.
- Demsetz, H., 1967, Toward a Theory of Property Rights, *American Economic Review*, 57, 347-59.
- DeBellevue, E.B., E. Hitzel, K. Cline, J. A. Benitez, J. Ramos-Miranda, and O. Segura, 1994, The North American Free Trade Agreement: An Ecological-Economic Synthesis for the United States and Mexico, *Ecological Economics*, 9(1), 53-71.
- Dorfman, M.H., W.R. Muir, and C.G. Miller, 1992, *Environmental Dividends: Cutting More Chemical Wastes*, New York: INFORM.
- Dua, A. and D.C. Esty, 1997, *Sustaining the Asia Pacific Miracle*, Washington, DC: Institute for International Economics.
- Duerksen, C., and H.J. Leonard, 1980, Environmental Regulations and the Location of Industries: an International Perspective, *Columbia Journal of World Business*, 15, 52-68.
- Ekins, P., C. Folke, and R. Costanza, 1994, Trade, Environment and Development: The Issues in Perspective, *Ecological Economics*, 9(1), special issue.
- Eliste, P., and P. G. Fredriksson, 1998a, Does Open Trade Result in a Race to the Bottom? Cross-Country Evidence, mimeo, The World Bank.
- Eliste, P., and P. G. Fredriksson, 1998b, The Political Economy of Environmental Regulations, Government Assistance, and Foreign Trade: Theory and Evidence, mimeo, The World Bank.
- Esty, D.C., 1994, *Greening the GATT: Trade, Environment, and the Future*, Washington, DC: Institute for International Economics.

- Esty, D.C., and D. Geradin, 1997, Market Access, Competitiveness, and Harmonization: Environmental Protection in Regional Trade Agreements, *The Harvard Environmental Law Review*, 21(2), pp. 265-336.
- Friedman, J., D.A. Gerlowski, and J. Silberman, 1992, What Attracts Foreign Multinational Corporations? Evidence from Branch Plant Location in the United States, *Journal of Regional Science*, 32(4), 403-18.
- Gardiner, D., 1994, Does Environmental Policy Conflict with Economic Growth, *Resources*, Spring (115), 20-21.
- Grossman, G.M., and A.B. Krueger, 1993, Environmental Impacts of North American Free Trade Agreement, in *The US-Mexico Free Trade Agreement*, (P. Garber ed.), Cambridge, MA: MIT Press.
- Grossman, G.M. and A.B. Krueger, 1995, Economic Growth and the Environment, *Quarterly Journal of Economics*, 110, 353-77.
- Hettige, H., R.E.B. Lucas, and D. Wheeler, 1992, The Toxic Intensity of Industrial Production: Global Patterns, Trends and Trade Policy, *American Economic Review, Papers and Proceedings*, 82, 473-481.
- Hung, N.M., and Y. Richelle, 1997, Trade Gains, Paretian Transfer, and the Tragedy of the Commons, *The Japanese Economic Review*, 48, 213-225.
- Jaffe, A.B., S.R. Peterson, P.R. Portney, and R. N. Stavins, 1995, Environmental Regulation and the Competitiveness of US Manufacturing: What Does Evidence Tell Us, *Journal of Economic Literature*, XXXIII, 132-163.
- Kalt, J.P., 1988, The Impact of Domestic Environmental Regulatory Policies on U.S. International Competitiveness, in *International Competitiveness*, Eds. A.M. Spence and H.A. Hazard, Bellinger, Cambridge, MA.
- Kennedy, P.W., 1994, Equilibrium Pollution Taxes in Open Economies with Imperfect Competition, *Journal of Environmental Economics and Management*, 27, 49-63.
- Knodgen, G., 1979, Environment and Industrial Siting: Results of an Empirical Survey of Investment by West German Industry in Developing Countries, *Zeitschrift fur Umweltpolitik*, 2.
- Lee, H., and D. Roland-Holst, 1994, International Trade and Transfer of Environmental Costs and Benefits, in *Applied Trade Policy Modelling*, (J. Francois and K. Reinert eds.) Cambridge: Cambridge University Press.
- Lee, J.R., 1996, Basic Attributes of Trade and Environment: What do the Numbers Tell Us? *Ecological Economics*, 19, 19-33.
- Levinson, A., 1992, *Environmental Regulations and Manufacturers' Location Choices: Evidence from the Census of Manufactures*, New York: Columbia University.
- Lopez, R., 1994, The Environment as a Factor of Production: The Effects of Economic Growth and Trade Liberalization, *Journal of Environmental Economics and Management*, 27, 163-184.

- Lopez, R., 1997, Environmental Externalities in Traditional Agriculture and the Impact of Trade Liberalization: The Case of Ghana, *Journal of Development Economics*, 53, 17-39.
- Low, P., 1992, *International Trade and the Environment*, Washington, DC: World Bank.
- Low, P., and A. Yeats, 1992, Do “Dirty” Industries Migrate, *in International Trade and the Environment*, (P. Low, ed.), Washington, DC: World Bank.
- Lucas, R.E.B., H. Hettige, and D. Wheeler, 1992, Economic Development, Environmental Regulation, and the International Migration of Toxic Industrial Pollution: 1960-1988, *in International Trade and the Environment*, (P. Low ed.), Washington, DC: World Bank.
- Magee, S., and W.F. Ford, 1972, Environmental Pollution, the Terms of Trade, and the Balance of Payments, *Kyklos*, 25, 101-18.
- McGuire, M.C., 1982, Regulation, Factor Rewards, and International Trade, *Journal of Public Economics*, 17 (3), 335-54.
- Merrifield, J.D., 1988, The Impact of Selected Abatement Strategies on Transnational Pollution, the Terms of Trade, and Factor Rewards: A General Equilibrium Approach, *Journal of Environmental Economics and Management*, 15, 259-284.
- OECD, 1978, *Macroeconomic Evaluation of Environmental Programmes*, Paris.
- Palmer, K. P., W. E. Oates, and P. R. Portney, 1995, Tightening Environmental Standards: The Benefit-Cost or No-Cost Paradigm, *Journal of Economic Perspectives*, 9(4), 119-132.
- Pasurka, C.A., 1985, Environmental Control Costs and U.S. Effective Rates of Protection, *Public Finance Quarterly*, 13(2), 161-182.
- Pethig, R., 1976, Pollution, Welfare and Environmental Policy in the Theory of Comparative Advantage, *Journal of Environmental Economics and Management*, 2, 160-69.
- Petrakis, E., and A. Xepapadeas, 1996, Environmental Consciousness and Moral Hazard in International Agreements to Protect the Environment, *Journal of Public Economics*, 60, 95-110.
- Piggott, J., J. Whalley, and R. Wigle, 1991, International Linkages and Carbon Reduction Initiatives, *in The Greening of World Trade Issues*, (K. Anderson and R. Blackhurst eds.), Ann Arbor: University of Michigan Press.
- Porter, M. A., 1991, America’s Green Strategy, *Scientific American*, 168, 264.
- Porter, M. A., and C. van der Linde, 1995, Towards a New Conception of the Environment-Competitiveness Relationship, *Journal of Economics Perspectives*, 9(4), 97-118.
- Rauscher, M., 1994, On Ecological Dumping, *Oxford Economic Papers*, 46(5), 822-40.
- Richardson, J.D., and J.H. Mutti, 1977, International Competitive Displacement from Environmental Control, *Journal of Environmental Economics and Management*, 4, 135-52.

- Robinson, H.D., 1988, International Pollution Abatement: the Impact on the Balance of Trade, *Canadian Journal of Economics*, 21, 187-99.
- Ropke, I., 1994, Trade, Development and Sustainability – A Critical Assessment of the “Free Trade Dogma”, *Ecological Economics*, 9(1), 13-22.
- Sartzetakis, E. S., and C. Constantatos, 1995, Environmental Regulation and International Trade, *Journal of Regulatory Economics*, 8(1), 61-72.
- Selden, T.M. and D. Song, 1994, Environmental Quality and Development: Is There a Kuznets Curve for Air Pollution Emissions?, *Journal of Environmental Economics and Management*, 27, 147-162.
- Siebert, H., 1977, Environmental Quality and Gains From Trade, *Kyklos*, 30 (4), 657-73.
- Simpson, R. D., and R. L. Bradford, 1996, Taxing Variable Cost: Environmental Regulation as Industrial Policy, *Journal of Environmental Economics and Management*, 30, 282-300.
- Tobey, J., 1990, The Effects of Domestic Environmental Policies on Patterns of World Trade: an Empirical Test, *Kyklos*, 43, 191-209.
- Tinbergen, J., 1952, *On the Theory of Economic Policy*, Amsterdam: North Holland Press.
- Ugelow, J., 1982, A Survey of Recent Studies on Costs of Pollution Control and the Effects on Trade, in *Environment and Trade*, (S. Rubin ed.), New Jersey: Allanheld, Osmun and Co.
- Ulph, A., 1990, The Choice of Environmental Policy Instruments and Strategic International Trade, University of Southampton Discussion Paper in Economics and Econometrics, 9012.
- Ulph, A., 1994, Environmental Policy and International Trade—A Survey of Recent Economic Analysis, University of Southampton Discussion Paper in Economics and Econometrics, 9423.
- Van Beers, C. and J.C.J.M. van den Bergh, 1996, An Overview of Methodological Approaches in the Analysis of Trade and Environment, *Journal of World Trade*, 30(1), 143-167.
- Van Beers, C. and J.C.J.M. van den Bergh, 1997, An Empirical Multi-Country Analysis of the Impact of Environmental Policy on Foreign Trade Flows, *Kyklos*, 50(1), 29-46.
- Walter, I., 1973, The Pollution Content of American Trade, *Western Economic Journal*, 11, 61-70.
- Walter, I., 1982, Environmentally Induced Industrial Relocation to Developing Countries, in *Environment and Trade*, (S. Rubin ed.), New Jersey: Allanheld, Osmun, and Co.
- World Bank, 1992, *World Development Report*, Washington D.C.