EE475 Natural Resource Economics

Evaluating Trade-offs: Benefit-Cost Analysis and Other Decision-Making Metrics

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Outline

- Normative Criteria for Decision Making
  - Benefit-Cost Analysis
  - Finding Optimal Outcomes
  - Relating Optimality to Efficiency
- Valuing the Environment
  - Why? And How?
  - Issues in Benefit Estimation
  - Approaches to Cost Estimation
  - Risk
  - Valuation Methods

Positive vs Normative Economics

- What is Positive Economics?
- What is Normative Economics?
- What do we, homoeconomicus, do when we make a decision?

Normative Criteria for Decision Making

Normative choices can arise in two different contexts

- Choose among options that have been predefined -> **Benefit-Cost Analysis**
- Find optimal choice among all the possible choices -> **Optimal Outcome**

Evaluating predefined options: Benefit-Cost Analysis

- If *Benefit (B)* > *Cost (C)*, support the action

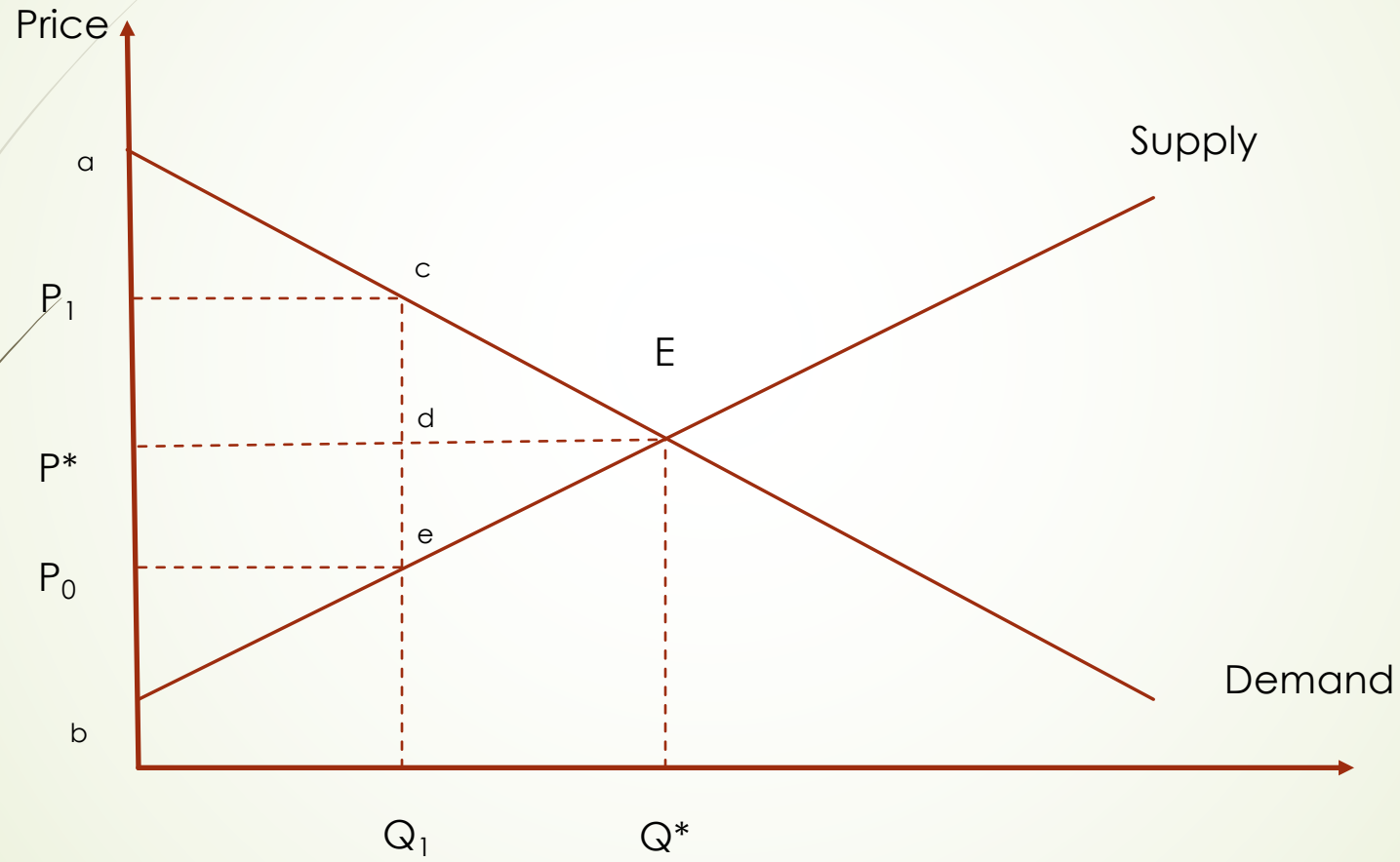
- If *B/C* > 1, support the action ;

As long as *B and C* are positive

Evaluating predefined options: Benefit-Cost Analysis

- In economics the measurement system is **Anthropocentric.**
  - All benefits and costs are valued in terms of their effects (broadly defined) on humanity.
- Not only direct effect on human is concerned, but also indirect effect.

Considering demand and supply curves, which areas are total benefits and total costs?



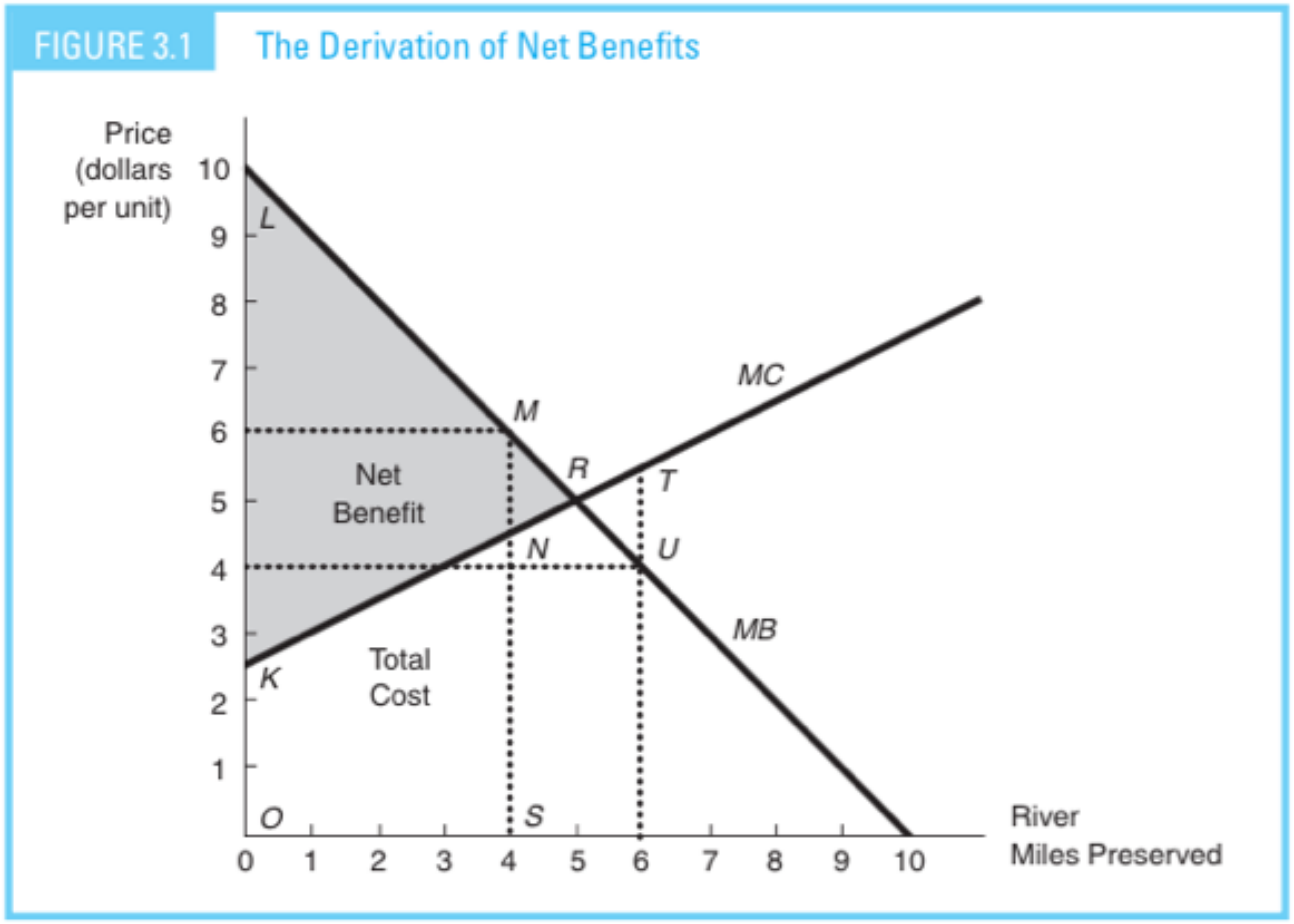
Example: Preservation of a River

White-water Canoeing

VS

Dam for Electricity Generation

Example: Preservation of a River

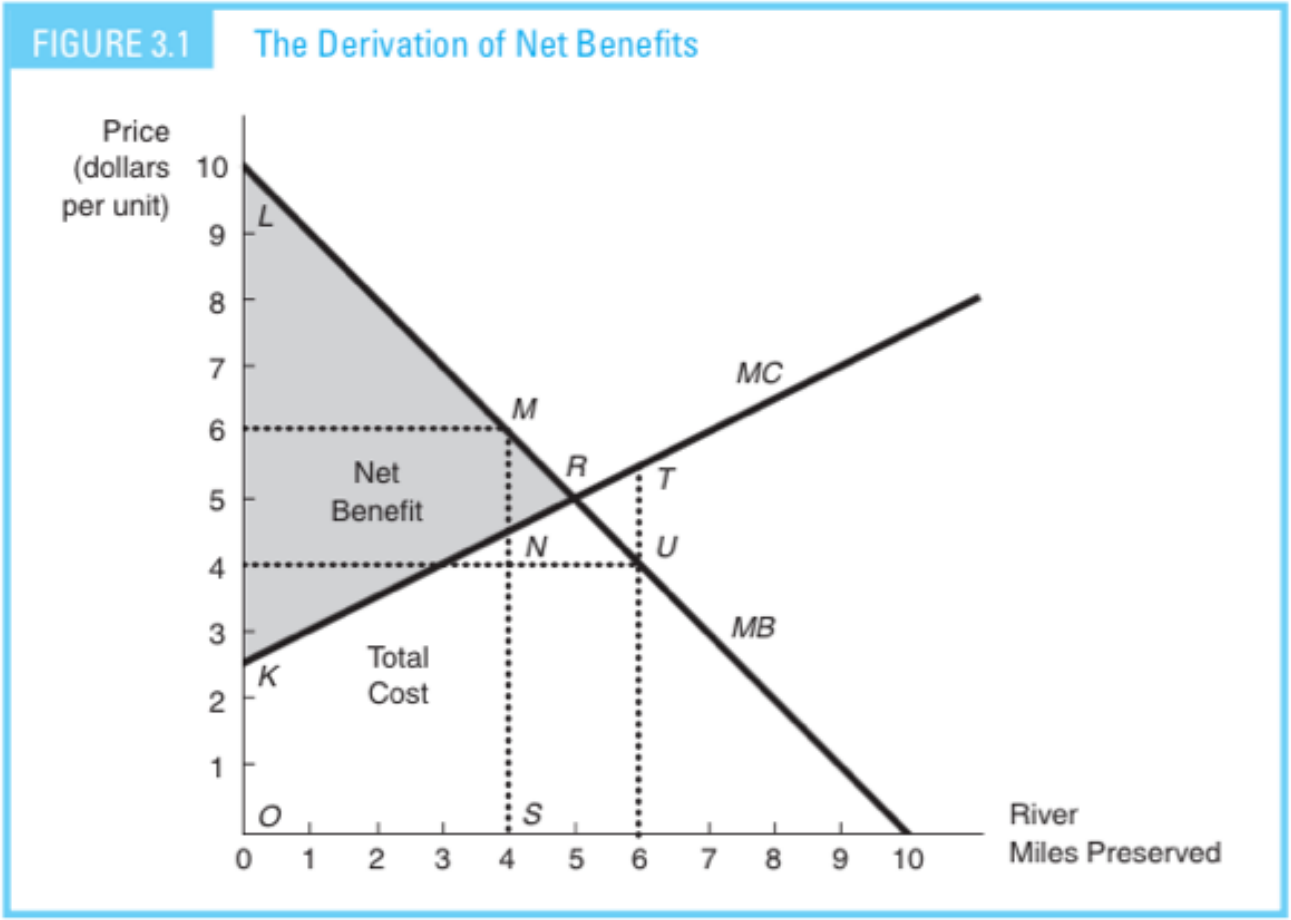


Source: Tietenberg & Lewis (2012), pp 49

Evaluating predefined options: Benefit-Cost Analysis

- What is opportunity cost?
- *Opportunity Cost* for using resources in a new or an alternative way
  - The net benefit lost when specific environmental services are foregone in the conversion to the new use.
- Marginal opportunity cost curve -
  - The additional cost of producing another unit of alternative use of environmental service resulting from the associated incremental loss of net benefits due to reduced opportunities for the other environmental service.
- Net benefit - Excess of benefits over costs

Example: Preservation of a River



Why don't we preserve more miles of the river?

Source: Tietenberg & Lewis (2012), pp 49

Finding Optimal Outcomes

- General steps in Normative analysis
  1. Identify an optimal (best) outcome
  2. Attempt to understand the extent to which our institutions produce optimal outcomes and, where divergences occur between actual and optimal outcomes —> Identifying the behavioral sources of problems
  3. Design appropriate policy solutions

Finding Optimal Outcomes

- Example: Fishery resource

1. Defining the optimal stock of fish and the optimal rate of harvest of the fishery
2. Compare the optimal levels with the actual stock and harvest level
3. Design appropriate policies

Relating Optimality to Efficiency

- The **optimal (best) policies** are those that **maximize net benefits** (benefits-costs).
- The net benefits area to be maximized in an **"optimal outcome"** for public policy is **identical** to the **"economic surplus"** that is maximized in an efficient allocation.
- Hence efficient outcomes are also optimal outcomes.

Is optimal outcome always fair?

Valuing the environment and natural resource, Why?

- Estimate damages caused by environmental events such as pollution, or oil spill
- Estimate benefits and costs for policy process
- Estimate non-market values and intangible value

Valuing the environment and natural resource, How?

- Total willingness to Pay (TWP)
- = Use Value + Option Value + Nonuse Value

Use Value
    Consumptive (active) vs non-consumptive (passive) use value
Option Value
Nonuse Value
    Bequest value
    Existence value

Example: Mae Wong Dam

2 teams – Using benefit and cost to debate

- Team 1 – Support Dam Construction
- Team 2 – Against Dam Construction

Issues in Benefit Estimation

- Primary versus Secondary Effects
- Accounting Stance
- With and without principle
- Tangible versus Intangible Benefits

Approaches to Cost Estimation

- **The survey approach** : Ask those who bear the costs directly.
  - Problem?: Strong incentive not to be truthful.
- **The Engineering approach** : Bypass those who bear the costs and use engineering information.
  - Problem? : Unique circumstances of some firms may cause the costs to be higher or lower than estimated.

Treatment of Risk

- Future is uncertain. --> Risk

	Outcome E = 100	Outcome F = 50	Outcome G = 0
Policy A	40%	10%	50%
Policy B	20%	50%	30%
Policy C	40%	30%	30%
Policy D	50%	0%	50%

Risk in the policy process

- Two major dimensions of the treatment of risk in the policy process
  - Identifying and quantifying the risks (scientific and descriptive)
  - Deciding how much risk is acceptable (evaluative/normative)

Treatment of Risk

$$EPVNB_j = \sum_{i=0}^{I} P_i PVNB_{ij}, \qquad j = 1, \ldots, J$$

- $EPVNB_j$ = expected present value of net benefit for policy *j*
- P_i = probability of the *i* th outcome occurring
- $PVNB_{ij}$ = present value of net benefits for policy *j* if outcome *i* prevails
- *J* = number of policies being considered
- I = number of outcomes being considered

Valuation Methods

Table 4.1 Economic Methods for Measuring Environmental and Resource Values

Methods	Revealed Preference	Stated Preference
Direct	Market Price	Contingent Valuation
	Simulated Markets	
Indirect	Travel Cost	Attribute-Based Models
	Hedonic Property Values	Conjoint Analysis
	Hedonic Wage Values	Choice Experiments
	Avoidance Expenditures	Contingent Ranking

Source: Modified by the author from Mitchell and Carson, 1989.

Source: Tietenberg & Lewis 2012, p,82