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OECD ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT

Assessing Environmental Policies

Introduction

Are policies to protect the environment giving value for money – and how can we know? Recognising that policy decisions should be based on a comparison of costs and benefits, a number of OECD governments have introduced legal provisions requiring a cost-benefit analysis (CBA) of new environmental regulations or measures.

Cost-benefit analysis involves comparing the costs and benefits of a given policy in a common unit of measurement – namely, money. The costs of environmental protection are, at least in principle, fairly easy to measure in monetary terms. They include the regulatory costs of implementing and enforcing the measure on the government budget, as well as the compliance costs borne by firms and households in order to meet regulatory standards, environmental taxes, tradable permits or other policy measures. However, the benefits of environmental policies are often far harder to calculate for the simple reason that many benefits are not reflected in marketed goods and services.

How can we measure these elements and give them a monetary value? How can we take into account future generations? How can we deal with equity? How can we address issues of uncertainty and irreversibility? Drawing upon leading experts in the field, the OECD has taken stock of these new developments, and assessed the contribution of CBA to efficient decision making. This Policy Brief looks at the outcome of this study and the lessons that can be drawn from it. ■

Observer oecd

What is cost-benefit analysis?

Cost-benefit analysis basically compares the increases in human wellbeing (benefits) and the reductions in social welfare (costs) of a given action or policy. So for a project or policy to qualify on cost-benefit grounds, its social benefits must exceed its social costs. Cost-benefit analysis is usually carried out for specific projects, but the scope could readily be extended to wider limits, for example, to assess policies to combat climate change.

Conducting a well-executed cost-benefit analysis requires the analyst to follow a logical sequence of steps. The first stage involves asking a number of questions: what policy or project is being evaluated? What alternatives are there?

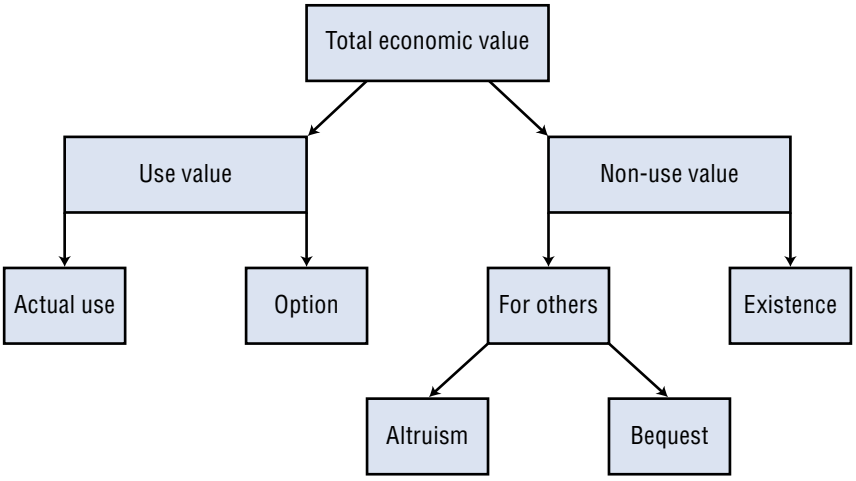
The analyst must also determine whose costs and benefits to count and over what time period.

Several governments already require CBA of new environmental regulations or measures. For example, In Canada all regulatory proposals with an estimated present value of cost greater than $50 million must be subject to a CBA. In the United States, regulations with annual costs in excess of $100 million (or with other significant impacts such as employment effects, competition effects, etc.) require a CBA (OECD 2004a.) In the European Union, any EU-financed project must be accompanied by a CBA (OECD 2004b). ■

What are environmental benefits?

There are different types of environmental benefits, but the overall economic value of any environmental asset is equal to its "total economic value" (TEV). This includes the "use value" and the "non-use value" of environmental assets. The use value refers to the direct benefits of actually using an environmental asset, such as water withdrawn for irrigation, harvesting of plants with medicinal value, and visits to a natural park. It also includes planned and possible future benefits of using the

Figure.
TOTAL ECONOMIC VALUE



resource. The latter is known as the "option value". Non-use values refer to environmental assets that people will *not* actually use themselves at any point, but may want to preserve for others (*altruism*), for future generations (*bequest values*), or simply because they attach a value to its very existence (*existence values*).

When evaluating any project or policy in which an environmental asset is destroyed or depreciated, the TEV of the lost asset needs to be determined. And any positive change in the TEV of an environmental asset arising out of a project or policy would need to be counted as a benefit. ■

How to value environmental benefits?

Putting a monetary value on environmental assets is particularly challenging, not least because the benefits frequently do not have a market value and are not tangible – how can you measure the value of a beautiful view, or a less noisy street? Two broad approaches can be applied to determine the value which people place on environmental assets: *revealed preferences* and *stated preferences*.

When relying upon *revealed preferences* in the valuation exercise, economists use market information and behaviour related to traded goods in order to infer values of non-market goods. In the case of *hedonic pricing*, the specific value associated with an intangible asset is embedded in prices for marketed assets, and these can be "teased out" by unbundling the values attached to different characteristics of the asset. For instance, a house next to a busy street which is exposed to high noise levels would lose part of its value compared to similar houses further from the highway. This price difference can be used to determine the "cost of noise".

Alternatively, *travel cost methods* can be used to determine how much time and money people are willing to spend to gain access to an intangible "good" such as a protected wildlife area. *Averting behaviour* and *defensive expenditure* methods are similar, assessing how much time and money people are willing to spend to avoid negative intangible impacts. If people buy bottled water to avoid exposure to water pollutants, or double-glazing to reduce traffic noise, they reveal the value they place on avoiding accidents and noise. *Cost of illness* methods can be used to measure impacts on human health of air or water pollution. The value of increased medical costs in treating associated illnesses, as well as lost wages and profits because people are unfit to work are determined.

It is not always possible to identify a market for a good which is associated in some way with the environmental asset which is to be valued. In such cases, there are no prices which can be used to 'reveal' values attached to the asset. A hypothetical market has to be created in which people are asked to indicate how much they would be willing to pay to preserve an environmental asset. *Contingent valuation* is the most common stated preference method applied. By means of an appropriately designed questionnaire, the respondent is given information on the environmental

good or bad, the institutional and policy context in which it is to be preserved or mitigated, and the means by which this will be financed.

While contingent valuation methods are often applied to environmental assets which provide a distinct and discrete benefit, *choice modelling* is designed to help evaluate intangible "goods" and "bads" when the environmental problem being valued is multidimensional. An example would be investments which reduce storm-water overflow, with benefits in terms of reduced fish deaths and fewer adverse health impacts. On the basis of choices made it is possible to derive values associated with different dimensions of the environmental asset. ■

How to deal with long-run impacts?

Both the costs and benefits of project implementation or a policy intervention occur over time, and sometimes over very long horizons. Carbon dioxide emitted today has an atmospheric lifetime of over 200 years, air pollutants to which people are exposed today can generate adverse health impacts in 50-60 years, over-exploited fish stocks can take decades to recover, and hazardous nuclear waste can take millennia to become harmless. Similarly, some policy interventions impose costs on future generations which can be considerable.

It is, therefore, important to be able compare costs and benefits borne today and far into the future. Costs and benefits borne today have a higher value than those borne in the future, for reasons of both pure time preference, as well as the opportunity cost of capital. As such, CBA requires the discounting of the future stream of costs and benefits. And the discount rate selected can have significant implications for the balance of costs and benefits – for example, with a discount rate of 4%, a benefit (or cost) borne 50 years into the future will only be 14% of its value should it arise today.

Many find the practice of discounting morally unacceptable as it seems to suggest that future costs or benefits are less important than present ones, and is therefore unfair to future generations. Thus, current activities imposing large costs on future generations may appear insignificant in a cost-benefit analysis. Similarly, actions whose costs are borne now, but whose benefits will only be seen by future generations may not be undertaken.

Recent advances in economic theory have begun to weaken the apparent "tyranny of discounting". Due to uncertainty about future interest rates and future economic conditions, the appropriate discount rate to apply may vary over the life of the project or policy. Indeed, in the face of such uncertainty, a declining rate should be applied through time. Interestingly, a minority of OECD countries have adopted time-varying discount rates in their project appraisal guidelines. ■

How to value uncertain impacts?

The exact costs and benefits of a policy at any point in time are never known with certainty, and this uncertainty must also be taken into account in CBAs. Uncertainty is distinct from risk, in which probabilities of different outcomes may be known. In such cases, different weights can be attached to different outcomes, depending upon the probability of their arising. For instance, if probabilities can be attached to the likelihood of an accident arising at a waste management facility, the associated costs can be weighted according to such probabilities.

However, in cases where probabilities can not be reasonably attached to different outcomes, there is no means by which to weight different outcomes. In such cases, sensitivity analysis is required, in which different values are used for key parameters. For instance, there is considerable uncertainty about some of the epidemiological impacts of exposure to certain air pollutants, and reducing this to probabilities would be inappropriate. Sensitivity analysis avoids giving a misleading impression of accuracy about the values obtained.

Particular concerns arise when losses are uncertain, but potentially irreversible. Examples in the environmental sphere would include species extinction, melting of the Greenland ice cap, and loss of primary forest cover. Valuing such losses is an area of growing importance to policymakers. The combination of uncertainty and irreversibility can be addressed through the notion of *quasi option value*, which reflects the value of gaining new information before committing to an irreversible policy action. ■

How to value health impacts?

Some of the most significant benefits of environmental policies relate to human health. For instance, a recent review of European studies found that health benefits account for a minimum of one-third and a maximum of 100% of overall benefits of pollution control. To a great extent, health impacts of environmental policies play a preponderant role in determining whether the benefits of a given policy outweigh the costs.

Most valuation studies of human health involve immediate risk, such as an accident. However, valuing health impacts arising out of environmental degradation can be more complicated because the risks can be latent or cumulative. Air pollution may not have an immediate effect on a healthy 30-year-old, but if pollution levels are the same when he reaches 60, his weaker lungs may be unable to cope. Asbestos exposure during your 20s may not manifest itself as asbestosis until you are 40 or 50. In addition, respondents may have difficulty understanding the relatively small changes in health risk associated with environmental pressures. This is less important for non-fatal ill-health arising out of environmental degradation, and there is a growing body of evidence in this area on issues such as the links between air pollution and respiratory diseases.

Epidemiological evidence indicates that children are often more highly exposed and more susceptible to environment-related health impacts. However, applying cost-benefit analysis to health risks for children is particularly problematic since the assumptions required to estimate willingness to pay do not seem to hold. Children do not have command over financial resources and may not understand the trade-offs involved. However, we can instead ask parents to value risks on their children's behalf. Such work is fairly recent and there are numerous methodological complications, but suggests that adults may be willing to pay more to alleviate environmentally-related health risks to children than to themselves. ■

Are costs and benefits shared fairly?

In CBA, a policy intervention is deemed to be economically efficient if the benefits from its introduction exceed the costs, irrespective of the identity of the "winners" and "losers". Even if some people are made worse off, in theory the "winners" could compensate the "losers" for their losses and still end up better off themselves. The alternative, demanding that all people affected were made better off directly by each and every policy intervention, would be a recipe for policy paralysis.

However, in the absence of explicit compensation mechanisms, the project or policy is unlikely to be politically acceptable when costs and benefits are distributed very unevenly. For instance, if a water treatment plant is set up at the poorest end of town, one might argue that while all residents benefit from cleaner water, those living near the plant are exposed to the unsightly facility. Housing values near the plant will likely fall, so that ultimately the town's poorest residents will bear the cost burden disproportionately.

Thus, assessing the distributional impacts of different policy interventions requires an understanding of the distribution of project costs and benefits. These data could then be used to ask what weight or distributional adjustment would need to be placed on the net benefits (net costs) of a social group of interest for a given project proposal to pass (fail) a distributional cost-benefit test. Explicit weights reflecting judgement about society's preferences towards distributional concerns can be assigned and net benefits re-estimated on this basis.

Higher weights may be given to the benefits and costs accruing to disadvantaged or low income groups, as the welfare implications of a small monetary gain or loss may be thought to be higher for the low income group than for higher income groups. A more overtly "political" justification for such an approach can be gleaned from the behaviour of democratic and accountable governments with regard to public policies in which distributional concerns are a significant concern – *i.e.* prevailing income tax schedules.

This weighting will affect whether or not a particular policy or project passes the CBA test. However, some groups may still be made worse off,

and in some cases significantly. The key question is whether to compensate them, and if so how. While this is a broad topic, there is one key insight from economic theory which should be always be borne in mind – if compensation is to be provided, it is better to do so through other policy levers, and not through adjustments in the environmental policy itself. ■

Why are CBAs not used more widely in policy formulation?

It is difficult to make any hard and fast rules about which specific environmental policies are likely to generate positive net benefits. However, under the usual assumption of rising marginal costs and decreasing marginal benefits of increased levels of environmental protection, the case for the use of CBA becomes even more pressing in areas in which policy measures in OECD countries are becoming increasingly stringent, or where the policies do not target the environmental damages cost-effectively. While CBA's of proposed air pollution policies frequently have positive net benefits, for many existing and proposed policies related to solid waste and water pollution this is less frequently the case.

Cost-benefit analysis is, therefore, a key element in establishing policy priorities. By setting out a theoretically consistent manner in which the costs and benefits of policy interventions can be assessed, CBA provides valuable information for decision-makers. However, while the environmental sphere is perhaps the policy context in which the largest number of CBAs have been undertaken, their role in "informing" policy decisions in OECD countries remains relatively restricted.

Why is this the case? One reason relates to the political process. Clearly, establishing policy priorities cannot be divorced from politics. There are a variety of pressures on governments to introduce policies which are not consistent with social welfare maximisation. It takes an exceptionally far-sighted government to introduce policies whose costs are borne in the present political term, but whose benefits stretch long into the distant future.

More fundamentally, there may be aversion to the notion of determining policy priorities on the basis of individual preferences, a keystone of CBA. It is sometimes argued that political decisions should not be based on such individual preferences. This is not a debate that can be resolved within economics, but it is important to note that there is nothing about the notion of individual preferences which pre-supposes purely self-interested motivations.

Disquiet with respect to the use of "money" in the valuation of some environmental assets may also go some way toward explaining reluctance to fully benefit from the outcomes of CBAs in establishing policy priorities. However, few would argue that meeting all environmental objectives is costless, and the use of the same unit of measurement for both costs and benefits is necessary to reflect the trade-offs involved. Such trade-offs do not disappear if they are left opaque. ■

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For further information

For more information about OECD's work on valuing the environment and the use of cost-benefit analysis, please contact:
Nick Johnstone, tel.: +33 (0) 1 45 24 79 22, e-mail: nick.johnstone@oecd.org or see: *www.oecd.org/env*.

For further reading

OECD (2006), David Pearce, Giles Atkinson and Susana Mourato, **Cost Benefit Analysis and the Environment: Recent Developments** ISBN 978-92-64-01004-8, 314 p., € 50.

OECD (2006), **Economic Valuation of Environmental Risks to Children**, 2006, ISBN 978-92-64-01397-1, 310 p., € 57.

OECD 2006, Ysé Serret and Nick Johnstone (eds.), **The Distributional Effects of Environmental Policy**, and Edward Elgar, ISBN 978-18-45-42315-5, 336 p.

OECD (2004a) **Regulatory Impact Analysis Inventory**, available at *www.oecd.org/regreform*.

OECD (2004b) **Sustainable Development in OECD Countries: Getting the Policies Right**, ISBN 978-92-64-01693-4, 194 p., € 24.

Where to contact us?

OECD HEADQUARTERS
2, rue André-Pascal
75775 PARIS Cedex 16
Tel.: (33) 01 45 24 81 67
Fax: (33) 01 45 24 19 50
E-mail: sales@oecd.org
Internet: *www.oecd.org*

GERMANY
OECD Berlin Centre
Schumannstrasse 10
D-10117 BERLIN
Tel.: (49-30) 288 8353
Fax: (49-30) 288 83545
E-mail:
berlin.contact@oecd.org
Internet:
www.oecd.org/deutschland

JAPAN
OECD Tokyo Centre
Nippon Press Center Bldg
2-2-1 Uchisaiwaicho,
Chiyoda-ku
TOKYO 100-0011
Tel.: (81-3) 5532 0021
Fax: (81-3) 5532 0035
E-mail: center@oecdtokyo.org
Internet: *www.oecdtokyo.org*

MEXICO
OECD Mexico Centre
Av. Presidente Mazaryk 526
Colonia: Polanco
C.P. 11560 MEXICO, D.F.
Tel.: (00.52.55) 9138 6233
Fax: (00.52.55) 5280 0480
E-mail:
mexico.contact@oecd.org
Internet:
www.oecd.org/centrodemexico

UNITED STATES
OECD Washington Center
2001 L Street N.W., Suite 650
WASHINGTON DC. 20036-4922
Tel.: (1-202) 785 6323
Fax: (1-202) 785 0350
E-mail:
washington.contact@oecd.org
Internet: *www.oecdwash.org*
Toll free: (1-800) 456 6323

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