An Overview of Various Methods of Environmental Valuation

Session 5: Methods of Environmental Valuation

The Cost of Environmental Degradation
A PERSGA Training Workshop
18-21 January 2015
Cairo, Egypt
The Economics of Ecosystems & Biodiversity
Approaches to Valuing Ecosystem Services

- Direct market valuation approaches: use data from actual markets
- Revealed preference approaches: economic agents “reveal” their preferences through their choices
- Stated preferences approaches: simulated markets where values are sought for changes in provision or policy
Direct market valuation: Market-based

- **Market price based approaches**
  - Most often used to obtain values for provisioning services
  - Preferences and marginal cost of production are reflected in market price
  - In well functioning markets, price provides accurate information on value
Direct market valuation: Cost-based

- **Cost based approaches**
  - Costs incurred in recreating an ecosystem service artificially
    - *Avoided cost method*
    - *Replacement cost method*
    - *Mitigation or restoration cost*
  - Appropriate for regulating services
Direct market valuation: Production function

- Production function approaches
  - Estimates contribution of an ecosystem service to a final commodity
  - Improvement in resource base or environmental quality, i.e. enhanced ecosystem services, lowers costs and prices or increases quantity of goods
  - Requires knowledge of relationships between ecosystems services and valued end points

- Applicable to regulating and supporting services
Revealed preference

- RP methods are based on observations of individual choices related to an ecosystem service
- Appropriate for direct and indirect use goods
- Stages
  1. Determine existence of surrogate market for ecosystem service
  2. Select appropriate RP method
  3. Collect market data to estimate demand function
  4. Infer value of change in quantity/quality from demand function
  5. Aggregate values
  6. Discount values where appropriate
Revealed preference: Travel Cost Method

- **Travel cost method (TCM)**
  - The value of an environmental good is reflected in the time and money people spend getting to it e.g. forests, mountains, fishing sites
  - Based on actual behaviour, mostly used for recreation studies
  - Visitor surveys are used to determine distance travelled to site, values are estimated from cost per mile or per hour spent travelling
  - Travel costs are used to estimate the number of visits made
  - Only direct use values are estimated

- Appropriate for cultural services
Revealed preference: Hedonic pricing

- **Hedonic pricing (HP)**
  - The value of a good is a function of its characteristics, e.g. house prices (or rents) are determined by a number of attributes:
    - Structural: number of rooms, garden size, garage size, central heating, double glazing…
    - Socio-economic: quality of schools, unemployment rate, local taxes…
    - Local amenities: access to services, transport links, environmental quality…
Stated preference

- SP approaches use simulated markets to elicit willingness to pay (WTP) or accept (WTA) values for changes in ecosystem service provision.
- Appropriate for both use and non-use values.
  - May be difficult to segregate these value motives from WTP.
- Survey based methods in which respondents are presented with a hypothetical market describing the change in service provision.
Stated preference
Summary on methods covered

☐ Contingent valuation method
  – One policy-on scenario compared with Business As Usual (BAU)

☐ Choice Experiments
  – Attributes are compared, e.g. ‘visibility in the sea’
  – Some baseline BAU level for each attribute and this is compared with varying levels (with policy-on)

☐ Group valuation
  – Less commonly applied – links valuation with deliberative methods
Stated preference: Contingent valuation

- **Contingent valuation method (CVM)**
- A hypothetical market is described in which respondents either buy (WTP) or sell (WTA) a specified level of an environmental good or service
- The values which are elicited are “contingent” on the hypothetical market with which respondents are presented
Stated preference: Choice modelling

- Choice modelling (CM)
  - Also referred to as choice experiments (CE)
  - Type of conjoint analysis
  - Survey respondents make choices across environmental goods with varying bundles of attributes
  - Trade-offs between attributes reveals their values
  - Can combine qualitative and quantitative attributes
Stated preference: Group valuation

Group valuation

- Combination of stated preference techniques with deliberative techniques
- Offer a deeper exploration of environmental information, values and preference formation
- Trade-off of smaller groups versus survey approaches versus more precise values
Comparisons between approaches: Market-based

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<th>Advantages</th>
<th>Disadvantages</th>
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<tr>
<td>Market prices</td>
<td>• Reflect private WTP</td>
<td>• Market imperfections and policy failures distort prices</td>
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<td>• Construct financial accounts</td>
<td>• Seasonal variations</td>
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<td></td>
<td>• Easy to obtain</td>
<td>• Currency variations</td>
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<td>Shadow prices</td>
<td>• Reflect true economic value or opportunity cost to society</td>
<td>• Complex to derive</td>
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<td>• Require substantial data</td>
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<td>• Considered ‘artificial’</td>
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<td>Production function</td>
<td>• Links ecosystem functions to market values</td>
<td>• Requires modelling of dose response relationships</td>
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<td>• Complex for multi-use systems</td>
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<td>• Potential double counting</td>
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Comparisons between approach - cost-based

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<th>Disadvantages</th>
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<tr>
<td>Mitigation/restoration costs</td>
<td>• Useful when valuing particular ecosystem functions</td>
<td>• Diminishing returns and difficulty in restoring functions</td>
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<td>Replacement costs</td>
<td>• Estimates indirect benefits when ecological data not available for estimating damage functions</td>
<td>• Net benefits of replacement may exceed original function</td>
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<td>• May overstate WTP</td>
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<td>Avoided damage cost</td>
<td>• Precautionary principle applied</td>
<td>• Data or resource limitations may rule out first-best valuation methods</td>
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## Comparisons between approach - Revealed and stated preference

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<th>Disadvantages</th>
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<tr>
<td>Hedonic pricing</td>
<td>• Reflects private WTP&lt;br&gt;• Based on observed behaviour</td>
<td>• Data intensive&lt;br&gt;• Requires defined surrogate market</td>
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<td>Travel cost</td>
<td>• WTP for recreational sites&lt;br&gt;• Based on observed behaviour</td>
<td>• Data intensive&lt;br&gt;• Restrictive assumptions about behaviour&lt;br&gt;• Sensitive to statistical methods</td>
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<td>Contingent valuation</td>
<td>• Can measure non-use value and give estimate of TEV</td>
<td>• Sensitive to biases in survey design and implementation</td>
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<td>Choice modelling</td>
<td>• Simultaneously elicits values for a range of goods and services</td>
<td>• Complex statistical design and analysis&lt;br&gt;• Potential burden on respondents – choice heuristics</td>
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What do the methods capture? TEV and valuation methods

- Use values
  - Direct
  - Indirect
  - Option
- Non-use values
  - Existence
  - Bequest

- Market
- Production Function
- Revealed Preference
- Stated Preference

Value?
Confidence?
Session Summary

- Different methods available but variability in terms of:
  - Data needs
  - Categories of TEV valued
  - Confidence in value outcomes

- Those that rely on market prices (or surrogates/proxies) tend to only value a sub-set of ecosystem services
What is Benefit Transfer?

- BT takes an existing value for an ecosystem or policy change (at the ‘study site’) and applies it to a new, similar, site (the ‘policy site’)

- Why transfer values?
  - Ideally new ecological and economic studies would be commissioned
  - New valuation studies are expensive and time consuming

- There are four categories of BT:
  - Unit BT
  - Adjusted unit BT
  - Value function transfer
  - Meta-analytic transfer
Summary on Benefits Transfer

- BT seeks to use existing values to avoid expense and time needed for primary valuation study.
- Value function and meta-analytic BT preferred to unit BT as it accounts for differences between sites and beneficiaries – but can be expensive and time consuming to do robustly.
- BT is prone to errors due to poor primary studies, generalisation during transfer, and publication bias.
- A number of challenges arise due to complex nature of ecosystems, ES provision, context and differing socio-economic factors.
- Scaling-up raises particular challenges due to changing marginal values and critical thresholds.
Environmental Economics:
Determining values and analyzing options

John A. Dixon

Kailua, Hawai‘i
So, How much is nature worth? Many techniques exist to value the “unpriced/underpriced”!

- Many rely on observing the behavior of people (revealed preferences) in markets or other situations.

- Some techniques rely on people stating their preferences in hypothetical situations (stated preferences), such as contingent valuation methods, survey-based techniques,..
Valuation techniques: Change in production (a revealed preference technique)

- A basic “price x quantity” approach that is very useful in many NRM projects, e.g. changes in production of crops or fisheries.
- Changes in production may have been ignored because they occurred “off-site” (externalities) or because of pricing problems (valuation).
- Fairly easy to estimate and also easy for decision makers to understand.
Cost-of-Illness approaches (both revealed and stated preferences)

- **Morbidity costs:**
  - Cost of medical treatment, lost work time, medicines, care giving
  - Costs of avoiding getting sick

- **Mortality costs:**
  - Lost productivity (human capital-HC-approach)
  - Value of statistical life (VSL) includes both revealed and stated preferences – is a willingness-to-pay measure, often 10 times larger than HC approach – WHY?
Cost-of-Illness approaches (revealed preferences)-continued

- Very widely used in the Bank in both “cost of environmental degradation” studies, as well as in justifying investment projects in pollution control, road safety, health care, disease prevention,…

- Mortality (death) costs are almost always big numbers and swamp morbidity figures (WHY might this be so??). US average VSL now is over $5 million. How can this be used in developing countries? Why might CEA be preferred to BCA in this case?
Valuation techniques: **Contingent valuation method (CVM)** (stated preferences)

- CVM as a second-best approach that relies on surveys and questions on willingness-to-pay (WTP) or willingness-accept-compensation (WTAC) for such things as an environmental good or service, or damage to health
- When should you use WTP and when WTAC?? – in theory and in practice??
- Especially useful when the market does not exist (e.g. a yet to be established protected area) or for non-use values like bequest and existence values (e.g. for endangered species)
Valuation techniques: Contingent valuation method (CVM) —contd.

- Extensively used for ecosystem damage assessments when there is human use or knowledge of the ecosystem.
- Sometimes applied by the use of **Benefit Transfer** techniques — applies the valuation results (or benefit functions) from study site A to a similar resource in study site B (may be in different countries).
  - A quick way to get an answer overnight
  - Use of “meta analysis” from the literature helps strengthen credibility of benefit transfer
- Important caveats
  - Both study sites (the resource being valued) must be similar
  - Population using each site must be similar wrt important characteristics
  - Not a substitute for actual work in location B if time and money permit
- Good point about CVM – you always get an answer!
- Bad point about CVM – you always get an answer!!
Valuation techniques: Travel cost method (revealed preferences)

- A “revealed preference” approach based on observation or survey data on actual travel patterns including the monetary costs and time involved in travel
- Solid theoretical and practical foundations and applications
- A good technique for many recreational/cultural amenities where visitation is an important use
- Remember: the travel cost itself is not the value of the resource – but this information is used to derive a demand curve to then estimate values for the resource
Valuation techniques: **Hedonic price methods (revealed preferences)**

- Value environmental amenities (and disamenities) by changes in property values or location-specific prices (such as sites with differing views)
- Applied to housing, hotels, land and other site-specific valuation issues
- A very strong revealed preference approach
- However, willingness to pay is naturally limited by the ability to pay
Conclusions

- Environmental economics is economic analysis when one is concerned with valuation, externalities, rent capture, market failures, and policy failures.

- Economic valuation is a key issue and a wide variety of valuation techniques exist and can be used – in WB projects the most common applications are those relating to changes in health (usually from pollution; could also be from STDs or other causes) or changes in production of crops, fisheries, forests, ...

- The applied literature on environmental economics is expanding rapidly in both developed and developing countries.
Conclusions (contd.)

- There is increased acceptance of both the analytical techniques and the results by government decision makers and the general public. The next session on global warming illustrates this.
- Cannot value all environmental components – e.g. what is biodiversity worth????
- Valuation can be built into project design and does not have to be terribly expensive
- Some short cuts are possible (quick and dirty approaches, e.g. benefit transfer, rules of thumb or simple CEA results) but have to be used with caution
- For more advice, see your friendly local World Bank environmental economist for assistance!!!
The many ways to value the environment

- **Revealed Preference**
- Change in Production
- Cost-of-Illness
- Hedonic Pricing
- Travel Cost

- **Stated Preference**
- Contingent Valuation
- Choice Experiment

- **Benefits Transfer**

Choosing Valuation Methods for Egypt