Overseas Development Institute

Briefing Paper

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ENVIRONMENT, MARKETS AND DEVELOPMENT

Environmental economics, a body of techniques to analyse environmental problems and make policy prescriptions, is challenging conventional economic thinking in countries at all stages of development. In the UK, the Secretary of State for the Environment has publicly accepted the main ideas in the Pearce Report,[1] and has indicated that they will find expression in this year's White Paper on the Environment. The Report makes a strong case for the use of the market to value and price environmental services. This Briefing Paper examines the basic ideas in environmental economics, considers their particular relevance to developing countries, and looks at their implications for development policies and aid.

Environmental Economics (EE)

Environmental effects are often not directly captured in prices and therefore do not influence decisions based on the market. EE seeks to value these effects where possible, in order to provide better guidance for public decisions. Externalities are an important category of environmental effect. The repercussions of an action on others create costs (or benefits) which are not borne by the party responsible for them.

What is 'external' depends partly on a country's laws, as well as the scale of the operation. If industrial concerns are required by law to clean up emissions before discharging them a potential externality becomes an internal cost. Likewise, what are externalities in a farming system of many small holdings are internalised in a large estate.

EE asserts that the environment can be viewed as a form of capital, which produces a flow of services to mankind. Both assets and recurrent services can be valued in economic terms. These underlying values are the bases on which environmental policy can be made. Prices and incentives can be fixed in order to encourage desirable behaviour towards the environment and penalise its abuse. The conservation and sustainable use of the environment may be encouraged by giving its users a stake in its management or ownership (property rights).

Five interrelated ideas will be examined here: the concept of the environment, the notion of sustainable development, the principles of environmental valuation, new measures of economic performance, and the use of market incentives to mould environmental behaviour. In the second part of the Briefing Paper we offer a commentary on the usefulness of these ideas for developing countries.

Concept of the environment

What makes EE distinct from earlier economic treatment of natural resources is a much broader view of what makes up the environment in question. EE considers three broad categories. Firstly, the environment is a source of raw materials and energy which are the physical inputs to recurrent production. Some of these are renewable, others are finite. Renewable resources may nevertheless be *depleted* if not properly maintained or worked to excess.

Secondly, the environment absorbs the waste products of our civilisation, through its air, soil and water. This 'sink' function is also partly 'renewable' (where the waste can be safely assimilated by natural processes) and partly non-renewable — where the natural system reaches saturation or super-charged state.

Thirdly, the environment serves a variety of other functions to mankind, such as life-support (e.g. the atmosphere, the ozone-layer, bio-diversity), health, amenity, etc.

Most earlier writers on natural resources focused on the first of these concepts. The alarms of the Club of Rome twenty years ago were also based on projections of a future growing short of materials, rather than a world pressing against the environment's ability to assimilate its wastes or support its life forms. The second and third environmental functions have been acknowledged only sporadically until recently.

Sustainable development

There are many definitions of sustainable development (a recent World Bank report lists almost 60). The concept used by the Brundtland Commission[2] is the most widely adopted: development is regarded as sustainable if it satisfies the needs of the present generation without compromising the ability of future generations to meet their own needs.

Environmental economists treat the environment as natural 'capital'. The services derived from air, water, soil, biological diversity ('life support systems') and the enjoyment of wildlife, forests, etc. depend on maintaining those environmental assets intact, or renewing them when they are used up or degraded.

If this is not done, those services will sooner or later decline. This obvious point recalls the classic distinction between income and capital, whereby 'income' is the amount that can be consumed in a given period without being any worse off at the end of it. If a forest can be used for various purposes without reducing its long term value in those uses, this can be regarded as 'sustainable development'. Likewise for discharges into the air or water that are within the capacity of the natural systems to assimilate and harmlessly transform from waste.

Economists recognise that there are different kinds of environmental 'capital'. Some of it is renewable or restorable after use (e.g. forest, water, farmland). Some can be substituted for man-made capital for the purpose of generating an income stream (e.g. abundant minerals can be converted into financial capital, or used to finance physical productive assets). Some environmental capital is by definition irreplaceable once lost or degraded (e.g. wilderness ecology, virgin tropical forest, biological diversity, rare species of plants and animals). There is a further category of assets whose condition and properties are insufficiently known, (e.g the earth's atmosphere, many wetlands, drylands), and which should be 'used' sparingly until we know more.

The notion of replacing environmental assets by replicating or compensating projects relies on putting economic values on environmental functions. The idea of sustainability also depends on separating true income from capital depletion when measuring a country's economic performance. We now turn to these two ancillary aspects, before considering the role of prices in policy formation.

Valuation of the environment

Current work aims to extend economic valuation techniques to cover environmental effects that do not appear in the normal cost-benefit analyses of projects. A toolkit exists (see Box). The task now is to judge how plausible it is to extend its use into situations typical of developing countries, since most of the applications so far have been in high-income developed countries.

Measurement of economic performance

EE asserts that growth, as measured by changes in GNP, fails to allow for the depletion of natural capital (analogous to the depreciation of physical capital). Many resources that can be considered to be environmental assets such as forests, hill farms, and fisheries are being worked at unsustainable rates,

Some concepts and techniques for valuing environmental effects:

Effect on output and productivity: where a change in the environment has a direct effect on output, either on-site or off-site e.g. damage caused by soil erosion to farm productivity, downstream siltation of irrigation channels, damage to hydropower intakes.

Impairment of human health and productivity (the '**human capital**' approach): the reduction in a person's lifetime earnings from illness, accident or premature death resulting from environmental degradation (e.g. from urban air pollution, build up of heavy metals in water, soil and foodchain, chronic occupational hazards in industry and agriculture).

Inferring environmental values from property price and wage differentials (**'hedonic' methods**): the implicit value placed on environmental nuisances can be discovered by examining the discounts (or, in the case of wages, premia) that the market puts on properties (or workers) exposed to these effects (e.g. aircraft noise, proximity to industrial noise and fumes, sewage smells, unhealthy occupations).

Travel cost: deducing the value people place on intangible assets like public parks, scenic views or wildlife by the amount they expend in travelling to the amenity, including the value of their time.

Direct enquiry amongst people of the values they would place on hypothetical changes in their environments (**'contingent valuation methods'**): representative samples of the population directly and indirectly affected are questioned about their hypothetical willingness to pay (for environmental improvements) or to accept compensation (for environmental damage), e.g. cleaner air, loss of amenity or view, preservation of wildlife and rare species.

The **cost of preventing environmental damage, or of replacing assets** lost once this occurs (e.g. flood prevention measures, post-flood repair costs, respectively) can be used as a proxy for the value of environmental services.

often because not enough is being spent on maintaining the asset. In such cases, capital consumption is being treated as income. This gives the wrong signals to policy-makers in these countries, and produces misleading measures of their comparative international performance. For producers and exporters of primary products, allowing for capital depletion can drastically change their measured growth rates.

A recent attempt was made to rework the national accounts of Indonesia allowing for the depletion of its natural assets.[3] Taking account of estimated real depletion in Java's hill farming and national forestry and petroleum, it was estimated that Indonesia's national income in 1984 would be lower by about 17%. Its rate of growth between 1971 and 1984 would be nearer 4% rather than the 7% which it is normally credited with.

Secondly, services that are provided by the environment are frequently omitted from national income because they are not priced or marketed. But when these services are lost, society is forced into 'defensive expenditure' to replace them, (e.g. cleaning up after pollution, dredging eroded soil from water courses) and this spending does count as part of national income. Thus the degradation of environmental resources appears to raise, rather than lower, national income.

Prices, incentives, and environmental behaviour

The valuation of environmental services and assets is only an intermediate step to the production of a system of actual prices which reflects these underlying values. Only then would economic actors be rational in their use of the environment.

There is elementary justice in raising prices and levying fees and fines from parties harming the environment. In its simplest form, the 'Polluter Pays' principle would require that, if the effluent from a chemical works 'costs' the environment $1m p.a., that is the amount the firm should pay to compensate society, or to defray the actual cost of cleaning it up.

Public policy has a broad choice between using legally-enforceable environmental controls ('command and control' methods) and the manipulation of prices, taxes and other economic instruments that rely on individuals and firms responding to market signals. Most countries currently have a bias towards management by command and control.

Economic instruments can enable public policy aims to be achieved more efficiently — that is, with fewer resources — than the approach based on regulation. For instance, in the tradeable permit method used in the USA for controlling industrial air pollution, firms are set a pollution quota, which can be based on any level society chooses, and can taper down over time. Clean and efficient firms can benefit from trading their quotas, while the bad polluters have to buy the unused quotas of others. Most abatement falls on firms who can do it most efficiently.

Another advantage of economic instruments is that they should require less administration, compared with the regulatory approach. Raising the price of petrol or pesticide is administratively easier than attempting to ration or otherwise reduce their usage.

The relevance of Environmental Economics to developing countries

This section reviews the usefulness of four of the key ideas discussed above: sustainable development, the valuation of environmental assets, environmental accounting, and the use of economic incentives.

Sustainable development

The principle of keeping options open for future generations and bequeathing them the same patrimony that we enjoy is difficult to apply where populations are growing rapidly. There are many countries in the world whose populations are likely to double before they stabilise. The needs, tastes, technologies and expectations of future generations are hard to predict, but are likely to be unrecognisable from our own (compare our lifestyle with that of our grandparents). Profound structural changes are afoot in developing countries, such as growing urbanisation, agricultural transformation and industrialisation. The way in which they satisfy their needs for food, shelter, energy and recreation must inevitably adapt to growing populations and structural shifts.

Developing countries also have a degree of 'catching up' to do. Consumption of depletable physical resources per head in the poorer countries is a fraction of that in the industrial world. As development occurs, incomes rise, the structure of their economies more closely resembles our own, and their use of resources is bound to increase — unless technology responds to the challenge of scarcity in a way which we cannot now predict.

Where development would entail damage to the environment, sustainability would require either the imposition of 'safe minimum standards' (especially for irreplaceable natural assets) or the introduction of 'compensating projects' to recreate assets lost by the proposed development.

In practice, it is difficult to conceive of many schemes that would fully offset the environmental losses of projects. Replanting trees to replace those lost when a road cuts through a wood only compensates the initial loss when the trees are fully grown. It would be possible to fully compensate for some functions, such as biomass, without replacing, say, biodiversity.

Sustainability requires project designers to ensure that financial and economic resources are available to cover essential maintenance and upkeep of projects, without which they will collapse or underperform. This basic insight is not, however, peculiar to EE.

The valuation of environmental assets

Some of the problems in this kind of valuation are:

- physical and biological relationships are imperfectly understood (e.g. the precise link between air pollution and bad health, deforestation and local climatic change, soil erosion and destruction of fisheries).
- scarcity of data and the high cost of generating them.

Reliable data are highly site-specific, and usually result from careful and time-consuming studies of the problem in question. There may not be the time or professional resources to develop information specifically relevant to a locality or project. Rules of thumb should be applied sparingly.

- markets may be poorly-developed or imperfect, and hence give misleading indicators for valuation purposes (e.g. property values, willingness-to-pay surveys, value of subsistence production, spending on health). Environmental awareness is very uneven. What is the relevant sample of consumers? Some of the hypothetical tests or proxies would put a low value on preserving environmental services (e.g. revealed local attitudes to rain forest, urban air pollution, industrial effluent).
- the present valuation of effects arising in the future is normally done through the medium of a discount rate (equivalent to the inverse of an interest rate) on the grounds that future costs and benefits are worth less than those arising in the present. This is a standard feature of cost-benefit analysis and investment appraisal, and is uncontroversial for most projects that do not have major environmental implications.

However, it is objected that long term damage to the environment, when discounted at the usual rates (anything from 5%-15% p.a.) pales into insignificance compared to other, more immediate, facets of many projects. Crucial costs affecting future generations are given negligible weight in arriving at decisions (e.g. decommissioning costs of nuclear power stations, future exhaustion of certain fish stocks, major drainage outlays for irrigated systems, and all future maintenance outlays).

It is not practical to have lower discount rates for 'environmental' projects compared with others, while to jettison discounting completely would be to set the art of project appraisal back by forty years or more. Unless a capital constraint were introduced — which would have to be done by national governments — subjecting projects to lower discount rates would result in more projects being undertaken, and so create greater aggregate pressure on environmental resources.

There is not yet a consensus in EE about the role and level of a discount rate. Until there is, useful work can be done to clearly identify all important environmental effects of a scheme, value them to the extent possible, and bring to the attention of decision makers non-quantifiable risks (or benefits) with major consequences for the future.

Whatever method is adopted for valuation and discounting cannot substitute for due care in project design. It may sometimes be wise to postpone investment pending further research or the preparation of strategic plans (e.g. of energy sources). Such sustainable behaviour can be fully consistent with the use of a conventional discount rate. In any case, a zero or low discount rate is implicit in the decision to place special, or absolute, value on a certain effect (e.g. preservation of a rare species, maintaining a forest intact, not destroying a cultural monument).

Environmental accounting

In principle, there is a good case for netting environmental depletion out of income when drawing up national accounts. Such a practice would remind economic policy-makers of the true position of the economy, and give the right signals to donors and creditors about the performance of their recipient/borrower.

A number of problems remain to be overcome before environmental accounting becomes widespread and comprehensive. First, there are conceptual disagreements to be ironed out, such as whether sales of minerals represent asset sales or income, and in what proportion.

Secondly, there is the vexed question of how to treat 'defensive expenditure' without opening a huge Pandora's Box. Spending on measures to protect against the effects of environmental deterioration (e.g. double glazing against aircraft and traffic noise) is no different in principle from other kinds of defensive spending, such as on longer commuting journeys, repair costs from vehicle accidents, domestic burglar alarms, industrial and personal security, and costs arising from drug, tobacco and alcohol abuse. The national defence budget is similar. It is difficult to draw the dividing line between these 'defensive' cost items and outlays for more positive and agreeable purposes. Netting all such items out of national income would leave the accounts in tatters.

Thirdly, there is the debate about whether or not to tackle the issue head-on, by seeking reforms to the United Nations System of National Accounts, which has been the basis of national accounting worldwide since the 1960s. The alternative would be to complement the existing system with a set of satellite accounts to illustrate the state of the environment and give pointers to sustainable growth. France and Norway have gone furthest in developing environmental accounts, and both rely heavily on physical measures which are hard to integrate into conventional national accounts.

If the practice of environmental accounting, in whichever form, spread amongst developing countries, it would be important to avoid biases against those relying more heavily on natural resource exploitation. A number of industrial and semi-industrial countries (e.g. East Europe, the Asian NICs, Mexico, Brazil) have formidable problems of urban and industrial pollution. In a real sense, they are 'running down' their environment for the sake of current output, and will either have to curtail future development of the same kind, or spend heavily on pollution abatement and control. Yet we are a long way from developing measures of industrial and urban environmental depletion, analogous to those starting to appear for agriculture, forestry, minerals and hydrocarbons.

Use of market incentives

The use of market mechanisms has returned to favour in many developing economies during the last decade and also more recently in East Europe. There could be some resistance to the manipulation of the market (e.g. by imposing green taxes) in countries embarking on economic liberalisation. There could also be a risk, especially in countries emerging from socialist economic management, of jettisoning controls before a proper price system has settled down, making environmental control doubly difficult.

It is as well to recall some of the obstacles for framing and enforcing any kind of environmental policy in developing countries:

- weak enforcement of regulations, especially against politically powerful interests (loggers, mining companies, industrial concerns, but also urban motorists). Difficulties of enforcing standards or rules amongst a large number of small businesses and households, many of whom are effectively outside the law.
- resistance to taxes or higher charges from influential groups (e.g. urban constituents) especially where the objectives of environmental protection are not widely understood or shared.
- in developing countries, many natural resource users operate largely outside the market economy, which limits their response to market devices (e.g. marginal farmers, nomadic herders).

On the positive side, some governments have shown a willingness to adopt drastic measures to meet desperate situations (e.g. the ban on logging in Thailand, the campaign to clean up Lagos, the 'social pact' in Cubatao, Brazil). However, with the exception of some urban traffic control experiments, most attempts by ldc governments to manage their environments consist of 'command and control' solutions, or project-by-project investments to remedy previous neglect. There is little sign so far of widespread recourse to market solutions in the environmental policies of the Third World.

This is not to say that market solutions would necessarily be less successful than regulation. Where industrial and urban pollution results from the actions of many small agents (e.g. households, automobiles, small industrial workshops) prices, subsidies and indirect taxes are likely to be a more potent means of control than bans, rationing or licensing. Such market devices as emissions trading, however, depend on possessing a high level of technical data and expertise, close monitoring by the authorities, and better records of emissions than even the majority of American states possess.

The use of market instruments in the natural resource sectors is likely to have greatest impact in setting the prices

of output and major inputs. Crop prices fixed by marketing boards, or real prices affected by export taxes, cesses, and the level of the exchange rate are basic variables, taken in conjunction with prices fixed for such important inputs as irrigation water, agro-chemicals, farm machinery and seedlings. In forestry and fisheries the financial terms of licences and concessions can also be adjusted to serve environmental ends. The real problems arise in trying to influence poor and subsistence producers who are not major buyers or sellers in agricultural markets, and who are difficult to reach through official channels.

A prominent element in the 'market' approach to policy is the creation of property rights to environmental services as a way of giving owners an incentive to manage and conserve their resource. Trading emissions permits are an example of a 'right' to pollute a certain amount, which can either be retained or sold. Granting property rights to Colombian Indians in the Amazon confirms their stake in the forest, and gives them the legal basis to control commercial incursions. Vesting the ownership of big game animals in local peoples gives them some stake in controlling hunting.

More generally, the acknowledgement of the right of a person or community to clean air, unpolluted water, and quiet skies (which can be enshrined in law as minimum technical standards), creates a case for compensation when these rights are infringed. Although the principle is widely accepted, translating it into policy runs into the familiar problems of defining the standards, monitoring their observance, fixing appropriate compensation and enforcing payments.

Implications for development policy and aid

Among the many potential repercussions of environmental economics on the way development is planned, judged, managed and assisted are:

- The tools potentially available for environmental control and management have been increased, and have become more sophisticated. Activities which it is not feasible to regulate can be reached through prices (e.g. by taxation of petrol, crop pricing, reducing pesticide subsidies). Apart from stressing the efficacy of existing market methods, economists have also been ingenious in designing systems of management and control that use the market, and are efficient (achieving the goals at least economic cost) as well as just — tradeable permits, creation of property rights, emissions taxes, etc.

In practice, in most countries the use of economic instruments will be combined with an array of command and control devices, and, for the foreseeable future, the latter are likely to predominate. Economic techniques of environmental management using 'market' mechanisms often depend on high levels of information, close monitoring and effective policing. Market solutions are by no means the same as laissez-faire.

- Natural resource accounting provides new criteria for judging a country's economic performance. Nationally, planning and finance ministers will have a new set of targets to aim at. Maximising Net Domestic Product, defined to omit natural capital depletion, will force some attention to be paid to better environmental management.

Internationally, agencies (and eventually banks and private investors) are likely increasingly to assess countries by some measure of their environmental performance, such as the net measure of National Product, or physical satellite accounts. The systematic and equitable use of such measures will depend on removing any bias against natural resource-based economies by developing equivalent measures for long term environmental damage inflicted by industrial development.

- New decision rules for the choice of projects and programmes may need to evolve. For the time being, environmental economics has thrown a life-line to conventional methods of project appraisal by its stress on the possibility of valuing environmental effects (and treating them on a par with traditional costs and benefits) and retaining a conventional discount rate. The first is subject to practical trial, while the second is hotly debated. If the scope for valuation proves to be small, and if arguments against conventional discounting win the day, appraisal will have to accommodate other techniques, and in any case give a greater role to risk analysis.
- There are many other possible implications for the way aid is offered and used. All countries need assistance in understanding the implications of global environmental changes for their future development, especially those close to sea level. Donors can help with inventories of natural resources, by planning aid strategies to include compensatory projects, promoting research into safe minimum standards for sensitive environments, and eventually by including environmental conditionality in policy-related aid. There may be ways of enlisting private companies in the transfer of environmental technologies, e.g. by long term contracts involving technical help and supervision.
- Discussions on the appropriate international measures to cope with global warming etc. have included a variety of 'economistic' solutions. Some of these aim to tackle control, compensation and aid simultaneously. The elementary ideas of international externalities, the 'Polluter Pays' principle, the notion of gainers having the surplus from which to compensate losers, and the concept of 'existence values' (held by people not directly involved in exploitation — e.g. in the Amazon forest) provide the rationale for international compensation schemes.

The common element of many of these ideas is economic efficiency, as well as management and fairness. For example, where one country's emissions are another's acid rain it might be more efficient for the victim to bribe its neighbours to reduce their emissions than to spend exorbitant sums on further cleaning up its own pollution sources. Likewise for the pollution of international rivers vital for irrigation.

A tradeable carbon emissions quota based on adult population size is another interesting suggestion.[4] Holders could either use or sell their quotas, and countries with insufficient quotas would buy licences from those with quotas to spare. A system of international flows would emerge, possibly not unlike aid in their pattern but with a different rationale.

There are likely to be many more proposals for coping with international environmental problems. Many of them will be inspired by principles brought to public notice by EE. EE has been influential in turning ideas thought outlandish a few years ago into topics for serious discussion in policy circles. As Chris Patten, UK Environment Secretary and former Aid Minister, asserted before a London conference on Latin America,[5] 'The environment is our new aid imperative, replacing perhaps some of the ideological and strategic arguments for aid which were often used to justify it in the Cold War years'.

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