Introduction

Environmental issues are growing in importance in the political agenda of developing countries with high industrial and urban levels and modern agricultural activities. However, growth expectations in these economies are still high, particularly to accommodate unsolved social problems, and consequently the introduction of environmental concerns in policymaking is becoming more complex.

As has been fully discussed elsewhere, environmental management deals with issues of inter- and intratemporal equity. When ecological degradation costs are not paid by those generating them, they are externalities to the economic system. Economic activities are then planned without taking into account these environmental externalities and so people's consumption patterns are forged without any internalisation of environmental costs. The result is a pattern of natural capital appropriation in which benefits accrue to some users of environmental services without compensating for the costs incurred by the excluded users. Moreover, future generations will be left with a degraded natural capital stock, bearing the costs that may result. In addition, sectoral and macro policymaking areas show very little concern about and knowledge of the economic aspects of ecological matters. Such a vacuum increases the difficulty of improving the allocation of natural resources in the economy.

In the presence of these externalities we have a good case for governmental intervention. This intervention may include distinct instruments, such as the assignment of property rights, the use of pattern standards, compensations and so on.

Although governmental intervention is legitimated, it is not trivial. First, our knowledge of ecological functions is still limited, which poses serious restrictions on environmental impact assessment. Secondly, since environmental management will affect production and consumption patterns it will reveal distinct costs and benefits across society. Governmental intervention, consequently, is inevitably faced with the challenge of balancing costs and benefits among contemporary and future generations to justify policy actions in a way which maximises social welfare. Although such an optimisation path is not easily identified, there are good opportunities to internalise environmental matters in a cost-effectiveness approach in which selected

environmental targets can be achieved at the least social costs. To take this further, apart from physical, biological or geographical criteria, environmental policymaking could also rely on complementary economic criteria.

In the context of developing countries, where growth expectations are high, least-cost environmental policies are crucial since they reduce the conflict with environmental issues. Therefore, policymakers in the region must be very aware of the specific issues of the relationship between economic aspects and environmental phenomena to offer policy initiatives which can increase efficiency and improve equity.

The set of articles invited by the editor to make up this volume is an attempt to give guidance on these matters. They cover topics which vary from very general analysis of growth and conservation to specific issues such as environmental taxation, deforestation and climate change. The idea behind the order of the chapters is to offer policymakers in developing countries a comprehensive view of the challenges and legacies they have in order to convert environmental policymaking into an actual exercise of welfare improvement.

This set of articles was first published in a Brazilian periodical, *Planejamento e Políticas Públicas* (*Planning and Public Policy*) sponsored by the Research Institute for Applied Economics (IPEA) in Rio de Janeiro, Brazil. The authors are well known environmental economists who have considerable experience and expertise on developing issues. The Brazilian writers are those who have been working or collaborating with IPEA. I am extremely indebted to them for their valuable contributions.

We have made every effort to present these topics in an accessible language, without oversimplifying the economic issues. Such an approach can sometimes fail, with parts of the texts being thought of as either too simple for experts or too complex for non-specialists. We hope to have reached a fair balance. The following summarises the contributions to this volume.

CAN GROWTH AND TRADE BE COMPATIBLE WITH THE ENVIRONMENT?

The prime policy-related environmental issues are the links between economic growth and environmental impacts. We expect that the scale of production increases pressure levels on the natural resources basis. Does environmental degradation tend to reduce as the economy grows beyond certain income levels?

Each level of income gives rise to a certain level of degradation pressure. Higher income levels may create the desire for higher consumption of the clean environment, which induces an endogenous technological path that

reduces degradation intensity. When this rate of decline exceeds the income growth rate, total degradation decreases despite consumption growth. If this happens, it is expected that when the average income exceeds a certain threshold level, economic activity may be separated from degradation. In other words, the income and environment relationship may follow an inverse U curve form.

This is the kind of relationship that the Nobel prizewinner Simon Kuznets first observed between income distribution and economic growth and, therefore, in the case of degradation it is called an environmental Kuznets curve (henceforth EKC). The existence of EKC is crucial for developing countries since it gives room for reducing the conflict between growth and the environment through technological advancement. If that is possible, the technological transfer from rich countries is paramount for accelerating delinking in emerging economies.

The first chapter by Hans Opschoor is aimed at these issues. It first sets the general framework for the discussion of the integration of environment and growth and welfare issues by discussing the sustainability of development policies. Next it presents a detailed analysis of EKC studies. The author suggests that they are far from being conclusive, and there is no strong empirical evidence to expect that rising average income alone will allow for the process of 'delinking' economic activity from environmental degradation.

Opschoor shows that data problems in capturing appropriated environmental indicators and limitations in econometric techniques cast doubts on the evidence presented in these studies. Moreover, most of them adopted cross-country analysis which does not capture developmental factors over time and, consequently, misleads the evidence. Although there is no strong evidence of EKCs, this chapter shows that the scale effects of growth on the environment have to be reduced by induced technological progress and demand-driven sectoral composition effects. Therefore, developing countries may pursue policies which alter consumption patterns to create cleaner outputs and improve technological performance at production and consumption levels.

However, can developing countries attain these policy improvements without jeopardizing their comparative advantages in the use of natural resources in the current globalization process? The relationship between international trade and environmental policy is carefully analysed in the following chapter by van Beers and de Moor. Although they show that the effects of trade on the environment can be both positive and negative, it is possible to confirm that perverse subsidies, which hide environmental externalities, affect trade patterns by increasing pressure on the natural resource base. This is a case of comparative advantage at the expense of environmental degradation.

Consumption subsidies which are usually found in developing countries (for example, in energy) may lead to overconsumption, aggravating both the

environment and trade deficit in these economies. The authors go further, indicating that perverse subsidies in rich countries are mainly on the production side, particularly in agriculture. This is causing harmful implications by distorting the possible positive effects of the comparative advantages of developing countries which are then led to increase their reliance on natural resource exploitation.

The chapter emphasises that the reform of subsidies will require an internationally coordinated policy effort within the World Trade Organization (WTO) in which OECD countries would reduce their barriers against imports from developing countries, thus creating additional market access for exports in order to allow the latter to reduce domestic perverse subsidies.

WHAT ARE THE COSTS OF DEGRADATION?

As can be seen, the above policy strategies to reduce the impacts of growth and trade on the environment have to be based on a clear understanding of the economic costs caused by degradation which, in fact, would be the major incentives to carry out these initiatives. What is the economic importance of these environmental impacts and how much does society value them? In other words, without a proxy for environmental costs and benefits, how can society allocate its scarce resources? This is one of the key questions a policymaker has to deal with.

Cost-benefit analysis (CBA) is the most widely used technique to create economic indicators for the setting up of priorities in policy appraisal. Its objective is to compare the costs and benefits of impacts of alternative policy strategies, with distinct priorities, in terms of their monetary values. Note that benefits here are those ecological goods and services which will be recovered or maintained in society and which have impacts on people's welfare. Costs, on the other hand, are the foregone welfare, and flow of non-ecological goods and services due to the diversion of the economy's resources to ecological policies rather than to other economic activities. Benefits as well as costs should be also determined as to whom they accrue, that is, identifying beneficiaries and losers to properly address the resulting equity issues.

Ecological goods and services are measured by their total economic value in two parts, namely: (i) use values which are related to current and future environmental goods and services, and (ii) non-use (passive) values which are derived from existence or intrinsic values as a bequest and stewardship.

Use values are associated with direct and indirect uses currently undertaken by individuals or option values related to future uses. Non-use or passive values are those that individuals place on biological resources that they do not intend to use, and include cultural, religious and heritage values.

Ecological values can be estimated with economic valuation methods which rely on the same theoretical background of microeconomics. These methods can be classified in various ways and literature is prone to offer distinct proposals. We can, for example, classify them into production and demand approaches as follows:

Production Approach

This approach assumes that impacts are valued equal to the foregone income or avoided costs valued at market prices. If impacts from degradation affect production processes elsewhere in the economy by reducing the supply of ecological inputs, one may estimate how much these production losses are valued in the market. This market value reflects a use value, for example: (i) soil erosion costs which diminish agricultural yields, where production losses can be easily estimated from yield-declining rates by multiplying foregone output by respective market price; and (ii) deforestation for land conversion for agriculture and livestock generates income but it also eliminates a flow of income from sustainable logging and non-wood extracting activities, which offers a good indicator of environmental losses associated with other use values of the forest. Foregone output from these activities is estimated using their market prices.

Alternatively, if the increased benefits from conservation mean that costs are avoided elsewhere in the economy, these avoided costs are good estimates of use values. For example, health costs associated with a certain illness can be avoided with medicines developed from genetic resources prospecting. Use values can be estimated by hospital expenditures related to this illness which would be avoided with the new medicine.

Also, if impacts from conservation result in the substitution of ecological inputs for private goods, the market value of these private goods offer a good indicator of use values. For example, the investment costs incurred on habitat recreation due to dam flooding needed for hydropower generation can be assigned as use values for this habitat.

Demand Approach

This approach assumes that welfare changes are equal to the consumer surplus measured as the difference between the total willingness to pay for the environmental good or service minus what was actually paid. Surplus estimation, then, requires the identification of demand functions which can be done using the following methods:

- a. *Property prices method* – Property prices vary according to the many

attributes associated with them. House prices, for example, reflect size, commercial facilities, local infrastructure and other attributes including the environmental quality of the location of the house. Statistically analysing house prices, one can assess the contribution of environmental quality to house price variations and estimate how much people are willing to pay for changes in environmental quality. That measurement represents a use value for that environmental change from which the demand function can be estimated.

- b. *Travel cost method* – Plotting visitation rates to a natural site against travel costs incurred by visitors, one can estimate a demand curve for the site where travel costs are use values. Travel costs will, in this case, also consider the costs of time spent travelling. However, any other purpose for the visit, which is not related to natural appreciation has to be included in the estimation procedures.
- c. *Contingent valuation method* – Asking people directly how much they are willing to pay for a change in a provision of benefits from biological conservation, one can create a hypothetical market where a demand curve for ecological services can be estimated. This method is the only one which allows for the estimation of non-use values since hypothetical markets can be created for them. Based on associated preferences, and not on revealed preferences as in the other demand approaches, contingent valuation may incur various biases from strategic answers to lack of information. Such biases are currently well documented and techniques have been developed to avoid them.

Other methods vary according to their assumptions on market equilibrium, data availability and the benefit being measured. Therefore, the choice of method will also depend on these factors and the estimation of the monetary values of ecological impacts will be difficult due to: (i) reduced knowledge on ecological linkages to economic activities; (ii) lack of data and indicators; and (iii) methodological limitations on theoretical grounds.

Although one will always face many shortcomings on environmental valuation, the process of establishing economic values raises socioeconomic issues which ecological criteria alone cannot. It is worth mentioning that the valuation of a few of the environmental impacts of a given policy may be enough to show that they are already justifying a change in policy targeting.

Identifying how the costs and benefits are distributed across society (that is, who are paying the costs and who are getting the benefits), policymakers can also find ways to compromise other alternatives and build a consensus which facilitates policy implementation. This feature of CBA, very often disregarded, is vital in developing countries where equity issues usually constrain policy implementation due to the unequal distribution of income.

The use of CBA on this basis is an important step before society can implement a more sophisticated ecological–economic criteria approach.

The effects of pollution on human health is a dominant issue in environmental policy. In wealthy countries these negative health effects have been among the most applied indicators of environmental costs associated with pollution-related effects; that is, indicators associated with variation of risk levels of premature mortality and morbidity. This is still more appropriate in the case of developing countries where low income levels in the poorer classes warrant defensive expenditures against pollution effects. However, this poses an additional complexity to monetary valuation since it requires the valuation of health costs associated with people's life and sickness. Literature on the health costs of pollution suggest several methodological procedures to value health benefits.

Measures based on foregone output due to premature death and sick leave are estimated on the income of those affected and, consequently, have been strongly criticised since, in the context of low-income countries, it would reveal very low bounds for health costs. Literature has given alternative emphasis on methods based on people's willingness to pay (WTP) for risk reduction which, in turn, are costly to implement. Therefore, several studies of developing countries have applied back-of-the-envelope procedures to account for health costs associated with pollution. More recently, transfer functions have been seen as a promising methodological shortcut to apply WTP-based estimates, thus avoiding expensive willingness-to-pay direct surveys.

Chapter 3 by Pearce and Chapter 4 by Markandya cover this controversial issue. Pearce's chapter gives us a careful overview of the theoretical and methodological basis for measuring the statistical value of life. He emphasises that risk reduction is not a costless activity, since society has to choose among many sets of risks and other key activities such as education. In so doing, the value of mortality risk reduction has to be estimated to guide priorities in policymaking.

Pearce then brilliantly discusses the controversial concept of the statistical value of lives through the perspective of risk analysis and comparing its methodological alternatives. He offers us evidence to show the importance of the careful valuation of these estimates and how they tend to dominate overall damage estimates in environmental cost–benefit studies.

In many developing countries, however, this risk analysis is not practicable due to data and research constraints. Therefore, Markandya's chapter presents detailed methodological guidance on how to use functions and data from other countries to estimate health costs in developing countries. His analysis includes an interesting transference exercise for developing countries of the statistical values of lives based on the sophisticated research efforts in this field in the European Union context.

Understanding environmental costs and benefits is crucial for setting policy priorities and strategies. However, reductions in public budget requirements can allow government expenditure on more objective current needs, such as health and education, than on diffuse ones, such as environmental protection.

The current world financial crisis is imposing severe fiscal constraints on the emerging economies. Fiscal reforms are being urgently conceived to reduce public expenditure and increase fiscal capacity. In this context, charging for natural resources can be advocated as a more efficient way to shift the tax burden from positive things, such as capital and labour, to negative things, such as pollution and the depletion of natural resources.

Very few countries have experienced this shift on a macroeconomic basis. It is not a trivial matter. It depends on a solid fiscal system able to make adjustments, and also on a good environmental monitoring and regulation enforcement to make the shift viable.

The economic literature, however, is prone to proposing economic instruments (EIs) as a more efficient way to apply environmental policies than the emission/use and technological standards, commonly denominated as command-and-control mechanisms (CAC), usually adopted elsewhere. However, the choice of an appropriate economic instrument is not only theoretically complex but also the experience of its application is full of controversy about its effectiveness in accomplishing the proposed environmental targets.

The pricing procedures for natural resources can be summarised according to three distinct criteria:

1. Achievement of the optimal use level: pricing the full environmental costs of production and consumption activities to adjust output to optimal levels (Pigovian taxes).
2. Improvement of cost-effectiveness: pricing natural resource users in order to allow flexibility for producers and consumers to achieve environmental goals with lower costs (incentive taxes).
3. Generation of revenue: pricing natural resource users to generate revenue for financing investments or the costs of providing environmental goods and services (public prices).

The choice of one of these three criteria is also important and is not always recognised through the design, implementation and performance analysis of an economic instrument. Above all, it is important, particularly in developing countries, to consider the capacity for institutional enforcement capacity and public opinion awareness.

Very few cases are made for Pigovian and incentive taxes, although the use of EIs to raise revenue in order to fund environmental programmes and projects and/or to finance environmental management services is widely re-

ported in the literature with several successful experiences, particularly in the OECD countries.

Chapter 5 by Seroa da Motta and Sayago discusses some of these issues and offers estimates of the social benefit of recycling in Brazil. After an introduction to the theoretical and conceptual issues on the application of economic instruments, they identify opportunities for the adoption of fiscal devices which are already in place and under discussion in recycling and package law bills in Brazil, in order to enhance the efficiency and equity performance of the package and recycling markets in the country. To accomplish this the authors have made some estimates of the social benefits of recycling and, based on these values, analyse the taxation levels of these bills. Results show that the choice and design of economic instruments are crucial and monetary valuation may be helpful in this process. However, analysis of the economic and social implications of the instruments can be constrained by data availability.

WHAT ARE THE CAUSES OF DEFORESTATION?

In developing countries, ecological distress is not only due to pollution damage from the intense process of industrialisation and urbanisation. Deforestation is another key issue which generates serious and irreversible ecological damage. Since developing countries control the last sources of native forests in the world, quite often deforestation issues receive higher priority by international agencies and organisations than urban problems.

One of the most important characteristics of tropical forests is their open access feature. It is very important to understand the peculiar characteristics that allow agricultural peasants and timber loggers to clear the forests without any concern about resource scarcity and its economic consequences.

Deforestation is driven mainly by agricultural and logging activities. The expansion of these activities into open access areas has been rapid despite legal restrictions. Apart from an institutional weakness in enforcing norms and rules in developing economies, the deforestation of important ecosystems is also a result of several economic factors, namely: (i) a highly concentrated personal income distribution and land tenure system which creates an immense surplus of low-income workers ready to seek occupations in frontier areas; and (ii) favourable credit and fiscal systems to agricultural activities with no regard to soil agroecological features and managerial practices which result in a mere replication of agricultural technologies already in place in areas with distinct ecological conditions.

In Latin America, deforestation is mainly related to agricultural frontier expansion rather than to timber extraction, as observed in Southeast Asian

cases, although farming and logging activities show an interesting synergy in the region. First, the land titling of a property is based on the productive use of the land, such as the area allocated to farming which has to be separated from deforestation. Therefore, in an open access regime, land titling not only legalises clearing but encourages it. Secondly, timber which is taken from the clearing can then finance land conversion and titling.

How much is deforestation related to rural poverty and land conversion for agricultural activities? This is the topic addressed in Chapter 6 by Barbier when he reviews studies applying cross-country econometric analyses to identify the relationships of population, income, agricultural yields and timber production with forest clearance in Latin America. He acknowledges that results are affected by the problems of obtaining comparable and reliable data across countries. Despite this, he concludes that the alleviation of rural poverty would act to reduce forest clearance. This relationship, however, needs to be qualified since poverty, rather than being a direct cause of deforestation, may instead constrain poor rural households in their ability to mitigate rural degradation. If so, policy reform can no longer ignore these rural poverty–deforestation linkages and more targeted policies are required, such as rural extension and marketing programmes, improved access of the poor to fiscal and credit schemes and extended key infrastructure.

Looking at the same perspective, the deforestation process in Brazil is carefully analysed by Young in Chapter 7. His empirical analysis attempts to capture the contribution of sectoral and macro policy-related actions to forest clearance in Brazil in the period 1970–85. His focus is placed particularly on export promotion policies and regional development programmes and their fiscal and credit aspects and implications on labour and land markets. The chapter concludes that, apart from the appreciation of land and agricultural prices, the low opportunity cost of labour will also play a major role in the deforestation process in Brazil. Finally, it stresses the importance of property rights in order to prevent natural capital losses caused by the mining of the forest in open access basis.

The issue of forest management and climate change is inescapable. Apart from local environmental problems, either pollution or deforestation-related, there are also policy concerns on the so-called global issues, such as acid rain, the depletion of the ozone layer and climate change. The ozone problem is by far the most alarming global problem. It will not only alter earth temperature but also increase flood risks by causing rising sea levels and affecting dry seasons by the changing rainfall pattern.

Although the burden of controlling greenhouse gases was mainly assigned to developed countries in the emission caps set at the Kyoto Protocol, developing countries must be aware of the potential impacts of climate change.

Only by recognising them can policy be effective, particularly for adaptation strategies.

Most developing countries still rely heavily on the agriculture sector which is the economic activity most strongly affected by changes in climatic conditions. Chapter 8 by Evenson and Alves analyses the implications of climate change effects on the Brazilian agriculture due to variations on land productivity levels. Their results indicate that the least advantaged areas in the Northern and Northeastern regions and part of the Centre-Western region will suffer most, whereas some currently advantaged areas in the South, Southeast and Centre-East may, in fact, benefit from climate change effects. Conclusions emphasise the importance of mitigating these effects by enhancing agricultural technology policies and reducing forestland conversion.

Can we propose policies which increase forestland values for activities that do not lead to deforestation? In other words, can forests create values out of the slash-and-burn practices for agricultural conversion? How to make this change in the property right regime is the crucial challenge. Therefore, a policy alternative would be to promote sustainable logging as an option for agricultural expansion. One way to achieve this is through a system of public concessions where long-term leasing contracts of large tracts of forests are made to private corporations with clauses specifying accepted conditions on the use of land and natural resources. Non-compliance with sustainable practices defined in concession licensing would be subject to sanctions and concession termination. Supervision and monitoring of these concessions could be shared with NGOs.

Such a scheme is particularly feasible, for example, in the Amazon forest where there is still a large availability of unclaimed areas. However, apart from the serious technical procedures which need to be addressed (managerial practices, concession period, stumpage fees, and so on), such a change in property right assignments may face numerous political barriers, such as land concentration, international ownership and agricultural activity restrictions.

The final chapter, by Ferraz and Seroa da Motta, draws attention to some economic issues that are crucial for the attainment of the objective of promoting sustainable logging extraction in concessional terms in the Amazon. Departing from the failures which occurred in other countries with similar experiences, and accounting for institutional and economic barriers found in the region, they identify economic incentives to counteract deforestation trends and open room for making sustainable logging a viable alternative for the use of forestland in the Amazon.

As readers can see from this overview, the main topics of this edition are at the forefront of the environmental policy agenda and reflect a special selection of studies. I hope readers will benefit from their analysis, results and recommendations.

I wish to express again my gratitude to the authors for their prompt response to my request for collaboration and their ability to grasp the spirit of this policy issue in their very qualified articles, particularly considering their tight professional schedules. I also thank Edward Elgar Publishing Ltd for their initiative in dedicating this special edition to economic issues for environmental policymaking in developing countries.

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