

Introduction and Overview of the Economics of International Trade and the Environment¹

by

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Abstract

We describe the theoretical and empirical contributions that rigorous economic analysis can make in improving our understanding of the salient issues relating to environmental protection in the presence of international trade. We do this by analyzing and summarizing the intellectual contributions of nineteen theoretical and empirical papers about the nexuses between environmental and trade policy.

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1. Preliminaries

There is no gainsaying the fact that the subject of trade, particularly international trade, has been central to economic thinking for well over two centuries. Beginning with the seminal work of Adam Smith (1776) and continuing with the well known work of David Ricardo (1817), economists have generally considered unfettered international trade to be a source of many gains. For instance, with regard to trade⁴ with more efficient countries, economists have used the notion of *comparative advantage* to demonstrate that two nations can trade to their mutual advantage even when one of these two nations is more efficient than the other at producing everything. In addition to this, economists have shown that international trade is salutary because it allows nations to export goods whose production makes relatively heavy use of resources that are plentiful nationally, while importing goods whose production makes heavy use of resources that are scarce nationally. Finally, economists have pointed out that international trade permits nations to specialize in producing a narrower range of goods, thereby permitting them to enjoy the greater efficiencies of large scale production.⁵

Despite this demonstration of the many gains from international trade, in recent times, the desirability of free trade has been questioned by several groups of people. Environmentalists in particular, disheartened by the General Agreement on Tariffs and Trade (GATT) ruling in favor of Mexico and free trade and against the US and the apparent welfare of the dolphin, have been

⁴In the rest of this chapter, we shall use the terms “international trade” and “trade” interchangeably.

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For more on the gains from trade, see Krugman and Obstfeld (1994), Ethier (1995), and Rauscher (1997).

aggressive in pointing out what they believe to be the many problems with free trade.⁶ Some, such as D. Morris (1990), have even referred to free trade as the great destroyer.⁷

Why do environmentalists and other like minded people object to free trade? To comprehend this, consider three issues that have been raised by the opponents of free trade.⁸ First, there is the *specialization* issue. It has been pointed out that with free trade, some nations may end up specializing in the production of pollution-intensive goods. Not only will this lead to greater environmental degradation in these nations but it is also likely to lead to substantial welfare losses in the same nations.

Second, it has been claimed that unfettered international trade will encourage trade in *hazardous substances*, with the developed nations of the world typically exporting such substances to the developing nations of the world. The recipients of such substances are generally ill prepared to handle them; moreover, it has been said that this kind of trade will only encourage cost conscious “Northern” corporations to export environmental problems to the nations of the “South.”

Finally, there is the *interjurisdictional competition* issue. Because all governments are interested in attracting mobile factors of production to their own nations and because it is costly to comply with stringent environmental regulations, governments may deliberately lower their environmental regulations in order to attract these mobile factors of production. This is likely to lead to suboptimal levels of environmental regulation throughout the world.

⁶See Whalley (1991) for additional details on this issue.

⁷For more on the environmentalist perspective on free trade, see Ekins (1989), Arden-Clarke (1992), the debate between Bhagwati (1993) and Daly (1993) in *Scientific American*, and Ropke (1994).

⁸For a more detailed description of these and other related issues, see chapter 1 in Rauscher (1997).

Recognizing the salience of these issues pertaining to international trade and the environment, the chapters in this book explore, from an economic standpoint, many of the questions that are germane in increasing our knowledge of environmental policy in the presence of international trade and trade policy in the presence of environmental externalities. What can economic *theory* tell us about the connections between environmental and trade policy? This is the general question that is addressed by the ten chronologically arranged chapters that comprise Part II of this book. The tools of game and microeconomic theory are used efficaciously by the authors of the different chapters to analyze diverse issues such as (i) the effects of international trade in waste products in the presence of illegal disposal, (ii) the nature of environmental policy when market structure and plant locations are endogenous, and (iii) ecological dumping.

The authors of the nine chronologically arranged chapters of Part III *apply* economic theory to practical settings to ascertain, *inter alia*, the extent to which this theory can inform actual policy decisions about problems at the interface of international trade and the environment. This part of the book focuses on topics such as (i) the impact of industrial pollution abatement on a nation's balance of trade, (ii) the German tax initiative in which carbon taxes with exemptions were used to combat carbon dioxide (CO₂) emissions, and (iii) the effects of the North American Free Trade Agreement (NAFTA) on Mexico's environmental policies.

2. Theory

Given recent discussions about the desirability of instituting environmental policies to deal with transboundary pollution, it is salient to ascertain how transboundary pollution flows, production, factor prices, and the terms of trade are affected by alternate pollution control policies. This question is addressed comprehensively by John Merrifield in chapter 2. Merrifield analyzes the effects of production taxes and best available control technology standards in a two-

country, static, general equilibrium model. Unsurprisingly, this analysis shows that in an international setting, neither country is able to use policies *unilaterally* to deal with transboundary pollution effectively. More interestingly, comparing the pros and cons of two pollution control instruments, Merrifield shows that a production tax (a domestic policy instrument) can actually have a perverse effect on pollution. In particular, the use of a production tax to control pollution can actually *increase* pollution.

If domestic policies cannot always be relied upon to control external diseconomies, then can one rely on trade policies to control externalities? This question is the subject of the interesting chapter 3 by Brian Copeland. Copeland analyzes this question in the context of international trade in waste products. He shows that there are two circumstances in which the use of trade policies to restrict trade in waste can be welfare improving. First, when the waste disposal sector is *not* taxed optimally, a policy that restricts foreign waste disposal is optimal in a second-best sense. Second, in the presence of illegal waste disposal, a trade tax, when used to supplement a production tax, can improve welfare. This is because the trade tax reduces both the flow of waste *and* the fraction of waste that is illegally disposed.

Because Copeland works with a single country model, his analysis does not account for the *strategic* aspects of the use of a trade tax to control waste disposal. The strategic aspects of environmental policy are nicely studied by James Markusen *et al.* in chapter 4. These authors use a two-country, two-firm, three-good model with increasing returns and pollution to examine the links between environmental policy, plant location, and market structure. Their model permits polluting firms to alter the number and the location of their plants in response to specific environmental policies, and general equilibrium is found as the solution to a two-stage game. In this setting, two key results are obtained. First, it is shown that when firm specific fixed costs are

high (low) and plant specific fixed costs are low (high), a multi-plant (single-plant) market structure is likely to emerge. Second, the authors convincingly argue that when setting pollution taxes, regulators need to account for the endogeneity of the market structure to environmental policies.⁹

Like chapter 4, chapter 5 also focuses on the strategic aspects of environmental policy in an international setting. In this important chapter, Michael Rauscher tells us that two interpretations can be given to the notion of *ecological dumping*. With these two interpretations in place, Rauscher identifies the economic motives for engaging in ecological dumping. His analysis tells us that ecological dumping can be rationalized by appealing either to strategic trade policy arguments or to lobbying arguments. Rauscher favors the latter argument. As he explains, even though it is not always true, in actual policy settings, most exporting producers believe that less stringent environmental regulations will *help* them. This provides a rationale for employing lobbyists who will press for *relaxed* environmental regulations. In turn, if these export lobbies are more powerful than other lobbies, then this provides a possible explanation for ecological dumping.

Rauscher's less favored strategic trade policy arguments are elaborated upon by Scott Barrett in chapter 6. In particular, Barrett poses and answers the following salient question: When does it make sense for governments to set weak environmental standards? Using a model that is a stage game involving two governments and their industries that sell their output in a third market, Barrett shows that the domestic government will want to set weak environmental standards when the domestic industry is a monopoly, the foreign industry is imperfectly competitive, and firms

⁹An important issue in this setting concerns the incentives that firms have to agglomerate in a single location. For more on this issue, see Ulph and Valentini (1997).

engage in Cournot competition. More significantly, Barrett points out that this finding is *not* robust. Specifically, if the domestic industry is oligopolistic or if firms engage in Bertrand competition, the incentive to weaken environmental standards is itself weakened and may even disappear completely.

From Barrett's analysis in chapter 6, it is clear that in order to develop optimal environmental policies, one needs to comprehend the *nexuses* between markets and the environment. But, what about institutions such as *property rights*? In particular, what role do property rights over environmental resources play in encouraging or hindering trade between nations? This question is ably addressed by Graciela Chichilnisky in chapter 7.¹⁰ To conduct her analysis, Chichilnisky uses a two-factor, two-good, two-country model in which the environment—which is one of the factors of production—is owned as unregulated common property in one country (the South) and is owned as private property in the second country (the North). In this setting, Chichilnisky establishes two results. First, she shows that *differences* in the property rights regime in otherwise identical countries is sufficient to create North-South trade. Second, it is shown that this trade will result in *excessive* use of the environment in the South. To correct this excessive use, Chichilnisky recommends the use of property rights policies rather than taxes in the South.

A North-South world is also the setting of the chapter 8 analysis of trade and transboundary pollution by Brian Copeland and Scott Taylor. However, here, the difference between the Northern and the Southern countries is that the Northern countries are human capital abundant relative to the Southern countries. In this setting, three significant results are shown to

¹⁰Similar issues have been addressed in an interesting recent paper by Brander and Taylor (1997). However, the Chichilnisky and the Brander and Taylor models are quite different. As such, it is not surprising that some of Chichilnisky's results are not corroborated by the analysis of Brander and Taylor.

hold. First, in an equilibrium with factor price equalization, Northern countries lose from trade, Southern countries gain from trade, and trade does *not* affect world pollution. Second, in an equilibrium without factor price equalization, pollution in the North declines with trade, pollution in the South rises with trade, and world pollution is *higher* in the presence of free trade. These two results are valid when there are a *large* number of countries. As one would expect, when there are a small number of countries, the possibility that countries will want to use environmental policy *strategically*, i.e., to improve their terms of trade, must be considered. In this small-numbers case, Copeland and Taylor show that whereas the Southern countries would prefer that environmental policy *not* be used as an instrument of trade policy, the Northern countries would like to have a regime that *permits* environmental policy to be used as an instrument of trade policy.

Additional issues relating to this small-numbers case are analyzed by Alistair Ulph in chapter 9. Specifically, Ulph revisits the subject of chapter 5, namely, ecological dumping. However, unlike Michael Rauscher in chapter 5, Ulph favors a strategic trade policy interpretation of ecological dumping. He uses a partial equilibrium model in which there are two producers of a homogeneous good, and each firm is located in a different country. Because Ulph's focus is on *symmetric* equilibria, both producers and the relevant countries are identical. This construct is used by Ulph to obtain two interesting results about the nature of strategic policy formulation. First, it is shown that permitting producers to act strategically *diminishes*, but does not eliminate, the incentives for governments to loosen environmental policy. Second, allowing governments to act strategically only *increases* the incentives that producers have to act strategically.

Because Ulph's analysis is based on a number of specific assumptions, it is possible to question the generality of his results. For instance, one can ask what happens to his results when

producers and governments interact with each other over time. More generally, what insights do *dynamic* models provide about the connections between environmental and trade policy? This question is competently studied by Edward Barbier and Carl-Erik Schulz in chapter 10. Barbier and Schulz use an augmented bioeconomic model of species exploitation and habitat conversion and ask whether it makes sense for developed country importers of wildlife products to use trade interventions—such as tariffs and import bans—to influence the exploitation of wildlife and the conversion of natural habitats in developing countries. The comparative statics results presented in this chapter show that, in general, trade interventions *cannot* be relied upon to increase the long run total species stock. In contrast, an international transfer of funds will generally lead to *greater* long run conservation of species and natural habitat.

The analysis of Barbier and Schulz in chapter 10 tells us that in a *non-strategic* dynamic setting, trade interventions are unlikely to attain desired objectives. Is the same true of trade interventions in a strategic setting? In other words, in an imperfectly competitive game setting, can one make a case for using trade policies to achieve environmental goals? This and related issues are taken up by Amitrajeet Batabyal in his chapter 11 analysis of the links between environmental and trade policy. Specifically, Batabyal poses and answers two questions. First, can environmental policy, pursued strategically by a country in a Cournot game, immiserize that country when the incidence of pollution is domestic? Second, what are the effects of regulating international pollution with a tariff in a Cournot game in which national governments are affected by international pollution but polluting firms within nations are not.¹¹ The analysis in this chapter shows that the pursuit of strategic environmental policy *can* immiserize a country. Moreover, it *is* possible for a country to use a tariff to make its own consumers and producers better off.

¹¹For additional discussion of these two questions, see Batabyal (1996a) and Xu and Batabyal (2000a, 2000b).

However, as Batabyal points out, this latter result is very dependent on the values of specific parameters of his model.

Chapters 2 through 11 of this book provide us with diverse theoretical perspectives on the economics of international trade and the environment. Collectively, these chapters illustrate the many useful theoretical insights that can be gained by engaging in rigorous microeconomic and game-theoretic analyses of environmental protection in the presence of international trade. A logical question now is this: How can this theoretical knowledge be used to increase our understanding of the practical aspects of environmental and trade policy? It is to this application issue that we now turn.

3. Applications

In chapter 12, David Robison uses a 78 sector statistical model to shed light on two related questions. First, what effects do marginal changes in industrial pollution abatement have on the US balance of trade? Second, is it true that undertaking pollution abatement will reduce a nation's comparative advantage in the production of high abatement cost goods and improve it in the production of low abatement cost goods? With regard to the first question, Robison's statistical analysis tells us that marginal changes in industrial pollution abatement have *reduced* the US balance of trade for virtually every industry analyzed. As far as the second question is concerned, this chapter finds empirical support for the hypothesis that industrial pollution abatement *is* altering US comparative advantage so that the abatement content of imported goods is rising relative to that of goods exported by the US.

An implication of the analysis in chapter 12 is that high abatement cost industries are likely to move to countries that do not adopt stringent environmental regulations. Is this "industrial

flight” hypothesis valid?¹² This question is capably addressed by James Tobey in chapter 13. Tobey uses the cross-section Heckscher-Ohlin-Vanek (HOV) model to determine the impact of environmental regulations on the pattern of trade. Two different approaches are used. In the first approach, a qualitative variable is employed to represent the strength of environmental regulations in the estimated equation. In the second approach, the variable representing the strength of a country’s environmental regulations is omitted from the estimated equation and the signs of the estimated error terms are studied. Tobey’s econometric analysis shows that environmental regulations *per se* have *not* caused the pattern of trade to deviate from the predictions of the HOV model. This result is interesting because it contradicts an implication of one of David Robison’s central findings in chapter 12. In addition to this, Tobey’s analysis finds *no* evidence to support the “industrial flight” hypothesis.

Generally speaking, international *cooperation* is necessary to resolve disputes involving trade and the environment. However, as is well known, this cooperation will often *not* be forthcoming.¹³ Consequently, in such situations, individual countries may want to pursue environmental and/or trade policies unilaterally. The econometric analysis of chapter 13 tells us that the outcome of *unilateral* environmental regulations need *not* be deleterious.¹⁴ The subject of unilateral policy-making is clearly an important one and it needs to be studied in detail. This is what is done by Stefan Felder and Thomas Rutherford in chapter 14. In this chapter, Felder and Rutherford use a six-region dynamic general equilibrium model to conduct a detailed empirical analysis of the economic consequences of a unilateral cutback of carbon dioxide emissions by the

¹²This hypothesis has aroused a great deal of interest in the literature on international trade and the environment. For additional details, see Leonard (1984) and the papers cited in Batabyal (1991).

¹³For more on this, see Haas *et al.* (1993), Batabyal (1996b, 2000a), and the collection of papers in Batabyal (2000b).

OECD countries. The authors show that unilateral cuts create incentives for free riding by non-participating regions. Second, unilateral cuts lead to carbon leakage. Although this suggests that unilateral carbon abatement policies are *damaging*, it is important to note that this analysis does *not* take the benefits of reduced greenhouse gases into account. Consequently, it is still possible that when all the relevant effects have been considered, unilateral policies will have a salubrious effect on environmental quality and on national welfare.

Unilateral environmental policies receive some attention from Carlo Perroni and Randall Wigle in chapter 15 as well, but the primary focus of these authors is on the following salient question: Does trade liberalization necessarily have a negative impact on environmental quality or is it possible to treat environmental protection and trade liberalization as separate objectives? To answer this question, Perroni and Wigle analyze a general equilibrium model that is calibrated to a 1986 world data set. This analysis leads to two important conclusions. First, it is shown that although trade liberalization does have a noticeable effect on the environment, the cause-effect link between trade liberalization and environmental degradation is *weak*.¹⁵ Moreover, this weak link is likely to disappear when countries institute apposite environmental policies. Second, the authors point out that environmental and trade policies are not necessarily interdependent. Contrary to conventional wisdom, this means that optimally set environmental policies are *unlikely* to be immiserizing in an open economy.

The analysis in the previous chapter suggests that meaningful conclusions about the nexuses between environmental and trade policies can only be drawn by comprehending the

¹⁴Also see footnote 11 and Batabyal (1991, 1993).

¹⁵This conclusion has not received universal support. In a recent theoretical paper, Copeland and Taylor (1997) have shown that the cause-effect link between trade and environmental degradation can be “strong.” In other words, trade can lead to a cycle of increased pollution, lower environmental quality, and lower real incomes.

specific circumstances of each country's economy in relation to world markets. This suggestion is also made in chapter 16. Here, Kerry Smith and Andres Espinosa first observe that a key weakness of extant empirical models of trade and the environment is that these models have assumed *separable* preferences. They then extend a standard computable general equilibrium model and assess the extent to which the *assumptions* made in four different models have influenced their conclusions about the welfare effects of trade liberalization. *Inter alia*, this assessment is persuasive in documenting the far reaching implications of separability. As Smith and Espinosa note, if one assumes separable preferences, then one will be *unable* to recognize that externalities influence *and* are influenced by final good choices.

The suggestion that it is salient to comprehend the specific circumstances of a country's economy in relation to world markets is followed by the authors of chapters 17 through 19 as well. Specifically, the subject of chapter 17 is West Germany. In this chapter, Christoph Bohringer and Thomas Rutherford use a 58 sector general equilibrium model of the West German economy that is calibrated to 1990 data and they pose and answer three questions. First, do exemptions magnify the costs of unilaterally imposed carbon taxes? Second, if the objective is to protect jobs, then is it better to use direct wage subsidies or tax exemptions? Third, how do tax exemptions affect export performance? Bohringer and Rutherford's analysis of a static model yields interesting answers to these three questions. Exemptions *do* increase the costs of carbon taxation and it is significantly *cheaper* to protect jobs with a wage subsidy. Finally, it is shown that exports from the tax exempted sectors *decline*. These findings lead the authors to conclude that increases in emission reduction targets will pose serious adjustment problems for energy and export intensive sectors of the West German economy.

In chapter 18, Hiro Lee and David Roland-Holst point out that when it comes to studying issues pertaining to trade and the environment, Indonesia is a country that is most worthy of analysis. This is not only because Indonesia has a comparative advantage in polluting industries but also because Indonesia's trade has historically conferred asymmetric environmental effects on its trading partners. As such, Lee and Roland-Holst use a two-country computable general equilibrium model of Indonesia and Japan, and analyze the nature and the effects of Indonesian trade. This analysis leads to two striking conclusions. First, the authors point out that unilateral trade liberalization by Indonesia will *increase* emissions of virtually all industrial pollutants. This notwithstanding, it is noted that when uniform pollution taxation is combined with trade liberalization, it is possible to reduce industrial pollution *and* maintain or even increase welfare. These two conclusion show that welfare enhancement and environmental quality improvement need not be contradictory goals.

Mexico and the quality of its environment are the subject of chapter 19. In this chapter, Bryan Husted and Jeanne Logsdon ask a simple but important question: What effect has the North American Free Trade Agreement (NAFTA) had on the formulation and the implementation of environmental policy in Mexico? To answer this question, the authors provide empirical evidence and discuss the nature of environmental policy in Mexico before and after 1990, the year in which the drive to make NAFTA a reality began in earnest. The authors point out that Mexico's environment was in bad shape in the pre-1990 era. However, in the early 1990s, the time period in which NAFTA debates were vigorous, both environmental policy-making and enforcement improved. In particular, environmental programs were *not* subjected to budget cuts, even when the nation was going through the financial crisis of 1995. This and measures taken to make Mexico's environmental performance transparent to outsiders lead the authors of this

chapter to the following conclusion: Although it is still too early to make definitive statements about the total effect of NAFTA on Mexico's environment, the available evidence does suggest that the NAFTA experience has left an inextinguishable *positive* mark on environmental policy in Mexico.

NAFTA and the more general question of the impact of trade on the environment are looked at from a different angle by Lewis Gale and Jose Mendez in the concluding chapter 20. In a well known paper, Gene Grossman and Allan Krueger (1993) demonstrated the existence of an inverted-U relationship between pollution and per capita income. In addition to this, Grossman and Krueger also suggested that patterns of specialization have more to do with traditional sources of comparative advantage and less to do with cross-country differences in environmental standards. In this chapter, Gale and Mendez re-examine the causes of these two results. Unlike Grossman and Krueger, who used a single proxy to capture the effects of both scale and technique on environmental quality, Gale and Mendez use two proxies and find support for the Grossman and Krueger contention that first scale and then technique effects account for the inverted-U relationship. With regard to the Grossman and Krueger point about the pattern of specialization, the econometric analysis of Gale and Mendez shows that cross-country differences in endowments *do* have an impact on the environment. Specifically, pollution increases with the capital abundance of a country and falls with increases in land and labor abundance.

4. Conclusions

The different chapters in this book effectively describe the theoretical and empirical contributions that rigorous economic analysis can make in improving our understanding of the causes of and the solutions to a variety of problems concerning the conduct of environmental policy in the presence of international trade. These chapters also provide us with a "state of the

art” perspective on what is currently known about the theoretical and empirical nexuses between environmental and trade policy. The task for researchers now is to use the findings contained in this book to design and implement efficient environmental policies that will attain *environmental* policy goals. At the very least, this will assuage the increasingly acrimonious nature of international discussions about issues at the interface of international trade and the environment.

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