Cost-benefit analysis

Topics

- Political background
- Context question
- Federal Principles, Requirements & Guidelines
- Measuring benefits of an increased water supply
- Alternative costs as a benefit measure

Political gravity

- Major projects have been the Public sector's domain. Why?
- $$$ & multipurpose
- Major opportunities for relying on taxpayers instead of ratepayers
- Myths prevail (need, econ. development)

“A” CBA question

Mindful of the full range of available supply enhancement and demand management options:
- Is this project part of the best package?
U.S. Principles & Requirements

Political and water agency forces prefer projects, so U.S. law acted to require CBA, beginning in 1936.

But the agencies themselves do the analyses, and they have internal biases.

Yet, we want consistent (across agencies) and well done CBAs.

U.S. Principles, Requirements, and Guidelines

- downloadable at websites.
- quite readable; doesn’t develop allowed methods
- Required for national projects only.
- Past: Corps of Eng., BuRec, TVA, NRCS (USDA)
- added (2013): EPA, NOAA, FEMA, OMB
- for any water-related infrastructural planning

Historical Discount Rates
for Federal Water Projects (1957-2016)

[Graph showing historical discount rates from 1957 to 2016 with a peak around 1982 and a note: 3.25% for 2016 planning]
1983 U.S. Principles & Guidelines

- Water projects are multipurpose – difficult to analyze.
- 4 "accounts": NED, RED, EQ, OSE
  - RED includes secondary economic effects.
  - EQ, OSE include incommensurables and intangibles.
- NED: are annualized benefits > annualized costs?
  - If "yes", it can be built according to 1983 P&Gs.
  - "Variances" commonly given (in writing).
- Still needs appropriations (funding).

2013 U.S. PR&G

- 4 accounts are gone, at least in name.

"In consideration of the many competing demands for limited Federal resources, it is intended that Federal investments in water resources as a whole should strive to maximize public benefits, with appropriate consideration of costs. Public benefits encompass environmental, economic, and social goals, include monetary and nonmonetary effects and allow for the consideration of both quantified and unquantified measures." (p. 3, emphasis added).

U.S. PR&G

"Addressing the complex and often conflicting water resource needs of today and the future requires the formulation of a diverse range of solutions that need to be fully considered in the decision making process. Such solutions may produce varying degrees of effects relative to environmental, economic, and social goals. No hierarchical relationship exists among these three goals and as a result, tradeoffs among potential solutions will need to be assessed and communicated during the decision making process" (p. 3, emphasis added).
U.S. PR&G

“The ecosystems services approach is a way to organize all the potential effects of an action (economic, environmental and social) within a framework that explicitly recognizes their interconnected nature” (p. 7).

“A narrow focus on monetized or monetizable effects is no longer reflective of our national needs, and from this point forward, both quantified and unquantified information will form the basis for evaluating and comparing potential Federal investments in water resources” (p. 7).

U.S. PR&G

“Nonstructural approaches can often be the most cost effective and environmentally protective alternative to implement” (p. 11).

“Nonstructural measures include, but are not limited to, modifications to public policy, regulatory policy and pricing policy, as well as management practices, including green infrastructure” (p. 7).

That is, CBA is necessarily more than NPV (or similar measures), because all project impacts are not commensurable.
Table 3.2 1993 Initial Project Cost Estimate

<table>
<thead>
<tr>
<th>Facilities</th>
<th>Size</th>
<th>Costs ($ million)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bank Dam (MW)</td>
<td>1.80</td>
<td>70</td>
</tr>
<tr>
<td>Soldier Dam (MP)</td>
<td>1.80</td>
<td>165</td>
</tr>
<tr>
<td>Belle Isle Dam (MW)</td>
<td>1.80</td>
<td>137</td>
</tr>
<tr>
<td>Pumping Plant w. Soldier Dam (p)</td>
<td>2.00</td>
<td>177</td>
</tr>
<tr>
<td>San Antonio River Pumping Plant p</td>
<td>2.00</td>
<td>177</td>
</tr>
<tr>
<td>San Antonio River Pumping Plant (p)</td>
<td>2.00</td>
<td>177</td>
</tr>
<tr>
<td>Fund's Reservoir Identification (p)</td>
<td>1.00</td>
<td>47</td>
</tr>
<tr>
<td>Long Tunnel at mill and water (p)</td>
<td>1.00</td>
<td>126</td>
</tr>
<tr>
<td>South Road Alternative (p)</td>
<td>1.00</td>
<td>140</td>
</tr>
<tr>
<td>Reservoir (Red cost)</td>
<td>1.00</td>
<td>32</td>
</tr>
<tr>
<td>COG (Capital and TRB; present)</td>
<td>1.00</td>
<td>27</td>
</tr>
<tr>
<td>Pipeline and Pumps from TRB to Funks (p)</td>
<td>1.00</td>
<td>30</td>
</tr>
<tr>
<td>TCC Conservation (p)</td>
<td>2.00</td>
<td>33</td>
</tr>
<tr>
<td>Levee Acquisition (p)</td>
<td>1.00</td>
<td>29</td>
</tr>
<tr>
<td>Total Fuel Costs</td>
<td>1.00</td>
<td>495</td>
</tr>
<tr>
<td>Total Construction Costs</td>
<td>2.474</td>
<td>425</td>
</tr>
<tr>
<td>Total Capital Costs</td>
<td>2.803</td>
<td>254</td>
</tr>
<tr>
<td>Annual Costs</td>
<td>4.00</td>
<td>47</td>
</tr>
<tr>
<td>Total Annual Costs</td>
<td>4.00</td>
<td>47</td>
</tr>
</tbody>
</table>

* Includes pipeline, reverse flow facilities, and flood control structures in Funds.
* Includes TCC spending.
* Includes pumping-generating plant.
* Levee Acquisition includes placement and right-of-way for Sites Reservoir and Reservoirs.
* Engineering costs include construction management and design.
* Environmental Mitigation and Permits are not included in the total costs.
* Interest during construction is in the federal terminology.

San Antonio's Applewhite Reservoir

![Graph showing the value of the reservoir over time](image)

**Alternative Costs**

- Let's say we wish to measure the added benefits of $A_0$ for some project.
- Instead of using $\frac{A}{1+r}$, could we use the alternative cost procedure?
- What other costs will be avoided if this project is built? Can they be claimed to be the benefits?
Alternative Costs (cont.)

Presented as a fill-in-the-blank application:

“By increasing the water supply with project A, the region will avoid paying option B’s $X$ million, so the benefits of project A are at least $X$ million.”

<table>
<thead>
<tr>
<th>Proj. A</th>
<th>Alternative B</th>
<th>Okay?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hott Dam</td>
<td>Losing $X$ m. in regional economic activity</td>
<td>no, the alternative costs are secondary econ. effects</td>
</tr>
<tr>
<td>Hott Dam</td>
<td>Paying $X$ m. for an interbasin transfer</td>
<td>maybe, but only if B would occur &amp; is efficient</td>
</tr>
<tr>
<td>Hott Dam</td>
<td>Paying $X$ m. for a desalination plant</td>
<td>maybe, but only if B would occur &amp; is efficient</td>
</tr>
</tbody>
</table>

The PR&G’s dictates (f.y.i only)

“Alternative plans, strategies, or actions are to be formulated in a systematic manner to ensure that a range of reasonable alternatives are evaluated.” (p. 12)

“In some cases, plans, strategies, or actions may be formulated which require changes in existing statutes, implementation authority, administrative regulations, and/or established law and policies” (p. 12)

“Alternative plans, strategies, or actions that can effectively address a problem through the use of nonstructural approaches, if they exist, must be fully considered and carried forward to the final array of solutions.” (p. 12)

“An alternative plan, strategy, or action that is preferred by a local interest with oversight or implementation responsibilities must be included in the final analysis.” (p. 12)