Cost-Benefit Analysis and Decision Tools (ESM 245)
Bren School of Environmental Science & Management
University of California, Santa Barbara
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Course Objectives and Rationale

Cost-benefit analysis provides a framework for conducting economic analysis of public policy, as well as examining tradeoffs in decision making within organizations—firms, NGO, government agencies. The application of cost-benefit analysis to environmental and natural resource policy is both common and controversial. This is a course in evaluation of tradeoffs encountered in assessing options for government, NGOs, and private firms. Cost-benefit analysis and feasibility studies are key tools.

Decisions within organizations and government regarding environmental issues always involve tradeoffs. To accurately assess these tradeoffs, costs and benefits have to be measured; relevant parties determined; timelines decided; and discount rates selected. Anyone can create a benefit/cost ratio or calculate NPV. The issue is whether or not they are credible and useful. Accordingly, the course will be more than a practical exercise in cost benefit analysis.

It will cover the underlying theory of social decision-making based on a comparison of economic costs and benefits, as well as cover more focused application within organizational units. We will consider numerous applications in the context of environmental and natural resource management, and have as many presentations of application as possible. We also will read the literature on key issues in cost-benefit analysis. In many cases, as we will see, cost-benefit analysis requires an understanding of methods of nonmarket valuation, selection of appropriate discount rates, addressing uncertainty in the flow of costs and benefits, and issues of their distribution since they rarely are distributed uniformly in the society. Hence we will spend time covering the theory of nonmarket values and the methods for estimation in the context of environmental and natural resources; assessment of discounting options; weighting of costs and benefits; consideration of uncertainty; and distributional implications.

Students will learn the skills necessary to conduct original cost-benefit analyses and feasibility studies and to evaluate those conducted by others. Additionally, students will gain an appreciation for the potential advantages and disadvantages of cost-benefit analysis, along with
its relation to other approaches for decision-making about environmental and natural resource concerns.

Students will apply this learning to a real project that has both private and public benefits and costs with implications for all aspects of environmental decision making.

All group projects represented in the class will have a cost benefit analysis completed by the end of the term.

Approach and Grading

Students will divide into teams of 3-5. The objective is to have teams organized around Group Projects. Each team will conduct a cost benefit analysis for the Group Project. Grading will be based on a). class discussion of course material and comprehension of material as applied to the GP. b). critiques of the CBA analyses of other GPs and a final CBA for the Group Project due at the end of the term to include details on approach, problems encountered, caveats, references, and technical appendix, if appropriate.

Students will be graded individually on CBA problems assigned separately in class. Weights 50% times individual problem set grades and 50% times group presentation and final CBA submission.

Course Materials

Required text is Cost Benefit Analysis and the Environment: Recent Developments by David Pearce, Giles Atkinson, and Susana Mourato, OECD, 2006. It is available on the web at http://www.oecd-ilibrary.org/content/book/9789264010055-en and UCSB has a subscription to OECD publications so that students can download chapters. There will be other cases and readings that will be posted on the web.

Other course materials for the project will be posted.

Course Requirements

You are expected to complete all of the assigned reading before class, as lectures will build on, rather than reiterate, reading material. The aim is to have much of class based on discussion, so being prepared will be important.

Classes generally will involve lectures, discussion of CBA problems, and student team presentations and critiques. All team assignments will be due the day prior at 8 am. Presenting teams will take 10 minutes, followed by 10 minutes of class discussion.

Course Outline and Reading List

• Course overview. Present syllabus.
• **GP teams due to Libecap by September 27.** 3-5 members. GP members with less than that should join another team.
• Review of microeconomic principles for environmental management. Efficiency criterion and what that means.
• Problem set # 1 introduction: Evaluation of transportation improvement options for Houston: Buses or Light Rail. **Individuals submit analysis to Gary Libecap/Dan Szmurlo by 8 am Thursday September 29 and be prepared to lead discussion.**
• Discussion for 9/27: How would you do a cost benefit analysis of dam removal? The case of Milltown dam, Montana.

**September 27: What is Cost-Benefit Analysis (CBA) and Why is it Important?**
Lecture 2

• Shively and Galopin, “An Overview of Benefit-Cost Analysis,’ Purdue University mimeo. **Be sure to go over this carefully for the class discussion.**
• Pearce, et al, 2006, Chapters 1, 2
• Team announcements.
• Class discussion of CBA for dam removal. **Milltown Dam.**

**September 29: Problem Set 1: Houston’s Transport Problem**
Lecture 3

• Discussion of Houston transport problem led by Dan Szmurlo and selected students.
• Problem set #2 introduction. Analysis of American Solar’s planned expansion. **Individuals submit analysis to Gary Libecap/Dan Szmurlo by 8 am Thursday October 6 and be prepared to lead discussion**

**October 4: Introduction to Evaluation Tools.**
Lecture 4

• Introduction to discounting, distribution of costs and benefits, impact of shifting costs to benefits, scale effects, differences in time frame across options.
• Discussion of: Benefit-Cost Ratios, Cost Minimization, Net Present Value Analysis, Internal Rate of Return, Equivalent Annual Net Benefits.
• Cost Benefit Analysis, “Evaluating Quantitatively Whether to Follow a Course of Action.” **Be sure to go over this short example carefully to understand the concepts prior to class.**
• Direct and indirect costs and their importance in CBA.
• CBA in a Economic Development/Environmental Context: “Simple Introduction to Cost-Benefit Analysis.” Howard. Be sure to go over this real world example in Samoa prior to class.

October 6: Problem Set #2 American Solar’s Planned Expansion. Lecture 5.

• Discussion of American Solar’s planned expansion problem led by Dan Szmurlo and selected students.
• Problem set #3 introduction. Distribution of Costs and Benefits Problem. Be prepared also to discuss why distributional issues are important in CBA. Individuals submit analysis to Gary Libecap/Dan Szmurlo by 8 am Thursday October 13 and be prepared to lead discussion.


• Readings: Pearce et al Chapter 6
• Segerson (2014) “Distribution and Compensation in Economics”
• Class discussion of CBA of the re-introduction of wolves in the northern Rockies, including distributional impacts. Distribution and the Reintroduction of the Wolf
• 8 Pros and Cons of Wolf Introduction
• Smith and Sime, Policy Issues Related to Wolves
• Wolves in the Northern Rockies
• Costs of Wolf Reintroduction
• Wolves and People (Duffield, Neher, and Patterson, 2006).


• Discussion of Distributional Issues in CBA led by Dan Szmurlo and selected students.
• Problem set #3 introduction. Distribution of Costs and Benefits Problem. Be prepared also to discuss why distributional issues are important in CBA.
• Introduction of problem set #4, CBA of Santa Barbara’s Desalinization plant. Individuals submit analysis to Gary Libecap/Dan Szmurlo by 8 am Thursday October 20 and be prepared to lead discussion.
October 18: Introduction to Benefit Valuation: Revealed Preference:
Lecture 8.

- Readings: Pearce et al Chapter 6, 7.
- Various means of determining value from revealed preference.
- Averting Behavior
- Travel Cost Estimates

October 20: Problem Set #4: CBA of Santa Barbara’s Desalinization Plant.
Lecture 9.

- Discussion of CBA of Santa Barbara’s Desalinization Plant led by Dan Szmurlo and selected students.
- Problem set #5 introduction: Ecosystem Services Valuation, Wetlands. Individuals submit analysis to Gary Libecap/Dan Szmurlo by 8 am Thursday October 27 and be prepared to lead discussion.

October 25: Introduction to Benefit Valuation: Revealed Preference
Lecture 10.

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- Hedonic Prices—property valuation
- Hedonic Pricing discussion file.
- Examples of Hedonic Pricing Calculations.

October 27: Problem Set #5: Ecosystem Valuation, Wetlands.
Lecture 11.

- Discussion of Ecosystem Valuation, Wetlands led by Dan Szmurlo and selected students.
- Problem set #6 introduction: Value of Ecosystem Services: Clean Water. Individuals submit analysis to Gary Libecap/Dan Szmurlo by 8 am Thursday November 3 and be prepared to lead discussion.

November 1: Introduction to Benefit Valuation: Contingent Valuation. Examples
Lecture 12.

- Stated Preference: Introduction to Contingent Valuation and Existence Value.
• Readings: Pearce, et al, Chapter 7, 8.

• Discussion of valuation of clean water Ecosystem Valuation, Wetlands led by Dan Szmurlo and selected students.
• Problem set #7 introduction: Value of Ecosystem Services: Prairie Restoration. Clean Water. Individuals submit analysis to Gary Libecap/Dan Szmurlo by 8 am Thursday November 10 and be prepared to lead discussion.

November 8: First Team Presentations with Critical Reviews by Class: Lecture 14.
• Benefit/Cost Valuation: 10 minutes per team. 3-4 teams.

November 10: Problem Set # 7 Valuing Ecosystem Services, Prairie Restoration, Travel Cost and Hedonic Measures. Lecture 15.
• Discussion of valuation of ecosystem services, prairie restoration, led by Dan Szmurlo and selected students.
• Problem set #8 introduction: Value of lions and human lives. VSL and hedonic measures. Individuals submit analysis to Gary Libecap/Dan Szmurlo by 8 am Thursday November 17 and be prepared to lead discussion.

November 15: Second Team Presentations with Critical Reviews by Class. Lecture 16
• Benefit/Cost calculations, 10 minutes per team, 3-4 teams.

• Discussion of valuation of lions and humans using VSL and hedonic measures led by Dan Szmurlo and selected students.
• General discussion of problem sets and their application to CBA and GP analyses.
November 22: *Introduction to Benefit Valuation Continued; Contingent Valuation Examples, Continued.*
Lecture 18.

- Discussion of survey instruments: Kotchen and Reiling; Loomis.
- Class discussion of CV in GP analyses.

**November 24: No class Thanksgiving Holiday**

**November 29: Benefit Measures: Health Valuing Health and Life Risk**
Lecture 19.

- Pearce et al, Chapter 14
- Class discussion of human valuation issues. More complicated than ecosystem services?

**December 1: Third** Team Presentations on Cost/Benefit Calculations, 10 minutes per team, 3-4 teams.

**December 8, 8 am: GP CBA analysis due. All research papers (10 pages with references for each project).**