

costs and cash revenues and costs. We also went over the calculation of depreciation expense under current tax law.

4. Some special cases encountered in using discounted cash flow analysis. Here we looked at three special issues: evaluating cost-cutting investments, how to go about setting a bid price, and the unequal lives problem.

The discounted cash flow analysis we've covered here is a standard tool in the business world. It is a very powerful tool, so care should be taken in its use. The most important thing is to get the cash flows identified in a way that makes economic sense. This chapter gives you a good start in learning to do this.

Chapter Review and Self-Test Problems

- 10.1 Capital Budgeting for Project X** Based on the following information for Project X, should we undertake the venture? To answer, first prepare a pro forma income statement for each year. Next, calculate operating cash flow. Finish the problem by determining total cash flow and then calculating NPV assuming a 28 percent required return. Use a 34 percent tax rate throughout. For help, look back at our shark attractant and power mulcher examples.

Project X involves a new type of graphite composite in-line skate wheel. We think we can sell 6,000 units per year at a price of \$1,000 each. Variable costs will run about \$400 per unit, and the product should have a four-year life.

Fixed costs for the project will run \$450,000 per year. Further, we will need to invest a total of \$1,250,000 in manufacturing equipment. This equipment is seven-year MACRS property for tax purposes. In four years, the equipment will be worth about half of what we paid for it. We will have to invest \$1,150,000 in net working capital at the start. After that, net working capital requirements will be 25 percent of sales.

- 10.2 Calculating Operating Cash Flow** Mont Blanc Livestock Pens, Inc., has projected a sales volume of \$1,650 for the second year of a proposed expansion project. Costs normally run 60 percent of sales, or about \$990 in this case. The depreciation expense will be \$100, and the tax rate is 35 percent. What is the operating cash flow? Calculate your answer using all of the approaches (including the top-down, bottom-up, and tax shield approaches) described in the chapter.

- 10.3 Spending Money to Save Money?** For help on this one, refer back to the computerized inventory management system in Example 10.3. Here, we're contemplating a new automatic surveillance system to replace our current contract security system. It will cost \$450,000 to get the new system. The cost will be depreciated straight-line to zero over the system's four-year expected life. The system is expected to be worth \$250,000 at the end of four years after removal costs.

We think the new system will save us \$125,000, before taxes, per year in contract security costs. The tax rate is 34 percent. What are the NPV and IRR on buying the new system? The required return is 17 percent.

Answers to Chapter Review and Self-Test Problems

- 10.1** To develop the pro forma income statements, we need to calculate the depreciation for each of the four years. The relevant MACRS percentages, depreciation allowances, and book values for the first four years are:

Year	MACRS Percentage	Depreciation	Ending Book Value
1	14.29%	$.1429 \times \$1,250,000 = \$178,625$	\$1,071,375
2	24.49	$.2449 \times 1,250,000 = 306,125$	765,250
3	17.49	$.1749 \times 1,250,000 = 218,625$	546,625
4	12.49	$.1249 \times 1,250,000 = 156,125$	390,500

The projected income statements, therefore, are as follows:

	Year			
	1	2	3	4
Sales	\$6,000,000	\$6,000,000	\$6,000,000	\$6,000,000
Variable costs	2,400,000	2,400,000	2,400,000	2,400,000
Fixed costs	450,000	450,000	450,000	450,000
Depreciation	<u>178,625</u>	<u>306,125</u>	<u>218,625</u>	<u>156,125</u>
EBIT	\$2,971,375	\$2,843,875	\$2,931,375	\$2,993,875
Taxes (34%)	<u>- 1,010,268</u>	<u>- 966,918</u>	<u>- 996,668</u>	<u>- 1,017,918</u>
Net income	<u>\$1,961,108</u>	<u>\$1,876,958</u>	<u>\$1,934,708</u>	<u>\$1,975,958</u>

Based on this information, the operating cash flows are:

	Year			
	1	2	3	4
EBIT	\$2,971,375	\$2,843,875	\$2,931,375	\$2,993,875
Depreciation	178,625	306,125	218,625	156,125
Taxes	<u>- 1,010,268</u>	<u>- 966,918</u>	<u>- 996,668</u>	<u>- 1,017,918</u>
Operating cash flow	<u>\$2,139,732</u>	<u>\$2,183,082</u>	<u>\$2,153,332</u>	<u>\$2,132,082</u>

We now have to worry about the nonoperating cash flows. Net working capital starts out at \$1,150,000 and then rises to 25 percent of sales, or \$1,500,000. This is a \$350,000 change in net working capital.

Finally, we have to invest \$1,250,000 to get started. In four years, the book value of this investment will be \$390,500, compared to an estimated market value of \$625,000 (half of the cost). The aftertax salvage is thus $\$625,000 - .34 \times (\$625,000 - 390,500) = \$545,270$.

When we combine all this information, the projected cash flows for Project X are:

	Year				
	0	1	2	3	4
Operating cash flow		\$2,139,732	\$2,183,082	\$2,153,332	\$2,132,082
Change in NWC	<u>- \$1,150,000</u>	<u>- 350,000</u>			<u>1,500,000</u>
Capital spending	<u>- 1,250,000</u>				<u>545,270</u>
Total cash flow	<u><u>- \$2,400,000</u></u>	<u><u>\$1,789,732</u></u>	<u><u>\$2,183,082</u></u>	<u><u>\$2,153,332</u></u>	<u><u>\$4,177,352</u></u>

With these cash flows, the NPV at 28 percent is:

$$\begin{aligned} \text{NPV} &= -\$2,400,000 + 1,789,732/1.28 + 2,183,082/1.28^2 \\ &\quad + 2,153,332/1.28^3 + 4,177,352/1.28^4 \\ &= \$2,913,649 \end{aligned}$$

So this project appears quite profitable.

10.2 First, we can calculate the project's EBIT, its tax bill, and its net income.

$$\begin{aligned} \text{EBIT} &= \text{Sales} - \text{Costs} - \text{Depreciation} \\ &= \$1,650 - 990 - 100 = \$560 \end{aligned}$$

$$\text{Taxes} = \$560 \times .35 = \$196$$

$$\text{Net income} = \$560 - 196 = \$364$$

With these numbers, operating cash flow is:

$$\begin{aligned} \text{OCF} &= \text{EBIT} + \text{Depreciation} - \text{Taxes} \\ &= \$560 + 100 - 196 \\ &= \$464 \end{aligned}$$

Using the other OCF definitions, we have:

$$\begin{aligned} \text{Bottom-up OCF} &= \text{Net income} + \text{Depreciation} \\ &= \$364 + 100 \\ &= \$464 \end{aligned}$$

$$\begin{aligned} \text{Top-down OCF} &= \text{Sales} - \text{Costs} - \text{Taxes} \\ &= \$1,650 - 990 - 196 \\ &= \$464 \end{aligned}$$

$$\begin{aligned} \text{Tax shield OCF} &= (\text{Sales} - \text{Costs}) \times (1 - .35) \\ &\quad + \text{Depreciation} \times .35 \\ &= (\$1,650 - 990) \times .65 + 100 \times .35 \\ &= \$464 \end{aligned}$$

As expected, all of these definitions produce exactly the same answer.

10.3 The \$125,000 pretax saving amounts to $(1 - .34) \times \$125,000 = \$82,500$ after taxes. The annual depreciation of $\$450,000/4 = \$112,500$ generates a tax shield of $.34 \times \$112,500 = \$38,250$ each year. Putting these together, we calculate that the operating cash flow is $\$82,500 + 38,250 = \$120,750$. Because the book value is zero in four years, the aftertax salvage value is $(1 - .34) \times \$250,000 = \$165,000$. There are no working capital consequences, so the cash flows are:

	Year				
	0	1	2	3	4
Operating cash flow		\$120,750	\$120,750	\$120,750	\$120,750
Capital spending	-\$450,000				165,000
Total cash flow	-\$450,000	\$120,750	\$120,750	\$120,750	\$285,750

You can verify that the NPV at 17 percent is $-\$30,702$, and the return on the new surveillance system is only about 13.96 percent. The project does not appear to be profitable.

Concepts Review and Critical Thinking Questions

1. **Opportunity Cost** In the context of capital budgeting, what is an opportunity cost?
2. **Depreciation** Given the choice, would a firm prefer to use MACRS depreciation or straight-line depreciation? Why?
3. **Net Working Capital** In our capital budgeting examples, we assumed that a firm would recover all of the working capital it invested in a project. Is this a reasonable assumption? When might it not be valid?
4. **Stand-alone Principle** Suppose a financial manager is quoted as saying, “Our firm uses the stand-alone principle. Because we treat projects like minifirms in our evaluation process, we include financing costs because they are relevant at the firm level.” Critically evaluate this statement.
5. **Equivalent Annual Cost** When is EAC analysis appropriate for comparing two or more projects? Why is this method used? Are there any implicit assumptions required by this method that you find troubling? Explain.
6. **Cash Flow and Depreciation** “When evaluating projects, we’re only concerned with the relevant incremental aftertax cash flows. Therefore, because depreciation is a noncash expense, we should ignore its effects when evaluating projects.” Critically evaluate this statement.
7. **Capital Budgeting Considerations** A major college textbook publisher has an existing finance textbook. The publisher is debating whether or not to produce an “essentialized” version, meaning a shorter (and lower-priced) book. What are some of the considerations that should come into play?

To answer the next three questions, refer to the following example. In early 1998, General Motors announced plans to launch the Cadillac Escalade, its first truck under the Cadillac brand name and its first luxury sport-utility vehicle (SUV). GM’s decision was primarily a reaction to the runaway success of such new luxury SUVs as Ford’s Lincoln Navigator and Mercedes-Benz’s new M-class. These vehicles were exceptionally profitable; for example, each of the 18,500 Lincoln Navigators that sold in the four months after their introduction in June 1997 generated well over \$10,000 in profit for Ford. GM had previously been unwilling to build a luxury SUV, but these profit margins were too large to ignore.

GM planned to introduce the truck as a revised version of the new GMC Denali, which was introduced in February 1998. However, some analysts questioned GM’s decision, suggesting that GM was too late entering the market; concerns were also expressed about whether GM would just end up taking sales from its other SUV lines.

8. **Erosion** In evaluating the Escalade, under what circumstances might GM have concluded that erosion of the Denali line was irrelevant?
9. **Capital Budgeting** GM was not the only manufacturer looking at the big sport-utility category. Chrysler, however, initially decided *not* to go ahead with an entry (Chrysler later reversed course on this issue). Why might one company decide to proceed when another would not?
10. **Capital Budgeting** In evaluating the Escalade, what do you think GM needs to assume regarding the enormous profit margins that exist in this market? Is it likely they will be maintained when GM and others enter this market?

Questions and Problems

Basic

(Questions 1–19)

- Relevant Cash Flows** Cheesy Poofs, Inc., is looking at setting up a new manufacturing plant in South Park to produce Cheesy Poofs. The company bought some land six years ago for \$5 million in anticipation of using it as a warehouse and distribution site, but the company has since decided to rent these facilities from a competitor instead. The land was appraised last week for \$4.2 million. The company wants to build its new manufacturing plant on this land; the plant will cost \$7.3 million to build, and the site requires \$325,000 worth of grading before it is suitable for construction. What is the proper cash flow amount to use as the initial investment in fixed assets when evaluating this project? Why?
- Relevant Cash Flows** Winnebagel Corp. currently sells 20,000 motor homes per year at \$45,000 each, and 8,000 luxury motor coaches per year at \$78,000 each. The company wants to introduce a new portable camper to fill out its product line; it hopes to sell 16,000 of these campers per year at \$12,000 each. An independent consultant has determined that if Winnebagel introduces the new campers, it should boost the sales of its existing motor homes by 5,000 units per year, and reduce the sales of its motor coaches by 1,000 units per year. What is the amount to use as the annual sales figure when evaluating this project? Why?
- Calculating Projected Net Income** A proposed new investment has projected sales of \$700,000. Variable costs are 60 percent of sales, and fixed costs are \$175,000; depreciation is \$75,000. Prepare a pro forma income statement assuming a tax rate of 35 percent. What is the projected net income?
- Calculating OCF** Consider the following income statement:

Sales	\$864,350
Costs	501,500
Depreciation	<u>112,000</u>
EBIT	<u>?</u>
Taxes (34%)	<u>?</u>
Net income	<u><u>?</u></u>

Fill in the missing numbers and then calculate the OCF. What is the depreciation tax shield?

- OCF from Several Approaches** A proposed new project has projected sales of \$85,000, costs of \$43,000, and depreciation of \$3,000. The tax rate is 35 percent. Calculate operating cash flow using the four different approaches described in the chapter and verify that the answer is the same in each case.
- Calculating Depreciation** A piece of newly purchased industrial equipment costs \$847,000 and is classified as seven-year property under MACRS. Calculate the annual depreciation allowances and end-of-the-year book values for this equipment.
- Calculating Salvage Value** Consider an asset that costs \$320,000 and is depreciated straight-line to zero over its eight-year tax life. The asset is to be used in a five-year project; at the end of the project, the asset can be sold for \$70,000. If the relevant tax rate is 35 percent, what is the aftertax cash flow from the sale of this asset?
- Calculating Salvage Value** An asset used in a four-year project falls in the five-year MACRS class for tax purposes. The asset has an acquisition cost of

\$8,400,000 and will be sold for \$1,600,000 at the end of the project. If the tax rate is 35 percent, what is the aftertax salvage value of the asset?

Basic
(continued)

9. **Identifying Cash Flows** Last year, Ripa Pizza Corporation reported sales of \$61,800 and costs of \$26,300. The following information was also reported for the same period:

	Beginning	Ending
Accounts receivable	\$41,620	\$38,240
Inventory	54,810	57,390
Accounts payable	69,300	71,600

Based on this information, what was Ripa Pizza's change in net working capital for last year? What was the net cash flow?

10. **Calculating Project OCF** Bush Boomerang, Inc., is considering a new three-year expansion project that requires an initial fixed asset investment of \$2.1 million. The fixed asset will be depreciated straight-line to zero over its three-year tax life, after which time it will be worthless. The project is estimated to generate \$1,900,000 in annual sales, with costs of \$850,000. If the tax rate is 35 percent, what is the OCF for this project?
11. **Calculating Project NPV** In the previous problem, suppose the required return on the project is 15 percent. What is the project's NPV?
12. **Calculating Project Cash Flow from Assets** In the previous problem, suppose the project requires an initial investment in net working capital of \$275,000 and the fixed asset will have a market value of \$325,000 at the end of the project. What is the project's Year 0 net cash flow? Year 1? Year 2? Year 3? What is the new NPV?
13. **NPV and Modified ACRS** In the previous problem, suppose the fixed asset actually falls into the three-year MACRS class. All the other facts are the same. What is the project's Year 1 net cash flow now? Year 2? Year 3? What is the new NPV?
14. **Project Evaluation** Dog Up! Franks is looking at a new sausage system with an installed cost of \$410,000. This cost will be depreciated straight-line to zero over the project's five-year life, at the end of which the sausage system can be scrapped for \$70,000. The sausage system will save the firm \$115,000 per year in pretax operating costs, and the system requires an initial investment in net working capital of \$15,000. If the tax rate is 34 percent and the discount rate is 10 percent, what is the NPV of this project?
15. **Project Evaluation** Your firm is contemplating the purchase of a new \$750,000 computer-based order entry system. The system will be depreciated straight-line to zero over its five-year life. It will be worth \$80,000 at the end of that time. You will save \$310,000 before taxes per year in order processing costs and you will be able to reduce working capital by \$125,000 (this is a one-time reduction). If the tax rate is 35 percent, what is the IRR for this project?
16. **Project Evaluation** In the previous problem, suppose your required return on the project is 20 percent and your pretax cost savings are only \$300,000 per year. Will you accept the project? What if the pretax cost savings are only \$200,000 per year? At what level of pretax cost savings would you be indifferent between accepting the project and not accepting it?

Basic*(continued)*

17. **Calculating EAC** A five-year project has an initial fixed asset investment of \$225,000, an initial NWC investment of \$20,000, and an annual OCF of $-\$25,000$. The fixed asset is fully depreciated over the life of the project and has no salvage value. If the required return is 15 percent, what is this project's equivalent annual cost, or EAC?
18. **Calculating EAC** You are evaluating two different silicon wafer milling machines. The Techron I costs \$195,000, has a three-year life, and has pretax operating costs of \$32,000 per year. The Techron II costs \$295,000, has a five-year life, and has pretax operating costs of \$19,000 per year. For both milling machines, use straight-line depreciation to zero over the project's life and assume a salvage value of \$20,000. If your tax rate is 35 percent and your discount rate is 14 percent, compute the EAC for both machines. Which do you prefer? Why?
19. **Calculating a Bid Price** Guthrie Enterprises needs someone to supply it with 170,000 cartons of machine screws per year to support its manufacturing needs over the next five years, and you've decided to bid on the contract. It will cost you \$510,000 to install the equipment necessary to start production; you'll depreciate this cost straight-line to zero over the project's life. You estimate that in five years, this equipment can be salvaged for \$40,000. Your fixed production costs will be \$160,000 per year, and your variable production costs should be \$8 per carton. You also need an initial investment in net working capital of \$60,000. If your tax rate is 35 percent and you require a 16 percent return on your investment, what bid price should you submit?
20. **Cost-Cutting Proposals** Massey Machine Shop is considering a four-year project to improve its production efficiency. Buying a new machine press for \$450,000 is estimated to result in \$150,000 in annual pretax cost savings. The press falls in the MACRS five-year class, and it will have a salvage value at the end of the project of \$90,000. The press also requires an initial investment in spare parts inventory of \$18,000, along with an additional \$3,000 in inventory for each succeeding year of the project. If the shop's tax rate is 35 percent and its discount rate is 14 percent, should Massey buy and install the machine press?
21. **Comparing Mutually Exclusive Projects** Pags Industrial Systems Company (PISC) is trying to decide between two different conveyor belt systems. System A costs \$405,000, has a three-year life, and requires \$105,000 in pretax annual operating costs. System B costs \$450,000, has a five-year life, and requires \$60,000 in pretax annual operating costs. Both systems are to be depreciated straight-line to zero over their lives and will have zero salvage value. Whichever project is chosen, it will *not* be replaced when it wears out. If the tax rate is 34 percent and the discount rate is 20 percent, which project should the firm choose?
22. **Comparing Mutually Exclusive Projects** Suppose in the previous problem that PISC always needs a conveyor belt system; when one wears out, it must be replaced. Which project should the firm choose now?
23. **Calculating a Bid Price** Consider a project to supply 60 million postage stamps per year to the U.S. Postal Service for the next five years. You have an idle parcel of land available that cost \$750,000 five years ago; if the land were sold today, it would net you \$900,000. You will need to install \$2.4 million in new manufacturing plant and equipment to actually produce the stamps; this plant and equipment will be depreciated straight-line to zero over the project's

Intermediate*(Questions 20–24)*

five-year life. The equipment can be sold for \$400,000 at the end of the project. You will also need \$600,000 in initial net working capital for the project, and an additional investment of \$50,000 in every year thereafter. Your production costs are 0.6 cents per stamp, and you have fixed costs of \$600,000 per year. If your tax rate is 34 percent and your required return on this project is 15 percent, what bid price should you submit on the contract?

Intermediate
(continued)

24. **Interpreting a Bid Price** In the previous problem, suppose you were going to use a three-year MACRS depreciation schedule for your manufacturing equipment, and that you felt you could keep working capital investments down to only \$25,000 per year. How would this new information affect your calculated bid price?
25. **Project Evaluation** Aguilera Acoustics (AAI), Inc., projects unit sales for a new 7-octave voice emulation implant as follows:

Challenge
(Questions 25–27)

Year	Unit Sales
1	95,000
2	107,000
3	110,000
4	112,000
5	85,000

Production of the implants will require \$1,500,000 in net working capital to start and additional net working capital investments each year equal to 20 percent of the projected sales increase for the following year. Total fixed costs are \$750,000 per year, variable production costs are \$210 per unit, and the units are priced at \$330 each. The equipment needed to begin production has an installed cost of \$14,000,000. Because the implants are intended for professional singers, this equipment is considered industrial machinery and thus qualifies as seven-year MACRS property. In five years, this equipment can be sold for about 30 percent of its acquisition cost. AAI is in the 35 percent marginal tax bracket and has a required return on all its projects of 30 percent. Based on these preliminary project estimates, what is the NPV of the project? What is the IRR?

26. **Calculating Required Savings** A proposed cost-saving device has an installed cost of \$540,000. The device will be used in a five-year project, but is classified as three-year MACRS property for tax purposes. The required initial net working capital investment is \$40,000, the marginal tax rate is 35 percent, and the project discount rate is 12 percent. The device has an estimated Year 5 salvage value of \$60,000. What level of pretax cost savings do we require for this project to be profitable?
27. **Financial Break-Even Analysis** To solve the bid price problem presented in the text, we set the project NPV equal to zero and found the required price using the definition of OCF. Thus the bid price represents a financial break-even level for the project. This type of analysis can be extended to many other types of problems.
- a. In Problem 19, assume that the price per carton is \$11 and find the project NPV. What does your answer tell you about your bid price? What do you know about the number of cartons you can sell and still break even? How about your level of costs?

Challenge*(continued)*

- b. Solve Problem 19 again with the price still at \$11 but find the quantity of cartons per year that you can supply and still break even. Hint: It's less than 170,000.
- c. Repeat (b) with a price of \$11 and a quantity of 170,000 cartons per year, and find the highest level of fixed costs you could afford and still break even. Hint: It's more than \$160,000.

**Spreadsheet Templates** 10-6, 10-7, 10-10, 10-14, 10-18, 10-21, 10-25