

Problem Set
Benefit-Cost Analysis

2006

1) A government Agency is considering sites in a river valley in West Virginia (the New River) for dams to generate hydroelectric power. There is already one dam in the valley, at site B. This is owned by a private firm, and is used to generate power for a smelting works also owned by the firm. Two sites are available for additional dams: site A, upstream of B, and site C, downstream of B.

The purpose of dams is to store water during rainy periods to release in dry periods. Thus a dam helps to even out the flow of the river downstream of it and so increases the electricity-generating capacity of any downstream dams. The generating capacities of the three dams—the one existing dam and the two proposed ones—are summed up in Table 1. (Thus, for example, if B is the only dam on the river, it generates electricity worth \$1.2m per year. If dam A is built, B's output increases in value by \$0.4m per year: and if dam C is built, the existence of B contributes \$0.3m to the output of that dam.) The price of electricity is taken to be constant over time and independent of how many dams are built: all output can be sold at this constant price.

Table 1

Value of Electricity Generated at Three Dams
Values in Millions of Dollars per Year

Electricity Generated at Site alone:	Separate Generation by A, B, C	A Total Generated at B if A is build	Total Generated at C if A is build	Total Generated if A and C are Built
A	1.0	-	-	1.0
B	1.2	1.6	-	1.9
C	1.1		1.25	1.1

The cost of building a dam and generating station at A is \$19.0m, to be paid the year before the dam comes into use (year 0). The equivalent cost for C is \$20.5m. The market interest rate is 6 per cent.

There are four alternative courses of action for the Agency: to build only at A, build only at C, build at both, and to build at neither. The costs and returns of the first three alternatives, measured relative to the fourth alternative of doing nothing, are summarized in Table 2. (It is assumed that each of the proposed dams would have a life of 50 years, that the existing, privately owned dam would remain in use throughout that period, and that if dams were built both at A and C they would come into use simultaneously.) The figures in the third column of this table show the present values of

the net financial returns to the Agency from adopting each of the three alternatives. It emerges that the project of building a dam only at A has a negative present value: it would be better for the Agency to do nothing at all. The other two alternatives both have

Table 2

Dams at	Construction Costs (year 0)	Annual Returns to Agency (1-50 yrs)	Net Present Value in Year 0 to Agency	Annual Gain to Firm Owner of B	Net Present Value to Firm Owner of B	Net Present Value to Firm + Agency
A	19	1.0	-3.238	0.4	6.305	3.067
C	20.5	1.4	1.567	-	-	1.567
A & C	39.5	2.55	0.693	0.4	6.305	6.998

positive present values, but that of building only at C has the higher present value to the Agency. According to the criteria of financial appraisal, and from the Agency's perspective, this is the best policy for the Agency to adopt.

One interesting possibility remains. In calculating the financial returns of the projects to the public Agency it was assumed that the Agency was not able to charge the private firm for the benefits that the latter would receive if a dam were built at A. Financial appraisal then produces the conclusion that it is not in the interests of the Agency to build a dam there.

There remains, however, an opportunity for the firm and the Agency to come to a mutually satisfactory arrangement by which dams would be built at both A and C. For the Agency to build both dams, rather than only the one at C, is for it to incur financial losses with a present value of \$0.874m (the difference between \$1.567m and \$0.693m). But the existence of the dam at A confers benefits on the firm by increasing the output of the firm's own dam. These benefits have a present value of \$6.305m. It would thus be in the interests of both parties to agree that the Agency build both at A and C in return for payments by the private firm with a present value in the range \$0.874m to \$6.305m.

Questions: answers together should be no longer than two typed pages.

1. What are values that may be left out of this analysis on the cost side?
2. How does the issue of standing come into this BCA decision?
3. Is the market interest rate the correct rate? Why or why not?
4. If a lower interest rate were used, would the NPV's be higher or lower?
5. Is the lack of agreement between the two firms an externality? Elaborate.