

Exam: Introduction to Cost-Benefit Analysis.

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Duration: 3 hours (+45 min if exception)

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

Softwares (excel, word) allowed.

Exam to be submitted in blackboard (SDU assignment).

Definitions and Problem count each for half of the total grade. Each question (both in Definitions and Problem) counts the same, except for question 9 in Definitions, which counts for 2 questions.

Definitions:

- 1) Give a concise definition of CBA and list a few examples of projects for which CBA analysis is useful.
- 2) Who is usually in charge of conducting CBA. Would a company also conduct a CBA when making its own decisions? Explain.
- 3) Define the individual's willingness to pay using a generic utility function.
- 4) How would you infer people's willingness to pay for visiting Møn's cliff?
- 5) What is social welfare and how do we usually define it?
- 6) What is the standing of the project? Give two examples of projects where the standing differs.
- 7) Why do we need to discount future benefits and costs?
- 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 swimming pool. The estimated construction cost is 9 million with annual staffing and maintenance costs of 0.3 million over the 30 year life of the project. The construction cost is borne today (year 0), while staffing and maintenance costs are borne between year 1 and year 30. The annual benefits (from year 1 to year 30) are equal to 0.9 million.

- a) Calculate the net present value of the project for a discount rate of 5%. 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?
- c) Assume the annual benefits grow over time at a growth rate of 3% (starting from 0.9 million in year 0). Calculate the net present value for a discount rate of 5%.

Assume there is now uncertainty about the construction cost. With probability 25% the cost will be 6 million, with probability 75% the construction cost will be 10 million. The annual benefits are constant over time and equal to 0.9 million.

- d) What is the net present value in expectation?
- e) Why should the CBA recommendation possibly differ from the one in question a)?

Assume there are 100,000 taxpayers in Odense, which means each taxpayer would pay either 60 (with probability 25%) or 100 (with probability 75%) for constructing the swimming pool (year 0), then 3 every year for staffing and maintenance costs (from year 1 to 30), while getting a yearly benefit of 9 for enjoying the swimming pool (from year 1 to 30). Furthermore, assume that each taxpayer has a yearly revenue of 500 and that her annual utility is given by $u(x) = \sqrt{x}$, where x is her annual net revenue (after paying for the construction of the pool, and receiving the annual benefit from enjoying the pool). A taxpayer's aggregate utility is the discounted sum of her annual utilities from year 0 to year 30.

- f) Are taxpayers risk averse, risk neutral or risk lover? Justify.
- g) Write each taxpayer's (discounted) expected utility from building the new swimming pool (summing over the next 30 years) for a discount rate of 5%.
- h) Write each taxpayer's discounted expected utility (summing over the next 30 years) if the swimming pool is not built for a discount rate of 5%.
- i) Write the social welfare in both cases and determine whether the project is worthwhile (whether the social welfare is larger with than without the swimming pool).