LISBON SCHOOL OF ECONOMICS & MANAGEMENT
UNIVERSIDADE DE LISBOA

GESTÃO FINANCEIRA I

CADERNO DE EXERCÍCIOS 4

Capítulos 8, 9 e 10
Investment Decision Rules, Fundamentals of Capital Budgeting & a second look at Stock Valuation

(de BERK, DEMARZO e HARFORD'S "FUNDAMENTALS OF CORPORATE FINANCE")

LICENCIATURA

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Chapter 8
Investment Decision Rules

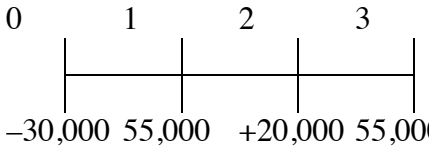
2. You have an opportunity to invest $125,000 now in return for $50,000 in one year and $90,000 in two years. If your cost of capital is 12%, what is the NPV of this investment?

$$NPV = -\$125{,}000 + \frac{\$50{,}000}{1.12} + \frac{\$90{,}000}{1.12^2} = -\$8{,}609.69$$

This is a bad investment opportunity as it produces a negative NPV. Even though the total of the cash flows is more than the investment, they come later in time and are not enough to overcome the time value of money at your cost of capital.

7. Marian Plunket owns her own business and is considering an investment. If she undertakes the investment, it will pay $55,000 at the end of each of the next three years. The opportunity requires an initial investment of $30,000 plus an additional investment at the end of the second year of $35,000. What is the NPV of this opportunity if the cost of capital is 8% per year? Should Marian take it?

Draw the timeline of the cash flows for the investment opportunity. Compute the NPV of the investment opportunity at 8% interest per year to determine if it is an attractive investment opportunity.



$$\text{NPV} = -\$30{,}000 + \frac{\$55{,}000}{1.08} + \frac{\$20{,}000}{1.08^2} + \frac{\$55{,}000}{1.08^3}$$

$$= -\$30{,}000 + 50{,}925.93 + 17{,}146.78 + 43{,}660.77$$

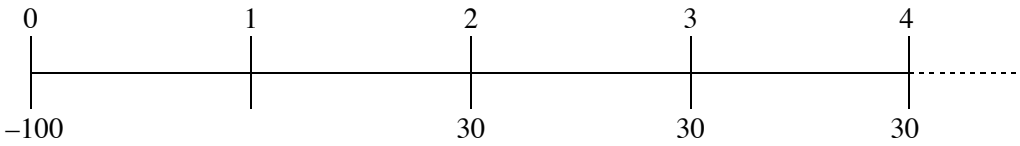
$$= \$81{,}733.48$$

Since the investment opportunity has a positive NPV of $81,733.948 Marian should make the investment.

9. You are considering opening a new plant. The plant will cost $100 million up front and will take one year to build. After that, it is expected to produce profits of $30 million at the end of every year of production. The cash flows are expected to last forever. Calculate the NPV of this investment opportunity if your cost of capital is 8%. Should you make the investment? Calculate the IRR and use it to determine the maximum deviation allowable in the cost of capital estimate to leave the decision unchanged.

We can compute the NPV of the project using an approach similar to Eq. 8.3. The cash flows are an immediate $100 million outflow followed by a perpetuity inflow of $30 million
per year, starting in year 2, and a discount rate of 8%. We can compute the IRR using a financial calculator or spreadsheet or by setting the NPV equal to zero and solving for *r*. After we find the IRR, we can compute the maximum deviation allowable in the cost of capital estimate to leave the decision unchanged by subtracting the cost of capital from the IRR.

Timeline:



$$\text{NPV} = \left(\frac{1}{1.08}\right)\frac{30}{0.08} - 100$$
$$= \$247.22 \text{ million}$$

The IRR solves

$$\left(\frac{1}{1+r}\right)\frac{30}{r} - 100 = 0 \Rightarrow r = 24.16\%$$

So, the cost of capital can be underestimated by 16.16% without changing the decision.

The NPV rule indicates that by making the investment, your factory will increase the value of the firm today by $247.22 million, so you should undertake the project. The IRR is the discount rate that sets the net present value of the cash flows equal to zero. The difference between the cost of capital and the IRR tells us the amount of estimation error in the cost of capital estimate that can exist without altering the original decision.

10. Bill Clinton reportedly was paid $10 million to write his book *My Life*. The book took three years to write. In the time he spent writing, Clinton could have been paid to make speeches. Given his popularity, assume that he could earn $8 million per year (paid at the end of the year) speaking instead of writing. Assume his cost of capital is 10% per year.

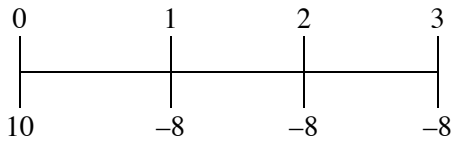
a. What is the NPV of agreeing to write the book (ignoring any royalty payment)?

b. Assume that, once the book was finished, it was expected to generate royalties of $5 million in the first year (paid at the end of the year) and these royalties were expected to decrease at a rate of 30% per year in perpetuity. What is the NPV of writing the book with the royalty payments?

We can compute the NPV of agreeing to write the book, ignoring any royalty payments, using an approach similar to Eq. 8.3. The cash flows are an immediate $10 million outflow followed by an annuity inflow of $8 million per year for three years and a discount rate of 10%. We can compute the NPV of the book with the royalty payments by first computing the present value of the royalties at year 3. Once we compute the royalties at year 3 we can

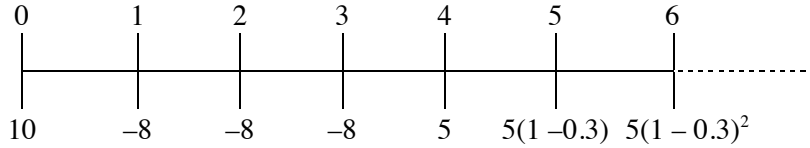
compute the present value of the royalties today and add that number to the NPV of agreeing to write the book ignoring any royalty payments.

a. Timeline:



$$\text{NPV} = 10 - \frac{8}{0.1}\left(1 - \frac{1}{(1.1)^3}\right) = -\$9.895 \text{ million}$$

b. Timeline:



First, calculate the PV of the royalties at year 3. The royalties are a declining perpetuity:

$$\begin{aligned} \text{PV}_3 &= \frac{5}{0.1 - (-0.3)} \\ &= \frac{5}{0.4} \\ &= 12.5 \text{ million} \end{aligned}$$

so the value today is

$$\begin{aligned} \text{PV}_{\text{royalties}} &= \frac{12.5}{(1.1)^3} \\ &= 9.391. \end{aligned}$$

Now add this to the NPV from part (a),

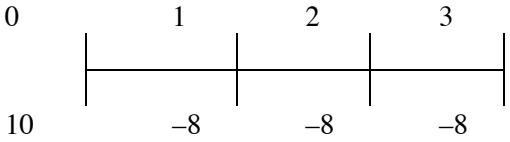
$$\begin{aligned} \text{NPV} &= -9.895 + 9.391 \\ &= -\$503{,}381. \end{aligned}$$

The NPV rule indicates that by agreeing to write the book (ignoring any royalties), you will decrease the value of Clinton's wealth today by $9.895 million, and by agreeing to write the book including royalties, you will decrease the value of the firm by only $503,381 and therefore Bill should not undertake either project because both will decrease the value of the firm.

15. How many IRRs are there in part (a) of problem 10? Does the IRR rule give the correct answer in this case?

We can compute the IRR by first computing the NPV and find the rate that sets that NPV equal to zero. In order to determine how many IRRs will set NPV equal to zero we can plot NPV as a function of the discount rate.

Timeline:

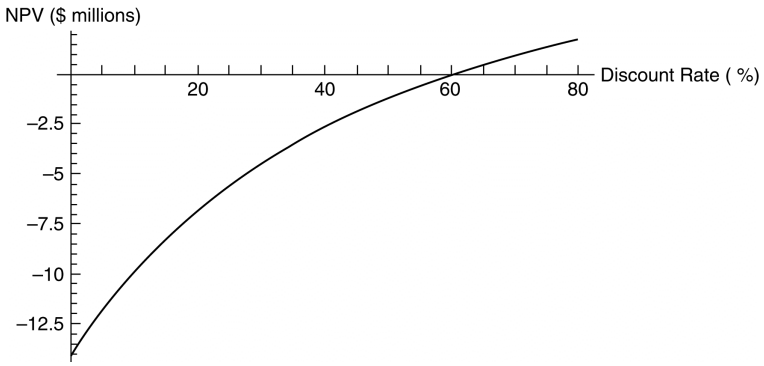


IRR is the r that solves

$$\text{NPV} = 0$$

$$= 10 - \frac{8}{r}\left(1 - \frac{1}{(1+r)^3}\right)$$

To determine how many solutions this equation has, plot the NPV as a function of r.



From the plot there is one IRR of 60.74%.

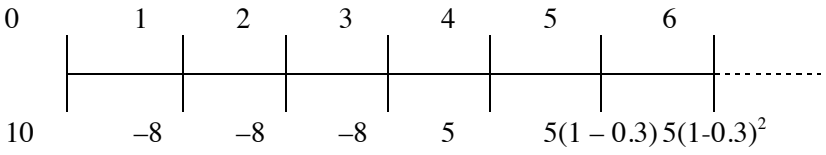
Because the IRR is much greater than the discount rate, the IRR rule says write the book. Because this is a negative NPV project (from 9.2(a)), the IRR gives the wrong answer.

In this case, there is only one IRR (the intercept on the x-axis), and the IRR is greater than the discount rate. According to the IRR rule, Bill should accept the project, yet because the NPV is negative, the NPV rule states that Bill should not accept the project. Although the two rules are conflicting, the NPV rule tends to be more reliable.

16. How many IRRs are there in part (b) of problem 10? Does the IRR rule give the correct answer in this case?

We can compute the IRR by first computing the NPV and finding the rate that sets that NPV equal to zero. In order to determine how many IRRs will set NPV equal to zero, we can plot NPV as a function of the discount rate.

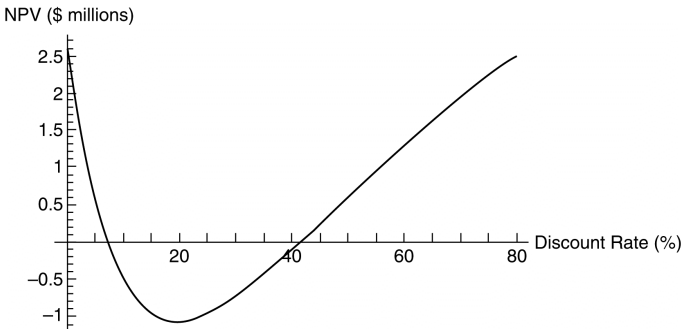
Timeline:



From 9.2(b) the NPV of these cash flows is:

$$\text{NPV} = 10 - \frac{8}{r}\left(1 - \frac{1}{(1+r)^3}\right) + \frac{1}{(1+r)^3}\left(\frac{5}{r+0.3}\right)$$

Plotting the NPV as a function of the discount rate gives:

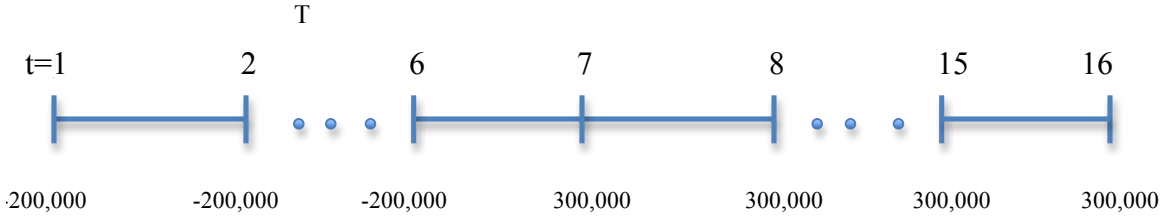


The plot shows that there are two IRRs — +7.165% and +41.568%. The IRR does give an answer in this case, so it does *not* work. In this case, there are two IRRs (the intercepts on the *x*-axis), and the IRR does not provide an answer, so we cannot use the IRR rule, and therefore the IRR rule does not work.

***11. FastTrack Bikes, Inc. is thinking of developing a new composite road bike. Development will take six years and the cost is $200,000 per year. Once in production, the bike is expected to make $300,000 per year for 10 years. The cash inflows begin at the end of year 7.Assume the cost of capital is 10%.**

a. Calculate the NPV of this investment opportunity. Should the company make the investment?

Timeline:



$$\text{NPV} = -\frac{200{,}000}{r}\left(1 - \frac{1}{(1+r)^6}\right) + \left(\frac{1}{(1+r)^6}\right)\frac{300{,}000}{r}\left(1 - \frac{1}{(1+r)^{10}}\right)$$

$$= -\frac{200{,}000}{0.1}\left(1 - \frac{1}{(1.1)^6}\right) + \left(\frac{1}{(1.1)^6}\right)\frac{300{,}000}{0.1}\left(1 - \frac{1}{(1.1)^{10}}\right)$$

$$= \$169{,}482$$

NPV > 0, so the company should take the project.

b. By how much must the cost of capital estimate deviate to change the decision? (*Hint*: Use Excel to calculate the IRR.)

Setting the NPV = 0 and solving for r (using a spreadsheet) the answer is IRR = 12.66%.

So if the estimate is too low by 2.66%, the decision will change from accept to reject.

	1	2	3	4	5	6	1	2	3	4	5	6	7	8	9	10
	-200	-200	-200	-200	-200	-200	300	300	300	300	300	300	300	300	300	300
IRR	12.66%															
NPV																
10%	$169.482															
14%	($64.816)															

c. What is the NPV of the investment if the cost of capital is 14%?

$$\text{NPV} = -\frac{200{,}000}{r}\left(1-\frac{1}{(1+r)^6}\right)+\left(\frac{1}{(1+r)^6}\right)\frac{300{,}000}{r}\left(1-\frac{1}{(1+r)^{10}}\right)$$

$$= -\frac{200{,}000}{0.14}\left(1-\frac{1}{(1.14)^6}\right)+\left(\frac{1}{(1.14)^6}\right)\frac{300{,}000}{0.14}\left(1-\frac{1}{(1.14)^{10}}\right)$$

$$= -\$64.816$$

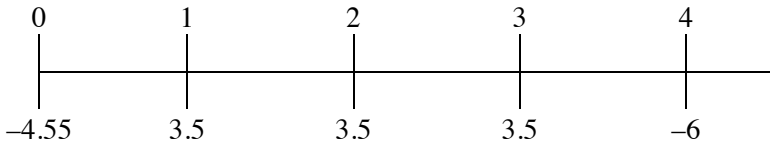
20. Your firm is considering a project that will cost $4.55 million up front, generate cash flows of $3.5 million per year for three years, and then have a cleanup and shutdown cost of $6 million in the fourth year.

a. How many IRRs does this project have?

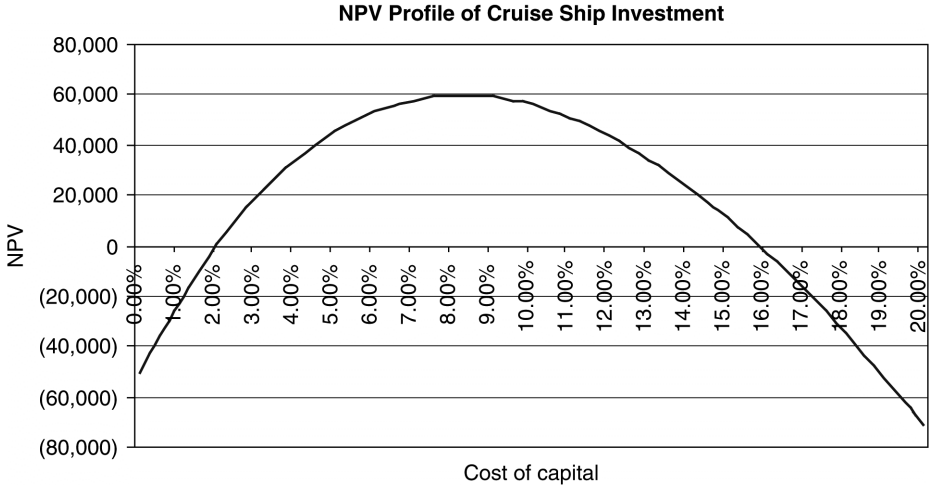
b. IGNORE

c. Using the MIRR and a cost of capital of 10%, would you take the project?

Compute various IRR calculations for the proposed project. The timeline of the investment opportunity is:



a. Looking at the NPV profile below, this project has two IRRs.



c. To use the MIRR approach, calculate the PV of the cleanup costs and add this value to the initial startup costs.

$$PV_{(\text{cleanup costs})} = \frac{-6}{(1.10)^4}$$
$$= -\$4.098$$

t	0	1	2	3	4	NPV@10%
CFt	-4,55	3,5	3,5	3,5	-6	0,0559012
Modified CFt	-8,64	0	0	0	12,7435	0,0559012

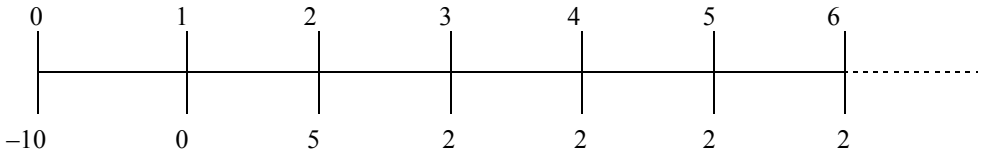
Modified CF0=-4.55-4.098=-8.64

Modified CF4=3.5^3+3.5^2+3.5^1=12,7435

-8,64+12,7435/((1+MIRR)^4) = 0

MIRR of these cash flows is 10.177%.
MIRR is greater than the cost of capital, so the investment should be taken.

25. You are considering making a movie. The movie is expected to cost $10 million upfront and take a year to make. After that, it is expected to make $5 million when it is released in one year and $2 million per year for the following four years. What is the payback period of this investment? If you require a payback period of two years, will you make the movie? Does the movie have positive NPV if the cost of capital is 10%?



It will take 5 years to pay back the initial investment, so the payback period is 5 years. You will not make the movie.

$$NPV = -10 + \frac{5}{(1+r)^2} + \frac{2}{r}\left(1 - \frac{1}{(1+r)^4}\right)\frac{1}{(1+r)^2} = -10 + \frac{5}{(1.1)^2} + \frac{2}{0.1(1.1)^2}\left(1 - \frac{1}{(1.1)^4}\right) = -\$628,322$$

So the NPV agrees with the payback rule in this case.

Although simple to compute, the payback rule requires us to use an arbitrary cutoff period in summing the cash flows. Further, the payback rule does not discount future cash flows. Instead it simply sums the cash flows and compares them to a cash outflow in the present. In this case, you will not make the movie because your cutoff point is two years and it will take five years to pay back the initial investment. The NPV of this project came back as negative, so this also agrees with the payback rule, and the movie should therefore not be made.

26. You are choosing between two projects, but can only take one. The cash flows for the projects are given in the following table:

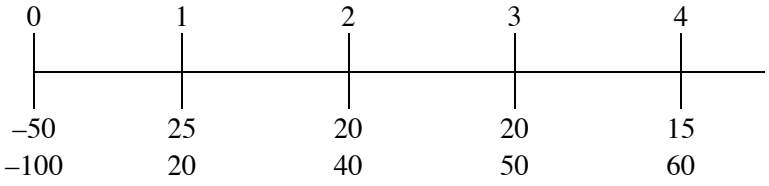
	0	1	2	3	4
A	-50	25	20	20	15
B	-100	20	40	50	60

a. What are the IRRs of the two projects?

b. If your discount rate is 5%, what are the NPVs of the two projects?

c. Why do IRR and NPV rank these projects differently?

We can compute the IRR by using an approach similar to Eq. 8.3 and then rearranging it so that NPV equals zero and solving for r. Once we compute r, we can compute the NPV of both projects.



a. $$0 = -50 + \frac{25}{1+r} + \frac{20}{(1+r)^2} + \frac{20}{(1+r)^3} + \frac{15}{(1+r)^4}$$

IRR (A) = 24%

$$0 = -100 + \frac{20}{1+r} + \frac{40}{(1+r)^2} + \frac{50}{(1+r)^3} + \frac{60}{(1+r)^4}$$

IRR (B) = 21%

b. $$NPV_A = -50 + \frac{25}{1+0.05} + \frac{20}{(1+0.05)^2} + \frac{20}{(1+0.05)^3} + \frac{15}{(1+0.05)^4}$$
$$= 21.57$$
$$NPV_B = -100 + \frac{20}{1+0.05} + \frac{40}{(1+0.05)^2} + \frac{50}{(1+0.05)^3} + \frac{60}{(1+0.05)^4}$$
$$= 47.88$$

c. The IRR and NPV rank differently due to the difference in the initial investment. Investment *A* earns a higher rate of return on a smaller investment.

27. You are deciding between two mutually exclusive investment opportunities. Both require the same initial investment of $10 million. Investment A will generate $2 million per year (starting at the end of the first year) in perpetuity. Investment B will generate $1.5 million at the end of the first year and its revenues will grow at 2% per year for every year after that.

a. Which investment has the higher IRR?

	0	1	2	3
A	−10	2	2	2
B	−10	1.5	1.5(1.02)	$1.5(1.02)^2$

$$NPV_A = \frac{2}{r} - 10$$

Setting $NPV_A = 0$ and solving for r

$IRR_A = 20\%$

$$NPV_B = \frac{1.5}{r - 0.02} - 10$$

Setting $NPV_B = 0$ and solving for r

$$\frac{1.5}{r-0.02} = 10 \Rightarrow r - 0.02 = 0.15 \Rightarrow r = 17\%.\ So,\ IRR_B = 17\%$$

Based on the IRR, you always pick project A.

b. Which investment has the higher NPV when the cost of capital is 7%?

Substituting r = 0.07 into the NPV formulas derived in part (a) gives

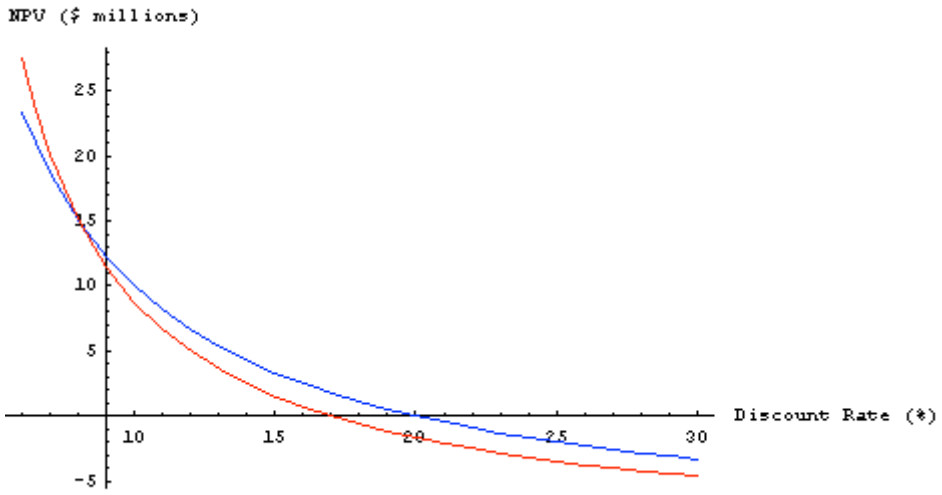
NPV_A = $18.5714 million,

NPV_B = $20 million.

So the NPV says take B.

c. In this case, for what values of the cost of capital does picking the higher IRR give the correct answer as to which investment is the best opportunity?

Here is a plot of NPV of both projects as a function of the discount rate. The NPV rule selects A (and so agrees with the IRR rule) for all discount rates to the right of the point where the curves cross.



$$NPV_A = NPV_B$$
$$\frac{2}{r} = \frac{1.5}{r - 0.02}$$
$$\frac{r}{2} = \frac{r - 0.02}{1.5}$$
$$1.5r = 2r - 0.04$$
$$0.5r = 0.04$$
$$r = 0.08$$

So the IRR rule will give the correct answer for discount rates greater than 8% (crossover point).

31. Gateway Tours is choosing between two bus models. One is more expensive to purchase and maintain, but lasts much longer than the other. Its discount rate is 11%. The company plans to continue with one of the two models for the foreseeable future. Based on the costs of each model shown below, which should it choose?

Model	0	1	2	3	4	5	6	7
Old Reliable	-200	-4	-4	-4	-4	-4	-4	-4
Short and Sweet	-100	-2	-2	-2	-2			

Compute the NPV and the EAA of each bus. Choose the bus with the lowest costs.

The timeline of the investment opportunity is:

	0	1	2	3	4	5	6	7
Old Reliable:	–200	–4	–4	–4	–4	–4	–4	–4
Short and	–100	–2	–2	–2	–2			

Sweet:

$$\begin{aligned}
\text{NPV}_{\text{Old Reliable}} &= -200 + \frac{-4}{0.11}\left(1 - \frac{1}{(1+0.11)^7}\right) \\
&= -218.85 \\
-218.85 &= \frac{\text{EAA}_{\text{Old Reliable}}}{0.11}\left(1 - \frac{1}{(1+0.11)^7}\right) \\
\text{EAA}_{\text{Old Reliable}} &= -46.44 \\
\text{NPV}_{\text{Short and Sweet}} &= -100 + \frac{-2}{0.11}\left(1 - \frac{1}{(1+0.11)^4}\right) \\
&= -106.20 \\
-106.20 &= \frac{\text{EAA}_{\text{Short and Sweet}}}{0.11}\left(1 - \frac{1}{(1+0.11)^4}\right) \\
\text{EAA}_{\text{Short and Sweet}} &= -34.23
\end{aligned}$$

The equivalent annual cost of the Short and Sweet bus is less, so they should buy this bus.

36. Orchid Biotech Company is evaluating several development projects for experimental drugs. Although the cash flows are difficult to forecast, the company has come up with the following estimates of the initial capital requirements and NPVs for the projects. Given a wide variety of staffing needs, the company has also estimated the number of research scientists required for each development project (all cost values are given in millions of dollars).

Project Number	Initial Capital	Number of Research Scientists	NPV
I	$10	2	$10.1
II	15	3	19.0
III	15	4	22.0
IV	20	3	25.0
V	30	12	60.2

a. Suppose that Orchid has a total capital budget of $60 million. How should it prioritize these projects?

b. Suppose that Orchid currently has 12 research scientists and does not anticipate being able to hire more in the near future. How should it prioritize these projects?

Compute the NPV and Profitability Index of each proposed investment. Select the best combination of investments.

Project	NPV/Initial Capital	NPV/Head Count
I	1.01	5.1
II	1.27	6.3
III	1.47	5.5
IV	1.25	8.3
V	2.01	5.0

a. The PI rule selects Projects V, III, and II. These are also the optimal projects to undertake (as the budget is used up fully taking the projects in order).

b. The **additional constraint** that only 12 research scientists are available will alter the set of projects that can be selected and the optimum number of projects to select. Specifically, Project V is the most attractive project with the highest PI=NPV/Capital. But because Project V requires 12 research scientists, selecting it would mean no other projects could be selected. (Taking Project V would also only use $30 million of the $60 million available.)

The PI=NPV/Headcount rule selects IV, II, III, and I because these projects have the highest PI and use the entire $60 million and 12 research scientists. However, this choice of projects does not necessarily maximize NPV. This solution shows that it may be optimal to skip some projects in the PI ranking if they will not fit within the budget and other resource constraints.

Chapter 9
Fundamentals of Capital Budgeting

5. Kokomochi is considering the launch of an advertising campaign for its latest dessert product, the Mini Mochi Munch. Kokomochi plans to spend $5 million on TV, radio, and print advertising this year for the campaign. The ads are expected to boost sales of the Mini Mochi Munch by $9 million this year and by $7 million next year. In addition, the company expects that new consumers who try the Mini Mochi Munch will be more likely to try Kokomochi's other products. As a result, sales of other products are expected to rise by $2 million each year.

Kokomochi's gross profit margin for the Mini Mochi Munch is 35%, and its gross profit margin averages 25% for all other products. The company's marginal corporate tax rate is 35% both this year and next year. What are the incremental earnings associated with the advertising campaign?

We need four items to calculate incremental earnings: (1) incremental revenues, (2) incremental costs, (3) depreciation, and (4) the marginal tax rate.

	Year	1	2
Incremental Earnings Forecast ($000s)			
1	Sales of Mini Mochi Munch	9,000	7,000
2	Other Sales	2,000	2,000
3	Cost of Goods Sold	(7,350)	(6,050)
4	**Gross Profit**	3,650	2,950
5	Selling, General & Admin.	(5,000)	—
6	Depreciation	—	—
7	**EBIT**	(1,350)	2,950
8	Income tax at 35%	473	(1,033)
9	**Unlevered Net Income**	**(878)**	**1,918**

These incremental earnings are an intermediate step on the way to calculating the incremental cash flows that would form the basis of any analysis of the project. Net income is negative in the first year because the additional selling, general, and administrative costs occurred only in the first year.

22. **Home Builder Supply, a retailer in the home improvement industry, currently operates seven retail outlets in Georgia and South Carolina. Management is contemplating building an eighth retail store across town from its most successful retail outlet. The company already owns the land for this store, which currently has an abandoned warehouse located on it. Last month, the marketing department spent $10,000 on market research to determine the extent of customer demand for the new store. Now Home Builder Supply must decide whether to build and open the new store.**

Which of the following should be included as part of the incremental earnings for the proposed new retail store?

a. The original purchase price of the land where the store will be located.

No, this is a sunk cost and will not be included directly. (But see part (f) below.)

b. The cost of demolishing the abandoned warehouse and clearing the lot.

Yes, this is a cost of opening the new store.

c. The loss of sales in the existing retail outlet, if customers who previously drove across town to shop at the existing outlet become customers of the new store instead.

Yes, this loss of sales at the existing store should be deducted from the sales at the new store to determine the incremental increase in sales that opening the new store will generate for HBS.

d. The $10,000 in market research spent to evaluate customer demand.

No, this is a sunk cost.

e. Construction costs for the new store.

This is a capital expenditure associated with opening the new store. These costs will, therefore, increase HBS's depreciation expenses.

f. The value of the land if sold.

Yes, this is an opportunity cost of opening the new store. (By opening the new store, HBS forgoes the after-tax proceeds it could have earned by selling the property. This loss is equal to the sale price less the taxes owed on the capital gain from the sale, which is the difference between the sale price and

the book value of the property. The book value equals the initial cost of the property less accumulated depreciation.)

g. Interest expense on the debt borrowed to pay the construction costs.

While these financing costs will affect HBS's actual earnings, for capital budgeting purposes we calculate the incremental earnings without including financing costs to determine the project's unlevered net income.

11. Castle View Games would like to invest in a division to develop software for video games. To evaluate this decision, the firm first attempts to project the working capital needs for this operation. Its chief financial officer has developed the following estimates (in millions of dollars):

	Year 1	Year 2	Year 3	Year 4	Year 5
Cash	6	12	15	15	15
Accounts Receivable	21	22	24	24	24
Inventory	5	7	10	12	13
Accounts Payable	18	22	24	25	30

Assuming that Castle View currently does not have any working capital invested in this division, calculate the cash flows associated with changes in working capital for the first five years of this investment.

We can project the net working capital needed for this operation by adding cash, inventory, and receivables and subtracting payables.

Net working capital in this problem is the sum of Cash, Accounts Receivable, and Inventory (Lines 1, 2, and 3 below) less Accounts Payable (Line 4). Line 5 is net working capital, and Line 6 is the changes in working capital from year to year. For example, net working capital in year 1 was 14, and in year 2, it grew to 19, so the increase in NWC, as computed on Line 6 for year 2, is 5. The firm must add 5 to working capital in year 2, so it represents a reduction in cash flow available to investors.

		Year0	Year1	Year2	Year3	Year4	Year5
1	Cash		6	12	15	15	15
2	Accounts Receivable		21	22	24	24	24
3	Inventory		5	7	10	12	13
4	Accounts Payable		18	22	24	25	30
5	Net working capital (1+2+3-4)	0	14	19	25	26	22
6	Increase in NWC		14	5	6	1	-4

13. Elmdale Enterprises is deciding whether to expand its production facilities. Although long-term cash flows are difficult to estimate, management has projected the following cash flows for the first two years (in millions of dollars):

	Year 1	Year 2
Revenues	125	160
Costs of goods sold and operating expenses other than depreciation	40	60
Depreciation	25	36
Increase in net working capital	5	8
Capital expenditures	30	40
Marginal corporate tax rate	35%	35%

a. What are the incremental earnings for this project for years 1 and 2?

b. What are the free cash flows for this project for the first two years?

We need four items to calculate incremental earnings: (1) incremental revenues, (2) incremental costs, (3) depreciation, and (4) the marginal tax rate.

Earnings include non-cash charges, such as depreciation, but do not include the cost of capital investment. To determine the project's free cash flow from its incremental earnings, we must adjust for these differences. We need to add back depreciation to the incremental earnings to recognize the fact that we still have the cash flow associated with it.

Solution: Note—we have assumed any incremental cost of goods sold is included as part of operating expenses.

a.

	Year	1	2
Incremental Earnings Forecast ($000s)			
1	Sales	125.0	160.0
2	Operating Expenses	(40.0)	(60.0)
3	Depreciation	(25.0)	(36.0)
4	**EBIT**	60.0	64.0
5	Income Tax at 35%	(21.0)	(22.4)
6	**Unlevered Net Income**	**39.0**	**41.6**

b.

	Free Cash Flow ($000s)	**1**	**2**
7	Plus: Depreciation	25.0	36.0
8	Less: Capital Expenditures	(30.0)	(40.0)
9	Less: Increases in NWC	(2.0)	(8.0)
10	**Free Cash Flow**	**32.0**	**29.6**

These incremental earnings are an intermediate step on the way to calculating the incremental cash flows that would form the basis of any analysis of the project. Earnings are an accounting measure of the firm's performance. They do not represent real profits, and a firm needs cash. Thus, to evaluate a capital budgeting decision, we must determine its consequences for the firm's available cash.

***16. One year ago, your company purchased a machine used in manufacturing for $110,000. You have learned that a new machine is available that offers many advantages and you can purchase it for $150,000 today. It will be depreciated on a straight-line basis over 10 years and has no salvage value. You expect that the new machine will produce a gross margin (revenues minus operating expenses other than depreciation) of $40,000 per year for the next 10 years. The current machine is expected to produce a gross margin of $20,000 per year. The current machine is being depreciated on a straight-line basis over a useful life of 11 years, and has no salvage value, so depreciation expense for the current machine is $10,000 per year. The market value today of the current machine is $50,000. Your company's tax rate is 45%, and the opportunity cost of capital for this type of equipment is 10%. Should your company replace its year-old machine?**

Replacing the machine increases EBITDA by 40,000 – 20,000 = 20,000. Depreciation expenses rises by $15,000 – $10,000 = $5,000. Therefore, FCF will increase by (20,000) × (1 – 0.45) + (0.45)(5,000) = $13,250 in years 1 through 10.

In year 0, the initial cost of the machine is $150,000.

Because the current machine has a book value of $110,000 – 10,000 (one year of depreciation) = $100,000, selling it for $50,000 generates a capital gain of 50,000 – 100,000 = –50,000. This loss produces tax savings of 0.45 × 50,000 = $22,500, so that the after-tax proceeds from the sales including this tax savings is $72,500.

Thus, the FCF in year 0 from replacement is –150,000 + 72,500 = –$77,500.

NPV of replacement = $-77{,}500 + 13{,}250 \times (1/0.10)(1 - 1/1.10^{10}) =$ $3,916. There is a small profit from replacing the machine.

Even though the decision has no impact on revenues, it still matters for cash flows because it reduces costs. Further, both selling the old machine and buying the new machine involve cash flows with tax implication.

29. Bauer Industries is an automobile manufacturer. Management is currently evaluating a proposal to build a plant that will manufacture lightweight trucks. Bauer plans to use a cost of capital of 12% to evaluate

this project. Based on extensive research, it has prepared the following incremental free cash flow projections (in millions of dollars):

	Year 0	Years 1–9	Year 10
Revenues		100.0	100.0
– Manufacturing expenses (other than depreciation)		–35.0	–35.0
– Marketing expenses		–10.0	–10.0
– Depreciation		–15.0	–15.0
= EBIT		40.0	40.0
– Taxes (35%)		–14.0	–14.0
= Unlevered net income		26.0	26.0
+ Depreciation		+15.0	+15.0
– Increases in net working capital		–5.0	–5.0
– Capital expenditures	–150.0		
+ Continuation value			+12.0
= Free cash flow	–150.0	36.0	48.0

a. For this base-case scenario, what is the NPV of the plant to manufacture lightweight trucks?

	Year	0	1	2	3	4	5	6	7	8	9	10
Free Cash Flow Forecast ($ millions)												
1	Sales	—	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
2	Manufacturing	—	(35.0)	(35.0)	(35.0)	(35.0)	(35.0)	(35.0)	(35.0)	(35.0)	(35.0)	(35.0)
3	Marketing Expenses	—	(10.0)	(10.0)	(10.0)	(10.0)	(10.0)	(10.0)	(10.0)	(10.0)	(10.0)	(10.0)
4	Depreciation	—	(15.0)	(15.0)	(15.0)	(15.0)	(15.0)	(15.0)	(15.0)	(15.0)	(15.0)	(15.0)
5	EBIT	—	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0
6	Income tax at 35%	—	(14.0)	(14.0)	(14.0)	(14.0)	(14.0)	(14.0)	(14.0)	(14.0)	(14.0)	(14.0)
7	**Unlevered Net Income**	—	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0
8	Depreciation	—	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0
9	Inc. in NWC	—	(5.0)	(5.0)	(5.0)	(5.0)	(5.0)	(5.0)	(5.0)	(5.0)	(5.0)	(5.0)
10	Capital Expenditures	(150.0)	—	—	—	—	—	—	—	—	—	—
11	Continuation value	—	—	—	—	—	—	—	—	—	—	12.0
12	**Free Cash Flow**	(150.0)	36.0	36.0	36.0	36.0	36.0	36.0	36.0	36.0	36.0	48.0
13	**NPV at 12%**	**57.3**	—	—	—	—	—	—	—	—	—	—

The NPV of the estimate free cash flow is

$$\text{NPV} = -150 + 36 \times \frac{1}{0.12}\left(1 - \frac{1}{1.12^{9}}\right) + \frac{48}{1.12^{10}} = \$57.3 \text{ million.}$$

b. Based on input from the marketing department, Bauer is uncertain about its revenue forecast. In particular, management would like to examine the sensitivity of the NPV to the revenue assumptions. What is the NPV of this project if revenues are 10% higher than forecast? What is the NPV if revenues are 10% lower than forecast?

Initial Sales	90	100	110
NPV	20.5	57.3	94.0

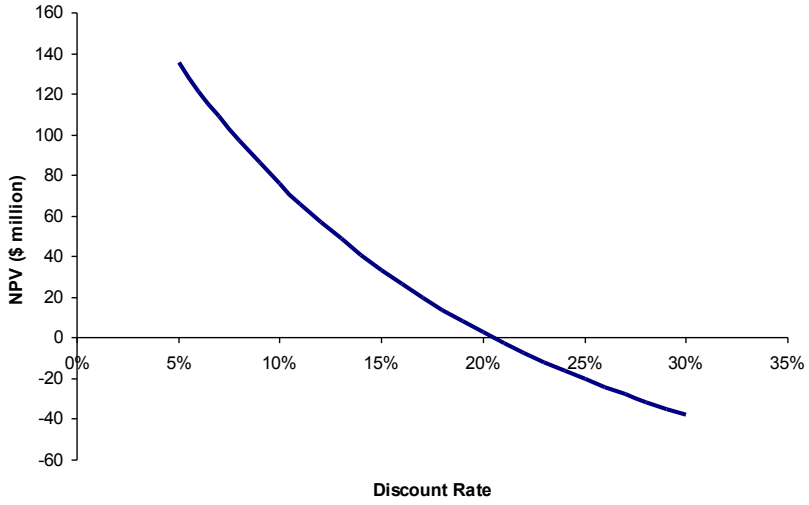
c. Rather than assuming that cash flows for this project are constant, management would like to explore the sensitivity of its analysis to possible growth in revenues and operating expenses. Specifically, management would

like to assume that revenues, manufacturing expenses, and marketing expenses are as given in the table for year 1 and grow by 2% per year every year starting in year 2. Management also plans to assume that the initial capital expenditures (and therefore depreciation), additions to working capital, and continuation value remain as initially specified in the table. What is the NPV of this project under these alternative assumptions? How does the NPV change if the revenues and operating expenses grow by 5% per year rather than by 2%?

Growth Rate	0%	2%	5%
NPV	57.3	72.5	98.1

d. To examine the sensitivity of this project to the discount rate, management would like to compute the NPV for different discount rates. Create a graph, with the discount rate on the *x*-axis and the NPV on the *y*-axis, for discount rates ranging from 5% to 30%. For what ranges of discount rates does the project have a positive NPV?

NPV is positive for discount rates below the IRR of 20.6%.



Plan: Compute the Free Cash Flow forecast for the next 10 years. Compute the NPV of the project based on the forecasted Free Cash Flows. Then compute the NPV under different assumptions about Initial Sales and Growth. Then compute the NPV of the project under a range of discount rates.

	Year	0	1	2	3	4	5	6	7	8	9	10
Free Cash Flow Forecast ($ millions)												
1	Sales	—	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
2	Manufacturing	—	(35.0)	(35.0)	(35.0)	(35.0)	(35.0)	(35.0)	(35.0)	(35.0)	(35.0)	(35.0)
3	Marketing Expenses	—	(10.0)	(10.0)	(10.0)	(10.0)	(10.0)	(10.0)	(10.0)	(10.0)	(10.0)	(10.0)
4	Depreciation	—	(15.0)	(15.0)	(15.0)	(15.0)	(15.0)	(15.0)	(15.0)	(15.0)	(15.0)	(15.0)
5	EBIT	—	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0	40.0

6	Income Tax at 35%	—	(14.0)	(14.0)	(14.0)	(14.0)	(14.0)	(14.0)	(14.0)	(14.0)	(14.0)	(14.0)
7	**Unlevered Net Income**	—	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0
8	Depreciation	—	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0
9	Inc. in NWC	—	(5.0)	(5.0)	(5.0)	(5.0)	(5.0)	(5.0)	(5.0)	(5.0)	(5.0)	(5.0)
10	Capital Expenditures	(150.0)	—	—	—	—	—	—	—	—	—	—
11	Continuation Value	—	—	—	—	—	—	—	—	—	—	12.0
12	**Free Cash Flow**	(150.0)	36.0	36.0	36.0	36.0	36.0	36.0	36.0	36.0	36.0	48.0
13	**NPV at 12%**	**57.3**	—	—	—	—	—	—	—	—	—	—

Execute:

a. The NPV of the estimate free cash flow is:

$$\text{NPV} = -150 + 36 \times \frac{1}{0.12}\left(1 - \frac{1}{1.12^9}\right) + \frac{48}{1.12^{10}}$$
$$= \$57.3 \text{ million}$$

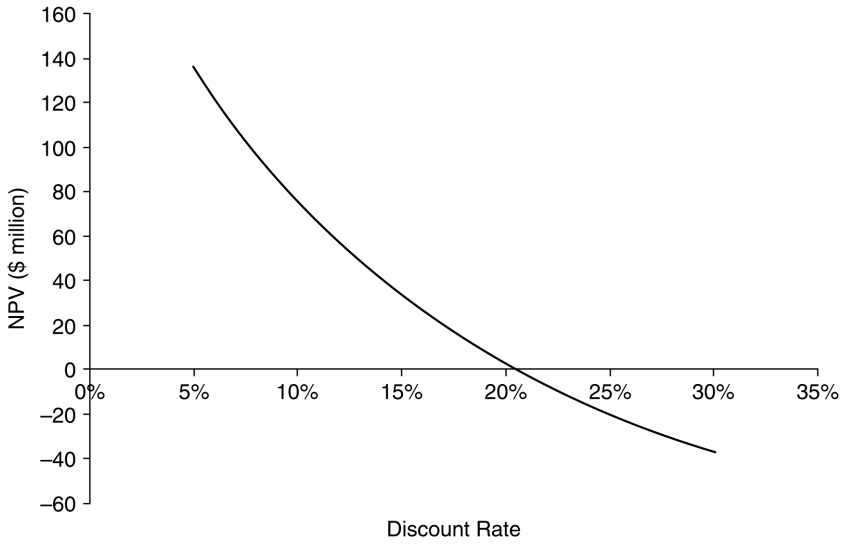
b.

Initial Sales:	90	100	110
NPV:	20.5	57.3	94.0

c.

Growth Rate:	0%	2%	5%
NPV:	57.3	72.5	98.1

d. NPV is positive for discount rates below the IRR of 20.6%.



Evaluate: Under the forecast assumptions, the project has an NPV of $57.3 million and therefore should be accepted. Under various scenarios of assumed initial sales and growth the project continues to have a positive NPV, meaning that even if the forecast assumption proves too optimistic or pessimistic, the project will still create firm value. Finally, the discount rate used in the forecast assumptions is 12%, but the project would have a positive NPV using any discount rate below 20.6%. The project is positive and the results are robust.

Chapter 10
Stock Valuation: a second look

5. Heavy Metal Corporation is expected to generate the following free cash flows over the next five years:

Year	1	2	3	4	5
FCF ($ million)	**53**	**68**	**78**	**75**	**82**

After 5 years, the free cash flows are expected to grow at the industry average of 4% per year. Using the discounted free cash flow model and a weighted average cost of capital of 14%:

a. Estimate the enterprise value of Heavy Metal.

b. If Heavy Metal has no excess cash, debt f $300 million, and 40 million shares outstanding, estimate its share price.

The first step is to determine the value of Heavy Metal Corporation. Because the firm has specific cash flow estimates for years 1 to 5, these must be discounted to the present. Starting in year 6, the firm's cash flows are expected to grow at 4%, so they can be valued using the dividend growth model. Once the value of the entire firm is estimated, the second step is to determine the value of a share of equity.

a. $V(5) = 82 \times (1.04)/(14\% - 4\%) = \$852.80$ which is the value of the constant growth in dividends which starts in year 6.

$V(0) = 53/1.14 + 68/1.14^2 + 78/1.14^3 + 75/1.14^4 + (82 + 852.8)/1/14^5 = \$681.37$

which is the value of the entire firm at time 0.

b. $P = (681 + 0 - 300)/40 = \$9.53$ is the value per share of equity. This is the value of the entire firm, minus the value of debt, divided by the number of shares outstanding.

The entire firm is worth $681 million dollars. The equity of the firm is worth the entire firm value less the value of the outstanding debt ($681 million minus $300 million) or $381 million. We now divide the value of the equity by the number of outstanding shares ($381 million divided by 40 million) to determine a per share value of $9.53.

6. Covan Inc., is expected to have the following free cash flows:

Year	1	2	3	4	…
FCF	10	12	13	14	Grow by 4% per year

a. Covan has 8 million shares outstanding, $3 million in excess cash, and it has no debt. If its cost of capital is 12%, what should its stock price be?

b. Covan reinvests all its FCF and has no plans to add debt or change its cash holdings. If you plan to sell Covan at the beginning of year 2, what should you expect its price to be?

c. Assume you bought Covan stock at the beginning of year 1. What is your expected return from holding Covan stock until year 2?

Use Eqs. 10.3 and 10.4 to compute the enterprise value and then price per share of Covan. At any point in time, the enterprise value is the PV of the remaining expected FCF. Once the two prices per share are computed, you can calculate the return.

a. $$V_0 = \frac{10}{1.12} + \frac{12}{1.12^2} + \frac{13}{1.12^3} + \frac{14}{1.12^4} + \left(\frac{1}{1.12^4}\right)\left(\frac{14(1.04)}{0.12-0.04}\right) = 152.31$$

$$P_0 = \frac{V_0 + Cash - Debt}{\text{shares outstanding}} = \frac{152.31+3-0}{8} = 19.41$$

b. At any point in time, the enterprise value is still the PV of all remaining FCF:

$$V_1 = \frac{12}{1.12^1} + \frac{13}{1.12^2} + \frac{14}{1.12^3} + \left(\frac{1}{1.12^3}\right)\left(\frac{14(1.04)}{0.12-0.04}\right) = 160.59$$

$$P_1 = \frac{V_1 + \text{Cash} - \text{Debt}}{\text{shares outstanding}} = \frac{160.59+3-0}{8} = 20.45$$

c. $$r = \frac{20.45-19.41}{19.41} = 0.054$$

Given your forecast of Covan's FCFs and its investment plans, you expect the stock price to rise from $19.41 to $20.54, giving you a return of 5.4%.

10. You notice that Coca-Cola has a stock price of $41.09 and EPS of $1.89. Its competitor PepsiCo has EPS of $3.90. But, Jones Soda, a small batch Seattle-based soda producer has a P/E ratio of 35. Based on this information, what is one estimate of the value of a share of PepsiCo stock price?

All three companies are in the same industry, but it is critical when using multiples that the companies be truly comparable. Jones does not have the size or the breadth of product line that Coca-Cola and Pepsi do, so the better choice is to use Coca-Cola's information to value Pepsi.

Coca-Cola has a price of 41.09 and an EPS of 1.89, giving it a P/E of 41.09/1.89 = 21.74. Applying that multiple to Pepsi's EPS results in a price of 21.74 × $3.90 = $84.79.

11. CSH has EBITDA of $5 million. You feel that an appropriate EV/EBITDA ratio for CSH is 9. CSH has $10 million in debt, $2 million in cash, and 800,000 shares outstanding. What is your estimate of CSH's stock price?

You can use the EV/EBITDA ratio to estimate the enterprise value and then use Eq 10.4 to calculate the price per share based on that estimate.

Using the EV/EBITDA ratio, you estimate CSH's enterprise value as $5 million × 9 = $45 million.

$$P_0 = \frac{V_0 + Cash - Debt}{\text{shares outstanding}} = \frac{45{,}000{,}000 + 2{,}000{,}000 - 10{,}000{,}000}{800{,}000} = 46.25$$

Based on an EV/EBITDA ratio of 9, you would estimate a price of $46.25. This price estimate is only valid if the ratio is a reasonable one for CSH.

16. Suppose that in July 2013, Nike had EPS of $2.52 and a book value of equity of $12.48 per share

a. Using the average P/E multiple in Table 10.1, estimate Nike's share price.

b. What range of share prices do you estimate based on the highest and lowest P/E multiples in Table 10.1.

c. Using the average price-to-book value multiple in Table 10.1, estimate Nike's share price.

d. What range of share prices do you estimate based on the highest and lowest price-to-book value multiples in Table 10.1?

Table 10.1 Stock Prices and Multiples for the Footwear Industry (excluding Nike), July 2013

Name	Market Capitalization ($ million)	Enterprise Value ($ million)	P/E	Price/Book	Enterprise Value/Sales	Enterprise Value/EBITDA
Nike, Inc.	55,970	54,023	23.29	5.07	2.03	15.71
Adidas AG	23,105	23,317	32.33	3.06	1.20	11.88
Puma AG	4,330	4,085	70.56	1.96	0.96	9.34
Wolverine World Wide	2,910	3,981	37.6	4.13	1.22	9.28
Steve Madden, Ltd.	2,320	2,140	18.4	3.68	1.74	10.70
Deckers Outdoor Corp.	1,990	1,923	16.74	2.67	1.36	8.73
Crocs, Inc.	1,470	1,240	11.46	2.4	1.10	6.74
Skechers U.S.A.	1,340	1,213	67.41	1.54	0.78	18.16
Weyco Group, Inc.	301	325	16.53	1.71	1.11	9.69
R. G. Barry Corp.	197	174	14.92	2.31	1.19	6.44
Rocky Brands, Inc.	113	132	12.46	0.89	0.58	6.61
		Average	**29.84**	**2.44**	**1.12**	**9.76**
		Maximum	+136%	+70%	+55%	+86%
		Minimum	−62%	−63%	−48%	−34%

Compute various estimates of the value of a share of Nike.

a. Average P/E ratio is 29.84. Multiplied by EPS of $2.52 gives $75.20.
b. Range of $28.88 ($2.52 × 11.46) to $177.81 ($2.52 ×70.56).
c. Average P/B ratio is 2.44. Multiplied by Book equity of $12.48 per share gives $30.45.
d. Range of $11.11 ($12.48 ×0.89) to $51.54 ($12.48 ×4.13).