

Cost-Benefit Analysis (90-824)

Carnegie Mellon University
Spring 2024, Heinz College
Wednesdays, 6:00-8:50 pm

Faculty Contact Information

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Review sessions: as announced

Course Description

Individuals and organizations are frequently presented with decisions about how best to allocate limited resources. Public organizations in particular have an obligation to use consistent and transparent analytic tools to inform tradeoffs among competing policy priorities such as the environment, health, safety, and security. Economics provides a theoretical foundation for the allocation of scarce resources, but in practice, there are a variety of challenges in measuring benefits and costs in quantitative and monetary terms. Such challenges include determining how to value benefits and costs experienced in the future, reductions in the risk of premature death and injury, and the distribution of these impacts among affected populations, as well as appropriately characterizing uncertainty. The ability to assess key assumptions and limitations is critical for both producers and consumers of cost-benefit analysis.

Learning Objectives

Through case studies, discussions, readings, lectures, problem sets, written assignments, and presentations, students will develop knowledge and skills that will enable them to:

- Understand and identify the assumptions and limitations of cost-benefit analyses.
- Critically assess cost-benefit analyses conducted by others.
- Evaluate and compare alternative policies using the tools of cost-benefit analysis and microeconomics.
- Communicate the results of the cost-benefit analysis to stakeholders in such a way as to facilitate political or administrative processes.
- Apply the analytic tools and techniques of cost-benefit analysis and microeconomics in the formulation and assessment of real-world policies.
- Contribute to the development of defensible and transparent cost-benefit analyses.

The learning objectives above will be evaluated by completion of the course requirements below.

Course Requirements

Course grades will be based on the following requirements:

1. Class participation and engagement (35 percent)
 - In addition to completing reading assignments for each class, active participation in class discussion and acceptance of cold calls in class are expected.
 - For certain classes, students may be asked to complete a discussion problem in advance of the class. Students will sometimes be asked to submit responses electronically in advance of class. We will ask 1-2 students to volunteer to lead the class discussion for the problem for each class.
 - The participation and engagement grade will depend on regular attendance and active involvement in class discussions, presentations, and discussion problems. Students are expected to attend all classes, but may be granted an excused absence that could include an illness or personal emergency or an apprenticeship-related travel/opportunity worked out in advance of the missed class. Please try not to miss class, as class discussions and lectures are the most important source of information for the final project. If you are late or have to miss class, please be sure to get notes from a classmate and download relevant materials from Canvas.
2. CBA in the News (10 percent)
 - Students will organize into pairs to prepare a short presentation (5-10-minutes) about contemporary cost-benefit analysis issues in the news, drawn from a current newspaper, magazine, or journal article selected by each student. Beyond being related to cost-benefit analysis, the only requirement for selecting the issues is that it interests you!
 - Beginning on January 25, each class 2 pairs of students will be presenting. The Teaching Assistant will organize the schedule of presentations; please let the Teaching Assistant know when you would like to present.
3. Problem sets (20 percent)
 - There will be two problem sets that will include work on spreadsheets and computer models and simulations.
 - Collaboration on problem sets must not include the preparation of final answers: all students must write up their answers independently. This means that problem set collaboration is limited to discussion only, perhaps with the help of a white board or scrap paper. No text, Excel formula, or equation should be copied verbatim in the process, and no student should share his or her write-ups with others. While students may share a common approach and even final numeric solutions, all write-ups must be independent. That said, be open and generous in your discussions; helping others is a good thing in CBA, as in life.
4. Final Project (35 percent)
 - The final project for this course requires students to organize into several small groups to analyze real-world cost-benefit analyses, and then to prepare and deliver a memo that evaluates the CBA and a presentation of the group's evaluation in class on March 1st.

- Each group will select a completed cost-benefit analysis to analyze from among a sample provided in class.

Late assignments are penalized 10 points immediately and then 10 additional points for each additional 24-hour period.

Course Materials

There is no required textbook for the course. However, a number of the classes will include selections from the following text:

- *Cost-benefit Analysis: Concepts and Practice* (Boardman, A.E., D.H. Greenberg, A.R. Vining, and D.L. Weimer, 2011, Fourth Edition). Upper Saddle River, N.J.: Pearson. The text is available for purchase online at [Amazon](#).

Although the required selections from the text will be posted on Canvas, students may wish to purchase the text for additional reading beyond the selections provided.

In addition to the text, other readings will include case studies, journal articles, book chapters, and published cost-benefit analyses. As with the selections from the text, these materials will be posted to the course page on Canvas. The case studies, in particular, are copyrighted and permission to use these materials is obtained through the College at a discounted rate so they can be easily shared with the course roster. Your student account will be charged a nominal fee to cover the cost of these materials. Please see the Heinz College handbook for further information.

The syllabus and reading list may be revised throughout the semester and all updates will be announced in class and posted on Canvas.

Student Well-Being

The past few years have been unlike any others. We are all under a lot of stress and uncertainty at this time. Attending Zoom classes all day can take its toll on our mental health.

Take care of yourself. Do your best to maintain a healthy lifestyle this semester by eating well, exercising, getting enough sleep, and taking some time to relax. This will help you achieve your goals and cope with stress. All of us benefit from support during times of struggle. There are many helpful resources available on campus and an important part of the university experience is learning how to ask for help. Asking for support sooner rather than later is almost always helpful.

If you or anyone you know experiences any academic stress, difficult life events, or feelings like anxiety or depression, we strongly encourage you to seek support. Counseling and Psychological Services (CaPS) is here to help: call 412-268-2922 and visit their website at <http://www.cmu.edu/counseling/>. Consider reaching out to a friend, faculty or family member you trust for help getting connected to the support that can help.

Use of Electronic Devices during Class

This semester CBA will be in remote-only format and so it involves the regular use of technology during class. Research has shown that divided attention is detrimental to learning, so please close any windows not directly related to what we are doing while you are in class. Please also turn off your phone notifications and limit other likely sources of technology disruption, so you can fully engage with the material, each other, and me. This will create a better learning environment for everyone.

Academic Integrity

Students are expected to honor the letter and the spirit of the Carnegie Mellon University Policy on Academic Integrity. Students are expected to familiarize themselves with this policy. Students are also encouraged to review the Carnegie Mellon University Academic Disciplinary Actions Overview for Graduate Students, which details penalties and sanctions, as well as students' rights. Departmental leadership will be consulted on appropriate action for all violations of the Policy on Academic Integrity.

Certain assignments in this course will permit or even encourage the use of generative artificial intelligence (AI) tools, such as ChatGPT. When AI use is permissible, it will be clearly stated in the assignment prompt posted in Canvas. Otherwise, the default is that use of generative AI is disallowed. In assignments where generative AI tools are allowed, their use must be appropriately acknowledged and cited. For instance, if you generated the whole document through ChatGPT and edited it for accuracy, your submitted work would need to include a note such as "I generated this work through Chat GPT and edited the content for accuracy." Paraphrasing or quoting smaller samples of AI generated content must be appropriately acknowledged and cited, following the guidelines established by [the APA Style Guide](#). It is each student's responsibility to assess the validity and applicability of any AI output that is submitted. You may not earn full credit if inaccurate or invalid information is found in your work. Deviations from the guidelines above will be considered violations of CMU's academic integrity policy. Note that expectations for "plagiarism, cheating, and acceptable assistance" on student work may vary across your courses and instructors. Please email me if you have questions regarding what is permissible and not for the course or a particular assignment.

- [Carnegie Mellon University Policy on Academic Integrity](#)
- [Carnegie Mellon University Academic Disciplinary Actions Overview for Graduate Students](#)

Diversity Statement

We must treat every individual with respect. We are diverse in many ways, and this diversity is fundamental to building and maintaining an equitable and inclusive campus community. Diversity can refer to multiple ways that we identify ourselves, including but not limited to race, color, national origin, language, sex, disability, age, sexual orientation, gender identity, religion, creed, ancestry, belief, veteran status, or genetic information. Each of these diverse identities,

along with many others not mentioned here, shape the perspectives our students, faculty, and staff bring to our campus. We, at CMU, will work to promote diversity, equity and inclusion not only because diversity fuels excellence and innovation, but because we want to pursue justice. We acknowledge our imperfections while we also fully commit to the work, inside and outside of our classrooms, of building and sustaining a campus community that increasingly embraces these core values.

Each of us is responsible for creating a safer, more inclusive environment. Unfortunately, incidents of bias or discrimination do occur, whether intentional or unintentional. They contribute to creating an unwelcoming environment for individuals and groups at the university. Therefore, the university encourages anyone who experiences or observes unfair or hostile treatment on the basis of identity to speak out for justice and support, within the moment of the incident or after the incident has passed. Anyone can share these experiences using the following resources:

- **Center for Student Diversity and Inclusion:** csdi@andrew.cmu.edu, (412) 268-2150
- **Report-It online anonymous reporting platform:** reportit.net username: *tartans* password: *plaid*

All reports will be documented and deliberated to determine if there should be any following actions. Regardless of incident type, the university will use all shared experiences to transform our campus climate to be more equitable and just.

Course Overview

Week	Lecture Topics
January 17	Conceptual Framework
January 24	Economic Foundations
January 31	Valuing Market Effects
February 4	First problem set due
February 7	Time Preferences and Discounting
February 14	Nonmarket Valuation
February 18	Second problem set due
February 21	Risk and Uncertainty
February 28	Final projects

Weekly Class Meetings, Readings, and Assignments

January 17: Conceptual Framework

Read:

- “Learning by the Case Method,” Harvard Kennedy School (HKS) note N15-86-1136. Please be sure to read this note before you read the case.

- HKS Case 2084.0, “Miami-Dade County and Sea Rise.” Please read the case and come to class prepared to explain what you would advise Mayor Gimenez to do.

January 24: Economic Foundations

Read:

- Boardman et al. Chapter 3, “Microeconomic Foundations of Cost-benefit Analysis,” pages 52-56 (skip section on Taxes on pages 56-57), pages 57-61.
- Kellogg School of Management, Case KEL001, “Sugar Daddy: Quotas and the U.S. Government.” Please read the case and come to class prepared to discuss your responses to the 5 questions on page 4 of the case.

Optional. Though not required, those seeking an alternative treatment of the Boardman Chapter 3 material may find the following to be helpful:

- Varian, Intermediate Microeconomics, Chapter 14, “Consumer’s Surplus,” pages 251-257 on consumer surplus, pages 262-264 on producer surplus, and pages 264-267 on applications to Cost-Benefit Analysis.

January 31: Valuing Market Effects

Read:

- Boardman et al. Chapter 4, “Valuing Benefits and Costs in Primary Markets,” pages 78-85, 91-94, and 99-104.
- HKS Case 1973.0, “Corporate Average Fuel Economy Standards 2017-2025.” Please read the case and be prepared to discuss the following questions:
 1. What are the major costs and benefits of the proposed rule? Which are private (borne by the party making the decision) and which are external (borne by other parties)?
 2. What factors do you think explain the fact that the current fuel efficiency of vehicles is substantially less than the NHTSA's estimates of costs and benefits indicate would be in the private interests of vehicle buyers and manufacturers?
 3. What policy alternatives are there to CAFE standards? What are their relative pros and cons?

Optional. Those seeking an alternative treatment of the Boardman Chapter 4 material may find the following to be helpful:

- Varian, Intermediate Microeconomics, Chapter 35, "Externalities."

February 7: Time Preferences and Discounting

Read:

- Boardman et al. Chapter 6, “Discounting Benefits and Costs in Future Time Periods,” pages 133-141
- Arrow, K. et al. 2013. “[Determining Benefits and Costs for Future Generations.](#)” Science. 341: 349-350.
- HKS Case 1932.0, “Electric Vehicles in Cities.” Please read the case and be prepared to discuss the following questions:
 1. Does it make sense for San Francisco to unilaterally provide a public good?

2. Are consumers likely to adopt electric vehicles in large number?
3. How substantial are the savings in greenhouse gas emissions per vehicle mile?
4. On what does the difference in operating costs depend?
5. Be prepared to organize into small groups for an exercise to estimate how sensitive the results in Exhibits 8 and 9 are to the assumption of the discount rates.

Optional. Those seeking an alternative treatment of the Boardman Chapter 6 material may find the following to be helpful:

- Varian, Intermediate Microeconomics, Chapter 10, "Intertemporal Choice."

February 14: Nonmarket Valuation

Read:

- HKS Case 1680.0, "Arsenic in Drinking Water." Please read the case and be prepared to explain and justify what you would do if you were EPA Administrator Whitman. As part of your answer please consider:
 1. What does the CBA show?
 2. How were benefits estimated? Why might benefits have been understated? Why might benefits have been overstated?
 3. What does the marginal analysis of costs and benefits indicate?
- Schelling, T. "The Life you Save May be Your Own," in the book Choice and Consequence, Harvard University Press, 1985, pp. 113-146.

February 21: Risk and Uncertainty

Read:

- HBS Case 9-181-027, "Freemark Abbey Winery." In preparation for the case, please draw a decision tree for Mr. Jaeger's problem. Also think about the following questions:
 1. Are there any missing data? If so, what are they and are they relevant?
 2. What conclusions do you draw from your analysis? That is, what would you advise Mr. Jaeger to do?
 3. How sensitive are your conclusions to Mr. Jaeger's probability assessments?
 4. To what extent might risk be a factor in Mr. Jaeger's decision?
- Slovic, Fischhoff, Lichtenstein, (1982), [Why Study Risk Perception?](#) *Risk Analysis*, Vol. 2, No. 2. 1982
- Pages 11-15 (up to Section 3.5 on "Completion of the Scenario List") in Kaplan and Garrick, (1981). On the Quantitative Definition of Risk, *Risk Analysis*, Vol. 1, No. 1.

Optional:

- Robinson, L.A., J.K. Hammitt, and R. Zeckhauser, (2014). [The Role of Distribution in Regulatory Analysis and Decision Making](#), Regulatory Policy Program Working Paper RPP-2014-03, Mossavar-Rahmani Center for Business and Government, Harvard Kennedy School.

February 28: Final projects