Valuation and Incentive Measures for Sub-Saharan West Africa

Cost Based Methods

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Key take home message:

- In some circumstances, one can to base the valuation of non-market goods and services on **estimation of costs that would be incurred if the ecosystem service under valuation had to be recreated using artificial means**.

Key questions addressed in this lecture:

i. What are **cost based approaches** to economic valuation of non-market goods and services?

ii. **Avoided cost**, **replacement cost**, **mitigation cost**, and **restoration cost** methods: what are they and how can they be applied to non-market valuation?

iii. **Advantages** and **disadvantages** of each method.

iv. A word on "**Opportunity Cost Techniques**"

v. Some practical exercises.

References:

- I used many references to compile this lecture including:

- **TEEB for National and International Policy Makers Chapter 4**: Integrating Ecosystems and Biodiversity Values into Policy Assessment.

- **TEEB Ecological and Economic Foundations Chapter 5**: The Economics of Valuing Ecosystem Services and Biodiversity.

Cost Based Valuation Approaches:

- **Cost-based approaches** are based on estimating the costs that would be incurred if **ESS benefits had to be recreated through artificial means**.

- **Example**: we could infer a value of an ESS by how much it costs to **replace** it or **restore** it **after it has been damaged**.

- These approaches **assume** that the **cost** of **replacing** or **restoring** an ESS is a reasonable estimate of **its value to society**.

Cost Based Valuation Approaches:

- **Four common techniques**:

i. **Avoided cost method:** relates to the costs that would have been incurred in the **absence** of the ESS.

ii. **Replacement cost method:** estimates the costs incurred by **replacing** the ESS with artificial (man made) technologies.

iii. **Mitigation cost method:** refers to the cost of **mitigating the effects of loss** of the ESS.

iv. **Restoration cost method:** refers to the cost of getting the ESS **restored**.

Cost Based Valuation Approaches:

- **Main advantage**: **much easier** to **measure costs** of producing benefits (artificially producing ESS) rather than **value benefits** of ESS, especially when benefits are non-marketed.

- **Example**: it is much easier to estimate the cost of building a swimming pool, that to value the recreational benefits of a swim in the ocean.

- In addition, the techniques under this method are **less data** and **resource-intensive**.

Cost Based Valuation Approaches:

- **Their main disadvantage** is that they **assume**:

i. Expenditure on man-made alternatives **provide positive benefits** (do HEP supplying dams **only provide positive benefits**?), and

ii. The net benefits generated by such expenditure **match the original level of benefits** from ES.

- Theoretically, even when these conditions are met, **costs are not an accurate measure of benefits from ES** (to obtain benefits from ES, you have to ask beneficiaries for their WTP/WTA).

1. Avoided Cost Technique:

- **Avoided-cost technique** relates to **costs that would have been incurred in the absence of ESS**.
- **Idea**: in the absence of ESS, a **substitute** with a similar function would have been used.
- Presence of ESS **avoids** the **costs** associated with supplying **substitute**.
- This technique considers **cost of providing a substitute with a similar function** as the **monetary value** of the **ESS in question**.

1. Avoided Cost Technique:

- **Example 1**: the **flood protection service** from a **wetland ecosystem** may be valued on the basis of the **cost** of **building man-made defences** of equal effectiveness.

- The **monetary value** of the **flood protection ecosystem service** from a **natural wetland** is equal to the cost of building man-made defences for flood protection of equal effectiveness.

1. Avoided Cost Technique:

- **Example 2**: the H_2O quality control **ecosystem service** provided by a **natural wetland ecosystem** may be valued based on the cost of building man-made H_2O filtration infrastructure of equal effectiveness.

- Given the **wetland ecosystem** provides a wider range of **ecosystem services** (**in addition** to H_2O quality control), this costing would be a **minimum estimate** of the value of ecosystem services coming out of the wetland ecosystem.

1. Avoided Cost Technique:

- Avoided-cost technique can be used for the **monetary valuation** of the following ESS:

i. Valuation of intermediate ESS:

  - Livestock grazing and livestock watering ESS.

ii. Indirect benefits of natural capital to local households:

  - School fees,
  - dispensaries,
  - building schools,
  - irrigation infrastructure maintenance, etc.

2. Replacement Cost Technique:

- The **replacement cost technique** estimates the costs of **replacing** ESS with **artificial technologies**.
- **Idea:** if an ESS **was not naturally supplied**, an **alternative artificial technology** has to be found to **provide the lost service**.
- Replacement cost technique assigns **cost of the replacement** as the **monetary value** of the **lost ESS**.
- Technique is **widely used** because it is **often easy** to find estimates of such replacement costs.

2. Replacement Cost Technique:

- **Advantage:** a useful technique in estimating indirect use benefits in the absence of ecological data (required to estimate damage functions with first-best methods).

- **Disadvantage:** difficult to ensure net benefits of the replacement **do not exceed** those of the original function.

- **Stated otherwise**: replacement cost **may overstate** willingness to pay (WTP) if only physical indicators of benefits are available.

2. Replacement Cost Technique:

- **Replacement cost technique** can be used for the monetary valuation of similar ESS as **avoided cost technique**:

i. Valuation of intermediate ESS:

- Livestock grazing and livestock watering ESS.

ii. Indirect benefits to local households:

- School fees,
- dispensaries,
- building schools,
- irrigation infrastructure maintenance, etc.

3. Mitigation Cost Technique:

- **Mitigation cost technique** refers to **cost of mitigating effects** of ESS loss.
- Focuses on cost incurred **militating against** adverse environ impacts created by **absence of an ESS**.
- **Idea**: loss of ESS will be associated with **adverse** environ impacts, with **adverse** consequences for **welfare**.
- Application of technique relies on **existence** of **relevant markets** for **technologies** which **militate against** the relevant adverse environmental impacts.

3. Mitigation Cost Technique:

- **Example**: grazing ESS might be lost due to mining activities in a wetland.
- **Adverse impacts on welfare**: loss of opportunities for grazing local livestock.
- **Aversion**: acquire livestock feed from market.
- **Costs** of **acquiring livestock feed** may be used as a **proxy** for the **value of the grazing ESS**, which would normally feed the local livestock.

4. Restoration Cost Technique:

- **Restoration cost technique**: monetary value of the ESS is estimated to be the cost associated with its **restoration to its original state** if it happened to be **degraded** or **lost**.

- This technique can be used for the monetary valuation of the **same** ESS as the **avoided** and **replacement cost techniques**.

5. Opportunity Cost Technique:

- **Idea**: considers the **value foregone** so as to **protect**, **enhance** or **create** a **particular ESS**.

- **Example**: to conserve wildlife in local protected area, the local people **may have to forego** many production opportunities.

- **Examples of lost opportunities**: *lost agric output, lost cultural values, lost grazing and livestock watering opportunities, lost wildlife hunting values etc.*

Practical Exercises in the Application of Cost-Based Approaches to ESS Valuation.

1. Avoided Cost Technique:

- Use **avoided cost technique** to estimate the "**annual value of the grazing ESS** to society from an **open access** rangeland".

- **Assume:** 10,000 heads graze the range.

- Write a paragraph giving feedback of the research exercises (include proposed policy value of your work).

- **Hint**: use the EXCEL worksheet "Avoided Cost Technique".

2. Replacement Cost Technique:

- Suppose a wetland provides **H_2O quality enhancement ESS** to local households.
- Use **replacement cost technique** to estimate the "**annual value of H_2O quality enhancement ESS** to local households".
- Write a paragraph giving feedback on the research exercise (include proposed policy value of your work).
- **Hint**: just provide a **qualitative explanation** of what you would do.

3. Mitigation Cost Technique:

- A rangeland provides **grazing ESS** to local livestock.
- Assume the grazing ESS is lost to mining.
- Use **mitigation cost technique** to estimate the "**annual value of the lost grazing ESS** provided by the rangeland".
- Write a paragraph giving feedback of the research exercise (include proposed policy value of your work).
- **Hint**: appropriately modify the EXCEL worksheet "Mitigation Cost Technique".