

# CONCEPTUAL FOUNDATIONS OF CBA

---

EE465/EE463 Project Evaluation

Semester 2/2014

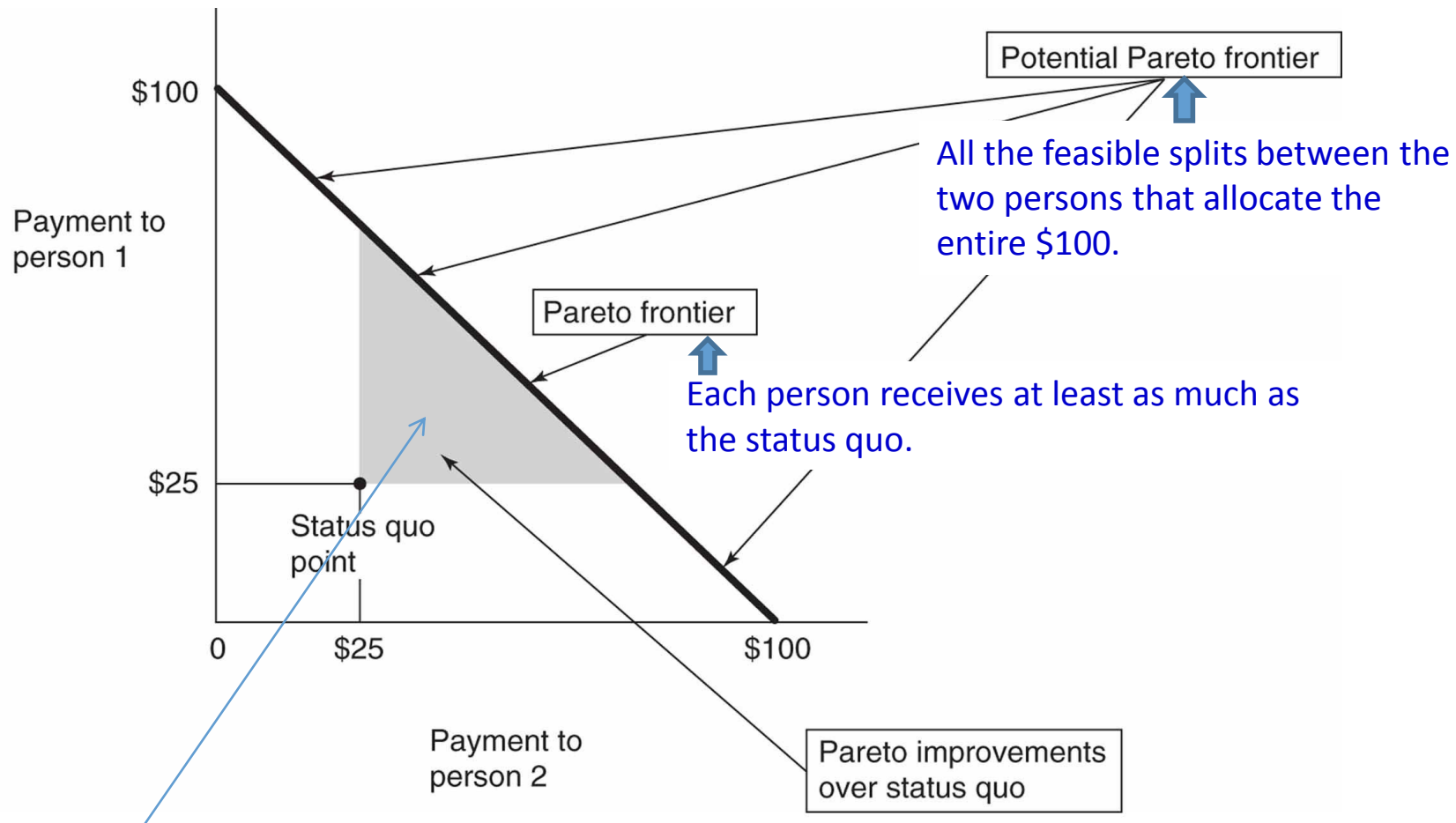
# Topics

- CBA as a framework for measuring efficiency
- Using CBA for decision making
- Fundamental issues related to willingness to pay
- Concerns about the role of CBA in the political process
- Limitations of CBA: other analytical approach

# CBA as A Framework for Measuring Efficiency

- CBA: a direct method for making direct comparison among alternative policies.
  - Provide information about **relative efficiency** of **alternative policies**.
- **Pareto efficiency**
  - “An allocation of goods is *Pareto efficient* if no alternative allocation can make at least one person better off without making anyone else worse off.”

# Pareto Efficiency

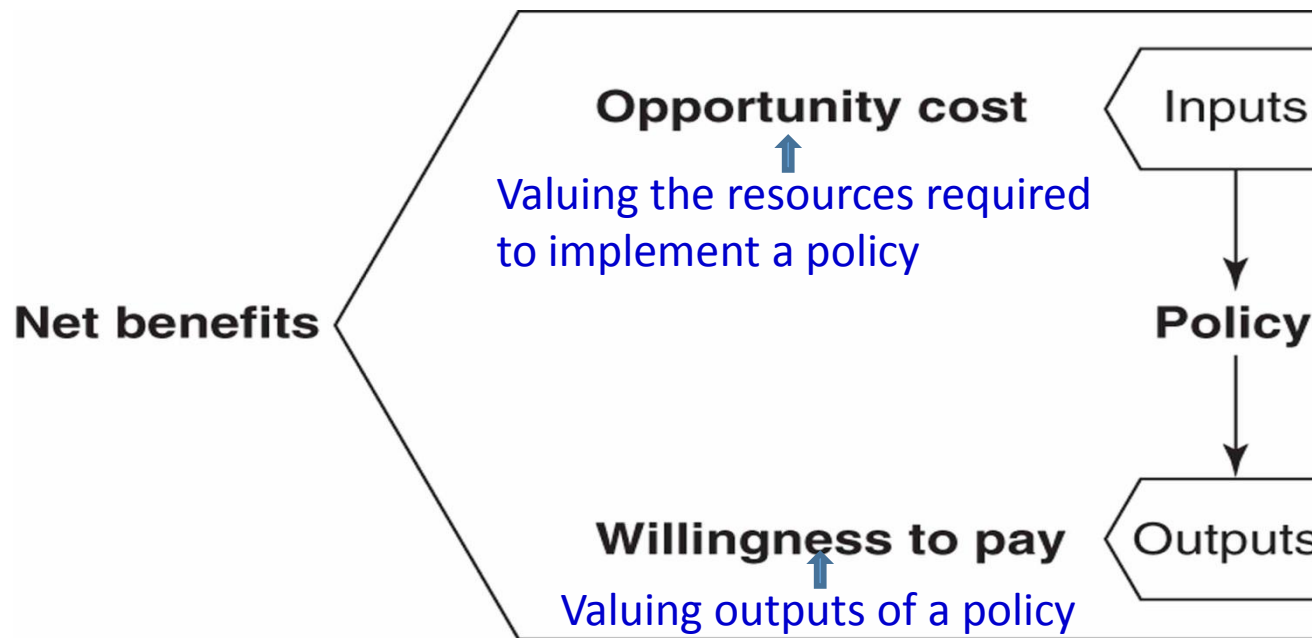


**Pareto Improvement** – all the alternative allocations that would make at least one person better off than the status quo without making the other worse off.

**Question** – Is status quo Pareto efficient? → **NO!**

# Net Benefits and Pareto Efficiency

- Link between **net social benefits** and **Pareto efficiency**:
  - *If a policy has positive net benefits, then it is possible to find a set of transfers, or “side payment,” that makes at least one person better off without making anyone else worse off.*



# Willingness to Pay (WTP)

- **WTP** is the **payment** that one would have to **make or receive** under the policy so one would be **indifferent between the status quo and the policy with the payments**.
  - The algebraic **sum of the WTP values** is the measure of the **net benefits of the impacts** of a policy.

## Example:

- A policy affects 3 persons, where  $WTP_1 = \$100$ ,  $WTP_2 = \$100$ , and  $WTP_3 = -\$250$
- For person 3, the policy *takes something away* from him, so the negative WTP is called “**willingness to accept**” (WTA).
- Suppose the policy require no resources to implement, the **net benefits** =  $(\$100 + \$200) - \$250 = \$50$ .
- Question: Is this policy a Pareto efficient (with respect to status quo)?
  - **Answer: No! Why?**

## WTP (Cont'd)

- Suppose now the policy is altered so that **person 3 receives \$75 from person 1** and **\$175 from persons 2** as part of the policy. Is this new policy a Pareto efficient?
  - Yes, both person 1 and person 2 are better off, while person 3 is no worse off.
  - To see this,  $NB_1 = 100 - 75 = 25$ ;  $NB_2 = 200 - 175 = 25$ ; and  $NB_3 = 250 - 250 = 0$
- Thus, if and only if, **the aggregate net benefits of the policy (as measured by WTP) are positive**, then there exists *a set of contributions and payments* that makes a *Pareto improvement* over status quo.

# Opportunity Cost

- The **opportunity cost** of using an input to implement a policy is **its value in its best alternative use**.
  - Example: what would be the opportunity cost of building an underground parking lot?
- Consider the previous example of 3 persons whose aggregate WTP was \$50.
  1. Suppose the opportunity cost is \$75.
    - NB = -\$25, i.e. Not Pareto efficient.
  2. Suppose the opportunity cost is \$20.
    - NB = \$30, i.e. Pareto efficient.
- In general, if the net benefits of a policy are positive, then it is *potentially* Pareto improving.

# Using CBA for Decision Making

- *If all impacts are valued using WTP and all inputs are valued using opportunity costs, then the **sign of net benefits** indicates if it is possible to increase Pareto efficiency.*
- **Actual Pareto efficient rule:** *Adopt policies that are actually Pareto efficient.*
- However, using this decision rule is impractical for the following reasons:
  - The information burden of measuring benefits and costs for each individual.
  - The administrative burden of actually making each required transfers.
  - Compensation would induce people to overstate costs and understate benefits.

# Potential Pareto Efficiency

- An alternative decision rule is **potential Pareto efficiency rule** (or the **net benefits criterion**):
  - *Adopt only policies that have positive net benefits.*
- The potential Pareto efficiency rule is based on ‘**Kaldor-Hick criterion**’:
  - A policy should be adopted if and only if those who will gain could fully compensate those who will lose and still be better off.
- Reasons for adopting the potential Pareto efficiency rule:
  - Society maximizes aggregate wealth.
  - If there are different winners and losers, in aggregate, costs and benefits will average out over the entire population.
  - It is possible to do redistribution “wholesale” rather than within each separate policy.

# Application of the Decision Rule in Practice

- If all relevant projects are independent, *adopt all policies that have positive net benefits.*
- If policies enhance or interfere with each other, *choose the combination of policies that maximizes net benefits.*
- Benefit-cost can confuse choice. When ranking policies, one should generally choose the policy with the largest net benefits because B-C can be manipulated (See example on slide 12)
- Care must be taken to determine interactions among projects (i.e. find interferences and synergies)
  - Ex: A dam and recreation site

# Example: Choosing Efficient Projects

	<i>Costs (millions of dollars)</i>	<i>Benefits (millions of dollars)</i>	<i>Net Benefits (millions of dollars)</i>	<i>Benefits/Costs</i>
No project	0	0	0	—
Project A	1	10	9	10
Project B	10	30	20	3
Project C	4	8	4	2
Project D	3	5	2	1.7
Projects C and D	7	21	14	3
Project E	10	8	-2	0.8

## Case 1: No constraints

→ Choose A, B, and combination of C & D

## Case 2: All projects are mutually exclusive (ie. Choose one)

→ Choose B

## Case 3: Total costs cannot exceed \$10 billion

→ Choose A and combination of C & D

# Example: Benefit-cost Ratios

	<i>Costs (millions of dollars)</i>	<i>Benefits (millions of dollars)</i>	<i>Net Benefits (millions of dollars)</i>	<i>Benefits/Costs</i>
No project	0	0	0	—
Project A	1	10	9	10
Project B	10	30	20	3
Project C	4	8	4	2
Project D	3	5	2	1.7
Projects C and D	7	21	14	3
Project E	10	8	-2	0.8

- Project B has the largest net benefits, while Project A has the largest benefit-cost ratio. So, which project should be selected?

**Answer:**      **Project B**

- Consider Project B. Suppose WTP for one group is 40, and WTP for another group is -10.
  - If  $-WTP$  is treated as a *negative benefit*, then **B-C ratio = 3**.
  - If  $-WTP$  is treated as a *cost*, then **B-C ratio =  $40/20 = 2$** .

# Fundamental Issues Related to WTP:

## Issue 1: Theoretical limitations of WTP as basis for social orderings

- Ranking policies in terms of net benefits does not guarantee a *transitive social ordering*.
- Example: Cyclical social preferences

<i>Preference Ordering</i>	<i>Voter 1</i>	<i>Voter 2</i>	<i>Voter 3</i>
First Choice	<i>X</i>	<i>Z</i>	<i>Y</i>
Second Choice	<i>Y</i>	<i>X</i>	<i>Z</i>
Third Choice	<i>Z</i>	<i>Y</i>	<i>X</i>

- For the use of WTP in implementing the potential Pareto principle to produce a transitive ordering of policies, some assumptions must be placed on individual preferences.
  1. The utility function of individuals must be such that the implied individual demand functions can be aggregated into a market demand curve with the sum of individual incomes as an argument.
  2. All individuals must see the same prices.

# Fundamental Issues Related to WTP:

## Issue 2: Dependence of WTP on Distribution of Wealth

- The WTP of a person depends on the wealth of the individual.
  - If the distribution of wealth of society changes, then individual WTP changes, and perhaps, the ranking of alternatives could change.
- When applying the *potential Pareto principle*, it is possible that the policy could lower the sum of utilities if people with different levels of wealth have different *marginal utilities of money*.
  - Example: Suppose a policy gives \$10 benefit to a person with high wealth (P1) and incurs \$9 costs on a person with low wealth (P2).
    - ➔ P2's utility loss could outweigh P1's utility gain.
  - Therefore, the potential Pareto principle weakens for policies with costs and benefits concentrated on different wealth groups.

# Fundamental Issues Related to WTP:

## Issue 3: Dependence of Net Benefits on Assumptions about Standing

- **Jurisdictional definition of society**
  - CBA usually defines society at the national level. The distinction becomes relevant in policies that spill over national boundaries.
- **Jurisdictional membership**
  - This is a question as to whose utility should be counted (i.e., illegal aliens, citizens abroad, legal non-citizens, etc.).
- **Exclusion of socially unacceptable preferences**
  - This uses prohibitions to legal rights as a guide about prevailing social values and whether certain preferences should have standing.
- **Inclusion of the preferences of future generations**
  - This should be included, but it is difficult to measure the WTP of future generations

# Concerns about the Role of CBA in the Political Process

## Does CBA Debase the Terms of Public Discourse?

- There are several objections to the pricing of certain goods (i.e. life):
  - Decreases perceived value by implying they can be compared to goods traded in markets.
  - Decreases value by weakening the claim that some goods should not be for sale at any cost.
  - Undercuts the claim that some goods are priceless.
- But CBA does not necessarily lower the discourse.
  - Monetization of a life isn't the *value* of a life.
  - Actually, we estimate the value of a *statistical life* – WTP to avoid risks that will result in one less death in a population.

# Concerns about the Role of CBA in the Political Process (Cont'd)

## Does CBA Undermine Democracy?

- The general answer is No!
- The concern is that CBA imposes the single value of efficiency on public policy.
  - Would be justified if comparing between a world with public policy determined solely through democratic processes and a world with public policy determined strictly through CBA.
- In real life, however, the actual government is not an ideal democracy and CBA only has a modest influence on public policy.
- CBA actually may contribute to a more democratic process by paying attention to diffuse interests that are typically underrepresented.

# Limitations of CBA: Other Analytical Approach

- Technical limitations of CBA

- Limitations in theory, data, or analytical resources may make it impossible to measure and value of all impacts of a policy.

- Qualitative CBA

- Monetize as many impacts as possible. Then make qualitative estimates of the remaining costs and benefits (rough estimates).

- The analyst can also utilize estimates founds in other CBA's (if short on time or resources). Even if the impact is not monetized, the analyst should quantify it numerically.

# Other Analytical Approach

- **Cost-effectiveness analysis**
  - This can be used if the major benefit can be quantified but not monetized.
  - Policies can then be ranked in terms of cost-effectiveness. But this gives only *relative* information.
  - The analyst can evaluate policies in two ways:
    1. Get as much impact for a specific cost.
    2. Get a specific impact at the lowest cost.