

## CHAPTER 11

### CONCLUSIONS

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#### 1. INTRODUCTION

This book provides a combination of guidelines from analytical results, methodology, and detailed empirical analysis in a comprehensive appraisal of the interface between outward-oriented growth and the environment in seven developing countries: Chile, China, Costa Rica, Indonesia, Mexico, Morocco, and Vietnam. Part A of the book focuses on insights gained from analytical results and methodology. Part B presents the numerical results established for the seven-country case studies based on the methodology developed in Part A.

The countries considered in this book have been undertaking or contemplating various forms of trade integration via unilateral liberalisation and regional and global agreements. These countries also differ by their development levels and the extent of their transition to markets and privatisation, from transition economies, such as Vietnam and China, to accomplished market economies, such as Chile.

The major contribution of this volume resides in the wealth of empirical evidence generated on the nexus between growth, trade, and the environment. Throughout the book, we make special reference to the policy challenges faced by developing countries. The book also emphasises what could be learned from analytical models and their limitations. The book makes some methodological contributions as well. The following sections briefly summarise key points and findings made in the book. The chapter then concludes with some suggested directions for future research.

#### 2. GUIDELINES FROM ANALYTICAL RESULTS

Several robust guidelines emerge from the analytical literature presented in Chapter 2. The use of trade barriers for environmental protection is inadequate, even in a second-best sense. In general, both consumption and production activities pol-

lute, and tariffs are inadequate and ineffectual instruments to tackle pollution and environmental degradation.

An implicit ranking of instruments, which follows the targeting principle, exists in policy reforms to address pollution emissions. Emission taxes are the best instrument to address pollution emission and to minimise distortionary effects elsewhere in the economy; feasible input taxes are preferable to production taxes, which are themselves preferable to tariffs.

The case against harmonisation of environmental policies across nations is very strong for most environmental problems faced by a developing country. However, the case against coordination of environmental policy across borders is less strong, especially in the context of regional agreements or when firms exhibit strategic behaviour. This conclusion is in contrast to the promotion of global harmonisation of environmental policy by Cole (2000), which is surprising given the local, or at most regional, nature of most of the environmental degradation faced by developing economies.

### 3. METHODOLOGICAL CONTRIBUTIONS

The book makes several methodological contributions, which are easily transferable to other investigations. The modelling approach introduced in Chapter 3 incorporates pollution emitted in consumption. This addition is especially useful in the investigation of Vietnam because of its unusual pollution intensity of absorption. However, we did not address solid waste and other post-consumption forms of pollution. This important but neglected aspect of environmental degradation is a promising area for further research.

In Chapter 4, the authors propose that we look at input-based coefficients of pollution rather than output-based coefficients, which are used in nearly all investigations of the nexus between trade and the environment. The use of input-based coefficients allows one to derive a technical effect via substitution of cleaner value added (labour and capital) for dirty inputs. The substitution/complementarity of effluents is then an empirical issue. Armed with the input-based estimates of effluent intensity, the book establishes some important common stylised facts on pollution hot spots and important linkages on which to focus in each case study.

A major finding emerges from this methodology exercise in Chapter 4. A few inputs cause the greatest share of emissions. Ninety per cent of the variation in effluent emissions in the Industrial Pollution Projection System (IPPS) database (Hettige et al. 1995) is explained by 10 inputs for airborne media, 5 inputs for waterborne emissions, and 8 inputs for emissions released in soil. Monitoring and regulating these few dirty inputs and their downward linkages would abate a lion's share of the pollution. This finding suggests that input taxes proportional to efflu-

ent emissions may approximate effluent taxes, although the former provide fewer incentives to abate.

The modelling of health damages presented in Chapter 5 and imbedded in the applied general equilibrium (AGE) analysis is a novelty in the context of this type of analysis of developing economies. Although the methodology is based mostly on existing toolkits, it is a welcome addition rarely seen in the trade and environment literature in general equilibrium, especially in a developing country context. This added health dimension is easily implementable and transferable once critical information exists on pollution inventory and dispersion of effluents into ambient pollution.

#### 4. COMMON STYLISTED FACTS

In Part B, the case studies are presented starting with Chile in Chapter 6, then China in Chapter 7, followed by Morocco in Chapter 8 and Vietnam in Chapter 9. Chapter 10 presents a summary of findings for Costa Rica, Indonesia, and Mexico, which have appeared previously in article form. The book identifies patterns common to all seven investigated economies that are likely to be shared by other countries.

First, the series of investigations did not unearth any “horror” stories to report, in terms of environmental degradation induced by trade integration. However, China is found to be a country facing serious environmental problems, which are exacerbated by trade integration. To a lesser extent, Vietnam, Indonesia, and Chile are also troubling, with economies that are or could become more pollution-intensive. For the other countries, pollution expands with trade integration but the pollution intensity of gross domestic product (GDP) tends to decrease or at least shows no signs of aggravation.

As just mentioned, a small set of dirty inputs is found to cause pollution. In addition, policy simulation exercises reveal several groups of pollution “complements”—a useful finding for policy design.<sup>1</sup> The effective number of effluents to monitor and regulate could be reduced using the information on these complementarities. For narrow subsets of effluents (all toxics, all bio-accumulative effluents, and the subset of nitrogen dioxide, sulphur dioxide, and particulates), the complementarity among effluents within the subset “survived” under most trade and environmental policy regimes explored in the book.

For the larger set of effluents, this complementarity is conditioned on trade policy, both in terms of the magnitude of the complementarity effect and the number of effluents that are complements. Two effluent types that are complements under a distorted trade regime could become substitutes under free trade. Under free trade, the number of effluent types that are complements typically decreases and the magnitude of the “cross” abatement decreases as well. The set of effluent complements is country specific.

In most countries, except China, pollution abatement of most effluent types is found to be cheap in terms of the foregone growth induced by the abatement. The

Chinese exception arises from the fact that many key sectors are both labour and pollution intensive. Abatement possibilities are limited because of the reliance on dirty energy. The bio-accumulative toxic effluent released in water (BIOWAT) is expensive to abate in all countries. This is because a few key sectors emit BIOWAT (e.g., electricity and cement).

In all countries, except China, we establish a dynamic double dividend in the form of reduced pollution and an increase in real income with tax-revenue-neutral reforms. Tax revenues are held constant in all our policy reforms. Environmental taxes, coupled with the removal of trade taxes, pay for themselves in most cases (countries and effluent types), except for several effluent taxes in China and for the tax on BIOWAT combined with trade liberalisation in several countries.

Health effects of pollution are tangible and lead to significant damages, as suggested by our investigation of air pollution in the metropolitan Santiago area. This result on health damage casts doubt on back-of-the-envelope estimates, such as the ones provided by Cole (2000), on the small health damages induced by the Uruguay Round Agreement of the World Trade Organisation (WTO). There are several reasons for this. The worst air pollution often occurs in urban and industrial areas in developing economies. These areas are often one and the same; people cannot easily use avoidance strategies, such as relocation or commuting to reduce damage caused by air pollution. The high ambient air pollution typically affects urban populations, which have higher population densities than their counterparts in industrialised countries.<sup>2</sup> The size of aggregate damage is likely to be larger because of the larger population affected. Hence, it is critical to further assess this health linkage in the trade and environment debate. Data limitation may be a problem in many countries in assessing the health costs of pollution.

The book also rediscovers an important truism: the “environment” is multidimensional, even in the simple context of our AGE framework. This multidimensional aspect refers not only to effluent types but also to natural resource use in agriculture and other primary sectors. The natural resource based sectors can either expand or contract following the trade and environmental policy reforms. These added dimensions complicate the substitution/complementarity effects of some tax instruments across environmental indicators. This added complexity makes the overall assessment of the trade-offs associated with different growth strategies more difficult as well.

## 5. COUNTRY-SPECIFIC FINDINGS

Other results and findings in this book are country specific. Rules of thumb and anecdotal evidence on the environmental impact of free trade are found to be misleading. The results presented in the empirical chapters reveal several instances of cleaner and dirtier specialisations induced by free trade. Hence, it is imperative to quantify these effects to assess the impact between outward orientation and the environment.

Chile is a fascinating case because it illustrates how growing income and wealth translate into higher consumer demand for environmental protection and eventually into actual implementation of new regulations. Environmental protection has been rapidly evolving in this country, with notable decreases in urban pollution concentration in the 1990s caused by a phaseout of lead gasoline, the introduction of cleaner imported sources of energy, and a more stringent regulation of air pollution. This rapid evolution prompted us to update our investigation to reflect changes that had occurred between the completion of the health methodology in Chapter 5 and the country study presented in Chapter 6.

A major finding in Chapter 7 is that among the seven countries investigated in this book, China has the dirtiest specialisation under free trade, followed by Vietnam and Indonesia. Pollution abatement in China appears difficult for several effluents, which has a high impact on health.

The analysis of Morocco in Chapter 8 provides an optimistic message in sharp contrast to the China case. Abatement of emissions is clearly feasible because the foregone growth is minimum. Given that Morocco will be under pressure by the European Union (EU) to abate pollution because of its free trade agreement (FTA) with the EU, the FTA may become an opportunity to transfer institutional capacity from the EU to Morocco in environmental regulation and protection. This case study is definitely reminiscent of the Mexico case in the context of the North American Free Trade Agreement (NAFTA).

In Chapter 9, the findings on Vietnam are of concern because of the high pollution intensity of aggregate output and absorption. Absorption becomes noticeably dirtier with trade integration, a unique feature among our seven case studies.

The summary in Chapter 10 on Costa Rica, Indonesia, and Mexico illustrates the diversity of specialisation patterns induced by trade integration. The assessment is the most pessimistic for Indonesia but much more hopeful for the other two countries. Abatement appears feasible in all three countries.

## 6. FUTURE RESEARCH DIRECTIONS

This chapter brings our research program to a close. What are the promising topics and challenging shortcomings in the existing literature that were identified during the investigation reported in previous chapters?

The double dividend in developing countries is a topic of promise and is relatively unexplored. Beyond labour market distortions, there are trade distortions and other taxes used in developing economies that could be replaced by environmental taxes and fees, thus generating alternative tax revenues. This is to some extent an academic debate but with potentially substantial gains at stake for developing economies. In these economies, trade distortions are often a significant source of revenues, and environmental degradation may remain unaddressed by policy makers, representing an untapped source of public revenues (Beghin and Dessus 2001, Smulders and Sen 2001).

Health assessment in other developing countries could be done when the data are available.<sup>2</sup> More needs to be done, for example, on Mexico City and on NAFTA-induced growth. Another potential application relates to the ancillary health benefits of carbon dioxide abatement in the context of abatement of greenhouse gases (Dessus and O'Connor 1999). The decrease in energy use caused by energy taxes induces cleaner air and lower health damages associated with air pollution.

The usual litany on data limitation applies here. The IPPS database, the "New Ideas in Pollution Regulation" program developed at the World Bank (Hettige et al. 1995), and our input-based estimates derived from the IPPS database, although old, are still major sources of information for many investigations looking at the pollution content of output in developing economies. Actual data on pollution intensity of disaggregated output in developing economies are still partial and limited. Some data exist for China, Indonesia, and Mexico. Further, better data on linkages between national and regional/metropolitan area activities are needed to evaluate the impact of growth strategies at the level of large metropolitan areas. Data on dispersion and pollution inventory in polluted urban areas are also required. These data are intensive in human and physical capital. Hence, it will take some time before many developing countries can reach the optimal institutional capacity to monitor and eventually decrease urban pollution, as Chile has done in the case of Santiago.

Finally, it would be useful to provide further systematic assessments of trade and environment linkages in other developing economies. Because of our vested interest in the AGE toolkit, we are partial to the AGE approach. However, what is needed is a comprehensive combination of AGE calibration exercises such as the ones used in this book; industry case studies such as those led by Jha, Vossenaar, and associates at the United Nations Conference on Trade and Development (Jha, Markandya, and Vossenaar 1999); and panel data analysis focusing on specific effluents or industries such as the work undertaken by Wheeler and associates at The World Bank (Dasgupta and Wheeler 1997; Pargal and Wheeler 1996; Wang and Wheeler 2000). It is useful to have industry case studies such as those used in Jha, Markandya, and Vossenaar (1999), which collect a wealth of information on regulatory efforts and industry-stylised facts that corroborate or cast doubts on gross assessment provided by AGE models. Panel data collection and exploratory analyses allow researchers to identify more systematic patterns and establish useful stylised facts that could be compared to predictions from AGE models (Reppel-Hill 1999; Pargal and Wheeler 1996).

Economists, as social scientists, face serious limitations in experiment design and measurement, especially when it comes to quantifying institutional capacity. Combining these three approaches provides compelling evidence that sustains scrutiny from complementary angles and dispels the notion that trade-led growth is necessarily bad for the environment.

## NOTES

- <sup>1</sup> By assumption of fixed effluent intensity in the Indonesia case study, abatement via the technical effect is precluded. For that reason, all effluent types are much more likely to be complements in that country.
- <sup>2</sup> For instance, *The Economist* (2001) reports that for sulphur dioxide emissions, 19 out of the 20 most polluted cities in the world are located in developing or transition economies.

## REFERENCES

- Beghin J., and S. Dessus (2001), "The Environmental Double Dividend with Trade Distortions. Analytical Results and Evidence from Chile," mimeo., revised March.
- Cole, M.A. (2000), *Trade Liberalisation, Economic Growth and the Environment*. Cheltenham, UK, and Northampton, MA: Edward Elgar Publishing.
- 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.
- Dessus, S., and D. O'Connor (1999), "Climate Policy without Tears: CGE-Based Ancillary Benefits Estimates for Chile," Organisation for Economic Cooperation and Development, Development Centre Technical Papers 156, November, Paris.
- The Economist* (2001), *Pocket World in Figures*, 2001 Edition. London: Profile Books.
- Hettige, H., P. Martin, M. Singh, and D. Wheeler (1995), "The Industrial Pollution Projection System," World Bank Policy Research Working Paper No. 1431, March, Washington, D.C.
- Jha, V., A. Markandya, and R. Vossenaar (1999), *Reconciling Trade and the Environment: Lessons from Case Studies in Developing Countries*. Cheltenham, UK, and Northampton, MA: Edward Elgar Publishing.
- 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.
- Reppelin-Hill, V. (1999), "Trade and Environment: An Empirical Analysis of the Technology Effect in the Steel Industry," *Journal of Environmental Economics and Management* 38 (3 November): 283-301.
- 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.
- Wang, H., and D. Wheeler (2000), "Endogenous Enforcement and Effectiveness of China's Pollution Levy System," World Bank Research Policy Paper 2336, May, The World Bank, Washington, D.C.



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