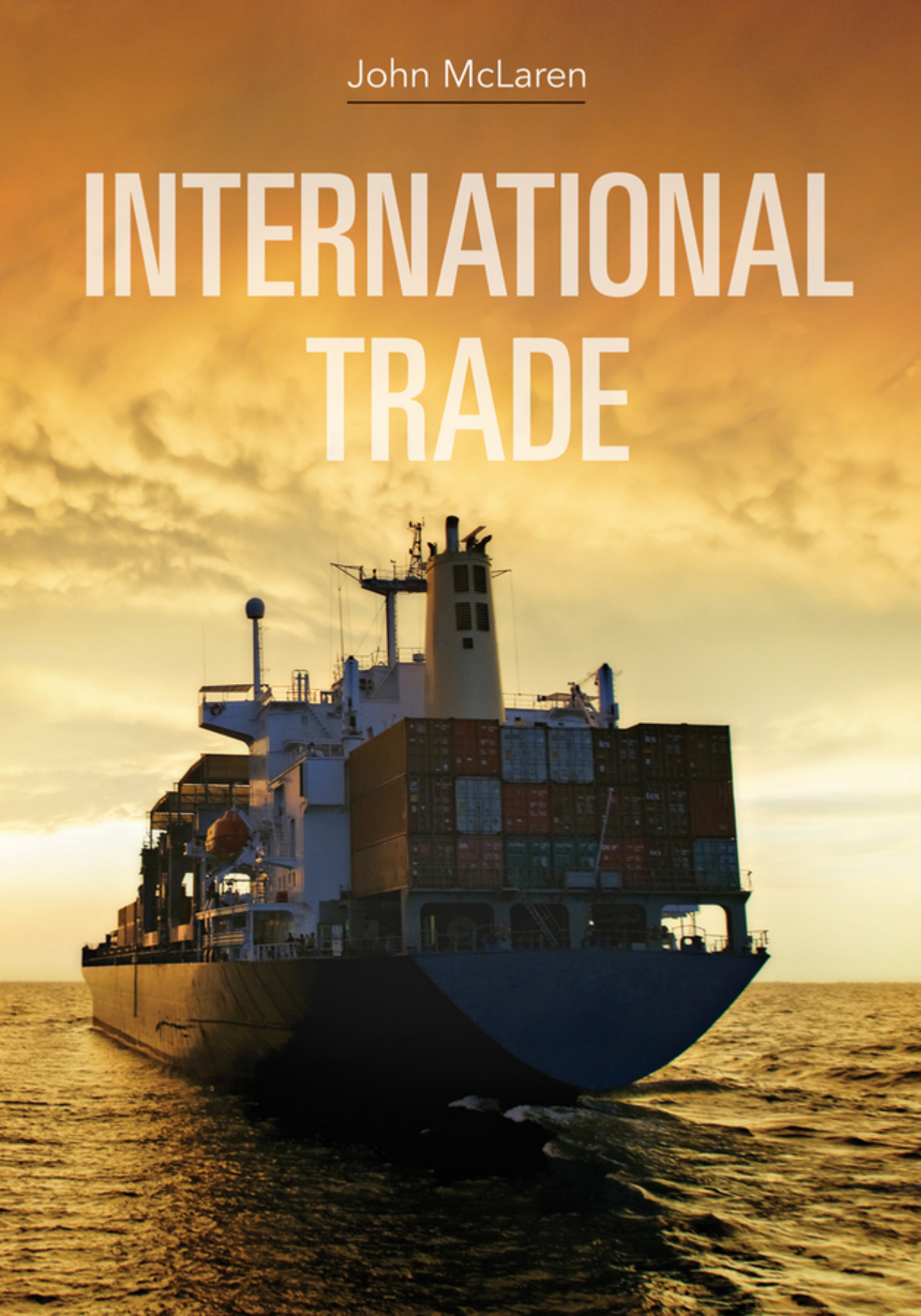
John McLaren

# INTERNATIONAL TRADE



# INTERNATIONAL TRADE

## ECONOMIC ANALYSIS OF GLOBALIZATION AND POLICY

**John McLaren**
*University of Virginia*

WILEY

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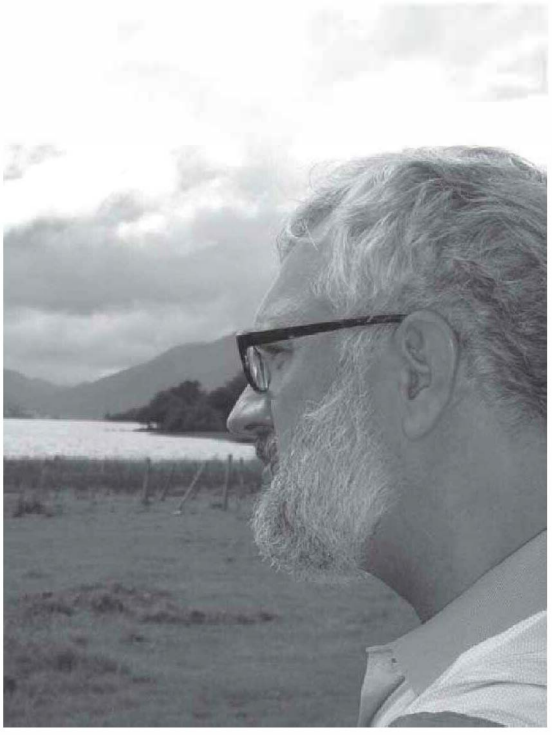
ISBN-13: 978-0-470-40879-7

Printed in the United States of America
10 9 8 7 6 5 4 3 2 1

*To Ella, Kennan, Alev, and, of course, to Mom.*

# About the Author



John McLaren's research has ranged across the fields of international trade, development, industrial organization, and political economy, and has appeared in the *American Economic Review, Quarterly Journal of Economics*, the *Review of Economic Studies*, and a range of other outlets. He received his PhD at Princeton in 1992, has taught at the University of Virginia since 2000, and at one time or another has also taught at Princeton, Yale, Columbia, the University of Maryland, and—farthest afield—the University of World Economy and Diplomacy in Tashkent, Uzbekistan.

# PREFACE

## Approach

This is a textbook for undergraduate, MBA, and Master's of Public Administration courses in international economics. It is appropriate to either a one-semester course in international economics with two or three weeks of macroeconomics topics or a course specialized in international trade. This text covers all of the conventional theory that undergraduates are expected to learn in a course of that sort, but presented in a radically different way. A standard course in international trade will present a sequence of models—the Ricardian model, specific factors, Heckscher-Ohlin, and a few others—following up each theoretical model with an application to one or more policy questions or with a discussion of empirical evidence. This time-tested method works fairly well, particularly with highly motivated students, but it suffers from two important limitations that I have noticed after long experience.

- *The absorption of the theory* suffers from a lack of enthusiasm, because for most students it is difficult to sustain motivation through the many technical details required to understand the models well, before the *usefulness* of the model has been established in the mind of the student.

- *The application of the theory* suffers because the student tends to think of "theory" and "policy" as two different topics, which refer to each other but do not depend on each other in any crucial way. Often, the real-world applications are presented in text boxes, which signal to the students that they are not part of the core material and are unlikely to be on the exam. I have found that in practice, students tend to suffer through the theory, then perk up somewhat during discussion of policy controversies, but generally fail to make a strong connection between the two. When, at the end of my course, I have assigned a short written assignment in which students are required to analyze a real-world trade policy, I have found that even students who have understood the theoretical models reasonably well simply do not use them in analyzing real-world problems. Put differently, *using* economic theory is a different skill from merely *understanding* economic theory, and our economics courses ought to aim to teach this skill.

In this text I have used what I call the *inversion technique*: I introduce a real-world policy problem at the *beginning* of each topic, and spend some time presenting the key facts and background, showing the students why the problem is important, achieving a certain level of emotional investment in the policy question. I then present one or more key arguments that are made in answering the question by advocates for one answer or another, and *then*, in the process of elucidating the particular argument I want to highlight, I present

a theoretical model that is *necessary to understand that argument*. In this way, the theory model is not separate from an inquiry into the real world, but it is presented at the outset as a *tool* for understanding the world, and the students appreciate it as a possible solution to an important real-world question.

Since I began using this technique to present my course at the University of Virginia, I have found a sharp improvement in students' engagement with the material (and my own enjoyment of it). Each major theoretical idea can be motivated by a vivid problem from the real world. For example, I introduce the Ricardian model not as a theory of why nations trade in general, but as part of the answer to the question: "Should Nigeria pursue self-sufficiency in food?" The government of Nigeria has indeed had food self-sufficiency as an explicit goal for many years, and in fact for several years in the 1980s banned rice imports as a step to achieving it. Some arguments can be made in favor of this sort of policy in some cases, which I note, but economists overwhelmingly reject this as helpful policy, because it denies the country the benefits of specialization on the basis of comparative advantage. The Ricardian model makes that line of argument as clear as it can be, including the observation, surprising to many noneconomists, that a country may well boost its food consumption by abandoning food self-sufficiency, because of the higher incomes that result from the gains from trade. In this way, the Ricardian model unfortunately but literally becomes a matter of life and death, and vastly more interesting to students than if it was a mere abstract exercise.

## Coverage

Although the manner of presentation is unusual, and the table of contents shows a series of real-world policy problems rather than theoretical topics, the textbook contains *the full set of theoretical models* contained in any standard international textbook, presented in *full analytical rigor*. As a result, one might well interpret this volume as a conventional trade theory textbook in disguise, although I hope its contribution will be greater than that. I have laid out in the accompanying two tables which model is covered in each chapter. The Theory Guide shows a brief list of the main theory ideas, with the chapter location of each one, and the Chapter List with Detailed Guide to Theory Contents shows the theory content in each chapter.

## Technical Level

The technical level of the text is moderate. The text does not use calculus, but many models involve the simultaneous solution of two linear equations with two unknowns and a lot of fairly elaborate diagrams are analyzed with a lot of geometry. Key microeconomic tools are defined before being used, so one could use the course with only a Principles course as a prerequisite, although I think that students are likely to get the most out of it if they have already completed intermediate microeconomics. The analysis of the models is fairly detailed, but I have found that building each chapter around a motivating example enhances students' willingness to push through detailed equilibrium analysis. In that sense, the factual material that begins each chapter and the theoretical elaboration that makes up the bulk of the chapter should be seen as complements, not substitutes.

## Additional Features

A few additional features of the text are worth mentioning.

(i) *Empirical assignments*. Students can learn a great deal about globalization in practice by working out simple exercises with spreadsheets on actual data. I have found that students appreciate this feature both because of what they learn about globalization and because it sharpens some quantitative skills that are useful in every walk of life. For example, for Chapter 1, there is a simple spreadsheet of data from the World Bank on trade volumes, GDP, and populations by country and by year for a broad sample of countries. Problems at the end of that chapter ask students to identify both trends in openness over time and cross-country patterns, such as whether richer or larger countries tend to be more or less open than poorer or smaller ones. For the material on intra-industry trade for Chapter 3, a chapter problem asks students to pick a country and compute the fraction of U.S. trade with that country that is intra-industry in nature rather than inter-industry, and to speculate on the reasons it is high if it is high, and vice versa if it is low. This computation is easy to do with a spreadsheet with the formula given in the chapter.

(ii) *Theory exercises on spreadsheets*. For some problems, where a full mathematical analysis involves heavy algebra, a good bit of the mathematical insight can be obtained by manipulation of a spreadsheet. I have taken some inspiration on this from the work of Soumaya Tohamy and J. Wilson Mixon Jr. of Berry College on the pedagogical use of spreadsheets for trade theory. Student homework problems on optimal tariffs in Chapter 7 and the productivity effects of a Melitz-type model in Chapter 3 are set up in this way.

(iii) *The family tree of trade models*. Real-world trade is complicated; trade between the United States and Canada does not in any way resemble trade between the United States and Nigeria; the effect of a voluntary export restraint in a competitive industry such as the apparel sector is very different from the effect in an oligopolistic industry such as the auto sector. For this reason, we need a portfolio of very different models to analyze the world. Students can find the variety of models overwhelming, and so I have organized them in a diagram that I call "the family tree of trade models." This is a single image that summarizes all of the theory in the course at a glance, and as a result it can serve as a map to help us navigate the course material. It grows out of three branches, each representing one of the three main reasons for international trade (comparative advantage, increasing returns to scale, and imperfect competition), as developed in the insightful and, I believe, underappreciated textbook by Wilfred Ethier. I show the tree at the beginning of the course, pointing out its three main branches, and at the end of each topic in class I show it again to indicate which branch of the tree we have now learned. At the end of each chapter in the book, the portion of the

tree that has been seen so far is reproduced under the heading "Where We Are." In that way, students always know how the different pieces of the course fit together. The full tree is reproduced on the inside back cover for convenience.

(iv) *Advanced theoretical topics*. The book incorporates a simplified account of the Melitz model; both the Feenstra-Hanson and the Grossman-Rossi-Hansberg models of offshoring; the Kala Krishna theory of voluntary export restraints (VER's) as facilitating practices; and simplified analytical equilibrium treatments of the ideas in theoretical work on the World Trade Organization by Bagwell and Staiger and on pollution by Copeland and Taylor. The last chapter incorporates a simple cash-in-advance model of international monetary equilibrium that builds on models of international trade developed earlier in the book. I do not believe that this collection of topics is treated in very many texts at this level.

## Theory Guide: The Location of Key Pieces of Theory by Chapter

Ricardian model: Chapter 2
Specific-factors model: Chapter 5
Heckscher-Ohlin model: Chapter 6
Oligopoly models: Chapter 4
Increasing-returns-to-scale models— internal: Chapter 3
Increasing-returns-to-scale models—external: Chapter 9
Monopolistic competition: Chapter 3
Heterogeneous firms: Chapter 3
Tariffs and quotas with perfect competition: Chapter 7
Tariffs and quotas under oligopoly: Chapter 10
Infant-industry protection: Chapter 9
Trade creation and trade diversion: Chapter 15
Intertemporal trade and unbalanced trade: Chapter 16
Exchange-rate determination: Chapter 17

### Chapter List with Detailed Guide to Theory Contents

**I. Engines of Globalization**

| | |
|---|---|
| 1. A Second Surge of Globalization. | Shows the key facts of rising globalization in historical context and introduces the three main reasons for trade, hence the idea behind each of the three main trade theories covered in the next three chapters. |
| 2. Should Nigeria Strive for Food Self-sufficiency? | Introduces the Ricardian model and comparative advantage as a reason for trade. |
| 3. Why Do Americans Get Their Impalas from Canada? | Introduces increasing returns to scale as a source of trade. Export-versus-FDI model of serving a foreign market. Monopolistic competition model of trade. Intuitive treatment of Melitz model. |

| | |
|---|---|
| 4. Kodak and Fuji: Is World Trade Rigged in Favor of Large Corporations? | Introduces oligopolistic models of trade, showing how oligopoly in and of itself can be a reason for trade and how oligopolists themselves can be the losers, with consumers the beneficiaries. Baldwin-Krugman model of reciprocal dumping. Coumot and Bertrand models. |
| **II. Politics and Policy in the World Economy** | |
| 5. Why Did the North Want a Tariff, and Why Did the South Call It an Abomination? | Introduces specific-factors models. |
| 6. Is Free Trade a Rip-off for American Workers? | Introduces the Heckscher-Ohlin model as well as empirical evidence on the trade-and-wages debate. |
| 7. Why Doesn't Our Government Want Us to Import Sugar? | Introduces basic tariff and quota analysis in comparative-advantage models, partial and general equilibrium. Terms-of-trade versus interest-group motivations for trade policy. Extension to VERs. |
| 8. Who Are the WTO, and What Do They Have Against Dolphins? | The prisoner's dilemma nature of protectionism and the rationale for multilateral cooperation. The problem of disguised protectionism and the intersection between trade and environmental policy. |
| 9. Should Third World Governments Use Tariffs to Jump-start Growth? | Tariffs in an economy with external increasing returns; infant-industry protection. |
| 10. Was Ronald Reagan Punked by Japanese Automakers? | Shows how VERs can have radically different effects in an oligopolistic model; examines evidence that Japanese firms benefited from VERs of the 1980s, and shows how this can arise in a Bertrand oligopoly. (Simplified version of Kala Krishna's theory of VERs as "facilitating practices.") Extension to strategic trade policy more generally: export subsidies and import tariffs under oligopoly. |
| **III. Current Controversies** | |
| 11. Should the iPod Be Made by American Workers? | Feenstra-Hanson and Grossman-Rossi-Hansberg models of offshoring; look at empirical evidence. |
| 12. Should We Build a Border Fence? | Shows how the models of Chapters 5 and 6 can clarify the different arguments regarding immigration; look at empirical evidence. |
| 13. Trade and the Environment: Is Globalization Green? | Reviews "pollution haven" argument that globalization harms the environment versus Antweiler-Copeland-Taylor Heckscher-Ohlin-based argument that globalization is good for the environment. Adds pollution and pollution regulation to the model of Chapter 6. |

| | |
|---|---|
| 14. Sweatshops and Child Labor: Globalization and Human Rights | Adds Basu-Van-type child labor to the model of Chapter 5 to understand the approach and findings of Edmonds, Pavcnik, and Topolova; addresses other questions in globalization and human rights less formally. |
| 15. Is NAFTA a Betrayal of the Poor or a Path to Prosperity? | Trade diversion, trade creation, and evidence on the effects of NAFTA on households in the United States and Mexico. Draws on models from Chapters 6, 7, and 11. |
| 16. Is the Trade Deficit a Time Bomb? | Intertemporal trade and the reasons trade may be unbalanced. Critical look at current views on the U.S. trade deficit. |
| 17. Trade and Exchange Rates: Is the Renminbi the Culprit? | Equilibrium model of exchange rates based on infinite-horizon cash-in-advance model. Critically evaluates claim that China achieves an unfair advantage through currency manipulation. |

## Additional Resources

**Companion Web Site.** A dedicated site for *International Trade* containing all of the following teaching and learning resources: www.wiley.com/college/mclaren

**Instructor's Manual.** Several valuable resources that enhance each chapter of the text, including a chapter summary, approaches to teaching the chapter, suggested related readings, and answers to all of the end-of-chapter questions.

**Test Bank.** Multiple choice and short-answer questions varying in level of difficulty for every chapter.

**Lecture Slides.** Slides of text art and lecture outlines for each chapter provided on the companion web site; can be viewed or downloaded to a computer.

**Additional Questions and Problems.** Similar to those found at the end of each chapter; additional questions and problems provided for further practice and/or assessment.

**Student Practice Quizzes.** Approximately 10 multiple-choice questions per chapter that help students evaluate individual progress.

**Excel Spreadsheets.** Throughout the book, the icon at left identifies selected problems that can be solved using Excel spreadsheets found on the book's companion web site.

## Acknowledgments

Too many colleagues have provided help and guidance on particular portions of this book to be able to thank them all individually. A partial list includes Erhan Artuç, Peter Debaere, Bob Staiger, Mary Lovely, Arik Levinson, and Giovanni Peri. Former graduate teaching assistants who have shaped the book before going on to greater things include Felipe Benguria, Shushanik Hakobyan, and Gihoon Hong. I am grateful as well to the students whose feedback improved the text on many occasions. The reviewers who read draft chapters and provided detailed comments improved the book a great deal, and

I send them my sincere thanks. They are listed below among others who wish to remain anonymous. The Wiley team has been a great help, and all have my gratitude; Jennifer Manias, Jeanine Furino of Furino Production, and Ellinor Wagner have worked particularly closely with me to bring the book together. Finally, I thank my family, who put up with a great deal indeed during the creation of this volume. Hearty thanks to all.

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# Who Are the WTO, and What Do They Have Against Dolphins?

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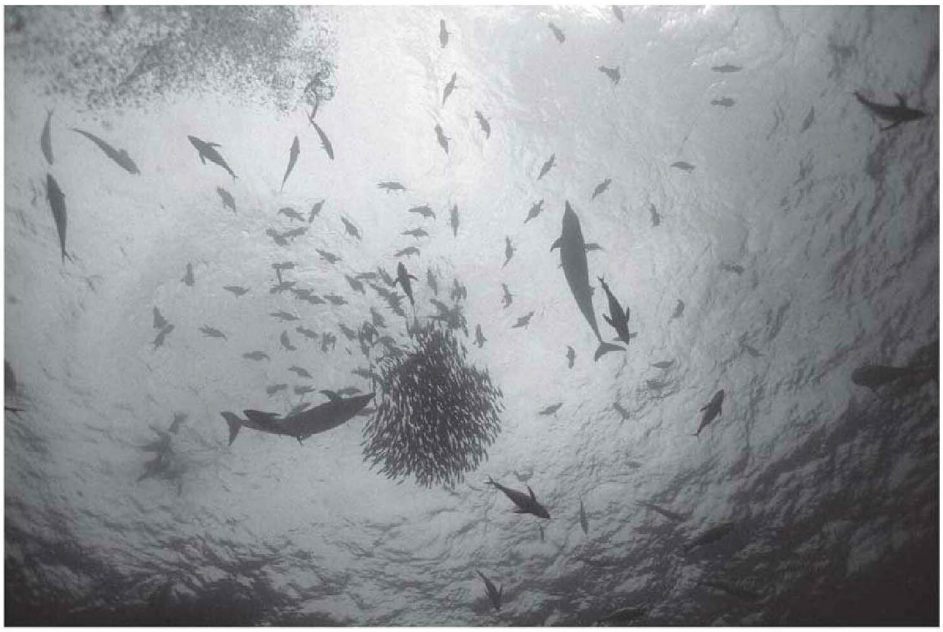

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**The source of the problem. Photographed from below, a floating log at the surface of the ocean off of Costa Rica attracts a ball of small fish, which in turn attracts both tuna and dolphins. Since they often hunt in the same place, dolphins are often caught in nets intended for the tuna.**

## 8.1 The Dolphin Fiasco and Other Stories

For many commentators who regard globalization as a problem, the dolphin fiasco is Exhibit A.

Dolphins tend to loiter under schools of tuna, as the two groups hunt for the same types of prey. As a result, industrial methods of catching tuna by dragging a gigantic net through the ocean to entrap tuna schools—encirclement nets, which became widespread in the 1950s—tend to kill large numbers of dolphins. During the 1960s and 1970s, public concern grew about the millions of dolphins killed in this way. In 1972, the U.S. Congress passed the Marine Mammal Protection Act, which banned the encirclement nets and further banned imports from countries that allowed them. The act was not enforced until the late 1980s, when a suit by an environmentalist group forced the government to take action. As a result, the

United States banned imports of tuna from Mexico, Venezuela, and Vanuatu, as countries harvesting tuna in dolphin-unsafe ways. A "secondary ban" was also imposed on imports from Costa Rica, Italy, Japan, Spain, France, the Netherlands Antilles, and the United Kingdom because those countries permitted imports of dolphin-unsafe tuna. (See Keleman, 2001, for a detailed account.)

Mexico filed a complaint with a panel of the General Agreement on Tariffs and Trade (GATT) (about which we will hear much more later) complaining that this ban was a discriminatory move, inconsistent with the United States' commitments under international agreements. The GATT panel ruled in favor of the Mexican government and struck down the U.S. import ban. To many citizens who wanted their government to be doing more to protect our environment, this signaled that institutions created ostensibly to foster free trade were an obstacle, standing in the way of good public policy and the democratic process itself (see, for example, the commentary by U.S. Senator Sherrod Brown in Brown, 2004, pp. 62–64, who concludes that the trade rules "simply would not let the United States do the right thing for the environment").

There have been several other prominent cases in which a similar outcome has occurred; a number of them are documented in Keleman (2001) and Brown (2004, Chapter 3). For example, in 1997, the World Trade Organization (WTO), which was created in the mid-1990s to govern the GATT, ruled against the United States in favor of shrimp-exporting countries whose exports had been banned because they did not require devices to protect sea turtles. These turtles are endangered species, and sometimes the turtles get caught in shrimp traps and drown. In these cases and in others, observers concerned with the environment have complained *that the institutions of international trade have gotten in the way of protecting the environment.*

On the other hand, there have been a good number of cases in which a regulation drafted ostensibly for health or environmental reasons appears to have recklessly interfered with international trade. One striking example is the case of Chilean grapes. Chile is a major supplier of grapes to the United States. In March 1989, anonymous calls to the U.S. embassy in Santiago warned of cyanide-contaminated grapes on their way to the United States from Chile. In response, U.S. officials quietly conducted inspections of 10% of all grape shipments from Chile, a substantial undertaking given imports of 600,000 boxes per day. On March 12, 1989, two grapes were found with what looked like puncture marks, and tests of those two grapes showed nonlethal traces of cyanide. The next day the U.S. government banned all Chilean grape imports. This occurred at the peak of the export season: 45% of the crop had already left Chile. The ban was devastating for Chile; over its 4-day lifespan, it is estimated to have caused $400 million of harm to the Chilean economy. Later, evidence emerged (partly through an investigation by the *Wall Street Journal*) that the grapes may have been contaminated not in Chile but in the United States. This fueled repeated, but unsuccessful, claims for compensation from the Chilean government. (See Engel, 2000, for a detailed account.)

In the grape case, the Chilean government complained that a flimsy and in fact erroneous claim of a health hazard led to an unwarranted disruption of trade that caused significant hardship to a trade partner. In a similar vein, the United States has complained that Russia's health standards imposed on frozen chicken from the United States, on one occasion banning imports of U.S. chicken altogether, are not motivated by genuine health concerns but rather by protection for domestic producers (White et al., 2004). Additional examples

abound. In these cases, plaintiffs have argued *that a weak claim of a health or environmental issue has been used in a reckless and unwarranted way to disrupt international trade*.

How did these tensions arise, and in particular, how did the WTO wind up in the middle of such disputes? To understand these questions, it is essential to understand the arguments for the necessity of multilateral cooperation on trade policy that gave rise to the WTO in the first place. These arguments flow naturally from the analysis of trade policy discussed in the previous chapter, and that is what will be discussed here. The point is that any country's trade policy confers a *terms-of-trade externality* on other countries. In the analysis of a tariff in Chapter 7, for example, this took the form of a terms-of-trade loss imposed on trade partners equal in size to the terms-of-trade benefit enjoyed by the tariff-using country. Because of these terms-of-trade externalities, if each country sets its own tariffs independently of all others, the resulting outcome will be inefficient, and so there is good reason for countries to try to coordinate trade policies through negotiation. This gives rise to the GATT and the WTO.[1] However, as episodes such as the grape incident above illustrate, terms-of-trade externalities arise not only from trade policy, but from environmental and health policy as well as many others. As a result, the same forces that make governments try to coordinate *trade* policies also provide a motive to coordinate those other policies, or at least create rules to minimize the resulting inefficiencies. This, then, explains why the WTO gets involved in so many environmental disputes, giving rise to episodes such as the dolphin–tuna conflict.

In the next section, we will look at the argument for international cooperation in trade policy, due to the terms-of-trade externality conferred on other countries by any country's trade policy. In the following section, we will see how that argument implies a case for cooperation in other areas as well, because even a country's health or environmental policies also tend to confer a terms-of-trade externality. This helps explain why multilateral trade institutions tend to get caught up in environmental disputes. The next section shows how, further, environmental policy can be used as a proxy for trade policy. The final section of the chapter provides a brief summary of how international institutions have evolved to handle these tensions.

## 8.2 The Trade War Problem and the Need for Coordination in Trade Policy

Every government can set its own trade policy, which is part and parcel of controlling its own borders. However, since the end of the Second World War, governments the world over have put a tremendous amount of effort into coordinating their trade policies with each other. The main argument for doing so has to do with neutralizing terms-of-trade externalities. To see this, we will employ a simple, stylized partial-equilibrium model of the same type as we used in Chapter 7.

[1] The idea of the WTO as a response to the problem of terms-of-trade externalities has been articulated with great care by Bagwell and Staiger (2002), which is an excellent source of further reading on this subject for advanced students. The reasoning explored throughout this chapter draws heavily from that book, although it is presented in a different form. The analysis in Staiger and Sykes (2011) is also very closely related.

For the sake of argument, suppose that the world consists of two countries, the United States and Japan. We will focus on two goods, tuna and apples (because they happen to be good examples of environmental disputes that have popped up between the two countries).[2] Suppose that the demand curves for tuna in the United States and in Japan are identical and are given by:

$$D^T = 100 - P^T, \tag{8.1}$$

where $D^T$ is the quantity of tuna demanded, in millions of pounds, and $P^T$ is the price in dollars per pound. Suppose that the supply curve for tuna in the United States is given by:

$$S^{T,US} = P^T \tag{8.2}$$

and the supply curve in Japan is given by:

$$S^{T,J} = 2P^T, \tag{8.3}$$

where $S^{T,i}$ is the quantity of tuna supplied in country $i$. Thus, the supply curve in Japan is shifted to the right compared to the curve for the United States, implying (together with the identical demand curves) that Japan will be an exporter of tuna under free trade.

Assume that the market for apples is identical with the roles switched. That is, both countries will have a demand curve for apples given by (8.1), with $D^A$ standing for the quantity of apples demanded, in millions of pounds, in place of $D^T$, and $P^A$ standing for the price of apples in place of $P^T$, in dollars per pound; the U.S. supply of apples will be given by (8.3), with $S^{A,US}$ replacing $S^{T,J}$; and Japan's supply of apples will be given by (8.2), with $S^{A,J}$ replacing $S^{T,US}$. Thus, we have a simple, symmetric model, in which the United States has a comparative advantage in apples and Japan in tuna.

Suppose that each country's government sets its tariff optimally, independent of the other, and for now assume that each government maximizes its own country's social welfare. This implies that the United States will set an optimal tariff on Japanese tuna and the Japanese government will set an optimal tariff on American apples. It turns out that in this case the optimal tariff for each country is equal to $4.80 per pound. (This can be verified by using the "optimal tariffs.xls" spreadsheet, or by verifying that this value satisfies the inverse elasticity formula from Section 7.4.1—both of which are good exercises for additional practice.)

A term from game theory will be useful throughout this discussion. Recall from Chapter 4 that in any game, a ***Nash equilibrium*** is an outcome in which each player is maximizing his or her payoff, taking as given the action of the other player. If we think of the situation at hand as a game in which the players are the governments of the United States and Japan and the choice each one needs to make is the tariff on that country's imported good, then the tariff outcome just described (tariffs of $4.80 for each good imposed by its importing country) is actually a Nash equilibrium, since each government is

[2] Unlike previous examples, we will look at an illustrative numerical example to make the argument as clear as possible, rather than a model with parameters calibrated to the data.

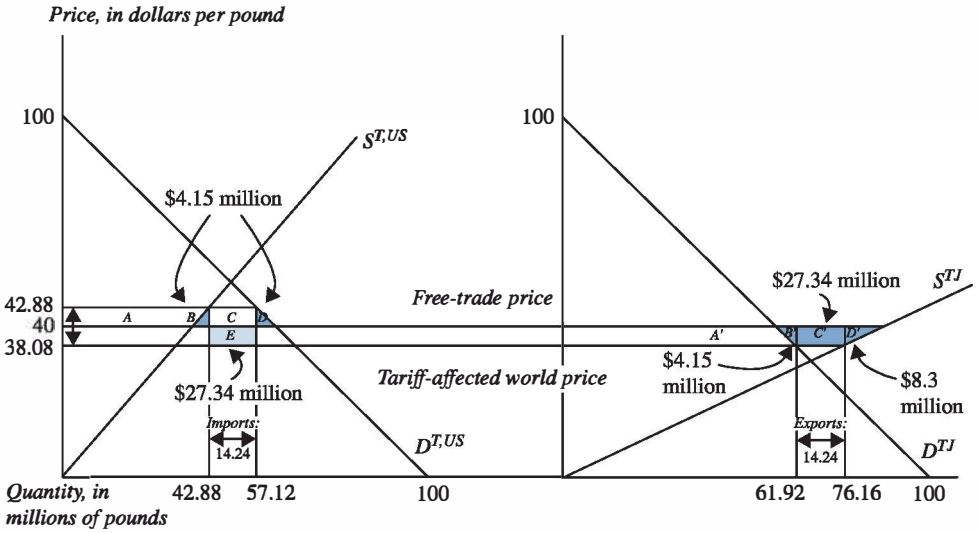


FIGURE 8.1
Tuna Protectionism.

choosing its tariff to maximize its own country's social welfare, taking the other country's tariff as given. Accordingly, we will refer to this outcome as Nash tariffs or noncooperative tariffs. It is also sometimes called a trade war.

Under Nash tariffs, we can calculate equilibrium outcomes just as with the sugar example in Chapter 7. The equilibrium is illustrated in Figure 8.1, with the U.S. market for tuna in the left panel and the Japanese market for tuna in the right panel. The welfare effects of the tariff are marked using the same color and notation as in Figures 7.7 and 7.8. The diagram for apples would be identical in every respect with the two countries' roles reversed, and so it is omitted. The equilibrium world price of tuna is equal to $40 under free trade and $38.08 under the Nash tariffs of $4.80 per pound. The domestic U.S. price of tuna is equal to $40 under free trade and $42.88 under Nash tariffs. The equilibrium quantity of tuna exported is 20 million pounds under free trade and 14.24 million pounds under Nash tariffs. For the crucial welfare outcomes, the U.S. consumption distortion amounts to $4.15 million, the production distortion also amounts to $4.15 million, and the terms-of-trade benefit equals the change in the world price of tuna, $(40 – 38.08) per pound, times the quantity imported, 14.24 million pounds, or $27.34 million. These are all shown in the left-hand panel of the figure. Clearly, the terms-of-trade benefit exceeds the sum of the two distortions, so the United States benefits from its tuna tariff.

Note from the right-hand panel of the figure, however, that the $27.34 million terms-of-trade benefit for the United States is also a $27.34 million terms-of-trade *loss* for Japan (recall that area *E* from Figure 7.7 is equal to area *C′* of Figure 7.8; the same principle applies here). This is the terms-of-trade externality: The U.S. tariff benefits the United States by improving its own terms of trade, which implies *worsening* its trade partner's terms of trade. Put in common language, the United States benefits from making Japanese tuna cheap, while the Japanese emphatically do not.

The same logic works in the opposite direction for apples: Japan receives a $27.34 million terms-of-trade *benefit* from its apple tariff, which amounts to a $27.34 million terms-of-trade *loss* to the United States. Therefore, in adding up the net effect on U.S. welfare of both countries' tariffs together, the terms-of-trade effects cancel out. All that is left is the sum of consumption and production distortions—thus an unambiguously negative effect. The analysis

for Japan is identical: *Both* countries are hurt by the combination of the two tariffs. In game theory, this type of situation is often called a *Prisoner's Dilemma* problem, meaning a Nash equilibrium that is a Pareto-inferior outcome. Note that the Nash tariff outcome is worse for both countries despite the fact that, by definition, in a Nash equilibrium each player is being completely rational and behaving optimally. (Recall that we encountered a Prisoner's Dilemma in Chapter 4, Section 4.6.)

To summarize, *because of the terms-of-trade externality, world social welfare is higher under free trade than it is under the Nash tariffs, and both countries can be made better off by negotiating to free trade.*

Essentially, this explains the motivation for the General Agreement on Tariffs and Trade (GATT), which was signed by a broad coalition of governments in 1948 precisely to negotiate lower trade restrictions. The interwar years had been marked by a sharp rise in U.S. tariffs, notably the Smoot-Hawley tariff bill of 1930, and a subsequent rise in European tariffs. (Recall that we have seen a picture of the Smoot-Hawley tariffs, in the form of the giant mountain peak of Figure 1.3.) The resulting situation, interpreted by many as a trade war, was blamed by many for exacerbating the Great Depression.[3] Following World War II, governments around the world were eager to find ways to foster international cooperation, and as they created the United Nations to avoid future military conflicts, the World Bank to help with reconstruction following the devastation of the war, and the International Monetary Fund to coordinate monetary policies and provide stability to international financial markets, they also drafted the GATT, in the same spirit, to avoid future trade wars and move as close as possible to free trade.

There have been eight renegotiations of the original GATT agreement, called GATT Rounds, each lowering trade barriers a bit further than the one before. The result has been a steady drop in tariffs worldwide, such as the downward trend in U.S. tariffs since World War II illustrated with Figure 1.3, resulting in average tariffs at the end of the twentieth century that were about one-third of their level at midcentury. Inasmuch as the original function of the GATT was the reduction of trade barriers, a glance at Figure 1.3 (or the corresponding figure for any of the other major signatory countries) shows that it has been a resounding success. As we noted in Chapter 1, this was part of the process that produced the second great wave of globalization.

The latest GATT Round to be completed (1994) is the Uruguay Round, named for the location in which negotiations began. This round not only reduced trade barriers further, but also replaced the loose organization that had sprung up as part of the original GATT process with a new, much better formalized organization, the World Trade Organization (WTO). The WTO organizes the negotiation of new rounds of tariff-reduction and ancillary agreements, and adjudicates disputes between members (see Hoekman and Kostecki, 2001, for an overview of the GATT and WTO). The agreements have become much more far-reaching than the original rounds, which were focused on manufacturing tariffs. The WTO now treats issues of trade in

[3] Irwin (1998) reviews available research on this issue and provides some new estimates. He argues that the Smoot-Hawley tariffs probably reduced U.S. trade by something like 4% and lowered real GDP by less than 1%. It is quite possible that world leaders in the postwar period overestimated the role of Smoot-Hawley in exacerbating the Great Depression.

services and in agricultural products, rules of conduct for treatment of foreign direct investment, intellectual property, and—as we shall see—the handling of a wide range of issues in health, safety, and environmental regulation.

A current round, begun in Doha, Qatar, in 2001, is still in progress and appears to be bogged down in stalemate. This was to have been the development round, meaning that the organizers had hoped that developing countries would participate much more fully, reducing their own trade barriers (which tend to be much higher than those of rich countries) in return for rich-country concessions. To summarize a long story, a number of agricultural-commodity-exporting countries have insisted on a reduction in rich-country agricultural producer subsidies; developing countries want a reduction in rich-country use of antidumping and countervailing duties; and rich countries want more access to the developing-country markets. After 10 years, the failure of participants to come to agreement on any of these issues has led to widespread frustration with the multilateral process. It has also increased interest in trade agreements between small groups of countries, "regional," or "preferential" trade agreements, such as those studied in Chapter 15, as a substitute for the broader liberalization that had been hoped for from the WTO process.

The original GATT is a complex treaty, and subsequent revisions have increased its complexity, but a handful of principles underpin the whole enterprise. A key GATT principle is known deceptively as the *most-favored-nation principle* (MFN—Article I of the original GATT agreement). This is simply a nondiscrimination principle. The MFN rule requires that any trade policy concession, such as a lowered tariff, that any country offers to *any* country (whether a WTO member or not) must also be offered to *all* WTO members. (In other words, all members are most favored nations. But what it really means is that no member is favored. It is not clear whether the original negotiators deliberately chose the most confusing language possible or whether it just turned out that way.)

A second important GATT principle is *national treatment* (Article III of the GATT text), which requires each member government to treat any product produced in any member country no less favorably than a similar product produced domestically, once it is inside the country's borders. For example, Switzerland may place a tariff on imported brake pads, but it may not impose safety regulations on French brake pads that are more stringent than the regulations it imposes on Swiss brake pads.

Both of these principles are subject to a large number of exemptions. A few of the more important ones are as follows:

1. Article XXIV allows two or more GATT signatories to sign a preferential trade agreement (PTA), which allows them to remove mutual trade barriers without removing them for other members. For example, along with 25 other countries, Spain and France are part of the European Union, which provides for free trade among all of its members, so French brake pads are imported into Spain duty free and Spanish brake pads are imported into France duty free, but importers must pay a tariff to import Canadian brake pads into either country. These PTAs are permitted provided they satisfy some requirements stipulated in Article XXIV; they will be discussed in Chapter 15.

2. Article VI allows for antidumping policies and countervailing duties. *Dumping* means exporting a product at a price below "fair market value," a legal term infuriating to economists that can mean either the price at which the product is sold in the exporter's home market or the production cost plus a mark-up for "reasonable" profit. The GATT allows for an importing country that finds a product to have been dumped into its market to impose a temporary tariff, an *antidumping duty*, on the dumping exporter. Similarly, if an importing country finds that an exporting country has been subsidizing its exports, that importing country can impose a *countervailing duty* no greater than the amount of the subsidy. It is difficult to rationalize this particular set of provisions on the basis of economic reasoning, but they may be explained as serving a political function.

   Both antidumping and countervailing duties have been extremely important and contentious forms of trade policy in practice, and their importance has grown as their practice has spread to more and more member governments over time. The use of antidumping duties first surged in the 1970s as the United States and a few other industrial countries issued changes to antidumping law that made it easier for a domestic firm to file a claim against a foreign competitor and receive a duty in response. From 1921 to 1967, about 15 antidumping cases were filed per year by U.S. firms, but by the 1980s this had jumped to 40 per year. At that time, antidumping cases worldwide were dominated by the United States, the European Union, Canada, and Australia. However, over the 1990s, as regular tariff levels fell, more and more countries such as India, South Africa, and Argentina began to use these duties regularly, and by 2000, "new users" amounted to 44% of the total antidumping cases worldwide (Lindsey and Ikenson, 2001). Bown (2005) has assembled a comprehensive international antidumping database and found that 15 countries account for 87% of antidumping actions worldwide, including such relative newcomers as Peru, Turkey and Mexico.

   Countervailing duties have also been used heavily by some WTO members. Between 1980 and 2004, the U.S. government imposed countervailing duties on foreign firms 1,070 times.[4] A recent example is the decision made by the U.S. International Trade Commission in December 2009 to approve duties on U.S. imports of Chinese-made steel pipes for use in petroleum extraction, in order to counterbalance alleged Chinese government subsidies on the production of those pipes.[5] This is one of many similar actions taken against Chinese manufactures in recent years as Chinese exports to the United States have grown, but it may be abruptly ending as a U.S. judge has recently ruled that China is a nonmarket economy and U.S. countervailing duties may be applied only to market economies.[6]

[4] This can be calculated from the extensive data on the antidumping and countervailing duties data web page maintained by Prof. Bruce Blonigen of the University of Oregon at: http://pages.uoregon.edu/bruceb/adpage.html.

[5] "U.S. Duties on Pipes from China Approved," *New York Times*, December 31, 2009, p B4.

[6] Eric Martin and Susan Decker, "Tax Duties Against China Tire Subsidies Ruled Illegal." Bloomberg News, December 20, 2011.

In general, most economists regard the Article VI exemptions to be disruptive substitutes to normal tariff protection that have grown in importance as regular tariffs have fallen, which is perhaps unavoidable politically but hard to justify economically.

3. Article XIX, the escape clause, allows a country to suspend its tariff concession temporarily for a particular industry if it has suffered "material injury" due to a surge in imports.

   A famous example of the escape clause in practice was the aggressive set of tariffs raised against a variety of types of steel imports by U.S. President George W. Bush in March 2002. A WTO panel later ruled that these tariffs were inadmissible because they were not truly imposed during an import surge, and so the tariffs were quickly rescinded. A later example is the Obama administration's imposition of tariffs against Chinese tires in September 2009 (under a special safeguards arrangement to which the Chinese government had agreed as part of its process of joining the WTO in 2001, constructed broadly under principles of the original GATT escape clause).

4. Article XX allows for exceptions for the protection of life, health, or natural resources, and for similar motives.

   These exemptions and the other GATT articles form the basis of international trade law. The desirability of each of these articles is the subject of debate; the provisions for antidumping in particular are very unpopular with economists. The international trade law that this structure has created has become complicated, but the main point remains that the GATT and the WTO have been created to overcome the trade war problem and to facilitate coordination of trade policies to the advantage of every country.

## 8.3 Problem: In an Interconnected World, *All* Policies Are Trade Policies

The foregoing shows why the WTO serves a useful function in facilitating multilateral cooperation on trade policy, but it does not explain why the organization would get involved in environmental or consumer protection policies. This involvement becomes easier to understand, however, when it is pointed out that anything a government does domestically tends to change world prices to some extent, thus affecting trade partners indirectly. (Exceptions are small countries, and even then, if many small countries pursue the same type of policy at the same time, they will also affect world prices.) For example, if the United States taxes domestic consumption of tuna, no matter where the tuna is from, it will shift the U.S. tuna demand curve to the left, shifting the U.S. import demand curve to the left, lowering the world price of tuna, and lowering Japanese welfare. This is not to say that it should not be done, but merely to observe that a portion of the cost is borne by non-Americans, who might have an interest in negotiating with the Americans over the tuna tax. From the point of view of terms-of-trade externalities, one can say that *all* policies are trade policies.

Now, returning to the U.S.-Japan tuna—apples example, suppose that the two countries have successfully achieved free trade through negotiation,

making both countries better off, but each learns of an environmental problem that arises from its trade with the other. Suppose, specifically, that each country perceives an environmental harm that could result from importing the other country's good and that this harm is valued at $H$ dollars.[7] (For simplicity, the amount of the harm does not depend on the amount imported.) In the case of the United States, the harm is a disutility from knowing that dolphins are being harmed by the fishing methods of the Japanese tuna harvesters, and in the case of Japan, the harm is the damage to Japanese apple growers from insects transported with American apples.[8] Suppose that the only way of mitigating or avoiding this harm is by banning the imports altogether, as the United States did at one point with Japanese tuna (as described at the beginning of this chapter) and the Japanese did for many years with American apples (see Egan, 1993; the ban was lifted on January 10, 1995). This means that the cost to the United States, for example, of mitigating the harm of the dolphin–unsafe tunas is to give up the gains from trade in tuna with Japan. Let us assume at first that each government acts unilaterally to maximize its own citizens' social welfare, taking environmental costs into account.

The economic cost of banning the tuna imports is shown in the left panel of Figure 8.2. The free-trade price of tuna is \$40, while the U.S. autarky price is \$50. Banning the imports lowers U.S. tuna consumer surplus by $F + G$ and raises U.S. tuna producer surplus by $F$, resulting in a net welfare loss of $G$.

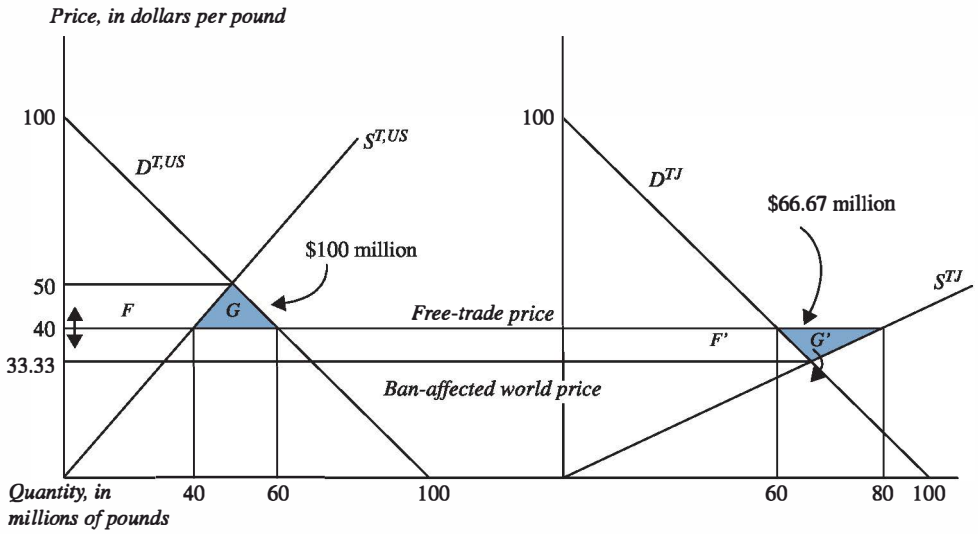


FIGURE 8.2
Economic Effects of a Tuna Import Ban.

[7] It may seem odd to place an economic value on environmental harm, but it is unavoidable in environmental policy making. Some environmental damage is actually economic, as the Japanese government claimed was the case with the apples, which they argued could spread infestations that would lower the income of Japanese apple growers. More generally, the question is how much economic sacrifice voters would be willing to make for the benefit of the improved environment; there is always a limit to how much of their lifestyle voters would be willing to sacrifice for a given environmental aim. Of course, the measurement of these valuations is extremely difficult—and controversial. "How much of a reduction in salary would you be willing to contemplate in order to save the dolphins?" is a very difficult question for most people to answer.

[8] Strictly speaking, if insects infest the Japanese apple orchards, that should be expected to raise the marginal cost of producing apples in Japan and shift the Japanese apple supply curve. However, this is a complication that is immaterial to the point being made, and so we will assume that the supply curve is not affected.

This is the gains from trade in tuna for the United States. Since it is a triangle with a base of 20 million pounds and a height of $10 per pound, it amounts to a loss of $100 million. The right panel of the figure shows the loss to Japan of a U.S. ban on Japanese tuna. The price of tuna in Japan falls from the free-trade price of $40 to the Japanese autarky price of $33.33. Japanese tuna consumer surplus rises by $F'$ and Japanese tuna producer surplus falls by $F' + G'$, for a net social welfare loss of $G'$. This amounts to a loss of $66.67 million. Of course, the diagram for an apple ban would be identical with the countries' roles reversed, yielding a loss to Japan of $100 million and a loss to the United States of $66.67 million.

As a result, if $H$ is less than $100 million, neither government will ban the others' exports, and the environmental harm will be tolerated for the sake of economic exchange. If $H$ is greater than $100 million, though, each government will ban the other country's exports, and there will be no trade in either good.

Suppose that $H$ takes a value of $140 million. In that case, the Nash equilibrium environmental policy outcome is for each country to ban the other's exports. Each government's action makes sense because the gains from trade for each importing country are exceeded by the avoided environmental harm. However, note that *each country also imposes a trade cost on the other country*. Specifically, the United States imposes a $66.67 million economic loss on Japan by banning tuna imports, and Japan imposes a $66.67 million economic loss on the United States by banning apple imports. As a result, compared to free trade, each country's net welfare effect is equal to ($140 − $100 − $66.67) million, or −$26.67 million. The net effect, in this example, is *negative* (and it will be so for any value of $H$ between $100 million and $166.67 million). Again we have a Prisoner's Dilemma: Both governments act rationally, but without coordinating their actions—and both wind up worse off.

Patrick Hagerty/Sygma/©Corbis

**Anti-WTO protesters, Seattle 1999.**

The point is the same one made above about trade policy: Because environmental policy imposes a terms-of-trade externality, unilateral environmental-policy setting will generally be inefficient, and there are international gains from cooperation in this field.

## 8.4 The Sham Problem

AP/Wide World Photos

**Police clash with protesters against the WTO, Seattle 1999.**

In the discussion so far, we have assumed that the governments are sincerely attempting to correct a legitimate environmental problem. However, part of the problem in practice is that governments often accuse each other of using a *fictitious* environmental problem to justify protection for domestic political purposes. Under this interpretation, an environmental measure is essentially used as disguised protectionism. This is sometimes called the sham problem; see Baldwin, 2001 for a detailed discussion.

For example, U.S. apple growers used to complain that the true purpose of Japanese regulations on imported apples—ostensibly imposed to protect the Japanese growers from insect infestations—was just to protect those growers from foreign competition. In 1993, U.S. growers in Washington State had produced a crop of apples to exacting standards, following Japanese government regulations to the letter, in order to tap into the Japanese market, growing apples headed for Japan separately from other apples, and even wrapping individual apples in paper while on the tree to ensure that they would be free of the pests. At the last minute the Japanese government found new pest threats that had not been previously raised and excluded U.S.-grown apples once again. U.S. growers complained bitterly that the Japanese government

now had instituted a "bug-of-the-month club," meaning that it would always conjure up a new insect threat to keep U.S. apples out. One grower complained: "[W]e get this close and the Japanese move the goal posts again. We can't win." (Egan, 1993).

Similarly, as described above, Chilean authorities argued that the cyanide grape scare of 1989 was a sham (Engel, 2000). For another example, U.S. authorities have complained about Russian restrictions on U.S. frozen chickens, described in detailed reporting by White et al. (2004). The Russian government imposes an exceptionally tough food safety regime for frozen chicken imports, requiring every U.S. plant that ships to Russia to be visited by Russian inspectors, including veterinarians. Regulations cover "everything from where the walls should be located to the state of garbage-can lids. Factory grounds had to be clear of mud and workers were to wear special boots that could only be used inside plants." (White et al., 2004, p. A1). At one point in 2002, Russian authorities banned all imports of frozen chicken from the United States for three weeks, citing bacteria concerns. Things got so tense over chicken that in a presidential summit in 2003 at Camp David, Presidents George W. Bush and Vladimir Putin took time out of negotiating nuclear nonproliferation and terrorism to work out chicken issues—including what boots workers could wear at the plants. In all this, the Russian government has claimed that the issue is safety, but U.S. chicken producers believe that it is an attempt to help domestic chicken producers avoid competition with imports. Their case was helped when a Russian deputy minister of agriculture at one point quipped that "the only tool of trade policy the Agriculture Ministry has left are our veterinarians."

For an economic analysis of the sham problem, return to our tuna-and-apples model. Suppose that the current governments of the United States and Japan are both constrained by prior GATT commitments, perhaps made under previous governments, not to use tariffs in the market for tuna or apples, but both of those governments face political pressures to do something to help their respective import-competing producers. In the notation of Chapter 7, Section 7.3, suppose that $A^{cons} = A^{tax} = 1$ but $A^{prod} > 1$ in each country, where $A^{prod}$ is the weight the government puts on producer surplus in tuna and apples. Suppose that in fact there is no environmental harm from Japanese tuna or U.S.-grown apples, so that in the notation of the previous section $H = 0$. Then if, for example, the U.S. government disingenuously claims environmental harm from Japanese tuna and bans it from the U.S. market, then the domestic price of tuna in the United States will rise from \$40 to \$50, which will raise U.S. tuna producer surplus and lower U.S. tuna consumer surplus more. If $A^{prod}$ is high enough, the U.S. government will consider this trade-off worthwhile and will impose the ban. Similarly, with the same high value for $A^{prod}$, the Japanese government will ban the U.S. apples. Given its own political priorities, each government is acting optimally, and so banning the imports is a Nash equilibrium.

However, *once again* there is a terms-of-trade externality to consider. The Japanese ban on U.S. grown apples lowers the price received by U.S. growers from \$40 to \$33.33, decreasing their producer surplus by $F' + G'$ from Figure 8.2, or \$489 million. This must be weighed against the gain to U.S. tuna producers accruing from the rise in the domestic U.S. tuna price from \$40 to \$50, a rise in producer surplus of $F$ from Figure 8.2, or \$450 million. Overall producer surplus in the United States, from tuna and apples combined,

therefore falls by $39 million. Compared to free trade, *both* consumer *and* producer surplus are lower in the Nash equilibrium. As a result, no matter how high $A^{prod}$ is, the U.S. government would prefer free trade to the Nash equilibrium. So would the Japanese government, by parallel reasoning.

To summarize, *because of the terms-of-trade externality, even if the environmental measures are purely for domestic political motives, both governments may prefer coordination on environmental policies to noncooperative environmental policy setting.*

## 8.5 The WTO's Wobbly Tightrope Walk

This simple tuna-and-apples model has served to demonstrate that terms-of-trade externalities can go a long way in explaining why international coordination of trade and environmental policies is desirable and why an institution like the WTO has a role to play in both types of policy. In practice, the WTO has tried to play this role not by including environmental policies in the multilateral bargaining together with tariffs, but by devising a code of conduct for governments in forming environmental policy, as well as a dispute-resolution mechanism. In effect, in doing so, the WTO has attempted a kind of balancing act, trying to provide enough space for governments to realize environmental goals while at the same time imposing rules to prevent excessive disruptions of trade (as seen in Section 8.3) or disguised protectionism (as seen in Section 8.4). Many critics have argued that at various times the multilateral system has gotten the balance quite wrong. Pressure from activists to reform the WTO to allow for more protection of the environment culminated in a famous series of high-profile protests at the WTO meetings in Seattle, Washington, in 1999. Accounts of the evolution of WTO policy in this area include Keleman (2001), Hoekman and Kostecki (2001, pp. 185–201, pp. 441–448), Baldwin (2001), and Brown (2004, Chapter 3). The WTO website itself (www.wto.org) has a wealth of information on the organization's evolution on these issues.

In 1991, the code of conduct for this type of question was not very well developed, and the panel that ruled against the United States in the dolphin–tuna case cited two principles that it interpreted as implicit in the GATT agreement itself. The first is that although Article XX of the GATT allowed for interruptions of trade for health and environmental reasons, the panel interpreted that as applying only to *product regulations*, or rules regarding which products can be imported, not *process regulations*, or rules strictly regulating only the way in which a product is produced. Since dolphin–safe tuna and dolphin unsafe tuna are identical products, and differ only in the fishing techniques used to produce them, the panel ruled that Article XX could not justify the U.S. ban. Second, the panel ruled that Article XX could be used to protect only the health of consumers or the environment in the country imposing the regulation, whereas the U.S. ban was designed to protect dolphin populations throughout the world. In other words, in the language that has evolved to discuss this decision, the panel rejected *extraterritoriality* in trade-based environmental regulations.

The widespread outrage that followed this decision helped fuel a reexamination of the rules as part of the ongoing negotiations for the Uruguay Round. In 1994, along with the revision of the GATT and the formation of the WTO,

two new agreements meant to clarify rules for this type of situation were agreed on. One was called the Technical Barriers to Trade Agreement (meaning an agreement on regulations that are not explicitly trade barriers but can act as one, such as requiring proof of dolphin-safe fishing techniques for all tuna sold). The other was the Sanitary and Phytosanitary Measures Agreement, which covers measures such as the rules to protect the domestic apple crop in Japan from contamination by foreign pests. These agreements essentially required that regulations be based in science and that they be nondiscriminatory and not unnecessarily disruptive of trade.

Another high-profile test came up in 1997, with the shrimp–turtle case. Shrimp harvesting often entangles sea turtles, which get caught in the net and drown. Nets can be fitted with Turtle Excluder Devices (TEDs), which U.S. law requires for shrimp harvesting in sensitive areas. In 1989, the United States banned imports of shrimp from any country that did not require TEDs. Banned countries included India, Malaysia, Thailand, and Pakistan, which filed a complaint with the WTO in 1997. The WTO panel ruled for the complainants—just as it did in the dolphin–tuna case. However, the reason is instructive. The panel ruled against the U.S. policy on the basis that it was discriminatory—the U.S. policy provided aid to some nearby countries to help comply with U.S. requirements, but left out other countries. The panel made it clear that it was not rejecting the policy because it was a process restriction or because of extraterritoriality; in the new legal regime, those were not obstacles to regulation. Indeed, following the decisions, the United States revised its policy to treat all affected exporters equally and was later ruled to be in compliance.

It is easy to argue that the multilateral process initially was biased toward excessive worry about disruption of trade (trying too hard to avoid a "poison-grapes problem" or "frozen-chicken problem," but in the process creating a "dolphin problem"), but that over time, with the help of a swift kick from public opinion, it has gotten the balance better over time.

## MAIN IDEAS

1. Any trade policy imposes a terms-of-trade externality on other countries.
2. For this reason, the Nash equilibrium in trade policy tends to be inefficient.
3. An immediate corollary is that governments have an incentive to coordinate over trade policy, giving rise to institutions such as the GATT and WTO. Specifically, governments have an incentive to try to agree to lower trade barriers. A coordinated, mutual reduction of trade barriers has the potential to make every country better off.
4. The GATT dates from 1948 and is the primary multilateral agreement for lowering trade barriers.
5. The WTO dates from 1994 and is the organization that coordinates refinements of the GATT and dispute settlement.
6. In addition to trade policy, any environmental or heath and safety regulation (as well as almost any domestic regulation of anything) confers a terms-of-trade externality in an interconnected world. As a result, the Nash equilibrium in environmental policies tends to be inefficient.
7. This gives a motive for multilateral coordination of environmental, health, and safety regulations as well as trade policies. This has been done by adding a kind of code of conduct for such policies to the WTO. The multilateral system needs to balance the need for countries to set environmental regulation against the need to protect trade from unwarranted disruption. The record of success on that balancing act is mixed.

## QUESTIONS AND PROBLEMS

**1.** In February 1996, President Bill Clinton signed the Telecommunications Act, which (among many other things) required all TV sets sold in the United States to be equipped with a V-chip, which allows parents to filter out sexual or violent content. The United States is a net importer of TVs. Suppose that the market for TVs can be represented by a partial-equilibrium model, much as the model of the market for tuna in the text, with TV exports supplied by Japan. If producing a TV with a V-chip increases the marginal cost of TV production by $10, how does the V-chip law affect producers, consumers, and social welfare in Japan? Explain diagrammatically (use no algebra).

**2.** Consider a model with two countries, Home and Foreign, and two goods, X and Y. The demand curve for each good in each country is given by:

$$D = 50 - P,$$

where $D$ is the quantity supplied and $P$ is the price. The supply curve for Y in Home and for X in Foreign is given by:

$$Q^S = P,$$

while the supply curve for X in Home and for Y in Foreign is given by:

$$Q^S = 4 + P,$$

where in each case $Q^S$ stands for the quantity supplied.

**(a)** Use the spreadsheet "optimal tariffs.xls" to find the Nash equilibrium tariffs for each country for this model.

**(b)** Calculate the change in social welfare in each country if we move from Nash equilibrium tariffs to free trade. Illustrate with a diagram.

**(c)** Given your results, would Home and Foreign prefer to negotiate trade policy, or would they prefer to maintain their sovereignty and discretion by leaving each country to set its trade policy on its own?

**3.** In the previous problem, suppose that we increase the size of Foreign by multiplying the Foreign demand and supply curves all by the same *large* number.

**(a)** Recalling the discussion of tariffs and small countries in Chapter 7 (Sections 7.4.1 and 7.4.2), what will the Nash equilibrium look like now? (Answer qualitatively; describe the characteristics of the Nash equilibrium, not the exact value of the tariffs. No new computation is necessary.)

**(b)** If we move from the Nash equilibrium to free trade, will social welfare in both countries rise? Why or why not?

**(c)** Given your answers above, are small countries or large countries likely to be more interested in pursuing negotiated free trade?

**4.** Returning to Problem 2, suppose that good X is a consumption good with a negative consumption externality (for example, automobiles, which create local air pollution), so the Foreign government imposes a tax of $4 per unit consumed in Foreign. (Recall from basic microeconomics that an optimal response to a negative externality is a tax equal to the social cost of the externality, the standard economist's prescription for dealing with externalities. This is often called a Pigouvian tax, after A. C. Pigou, who first proposed it.)

**(a)** Show diagrammatically how this affects the Foreign import demand curve for good X and changes the world equilibrium, and compute the new world price of good X. (Assume that neither country is using any tariff or other explicit trade policy.)

**(b)** What effect does Foreign's domestic environmental policy have on producers of X, consumers of X, and social welfare in Home? Would the government of Home be interested in negotiating with Foreign over this policy?

**(c)** Now suppose that instead of Foreign imposing a domestic consumption tax on good X, it was Home that became worried about the externalities from consuming X, and therefore imposed its own tax of $4 per unit consumed. How would the effect on Foreign compare with the effect of Foreign's tax on Home? (Thre is no need to compute the new equilibrium.)

**5.** In the model of the sham problem in Section 8.4, would there be any role for multilateral cooperation on environmental policy if $A^{prod} = 1$? Explain in detail why or why not.

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