

Week 6

Risk Analysis for Capital Budgeting

Lecture outline

- Worst-best scenarios
- Sensitivity analysis
- Break-even analysis
- Other considerations

Learning outcomes

- Be able to perform scenario analysis
- Be able to perform break-even analysis
- Gain a basic understanding of other issues in capital budgeting

Scenario analysis

The determination of what happens to NPV estimates when we ask what-if questions

Case study 1

Assume we are considering a new investment which costs €200,000, has a 5-year life and has no salvage value. For simplicity, depreciation is straight-line to 0. The required return is 12%, and the tax rate is 34%. In addition, we have compiled the following information:

	Base case	Lower bound	Upper bound
Unit sales	6,000	5,500	6,500
Price per unit	80	75	85
Variable costs per unit	60	58	62
Fixed costs per year	50,000	45,000	55,000

Base case NPV

Sales	
Variable costs	
Fixed costs	
Depreciation	
Profit before tax	
Taxes	
Net income	

Operating CF per year:

NPV (base case):

Best case vs. worst case

	Base case	Worst case	Best case
Unit sales	6,000	5,500	6,500
Price per unit	80	75	85
Variable costs per unit	60	62	58
Fixed costs per year	50,000	55,000	45,000

Worst case NPV

Sales	
Variable costs	
Fixed costs	
Depreciation	
Profit before tax	
Taxes	
Net income	

Operating CF per year:

NPV (worst case):

Best case NPV

Sales	
Variable costs	
Fixed costs	
Depreciation	
Profit before tax	
Taxes	
Net income	

Operating CF per year:

NPV (worst case):

In comparison

Scenario	Net income	CF	NPV	IRR (%)
Base				
Worst				
Best				

- However, using the worst-best scenarios might be misleading/not enough
- Instead, we could go with several optimistic and pessimistic cases

Sensitivity analysis

- Investigation of what happens to NPV when only one variable is changed

Case study 1 (cont.)

- Back to our case study
- Repeat the analysis when we only change the unit sales

	Base case	Worst case	Best case
Unit sales	6,000	5,500	6,500
Price per unit	80	80	80
Variable costs per unit	60	60	60
Fixed costs per year	50,000	50,000	50,000

Case study 1 (cont.)

- Back to our case study
- Repeat the analysis when we only change the fixed costs

	Base case	Worst case	Best case
Unit sales	6,000	6,000	6,000
Price per unit	80	80	80
Variable costs per unit	60	60	60
Fixed costs per year	50,000	55,000	45,000

Only change the unit sales

Scenario	Base	Worst	Best
Net income			
CF			
NPV			
IRR			

Only change the fixed costs

Scenario	Base	Worst	Best
Net income			
CF			
NPV			
IRR			

Break-even analysis

- Variable costs
 - Costs that change when the quantity of output changes
- Fixed costs
 - Costs that do not change when the quantity of output changes during a particular time period
- Total costs = variable costs + fixed costs
- Marginal (incremental) cost: the change in costs that occurs when there is a small change in output
- Marginal (incremental) revenue: the change in revenue that occurs when there is a small change in output

Accounting break-even

- The sales level that results in zero project net income

Case study 2

Suppose we retail USB flash drives for £5 apiece. We can buy drives from a wholesale supplier for £3 apiece. We have accounting expenses of £600 in fixed costs and £300 in depreciation. How many drives do we have to sell to break even – that is, for net income to be zero?

Sales	
Variables costs	
Fixed costs	
Depreciation	
Profit before tax	
Taxes	
Net income	

Why accounting break even?

- Relatively easy to calculate
- Help reduce forecasting risk
- A project that does not break even in an accounting sense reduces total earnings
- A project that just breaks even on an accounting basis loses money in a financial or opportunity cost sense

More generally...

- If ignoring taxes, operating cash flow (OCF) can be written as EBIT plus depreciation:
- Q is the sales volume needed to achieve any given OCF

Other break-even measures

- Cash break-even: the sales level that results in a zero operating cash flow
- Financial break-even: the sales level that results in a zero NPV

Operating leverage

- Operating leverage is the degree to which a firm or project relies on fixed costs
- Degree of operating leverage (DOL): the percentage change in operating cash flow relative to the percentage change in quantity sold

Implications of operating leverage

- Fixed costs act as a lever in the sense that a small percentage change in operating revenue can be magnified into a large percentage change in operating cash flow and NPV
- The higher the degree of operating leverage, the greater is the potential danger from forecasting risk
- From a managerial perspective, one way of coping with highly uncertain projects is to keep the degree of operating leverage as low as possible. This will generally have the effect of maintaining the break-even point (however measured) at its minimum level

Capital rationing

- Capital rationing refers to the situation that exists if a firm has positive-NPV projects but cannot find the necessary financing
- Soft rationing refers to the situation that occurs when units in a business are allocated a certain amount of financing for capital budgeting
- Hard rationing refers to the situation that occurs when a business cannot raise financing for a project under any circumstances

Example

Consider the following investment opportunities:

Project	Year				
	0	1	2	3	4
A	-5 mil	4 mil	4 mil	4 mil	4 mil
B	-7 mil	10 mil	10 mil	10 mil	10 mil
C	-3 mil	2 mil	2 mil	2 mil	2 mil

The required rate of return is 10%. What would be the investment decision if there is no capital rationing? How would the decision change if the firm applies capital rationing by restricting the total fund for investments to £10 mil?

Advantages of capital rationing

- Ensure a budget is followed
- Optimal utilization of resources
- More effective and efficient project management

Disadvantages of capital rationing

- Applying capital rationing = focusing on short-term rather than long-term growth

Quiz 1

Wettway Yachts Ltd is considering whether to launch its new Margo-class yacht. The selling price will be £40,000 per boat. The variable costs will be £20,000 per boat, and fixed costs will be £500,000 per year.

The total investment needed to undertake the project is £3,500,000. For simplicity, this amount will be depreciated straight-line to zero over the five-year life of the equipment. The salvage value is zero, and there are no working capital consequences. Wettway has a 20% required return on new projects.

Based on market surveys and historical experience, Wettway projects total sales for the five years at 425 boats, or about 85 boats per year. Ignoring taxes, should this project be launched?

If we only use NPV

Take into account accounting break-even

Take into account cash break-even

Take into account financial break-even

Quiz 2

Please see the attached pdf

Practical example: Sensitivity/Scenario analysis using Excel

Repeat Quiz 2 using Excel