

Exam: Introduction to Cost-Benefit Analysis, January 2024.

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Duration: 3 hours (+45 min if exception)

No aids allowed (notes, slides, books, pdfs, etc.), internet forbidden.

Softwares (excel, word) allowed.

Definitions and Problem count each for half of the total grade.

Definitions:

- 1) Explain the purpose of CBA in public policy decision-making with a real-world example.
- 2) Describe the decision rules used in CBA to evaluate if a project should be implemented.
- 3) Discuss the importance of timing in CBA and differentiate between ex-ante, ex-post, and midway evaluations.
- 4) Who is usually in charge of conducting CBA? Would a company also conduct a CBA when making its own decisions? Explain.
- 5) Define the individual's willingness to pay using a generic utility function.
- 6) How would you infer people's willingness to pay for visiting a National Park?
- 7) What is the standing of the project? Give two examples of projects where the standing differs.
- 8) Is it equivalent to use the benefit cost ratio instead of the difference between the benefits and the costs? Explain.
- 9) Describe the nine steps of a CBA analysis.

Problem:

The municipality of Odense is considering whether to construct a new museum. The estimated construction cost is 200 million with annual staffing and maintenance costs of 5 million per year over the 50 years life of the project. The construction cost is borne today (year 0), while staffing and maintenance costs are borne between year 1 and year 50. The annual benefits (from year 1 to year 50) are equal to 10 million.

- a) Calculate the net present value of the project for a discount rate of 4%. What is the CBA recommendation?
- b) Find the threshold value of the discount rate below which the project becomes profitable (use the formula for the geometric series to get the appropriate expression). How is this threshold called?

Assume there is now uncertainty about the construction cost. With probability 10% the cost will be 140 million, with probability 60% the construction cost will be 170 million, and with probability 30% the construction cost will be 250 million. All else stays the same.

- c) What is the NPV in expectation?
- d) Explain why using the expected NPV as a criterion for deciding whether the project is worthwhile can be problematic?

Assume there are 100,000 taxpayers in Odense, which means each taxpayer would pay either 1400 (with probability 10%), 1700 (with probability (60%)), or 2500 (with probability (30%)) for constructing the museum (year 0), then 50 every year for staffing and maintenance costs (from year 1 to 50), while getting a yearly benefit of 100 (from year 1 to 50). Furthermore, assume that each taxpayer has a yearly revenue of 50000 and that her annual utility is given by $u(x) = \ln(x)$, where x is her annual net revenue (after paying for the construction of the library, and receiving the annual benefit from enjoying the library). A taxpayer's aggregate utility is the discounted sum of her annual utilities from year 0 to year 50.

- e) Are taxpayers risk averse, risk neutral or risk lover? Justify.
- f) Write each taxpayer's (discounted) expected utility from building the new museum (summing over the next 50 years) for a discount rate of 4%.
- g) Write each taxpayer's discounted expected utility (summing over the next 50 years) if the museum is not built for a discount rate of 4%.
- h) Determine whether the project is worthwhile.