

# Environmental Economics

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EPFL ENAC LEUR

ENV-471

Master semester 2 or 4

# INTRODUCTION TO PUBLIC SECTOR DECISION MAKING (PUBLIC CHOICE)

# Possible public decision rules

1. Qualitative assessment
2. Multi-criteria decision analysis
3. Financial assessment
4. Cost-benefit analysis (CBA)
5. Social welfare assessment

# Possible public decision rules

1. Qualitative assessment: list positive and negative effects; the longest list carries the decision (e.g., early impact assessment)
2. Multi-criteria decision analysis: define criteria and scoring rules; place weights on criteria; calculate total weighted score; highest score carries the decision
3. Financial assessment: if (sum of revenues)  $>$  (sum of costs), carry out
4. CBA: extension of financial assessment
5. Social welfare assessment: see next

# Social welfare assessment (1)

Bergson-Samuelson social welfare function (SWF):

$$\text{Social welfare} = f[w_1(x_1), w_2(x_2), \dots, w_N(x_N)]$$

$w_i(\cdot)$  is welfare of person  $i$ , a function of a vector  $x_i$  of goods, services, rights, environmental conditions ... that this person enjoys

E.g. utilitarian SWF (with cardinal utility):

$$\text{Social welfare} = a_1 w_1(x_1) + a_2 w_2(x_2) + \dots + a_N w_N(x_N)$$

$a_i$  is social weight attached to the wellbeing of individual  $i$

# Social welfare assessment (2)

$$\textit{Social welfare} = a_1 w_1(x_1) + a_2 w_2(x_2) + \dots + a_N w_N(x_N)$$

Representative democracy, constituency, personal weighting, ...

Environmental justice ...

The ultra-rich have an ultra-large environmental impact: can this be reconciled with social welfare?

# Social welfare assessment (3)

Kenneth Arrow's impossibility theorem: when there are three alternatives or more, no collective decision rule can be coherent (complete and transitive) while considering the preferences of all

This means that there is no objective way of deriving a SWF from individual preferences, a political process is required

This rules out technocracy

Except in the case of public decisions that harm no one and make some people better off: 'Pareto Criterion of Social Welfare'

Such decisions lead to 'Pareto improvements'

# Compensation and potential compensation

- If a project is not a Pareto improvement, there are winners and losers
- Are the gains of the winners larger than the losses of the losers?
- Nicholas Kaldor's compensation criterion
- Only potential compensation (→ other names: potential Pareto criterion, compensability criterion)
- Actual compensation would be problematic and costly



# INTRODUCTION DU CBA

# Basic principles of CBA

1. Compare benefits and costs of a project or regulation; if benefits exceed costs, carry out; begin with projects and regulations with largest positive differential
2. Consider all benefits and costs (but see 3)
3. Human-centered assessment
4. Costs and benefits are expressed in a common unit (currency)
5. No consideration of who bears the costs and who enjoys the benefits, so long as total benefits exceed total costs
6. Social weights ( $a_i$  in SWF) are possible

# Link to WTP, WTA and surpluses

- Benefits and costs can be assessed based on WTP (benefits) and WTA (costs)
- Total WTP – total WTA = total surplus...
- Provided one accepts 'private' WTP and WTA

# CBA goes beyond financial analysis

- **Financial analysis**

- Question: is an action conducive to profit (incomes > expenses)?
- Basis: incomes and expenses, as stated in the firm's income statement

- **CBA** (also known as public economic analysis)

- Question: does an action improve the welfare of the community?
  - ⇒ Are its **social benefits** > its **social costs**?
  - ⇒ Which actions to choose with limited funds?
  - ⇒ Incomes > expenses is (almost) irrelevant
- Basis: social benefits and social costs

**Financial  
analysis**

*Firms*

**CBA**  
(public economic  
analysis)

*The entire  
community*

# CBA principles

Justification	economic scarcity, limited <u>real</u> resources $\Rightarrow$ efficient use of resources has major impact on the welfare and living standards of citizens public decisions impact people in many ways $\Rightarrow$ they should do them more good than harm
Time	<i>ex ante</i> or <i>ex post</i> analysis
Purpose	evaluation of projects / services / programs / regulation
Concept	comparison of social benefits (advantages) and social costs (disadvantages)
Quantification	monetary units
Rule	action should be carried out if its social benefits exceed its social costs, but there is always a final political decision

# Informal CBA

The New York Times

The Coronavirus Outbreak

LIVE

Latest Updates

Maps and Tracker

Markets

Stimulus Checks

What You Can Do

Newsletter

## *Shutdown Spotlights Economic Cost of Saving Lives*

President Trump and others have asked if halting normal life and commerce to fight the coronavirus is worth the cost. Here's how economists figure it.

<https://nyti.ms/3drPKLV>



By Eduardo Porter and Jim Tankersley

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Can we measure the cost of hundreds of thousands of dead?

President Trump and leading business figures are increasingly questioning the wisdom of a prolonged shutdown of the American [economy](#) — already putting millions out of work — to curb the spread of the [coronavirus](#) pandemic.

“Our people want to return to work,” Mr. Trump [declared Tuesday on Twitter](#), adding, “THE CURE CANNOT BE WORSE (by far) THAN THE PROBLEM!”

In essence, he was raising an issue that economists have long grappled with: How can a society assess the trade-off between economic well-being and health?

# CBA can be cruel

## Trois morts sur un passage trop cher à moderniser

**NIDWALD.** Un minibus de touristes a été percuté par un train hier à Wolfenschiessen. La tragédie était évitable.

En 2013, six personnes ont perdu la vie sur des passages à niveau. Et treize ont été gravement blessées, selon les statistiques de l'Office fédéral des transports (OFT). Hier, une collision entre un train de la Zentralbahn et un minibus a fait de nouvelles victimes (lire ci-dessous).

La problématique inquiète à ce point la Confédération qu'elle a exigé des entreprises de chemin de fer qu'elles sécurisent les mille passages encore démunis de barrières et/ou de feux d'ici à la fin de l'année. Et celui où s'est joué le drame d'hier aurait pu l'être. En 2009 déjà, le Parlement nidwaldien avait en effet accordé un crédit de 4,7 millions à la Zentralbahn. Mais le coût des travaux a été réestimé,



Le véhicule a été happé par le convoi. Un accident avait déjà eu lieu au même endroit le 21 juillet. —KEystone

passant à 17,8 millions, dont 9 à la charge des autorités. Trop cher pour le Grand Conseil, qui a exigé du gouvernement qu'il fasse diminuer la facture.

Un sujet que n'a pas commenté la conseillère d'Etat Karin Kayser, cheffe du Département de la sécurité. «Nous faisons tout pour que ces mises aux

normes se fassent au plus vite et nous accompagnons les entreprises de transport dans ce but», assure pour sa part le porte-parole de l'OFT. Dans ce

It was decided that making this railway crossing safe was too costly

# Example of payoffs (1)

Payoff matrix for a project:

Individual	Payoff (CHF equivalent)
A	10
B	8
C	0
D	-1
E	-3
F	-5

Should this project be undertaken?

It would be rejected in a popular vote: 2 vote YES, 3 vote NO, 1 abstains



# Example of payoffs (2)

A pays 6 to F; B pays 4 to E and 1 to D

Individual	Initial payoff	Payoff after transfer
A	10	4
B	8	3
C	0	0
D	-1	0
E	-3	1
F	-5	1

4 win, no one loses  $\Rightarrow$  project should be approved under Pareto criterion

It would win in popular vote: 4 vote YES, 2 abstain

# CBA IN ENVIRONMENTAL POLICY

# Specific challenges

- Often common resources → challenge of collective action
- A great deal of non-market costs and benefits (e.g. health, natural resources, etc.) → challenge of valuation
- Long horizon → challenge of discounting
- Spillover effects → challenge of geographic scope
- Environmental justice: history and general context matter → challenge of entitlement

# Cost of action vs cost of inaction

- Two alternatives are compared:
  - Action: cost  $C_A$  leading to state of the world  $S_A$  and welfare  $W(S_A)$
  - Inaction: cost 0 leading to state of the world  $S_{IA}$  and welfare  $W(S_{IA})$
- Take action if  $W(S_A) - C_A > W(S_{IA})$ , or  $C_A < W(S_A) - W(S_{IA})$
- $W(S_A) - W(S_{IA})$  is cost of inaction, i.e., loss in welfare if action is not taken and state of the world is 'worse'
- How to measure  $W(S_A) - W(S_{IA})$ ?
  - Lost incomes, cost of damages
  - Remediation cost (clean-up cost)

# **LIMITATIONS OF CBA**

# Limitations of CBA

- Human-centered assessment
- Hedonics-based assessment
- Only outcomes matter ('the ends justify the means')
- All costs and benefits have to be expressed in monetary terms (merchandising of environmental and social goods and bads)
- Assessment based on willingness to pay or to accept (WTP, WTA) gives more weight to wealthier individuals
- Are people's WTP/WTa the appropriate guides?
- What are the WTP/WTa of future generations?
- No consideration of who bears the costs and who enjoys the benefits
- Technocratic public decision making

# Intrinsic value of a natural resource (deep ecology)

## Whanganui River gets the rights of a legal person

MICHAEL DALY

Last updated 06:35, March 16 2017



The Whanganui River [in New Zealand] has gained its own legal identity with all the corresponding rights, duties and liabilities of a legal person.

Te Awa Tupua (Whanganui River Claims Settlement) Bill, which passed its third reading in Parliament on Wednesday [15.03.2017], will establish a new legal framework for the river.

It recognised the river as an indivisible and living whole from the mountains to the sea.