Chapter 14

Economic Analysis in the Public and Regulated Sectors

Exercise 1

The city of Columbus has identified three options for a public recreation area suitable for informal family activities and major organized events. As with most alternatives today, there are benefits, disbenefits, costs, and some savings. These have been estimated with the help of an external planning consultant and are identified in the table below. In each case, these are annualized over a 10-year planning horizon.

Alternative	**A**	**B**	**C**
Benefits	$300,000	$450,000	$600,000
Costs	$225,000	$375,000	$487,500
Disbenefits	$63,000	$112,500	$177,000
Savings	$22,500	$60,000	$82,500

1. Determine the B/C ratio for each project. Can you tell from these ratios which option should be selected?
2. Determine which option should be selected using the incremental B/C ratio.
3. Determine which option should be selected using B-C for each option.
4. Determine which option should be selected using incremental B-C.

Solution

1. B/C ratio for each project

$$(B/C)_A = \frac{Beneifit - Disbenefit}{Cost - saving} = \frac{300000 - 63000}{225000 - 22500} = 1.1704 \;\; > 1$$

$$(B/C)_B = \frac{Beneifit - Disbenefit}{Cost - saving} = \frac{450000 - 112500}{375000 - 60000} = 1.0714 \; > \; 1$$

$$(B/C)_C = \frac{Beneifit - Disbenefit}{Cost - saving} = \frac{600000 - 177000}{487500 - 82500} = 1.0444 \; > \;\; 1$$

All these projects are economical but we cannot select the best.

- B/C analysis is useful for evaluating one project.
- Incremental ΔB/ΔC analysis is **required** when comparing more than one alternative.

Solution

2. Incremental B/C ratio

$$\left(\frac{B}{C}\right)_{B-A} = \frac{(Beneifit - Disbenefit)_B - (Beneifit - Disbenefit)_A}{(Cost - saving)_B - (cost - saving)_A} =$$

$$\frac{(\,450\,000 - 112\,500) - (300\,000 - 63\,000)}{(375\,000 - 60\,000) - (225\,000 - 22500)} = \frac{186\,000}{112\,500} = 0.8933 < 1$$

$$(B/C)_{C-A} = \frac{(\,600\,000 - 177\,000) - (300\,000 - 63000)}{(487500 - 825000) - (225\,000 - 22\,500)} = \frac{186\,000}{202\,500} = 0.92 < 1$$

So , A is selected

Solution

3. B-C analysis (Ranking)

$$(B-C)_A = (300\,000 - 63\,000) - (225\,000 - 22\,500) = 34\,500$$

$$(B-C)_B = (450\,000 - 112\,500) - (375\,000 - 60\,000) = 22\,500$$

$$(B-C)_C = (600\,000 - 177\,000) - (487\,500 - 82\,500) = 18\,000$$

So, A is selected (highest)

Solution

4. B-C analysis (Incremental)

$$\Delta(B\text{-}C)_{B\text{-}A} = \Delta B_{B\text{-}A} - \Delta C_{B\text{-}A}$$

$$=[(450{,}000-112{,}500)-(300{,}000-63{,}000)]-[(375{,}000-60{,}000)-(225{,}000-22{,}500)]$$

$= -12{,}000 < 0$, so select A

$$\Delta(B\text{-}C)_{C\text{-}A} = \Delta B_{C\text{-}A} - \Delta C_{C\text{-}A}$$

$$=[(600{,}000-177{,}000)-(300{,}000-63{,}000)]-[(487{,}500-82{,}500)-(225{,}000-22{,}500)]$$

$= -16{,}500 < 0$, so select A

Exercise 2

A highway is to be built connecting two cities. Route A follows the old road and costs $4 million initially and $210,000/year thereafter. A new route, B, will cost $6 million initially and $180,000/year thereafter. Route C is an enhanced version of Route B with wider lanes, shoulders, and so on. Route C will cost $9 million at first, plus $260,000 per year to maintain. Benefits to the users, considering time, operation, and safety, are $500,000 per year for A, $850,000 per year for B, and $1,000,000 per year for C. Using a 7 percent interest rate, a 15-year study period, and a salvage value of 50 percent of first cost, determine which **road** should be constructed.

Government	Alternative A	Alternative B	Alternative C
Initial Cost ($)	4,000,000	6,000,000	9,000,000
Annual Maintenance Cost ($/year)	210,000	180,000	260,000

Public	Alternative A	Alternative B	Alternative C
Benefits ($/year)	500,000	850,000	1,000,000

Cost:

Cost (A) = 4,000,000 (A/P 7, 15) + 210,000 - 4,000,000 X 0.5 (A/F 7, 15)
= $ 569,580/year

Cost (B) = 6,000,000 (A/P 7, 15) + 180,000 - 6,000,000 X 0.5 (A/F 7, 15)
= $ 719,370/year

Cost (C) = 9,000,000 (A/P 7, 15) + 260,000 - 9,000,000 X 0.5 (A/F 7, 15)
= $ 1,069,055/year

Benefit :

Benefit (A) = $ 500,000/year

Benefit (B) = $ 850,000/year

Benefit (C) = $ 1,000,000/year

Incremental B/C ratio

$$\Delta B/C_{\text{B to A}} = \Delta B/C_{B\ to\ A} = \frac{(850{,}000 - 500{,}000)}{(719{,}370 - 569{,}580)} = 2.3 > 1 \text{ select B}$$

$$\Delta B/C_{\text{C to B}} = \Delta B/C_{C\ to\ B} = \frac{(1{,}000{,}000 - 850{,}000)}{(1{,}069{,}055 - 719{,}370)} = 0.43 < 1 \text{ select B}$$

B-C analysis (Ranking)

$(B-C)_A = (500{,}000 - 569{,}580) = -\$69{,}580$

$(B-C)_B = (850{,}000 - 719{,}370) = \$130{,}630$

$(B-C)_C = (1{,}000{,}000 - 1{,}069{,}055) = -\$69{,}055$

So, **B** is selected (highest)