Environmental Valuation in Europe

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Environmental Quality, Health and the Value of Life

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Front cover: Living next to industry – Communities face pollution as a price for jobs and due to low income. Photo: Digital Vision.

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Overview

One of the most basic services provided by the environment is support to life. Changes in environmental quality, such as pollution of water, air or soil, are likely to increase the frequency of diseases, lead to impairment of activities and reduced life expectancy. There are some well-known cases, such as Bophal and Chernobyl, where environmental contamination by chemicals or radioactivity left long-term health impacts for the exposed population. Daily exposure to small doses of pollutants, such as sulphur dioxide (SO_2) or nitrous oxides (NOx), can also provoke long-term adverse effects for large sections of current and future generations. Moreover, in the short term, the occurrence of episodic high concentrations of air pollution has been firmly linked with increases in the frequency of several types of diseases, such as bronchitis and asthma, with potentially large social and private costs.

The improvement of environmental quality, with the expectation of large potential benefits in terms of human health and life expectancy, is becoming a growing concern in many European countries.

While air pollution is an important case, used for illustration throughout this policy brief, other types of ambient pollution, such as groundwater pollution or soil and plant contamination, also significantly affect human health, generating potentially important economic losses. The improvement of environmental quality, with the expectation of large potential benefits in terms of health and life expectancy, is a growing concern in many European countries. While countries try to contain the growth of public health expenditures, policies designed to improve environmental quality are attractive complements for standard public health policies.

A central question is: how should these health impacts be incorporated into public policy? Most economists argue for conversion into 'monetary equivalents'. This allows for calibrating policy instruments in order to equate marginal costs and marginal benefits (including health benefits) from pollution abatement. Thus, cost-benefit analysis (CBA) reduces all complexity into one unique dimension (see Policy Research Brief 2). While this is regarded as a major simplifying advantage, an important debate has been raised about the use of CBA for environmental valuation because of the features of environmental assets, e.g. uniqueness, absence of close substitutes and uncertainty about future use. Incommensurable values, such as those relating to human health and life, cannot be captured by methodologies based on trade-offs such as CBA (see Policy Research Brief 4). In addition, there are passive use values attached to environmental changes which, unlike use values, can only be assessed employing controversial methods, such as contingent valuation (see Policy Research Brief 1).

Box 1: Respiratory Illness

"No matter what the source, air pollution generally affects children more severely than adults. Already, air pollution in [the] developing world is responsible for at least 50 million cases of chronic cough in those under 14 (World Bank, 1992). Respiratory disease is now the leading cause of death in children worldwide (WHO, 1997). As urbanization expands, more children will be exposed to hazardous pollutants in the air, driving the proportion with serious respiratory illness upward."

Source: World Resources Institute, Environmental Health Notes, September 1999.

What does it mean to convert into 'cash equivalents' reduced life years or increased chronic morbidity? The technical debate about whether monetary equivalents are an appropriate measure is irrelevant if the viewpoint is taken that health or life cannot be valued. Such a position may be supported on the basis that rights to health and life are fundamental human rights. If environmental quality is a necessary condition for maintaining these rights, it is therefore itself a fundamental human right. Bargaining these rights in the market place, as CBA does, is then unacceptable. However, people are often both victims and responsible for environmental degradation and fail to correct their own actions that cause damages to the environment, themselves and their children (see Box 1).

Young children are the more exposed because, for example, of a higher respiratory frequency: a three-year old child breathes on average twice the air compared with an active adult, and therefore inhales many more pollutants than an adult. Several European studies showed that a reduction in the number of days of high episodes of pollution significantly affected the frequency of respiratory illness and cardio-vascular disease (e.g. World Health Organization 1999). Box 2 summarises the health effects for the major air pollutants in cities, and provides information about the origin of these pollutants. In cities with over 9 million inhabitants, emissions are frequently high, e.g. in 1995, Dehli, Bombay and Beijing had particle concentrations 4 times the European standard (80ug/m^3).

Whether monetary valuation can be performed in a meaningful way is the central and overarching question addressed by this policy brief. The next two sections give a critical overview of the different methodologies that have been developed for estimating morbidity (pp. 5–6) and mortality (pp. 7–8) benefits and costs induced by changes in environmental quality. The following section outlines issues in estimating health and mortality benefits taking the example of greenhouse gas emissions reduction (pp. 9–10). Next, two of the major methodological difficulties that limit the use of CBA for assessing changes in health and life expectancy are highlighted: the disparity between willingness to pay and willingness to accept (p. 11), and the role of context for valuation exercises (pp. 12–13); followed by a brief discussion on the formation of preferences (p. 14). This raises ethical issues and the need for a new perspective on monetary valuation (pp. 15–16). A summary and policy recommendations conclude the brief (p. 17).

Valuing Morbidity

Health benefits generated by improved environmental quality are generally divided into two broad categories: reduced morbidity risk and reduced mortality risk. Several methods are employed to convert these into monetary units.

Morbidity is defined as a non-fatal illness characterised by different symptoms. A distinction is made between acute and chronic morbidity. Acute morbidity is a short-term illness, with a well-defined beginning and end, and which lasts generally for a few days. Chronic morbidity is a long-term illness with indefinite duration. In the case of air quality, the effects on acute morbidity are well known, but few studies are available for chronic morbidity. The link between air pollution and acute morbidity can be established on the basis of cross-sectional data whereas evaluating chronic morbidity requires cohort studies over long periods of time.

The costs of air pollution, and more generally of environmental quality degradation, can be detected through several channels: medical expenditures for treating illness; lost wages; averted expenditures and activities to prevent diseases; and disutility of illness and opportunity cost of impaired activities. Pollutants, such as SO_2, CO_2 or particles, affect various health indicators in the short term inducing important costs for the society as a whole (e.g. workdays lost, medical care) as well as hospitalisation/ private costs for individuals (e.g. pain, suffering, lost activity performance). Short-

Box 2: Sources and Health Effects of Major Air Pollutants

Air Pollutant	Acronym	Sources	Health Effects
Nitrogen Oxides	NOx	Automotive exhausts, gas stoves, heaters, burning of fossil fuels	Headache, cough, respiratory infections, thorax constraint, eyes irritation, asthma crisis, increase of bronchus sensitivity
Sulphur Dioxide	SO_2	Burning of fossil fuels, automotive exhausts, refineries	Cough, eye irritation, change in the pulmonary function, asthma, chronic bronchitis, excess of mortality
Ozone	O_3	Secondary pollutant	Eye irritation, cough, headache, corriza, for young people respiratory problems
Particles		Automotive exhausts (diesel engines), burning of fossil fuels, industrial dust	Decrease of the pulmonary function, excess of respiratory mortality, bronchus irritation, bladder cancer, impaired foetus development

term costs of high episodes of pollution are relatively well documented, but there is still considerable uncertainty and ignorance today about chronic morbidity and reduced life expectancy caused by background pollution, and in particular by synergetic effects of multiple pollutants. Several methods are employed for assessing these impacts of changes in the morbidity rate: Cost of Illness; Stated Preference Methods, e.g. Contingent Valuation Method (CVM); and methods based on Averting Behaviour.

Traffic fumes causing background pollution as well as high exposure during rush hour

Photo: Jenny Bates / FoE

The **Cost of Illness**, sometimes called 'real cost', takes into account only the social costs induced by an illness episode. The main advantage is that the data on expenditures is easily accessible. If dose-response functions allow the fraction of each disease attributable to the pollutant to be calculated, then the additional social costs induced by environmental quality degradation can be readily computed. The major criticism is that Cost of Illness lacks a basis in economic theory, because it takes into account only observable costs, i.e. mainly material costs.

Stated Preference to avoid or accept a day of illness (or symptom) can cover all costs induced by an illness, i.e. social and private costs. Since the social costs can be estimated by the Cost of Illness, the stated preference approach is generally used for assessing private cost alone. Social security and insurance systems which cover most of the social costs mean that many respondents fail to include them in their expressed preferences. Therefore, CVM questionnaires generally focus the respondent's attention only on their private cost of illness, by asking their willingness to pay (WTP) for avoiding one symptom day or one day with a disease. As discussed later, willingness to accept (WTA) compensation for suffering reduced health may often be a more appropriate measure.

Methods based on **Averting Behaviour** rely on individuals taking actions to avoid or to mitigate the effects of environmental quality degradation. For example, purchase of a filter for tap water, staying indoors during days of high air pollution or using an air filtering system. Similarly, individuals buy medicines or consult the doctor to mitigate adverse effects. WTP to avoid certain health risks due to pollution is indicated by the expenditures for averting and mitigating effects/activities. The advantage is use of observable actions although they prove difficult to identify in practice because many of them involve joint products. For example, air conditioning both filters and simultaneously cools the air; or a person may stay indoors for a combination of reasons. Furthermore, the method is based on the assumption that the individual or household has a *health production function* and maximises their health status by choosing optimally averting and mitigating inputs. This presupposes that they are capable of making predictions about the effectiveness of their actions and have a good knowledge of the links between environmental quality variables and health status.

Valuing Mortality Risks

Mortality benefits can be measured by several methods, including the gross production approach and WTP for preventing a fatality. In the case of air pollution, mortality prevention generally represents between 70 and 95 per cent of the aggregated health benefits of pollution reduction. However, large disparities in valuations can be attributed to methodological choices.

The idea that people accept trade-offs involving risk of death is not taken by economists to mean that they value life *per se*. Valuation of the risk of death or longevity is then misleadingly expressed as the 'value of life'. What is really valued is the WTA compensation for a small increase or the WTP for a small decrease in the probability of death. The aggregation of individual values over a whole population leads to the definition of the *value of preventing a fatality* or the *value of a statistical death avoided*. People are asked to 'buy' or 'sell' small variations of the probabilities associated with death by various causes.

The three main approaches used for measuring the value of life expectancy are:

- Gross Production
- Willingness to Pay
- Value of Life Year

The **Gross Production/Consumption Loss** approach evaluates the economic loss of a premature death by measuring the loss in income, production or consumption. The evaluation is made without taking into account individual differences in exposure to fatal accidents or air pollution, and the like. The main advantage is simplicity. However, the method has several major drawbacks which seriously limit its use in practice. Gross Production ignores individual aversion to premature death, since only material consequences of a fatality are taken into account. The method implicitly values individuals on the basis of their income, which given income disparity is highly controversial and deemed by many as ethically unacceptable. WTP to avoid a fatality and individual utility variations are also neglected. Finally, this approach requires discounting future consumption and income losses, which raises debates about the discount rate.

Box 3: Monetary Value of Preventing a (Statistical) Fatality

"Suppose that a group of 100,000 people enjoy a safety improvement that reduces the probability of premature death during a forthcoming period by, on average, 1 in 100,000 for each and every member of the group. The expected number of fatalities within the group during the forthcoming period will thereby be reduced by precisely one and the safety improvement is thus described as involving the prevention of one 'statistical' fatality. Now suppose that individuals within this group are, on average, each willing to pay £v for the 1 in 100,000 reduction in the probability of death afforded by the safety improvement. Aggregate willingness to pay will then be given by £v x 100,000. This figure is naturally referred to as the WTP-based value of preventing one statistical fatality (VPF)."

Source: Jones-Lee and Loomes 2000.

The **WTP** approach measures the **Value of Preventing a Statistical Fatality (VPF)**, also called **Value of Statistical Life (VOSL)**. This approach attempts to estimate the demand for an improvement in environmental quality. The idea is to assess individuals' maximum WTP to improve their own security. Thus, the sum of individual WTP indicates how much value is attributed to an improvement in security or to a reduction of environmental impact by the society as a whole (see Box 3). The main advantage of the WTP approach is that it is based on individual preferences. Several disadvantages also exist. WTP is dependent on an individual's income, which means a different distribution of income in the society will lead to a different aggregated value. WTP is also affected by the presence of insurance policies, leading to biased estimations. Furthermore, individuals find estimating their WTP for small variations of risk difficult.

The **Value of Life Year (VOLY)**, is a relatively new approach which is based on a concept derived from VPF. Empirically, most of the VPF measurements are based on the WTP for the reduction in risk of fatal road accidents. Victims of road accidents are typically in the age group 30 to 40 years with a remaining average life expectancy of 35 to 45 years. In contrast, the majority of victims of air pollution are generally much older (between 70 and 80 years) with a remaining life expectancy of about 10 to 15 years. Therefore, VPF values based on road accidents are an inadequate indicator for the monetary valuation of air pollution related fatalities. The VOLY proposes a constant value be attributed to each life year lost due to premature death. Often, this value is chosen so that the sum for the remaining life years, after discounting, equals the total VPF. The VOLY approach relies upon WTP while the monetary valuation of mortality risk is explicitly differentiated according to the age structure of the affected population.

Health and Greenhouse Gas Reduction

Mitigation strategies for greenhouse gas emissions have potentially large indirect effects. Until recently the models designed to predict the effects of greenhouse mitigating strategies failed to account for the indirect effects. Depending on the type of policy mix that is being implemented, indirect effects cover, for example, reduced road traffic congestion, improved ecosystems health and induced technological change. Direct effects correspond essentially to costs (e.g. increase in energy prices, slowdown in economic activity, increased unemployment), while indirect effects are mainly benefits. Among these potential benefits, the more immediate ones are due to the reduction in the frequency of high episodes of pollution in urban areas. Thus, the reduction of CO_2 emissions, for example, simultaneously reduces particulates, SO_2 and NOx emissions. Less immediate benefits are linked to the quality of life for future generations.

Transport choices affect environmental and human health

Photo: Gowan/Greenpeace

Monetary benefits of CO_2 abatement programmes have been estimated in a few regions and large disparities have been observed: in Europe savings in health care expenditure are estimated at $273 per ton of abated CO_2 emission (measured in 1996 US dollars), while in the USA only between $80 and $2 depending on the study. Some of these differences can be explained by demographic and geographic differences, e.g. higher density of population in Europe, however most are due to methodological differences (e.g. models used in Europe are less disaggregated). The methodologies themselves are based on assumptions that are a matter of considerable debate.

The greenhouse gas control literature has also employed estimates of mortality and morbidity. Cline (1992) briefly reviews some of the options. He calculates the value lost in the US from an increased number of deaths under a doubling of CO_2 at $595,000 per person on the basis of lifetime wages. That is, he takes the lifetime earnings as reflecting the amount society is willing to pay the individual and therefore a reflection of their social worth. He also explains the value could be much greater using a value for a statistical life on the basis of the relationship between wages and the risk of death by occupation and industry. The range might then be $2 million to $6 million per person. CVM studies that ask workers how much they would be willing to accept in order to take on more dangerous work result in values between $2 million to $3 million. Lower estimates arise from actual behaviour with regard to hazard avoidance.

Fankhauser (1995) also includes an estimate for mortality and in doing so states the need to elaborate because this is "a potentially controversial issue". He cites estimates from WTP studies in the range from $0.2 million to $16.0 million with an average of $3 million, and then adopts $1.5 million for developed countries. He goes on to note this estimate is dependent upon various contextual factors including income. While no adjustment is made for these other factors one is made for income to give "an arbitrary value of $300,000 for middle-income and $100,000 for low-income countries". The outcome is carefully qualified with emphasis as follows:

> "This of course does *not* mean that the life of, say, a Chinese is worth less than that of a European. It merely reflects the fact that the *willingness to pay* for increased safety (a lower mortality risk) is higher in developed countries." (Fankhauser 1995: 47).

This work informed 'Chapter 6' on economic benefits under the second assessment report by the Intergovernmental Panel on Climate Change (IPCC). The result of using this arbitrary differential of a factor of 15 between high- and low-income countries created considerable political controversy and economic criticisms. A letter petitioning removal of the chapter signed by about forty scientists and academics including some IPCC lead authors, was published in *Nature* (Meyer 1995).

Most notably, the Indian Environment Minister, Kamal Nath, wrote to other heads of delegations at the first meeting of the Conference of the Parties rejecting:

> "… the absurd and discriminatory Global Cost/Benefit Analysis procedures propounded by economists in the work of IPCC WG-III … we unequivocally reject the theory that the monetary value of people's lives around the world is different because the value imputed should be proportional to the disparate income levels of potential victims … it is impossible for us to accept that which is not ethically justifiable, technically accurate or politically conducive to the interests of poor people as well as the global common good." (quoted in Grubb, Vrolijk and Brack 1999: 306).

Nath called for industrially developing countries to veto all discussions under the Framework Convention on Climate Change until the offending calculations were removed from the process. The main defence from the responsible authors has been that distributional concerns should be kept separate from greenhouse gas abatement policy and dealt with as an independent policy issue. This approach is clear in 'Chapter 6' which, following the same approach as found in the IPCC chapter on discounting, separates valuation of a statistical life into 'descriptive' and 'prescriptive'; the authors claiming they perform only empirical investigation under the former approach while the latter would mean employing moral judgement.

WTP/WTA Disparity

According to standard economic theory, there are two possible concepts for defining a monetary equivalent of a change in the risk of a fatality or illness: WTP and WTA. WTP is generally used for evaluating a reduction in the risk of a fatality or illness: it measures the maximum amount of money an individual would spend for that risk reduction. On the other hand, WTA is used for evaluating an increase in the risk of a fatality: it measures the minimum amount of money required by the individual to compensate for that increase in risk. The real justification for using WTP or WTA, depends on the definition of 'property rights' (see Policy Research Brief 4) and more fundamentally of human rights, which are crucial for pricing environmental changes (see Policy Research Brief 6). If an individual is entitled to a reduction in risk, the relevant concept is WTA foregoing the risk reduction, and if there is no entitlement, the WTP to benefit from this change in risk is the relevant concept.

The distinction between the two concepts is important because the two values can differ by several orders of magnitude, WTA generally being considerably larger than WTP. The aggregated values can then lead to opposite public decision with respect to environmental quality. The observed disparity between WTP and WTA is therefore a matter of considerable debate both among economists and psychologists. Most economists believe that in many cases a large disparity between the two measures is inconsistent with economic theory. The main argument raised by economists for recommending WTP questions in CVM is that this is constrained by income, although in fact neither hypothetical WTP nor WTA is constrained in a CVM. Psychologists see the observed disparity as well-founded because gains and losses are perceived differently by individuals. An increase in the risk of a fatality from 3 to 5 per cent has a stronger psychological impact than the reduction of that risk from 5 to 3 per cent. This phenomenon, called 'loss aversion' is observed in many contexts. Most people estimate changes with respect to a reference point, and not in absolute terms. Moreover, in absolute terms, a loss has a stronger psychological impact on well-being than a gain of the same magnitude. In the case of a reduction from 5 to 3 per cent, the individual gains a 2 per cent improvement with respect to their initial position, while in the case of the increase in risk, the individual experiences a loss in well-being as well as a loss in their initial entitlement to a smaller risk. Experimental research has shown that people are more motivated to minimise losses (with respect to a reference point) than to maximise gains. Psychologists argue that large empirical disparities are justified by loss aversion and that WTA should be used in cases where environmental degradation is perceived as a loss by respondents.

Experimental research has shown that people are more motivated to minimise losses (with respect to a reference point) than to maximise gains.

Context-dependent Values

Stated preference methods for valuing risk reductions are preferable in market economies to other methods, such as the gross output approach. However, it has been shown that stated values are highly context-specific, for example WTP to reduce the risk of death from a road accident is much lower than WTP to reduce the same risk due to air pollution. Also people may value differently a 5 per cent reduction in the death probability from cancer compared with a 5 per cent death probability from an airplane crash. There is evidence showing that stated values for preventing a fatal injury are affected by the type of risk (e.g. road accident, train accident, air pollution). WTA for a compulsory increase in risk has been found to be up to 10 times larger than the same voluntary increase in risk. Therefore the stated preference approach is often criticised as being highly context-specific. Expressed preferences for risk reductions are influenced by: voluntariness, ability to control risks, degree of responsibility, equity and uncertainty.

Context and control matter: people may be less prepared to accept an increase in risk of ill health from an incinerator than from traffic pollution

Photo: © Morgan/Greenpeace

Most studies that evaluate mortality benefits or costs due to environmental quality changes, rely on WTP measures for avoiding a fatal road accident. However, if context and control matter, simply transferring values from road accidents to air pollution, for example, might considerably underestimate the value of avoiding a given increase in risk. Many people feel that they have neither control over air pollution nor direct responsibility. Therefore they require larger compensation for accepting a given increase in the risk of a fatality due to air pollution compared with road accidents. This means that current valuation figures should be adjusted to take into account context effects although there is no consensus on this issue (see also Policy Research Brief 8).

Many health economists argue in favour of a unique measure of value for a given marginal risk change, which could be applied to any context. However, people are willing to pay more to avoid certain 'bad deaths', and also have preferences over 'ways

Box 4: Two Approaches for Eliciting the Health Benefits of Improved Air Quality

The two possible designs for assessing the value of reduced symptom(s) days through CVM are illustrated in the figure below. Under the *indirect valuation approach*, the value of reduced symptom days is elicited without providing the information about the origin of the symptom days to the respondent, while in the *direct valuation approach*, such information is provided. If the information about the cause (here air pollution) has an impact, the question about the relevant design must be raised.

Indirect evaluation

AIR QUALITY ⇒ SYMPTOMS ⇒ WTP/WTA

Direct evaluation

AIR QUALITY ⇒ SYMPTOMS ⇒ WTP/WTA

to die', trying to avoid particularly dreaded, involuntary, inequitably distributed and uncontrollable deaths. From an empirical point of view this opens up a debate about the 'correct' measure of value: why should estimates of values for risking death in road accidents be taken as a reference instead of values for risking death in a plane crash or after toxic exposure? A similar question arises with respect to morbidity. Many valuation studies that link air pollution to health indicators are based on CVM aimed to elicit the WTP for reduced symptom days. If context affects WTP, should the origin of these symptom days be provided by the questionnaire (see Box 4)?

Lack of context means a respondent implicitly relies on their own judgement and evaluates a different object from the next respondent. A more detailed description of the relevant context would require a specific study of almost each health effect due to environmental quality, since causes as well as health consequences are highly specific to the local context. While such detailed studies might be deemed inpractical, because of limited resources and time, several studies could be required in order to assess the value for health and mortality risk in several reference contexts that can serve as baselines for future studies (see also Policy Research Brief 8).

Stated *versus* Constructed Preferences

The difficulties raised by context effects and the choice of the appropriate value indicator for CBA, leads to questioning the postulates underlying CBA. In this respect, one of the most fundamental assumption of CBA is that well-defined preferences exist. This means that people are always able to compare two choice options, independently of other available choice options, and to express the same preference whatever the response-mode. For example, if they are asked to choose between two health improvement policy programmes and they choose option A instead of option B, this implies they place a higher value on option A. Furthermore, their preference between options A and B neither depends on the way these options are framed nor on the set of other options which are available.

However, evidence from experimental research on stated preference methods strongly rejects these assumptions. Stated WTP and WTA are strongly influenced by question framing, response-modes and available choice options, while loss-aversion is a widespread trait of human behaviour. The increasing role of advertising and marketing not only reveals the growing informational needs in market-based economies, but also the possibility to manipulate consumer values. Knowing that a loss can be 'framed' as a gain, and *vice versa*, by merely changing the reference point means that there is a large range of possible manipulations of expressed values. The question is no longer what is the 'correct' value that should be taken into account, but more fundamentally whether a 'true value' really exists?

The standard economic view is that well-defined preferences exist, which means that the analyst can design a suitable methodology to observe them. But what is the purpose of the elicitation of preferences if the assessment methodology is simultaneously a process through which preferences are constructed? What method of construction should be recommended? What are the relevant criteria to select such a method?

Clearly, the answer to such questions cannot be based on purely economic justifications. One needs to take into account values that are usually considered as external to the economic domain, such as ethical values. The assessment of individual values must be focused towards the direction of some 'meta-value' – defined at another level than that of basic preferences for material goods. What is really at stake here is designing preferences on the basis of some reference principles. One such reference point, as far as health and life are considered, would be ethical values on which individuals agree.

Ethical Issues

The standard economic practice to use monetary equivalents to assess the value of a change in the risk to life is based on the assumption that most individuals make trade-offs in their everyday life between small changes in their risk of a fatality and material advantages or money. Such trade-offs implicitly reveal their WTP for changes in mortality risks. If this interpretation is correct, it means that life expectancy can be treated as an ordinary consumer good and be traded against other goods. This implies that life expectancy is not placed at a higher level in the hierarchy of 'human desires' than consumption – in contrast to what lexicographic preferences would predict (see Policy Research Brief 4). Some evidence of such trade-offs can be found in the labour market where people accept more dangerous jobs in exchange for higher wages. People also prefer a riskier car trip to the safer train trip, because they save time and avoid discomfort. If monetary valuation of changes in mortality probabilities can be justified at all, there are some serious ethical problems that are raised by current practices.

What is really being traded? From an *ex ante* perspective, people pay for reducing slightly the probability of being killed in a road accident. There is an implicit assumption that nobody knows who is going to be killed. At the time of the accident, the person being killed would be willing to pay an infinite amount of money to avoid dying, while those who are sure to be saved would pay very little to save someone else's life. Furthermore, in assuming that people are making implicit trade-offs, it is also assumed that they know the probabilities, or have some subjective assessment for them, and that these probabilities are beyond their own control. Public policy based upon monetary value of morbidity and mortality must face the characterisation of risk, health and death that this implies.

Greater innovation in the way value issues are conceptualised is required so that public policy can address ethical concerns. Compensation need not be in monetary terms but in provisions of bettering one's health, i.e. free holidays at the sea, medicine for improving one's immune system, provision for special clinics and scientific research. Such approaches make sure that health damages, even if unavoidable, remain independent of consumer goods. Thus, air polluters could join in anti-smoking campaigns, invest in public transport, and take other actions to improve the general health level.

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Another problem is due to income distribution. Monetary values are set within the context of (life-time) income, so that the distribution of income strongly affects aggregate CBA calculations. Aggregate money values will probably be larger in a society where income is more equally distributed, than in a society of the same population size, where 90 per cent of the income goes to 1 per cent of the population. Moreover, there are ethically unjustifiable disparities in reducing mortality probabilities because they occur in rich as opposed to poor regions. This type of problem shows how the Kaldor-Hick potential compensation test proves inadequate and fails to provide any guidance as to the best policy option. There are no shortcuts around issues of distribution and compensation.

Ethical issues are also often linked to human rights. A common social norm is that everyone has a right to a healthy environment, especially if it is difficult or impossible to leave a contaminated region (see Policy Research Brief 6). The negative health effects due to air, water or soil contamination conflict with such a right, and require compensation. In this respect, WTA should be prescribed as a measure of the induced damage in preference to WTP. In reality, cases may be more complex. Either it is easier to avoid polluted regions – even if still burdensome – or victims are in part responsible for the pollution. In the first case there is still a conflict with a human right, even if a less serious one. In the second case one perhaps has forfeited the right, or if not, one is standing on both sides, demanding compensation for an activity partially of one's own making. Being among the polluters may neutralise the invasion into one's rights as a victim of pollution.

There are three further collectives, whose rights to high environmental quality raises ethical concerns. First, present-day children normally are not in the position to leave the polluted region. Even if they could be included in economic evaluations of their reduced life expectancy, they are normally judged to lack a competent idea of what it means to live a full life. In sum, children cannot be compensated by invasion into their rights for a healthy environment. Second, future generations cannot be asked to accept a degraded and less healthy environment. Rights to have such an environment seem their best protection. Third, non-human species, ecosystems and the environment itself must be considered. Thus, the idea of degrading and destroying habitats because we as humans can move on somewhere else has ethical implications.

More general issues on valuation and ethics can be found in Policy Research Brief 4.

Summary & Recommendations

Environmental quality has potentially strong impacts on health and mortality risks. These should be systematically taken into account in the evaluation of public policies which affect environmental quality. The design of environmental policies should consider the induced health benefits as complementary to public health policies.

- Stated preference approaches (e.g. CVM) are preferable to other methods, both for morbidity valuation and mortality valuation, because they cover a wider range of benefits and costs of a change in morbidity or mortality risks due to environmental quality changes.
- There is a strong need for studies looking at long-term damages and chronic effects of environmental quality changes on health. Current valuation studies mainly focus on short-term effects because of the lack of epidemiological studies about long-term effects. Long-term effects might be much larger than short-term effects, even after discounting.
- Health and mortality benefits are major benefits from greenhouse gas mitigating strategies. Current practices ignore these benefits, overemphasising the cost of CO_2 abatement. How these benefits are to be taken into account is highly controversial, raising ethical issues in valuation.
- When health impacts of environmental quality degradation are considered, and when the victims are not themselves the polluters, valuation studies should take WTA as the relevant measure. The fact that people value gains and losses differently with respect to a reference point should be addressed by valuation studies, since such an attitude is not a cognitive illusion.
- Context matters for WTP and WTA measures of morbidity and mortality valuations. People are willing to pay more to avoid increases in mortality risk when death is uncontrollable, dreadful or involuntary. Therefore, context effects should be accounted for in morbidity and mortality valuation studies in which health effects are due to changes in environmental quality. There is a need to evaluate VPF for other causes than road accidents, because, for example, dying in a road accident is not perceived as equivalent to dying from exposure to air pollution.
- Individual values are to a large extent the expression of a social construction of preferences. Variables such as context, methodological choices and the framing of options affect the expressed values.
- Explicit reference points, based on ethical considerations, should be taken into account in valuation exercises of public goods. Environmental degradation causing increased morbidity and mortality risks raises concerns over protection of the innocent and silent voices, e.g. children, future generations, non-human species. Compensation for harm and inequitable distribution of health impacts on the poor bring ethical considerations to the fore. There are no shortcuts for avoiding these issues.

References & Further Reading

Burtraw, D., A. Krupnick, K. Palmer, A. Paul, M. Toman and K. Bloyd (1999) 'Ancillary benefits and reduced air pollution in the US from moderate greenhouse gas mitigation policies', Resources for the Future, *Discussion Paper* 99-51.

Cline, W.R. (1992) *Global Warming: The Benefits of Emission Abatement*. Paris: OECD.

Cropper, M., S. Aydede and P. Portney (1994) 'Preferences for life saving programs: how the public discounts time and age', *Journal of Risk and Uncertainty* 8: 243–265.

Dickie, M. (2001) 'Environmental toxicology and health risk assessment in the United States'. In C.L. Spash and S. McNally (eds) *Managing Pollution: Economic Valuation and Environmental Toxicology*. Cheltenham: Edward Elgar, pp. 30–54.

Fankhauser, S. (1995) *Valuing Climate Change: The Economics of the Greenhouse*. London: Earthscan.

Gregory, R., S. Lichtenstein and P. Slovic (1993) 'Valuing environmental resources: a constructive approach', *Journal of Risk and Uncertainty* 7: 177–197.

Grubb, M., C. Vrolijk and D. Brack (1999) *The Kyoto Protocol: A Guide and Assessment*. London: Earthscan and Royal Institute of International Affairs.

Johansson, P.O. (1995) *Evaluating Health Risks. An Economic Approach*, Cambridge: Cambridge University Press.

Jones-Lee, M. (1976) *The Value of Life: An Economic Analysis*, London: Martin Robertson.

Jones-Lee, M. and G. Loomes (2000) 'The monetary valuation of safety and its role in the appraisal of proposed air pollution abatement programmes', *Paper presented at the EVE workshop on 'Health and Value of Life'*, Strasbourg, October 2000.

Knetsch, J. (2000) 'Environmental valuation and standard theory: behavioural findings, context dependence and implications'. In T. Tietenberg and H. Folmer (eds) *The International Yearbook of Environmental and Resource Economics 2000/2001: A Survey of Current Issues*, Cheltenham: Edward Elgar, pp. 267–299.

Meyer, A. (1995) 'Economics of climate change', *Nature* 378 (30 November): 433.

The World Bank (1992) *World Development Report: Development and the Environment*, New York: Oxford University Press.

Viscusi, K. (1992) *Fatal Tradeoffs. Public & Private Responsibilities for Risks*, New York: Oxford University Press.

World Health Organization (WHO) (1997) *Health and Environment in Sustainable Development: Five Years after the Summit*, Geneva: World Health Organization.

Sommer, H., R. Seethaler, O. Chanel, M. Herry, S. Masson, J.-C. Vergnaud (1999) *Health Costs due to Road Traffic-related Air Pollution: An Impact Assessment Project of Austria, France and Switzerland* (Economic Evaluation). Prepared for the WHO Ministerial Conference on Environment and Health, London, June 1999. Bern: Federal Department of Environment, Transport, Energy and Communications.

World Resources Institute (1999) 'Urban air pollution risks to children: a global environmental health indicator', *Environmental Health Notes*, September 1999.

EVE Concerted Action

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Concerted Action on Environmental Valuation in Europe (EVE)

This policy briefing series communicates the findings from nine workshops and three plenary meetings under the EVE programme. These showed the diversity of research currently being undertaken in the area of environmental values and their policy expression. The type of information relevant to the decision process extends from ecological functioning to moral values. Thus a range of approaches to environmental valuation, from ecology to economics to philosophy were presented.

EVE was a 30 month project which started in June 1998 funded by the European Commission, Directorate General XII within Area 4, Human Dimensions, of the Environment and Climate RTD programme, Contract No. ENV4–CT97–0558.

The project was co-ordinated by Clive L. Spash and managed by Claudia Carter, Cambridge Research for the Environment (CRE) in the Department of Land Economy, University of Cambridge. The following research institutes were partners in the concerted action:

Bureau d'Economie Théorique et Appliquée (BETA), University Louis Pasteur, Strasbourg, France
Cambridge Research for the Environment, Department of Land Economy, University of Cambridge, UK
Centre for Human Ecology and Environmental Sciences, University of Geneva, Switzerland
Centre d'Economie et d'Ethique pour l'Environnement et le Développement (C3ED), University of Versailles Saint-Quentin-en-Yvelines, France
Centre for Social and Economic Research on the Global Environment (CSERGE), University of East Anglia, Norwich, UK
Department of Economics and Economic History, Autonomous University of Barcelona, Spain
Department of Economics and Social Sciences, Agricultural University of Norway, Åas, Norway
Department of Environmental Economics and Management, University of York, UK
Department of Philosophy, Lancaster University, UK
Department of Rural Development Studies, Swedish University of Agricultural Sciences, Uppsala, Sweden
Department of Applied Economics, University of Laguna, Tenerife, Canary Islands, Spain
Environmental Economic Accounting Section, Federal Statistical Office, Wiesbaden, Germany
Ethics Centre, University of Zurich, Switzerland
Fondazione Eni Enrico Mattei (FEEM), Milan, Italy
Istituto di Sociologia Internazionale di Gorizia (ISIG), Gorizia, Italy

The purpose of this concerted action was to analyse effective methods for expressing the values associated with environmental goods and services, ecosystem functions and natural capital, with a view to the achievement of the goals summarised in the concept of sustainability. The appropriate role of decision-makers and citizens in environmental policy-forming became a central focus in the debate over how different values should be expressed.

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