Outline

Economic Theory of Value

Social Use of Economic Values
Utility

- **Value** is a word heavy with multiple meanings
  - In economics, it has one, formal, meaning: Value as a difference in expenditures to reach a given utility
- There is 2 approaches, that are dual
  - That is, 2 sides of the same idea
  - Utility-based and Expenditure-based
Duality theory

- Recall that individual’s preferences
  - For anything from apple to social justice
  - Can be represented by a Utility function $U(.)$
    - That has certain properties
    - and depends on quantities $x$ of goods & services
- Individuals behave as if they are maximizing such function
  - Under a budget constraint $px \leq y$
    - $p$ is the vector of prices (some of these prices are fictitious)
    - $y$ is income (that comes, among others, from labour, so it is endogenous, but we take $y$ as exogenous)
- Individual’s choices lead to “optimal” demands $x(p, y)$
  - That have mathematical properties
Duality theory

- Plugging such demands in the utility function
  - Leads to the **Indirect Utility Function**
    \[
    V(p, y) = \max U(x) \mid px \leq y
    \]
  - But we can also look the income that would be needed
    - to achieve such utility level
    - given preferences \(U(.)\) and prices \(p\)
    - This is the **Expenditure Function**
      \[
      E(p, U) = \min px \mid U(x) \geq U
      \]
- The Duality Identity
  \[
  y \equiv E(p, v(p, y))
  \]
  shows that the 2 approaches are equivalent
Hicks, a famous economist,
- asks a straightforward question
  - What change in income would be equivalent to a given change of the vector of prices \( p \)?
- “Equivalent” means here “at the same level of utility”
  - Clearly the answer(s) must depend on individual preferences
    - So on \( U(.) \)
Hicksian Measures of Value

**Compensating Variation** of a price change from $p_0$ to $p_1$

- Reference Utility: *initial* $p_0$
- $CV(p_0, p_1)$
  - $= E(p_1, V(p_0, y)) - E(p_0, V(p_0, y)) = E(p_1, V(p_0, y)) - y$
  - s.t. $V(p_1, y + CV) = V(p_0, y)$

**Equivalent Variation**

- Reference Utility: *final* $p_1$
- $EV(p_0, p_1)$
  - $= E(p_1, V(p_1, y)) - E(p_0, V(p_1, y)) = y - E(p_0, V(p_1, y))$
  - s.t. $V(p_1, y) = V(p_0, y - EV)$
Hicksian Measures of Value

- Are the standard notions of value in applied economics
  - Other measures lack a similar fundamental construction
- So economic value
  - is about (individual) utility
    - the value is the (individual) conversion of a price change in an income change
  - is NOT a price or a cost
  - is NOT financial or accounting
  - May be purely immaterial, no actual (or future) transaction is required to define a value
Non-market Values

Hicksian Measures of an environmental change

- Let $z$ the “level” of environment (quality...)
  - Public good, pollution, externality
  - States of the world: wealth distribution, justice, equity...
  - All that is non-market

- Issues
  - Commensurability
    - Is the environment really amenable to a single quality index measure?
    - e.g. what is air “quality” what pollutants? How do you combine them?
  - Measurement, actually getting proper data

- Insert $z$ in the previous functions
  - $V(p, z, y)$ Indirect Utility & $E(p, z, U)$ Expenditure
  - Simplify notation: remove $p$
    - Since we will not discuss changes of prices
Non-market Values: definitions

- **Compensating Variation** (Reference Utility = *initial* $z_0$)
  
  - $CV(z_0, z_1)$
  
  - $= E(z_0, V(z_0, y)) - E(z_1, V(z_0, y)) = y - E(z_1, V(z_0, y))$
  
  - s.t. $V(z_1, y - CV) = V(z_0, y)$

  - Improvement $z_0$ to $z_1$ ⇒ Willingness To Pay to secure it (+)
  
  - Deterioration $z_0$ to $z_1$ ⇒ Compensation To Support it (-)

- **Equivalent Variation** (Reference Utility = *final* $z_1$)
  
  - $EV(z_0, z_1)$
  
  - $= E(z_0, V(z_1, y)) - E(z_1, V(z_1, y)) = E(z_0, V(z_1, y)) - y$
  
  - s.t. $V(z_1, y) = V(z_0, y + EV)$

  - Improvement $z_0$ to $z_1$ ⇒ Compensation To Support it (-)
  
  - Deterioration $z_0$ to $z_1$ ⇒ Willingness To Pay to avoid it (+)
Which one to use?

- Property rights
- Compensating Variation : right to level $z_0$
  - Improvement $z_0$ to $z_1 \Rightarrow$ Willingness To Pay to secure it (+) : The person must “buy” $z_1$
  - Deterioration $z_0$ to $z_1 \Rightarrow$ Compensation To Support it (-) : Compensate the person for the deterioration
- Equivalent Variation : right to level $z_1$
  - Improvement $z_0$ to $z_1 \Rightarrow$ Compensate the person to forfeit the improvement (-)
  - Deterioration $z_0$ to $z_1 \Rightarrow$ To avoid the deterioration, the person must “buy” $z_0$ (+)
Nonmarket Values

- As for the change in prices: the values are not limited to "financial" ones (price, cost, flows...)
- In a public sector context, no transaction is necessary
  - e.g. a collectivity decides to set aside part of its forests w/o exploitation
    - Since the owner is the collectivity, it does not have to pay itself for the un-realized sale of wood
    - its members do not have to "buy" the ecological services that they obtained in return
    - It is true that they forfeit the revenue from the sale of woods, this indicates that their value is at least as high
- Nonmarket Values are also not opportunity costs
  - Or differences of commercial / industrial / agricultural yields
Nonmarket Values

- WTP are limited by the individual budget
  - in this sense, they represent a capacity to pay
    - There is an interpretation in terms of public finance: the budget that a collectivity could levy to finance the environnemental corresponding to the WTP
  - Other things equal, with the utility function, a rich person’s WTP will be higher than a poor’s
    - So that the rich person’s “opinion” will weight more in the collectivity budget

- WTP and compensations are expressed in money
  - They are thus comparable between individuals and can be added
  - Usually not the case w/ non-economic notions of value
## Understanding the sources of economic value: a typology

<table>
<thead>
<tr>
<th>Source</th>
<th>Example in a forest context</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Direct Consumptive Use</strong> (private goods)</td>
<td>hunting and gathering products, wooden products / cultivation</td>
</tr>
<tr>
<td><strong>Direct Recreational Use</strong> (public goods)</td>
<td>hunting and gathering practices, hiking / nature watching</td>
</tr>
<tr>
<td><strong>Indirect/functional Use</strong></td>
<td>water: filter / flood protection, air: filter / fixing carbon, soil: erosion / desertification, landscape</td>
</tr>
<tr>
<td><strong>Option</strong></td>
<td>use: preserve future / 3rd party use, quasi-use: value of information</td>
</tr>
<tr>
<td><strong>Non-use</strong></td>
<td>“patrimonial”: existence &amp; heritage, “moral”: role of humanity wrt nature, non-human rights</td>
</tr>
</tbody>
</table>
Outline

Economic Theory of Value

Social Use of Economic Values
Public Cost-Benefit Analysis CBA

- Should a certain public project should be pursued?
  - e.g. should we renovate Part-Dieu? build a dam?
  - What are the indirect or non-market benefits/cost?
- This can be very difficult
  - The project may span many years, have many uncertainties
  - There maybe loosers and gainers
- This is currently a burgeoning industry
- CBA is frequently used in business
  - But business measures project according to the net revenue they generate
    - In the end, this is about sales generated
  - So the question of eliciting non-market values does not exist
CBA as a Social Decision Rule

- Inform (public) decision-makers
  - Precisely quantifying benefits & costs
  - Associating them to socio-economic profiles
    - e.g. is a certain project beneficial to the poor or to the rich people?
    - via econometric analysis

- Legal Contexts
  - Western countries legislation require evermore often that large public projects demonstrate that their benefits > their costs
    - Including all non-market benefits (or costs)
  - EU Directives
    - e.g. Water Framework Directive (“Cadre Eau”)
  - US “Acts”
    - e.g. Clean Air Act epa.gov/oar/sect812/
French Guidelines (Valeurs tutélaires) for the Transport ¹

- Context of road infrastructure, mainly
- Value of Statistical Life VSL (VVS) : 3 M€ 2010
  - Value of a Year of Life VYL (VAV) : 115 000 € 2010
  - Value of a seriously injured : 15 % of VSL, 450 000 € 2010
  - Value of a lightly injured : 2 % of VSL, soit 60 000 € 2010
- Value of carbon
  - Value 2013 : 32 € 2010/tCO2
  - Value 2030 : 100 € 2010/tCO2
- Value of time depends on
  - Motive (professional, holiday...)
  - Distance (urban, <20km, 20-80km, ...)
  - Mode

¹ Multiples values in transport sector : Environment, noise...

### French Guideline Values for Water

<table>
<thead>
<tr>
<th>Activity</th>
<th>Min-Max de la Valeur économique (en €2008/ha/an) issue des 15 études françaises¹</th>
<th>Nombres d’études concernées</th>
<th>Valeur économique moyenne (en €2008/ha/an) selon la méta-analyse de Brander et al. (2003) à partir de 89 sites</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Epuration de l’eau</strong></td>
<td>15-11300</td>
<td>4</td>
<td>272</td>
</tr>
<tr>
<td><strong>Soutien des étiages</strong></td>
<td>45-150</td>
<td>3</td>
<td>42</td>
</tr>
<tr>
<td><strong>Lutte contre les inondations</strong></td>
<td>37-617</td>
<td>6</td>
<td>438</td>
</tr>
<tr>
<td><strong>Activités récréatives pêche, chasse...</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Pêche</td>
<td>80-120</td>
<td>2</td>
<td>353</td>
</tr>
<tr>
<td>• Chasse</td>
<td>230-330</td>
<td>2</td>
<td>116</td>
</tr>
<tr>
<td>• Navigation/plaisance</td>
<td>15</td>
<td>1</td>
<td>pas évalué</td>
</tr>
<tr>
<td>• Canoë/kayak</td>
<td>28</td>
<td>1</td>
<td>pas évalué</td>
</tr>
<tr>
<td><strong>Valeur sociale</strong></td>
<td>200-1600</td>
<td>7</td>
<td>392</td>
</tr>
<tr>
<td><strong>Total des services rendus (en euros 2008/ha/an)</strong></td>
<td><strong>(650-14160)</strong></td>
<td></td>
<td><strong>1613</strong></td>
</tr>
</tbody>
</table>

¹ Issues de la Valeur économique issue des 15 études françaises.
Environmental Public Goods Examples

- Improve air or (surface) water quality
- Risks reduction
  - Contaminants in tapwater, in food (incl. GMO)
  - Transports
  - Job-related accidents
- Protect/restaure natural areas (wetlands, forests, rivers, beaches...), endangered species
Non-environmental Examples

- Improve public education, health services quality
- Basic services in developing countries
  - Water or electricity distribution, garbage collection déchets...
- Medical and health care research
- Food research e.g. WTP for new food
- Culture
  - Protect / restore cultural heritage sites
  - Value of a museum, an art company,...
Damages (dommages & intérêts) : Accidental Pollution

- The other domain in which economic values are used
- French “dommages environnementaux”
  - Fairly new, relatively small amounts
- US Damages
  - Routine, the EPA sues several times a year
Database of valuation studies: www.evri.ca

7000+ records
Benefit Transfert
EVRI by asset and by use

By environmental asset

By environmental use
EVRI by technique & area (older data)

By valuation technique

By continents
To conclude on economic value

- **Economic value**
  - Defined for market and non-market goods and services
    - Following ecological or social functions (see the Forest example)
  - Individualistic (depends on preferences)
    - in a public finance context
  - Quantitative
    - But we will see that estimation may suffer many biases

- Its context is
  - CBA, to inform decision-makers
  - Damages