

Monetary Valuation of Environmental Damages

Brigitte Desaignes

Université de Paris 1 - Panthéon-Sorbonne

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Which damages?

Quantified by ExternE so far:

- Morbidity and Mortality
- Loss of agricultural crops
- Damage to buildings and materials
- Global warming
- noise

In future phases of ExternE:

- Energy supply security (have preliminary estimates, but not yet used)
- Acidification and eutrophication
- Biodiversity
- Recreational activities

How to value?

Market goods (loss of crops, cleaning cost of buildings, ...):
use **Market prices**

Non-market goods (pain and suffering, noise, loss of biodiversity, ...):
WTP = willingness-to-pay to avoid the loss

Possible methods

- 1) **Hedonic prices:** e.g. higher rent or house prices paid by people to live in more pleasant areas (cleaner air, less noise, ...)
- 2) **Travel cost:** expenditures to visit a recreation area reflect the perceived value
- 3) **Contingent valuation:** ask people how much there are willing to pay to improve their well being (e.g. reduced morbidity)

Hedonic prices and travel cost only suitable for certain types of damage.
Contingent valuation suitable for all types of damage, but problematic
(do people give realistic answers for a hypothetical question about a good they are not used to paying for???)

Mortality due to air pollution

Very different from **accidents**, on which VSL (“value of statistical life”) is based, because typical loss 30 to 40 years,

by contrast to **air pollution** where loss is a few days to ten years (population average gain about 5 months for 50% reduction of ambient pollution)

For **air pollution** one needs **value of a life year (VOLY)**.

One also needs value for **cancers**

Note: value of life is unlimited, but $VSL = WTP$ to avoid an anonymous premature death

Current valuation practice

DG Environment workshop on valuation of mortality [November 2000]
recommended interim values:

For air pollution mortality of adults a **VSL** ~ **1 M€** (range 0.65 to 2.5 M€), obtained by starting with 1.5 M€ for transport fatalities and adjusting it for age;

For **fatal cancers** **1.5 M€** (range 1.0 to 3.8 M€).

Nothing for infant mortality

No **VOLY** (*value of a life year*)

ExternE before 2004 calculated **VOLY** ~ **100,000 €** by assuming that $VSL = 3.4M€ = \text{sum of discounted annual values over 30 to 40 years (loss in typical accident)}$

ExternE 2004: direct determination of **VOLY** by contingent valuation,
result **VOLY = 50,000 €**

Studies to Determine VOLY for Air Pollution

New research area, so far only 3 studies (all based on contingent valuation):

ExternE 2004:

Study in France, Italy and UK

using questionnaire developed by Krupnick et al
(air pollution not mentioned)

Result: VOLY = 50,000 €

Soguel & van Griethuysen 2000

Questionnaire based on health impacts of a proposed waste incinerator for
Lausanne

Result: VOLY = 34,000 €

Chilton et al 2004 for DEFRA, UK

Questionnaire based on air pollution

Result: (depends on question asked, but higher value more plausible)

VOLY = 10,000 €(if question asked about 6 months in good health)

15,000 €(if question asked about 3 months in good health)

42,000 €(if question asked about 1 monthsin good health)

The Questionnaire of Krupnick et al

Intended for valuation of air pollution (by asking only older people, about risk reduction appropriate for air pollution)

but air pollution is not mentioned

Computerized questionnaire, closed question

WTP for a **health product that will reduce risk of dying** by 1 in 1000 and by 5 in 1000, respectively, over a 10 year period; both the coming 10 years and the period from age 70 to 80 are considered.

Only people over 40 are asked

Risks are calculated by computer for each individual as function of sex and age, to ask:

“are you willing to pay x € for medication or treatment that will reduce your risk of dying during the next 10 years from 18 to 17/1000” for the example of 1/1000 risk reduction for a 40 year old woman

or *“... from 502 to 501/1000”* for a 70 year old man.

Variants of the questionnaire: sensitivity of responses to the elicitation question

Questionnaire of Krupnick et al is formulated in terms of risk of dying.

In France several **variants have been tested:**

Public good, open question, life expectancy gain

Results vary by factor ~2 (lower values for LE gain)

Direct formulation in terms of gain of life expectancy (LE) would be better

In France variants of the questionnaire in terms of LE have been tested:

individual is told his/her gain in LE for risk reduction 5/1000 (calculated by the computer in response to age and gender)

with debriefing to learn how the respondents interpret the question

Result: VOLY somewhat smaller than the indirect determination from risk of dying

But further work is needed to improve the questionnaire to make sure the respondents understand the issues

In the new phase of ExterneE (the NEEDS project 2004-2008) a **new questionnaire** is being developed, formulated **in terms of LE**

It will be applied in about ten countries of the EU (include. new member states)

Comparison of VOLY results: ExternE and other data

Study	VOLY [€/life year]	Comments
ExternE [1998]	~ 100,000 €	Calculated from VSL by assuming that VSL = sum of discounted annual VOLYs
ExternE [2004]	~ 50,000 €	Contingent valuation , using questionnaire of Krupnick et al [2002]
Cost of life saving interventions in medicine and fatal injury reduction		
Tengs et al [1995]	< 40,000 €	in USA (very comprehensive study by Harvard University)
Ramsberg and Sjöberg [1997]	< 20,000 €	in Sweden

Morbidity: European comparison

Netherlands, Norway, Portugal, Norway and United Kingdom

WTP (£ 1998)

	Netherlands	Norway	Portugal	Norway	UK	France
Eye irritation	40	31	70	53	14	14
Cough	28	36	28	39	20	20
Bed	71	119	88	113	83	29
Emergency room	128	239	185	146	131	36
Hospital	283	301	300	426	164	60

Ready R.C., S. Navrud, B. Day, W.R. Dubourg, F. Machado, S. Mourato, F. Spaninks, M.X. Vazquez Rodriquez, 1999 b, "Benefit transfer in Europe : are values consistent across countries?", paper presented at EVE workshop *Benefits transfer*, Lillehammar, Nov.

Monetary values of ExternE [2004]

Health impact (PM10, NOx, SO2, VOC)	€/case	% of cost
ADULTS mortality VOLY	50,000	66.8%
ADULTS Chronic bronchitis	169,000	22.7%
ADULTS Restricted activity days (RAD)	110	7.5%
ASTHMATICS adults Bronchodilator usage	40	0.6%
CHILDREN Chronic cough	225	0.3%
ENTIRE POPULATION Cerebrovascular hospital admissions	16,730	0.3%
ASTHMATICS adults Cough	45	1.4%
ELDERLY 65+ Congestive heart failure	3,260	0.0%
ASTHMATIC CHILDREN Bronchodilator usage	40	0.1%
ENTIRE POPULATION Respiratory hospital admissions	4,320	0.0%
ASTHMATIC ADULTS Lower respiratory symptoms	8	0.0%
ASTHMATIC CHILDREN Cough	45	0.1%
ASTHMATIC CHILDREN Lower respiratory symptoms	8	0.0%
<i>also</i>		
Cancers (As, Cd, Cr, Ni, dioxins, ...)	2 M€	
IQ decrement (Pb), €/IQ point	3000	