

# Appendix



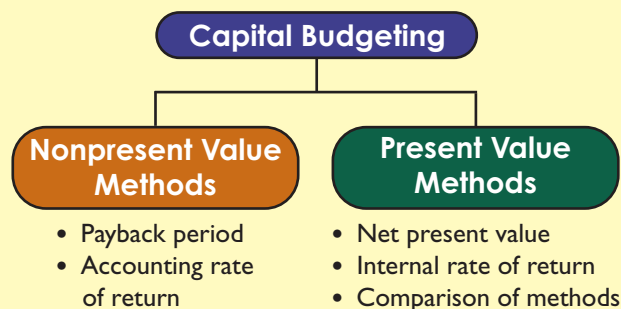
## Capital Budgeting Decisions

### Learning Objectives

- LO 1** Explain the importance of capital budgeting.
- LO 2** Compute payback period and describe its use.
- LO 3** Compute accounting rate of return and explain its use.
- LO 4** Compute net present value and describe its use.
- LO 5** Compute internal rate of return and explain its use.
- LO 6** Describe the selection of a hurdle rate for an investment.
- LO 7** Analyze a capital investment project using break-even time.

Capital budgeting decisions are among the most difficult and risky decisions a manager must make. The purpose of this

appendix is to illustrate methods for comparing alternative investments.



**LO1** Explain the importance of capital budgeting.

The capital expenditures budget is management’s plan for acquiring and selling plant assets. **Capital budgeting** is the process of analyzing alternative long-term investments and deciding which assets to acquire or sell. These decisions can involve developing a new product or process, buying a new machine or a new building, or acquiring an entire company. The goal for these decisions is to earn a satisfactory return on investment.

Capital budgeting decisions require careful analysis because they are usually the most difficult and risky decisions that managers make. These decisions are difficult because they require predicting events that will not occur until well into the future. These predictions can be unreliable. Specifically, a capital budgeting decision is risky because (1) the outcome is uncertain, (2) large amounts of money are usually involved, (3) the investment involves a long-term commitment, and (4) the decision could be difficult or impossible to reverse, no matter how poor it turns out to be. Risk is especially high for investments in technology due to innovations and uncertainty.

Managers use several methods to evaluate capital budgeting decisions. Most of these methods involve predicting cash inflows and cash outflows of proposed investments, assessing the risk of and returns on those flows, and then choosing the investments to make. Management often restates future cash flows in terms of their present value. This approach applies the time value of money: A dollar today is worth more than a dollar tomorrow. Similarly, a dollar tomorrow is worth less than a dollar today. The process of restating future cash flows in terms of their present value is called *discounting*. The time value of money is important when evaluating capital investments, but managers sometimes use methods that ignore present value. This section describes four methods for comparing alternative investments.

The nature of capital spending has changed with the business environment. Budgets for information technology have increased from about 25% of corporate capital spending 20 years ago to an estimated 35% today.

## Methods Not Using Time Value of Money



All investments, whether they involve the purchase of a machine or another long-term asset, are expected to produce net cash flows. *Net cash flow* is cash inflows minus cash outflows. Sometimes managers analyze an investment’s net cash flow without using the time value of money. This section explains two of the most common methods in this category: (1) payback period and (2) accounting rate of return.

### Payback Period

**LO2** Compute payback period and describe its use.

An investment’s **payback period (PBP)** is the expected time period to recover the initial investment amount. Managers prefer investing in assets with shorter payback periods to reduce the risk of an unprofitable investment over the long run. Acquiring assets with short payback periods reduces a company’s risk from potentially inaccurate long-term predictions of future cash flows.

**Computing Payback Period with Even Cash Flows** To illustrate use of the payback period for an investment with even cash flows, we look at data from FasTrac, a manufacturer of exercise equipment and supplies. (*Even cash flows* are cash flows that are the same each and every year; *uneven cash flows* are cash flows that are not all equal in amount.) FasTrac is considering several different capital investments, one of which is to purchase a machine to use in manufacturing a new product. This machine costs \$16,000 and is expected to have an eight-year life with no salvage value. Management predicts this machine will produce 1,000 units of product each year and that the new product will be sold for \$30 per unit. Exhibit C.1 shows the expected annual net cash flows for this asset over its life as well as the expected annual revenues and expenses (including straight-line depreciation and income taxes) from investing in the machine.

FASTRAC Cash Flow Analysis—Machinery Investment January 15, 2010		
	Expected Accrual Figures	Expected Net Cash Flows
Annual sales of new product .....	\$30,000	\$30,000
Deduct annual expenses		
Cost of materials, labor, and overhead (except depreciation) .....	15,500	15,500
Depreciation—Machinery .....	2,000	
Additional selling and administrative expenses .....	9,500	9,500
Annual pretax accrual income .....	3,000	
Income taxes (30%) .....	900	900
Annual net income .....	<u>\$ 2,100</u>	
<b>Annual net cash flow</b> .....		<b><u>\$ 4,100</u></b>

### Exhibit C.1

Cash Flow Analysis

Annual net cash flow in Exhibit C.1 equals net income plus depreciation (a noncash expense).

## IN THE NEWS

**Payback Phones** Profits of telecoms declined as too much capital investment chased too little revenue. Telecom success depends on new technology, and communications gear is evolving at a dizzying rate. Consequently, managers of telecoms often demand short payback periods and large expected net cash flows to compensate for the investment risk.



The amount of net cash flow from the machinery is computed by subtracting expected cash outflows from expected cash inflows. The expected net cash flows column of Exhibit C.1 excludes all noncash revenues and expenses. Depreciation is FasTrac's only noncash item. Alternatively, managers can adjust the projected net income for revenue and expense items that do not affect cash flows. For FasTrac, this means taking the \$2,100 net income and adding back the \$2,000 depreciation.

The formula for computing the payback period of an investment that yields even net cash flows is in Exhibit C.2.

$$\text{Payback period} = \frac{\text{Cost of investment}}{\text{Annual net cash flow}}$$

### Exhibit C.2

Payback Period Formula with Even Cash Flows

The payback period reflects the amount of time for the investment to generate enough net cash flow to return (or pay back) the cash initially invested to purchase it. FasTrac’s payback period for this machine is just under four years:

$$\text{Payback period} = \frac{\$16,000}{\$4,100} = 3.9 \text{ years}$$

The initial investment is fully recovered in 3.9 years, or just before reaching the halfway point of this machine’s useful life of eight years.

**Computing Payback Period with Uneven Cash Flows** Computing the payback period in the prior section assumed even net cash flows. What happens if the net cash flows are uneven? In this case, the payback period is computed using the *cumulative total of net cash flows*. The word *cumulative* refers to the addition of each period’s net cash flows as we progress through time. To illustrate, consider data for another investment that FasTrac is considering. This machine is predicted to generate uneven net cash flows over the next eight years. The relevant data and payback period computation are shown in Exhibit C.3.

**Exhibit C.3**

Payback Period Calculation with Uneven Cash Flows

Period*	Expected Net Cash Flows	Cumulative Net Cash Flows
Year 0 . . . . .	\$(16,000)	\$(16,000)
Year 1 . . . . .	3,000	(13,000)
Year 2 . . . . .	4,000	(9,000)
Year 3 . . . . .	4,000	(5,000)
Year 4 . . . . .	4,000	<b>(1,000)</b>
Year 5 . . . . .	5,000	<b>4,000</b>
Year 6 . . . . .	3,000	7,000
Year 7 . . . . .	2,000	9,000
Year 8 . . . . .	2,000	11,000

**Payback period = 4.2 years**

\* All cash inflows and outflows occur uniformly during the year.

Find the payback period in Exhibit C.3 if net cash flows for the first 4 years are: Year 1 = \$6,000; Year 2 = \$5,000; Year 3 = \$4,000; Year 4 = \$3,000.  
Answer: 3.33 years

Year 0 refers to the period of initial investment in which the \$16,000 cash outflow occurs at the end of year 0 to acquire the machinery. By the end of year 1, the cumulative net cash flow is reduced to \$(13,000), computed as the \$(16,000) initial cash outflow plus year 1’s \$3,000 cash inflow. This process continues throughout the asset’s life. The cumulative net cash flow amount changes from negative to positive in year 5. Specifically, at the end of year 4, the cumulative net cash flow is \$(1,000). As soon as FasTrac receives net cash inflow of \$1,000 during the fifth year, it has fully recovered the investment. If we assume that cash flows are received uniformly *within* each year, receipt of the \$1,000 occurs about one-fifth of the way through the year. This is computed as \$1,000 divided by year 5’s total net cash flow of \$5,000, or 0.20. This yields a payback period of 4.2 years, computed as 4 years plus 0.20 of year 5.

**Using the Payback Period** Companies desire a short payback period to increase return and reduce risk. The more quickly a company receives cash, the sooner it is available for other uses and the less time it is at risk of loss. A shorter payback period also improves the company’s ability to respond to unanticipated changes and lowers its risk of having to keep an unprofitable investment.

Payback period should never be the only consideration in evaluating investments. This is so because it ignores at least two important factors. First, it fails to reflect differences in the timing of net cash flows within the payback period. In Exhibit C.3, FasTrac’s net cash flows in the first five years were \$3,000, \$4,000, \$4,000, \$4,000, and \$5,000. If another investment had predicted cash flows of \$9,000, \$3,000, \$2,000, \$1,800, and \$1,000 in these five years, its payback period

would also be 4.2 years, but this second alternative could be more desirable because it provides cash more quickly. The second important factor is that the payback period ignores *all* cash flows after the point where its costs are fully recovered. For example, one investment might pay back its cost in 3 years but stop producing cash after 4 years. A second investment might require 5 years to pay back its cost yet continue to produce net cash flows for another 15 years. A focus on only the payback period would mistakenly lead management to choose the first investment over the second.

### HOW YOU DOIN'?

Answers—p. C-13

1. Capital budgeting is (a) concerned with analyzing alternative sources of capital, including debt and equity, (b) an important activity for companies when considering what assets to acquire or sell, or (c) best done by intuitive assessments of the value of assets and their usefulness.
2. Why are capital budgeting decisions often difficult?
3. A company is considering purchasing equipment costing \$75,000. Future annual net cash flows from this equipment are \$30,000, \$25,000, \$15,000, \$10,000, and \$5,000. The payback period is (a) 4 years, (b) 3.5 years, or (c) 3 years.
4. If depreciation is an expense, why is it added back to an investment's net income to compute the net cash flow from that investment?
5. If two investments have the same payback period, are they equally desirable? Explain.

## Accounting Rate of Return

The **accounting rate of return**, also called *return on average investment*, is computed by dividing a project's after-tax net income by the average amount invested in it. To illustrate, we return to FasTrac's \$16,000 machinery investment described in Exhibit C.1. We first compute (1) the after-tax net income and (2) the average amount invested. The \$2,100 after-tax net income is already available from Exhibit C.1. To compute the average amount invested, we assume that net cash flows are received evenly throughout each year. Thus, the average investment for each year is computed as the average of its beginning and ending book values. If FasTrac's \$16,000 machine is depreciated \$2,000 each year, the average amount invested in the machine for each year is computed as shown in Exhibit C.4. The average for any year is the average of the beginning and ending book values. For example, for year 1, the average book value is \$15,000, computed as  $(\$16,000 + \$14,000)/2$ .

**LO3** Compute accounting rate of return and explain its use.

General formula for *annual average investment* is the sum of individual years' average book values divided by the number of years of the planned investment.

	Beginning Book Value	Annual Depreciation	Ending Book Value	Average Book Value
Year 1 .....	\$16,000	\$2,000	\$14,000	\$15,000
Year 2 .....	14,000	2,000	12,000	13,000
Year 3 .....	12,000	2,000	10,000	11,000
Year 4 .....	10,000	2,000	8,000	9,000
Year 5 .....	8,000	2,000	6,000	7,000
Year 6 .....	6,000	2,000	4,000	5,000
Year 7 .....	4,000	2,000	2,000	3,000
Year 8 .....	2,000	2,000	0	1,000
Sum of yearly average book values .....				<u>\$64,000</u>
Average book value ( $\$64,000/8$ ) .....				<b>\$ 8,000</b>

### Exhibit C.4

Computing Average Amount Invested

Next we need the average book value for the asset's entire life. This amount is computed by taking the average of the individual yearly averages. This average equals \$8,000, computed as \$64,000 (the sum of the individual years' averages) divided by eight years.

If a company uses straight-line depreciation, we can find the average amount invested by using the formula in Exhibit C.5. Because FasTrac uses straight-line depreciation, its average amount invested for the eight years equals the sum of the book value at the beginning of the asset's investment period and the book value at the end of its investment period, divided by 2, as shown in Exhibit C.5.

### Exhibit C.5

Computing Average Amount Invested under Straight-Line Depreciation

$$\begin{aligned} \text{Annual average investment} &= \frac{\text{Beginning book value} + \text{Ending book value}}{2} \\ &\text{(straight-line case only)} \\ &= \frac{\$16,000 + \$0}{2} = \$8,000 \end{aligned}$$

If an investment has a salvage value, the average amount invested when using straight-line depreciation is computed as  $(\text{Beginning book value} + \text{Salvage value})/2$ .

Once we determine the after-tax net income and the average amount invested, the accounting rate of return on the investment can be computed from the annual after-tax net income divided by the average amount invested, as shown in Exhibit C.6.

### Exhibit C.6

Accounting Rate of Return Formula

$$\text{Accounting rate of return} = \frac{\text{Annual after-tax net income}}{\text{Annual average investment}}$$

This yields an accounting rate of return of 26.25% ( $\$2,100/\$8,000$ ). FasTrac management must decide whether a 26.25% accounting rate of return is satisfactory. To make this decision, we must factor in the investment's risk. For instance, we cannot say an investment with a 26.25% return is preferred over one with a lower return unless we recognize any differences in risk. Thus, an investment's return is satisfactory or unsatisfactory only when it is related to returns from other investments with similar lives and risk.

When accounting rate of return is used to choose among capital investments, the one with the least risk, the shortest payback period, and the highest return for the longest time period is often identified as the best. However, use of accounting rate of return to evaluate investment opportunities is limited because it bases the amount invested on book values (not predicted market values) in future periods. Accounting rate of return is also limited when an asset's net incomes are expected to vary from year to year. This requires computing the rate using *average* annual net incomes, yet this accounting rate of return fails to distinguish between two investments with the same average annual net income but different amounts of income in early years versus later years or different levels of income variability.

### HOW YOU DOIN'?

Answers—p. C-13

6. The following data relate to a company's decision on whether to purchase a machine:

Cost .....	\$180,000
Salvage value .....	15,000
Annual after-tax net income .....	40,000

The machine's accounting rate of return, assuming the even receipt of its net cash flows during the year and use of straight-line depreciation, is (a) 22%, (b) 41%, or (c) 21%.

7. Is a 15% accounting rate of return for a machine a good rate?

## Methods Using Time Value of Money

This section describes two methods that help managers with capital budgeting decisions and that use the time value of money: (1) net present value and (2) internal rate of return. (To apply these methods, you need a basic understanding of the concept of present value. An expanded explanation of present value concepts is in Appendix D available on the textbook's website. You can use the present value tables at the end of Appendix D to solve many of this appendix's assignments that use the time value of money.)



**LO4** Compute net present value and describe its use.

### Net Present Value

Net present value analysis applies the time value of money to future cash inflows and cash outflows so management can evaluate a project's benefits and costs at one point in time. Specifically, **net present value (NPV)** is computed by discounting the future net cash flows from the investment at the project's required rate of return and then subtracting the initial amount invested.

To illustrate, let's return to FasTrac's proposed machinery purchase described in Exhibit C.1. Does this machine provide a satisfactory return while recovering the amount invested? Recall that the machine requires a \$16,000 investment and is expected to provide \$4,100 annual net cash inflows for the next eight years. The amount invested includes all costs that must be incurred to get the asset in its proper location and ready for use. If we assume that net cash flows from this machine are received at each year-end and that FasTrac requires a 12% annual return on its investments, the net present value is computed as in Exhibit C.7.

The assumption of end-of-year cash flows simplifies computations and is common in practice.

	Net Cash Flows*	Present Value of 1 at 12%†	Present Value of Net Cash Flows
Year 1 .....	\$ 4,100	0.8929	\$ 3,661
Year 2 .....	4,100	0.7972	3,269
Year 3 .....	4,100	0.7118	2,918
Year 4 .....	4,100	0.6355	2,606
Year 5 .....	4,100	0.5674	2,326
Year 6 .....	4,100	0.5066	2,077
Year 7 .....	4,100	0.4523	1,854
Year 8 .....	4,100	0.4039	1,656
Totals .....	\$32,800		<b>\$20,367</b>
<b>Amount invested</b> .....			<b>(16,000)</b>
<b>Net present value</b> .....			<b>\$ 4,367</b>

### Exhibit C.7

Net Present Value Calculation with Equal Cash Flows

\* Cash flows occur at the end of each year.

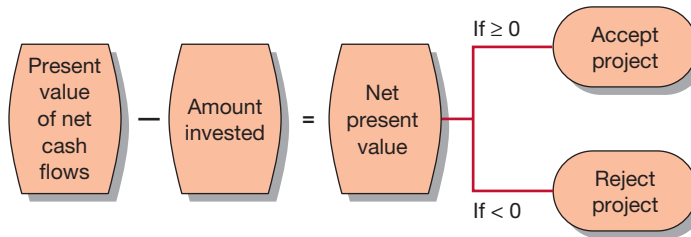
† Present value of 1 factors are taken from Table D.1 in Appendix D.

The first number column of Exhibit C.7 shows the annual net cash flows. Present value of 1 factors, also called *discount factors*, are shown in the second column. Taken from Table D.1 in Appendix D, they assume that net cash flows are received at each year-end. (To simplify present value computations and for assignment material at the end of this chapter, we assume that net cash flows are received at each year-end.) Annual net cash flows from the first column of Exhibit C.7 are multiplied by the discount factors in the second column to give present values shown in the third column. The last three lines of this exhibit show the final NPV computations. The asset's \$16,000 initial cost is deducted from the \$20,367 total present value of all future net cash flows to give this asset's NPV of \$4,367. The machine is thus expected to (1) recover its cost, (2) provide a 12% compounded return, and (3) generate \$4,367 above cost. We summarize this analysis by saying the present value of this machine's future net cash flows to FasTrac exceeds the \$16,000 investment by \$4,367.

What is the net present value in Exhibit C.7 if a 10% return is applied? Answer: \$5,873

**Net Present Value Decision Rule** The decision rule in applying NPV is as follows: When an asset's expected cash flows are discounted at the required rate and yield a *positive* net

present value, the asset should be acquired. This decision rule is reflected in the graphic at the right. When comparing several investment opportunities of about the same cost and same risk, we prefer the one with the highest positive net present value.



**Simplifying Computations** The computations in Exhibit C.7 use separate present value of 1 factors for each of the eight years. Each year’s net cash flow is multiplied by its present value of 1 factor to determine its present value. The individual present values for each of the eight net cash flows are added to give the asset’s total present value. This computation can be simplified in two ways if annual net cash flows are equal in amount. One way is to add the eight annual present value of 1 factors for a total of 4.9676 and multiply this amount by the annual \$4,100 net cash flow to get the \$20,367 total present value of net cash flows.<sup>1</sup> A second simplification is to use a calculator with compound interest functions or a spreadsheet program. Whatever procedure you use, it is important to understand the concepts behind these computations.

**Uneven Cash Flows** Net present value analysis can also be applied when net cash flows are uneven (unequal). To illustrate, assume that FasTrac can choose only one capital investment from among projects A, B, and C. Each project requires the same \$12,000 initial investment. Future net cash flows for each project are shown in the first three number columns of Exhibit C.8.

**Exhibit C.8**

Net Present Value Calculation with Uneven Cash Flows

	Net Cash Flows			Present Value of 1 at 10%	Present Value of Net Cash Flows		
	A	B	C		A	B	C
Year 1	\$ 5,000	\$ 8,000	\$ 1,000	0.9091	\$ 4,546	\$ 7,273	\$ 909
Year 2	5,000	5,000	5,000	0.8264	4,132	4,132	4,132
Year 3	5,000	2,000	9,000	0.7513	3,757	1,503	6,762
Totals	\$15,000	\$15,000	\$15,000		12,435	12,908	11,803
Amount invested					(12,000)	(12,000)	(12,000)
<b>Net present value</b>					<b>\$ 435</b>	<b>\$ 908</b>	<b>\$ (197)</b>

If 12% is the required return in Exhibit C.8, which project is preferred? Answer: Project B. Net present values are: A = \$10; B = \$553; C = \$(715).

The three projects in Exhibit C.8 have the same expected total net cash flows of \$15,000. Project A is expected to produce equal amounts of \$5,000 each year. Project B is expected to produce a larger amount in the first year. Project C is expected to produce a larger amount in the third year. The fourth column of Exhibit C.8 shows the present value of 1 factors from Table D.1 assuming 10% required return.

Computations in the right-most columns show that Project A has a \$435 positive NPV. Project B has the largest NPV of \$908 because it brings in cash more quickly. Project C has a \$(197) *negative* NPV because its larger cash inflows are delayed. Projects with higher cash flows in earlier years generally yield higher net present values. If FasTrac requires a 10% return,

<sup>1</sup> We can simplify this computation using Table D.3, which gives the present value of 1 to be received periodically for a number of periods. To determine the present value of these eight annual receipts discounted at 12%, go down the 12% column of Table D.3 to the factor on the eighth line. This cumulative discount factor, also known as an *annuity* factor, is 4.9676. We then compute the \$20,367 present value for these eight annual \$4,100 receipts, computed as 4.9676 × \$4,100.



it should reject Project C because its NPV implies a return *under* 10%. If only one project can be accepted, project B appears best because it yields the highest NPV.

**Salvage Value and Accelerated Depreciation** FasTrac predicted the \$16,000 machine to have zero salvage value at the end of its useful life (recall Exhibit C.1). In many cases, assets are expected to have salvage values. If so, this amount is an additional net cash inflow received at the end of the final year of the asset's life. All other computations remain the same.

Depreciation computations also affect net present value analysis. FasTrac computes depreciation using the straight-line method. Accelerated depreciation is also commonly used, especially for income tax reports. Accelerated depreciation produces larger depreciation deductions in the early years of an asset's life and smaller deductions in later years. This pattern results in smaller income tax payments in early years and larger payments in later years. Accelerated depreciation does not change the basics of a present value analysis, but it can change the result. Using accelerated depreciation for tax reporting affects the NPV of an asset's cash flows because it produces larger net cash inflows in the early years of the asset's life and smaller ones in later years. Being able to use accelerated depreciation for tax reporting always makes an investment more desirable because early cash flows are more valuable than later ones.

**Use of Net Present Value** In deciding whether to proceed with a capital investment project, we approve the proposal if the NPV is positive but reject it if the NPV is negative. When considering several projects of similar investment amounts and risk levels, we can compare the different projects' NPVs and rank them on the basis of their NPVs. However, if the amount invested differs substantially across projects, the NPV is of limited value for comparison purposes. To illustrate, suppose that Project X requires a \$1 million investment and provides a \$100,000 NPV. Project Y requires an investment of only \$100,000 and returns a \$75,000 NPV. Ranking on the basis of NPV puts Project X ahead of Y, yet X's NPV is only 10% of the initial investment whereas Y's NPV is 75% of its investment. We must also remember that when reviewing projects with different risks, we computed the NPV of individual projects using different discount rates. *The higher the risk, the higher the discount rate.*

## Internal Rate of Return

Another means to evaluate capital investments is to use the **internal rate of return**, which equals the rate that yields an NPV of zero for an investment. This means that if we compute the total present value of a project's net cash flows using the IRR as the discount rate and then subtract the initial investment from this total present value, we get a zero NPV.

To illustrate, we use the data for FasTrac's Project A from Exhibit C.8 to compute its IRR. Exhibit C.9 shows the two-step process in computing IRR.

When is it appropriate to use different discount rates for different projects? Answer: When risk levels are different.

**L05** Compute internal rate of return and explain its use.

### Step 1: Compute the present value factor for the investment project.

$$\text{Present value factor} = \frac{\text{Amount invested}}{\text{Net cash flows}} = \frac{\$12,000}{\$5,000} = 2.4000$$

### Step 2: Identify the discount rate (IRR) yielding the present value factor

Search Table D.3 for a present value factor of 2.4000 in the three-year row (equaling the 3-year project duration). The 12% discount rate yields a present value factor of 2.4018. This implies that the IRR is approximately 12%.\*

\* Since the present value factor of 2.4000 is not exactly equal to the 12% factor of 2.4018, we can more precisely estimate the IRR as follows:

Discount rate	Present Value Factor from Table D.3
12%	2.4018
15%	2.2832
	0.1186 = difference

$$\text{Then, IRR} = 12\% + \left[ (15\% - 12\%) \times \frac{2.4018 - 2.4000}{0.1186} \right] = \underline{\underline{12.05\%}}$$

## Exhibit C.9

Computing Internal Rate of Return (with even cash flows)

When cash flows are equal, as with Project A, we compute the present value factor (as shown in Exhibit C.9) by dividing the initial investment by its annual net cash flows. We then use an annuity table to determine the discount rate equal to this present value factor. For FasTrac’s Project A, we look across the three-period row of Table D.3 and find that the discount rate corresponding to the present value factor of 2.4000 roughly equals the 2.4018 value for the 12% rate. This row is reproduced here:

**Present Value of an Annuity of 1 for Three Periods**

Periods	Rate				
	1%	5%	10%	12%	15%
3 . . . . .	2.9410	2.7232	2.4869	2.4018	2.2832

The 12% rate is the Project’s IRR. A more precise IRR estimate can be computed following the procedure shown in the note to Exhibit C.9. Spreadsheet software and calculators can also compute this IRR.

**Uneven Cash Flows** If net cash flows are uneven, we must use trial and error to compute the IRR. We do this by selecting any reasonable discount rate and computing the NPV. If the amount is positive (negative), we recompute the NPV using a higher (lower) discount rate. We continue these steps until we reach a point where two consecutive computations result in NPVs having different signs (positive and negative). Because the NPV is zero using IRR, we know that the IRR lies between these two discount rates. We can then estimate its value. Spreadsheet programs and calculators can do these computations more quickly and accurately.

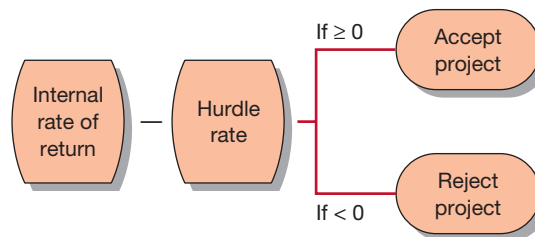
**IN THE NEWS**

**Fun-IRR** Many theme parks use both financial and nonfinancial criteria to evaluate their investments in new rides and activities. The use of IRR is a major part of this evaluation. This requires good estimates of future cash inflows and outflows. It also requires risk assessments of the uncertainty of the future cash flows.



**LO6** Describe the selection of a hurdle rate for an investment.

**Use of Internal Rate of Return** When we use the IRR to evaluate a project, we compare it to a predetermined **hurdle rate**, which is a minimum acceptable rate of return and is applied as follows.



Top management selects the hurdle rate to use in evaluating capital investments. Financial formulas aid in this selection, but the choice of a minimum rate is subjective and left to management. For projects financed from borrowed funds, the hurdle rate must exceed the interest rate paid on these funds. The return on an investment must cover its interest and provide an additional profit to reward the company for its risk. For instance, if money is borrowed at 10%, an average risk investment often requires an after-tax return of 15% (or 5% above the borrowing rate). Remember that lower-risk investments require a lower rate of return compared with higher-risk investments.

If the project is internally financed, the hurdle rate is often based on actual returns from comparable projects. If the IRR is higher than the hurdle rate, the project is accepted. Multiple projects are often ranked by the extent to which their IRR exceeds the hurdle rate. The hurdle rate for individual projects is often different, depending on the risk involved. IRR is not subject to the limitations of NPV when comparing projects with different amounts invested because the IRR is expressed as a percent rather than as an absolute dollar value in NPV.

## Comparison of Capital Budgeting Methods

We explained four methods that managers use to evaluate capital investment projects. How do these methods compare with each other? Exhibit C.10 addresses that question. Neither the payback period nor the accounting rate of return considers the time value of money. On the other hand, both the net present value and the internal rate of return do.

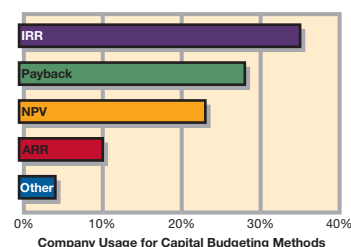
### Exhibit C.10

Comparing Capital Budgeting Methods

	Payback Period	Accounting Rate of Return	Net Present Value	Internal Rate of Return
<b>Measurement basis</b>	■ Cash flows	■ Accrual income	■ Cash flows ■ Profitability	■ Cash flows ■ Profitability
<b>Measurement unit</b>	■ Years	■ Percent	■ Dollars	■ Percent
<b>Strengths</b>	■ Easy to understand  ■ Allows comparison of projects	■ Easy to understand  ■ Allows comparison of projects	■ Reflects time value of money ■ Reflects varying risks over project's life	■ Reflects time value of money ■ Allows comparisons of dissimilar projects
<b>Limitations</b>	■ Ignores time value of money ■ Ignores cash flows after payback period	■ Ignores time value of money ■ Ignores annual rates over life of project	■ Difficult to compare dissimilar projects	■ Ignores varying risks over life of project

## IN THE NEWS

**And the Winner Is . . .** How do we choose among the methods for evaluating capital investments? Management surveys consistently show the internal rate of return (IRR) as the most popular method followed by the payback period and net present value (NPV). Few companies use the accounting rate of return (ARR), but nearly all use more than one method.



The payback period is probably the simplest method. It gives managers an estimate of how soon they will recover their initial investment. Managers sometimes use this method when they have limited cash to invest and a number of projects to choose from. The accounting rate of return yields a percent measure computed using accrual income instead of cash flows. The accounting rate of return is an average rate for the entire investment period. Net present value considers all estimated net cash flows for the project's expected life. It can be applied to even and uneven cash flows and can reflect changes in the level of risk over a project's life. Since it yields a dollar measure, comparing projects of unequal sizes is more difficult. The internal rate of return considers all cash flows from a project. It is readily computed when the cash flows are even but requires some trial and error estimation when cash flows are uneven. Because the IRR is a percent measure, it is readily used to compare projects with different investment amounts. However, IRR does not reflect changes in risk over a project's life.

HOW YOU DOIN'?

Answers—p. C-13

8. A company can invest in only one of two projects, A or B. Each project requires a \$20,000 investment and is expected to generate end-of-period, annual cash flows as follows:

	Year 1	Year 2	Year 3	Total
Project A . . . . .	\$12,000	\$8,500	\$4,000	\$24,500
Project B . . . . .	4,500	8,500	13,000	26,000

Assuming a discount rate of 10%, which project has the higher net present value?

9. Two investment alternatives are expected to generate annual cash flows with the same net present value (assuming the same discount rate applied to each). Using this information, can you conclude that the two alternatives are equally desirable?
10. When two investment alternatives have the same total expected cash flows but differ in the timing of those flows, which method of evaluating those investments is superior, (a) accounting rate of return or (b) net present value?

BREAK-EVEN TIME

**LO7** Analyze a capital investment project using break-even time.

The first section of this appendix explained several methods to evaluate capital investments. Break-even time of an investment project is a variation of the payback period method that overcomes the limitation of not using the time value of money. **Break-even time (BET)** is a time-based measure used to evaluate a capital investment's acceptability. Its computation yields a measure of expected time, reflecting the time period until the *present value* of the net cash flows from an investment equals the initial cost of the investment. In basic terms, break-even time is computed by restating future cash flows in terms of present values and then determining the payback period using these present values.

To illustrate, we return to the FasTrac case described in Exhibit C.1 involving a \$16,000 investment in machinery. The annual net cash flows from this investment are projected at \$4,100 for eight years. Exhibit C.11 shows the computation of break-even time for this investment decision.

Exhibit C.11

Break-Even Time Analysis\*

Year	Cash Flows	Present Value of 1 at 10%	Present Value of Cash Flows	Cumulative Present Value of Cash Flows
0 . . . . .	\$(16,000)	1.0000	\$(16,000)	\$(16,000)
1 . . . . .	4,100	0.9091	3,727	(12,273)
2 . . . . .	4,100	0.8264	3,388	(8,885)
3 . . . . .	4,100	0.7513	3,080	(5,805)
4 . . . . .	4,100	0.6830	2,800	(3,005)
5 . . . . .	4,100	0.6209	2,546	<b>(459)</b>
6 . . . . .	4,100	0.5645	2,314	<b>1,855</b>
7 . . . . .	4,100	0.5132	2,104	3,959
8 . . . . .	4,100	0.4665	1,913	5,872

\* The time of analysis is the start of year 1 (same as end of year 0). All cash flows occur at the end of each year.

The right-most column of this exhibit shows that break-even time is between 5 and 6 years, or about 5.2 years. This is the time the project takes to break even after considering the time value of money (recall that the payback period computed without considering the time value of money was 3.9 years). We interpret this as cash flows earned after 5.2 years contribute to a positive net present value that, in this case, eventually amounts to \$5,872.

Break-even time is a useful measure for managers because it identifies the point in time when they can expect the cash flows to begin to yield net positive returns. Managers expect a positive net present value from an investment if break-even time is less than the investment's estimated life. The method allows managers to compare and rank alternative investments, giving the project with the shortest break-even time the highest rank.

## Summary

**L01 Explain the importance of capital budgeting.** Capital budgeting is the process of analyzing alternative investments and deciding which assets to acquire or sell. It involves predicting the cash flows to be received from the alternatives, evaluating their merits, and then choosing which ones to pursue.

**L02 Compute payback period and describe its use.** One way to compare potential investments is to compute and compare their payback periods. The payback period is an estimate of the expected time before the cumulative net cash inflow from the investment equals its initial cost. A payback period analysis fails to reflect risk of the cash flows, differences in the timing of cash flows within the payback period, and cash flows that occur after the payback period.

**L03 Compute accounting rate of return and explain its use.** A project's accounting rate of return is computed by dividing the expected annual after-tax net income by the average amount of investment in the project. When the net cash flows are received evenly throughout each period and straight-line depreciation is used, the average investment is computed as the average of the investment's initial book value and its salvage value.

**L04 Compute net present value and describe its use.** An investment's net present value is determined by predicting the future cash flows it is expected to generate, discounting them at a rate

that represents an acceptable return, and then by subtracting the investment's initial cost from the sum of the present values. This technique can deal with any pattern of expected cash flows and applies a superior concept of return on investment.

**L05 Compute internal rate of return and explain its use.** The internal rate of return (IRR) is the discount rate that results in a zero net present value. When the cash flows are equal, we can compute the present value factor corresponding to the IRR by dividing the initial investment by the annual cash flows. We then use the annuity tables to determine the discount rate corresponding to this present value factor.

**L06 Describe the selection of a hurdle rate for an investment.** Top management should select the hurdle (discount) rate to use in evaluating capital investments. The required hurdle rate should be at least higher than the interest rate on money borrowed because the return on an investment must cover the interest and provide an additional profit to reward the company for risk.

**L07 Analyze a capital investment project using break-even time.** Break-even time (BET) is a method for evaluating capital investments by restating future cash flows in terms of their present values (discounting the cash flows) and then calculating the payback period using these present values of cash flows.

## Guidance Answers to HOW YOU DO IT?

- b*
- A capital budgeting decision is difficult because (1) the outcome is uncertain, (2) large amounts of money are usually involved, (3) a long-term commitment is required, and (4) the decision could be difficult or impossible to reverse.
- b*
- Depreciation expense is subtracted from revenues in computing net income but does not use cash and should be added back to net income to compute net cash flows.
- Not necessarily. One investment can continue to generate cash flows beyond the payback period for a longer time period than the other. The timing of their cash flows within the payback period also can differ.
- b*; Annual average investment =  $(\$180,000 + \$15,000)/2 = \$97,500$   
Accounting rate of return =  $\$40,000/\$97,500 = 41\%$
- For this determination, we need to compare it to the returns expected from alternative investments with similar risk.

- Project A has the higher net present value as follows:

Year	Present Value of 1 at 10%	Project A		Project B	
		Net Cash Flows	Present Value of Net Cash Flows	Net Cash Flows	Present Value of Net Cash Flows
1	0.9091	\$12,000	\$10,909	\$ 4,500	\$ 4,091
2	0.8264	8,500	7,024	8,500	7,024
3	0.7513	4,000	3,005	13,000	9,767
Totals		\$24,500	\$20,938	\$26,000	\$20,882
Amount invested			(20,000)		(20,000)
<b>Net present value</b>			<b>\$ 938</b>		<b>\$ 882</b>

- No, the information is too limited to draw that conclusion. For example, one investment could be riskier than the other, or one could require a substantially larger initial investment.
- b*

## Key Terms

**Accounting rate of return** (p. C-5) Rate used to evaluate the acceptability of an investment; equals the after-tax periodic income from a project divided by the average investment in the asset; also called *rate of return on average investment*.

**Break-even time (BET)** (p. C-12) Time-based measurement used to evaluate the acceptability of an investment; equals the time expected to pass before the present value of the net cash flows from an investment equals its initial cost.

**Capital budgeting** (p. C-2) Process of analyzing alternative investments and deciding which assets to acquire or sell.

**Hurdle rate** (p. C-10) Minimum acceptable rate of return (set by management) for an investment.

**Internal rate of return (IRR)** (p. C-9) Rate used to evaluate the acceptability of an investment; equals the rate that yields a net present value of zero for an investment.

**Net present value (NPV)** (p. C-7) Dollar estimate of an asset's value that is used to evaluate the acceptability of an investment; computed by discounting future cash flows from the investment at a satisfactory rate and then subtracting the initial cost of the investment.

**Payback period (PBP)** (p. C-2) Time-based measurement used to evaluate the acceptability of an investment; equals the time expected to pass before an investment's net cash flows equal its initial cost.

## Discussion Questions

1. What is capital budgeting?
2. Identify four reasons that capital budgeting decisions by managers are risky.
3. Capital budgeting decisions require careful analysis because they are generally the \_\_\_\_\_, \_\_\_\_\_, and \_\_\_\_\_ decisions that management faces.
4. Identify two disadvantages of using the payback period for comparing investments.
5. Why is an investment more attractive to management if it has a shorter payback period?
6. What is the average amount invested in a machine during its predicted five-year life if it costs \$200,000 and has a \$20,000 salvage value? Assume that net income is received evenly throughout each year and straight-line depreciation is used.
7. If the present value of the expected net cash flows from a machine, discounted at 10%, exceeds the amount to be invested, what can you say about the investment's expected rate of return? What can you say about the expected rate of return if the present value of the net cash flows, discounted at 10%, is less than the investment amount?
8. Why is the present value of \$100 that you expect to receive one year from today worth less than \$100 received today? What is the present value of \$100 that you expect to receive one year from today, discounted at 12%?
9. Why should managers set the required rate of return higher than the rate at which money can be borrowed when making a typical capital budgeting decision?
10. Why does the use of the accelerated depreciation method (instead of straight line) for income tax reporting increase an investment's value?

### QUICK STUDY

#### QSC-1

Analyzing payback periods **L02**

Park Company is considering two alternative investments. The payback period is 3.5 years for Investment A and 4 years for Investment B. (1) If management relies on the payback period, which investment is preferred? (2) Why might Park's analysis of these two alternatives lead to the selection of B over A?

#### QSC-2

Payback period **L02**

Freeman Company is considering an investment that requires immediate payment of \$27,000 and provides expected cash inflows of \$9,000 annually for four years. What is the investment's payback period?

#### QSC-3

Computation of net present value  
**L04**

If Quail Company invests \$50,000 today, it can expect to receive \$10,000 at the end of each year for the next seven years plus an extra \$6,000 at the end of the seventh year. What is the net present value of this investment assuming a required 10% return on investments? Use the present value tables in Appendix D.

#### QSC-4

Computation of accounting rate of return **L03**

Peng Company is considering an investment expected to generate an average net income after taxes of \$1,950 for three years. The investment costs \$45,000 and has an estimated \$6,000 salvage value. Compute the accounting rate of return for this investment.

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Quick Feet, a shoe manufacturer, is evaluating the costs and benefits of new equipment that would custom fit each pair of athletic shoes. The customer would have his or her foot scanned by digital computer equipment; this information would be used to cut the raw materials to provide the customer a perfect fit. The new equipment costs \$150,000 and is expected to generate an additional \$52,500 in cash flows for five years. A bank will make a \$150,000 loan to the company at a 10% interest rate for this equipment's purchase. Use the following table to determine the break-even time for this equipment.

Year	Cash Flows*	Present Value of 1 at 10%	Present Value of Cash Flows	Cumulative Present Value of Cash Flows
0	\$(150,000)	1.0000		
1	52,500	0.9091		
2	52,500	0.8264		
3	52,500	0.7513		
4	52,500	0.6830		
5	52,500	0.6209		

\* All cash flows occur at year-end.

### QSC-5

Computation of break-even time  
L07

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Compute the payback period for each of these two separate investments:

- A new operating system for an existing machine is expected to cost \$520,000 and have a useful life of six years. The system yields an incremental after-tax income of \$150,000 each year after deducting its straight-line depreciation. The predicted salvage value of the system is \$10,000.
- A machine costs \$380,000, has a \$20,000 salvage value, is expected to last eight years, and will generate an after-tax income of \$60,000 per year after straight-line depreciation.

### EXERCISES

#### Exercise C-1

Payback period computation;  
even cash flows L02

Beyer Company is considering the purchase of an asset for \$180,000. It is expected to produce the following net cash flows. The cash flows occur evenly throughout each year. Compute the payback period for this investment.

	Year 1	Year 2	Year 3	Year 4	Year 5	Total
Net cash flows . . . . .	\$60,000	\$40,000	\$70,000	\$120,000	\$38,000	\$328,000

#### Exercise C-2

Payback period computation;  
uneven cash flows L02

**Check** 3.083 years

A machine can be purchased for \$150,000 and used for 5 years, yielding the following net incomes. In projecting net incomes, double-declining-balance depreciation is applied, using a 5-year life and a zero salvage value. Compute the machine's payback period. Ignore taxes.

	Year 1	Year 2	Year 3	Year 4	Year 5
Net incomes . . . . .	\$10,000	\$25,000	\$50,000	\$37,500	\$100,000

#### Exercise C-3

Payback period computation;  
declining-balance depreciation  
L02

**Check** 2.265 years

A machine costs \$700,000 and is expected to yield an after-tax net income of \$52,000 each year. Management predicts this machine has a 10-year service life and a \$100,000 salvage value, and it uses straight-line depreciation. Compute this machine's accounting rate of return.

#### Exercise C-4

Accounting rate of return L03

B2B Co. is considering the purchase of equipment that would allow the company to add a new product to its line. The equipment is expected to cost \$360,000 with a 6-year life and no salvage value. It will be depreciated on a straight-line basis. The company expects to sell 144,000 units of the equipment's product each year. The expected annual income related to this equipment follows. Compute the (1) payback period and (2) accounting rate of return for this equipment.

#### Exercise C-5

Payback period and accounting  
rate of return on investment  
L02 L04

Sales .....	\$225,000
Costs	
Materials, labor, and overhead (except depreciation) .....	120,000
Depreciation on new equipment .....	30,000
Selling and administrative expenses .....	<u>22,500</u>
Total costs and expenses .....	<u>172,500</u>
Pretax income .....	52,500
Income taxes (30%) .....	<u>15,750</u>
Net income .....	<u>\$ 36,750</u>

**Check** (1) 5.39 years (2) 20.42%

**Exercise C-6**

Computing net present value  
**L04**

After evaluating the risk of the investment described in Exercise C-5, B2B Co. concludes that it must earn at least an 8% return on this investment. Compute the net present value of this investment. Use the present value tables in Appendix D.

**Exercise C-7**

Computation and interpretation of net present value and internal rate of return **L04 L05**

Phoenix Company can invest in each of three cheese-making projects: C1, C2, and C3. Each project requires an initial investment of \$228,000 and would yield the following annual cash flows.

	C1	C2	C3
Year 1 .....	\$ 12,000	\$ 96,000	\$180,000
Year 2 .....	108,000	96,000	60,000
Year 3 .....	<u>168,000</u>	<u>96,000</u>	<u>48,000</u>
Totals .....	<u>\$288,000</u>	<u>\$288,000</u>	<u>\$288,000</u>

(1) Assuming that the company requires a 12% return from its investments, use net present value to determine which projects, if any, should be acquired. (2) Using the answer from part 1, explain whether the internal rate of return is higher or lower than 12% for project C2. (3) Compute the internal rate of return for project C2. Use the present value tables in Appendix D.

**Check** (3) IRR = 13%

**Exercise C-8**

Comparison of payback and BET  
**L02 L07**

This chapter explained two methods to evaluate investments using recovery time, the payback period and break-even time (BET). Refer to QS C-5 and (1) compute the recovery time for both the payback period and break-even time, (2) discuss the advantage(s) of break-even time over the payback period, and (3) list two conditions under which payback period and break-even time are similar.



**PROBLEM SET A**

**Problem C-1A**

Computation of payback period, accounting rate of return, and net present value **L02 L04**



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Factor Company is planning to add a new product to its line. To manufacture this product, the company needs to buy a new machine at a \$480,000 cost with an expected four-year life and a \$20,000 salvage value. All sales are for cash, and all costs are out of pocket except for depreciation on the new machine. Additional information includes the following.

Expected annual sales of new product .....	\$1,840,000
Expected annual costs of new product	
Direct materials .....	480,000
Direct labor .....	672,000
Overhead excluding straight-line depreciation on new machine .....	336,000
Selling and administrative expenses .....	160,000
Income taxes .....	30%

**Required**

1. Compute straight-line depreciation for each year of this new machine's life.
2. Determine expected net income and net cash flow for each year of this machine's life.
3. Compute this machine's payback period, assuming that cash flows occur evenly throughout each year.
4. Compute this machine's accounting rate of return, assuming that income is earned evenly throughout each year.

**Check** (4) 21.56%



5. Compute the net present value for this machine using a discount rate of 7% and assuming that cash flows occur at each year-end. (*Hint:* Salvage value is a cash inflow at the end of the asset's life.) Use the present value tables in Appendix D.

(5) \$107,356

Most Company has an opportunity to invest in one of two new projects. Project Y requires a \$350,000 investment for new machinery with a four-year life and no salvage value. Project Z requires a \$350,000 investment for new machinery with a three-year life and no salvage value. The two projects yield the following predicted annual results. The company uses straight-line depreciation, and cash flows occur evenly throughout each year.

**Problem C-2A**

Analysis and computation of payback period, accounting rate of return, and net present value

L02 L03 L04

	Project Y	Project Z
Sales .....	\$350,000	\$280,000
Expenses		
Direct materials .....	49,000	35,000
Direct labor .....	70,000	42,000
Overhead including depreciation .....	126,000	126,000
Selling and administrative expenses .....	25,000	25,000
Total expenses .....	270,000	228,000
Pretax income .....	80,000	52,000
Income taxes (30%) .....	24,000	15,600
Net income .....	<u>\$ 56,000</u>	<u>\$ 36,400</u>

**Required**

1. Compute each project's annual expected net cash flows.
2. Determine each project's payback period.
3. Compute each project's accounting rate of return.
4. Determine each project's net present value using 8% as the discount rate. For part 4 only, assume that cash flows occur at each year-end. Use the present value tables in Appendix D.

**Check** For Project Y: (2) 2.44 years, (3) 32%, (4) \$125,286

**Analysis Component**

5. Identify the project you would recommend to management and explain your choice.

Manning Corporation is considering a new project requiring a \$90,000 investment in test equipment with no salvage value. The project would produce \$66,000 of pretax income before depreciation at the end of each of the next six years. The company's income tax rate is 40%. In compiling its tax return and computing its income tax payments, the company can choose between the two alternative depreciation schedules shown in the table.

**Problem C-3A**

Computation of cash flows and net present values with alternative depreciation methods L04

	Straight-Line Depreciation	MACRS Depreciation*
Year 1 .....	\$ 9,000	\$18,000
Year 2 .....	18,000	28,800
Year 3 .....	18,000	17,280
Year 4 .....	18,000	10,368
Year 5 .....	18,000	10,368
Year 6 .....	9,000	5,184
Totals .....	<u>\$90,000</u>	<u>\$90,000</u>

\* The modified accelerated cost recovery system (MACRS) for depreciation is discussed in Chapter 18.

**Required**

1. Prepare a five-column table that reports amounts (assuming use of straight-line depreciation) for each of the following for each of the six years: (a) pretax income before depreciation, (b) straight-line

depreciation expense, (c) taxable income, (d) income taxes, and (e) net cash flow. Net cash flow equals the amount of income before depreciation minus the income taxes.

2. Prepare a five-column table that reports amounts (assuming use of MACRS depreciation) for each of the following for each of the six years: (a) pretax income before depreciation, (b) MACRS depreciation expense, (c) taxable income, (d) income taxes, and (e) net cash flow. Net cash flow equals the income amount before depreciation minus the income taxes.
3. Compute the net present value of the investment if straight-line depreciation is used. Use 10% as the discount rate. Use the present value tables in Appendix D.
4. Compute the net present value of the investment if MACRS depreciation is used. Use 10% as the discount rate. Use the present value tables in Appendix D.

**Check** Net present value:  
(3) \$108,518, (4) \$110,303

**Analysis Component**

5. Explain why the MACRS depreciation method increases this project’s net present value.

**PROBLEM SET B**

**Problem C-1B**

Computation of payback period, accounting rate of return, and net present value **L02 L03 L04**

Cortino Company is planning to add a new product to its line. To manufacture this product, the company needs to buy a new machine at a \$300,000 cost with an expected four-year life and a \$20,000 salvage value. All sales are for cash and all costs are out of pocket, except for depreciation on the new machine. Additional information includes the following.

Expected annual sales of new product .....	\$1,150,000
Expected annual costs of new product	
Direct materials .....	300,000
Direct labor .....	420,000
Overhead excluding straight-line depreciation on new machine .....	210,000
Selling and administrative expenses .....	100,000
Income taxes .....	30%

**Required**

1. Compute straight-line depreciation for each year of this new machine’s life.
2. Determine expected net income and net cash flow for each year of this machine’s life.
3. Compute this machine’s payback period, assuming that cash flows occur evenly throughout each year.
4. Compute this machine’s accounting rate of return, assuming that income is earned evenly throughout each year.
5. Compute the net present value for this machine using a discount rate of 7% and assuming that cash flows occur at each year-end. (*Hint:* Salvage value is a cash inflow at the end of the asset’s life.) Use the present value tables in Appendix D.

**Check** (4) 21.88%  
(5) \$70,915

**Problem C-2B**

Analysis and computation of payback period, accounting rate of return, and net present value **L02 L03 L04**

Aikman Company has an opportunity to invest in one of two projects. Project A requires a \$240,000 investment for new machinery with a four-year life and no salvage value. Project B also requires a \$240,000 investment for new machinery with a three-year life and no salvage value. The two projects yield the following predicted annual results. The company uses straight-line depreciation, and cash flows occur evenly throughout each year.

	Project A	Project B
Sales .....	\$250,000	\$200,000
Expenses		
Direct materials .....	35,000	25,000
Direct labor .....	50,000	30,000
Overhead including depreciation .....	90,000	90,000
Selling and administrative expenses .....	18,000	18,000
Total expenses .....	193,000	163,000
Pretax income .....	57,000	37,000
Income taxes (30%) .....	17,100	11,100
Net income .....	<u>\$ 39,900</u>	<u>\$ 25,900</u>

**Required**

1. Compute each project's annual expected net cash flows.
2. Determine each project's payback period.
3. Compute each project's accounting rate of return.
4. Determine each project's net present value using 8% as the discount rate. For part 4 only, assume that cash flows occur at each year-end. Use the present value tables in Appendix D.

**Check** For Project A: (2) 2.4 years, (3) 33.3%, (4) \$90,879

**Analysis Component**

5. Identify the project you would recommend to management and explain your choice.

Grossman Corporation is considering a new project requiring a \$30,000 investment in an asset having no salvage value. The project would produce \$12,000 of pretax income before depreciation at the end of each of the next six years. The company's income tax rate is 40%. In compiling its tax return and computing its income tax payments, the company can choose between two alternative depreciation schedules as shown in the table.

	Straight-Line Depreciation	MACRS Depreciation*
Year 1 . . . . .	\$ 3,000	\$ 6,000
Year 2 . . . . .	6,000	9,600
Year 3 . . . . .	6,000	5,760
Year 4 . . . . .	6,000	3,456
Year 5 . . . . .	6,000	3,456
Year 6 . . . . .	<u>3,000</u>	<u>1,728</u>
Totals . . . . .	<u>\$30,000</u>	<u>\$30,000</u>

\* The modified accelerated cost recovery system (MACRS) for depreciation is discussed in Chapter 18.

**Problem C-3B**

Computation of cash flows and net present values with alternative depreciation methods **L04**

**Required**

1. Prepare a five-column table that reports amounts (assuming use of straight-line depreciation) for each of the following items for each of the six years: (a) pretax income before depreciation, (b) straight-line depreciation expense, (c) taxable income, (d) income taxes, and (e) net cash flow. Net cash flow equals the amount of income before depreciation minus the income taxes.
2. Prepare a five-column table that reports amounts (assuming use of MACRS depreciation) for each of the following items for each of the six years: (a) income before depreciation, (b) MACRS depreciation expense, (c) taxable income, (d) income taxes, and (e) net cash flow. Net cash flow equals the amount of income before depreciation minus the income taxes.
3. Compute the net present value of the investment if straight-line depreciation is used. Use 10% as the discount rate. Use the present value tables in Appendix D.
4. Compute the net present value of the investment if MACRS depreciation is used. Use 10% as the discount rate. Use the present value tables in Appendix D.

**Check** Net present value: (3) \$10,041, (4) \$10,635

**Analysis Component**

5. Explain why the MACRS depreciation method increases the net present value of this project.

*(This serial problem began in Chapter 1 and continues through most of the book. If previous chapter segments were not completed, the serial problem can begin at this point. It is helpful, but not necessary, that you use the Working Papers that accompany the book.)*

**SERIAL PROBLEM**

Success Systems

**SPC** Adriana Lopez is considering the purchase of equipment for Success Systems that would allow the company to add a new product to its computer furniture line. The equipment is expected to cost \$240,000 and to have a six-year life and no salvage value. It will be depreciated on a straight-line basis. Success Systems expects to sell 100 units of the equipment's product each year. The expected annual income related to this equipment follows.

Sales .....	\$300,000
Costs	
Materials, labor, and overhead (except depreciation) .....	160,000
Depreciation on new equipment .....	40,000
Selling and administrative expenses .....	<u>30,000</u>
Total costs and expenses .....	<u>230,000</u>
Pretax income .....	70,000
Income taxes (30%) .....	<u>21,000</u>
Net income .....	<u>\$ 49,000</u>

**Required**

Compute the (1) payback period and (2) accounting rate of return for this equipment.

## BEYOND THE NUMBERS

**ETHICS CHALLENGE**

L04

**BTNC-1** A consultant commented that “too often the numbers look good but feel bad.” This comment often stems from an estimation error common to capital budgeting proposals that relates to future cash flows. Three reasons for this error often exist. First, reliably predicting cash flows several years into the future is very difficult. Second, the present value of cash flows many years into the future (say, beyond 10 years) is often very small. Third, it is difficult for personal biases and expectations not to unduly influence present value computations.

**Required**

1. Compute the present value of \$100 to be received in 10 years assuming a 12% discount rate.
2. Why is understanding the three reasons mentioned for estimation errors important when evaluating investment projects? Link this response to your answer for part 1.

**WORKPLACE COMMUNICATION**

L02 L03 L04 L05

**BTNC-2** Payback period, accounting rate of return, net present value, and internal rate of return are common methods to evaluate capital investment opportunities. Assume that your manager asks you to identify the type of measurement basis and unit that each method offers and to list the advantages and disadvantages of each. Present your response in memorandum format of less than one page.

**TEAMWORK IN ACTION**

L02 L04

**BTNC-3** Break into teams and identify four reasons that an international airline such as **Southwest**, **Northwest**, or **American** would invest in a project when its direct analysis using both payback period and net present value indicates it to be a poor investment. (*Hint*: Think about qualitative factors.) Provide an example of an investment project supporting your answer.