WASCAL, Cost-Benefit Analysis. Day 4 notes

Agenda

1. Benefits are not independent of the design of a project
2. Recap: Benefit/unit and Cost/unit formula for economic benefits and costs of non-tradeables
3. Valuing tradeable goods: exports, imports
4. Value of labor (brief)
5. Value of a life!
6. What discount rate to use?

4. Value of a life!

Many projects save lives.

e.g. Hospital; seatbelts; wider roads; enforcing use of helmets for motorcyclists; more firefighters;

Question: How value the benefits of the lives saved?

Value of a statistical life.

None of us value our lives infinitely! We all take risks: walk across a busy street. Drive too fast.

Look at how much you need to pay someone to take on more risk: e.g. at work

    Compare the wages in jobs: one is risky, other less so, but other aspects of the job are similar.

    e.g. Job pays $1,000 per year; almost no risk. Risky job (probability of death is 0.1%): pays $1,200.

    Need $200 per year to offset a 0.1% risk of death

    $2,000 to offset a 1% risk

    $200,000 to offset a 100% risk. This is the value of a statistical life.

Varies by country. US government agencies use a figure of about $5 million. In a poorer country, this number would be much lower.
1. Benefits are not independent of the design of a project

ROAD: No Toll

\[ P \quad \Delta \quad S \quad C_S \quad Q_D \quad Q_{CEV5} \quad 1000 \text{ /day} \]

Doubled Toll

DWL quadrupled

DWL \( \propto T^2 \)

ROAD: Toll

\[ P \quad D \quad \Delta \quad S \quad E_S \quad Q_1 \quad Q_2 \quad Q \quad Q \]

Excess burden \( \approx \) Deadweight loss

toll revenue

\[ 2T \quad T \quad Q_2 \quad Q_1 \quad Q \]
2. **Recap**: Benefit/unit and Cost/unit formula for economic benefits and costs of non-tradeables

Suppose we have a sales tax. Also a new project to supply more hotel rooms.

\[
\text{Fixed Supply: } S = MC, \quad E = 0
\]

\[
\begin{align*}
\Delta Q &= Q_s^1 - Q_s^0 \\
P_o^b &= (1 + \eta) P_o^s \\
\beta_{\text{unit}} &= \frac{E P_s^s - \eta_q P_d^d (Q_d^d/Q_s^s)}{E - \eta_q P_d^d/Q_s^s} \\
\text{Cost}_{\text{unit}} &= \\
\text{If supply vertical, } E = 0 \Rightarrow \beta_{\text{unit}} = P_d^d \\
\text{Also: } \beta_{\text{unit}} &= W_s P_s^s + (1 - W_s) P_d^d \\
W_s &= \frac{1}{1 - \frac{\eta_q}{E}} \cdot \frac{Q_d^d}{Q_s^s} \\
\text{Key: } P_s^s, P_d^d, (\eta_q/E)
\end{align*}
\]
3. Valuing tradeable goods: exports, imports

Projects need imports; produce export. Question: How value these economically?

<table>
<thead>
<tr>
<th>$</th>
<th>Financial</th>
<th>Economic</th>
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<tbody>
<tr>
<td>Pfob</td>
<td>3000</td>
<td>3000</td>
</tr>
<tr>
<td>-Export tax</td>
<td>-400</td>
<td></td>
</tr>
<tr>
<td>P at port</td>
<td>2600</td>
<td></td>
</tr>
<tr>
<td>-transport to port</td>
<td>-200</td>
<td>-200</td>
</tr>
<tr>
<td>P factory gate</td>
<td>2400</td>
<td>2800</td>
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conversion factor = Ec val/Finan val = 2800/2400=1.16

EC. value is $p_{fob}$
3b. Project needs imported inputs (e.g. cement). What is the economic cost of the imports?

\[
\text{cif: cost, insurance, freight}
\]

\[
P_c \left(1 + \frac{k}{200}\right) \rightarrow \$220 \rightarrow P_{\text{cif}}
\]

\[
\text{Value of imports} = P_{\text{cif}}
\]
6. What discount rate to use?

NPV = sum of the PVs. \( PV = \frac{VF(t)}{(1+\text{discount rate})^t} \)

For financial analysis, look at the cost of capital to the investor. But for economic analysis, we want to measure the opportunity cost to society of using resources now rather than later.

1. Use marginal return on private investment (\( rz \))
   Project should get at least this return; otherwise leave it in the hands of private investors.
   USA. In practice: return on corporate bonds. About 4% (plus inflation).
2. Social marginal rate of time preference (\( \rho z \))
   Return that savers need (after tax) in order to save one more dollar.
   e.g. If I need a 3% interest rate (net of tax) in order to put my money into the bank.
   USA. Real return on US treasury bills. About 1.5% (plus inflation).
3. Cost of borrowing to the government.
   Return on 10-year US government bonds. About 3.5% (plus inflation)
4. Weighted average of the above. Question: What weights?

Problems with using market rates:

- Capital markets are imperfect; sometimes very thin.
- Individual preferences may not be time consistent.
- Philosophically: surely welfare of future generations is worth as much as the present generation, so discount rate for utility should be zero [Ramsey 1920s; Solow; Stern]

As we saw, lower discount rates favor projects with long payoff, especially helps environment.