Lecture 13

ECON 4910 Spring 2011

Monetary valuation
The ethics and politics of
cost-benefit analysis

Readings:
Perman et al., Ch. 12
Perman et al., Ch. 3.1-3.4.

[If your read Norwegian: See also Nyborg, K. (2002): Miljø og nytte-kostnadsanalyse. Noen prinsipielle vurderinger, Rapport 5/2002, Oslo: Frisch Centre.]

Monetary valuation

- Max net benefits/Pareto optimum:

  $$\sum_i(MWTP_i) = MAC$$

  – How to measure WTP?

- Theoretical issues
  – What is a marginal project?
  – WTP or WTA?
  – Private or political values?

- How to do it in practice?
  – Valuation methods

Marginal willingness to pay

- Homo Oeconomicus: $U_i = u_i(x_i, E)$
- MWTP = (u'_{iE}/u'_{ix}) (for improved E)
- WTP for small change dE: $(u'_{iE}/u'_{ix})dE$
- "Marginal": (u'_{iE}/u'_{ix}) considered fixed

MWTP = MRS
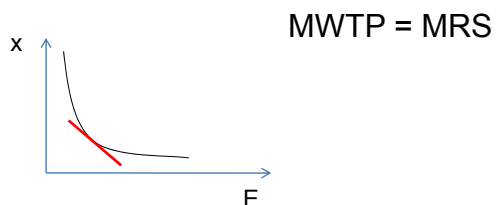
Non-marginal *increase* in E

- (u'_{iE}/u'_{ix}) = MRS cannot be considered constant
  - Cannot just use MRS·ΔE, since MRS not constant
  - Varies along the indifference curve (level of E (and x))
 - Varies across indifference curves (level of U)
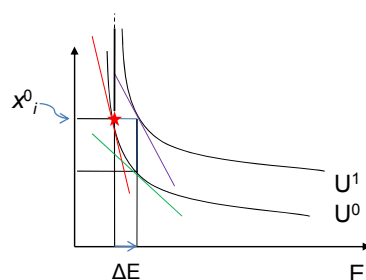
Discrete environmental changes

- Large enough that MWTP changes *due to the project*
- Discrete benefit measures:
- **Compensating surplus:** The income change required to keep *i* at the initial utility level (but assuming that the environmental change takes place).
- **Equivalent surplus:** The income change required to secure *i* the utility level she would have had if the change took place (but assuming it *does not* take place).
- Marginal change: CS = ES
- Discrete change: CS ≠ ES

Non-marginal *increase* in E

- **Compensating surplus**: The income change required to keep *i* at the initial utility level (U^0)
- = **Willingness to pay**

ES = WTA

x^0_i

CS = WTP

U^1
U^0

ΔE

E
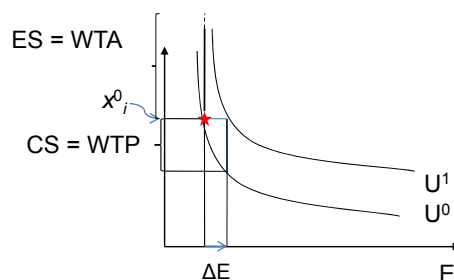
- **Equivalent surplus:** The income change required to keep *i* at the "after ΔE" utility level (U^1)
- = **Willingness to accept** (compensation requirement)

Non-marginal *decrease* in E

- WTP: Your willingness to pay to *avoid* ΔE
- = the *equivalent* surplus
- WTA: The compensation required to make you accept ΔE

WTA = CV

WTP = EV

U^0

U^1

x

ΔE

E
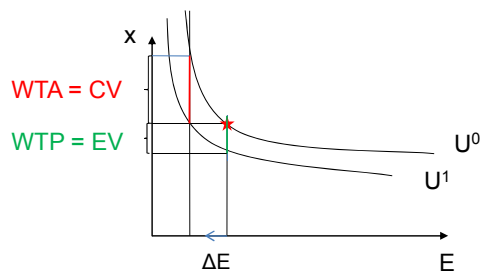
CS and ES versus WTA and WTP

- **If ΔE > 0:**
CS = WTP (to get ΔE)
ES = WTA (*not* getting ΔE)
- **If ΔE < 0:**
CS = WTA ("suffering" ΔE)
ES = WTP (to avoid ΔE)

WTA or WTP?

- Typically: WTA > WTP
  - more so if x and E are poor substitutes
- CS or ES
  - Which utility level is relevant?
  - Implicit: Property rights
  - Is the consumer "entitled to" the initial or ex post utility level?

Private or social values?

- Utility function: $U_i = u_i(x_i, E)$
- Social welfare function: $W = V(U_1, ..., U_n)$
- i's view of social welfare: $W_i = V_i(U_1, ..., U_n)$
- "What are you WTP to be as well off as before?"
  - Private value: based on properties of U_i
- "What do you think we should all be willing to pay?"
  - Social value: based on properties of W_i
- May be very different

Monetary valuation in practice

- **Methods for measurement of WTP**
  - Direct methods: Surveys, voting
  - Indirect methods: Use of market prices/revealed preferences
- **Motives:**
  - *Use value:* WTP to go fishing, hiking etc
  - *Existence value/non-use value:* WTP to know that the environmental good exists
- Non-use values can only be elicited through direct methods

Indirect methods

- Even if no markets for environmental goods: Market goods may be closely tied to the *use* of environmental goods
- Some goods are *complementary* to E:
  - Fishing rod/clean water
  - Bus tickets to a national park
- Some goods are *substitutes* to E:
  - Bottled drinking water/ clean tap water
  - Noise isolating window glass / quiet outdoors environment
- By making appropriate assumptions about the relationship between the market good and the environmental good, use value of environmental good can be estimated.
- Travel cost method, property prices, wages

Contingent valuation: Interview surveys

- «How much would you be willing to pay to improve air quality in Oslo by x pst.?»
- Problems:
  - Strategic reporting? (freeriding, support)
  - Misperceptions (what does «improve air quality by x pst.» mean?
  - Inexperience: Anchoring effects, framing effects
  - Costly
- Advantages:
  - Only way to measure existence values
  - Great flexibility: can ask almost anything

Cost-benefit analysis
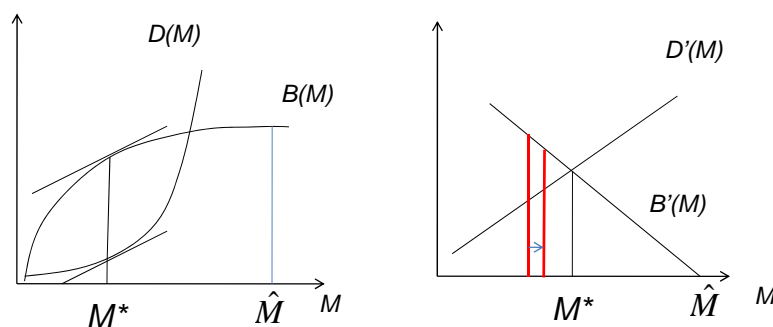
M*: **Max** net benefits [$f_j'(m_j) = \sum_i (u'_{iE} / u'_{ix}) z'(M)$]
Small change: Does it increase or decrease net benefits?

Cost-benefit analysis

- Project evaluation:
  - Are net benefits positive?
  - Are net benefits of *a* > net benefits of *b*?
- Standard cost-benefit analysis:

  Calculate: $\sum_j WTP_i - C$

  $\qquad = \sum_j WTP_i - \sum_j C_i$

  $\qquad = \sum_j(WTP_i - C_i) = \sum_j NWTP_i$

  where C_i = the cost *i* must cover
  - If $\sum_j WTP_i - C > 0$: Project defined as 'socially efficient'
- Present values (discounted)
- Marginal project (marg. values fixed)
- Here: disregard risk/uncertainty

Improvement: concepts

1. Pareto improvements   (**PI**)
2. Net benefits: $\sum(WTP) > C$

   = Potential Pareto improvements (**PPI**)

   (Hicks-Kaldor criterion)

PI ≠ PPI

- Costless redistribution & perfect info:
  - PPI   ->   PI is feasible (but is not *implied*)
  - If PI *does not* occur: relevant that it *could* have occurred?
- Costly redistribution & asymmetric info:
  - PPI   ->   PI may not be feasible (losers will exist)
  - Normative interpretation of standard CBA cannot be founded on the Pareto principle
  - Conflicting interests: Normative recommendations cannot be neutral

The social welfare function

- $W = w(U_1, ..., U_n)$ $\qquad$ $w'_i > 0$
- Welfarism: Only (human) utility matters
- What is a good society?
  - How should conflicting interests be balanced?
  - Inherently normative: no neutral or economically "correct" SWF exists
  - The regulator's view; an ethical observer; the analysts'...?

Welfare changes

- Project: Env. improvement dE, cost for person i C_i (= -dx_i)
- Will the project produce a welfare improvement?

$$W = w(U_1(x_1, E), ..., U_n(x_n, E))$$

$$dW = \sum_i [w'_i (-U'_{ix} C_i + U'_{iE} dE)]$$

$$= \sum_i [w'_i U'_{ix} (-C_i + (U'_{iE}/U'_{ix}) dE)]$$

$$= \sum_i [w'_i U'_{ix} (WTP_i - C_i)]$$

$$= \sum_i [w'_i U'_{ix} (NWTP_i)]$$

- Change in social welfare: A *weighted* sum of everyone's **net** willingness to pay.
- $\sum_j NWTP_i$: welfare measure if welfare weights $w'_i U'_{ix}$ equal for all i
- **If welfare weights are equal for all, standard CBA ranks projects according to social welfare.**

On welfare weights

$$dW = \sum_i w'_i \, U'_{ix} \, (NWTP_i)$$

- **w'_i** : *Purely normative* (how much emphasis should society put on person i's utility?)
  - Economic theory provides little guidance; must be discussed on a normative (ethical/political) basis.
- **U'_{ix}** (marginal utility of income): Descriptive, but not observable/verifiable
  - Requires cardinal & interpersonally comparable utility (standard utility concept: ordinal)
  - No generally accepted methodology exists to measure and compare U'_{ix} between individuals.
- **The assumption that $w'_i \, U'_{ix}$ is equal for all is not empirically verifiable.**

Aggregation of WTP

- WTP as measure of individual benefits
  - Assume identical costs of projects a and b. Then,
    $$WTP_i(a) > WTP_i(b) \quad \Longleftrightarrow \quad (U_i \,|\, a) > (U_i \,|\, b)$$
- But: Cannot compare between individuals!
  $$WTP_i(a) > WTP_j(a) \quad \times\!\!\!\Longleftrightarrow \quad (dU_i \,|\, a) > (dU_j \,|\, b)$$
  Reason: money is not equally important to all
- If compensation is paid, no losers:
  $$\sum_j WTP_j(a) > \sum_j WTP_j(b) \quad \Longleftrightarrow \quad (W \,|\, a) > (W \,|\, b) \ \ \text{(due to \textbf{PI})}$$
- If compensation is NOT paid:
  $$\sum_j WTP_j(a) > \sum_j WTP_j(b) \quad (W \,|\, a) \ ?? \ (W \,|\, b)$$
  Depends on who loses & gains!

# CBA and utilitarianism

- Unweighted utilitarianism:

  $W = U_1 + ...+ U_n$

  i.e.

  $w'_i = 1$ for all i

- Will this ensure that CBA measures dW?
- Welfare weights: $w'_i U'_{ix}$ -> U'_{ix} (since $w'_i = 1$)
- If $U'_{ix} > U'_{jx}$: $w'_i = w'_j$ implies *larger* weight on *i*'s WTP than *j*'s ($w'_i U'_{ix} > w'_j U'_{jx}$)
- If $U'_{ix} > U'_{jx}$: Standard CBA (*equal* weight on everyone's WTP) implies implicitly $w'_j > w'_i$
- **Systematically favors those who care little about money (on the margin)**

Normative aspects of CBA

- CBA measures social welfare effects if
  - compensations are paid: no losers
  - or: From a social welfare point of view, money is equally important for everyone
- Main message:
  - CBA measures costs and benefits in money; but *money* is not *utility* (we do not know how to measure utility)
  - CBA /net benefits is a controversial measure of welfare change
  - If conflicts of interest (losers and winners): **there exists no such thing as a "neutral" social benefit measure**

Political parties and CBA

An index for attitudes towards use of CBA as policy tool. Higher number means more positive attitude (Source: Nyborg 1998, Nyborg and Spangen 1996)

0	2	4	6	8	10	12
SV	Ap	Sp Ap Ap	H	H FrP	H	
SV	Ap		H			
	Ap		Ap			
	KrF		FrP			
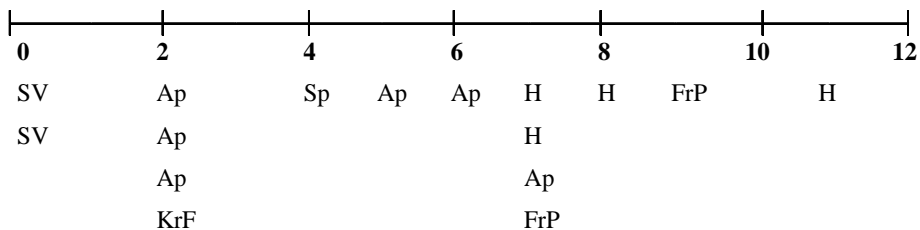
CBA and decision-making

- **Purpose 1:** Make final ranking of projects
  - Must choose normative premises (choose SWF)
  - *All* relevant concerns must be valued in monetary terms (to be counted)
- **Purpose 2:** Provide factual input to a (democratic) debate between decision-makers with different normative views (SWFs)
  - Requires that information improves decision-makers' (intuitive) understanding of effects
  - Requires distinction factual/normative judgements
  - Valuation: needed only if it improves the intuitve understanding
  - Rule of thumb: the harder to value something in money, the harder it is to understand, intuitively, what that money value means

Thank you

and good luck!