Lesson 13-1 – Sensitivity Analysis

Sensitivity & economic break-even analysis

- Projected and actual cash flows may differ due to:
  - technological change: changes to production costs;
  - changes in the size and number of competing firms;
  - introduction of new products: substitutes or complements;
  - changes to key macroeconomic variables, e.g. inflation, unemployment, economic growth, exchange rate;
  - international events.

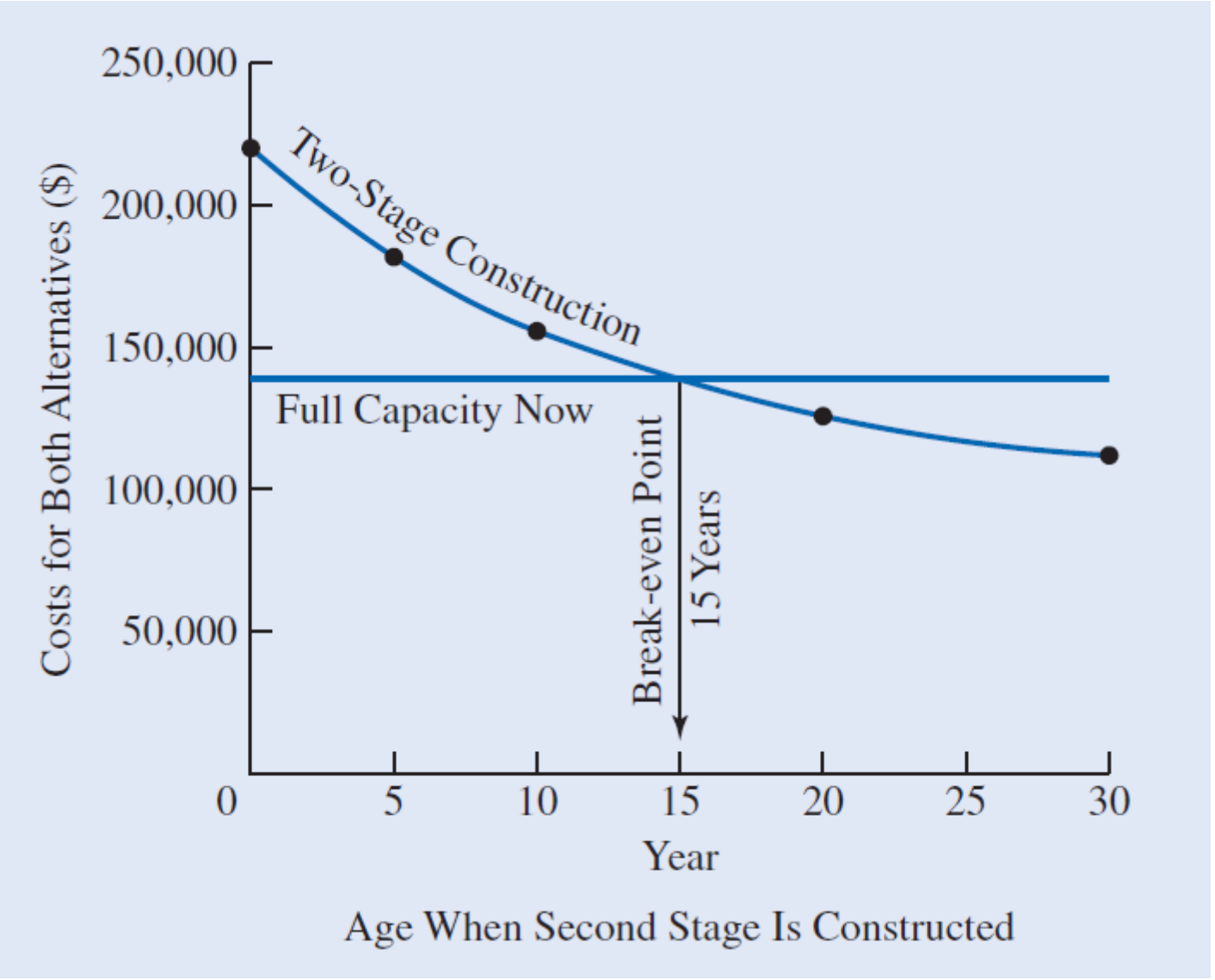
Sensitivity Analysis

- Since economic problem solving often considers future consequences, there is uncertainty regarding accuracy.
- We can calculate how much a change in an input variable affects the output. This is “sensitivity analysis”
  - Example: How much does the NPV of investing in some equipment upgrade change if the savings are 10% worse than anticipated?
- Types of Sensitivity Analyses:
  - Break-Even Analysis
  - ‘What-if’ Analysis

Break-Even Analysis

- **Break-even analysis is a form of sensitivity analysis**
- Typically presented as a break-even chart.
- It indicates the point at which two alternatives are equal to each other.

Break-Even Analysis: Example 9-11



- Shows present worth of building both stages now versus building a second stage at a later date.
- The point at which they are equal is when the second stage is built in Year 15.

What if analysis

- Financial and economic data are typically estimates or projections into the future, an inherently uncertain
- Our decision parameter (NPV, IRR, etc) is dependent on these uncertain estimates
- A “what if” analysis can show us how much a financial or economic parameter must change to alter the decision
- This allows us to make an assessment of the inherent **risk** in a project

Doing ‘What-If’ Analysis with Spreadsheets

- What-if analysis can be done easily in a spreadsheet
- Adjust variables to see potential outcomes
  - What if construction costs are higher than expected?
  - What if revenues are lower than expected?
- What-if analysis changes one or many estimates to see alternate results

Sensitivity analysis …

- Sensitivity example – which properties is the NPV most sensitive to?
  - system cost = $300,000
  - annual benefit = $85,000
  - salvage value = $60,000;
  - lifetime = 6 years
  - MARR = 14%

			Cashflows		
Property	**-30%**	**-15%**	**Base Case**	**15%**	**30%**
Initial Investment	$210,000	$255,000	$300,000	$345,000	$390,000
Annual Benefits	$59,500	$72,250	$85,000	$97,750	$110,500
Salvage Value	$42,000	$51,000	$60,000	$69,000	$78,000
Project Lifetime	4	5	6	7	8
Interest Rate	9.8%	11.9%	14.0%	16.1%	18.2%

			Net Present Values		
	-30%	**-15%**	**Base Case**	**15%**	**30%**
Initial Investment	$147,872	$102,872	$57,872	$12,872	($32,128)
Annual Benefits	($41,289)	$8,291	$57,872	$107,452	$157,033
Salvage Value	$49,671	$53,772	$57,872	$61,972	$66,072
Project Lifetime	($8,431)	$26,673	$57,872	$85,600	$110,244
Interest Rate	$106,617	$81,023	$57,872	$36,874	$17,779

Sensitivity & economic break-even analysis …

- What is the break even point for the two most sensitive properties?
  - Which properties? Initial investment and annual benefits
  - Keeping the base case and changing just initial investment, what initial investment sets NPV to zero?
  - NPV is $57,872 – increasing investment by that will set NPV to zero
    - Initial investment = $357,872, NPV = 0
  - Annual benefits – use goal seek, or guess between $59,500 and $72,500
    - Annual benefits = $70,118, NPV = 0

Sensitivity analysis - cases

- Above analysis only adjusts one parameter at a time
  - Worst case (not all the +/-30% values, but selected values)
    - $360,000 investment, $65,000 annual benefits, $42,000 salvage value, lifetime five years, 16% interest.
  - Best case:
    - $260,000 investment, $100,000 annual profit, $42,500 salvage value, lifetime seven years, MARR 10.5%.

		Cashflows	
Property	**Worst Case**	**Base Case**	**Best Case**
Initial Investment	$360,000	$300,000	$260,000
Annual Benefits	$65,000	$85,000	$100,000
Salvage Value	$42,000	$60,000	$42,000
Project Lifetime	5	6	7
Interest Rate	16.0%	14.0%	10.5%
NPV	**$ (127,174)**	**$ 57,872**	**$ 239,809**