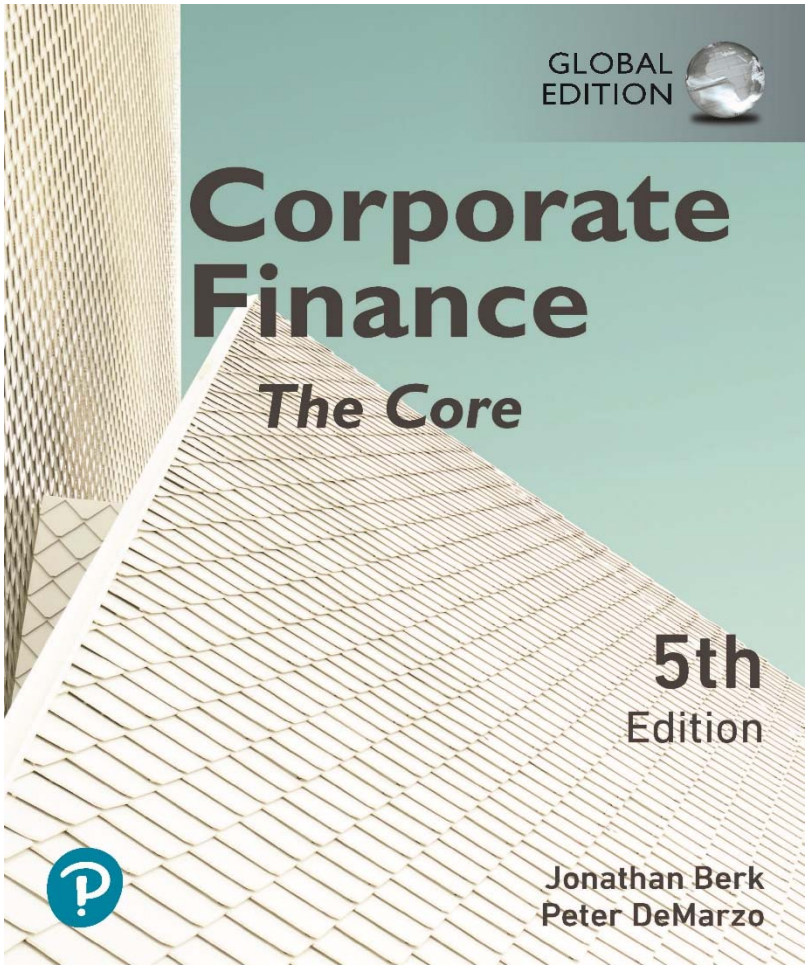
Corporate Finance: The Core

Fifth Edition, Global Edition



Chapter 8

Fundamentals of Capital Budgeting

Chapter Outline

Learning Objectives (1 of 2)

- Given a set of facts, identify relevant cash flows for a capital budgeting problem.
- Explain why opportunity costs must be included in cash flows, while sunk costs and interest expense must not.
- Calculate taxes that must be paid, including tax loss carryforwards and carrybacks.

Learning Objectives (2 of 2)

- Calculate free cash flows for a given project.
- Illustrate the impact of depreciation expense on cash flows.
- Describe the appropriate selection of discount rate for a particular set of circumstances.
- Use breakeven analysis, sensitivity analysis, or scenario analysis to evaluate project risk.

8.1 Forecasting Earnings

- Capital Budget
  - Lists the investments that a company plans to undertake
- Capital Budgeting
  - Process used to analyze alternate investments and decide which ones to accept
- Incremental Earnings
  - The amount by which the firm's earnings are expected to change as a result of the investment decision

Revenue and Cost Estimates (1 of 2)

- Example
  - Linksys has completed a $300,000 feasibility study to assess the attractiveness of a new product, HomeNet. The project has an estimated life of four years.
  - **Revenue Estimates**
    - Sales = 100,000 units/year
    - Per Unit Price = $260

Revenue and Cost Estimates (2 of 2)

- Example
  - **Cost Estimates**
    - Up-Front R&D = $15,000,000
    - Up-Front New Equipment = $7,500,000
      - Expected life of the new equipment is five years.
      - Housed in existing lab
    - Annual Overhead = $2,800,000
    - Per Unit Cost = $110

- Sales = 100,000 units/year
- Per Unit Price = $260

Incremental Earnings Forecast – table 8.1

	Year	0	1	2	3	4	5
Incremental Earnings Forecast ($000s)							
1 Sales			26,000	26,000	26,000	26,000	
2 Cost of Goods Sold			(11,000)	(11,000)	(11,000)	(11,000)	
3 **Gross Profit**			15,000	15,000	15,000	15,000	
4 Selling, General, and Administrative			(2,800)	(2,800)	(2,800)	(2,800)	
5 Research and Development		(15,000)					
6 Depreciation			(1,500)	(1,500)	(1,500)	(1,500)	(1,500)
7 **EBIT**		(15,000)	10,700	10,700	10,700	10,700	(1,500)
8 Income Tax at 20%		3,000	(2,140)	(2,140)	(2,140)	(2,140)	300
9 **Unlevered Net Income**		**(12,000)**	**8,560**	**8,560**	**8,560**	**8,560**	**(1,200)**

Incremental Earnings

- **Cost Estimates**
  - Up-Front R&D = $15,000,000
  - Up-Front New Equipment = $7,500,000
    - Expected life of the new equipment is five years.
    - Housed in existing lab
  - Annual Overhead = $2,800,000
  - Per Unit Cost = $110

	Year	0	1				
Incremental Earnings Forecast ($000s)							
1 Sales			26,000	26,000	26,000	26,000	
2 Cost of Goods Sold			(11,000)	(11,000)	(11,000)	(11,000)	
3 **Gross Profit**			15,000	15,000	15,000	15,000	
4 Selling, General, and Administrative			(2,800)	(2,800)	(2,800)	(2,800)	
5 Research and Development		(15,000)					
6 Depreciation			(1,500)	(1,500)	(1,500)	(1,500)	(1,500)
7 **EBIT**		(15,000)	10,700	10,700	10,700	10,700	(1,500)
8 Income Tax at 20%		3,000	(2,140)	(2,140)	(2,140)	(2,140)	300
9 **Unlevered Net Income**		**(12,000)**	**8,560**	**8,560**	**8,560**	**8,560**	**(1,200)**

Capital Expenditures and Depreciation

- The $7.5 million in new equipment is a cash expense, but it is not directly listed as an expense when calculating **earnings**. Instead, the firm deducts a fraction of the cost of these items each year as depreciation.
- Straight Line Depreciation
  - The asset's cost is divided equally over its life. Annual Depreciation

$$= \frac{\$7.5 \text{ million}}{5 \text{ years}} = \$1.5 \text{ million/year}$$

Interest Expense

- In capital budgeting decisions, interest expense is typically not included.
- The rationale is that the project should be judged on its own, not on how it will be financed.

Taxes (1 of 2)

- Marginal Corporate Tax Rate
  - The tax rate on the marginal or **incremental** dollar of pre-tax income
    - Note: A negative tax is equal to a tax credit

$$\text{Income Tax} = \text{EBIT} \times \tau_c$$

Taxes (2 of 2)

- Unlevered Net Income Calculation

$$\begin{aligned}\text{Unlevered Net Income} &= \text{EBIT} \times (1 - \tau_c) \\ &= (\text{Revenues} - \text{Costs} - \text{Depreciation}) \times (1 - \tau_c)\end{aligned}$$

Textbook Example 8.1 (1 of 2)

Taxing Losses for Projects in Profitable Companies

Problem

Kellogg plans to launch a new line of high-fiber, gluten-free breakfast pastries. The heavy advertising expenses associated with the product launch will generate operating losses of $20 million next year.

Kellogg expects to earn pre-tax income of $460 million from operations other than the new pastries next year. If Kellogg pays a 25% tax rate on its pre-tax income,

- What will it owe in taxes next year without the new product?
- What will it owe with it?

Textbook Example 8.1 (2 of 2)

Solution

Without the new pastries, Kellogg will owe

$\$450 \text{ million} \times 25\% = \$115 \text{ million}$ in corporate taxes next year.

With the new pastries, Kellogg's pre-tax income next year will be only

$\$460 \text{ million} - \$20 \text{ million} = \$440$ million, and it will owe

$\$440 \text{ million} \times 25\% = \$110$ million in tax. Thus, launching the new product reduces Kellogg's taxes next year by

$\$115 \text{ million} - \$110 \text{ million} = \$5 \text{ million}$, which equals the tax rate (25%) times the loss ($20 million).

Indirect Effects on Incremental Earnings (1 of 4)

- **Opportunity Cost**
  - The value a resource could have provided in its best alternative use
  - In the HomeNet project example, space will be required for the investment. Even though the equipment will be housed in an existing lab, the opportunity cost of not using the space in an alternative way (e.g., renting it out) must be considered.

Textbook Example 8.2 (1 of 2)

The Opportunity Cost of HomeNet's Lab Space

Problem

Suppose HomeNet's new lab will be housed in warehouse space that the company would have otherwise rented out for $200,000 per year during years 1 – 4. How does this opportunity cost affect HomeNet's incremental earnings?

Textbook Example 8.2 (2 of 2)

Solution

In this case, the opportunity cost of the warehouse space is the forgone rent. This cost would reduce HomeNet's

incremental earnings during years 1 – 4 by $\$200{,}000 \times (1 - 20\%) = \$160{,}000$,

the after-tax benefit of renting out the warehouse space.

Indirect Effects on Incremental Earnings (2 of 4)

- Project Externalities
  - Indirect effects of the project that may affect the profits of other business activities of the firm. **Cannibalization** is when sales of a new product displaces sales of an existing product.

Indirect Effects on Incremental Earnings (3 of 4)

- Project Externalities
  - In the HomeNet project example, 25% of sales come from customers who would have purchased an existing Linksys wireless router if HomeNet were not available. Because this reduction in sales of the existing wireless router is a consequence of the decision to develop HomeNet, we must include it when calculating HomeNet's incremental earnings.

Indirect Effects on Incremental Earnings (4 of 4) – including cannibalization and lost rent

	Year	0	1	2	3	4	5
Incremental Earnings Forecast ($000s)							
1 Sales			23,500	23,500	23,500	23,500	
2 Cost of Goods Sold			(9,500)	(9,500)	(9,500)	(9,500)	
3 **Gross Profit**			14,000	14,000	14,000	14,000	
4 Selling, General, and Administrative			(3,000)	(3,000)	(3,000)	(3,000)	
5 Research and Development		(15,000)					
6 Depreciation		Blank	(1,500)	(1,500)	(1,500)	(1,500)	(1,500)
7 **EBIT**		(15,000)	9,500	9,500	9,500	9,500	(1,500)
8 Income Tax at 20%		3,000	(1,900)	(1,900)	(1,900)	(1,900)	300
9 **Unlevered Net Income**		**(12,000)**	**7,600**	**7,600**	**7,600**	**7,600**	**(1,200)**

Sunk Costs and Incremental Earnings (1 of 4)

- **Sunk costs** are costs that have been or will be paid regardless of the decision whether or not the investment is undertaken
  - Sunk costs should not be included in the incremental earnings analysis

Sunk Costs and Incremental Earnings (2 of 4)

- Fixed Overhead Expenses
  - Typically overhead costs are fixed and not incremental to the project and should not be included in the calculation of incremental earnings.

Sunk Costs and Incremental Earnings (3 of 4)

- Past Research and Development Expenditures
  - Money that has already been spent on R&D is a **sunk cost** and therefore irrelevant.
  - The decision to continue or abandon a project should be based only on the incremental costs and benefits of the product going forward.

Sunk Costs and Incremental Earnings (4 of 4)

- Unavoidable Competitive Effects
  - When developing a new product, firms may be concerned about the cannibalization of existing products.
  - However, if sales are likely to decline in any case as a result of new products introduced by competitors, then these lost sales should be considered a sunk cost.

Real-World Complexities

- Typically,
  - sales will change from year to year
  - the average selling price will vary over time
  - the average cost per unit will change over time

Textbook Example 8.3 (1 of 3)

Product Adoption and Price Changes

Problem

1) Suppose sales of HomeNet were expected to be 100,000 units in year 1, 125,000 units in years 2 and 3, and 50,000 units in year 4.

2) Suppose also that HomeNet's sale price and manufacturing cost are expected to decline by 10% per year, as with other networking products.

3) By contrast, selling, general, and administrative expenses are expected to rise with inflation by 4% per year.

Update the incremental earnings forecast in the spreadsheet in Table 8.2 to account for these effects.

Textbook Example 8.3 (2 of 3)

Solution

Home Net's incremental earnings with these new assumptions are shown in the spreadsheet below:

Year	0	1	2	3	4	5
Incremental Earnings Forecast ($000s)						
1 Sales		23,500	26,438	23,794	8,566	
2 Cost of Goods Sold		(9,500)	(10,688)	(9,619)	(3,463)	
3 **Gross Profit**		14,000	15,750	14,175	5,103	
4 Selling, General, and Administrative		(3,000)	(3,120)	(3,245)	(3,375)	
5 Research and Development	(15,000)					
6 Depreciation		(1,500)	(1,500)	(1,500)	(1,500)	(1,500)
7 **EBIT**	(15,000)	9,500	11,130	9,430	228	(1,500)
8 Income Tax at 20%	3,000	(1,900)	(2,226)	(1,886)	(46)	300
9 **Unlevered Net Income**	**(12,000)**	**7,600**	**8,904**	**7,544**	**183**	**(1,200)**

Textbook Example 8.3 (3 of 3)

For example, sale prices in year 2 will be $\$260 \times 0.90 = \$234$ per unit for Home Net, and $\$100 \times 0.90 = \$90$ per unit for the cannibalized product. Thus, incremental sales in year 2 are equal to $125{,}000 \text{ units} \times (\$234 \text{ per unit}) - 31{,}250 \text{ cannibalized units} \times (\$90 \text{ per unit}) = \$26.438 \text{ million}.$

8.2 Determining Free Cash Flow and NPV

The incremental effect of a project on a firm's available cash is its **free cash flow**.

Calculating the Free Cash Flow from Earnings (1 of 4)

- Capital Expenditures and Depreciation
  - Capital Expenditures are the actual cash outflows when an asset is purchased
    - These cash outflows are included in calculating free cash flow
  - Depreciation is a non-cash expense
    - The free cash flow estimate is adjusted for this non-cash expense

Calculating the Free Cash Flow from Earnings (2 of 4)

	Year	0	1	2	3	4	5
Incremental Earnings Forecast ($000s)							
1	Sales	—	23,500	23,500	23,500	23,500	—
2	Cost of Goods Sold	—	(9,500)	(9,500)	(9,500)	(9,500)	—
3	**Gross Profit**	—	14,000	14,000	14,000	14,000	—
4	Selling, General, and Administrative	—	(3,000)	(3,000)	(3,000)	(3,000)	—
5	Research and Development	(15,000)	—	—	—	—	—
6	Depreciation	—	(1,500)	(1,500)	(1,500)	(1,500)	(1,500)
7	**EBIT**	(15,000)	9,500	9,500	9,500	9,500	(1,500)
8	Income Tax at 20%	3,000	(1,900)	(1,900)	(1,900)	(1,900)	300
9	**Unlevered Net Income**	**(12,000)**	**7,600**	**7,600**	**7,600**	**7,600**	**(1,200)**
Free Cash Flow ($000s)							
10	Plus: Depreciation	—	1,500	1,500	1,500	1,500	1,500
11	Less: Capital Expenditures	(7,500)	—	—	—	—	—
12	Less: Increases in NWC	—	(2,100)	—	—	—	2,100
13	**Free Cash Flow**	**(19,500)**	**7,000**	**9,100**	**9,100**	**9,100**	**2,400**

Calculating the Free Cash Flow from Earnings (3 of 4)

- Net Working Capital (NWC)

$$\begin{aligned}\text{Net Working Capital} &= \text{Current Assets} - \text{Current Liabilities} \\ &= \text{Cash} + \text{Inventory} + \text{Receivables} - \text{Payables}\end{aligned}$$

  - Most projects will require an investment in net working capital.
    - **Trade credit** is the difference between receivables and payables.
  - The increase in net working capital is defined as

$$\Delta NWC_t = NWC_t - NWC_{t-1}$$

Calculating the Free Cash Flow from Earnings (4 of 4)

Table 8.4 Spreadsheet HomeNet's Net Working Capital Requirements

Year	0	1	2	3	4	5
Net Working Capital Forecast ($000s)						
1 Cash Requirements	-	-	-	-	-	-
2 Inventory	-	-	-	-	-	-
3 Receivables (15% of Sales)	-	3,525	3,525	3,525	3,525	-
4 Payables (15% of COGS)	-	(1,425)	(1,425)	(1,425)	(1,425)	-
5 **Net Working Capital**	-	**2,100**	**2,100**	**2,100**	**2,100**	-

Textbook Example 8.4 (1 of 2)

Net Working Capital with Changing Sales

Problem

Forecast the required investment in net working capital for HomeNet under the scenario in Example 8.3.

Textbook Example 8.4 (2 of 2)

Solution

Required investments in net working capital are shown below:

	Year	0	1	2	3	4	5
Net Working Capital Forecast ($000s)							
1	Receivables (15% of Sales)	—	3,525	3,966	3,569	1,285	—
2	Payables (15% of COGS)	—	(1,425)	(1,603)	(1,443)	(519)	—
3	**Net Working Capital**	—	2,100	2,363	2,126	765	—
4	**Increases in NWC**	—	**2,100**	**263**	**(237)**	**(1,361)**	**(765)**

In this case, working capital changes each year. A large initial investment in working capital is required in year 1, followed by a small investment in year 2 as sales continue to grow. Working capital is recovered in years 3–5 as sales decline.

Calculating Free Cash Flow Directly

- Free Cash Flow

$$\text{Free Cash Flow} = \overbrace{(\text{Revenues} - \text{Costs} - \text{Depreciation}) \times (1 - \tau_c)}^{\text{Unlevered Net Income}} + \text{Depreciation} - \text{CapEx} - \Delta NWC$$

$$\text{Free Cash Flow} = (\text{Revenues} - \text{Costs}) \times (1 - \tau_c) - \text{CapEx} - \Delta NWC + \tau_c \times \text{Depreciation}$$

  - The term $\tau_C \times \text{Depreciation}$

    is called the **depreciation tax shield**

Calculating the NPV (1 of 2)

$$PV(FCF_t) = \frac{FCF_t}{(1+r)^t} = FCF_t \times \frac{1}{\underbrace{(1+r)^t}_{t=\text{year discount factor}}}$$

- HomeNet NPV (WACC = 12%)

$$\begin{aligned} NPV &= -19{,}500 + \frac{7000}{1.12} + \frac{9100}{1.12^2} + \frac{9100}{1.12^3} + \frac{9100}{1.12^4} + \frac{2400}{1.12^5} \\ &= \$7627 \end{aligned}$$

Calculating the NPV (2 of 2)

Table 8.5 Spreadsheet Computing HomeNet's NPV

	Year	0	1	2	3	4	5
Net Present Value ($000s)							
1 **Free Cash Flow**		(19,500)	7,000	9,100	9,100	9,100	2,400
2 Project Cost of Capital	12%						
3 Discount Factor		1.000	0.893	0.797	0.712	0.636	0.567
4 **PV of Free Cash Flow**		(19,500)	6,250	7,254	6,477	5,783	1,362
5 **NPV**		**7,627**					
6 **IRR**		27.9%					

8.3 Choosing Among Alternatives (1 of 6)

- Launching the HomeNet project produces a positive NPV, while not launching the project produces a 0 NPV.

8.3 Choosing Among Alternatives (2 of 6)

- Evaluating Manufacturing Alternatives
  - In the HomeNet example, assume the company could produce each unit in-house for $95 if it spends $5 million upfront to change the assembly facility (versus $110 per unit if outsourced).
  - The in-house manufacturing method would also require an additional investment in inventory equal to one month's worth of production.

8.3 Choosing Among Alternatives (3 of 6)

- Evaluating Manufacturing Alternatives
  - Outsource
    - Cost per unit = $110
    - Investment in A/P = 15% of COGS
      - $\text{COGS} = 100{,}000 \text{ units} \times \$110 = \$11 \text{ million}$
      - Investment in $\text{A / P} = 15\% \times \$11 \text{ million} = \$1.65 \text{ million}$
        - $\Delta\text{NWC} = -\$1.65$ million in Year 1 and will increase by $1.65 million in Year 5
        - NWC falls since this A/P is financed by suppliers

8.3 Choosing Among Alternatives (4 of 6)

- Evaluating Manufacturing Alternatives
  - In-House
    - Cost per unit = $95
    - Up-front cost of $5,000,000
    - Investment in A/P = 15% of COGS
      - $\text{COGS} = 100{,}000 \text{ units} \times \$95 = \$9.5 \text{ million}$
      - $\text{Investment in A/P} = 15\% \times \$9.5 \text{ million} = \$1.425 \text{ million}$

$$\text{Investment in Inventory} = \frac{\$9.5 \text{ million}}{12} = \$0.792 \text{ million}$$

  - ΔNWC in Year 1 = $0.792 million – $1.425 million = –$0.633 million
    - NWC will fall by $0.633 million in Year 1 and increase by $0.633 million in Year 5.

8.3 Choosing Among Alternatives (5 of 6)

- Evaluating Manufacturing Alternatives

Table 8.6 Spreadsheet NPV Cost of Outsourced Versus In-House Assembly of HomeNet

	Year	0	1	2	3	4	5
Outsourced Assembly							
1	**EBIT**	—	(11,000)	(11,000)	(11,000)	(11,000)	—
2	Income Tax at 20%	—	2,200	2,200	2,200	2,200	—
3	**Unlevered Net Income**	—	(8,800)	(8,800)	(8,800)	(8,800)	—
4	Less: Increases in NWC	—	1,650	—	—	—	(1,650)
5	**Free Cash Flow**	**—**	**(7,150)**	**(8,800)**	**(8,800)**	**(8,800)**	**(1,650)**
6	**NPV at 12%**	**(26,192)**					

	Year	0	1	2	3	4	5
In-House Assembly							
7	**EBIT**	(5,000)	(9,500)	(9,500)	(9,500)	(9,500)	—
8	Income Tax at 20%	1,000	1,900	1,900	1,900	1,900	—
9	**Unlevered Net Income**	(4,000)	(7,600)	(7,600)	(7,600)	(7,600)	—
10	Less: Increases in NWC	—	633	—	—	—	(633)
11	**Free Cash Flow**	**(4,000)**	**(6,967)**	**(7,600)**	**(7,600)**	**(7,600)**	**(633)**
12	**NPV at 12%**	**(26,878)**					

8.3 Choosing Among Alternatives (6 of 6)

- Comparing Free Cash Flows Cisco's Alternatives
  - Outsourcing is the less expensive alternative

8.4 Further Adjustments to Free Cash Flow

- Other Non-cash Items
  - Amortization
- Timing of Cash Flows
  - Cash flows are often spread throughout the year
- Accelerated Depreciation
  - Modified Accelerated Cost Recovery System (MACRS) depreciation

Textbook Example 8.5 (1 of 3)

Computing Accelerated Depreciation

Problem

What depreciation deduction would be allowed for HomeNet's equipment using the MACRS method, assuming the equipment is put into use by the end of year 0 and designated to have a five-year recovery period?

Table 8A.1 MACRS Depreciation Table Showing the Percentage of the Asset's Cost That May Be Depreciated Each Year Based on Its Recovery Period (1 of 2)

	Depreciation Rate for Recovery Period					
Year	3 Years	5 Years	7 Years	10 Years	15 Years	20 Years
0	33.33	20.00	14.29	10.00	5.00	3.750
1	44.45	32.00	24.49	18.00	9.50	7.219
2	14.81	19.20	17.49	14.40	8.55	6.677
3	7.41	11.52	12.49	11.52	7.70	6.177
4		11.52	8.93	9.22	6.93	5.713
5		5.76	8.92	7.37	6.23	5.285
6			8.93	6.55	5.90	4.888
7			4.46	6.55	5.90	4.522
8				6.56	5.91	4.462
9				6.55	5.90	4.461
10				3.28	5.91	4.462

	Depreciation Rate for Recovery Period					
Year	3 Years	5 Years	7 Years	10 Years	15 Years	20 Years
11					5.90	4.461
12					5.91	4.462
13					5.90	4.461
14					5.91	4.462
15					2.95	4.461
16						4.462
17						4.461
18						4.462
19						4.461
20						2.231

Textbook Example 8.5 (2 of 3)

Solution

Table 8A.1 in the appendix provides the percentage of the cost that can be depreciated each year. Based on the table, the allowable depreciation expense for the lab equipment is shown below (in thousands of dollars):

	Year	0	1	2	3	4	5
MACRS Depreciation							
1	Lab Equipment Cost	(7,500)					
2	MACRS Depreciation Rate	20.00%	32.00%	19.20%	11.52%	11.52%	5.76%
3	Depreciation Expense	(1,500)	(2,400)	(1,440)	(864)	(864)	(432)

Textbook Example 8.5 (3 of 3)

As long as the equipment is put into use by the end of year 0, the tax code allows us to take our first depreciation expense in the same year. Compared with straight-line depreciation, the MACRS method allows for larger depreciation deductions earlier in the asset's life, which increases the present value of the depreciation tax shield and so will raise the project's NPV (see Problem 8.17). Bonus depreciation would allow us to deduct the **full** $7.5 million cost of the equipment in year 0, accelerating the tax shield and increasing NPV even further.

Further Adjustments to Free Cash Flow (1 of 3)

- Liquidation or Salvage Value

$$\text{Capital Gain} = \text{Sale Price} - \text{Book Value}$$

$$\text{Book Value} = \text{Purchase Price} - \text{Accumulated Depreciation}$$

$$\text{After-Tax Cash Flow from Asset Sale} = \text{Sale Price} - (\tau_c \times \text{Capital Gain})$$

Textbook Example 8.6 (1 of 3)

Adding Salvage Value to Free Cash Flow

Problem

Suppose that in addition to the $7.5 million in new equipment required for HomeNet, some equipment will be transferred to the lab from another Cisco facility. This equipment has a resale value of $2 million and a book value of $1 million. If the equipment is kept rather than sold, its remaining book value can be depreciated next year.

When the lab is shut down in year 5, the equipment will have a salvage value of $800,000. What adjustments must we make to HomeNet's free cash flow in this case?

Textbook Example 8.6 (2 of 3)

Solution

The existing equipment could have been sold for $2 million. The after-tax proceeds from this sale are an opportunity cost of using the equipment in the HomeNet lab. Thus, we must reduce HomeNet's free cash flow in year 0 by the sale price less any taxes that would have been owed had the sale occurred:

$$\$2 \text{ million} - 20\% \times (\$2 \text{ million} - \$1 \text{ million}) = \$1.8 \text{ million}.$$

In year 1, the remaining $1 million book value of the equipment can be depreciated, creating a depreciation tax shield of $20\% \times \$1 \text{ million} = \$200{,}000.$

In year 5, the firm will sell the equipment for a salvage value of $800,000. Because the equipment will be fully depreciated at that time, the entire amount will be taxable as a capital gain, so the after-tax cash flow from the sale is **$800,000 × (1 – 20%) = $640,000**

The spreadsheet below shows these adjustments to the free cash flow from the spreadsheet in Table 8.3 and recalculates HomeNet's free cash flow and NPV in this case.

Textbook Example 8.6 (3 of 3)

	Year	0	1	2	3	4	5
Free Cash Flow and NPV ($000s)							
1 Free Cash Flow w/o equipment Adjustments for use of existing equipment		(19,500)	7,000	9,100	9,100	9,100	2,400
2 After-Tax Salvage Value		(1,800)					640
3 Depreciation Tax Shield			(200)				
4 **Free Cash Flow with equipment**		**(21,300)**	**6,800**	**9,100**	**9,100**	**9,100**	**3,040**
5 **NPV at 12%**		**6,011**					

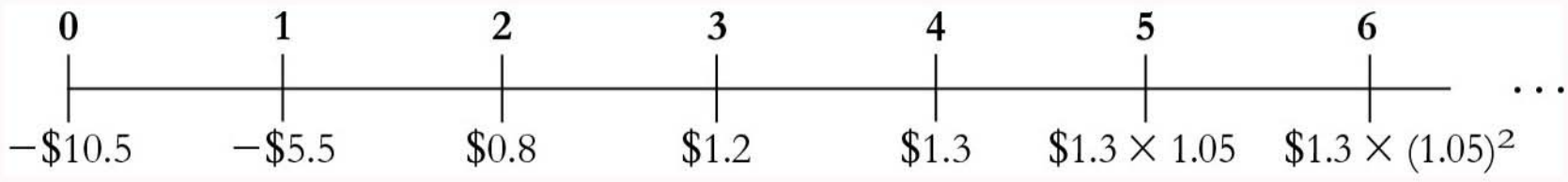
Further Adjustments to Free Cash Flow (2 of 3)

- Terminal or Continuation Value
  - This amount represents the market value of the free cash flow from the project at all future dates.

Textbook Example 8.7 (1 of 3)

Problem

Base Hardware is considering opening a set of new retail stores. The free cash flow projections for the new stores are shown below (in millions of dollars):



After year 4, Base Hardware expects free cash flow from the stores to increase at a rate of 5% per year. If the appropriate cost of capital for this investment is 10%, what continuation value in year 4 captures the value of future free cash flows in year 5 and beyond? What is the NPV of the new stores?

Textbook Example 8.7 (2 of 3)

Solution

Because the future free cash flow beyond year 4 is expected to grow at 5% per year, the continuation value in year 4 of the free cash flow in year 5 and beyond can be calculated as a constant growth perpetuity:

$$\begin{aligned}\text{Continuation Value in Year 4} &= PV(FCF \text{ in Year 5 and Beyond}) \\ &= \frac{FCF_4 \times (1+g)}{r-g} = \$1.30 \text{ million} \times \frac{1.05}{0.10-0.05} \\ &= \$1.30 \text{ million} \times 21 = \$27.3 \text{ million}\end{aligned}$$

Notice that under the assumption of constant growth, we can compute the continuation value as a multiple of the project's final free cash flow.

Textbook Example 8.7 (3 of 3)

We can restate the free cash flows of the investment as follows (in thousands of dollars):

Year	0	1	2	3	4
Free cash Flow (years0-4)	(10,500)	(5,500)	800	1,200	1,300
Continuation value					27,300
Free cash flow	(10,500)	(5,500)	800	1,200	28,600

The NPV of the investment in the new stores is

$$NPV = -10{,}500 - \frac{5500}{1.10} + \frac{800}{1.10^2} + \frac{1200}{1.10^3} + \frac{28{,}600}{1.10^4} = \$5597$$

or $5.597 million

Further Adjustments to Free Cash Flow (3 of 3)

- Tax Carryforwards
  - Tax loss carryforwards and carrybacks allow corporations to take losses during its current year and offset them against gains in nearby years.

Textbook Example 8.8 (1 of 3)

Tax Loss Carry forwards

Problem

Verian Industries has a net operating loss of $140 million this year. If Verian earns $50 million per year in pre-tax income from now on, what will its taxable income be over the next 4 years? If Verian earns an extra $10 million in the coming year, in which years will its taxable income increase?

Textbook Example 8.8 (2 of 3)

Solution

With pre-tax income of $50 million per year, Verian will be able to use its tax loss carryforwards to reduce its taxable income by $80\% \times 50 = \$40$ million each year:

	Year	0	1	2	3	4	5
Pre-tax Income		(140)	50	50	50	50	50
Tax Loss Carryforward			(40)	(40)	(40)	(20)	
Taxable Income			10	10	10	30	50

Textbook Example 8.8 (3 of 3)

If Verian earns an additional $10 million the first year, it will owe taxes on an extra $2 million next year and $8 million in year 4:

	Year	0	1	2	3	4	5
Pre-tax Income		(140)	60	50	50	50	50
Tax Loss Carryforward			(48)	(40)	(40)	(12)	
Taxable Income			12	10	10	38	50

Thus, when a firm has tax loss carryforwards, the tax impact of a portion of current earnings will be delayed until the carryforwards are exhausted. This delay reduces the present value of the tax impact, and firms sometimes approximate the effect of tax loss carryforwards by using a lower marginal tax rate.

8.5 Analyzing the Project (1 of 2)

- Break-Even Analysis
  - The **break-even** level of an input is the level that causes the NPV of the investment to equal zero.
  - HomeNet IRR Calculation

Table 8.7 Spreadsheet HomeNet IRR Calculation

Year	0	1	2	3	4	5
NPV($000s) and IRR						
1 **Free cash flow**	(19,500)	7,000	9,100	9,100	9,100	2,400
2 **NPV at 12%**	7,627					
3 **IRR**	**27.9%**					

8.5 Analyzing the Project (2 of 2)

- Break-Even Analysis
  - Break-Even Levels for HomeNet

Table 8.8 Break-Even Levels for HomeNet

Parameter	Break-Even Level
Units sold	77,121 units per year
Wholesale price	$228 per unit
Cost of goods	$142 per unit
Cost of capital	27.9%

  - **EBIT Break-Even of Sales**
    - Level of sales where EBIT equals zero

Sensitivity Analysis (1 of 2)

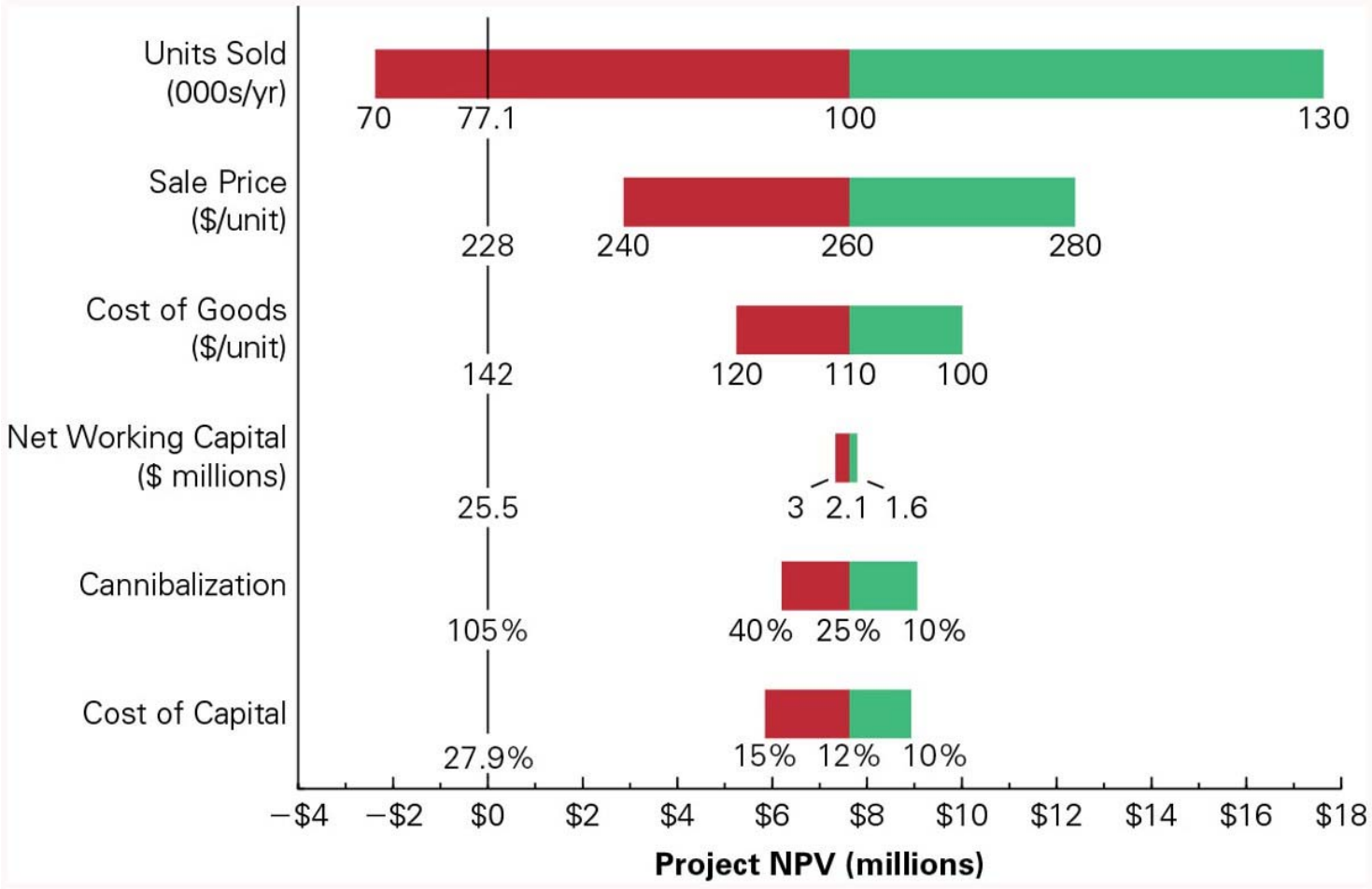
- Sensitivity Analysis shows how the NPV varies with a change in one of the assumptions, holding the other assumptions constant.

Sensitivity Analysis (2 of 2)

Table 8.9 Best-and Worst-Case Parameter Assumptions for HomeNet

Parameter	Initial Assumption	Worst Case	Best Case
Units sold (thousands)	100	70	130
Sale price($/unit)	260	240	280
Cost of goods($/unit)	110	120	100
NWC($ thousands)	2100	3000	1600
Cannibalization	25%	40%	10%
Cost of capital	12%	15%	10%

Figure 8.1 HomeNet's NPV Under Best-and Worst-Case Parameter Assumptions



Textbook Example 8.9 (1 of 2)

Sensitivity to Marketing and Support Costs

Problem

The current forecast for HomeNet's marketing and support costs is $2.8 million per year during years 1–4. Suppose the marketing and support costs may be as high as $3.8 million per year. What is HomeNet's NPV in this case?

Textbook Example 8.9 (2 of 2)

Solution

We can answer this question by increasing the selling, general, and administrative expense by $1 million in the spreadsheet in Table 8.3 and computing the NPV of the resulting free cash flow. We can also calculate the impact of this change as follows: A $1 million increase in marketing and support costs will reduce EBIT by $1 million and will, therefore, decrease HomeNet's free cash flow by an after-tax amount of $\$1 \text{ million} \times (1 - 20\%) = \$0.8 \text{ million}$ per year. The present value of this decrease is

$$PV = \frac{-0.8}{1.12} + \frac{-0.8}{1.12^2} + \frac{-0.8}{1.12^3} + \frac{-0.8}{1.12^4} = -\$2.4 \text{ million}$$

Home Net's NPV would fall to $\$7.6 \text{ million} - \$2.4 \text{ million} = \$5.2 \text{ million}$.

Scenario Analysis

- Scenario Analysis considers the effect on the NPV of simultaneously changing multiple assumptions.

Table 8.10 Scenario Analysis of Alternative Pricing Strategies

Strategy	Sale Price ($/unit)	Expected Units Sold(thousands)	NPV ($thousands)
Current strategy	260	100	$7627
Price reduction	245	110	$7032
Price increase	275	90	$7509

Figure 8.2 Price and Volume Combinations for HomeNet with Equivalent NPV