

## CHAPTER 2

# TRADE AND ENVIRONMENTAL POLICY INSTRUMENTS AND REFORMS

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### 1. INTRODUCTION

This chapter first presents and summarises results from recent analytical literature, explaining the implications of different policy menus to abate pollution in a small, polluted, competitive economy opening to world trade. This situation is consistent with the stylised facts of many developing economies evolving in a global marketplace and with emerging environmental concerns. The context of a developing economy constrains the choice of available policy instruments for environmental objectives because of scarce institutional capacity. This limitation brings the possible temptation to use blunt policy instruments, such as trade barriers, for environmental purposes. The third section evaluates the case for harmonisation of environmental policies, which has been promoted by anti-globalisation and labour interests in the current policy debate and through recent demonstrations. Following these analytical sections, the chapter briefly describes the policy reform scenarios considered in the empirical investigation (Part B of the book). Then the chapter looks at the feasibility of environmental policy implementation for developing economies based on the recent experience of industrialised and developing economies. In this context, institutional feasibility of policies dominates.

This chapter examines these various issues and explains that, in most cases, trade barriers are inadequate instruments for environmental purposes; they are inadequate because they are untargeted: they subsidise pollution in either production or consumption, while abating it in consumption or production. Other simple instruments, such as taxes on input, production, or consumption are much more targeted in the sense that they are likely to achieve substantial abatement of pollution while inducing smaller welfare losses, because they have a less-distorting impact on the rest of the economy.

Uniform effluent taxes correspond to an implicit tax on output, which is proportional to the outputs' pollution content. If they are available, effluent taxes or ambient standards are best suited to decrease intensities, because they decrease pollution with the smallest loss of economic welfare while providing

the best incentives to abate in industries where it is relatively easy to abate. However, they are difficult to implement because of monitoring cost and informational requirements, but there is emerging evidence that this difficulty has been overestimated in the past (Wang and Wheeler 2000). As a further encouraging note, the econometric results presented in Chapter 4 suggest that input taxes on the few inputs responsible for most of the emissions could achieve substantial abatement while minimising monitoring costs and the burden imposed on scarce institutional capacity. These input taxes could approximate effluent taxes quite well by providing incentives to substitute away from these dirty inputs.

Trade liberalisation expands economic opportunities but may be detrimental to the environment, stimulating pollution-intensive activities. There is no self-correcting mechanism under free trade that addresses these negative effects on the environment. Other policy interventions have to be introduced, such as the ones proposed in the previous paragraph, in coordination with free trade. Free trade enhances the effectiveness of environmental policies, because no trade barrier is present to influence and distort abatement decisions by firms and consumers. Further, under free trade, abatement of pollution in production can be achieved by importing without incurring welfare losses induced by trade impediments.

The numerical simulation results presented in the case studies in Part B of the book show that these broad policy-targeting principles established in a static context hold in the dynamic context of our case studies. Taxation with dynamics is more complicated because savings to be invested in the future are not currently taxed, whereas current production and consumption are taxed (Beghin, Roland-Holst, and van der Mensbrugge 1999).

## 2. NON-TECHNICAL DESCRIPTION OF RESULTS FOR A SMALL, OPEN, DISTORTED ECONOMY<sup>1</sup>

Consider the situation of a competitive and open economy. Pollution is produced by consumers and producers at different rates and all pollution produced accumulates into a public “bad” which decreases welfare of consumers. Producers face output prices, which are the sum of the world price, import tariff, and production tax. Pollution taxes also influence producers’ decisions. These pollution taxes function like the price of the environmental input. Producers are profit maximisers. Production-induced pollution is an input, which responds to taxes and output prices like any other input. By raising pollution taxes, goods will be less pollution intensive, and the output of pollution-intensive commodities will decrease because cost of production will be higher with higher taxes.

Consumers in this competitive economy maximise their well-being by allocating their income to consumption activities according to their preferences and the price of these commodities. Consumer prices reflect the world

price, border tariffs, consumption taxes, and pollution taxes applied to the pollution associated with the consumption of commodities. Consumers can only abate by changing their basket of consumption or by consuming less of everything. Raising the pollution tax discourages the consumption of commodities that are pollution intensive in consumption. Hence, consumption-induced pollution is also “price-responsive.” Total pollution is a “bad” affecting negatively the welfare of consumers. Consumers perceive total pollution as a given. They perceive their atomistic decisions as having a negligible impact on aggregate pollution. By aggregation of individual decision, however, total pollution reflects these choices. Total pollution is the sum of consumption and production externalities.

It follows that imports (consumption – production) respond to pollution taxes and that pollution responds to changes in trade policy because incentives to produce and consume goods that pollute are changed when trade policy reform occurs. It is useful to think of imports and pollution in terms of substitutes and/or complements. When pollution increases with higher tariffs or when imports increase with higher pollution taxes, then they are substitutes (like the old margarine/butter example). Substitution occurs when production processes are pollution intensive relative to consumption of the same commodity; complementarity arises with production being relatively cleaner than consumption of a good. It is difficult to categorise some goods a priori, such as fuel-based energy sources, because substantial effluents are emitted in both supply and demand. These cross-price responses must be assessed empirically. The approach assumes the economy is at equilibrium, with the balance of payments being satisfied; that is, the values, at world prices, of aggregate imports and exports are equal.

Next, the approach derives the effect of policy reforms, by changing tariffs, production and consumption taxes, and effluent taxes on pollution. Then the effect of these reforms on consumer welfare is assessed analytically to see if policy menus are welfare enhancing. There are two sources of distortions and welfare effects. Non-zero tariffs (departing from free trade) and non-optimal effluent taxes (where the tax per unit of pollution is less than the marginal damage of pollution imposed on consumers) are distortions which in turn have an impact on imports and pollution.

When considering tax reforms, abatement of pollution has four components. First, effluent taxes induce pollution abatement in consumption and production; second, there is the cross-price response of pollution to tariff changes; third, a feedback effect of pollution on itself arises because of changes in marginal damage of pollution; and last, a real income effect induced by changes in welfare occurs. Further, the abatement induced by the effluent tax can be decomposed into several sources (substitution in consumption and in production, and changes in emission intensities in production). Tariffs cannot target pollution because they have opposite effects on

consumption-induced and production-based pollution. One is subsidised while the other is taxed. These offsetting effects can be decoupled by using production and consumption taxes instead of tariffs. Similarly, import changes can be decomposed for changes in pollution taxes, tariffs, and feedback effects of pollution and real income.

### *2.1. Policy Reform to Address Pollution*

This section first looks at pollution reforms, taking one policy instrument at a time. I first vary effluent taxes only, assessing its effects on domestic pollution and trade. Then production and consumption taxes are evaluated as next-best abatement instruments. Finally, tariffs alone are evaluated in the same context.

#### *2.1.1. Effluent Taxes*

This optimum policy equates the effluent tax to the (general equilibrium) marginal damage of pollution, taking into account the feedback effect of the tax on welfare via trade.<sup>2</sup> With this in mind, I consider an effluent tax proportional to the deviations between the general equilibrium marginal damage and the existing tax. Such a reform has two effects on welfare. The first effect is a positive effect on the environment by decreasing pollution. With respect to pollution, this is the best policy type because the effluent tax has three direct component-effects: on production and consumption, holding per-unit effluent rate per unit of product constant; and on effluent rates via prices and effluent taxes, output and consumption being held constant.

The second effect is the indirect impact of the same pollution reform on imports. In general, it is not possible to sign this indirect effect because some imports and pollution are substitutes while other imports are complements. Two cases are of special interest. If imports and pollution are substitutes and if tariffs are positive, then the effluent tax reform is welfare improving. This arises because the effluent tax decreases pollution-intensive production, which is subsidised by tariffs. The tax decreases the deadweight loss of this implicit production subsidy<sup>3</sup>.

If imports and pollution are instead complements and if tariffs are negative (export taxes), then the effluent tax reform is welfare improving. The intuition is that the pollution tax penalises the consumption of goods that pollute more in consumption than in production. The consumption of these goods is subsidised by the export tax, and the pollution tax decreases the deadweight loss of these subsidies.

To illustrate these polar cases, consider an effluent tax on pollution related to gasoline. Gasoline pollutes when produced and consumed. First, consider a developing country with a protected domestic oil-refining industry but that (as a limiting case) exports all its output. All pollution arises in production, so it is

clear that the pollution tax will decrease output (trade and pollution are substitutes) and the deadweight loss associated with too much oil refining. Next, consider the other limiting case in which the country imports all its gasoline, subsidised by a negative tariff. In this case, imports and pollution are complements and an effluent tax will improve welfare by decreasing the deadweight loss of the implicit consumption subsidy. Many countries fall in between these two limits and are involved in both production and consumption of gasoline. In such cases, the effect of the effluent tax on trade is an empirical question.

### *2.1.2. Production and Consumption Taxes*

Production and consumption taxes are used because effluent taxes are not available and no distortions exist other than tariffs. Clearly, when both consumption and production pollute and at different rates, using two separate policy instruments allows one to decouple consumption and production pollution. Tariffs are incapable of doing so, and this reveals a major advantage of production and consumption taxes. The optimum consumption tax vector mimics the effluent tax, since it is related to the marginal damage of pollution but directly offsets the presence of tariffs. The combined trade and consumption taxes are equal to the marginal damage of pollution because the consumption pollution intensities are fixed. By contrast, the production taxes are less effective for abatement, since they provide less incentives to directly abate by decreasing pollution intensities of output.

Taxes that are proportional to the pollution induced by the consumption and output of commodities mimic the effluent tax reform discussed in the previous section. The direct effect of this consumption and production tax reform is to decrease pollution, but to a lesser extent than with the effluent tax as explained above. The indirect effect of these taxes on imports is ambiguous, as for the effluent tax, depending on the substitution/complementarity relationship between imports and pollution. However, these taxes have a stronger effect on imports because they influence the producer and consumer prices of commodities more directly than did the effluent tax.

### *2.1.3. Tariffs*

Tariff changes are considered to reduce pollution. When used alone, optimum tariffs are different from zero, reflecting the pollution externality, and they represent a compromise between pollution abatement in production and consumption and efficiency losses induced by trade effects of the tariffs. In addition, if the price responses of pollution to tariff changes have both positive and negative elements, tariffs may not reduce pollution to a targeted level. This ambiguity has to be assessed empirically. The investigation of Indonesia reported in Chapter 10 suggests that significant pollution abatement with tariffs is impossible and induces large trade effects in that country.

Trade liberalisation reform achieved by proportional tariff cuts have a positive effect on welfare via imports and an ambiguous effect on pollution. This latter indirect effect is symmetric to the indirect effect of the effluent tax on trade. Two special cases, symmetric to those of the effluent tax reform, exist. For example, if tariffs are positive and imports and pollution are substitutes, then a proportional decrease in tariffs is welfare improving. But, in general, the net welfare effects of trade liberalisation alone cannot be assessed analytically.

## 2.2. *Coordinated Trade and Pollution Reforms*

This section considers joint reforms: trade liberalisation and pollution targeting, first with effluent taxes, then with product taxes.

### 2.2.1. *Tariffs and Effluent Taxes*

If the two policy instruments are freely implementable, then their optimum levels dictate the standard result: free trade and an effluent tax equal to the general equilibrium marginal damage of pollution. Proportional tariff reductions and effluent tax changes, proportional to and towards the marginal damage of pollution, improve welfare. Two direct effects arise. The tariff reform increases consumption possibilities by increasing trade; the pollution reform decreases pollution towards its optimum level. Two symmetric and indirect effects also occur: tariff changes influence pollution and effluent taxes have an impact on imports. Although the sign of these indirect effects is unknown, by convexity of the economy, these effects cannot be bigger in absolute value than the direct positive effects.<sup>4</sup> Joint reform of environmental and trade policy appears even more crucial when capital is mobile across borders and can exacerbate a country's specialisation in dirty activities (Copeland 1994).

### 2.2.2. *Tariffs, Production, and Consumption Taxes*

The next reform considers proportional changes of all policies such that tariffs decrease proportionally, and consumption and production taxes are set to mimic the effluent tax, that is, set proportional to the pollution intensities of commodities in both production and consumption. As in the previous case, the tariff reform includes a positive utility effect and an ambiguous indirect pollution impact. Similarly, the production and consumption taxes bring positive environmental impacts but ambiguous indirect effects on imports.

Unfortunately, the two indirect effects are cumulative but not symmetric as in the previous case, and mathematical properties described in note 4 are not sufficient to guarantee a net positive welfare effect. However, if one abstracts from the effects of the policies on effluent intensities in production, the welfare effect of joint reform via substitution in consumption and production is

positive. Further, if the reform induces lower effluent rates, then the joint reform enhances welfare. This constitutes an *ex post* test, however.

### 2.3. *Extensions of the Results*

A first extension considers mixing quantitative interventions with tax instruments. Usually the mix of instruments induces a feedback effect of the reform on the open-ended distortion (trade if tariffs are used, or effluents if some environmental taxes are used). Further structure has to be imposed on the problem to be able to derive sufficient conditions for welfare-improving reforms. For mixed regimes in which both effluent taxes and quotas are used, it is extremely difficult to identify useful results. However, trade liberalisation under a regime in which all effluents are capped by quotas leads to welfare improvements because pollution cannot increase.<sup>5</sup>

A second extension relates to tax revenue considerations. Governments in developing economies have scarce public funds. Tax reforms may be more palatable if they are revenue neutral or revenue increasing. The results discussed previously on sufficient conditions for welfare-enhancing reforms hold for tax-revenue-neutral reform that combines tariff reductions and increases in environmental taxes such that tax revenues do not decrease—giving rise to a double dividend (Beghin and Dessus 2001; Killinger 2000, and Smulders and Sen 2001)—if the pre-reform tax structure is not optimum.

A last extension of these results concerns variable pollution intensities in consumption. A problem arises in this case because the production of exportables responds directly to pollution taxes set in the export market while it responds indirectly to the domestic tax on consumption pollution. When pollution intensities emitted in consumption respond to taxes, an additional policy instrument is required to cap pollution intensities of exportables, for example, an effluent standard, to ensure welfare enhancement (Metcalf and Beghin 2000). The standard is set at the existing pre-reform level and hence is easier to set and design than for effluent taxes, which require some knowledge of marginal damage of pollution. Harmonised policies between trading countries that equate effluent taxes domestically and abroad yield the same result, although it may not be optimal for countries to harmonise initially, especially if they have different valuation of the environment. Harmonisation is only a valid option between countries of comparable development levels and when their valuation of the environment is similar, as it would be within Organisation for Economic Cooperation and Development (OECD) or European Union (EU) countries. Harmonisation between a developing country and an industrialised country makes little sense, since it will not be optimal for at least one (probably both) of the countries. I discuss harmonisation further in the next section.

### 3. SHOULD ENVIRONMENTAL POLICIES BE HARMONISED?

Environmental and labour interest groups often petition for so-called fair trade, implying that environmental and labour standards and policies be harmonised globally. Although some coordination of policies between two or more countries makes sense in some situations, the call for global harmonisation is without merit. Regional, rather than global, approaches to environmental standards may also prove to be a positive and more feasible step, particularly on issues with a clear regional component, such as transboundary emissions, and shared water resources, and for countries with similar development levels or with strong prospects of rapid income convergence.

A regional approach does not imply uniform standards, in the broad sense of environmental protection (Bhagwati and Srinivasan 1996; Bhagwati and Hudec 1996) and in the narrow sense of standards referring to pollution per unit of output in value or in physical units. The case against harmonisation of policies is overwhelming in most settings (Ulph 1999; Bhagwati 1996). The major reason for such strong presumption resides in different levels of marginal damage of pollution across countries or, in other words, in different levels of the valuation of the marginal benefits of environmental protection.

When departing from the competitive market paradigm, the case against harmonisation remains strong, although coordination of policies between two countries may make sense. Coordination between countries is a better choice than using the subsidiary principle, where each country decides its policy level autonomously; “eco-dumping” could arise if governments are constrained in their choice of policy instruments and face incentives to lower environmental policies below their optimum levels (Ulph 1999).

In addition, some product standards constitute non-excludable attributes by providing a definition of goods and their quality. They reduce information asymmetries, just as labels do, and reduce transaction costs. They are endogenous and change with income and trade policy if the latter affects income (Casella 1996). Harmonisation or a move toward harmonisation may arise only if income levels between trading partners converge. These standards may become common to several countries if coalitions supporting these standards cross borders. Hence, one could conceive of “harmonised” standards generated by political economy within a coalition of firms spanning several countries within one industry.

### 4. POLICY SCENARIOS CONSIDERED IN THE CASE STUDIES

The analytical results described above lay the groundwork for the design of policy experiments in our empirical investigation of the seven countries. In order to compare patterns across the seven countries, a common set of policy reform scenarios is used for all the countries. First, environmental taxes



are considered alone, and their effects on growth, trade, and pollution emissions are evaluated. The taxes are imposed on one effluent type at a time and are increased over time to reach a targeted abatement level by the year 2010, the chosen future horizon for the simulations in all the country case studies. Next, unilateral trade liberalisation is considered. Trade barriers are progressively removed so that free trade prevails between the country and the rest of the world or between the country and a subset of countries by the year 2010. Moderate improvements in the terms of trade (the price of exports relative to the price of imports) are imposed to simulate market integration with the rest of the world. The last set of simulations combines the environmental and trade reforms and shows how they interact. For some countries, additional scenarios are considered because of specific policy circumstances, such as North American Free Trade Agreement (NAFTA) integration for Chile or the free trade agreement (FTA) with the European Community for Morocco. Also, different aggregations of pollutants are considered (e.g., in Indonesia). The three sets of reforms allow a gauge of the indirect effect of trade policy on pollution, of effluent taxes on trade, and of the gains realised with their coordination. All policy simulation results are presented in deviations from the results of a business-as-usual (BAU) scenario, which is used for calibration purposes. The BAU scenario relies on gross domestic product (GDP) forecasts from McGraw Hill-Data Resource, Incorporated for the year 2010 and calibrates productivity parameters in each country's model to make it consistent with the forecast. This provides a reference trajectory for each country, presenting estimates of GDP, trade, and pollution, if "nothing changes" in policy design.<sup>6</sup>

## 5. FEASIBLE ENVIRONMENTAL POLICY IN DEVELOPING ECONOMIES

Given that trade liberalisation and environmental protection should be undertaken jointly, which environmental policies are feasible in a developing economy? Environmental protection as part of the economic development process can be characterised by a continuum of institutional quality guiding and sustaining decentralised economic activity. There is both a supply side and a demand side to the quality of institutions protecting the environment, and both are influenced by the trade orientation of an economy.

Economic growth implies higher consumer income and increasing consumer demand for environmental protection. This is a "political" good since decentralised agents cannot readily purchase environmental protection on the market. This demand for environmental protection is multifaceted, like the environment. Economic agents first care about their immediate environment (water, air) or environmental factors directly affecting their health. At much higher levels of income, environmental problems further remote in space and

time eventually become prominent, but typically this is only after graduation from the developing economy stage. The “global village” is an industrialised country notion. Free trade reinforces the demand for effective environmental institutions by fostering the income prospects of economic agents through a greater pie and unfettered knowledge flows.

On the supply side, governments in developing economies have scarce resources and human capital to allocate to the provision of competing institutional functions, including environmental protection. These governments are accumulating policy and institutional experience, and some stylised facts are emerging. Institutional knowledge can be transferred across industries and borders. Hence, the free movement of institutional knowledge reinforces the sustainability of economic development. Environmental side-agreements to trade agreements could facilitate such knowledge transfer.

Cleaner technology innovation and adoption in industrial countries have been driven by environmental regulation. In all markets, transnational firms tend to standardise and replicate the technologies appropriate in the regulated North market. Combined with foreign direct investment and the use of technology-laden imported inputs, this cleaner technology is being transferred to developing economies. Hence, in the short run, environmental protection “spills over” from the North to the South and mitigates environmental degradation in the South, but falls short of providing full-fledged environmental protection in the South.

Nevertheless, it is unlikely that all firms adopt the new and cleaner technology. Indeed there is a wide range of capital vintage in many industries (e.g., Pargal and Wheeler 1996). Capital stock is dated in mature industries and is more likely to pollute. Lessons can be learned from the industrial country experience when thinking about feasible environmental policy in the context of developing economies (O’Connor 1994). As shown in our case studies in Part B of the book, it is clear that environmental protection is relatively inexpensive in terms of foregone growth. The same argument is valid while considering the capital cost of abatement for private firms. This is more obvious in fast-growing industries. Most industrialised countries have used “command and control” to address pollution in the last 30 years or so. Despite the well-known inefficiency of such an approach, the cost of compliance to industries has been small, and abatement has been substantial (Jaffe et al. 1995). Hence, the economic debate on efficiency of environmental policy instruments may be missing the point. Several approaches can be used by developing economies as long as they lead to a predictable outcome for private agents affected by the new policy.

What has been the developing countries’ experience with various policies and institutions? Market-based instruments have proven effective in tackling environmental problems. A reduction of subsidies on pollution-intensive activities or raising taxes on polluting activities (via discharge, input, or output

taxes) decreases pollution and increases tax revenues. There are instances of such policy changes in Bangladesh, Indonesia, Brazil, and other countries (The World Bank 1997). Market-based instruments also provide incentives to save on the taxed resource and to become more resource-efficient. The more targeted the instrument, the better. Some countries, such as China and Malaysia, use emissions charges with some success (Wang and Wheeler 2000). When the cost of monitoring is not prohibitive, the market instrument can be very targeted. For example, stumpage fees are successfully used in many countries to foster sustainable forest management (The World Bank 1997).

As institutional capacity progresses, more ambitious policies are feasible with political will. Chile and Malaysia offer examples of ambitious pollution control programs, which have been successful at abating air and water pollution. The development of environmental protection is a generic problem of institution building in a developing economy under severe scarcity of key inputs (human capital, financial resources, etc.). Inconsistent regulations, lack of enforcement, and weak monitoring are other generic problems faced by many countries (Jha, Markandya, and Vossenaar 1999), and not only in the area of environmental protection.

Public participation is an essential ingredient to successful environmental protection, because institution building relies on a political process and coalition formation. First, this process can be positive by fostering partnerships between the public, firms, and authorities. The government can be a facilitator for private industry by promoting the dissemination of information on new technology and environmental regulations. The process can also be coercive in the sense of fostering disclosure and violation of environmental regulations (illegal discharges). This principle has been effective in developing economies, such as China (Dasgupta and Wheeler 1997), although complaints tend to be positively associated with higher income and human capital.

## 6. CONCLUDING REMARKS

This chapter explores second-best policy issues affecting trade and environment linkages. I explain sufficient conditions for welfare-improving piecemeal trade and environmental policy reforms in a small, polluted economy. Several robust messages arise. First, the use of trade barriers for environmental protection is inadequate. In general, both consumption and production activities do pollute, and tariffs are usually ineffectual instruments to tackle pollution and environmental degradation. An implicit ranking of instruments emerges from our discussion of policy reforms to address pollution emissions, which follows the targeting principle (Bhagwati, Panagariya, and Srinivasan 1998). The closer is the instrument to the pollution, the less distorting it is elsewhere in the economy. Hence, an emissions tax is the best instrument to address pollution emissions and minimise distortionary effects elsewhere in the economy; feasible input taxes are preferable to production taxes, which are themselves preferable to tar-

iffs (see Lloyd 1992). Another message is that the case against harmonisation of environmental policies across nations is very strong.

Finally, environmental protection appears feasible in developing economies. Coordination of environmental protection with trade integration is important because it legitimises environmental side agreements in trade agreements to avoid the exacerbation of environmental distortions. These side agreements, such as in the case of NAFTA, can be based on reciprocal recognition of each country's environmental regulation and do not imply harmonisation of environmental standards across countries. They also achieve a pragmatic objective of putting to rest concerns of environmental regulatory "chill."

## NOTES

- <sup>1</sup> I refer technically oriented readers to Copeland 1994; Beghin, Roland-Holst, and van der Mensbrugghe 1997; Metcalfe and Beghin 2000; and Beghin and Dessus 2001 for a formal development of these results. See also the appendices in Bhagwati and Srinivasan 1996 for an alternative formal treatment of many of the issues discussed in this section.
- <sup>2</sup> The general equilibrium marginal damage of pollution is net of the feedback effect of pollution on tax revenue arising in consumption, via tariffs and taxes on pollution.
- <sup>3</sup> See Copeland 1994 for more of these special cases.
- <sup>4</sup> Convexity of the revenue function in prices and concavity of consumer expenditure in prices imply that the Hessian of second derivatives of net revenue (revenue – expenditure) is positive semi-definite; hence, the quadratic form made of the vector of distortions multiplied by the latter Hessian and post-multiplied by the vector of proportional changes in distortions is semi-positive. This result ensures that welfare is non-decreasing (or weakly increasing).
- <sup>5</sup> See Copeland 1994 and Metcalfe and Beghin 2000 for further details on these results on mixed regimes.
- <sup>6</sup> For China and Vietnam, we use consensus estimates of GDP growth as an alternative to the Data Resource, Incorporated forecast.

## REFERENCES

- Beghin, J., and S. Dessus (2001), "The Environmental Double Dividend with Trade Distortions: Analytical Results and Evidence from Chile," mimeo., revised March.
- Beghin, J., D. Roland-Holst, and D. van der Mensbrugge (1997), "Trade and Pollution Linkages: Policy Reform and Optimal Intervention," *Canadian Journal of Economics* 30: 442-55.
- (1999), "Long-Term Modelling of Trade and Environmental Linkages," in *Dynamic Issues in Applied Commercial Policy Analysis*, ed. by R.E. Baldwin and J.F. Francois. Cambridge; New York, and Melbourne: Cambridge University Press, pp. 345-66.
- Bhagwati, J.N. (1996), "The Demands to Reduce Diversity among Trading Nations," in *Fair Trade and Harmonization. Prerequisites for Free Trade?* ed. by J.N. Bhagwati and R.E. Hudec, Cambridge, MA: MIT Press, pp. 159-224
- Bhagwati, J.N., and R.E. Hudec, eds. (1996), *Fair Trade and Harmonization. Prerequisites for Free Trade?* Cambridge, MA: MIT Press.
- Bhagwati, J.N., and T.N. Srinivasan (1996), "Trade and the Environment: Does Environmental Diversity Detract from the Case for Free Trade?" in *Fair Trade and Harmonization. Prerequisites for Free Trade?* ed. by J.N. Bhagwati and R.E. Hudec. Cambridge, MA: MIT Press, pp. 159-224.
- Bhagwati, J.N., A. Panagariya, and T.N. Srinivasan (1998), *Lectures on International Trade*, second edition. Cambridge, MA: MIT Press.
- Casella, A. (1996), "Free Trade and Evolving Standards," in *Fair Trade and Harmonization. Prerequisites for Free Trade?* ed. by J.N. Bhagwati and R.E. Hudec. Cambridge, MA: MIT Press, pp. 119-56.
- Copeland, B.R. (1994), "International Trade and the Environment: Policy Reform in a Polluted Small Open Economy," *Journal of Environmental Economics and Management* 26: 44-65.
- Dasgupta, S., and D. Wheeler (1997), "Citizen Complaints as Environmental Indicators: Evidence from China." Policy Research Working Paper 1704, The World Bank, Washington, D.C.
- Jaffe, A., S. Peterson, P. Portney, and R. Stavins (1995), "Environmental Regulation and the Competitiveness of U.S. Manufacturing: What Does the Evidence Tell Us?" *Journal of Economic Literature* 33: 132-63.
- Jha, V., A. Markandya, and R. Vossenaar (1999), *Reconciling Trade and the Environment. Lessons from Case Studies in Developing Countries*. Cheltenham, UK: Edward Elgar Publishing.
- Killingler, S. (2000), *International Environmental Externalities and the Double Dividend*. Cheltenham, UK, and Northampton, MA: Edward Elgar Publishing.
- Lloyd, P.J. (1992), "The Problem of Optimal Environmental Policy Choice," in *The Greening of World Trade Issues*, ed. by K. Anderson and R. Blackhurst. Ann Arbor, MI: The University of Michigan Press.
- Metcalf, M., and J. Beghin (2000), "Piecemeal Reform of Trade and Environmental Policy when Consumption also Pollutes," mimeo., revised August.
- O'Connor, D. (1994), *Managing the Environment with Rapid Industrialisation: Lessons from the East Asian Experience*. Paris: Organisation for Economic Cooperation and Development, Development Centre Studies.
- Pargal, S., and D. Wheeler (1996), "Informal Regulation of Industrial Pollution in Developing Countries: Evidence from Indonesia," *Journal of Political Economy* 104(December): 1314-27.
- Smulders, S., and P. Sen (2001), "Greener Taxes, Freer Trade, Environmental Policy, and Tariff Reduction in a Second-Best World," mimeo., October, Tieburg, The Netherlands.
- Ulph, A.M. (1999). *Trade and the Environment, Selected Essays of A.M. Ulph*. Cheltenham, UK: Edward Elgar Publishing.
- Wang, H., and D. Wheeler (2000), "Endogenous Enforcement and Effectiveness of China's Pollution Levy System," World Bank Research Policy Paper 2336, May 2000, The World Bank, Washington, D.C.
- World Bank (1997), "Five Years after Rio. Innovations in Environmental Policy," Environment Department, The World Bank, Washington, D.C.

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