Chapter 14

Capital Investment Decisions

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Learning Objectives

- Explain the nature and importance of capital investment decisions.
- Identify the relevant cash inflows and outflows in an investment proposal.
- Format the relevant cash flow data in an investment proposal.
- Understand how to apply present value evaluation methods to capital investment decisions.
- Understand how to apply payback period and accounting rate of return methods to capital investment decisions.
- Compare strengths and weaknesses of capital investment evaluation methods.
- Comprehend how income taxes impact the cash flows of capital investments.

Chapter Outline

Introduction

This chapter discusses decision making for capital investment projects and helps you to:

1. Identify relevant cash flows in capital investments.
2. Understand techniques and methods for analyzing project data.

These decisions are made by the executive committee or the board of directors with input from medical and financial staff. The variety of proposals for a hospital system could include the following:

- Engineering is pushing to integrate a newly developed Open MRI machine. The new technology will push the hospital system into new markets with great sales potential but against stiff competition.
- Adding space to the corporate headquarters will bring three administrative departments together, increase efficiency, and reduce operating expenses.
- The patient care planning manager proposes rearranging several patient care areas to improve production efficiency for a family of current services.
- Another project adds capacity to a specialized patient care section.
- The facilities manager requests funding for an air purification system, which must be installed by year-end to meet new state air quality requirements.
- An information systems proposal would automate several manual operations and save personnel costs.
- The finance manager is negotiating for controlling interest in a new hospital group with technical expertise that the hospital system needs for new patient care services.
- Marketing has proposed a major jump in advertising spending for a patient care line that has not been meeting sales targets.

The hospital's board would want to get the "biggest bang for the bucks" from its limited capital investment budget. A quick calculation shows that this year's investment dollars will fund about half of these proposals. Some proposals are risky, while others have predictable outcomes. Some are straightforward, but many include a host of extraneous issues. Also, financial data are overstated for some proposals and understated for others. Some generate immediate returns; others promise big cash flows years from now.

In this chapter we look at how these **capital investment decisions** are made. Capital investment analysis is a planning task and is directly linked to budgeting, as discussed in Chapter 12. **Capital budgeting** is the process of evaluating specific projects, estimating benefits and costs of the projects, and selecting which projects to fund.

Capital budgeting depends on an understanding of the time value of money. For those who are unfamiliar with the time value of money or have not applied present values in financial accounting or other courses, Section 14.8 explains the concept. Present value tables necessary for discounting future cash flows are located in Section 14.8.

Capital investment projects usually involve more than one accounting period. Relevant revenues and operating costs for multiperiod decisions are defined as cash inflows and cash outflows, respectively. Since these decisions extend over a period of years, timing of these cash flows is a major factor.

14.1 The Importance of Capital Investment Decisions

Capital investment is the acquisition of assets with an expected life greater than a year. These decisions attract managers' interest for good reasons:

1. Long-term commitments. Capital decisions often lock the firm into assets for many years.
2. Large amounts of dollars. Capital projects often have big price tags. For example, the Hospital Corporation of America had a 2012 capital investment expense for property and equipment of $1.9 billion to a small medical clinic that might buy one piece of equipment for $50,000, and such large relative dollar amounts get attention. (Access the company's website for more information about SEC filings: http://phx.corporate-ir.net/phoenix.zhtml?c=63489&p=irol-sec&control_selectgroup=Annual%20Filings)
3. Key areas of the firm. New services, new patient care technology, and research efforts are crucial to a firm's ongoing competitiveness.
4. Source of future earnings. Investing with foresight is the key to the firm's future profits and financial performance.
5. Scarce capital dollars. In most firms, more demands exist for capital funds than the firm can meet. Only the best opportunities should be funded.

Excellent analyses and decisions increase the firm's capacity, technology, efficiency, and cash generating power. Poor decisions waste resources, lose opportunities, and impact profits for many years.

14.2 The Capital Investment Decision

A capital investment generally includes a cash outflow, which is the investment, and cash inflows, which are the returns on the investment. The decision maker expects cash inflows to exceed cash outflows. The typical investment project has cash outflows at the beginning and cash inflows over the life of the project.

Cash Flows

Cash flows are the key data inputs in capital investment analyses. Cash has an opportunity cost, since it could be used to buy a productive or financial asset with earning power. Cash is a basic asset. Prices, costs, and values can all be expressed in cash amounts. If the decision impacts several time periods, cash-flow timing becomes a relevant factor.

Cash outflows commonly include:

1. the cash cost of the initial investment plus any startup costs;
2. incremental cash operating costs incurred over the project's life;
3. incremental working capital such as inventories and accounts receivable;
4. additional outlays needed to overhaul, expand, or update the asset during the project's life; and
5. additional taxes owed on incremental taxable income.

Cash inflows include:

1. incremental cash revenues received over the project's life;
2. reduced operating expenses received over the project's life (A reduction of a cash outflow is treated as a cash inflow.);
3. cash received from selling old assets being replaced in the new project, net of any tax impacts;
4. released working capital, perhaps at the project's end; and
5. salvage value (net of taxes) realized from asset disposition at the project's end.

These relevant cash flows occur after the "go" decision is made to proceed with the project. Therefore, we are estimating future cash flows. Certain cash flows are estimated based on current patient fees and known technology, whereas others are estimates based on vague facts and unproven methods. Often, cost savings and project benefits are not easily quantified. Much time and expense are spent to develop supporting forecast data. It is important to understand that the same cash-flow estimates are used regardless of the project evaluation method used.

Decision Criteria

Winning projects generally have the highest rates of return on investment. Decisions are either:

Accept or reject or Select A or B or C, etc. (or some combination of these)

In the first type, we decide whether the return is acceptable or unacceptable. This is a screening decision. Is the return "good enough?" The second type is a preference or ranking decision—select the best choice from a set of mutually exclusive projects. By picking A, we reject B, C, and any other choices. One possible choice is to do nothing—the status quo.

Generally, projects are ranked on a scale of high to low returns. The highest ranking projects are selected, until the capital investment budget is spent. Often, funds are limited; many acceptable projects will go unfunded. The firm's goal is to select projects with the highest returns. Pertinent nonquantitative factors may sway a decision and cause lower-ranked projects to be selected, such as the need to meet joint commission standards might outweigh the decision for a new piece of medical equipment desired for the surgical wing.

Time Perspectives

In the real world, every conceivable combination of cash-flow timing can exist. However, we assume a simplified timeline. The present point in time is today, Year 0. This is when we assume investments are made—new assets acquired, old assets sold, and any tax consequences of these changes assessed. In real life, several years of cash outflows may precede the start of a project's operation.

Generally, annual time periods are used. Using shorter time periods is possible, such as 1-month periods for monthly lease payments. Annual flows of cash are assumed to occur at year-end due to the mathematics underlying the construction of the present value tables.

An Example—Equipment Replacement and Capacity Expansion

As an illustration, Clairmont Hospital is considering new radiology equipment costing $100,000 to replace an obsolete piece of radiology equipment:

1. The new equipment's expected life is 5 years and can probably be sold at the end of Year 5 for $10,000.
2. The vendor recommends an overhaul in Year 3 at a cost of $20,000.
3. Capacity will immediately increase by 1,000 x-rays per year. Net patient fees for each x-ray are $55, of which $30 are variable costs.
4. Additional radiology supplies of $3,000 are needed and will be released at the project's end (i.e., radiology supplies will be returned to the level they were at immediately prior to the purchase of the new equipment).
5. Operating costs will be reduced by $15,000 per year.
6. The old equipment can be sold for $8,000 now, which is its book value. Alternatively, as another option, it could be used for 5 more years with no salvage or book value at that time.

Remember that any cash revenue or cost that does not change is irrelevant and can be ignored. Any cash flow that differs among decision choices is relevant. Additional taxes or tax savings on incremental income or expenses are also relevant cash flows. But, until income tax issues are discussed, taxation implications are ignored.

Formatting the Relevant Data

First, you should adopt a uniform format for analysis of capital investment to help organize data and to present it in a logical pattern. Using data from the previous example, the timeframe format shown in Exhibit 14.1 is used throughout our capital investment discussions.

Cash outflows are negative numbers, and inflows are positive numbers. Project years begin now (Year 0 or today), and are shown as columns. Specific cash-flow items are shown as rows. The investments of $100,000 in equipment and $3,000 in radiology supplies costs are reduced by the sale of old equipment for $8,000. The **net initial investment** is $95,000. The additional 1,000 units of sales generate incremental contribution margin of $25,000, using $55 in net fees less a $30 variable cost per unit.

Remember that volumes of analytical support may be developed to back up each number in Exhibit 14.1. The $100,000 device cost would result from evaluations of many devices and negotiations with vendors. Estimates of additional revenues and variable costs come from marketing studies and capacity use. Estimates of cost savings come from service, industrial engineering, and cost accounting analyses.

Exhibit 14.1: Format for relevant capital investment data—Clairmont Hospital

		Life of the Project				
Cash Flows:	*Today*	*Year 1*	*Year 2*	*Year 3*	*Year 4*	*Year 5*
New equipment	$ (100,000)					
Salvage value						$ 10,000
Sale of old equipment	8,000					3,000
Added radiology supplies	(3,000)					
Added contribution savings		$ 25,000	$ 25,000	$ 25,000	$ 25,000	$ 25,000
Operating cost savings		15,000	15,000	15,000	15,000	15,000
Updating costs				(20,000)		
Net cash investment	$ (95,000)					
Net cash inflows		$ 40,000	$ 40,000	$ 20,000	$ 40,000	$ 53,000

14.3 The Evaluation Methods

The evaluation methods discussed here are:

1. present value methods (also called discounted cash-flow methods);
   a. net present value method (NPV);
   b. internal rate of return method (IRR);
2. payback period method; and
3. accounting rate of return method.

Nearly all managerial accountants agree that methods using **present value** (Methods 1a and 1b) give the best assessment of long-term investments. Methods that do not involve the time value of money (Methods 2 and 3) have serious flaws; however, since they are commonly used for investment evaluation, their strengths and weaknesses are discussed.

Net Present Value Method

The **net present value (NPV)** method includes the time value of money by using an interest rate that represents the desired rate of return or, at least, sets a minimum acceptable rate of return. The decision rule is:

> If the present value of incremental net cash inflows is greater than the incremental investment net cash outflow, approve the project.

Using Tables 14.1 and 14.2 found at the end of this chapter, the net cash flows for each year are brought back (i.e., discounted) to Year 0 and summed for all years. An interest rate must be specified. This rate is often viewed as the cost of funds needed to finance the project and is the minimum acceptable rate of return. To discount the cash flows, we use the interest rate and the years that the cash flows occur to obtain the appropriate present value factors from the present value tables. A portion of Table 14.1 appears below, showing the present value factors (the shaded numbers), corresponding to an interest rate of 12%, for each year during the Clairmont Hospital project's life.

Periods (*n*)	**1%**	**2%**	**4%**	**5%**	**6%**	**8%**	**10%**	**12%**	**14%**	**15%**	**16%**
0	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
1	0.990	0.980	0.962	0.952	0.943	0.926	0.909	0.893	0.877	0.870	0.862
2	0.980	0.961	0.925	0.907	0.890	0.857	0.826	0.797	0.769	0.756	0.743
3	0.971	0.942	0.889	0.864	0.840	0.794	0.751	0.712	0.675	0.658	0.641
4	0.961	0.924	0.855	0.823	0.792	0.735	0.683	0.636	0.592	0.572	0.552
5	0.951	0.906	0.822	0.784	0.747	0.681	0.621	0.567	0.519	0.497	0.476
6	0.942	0.888	0.790	0.746	0.705	0.630	0.564	0.507	0.456	0.432	0.410
7	0.933	0.871	0.760	0.711	0.665	0.583	0.513	0.452	0.400	0.376	0.354
8	0.923	0.853	0.731	0.677	0.627	0.540	0.467	0.404	0.351	0.327	0.305
9	0.914	0.837	0.703	0.645	0.592	0.500	0.424	0.361	0.308	0.284	0.263
10	0.905	0.820	0.676	0.614	0.558	0.463	0.386	0.322	0.270	0.247	0.227

These present value factors are used in Exhibit 14.2 to discount the yearly cash flows to their present values. In Exhibit 14.2, the net cash investment ($95,000) is subtracted from the sum of cash-inflow present values ($137,331). When the residual is positive, the project's rate of return (ROR) is greater than the minimum acceptable ROR. If:

Present value of incremental net cash inflows >
Incremental investment cash outflows

then:

Project's ROR ≥ Minimum acceptable ROR.

Net present value is the difference between the present value of the incremental net cash inflows and the incremental investment cash outflows. If net present value is zero or positive, the project is acceptable. When the sum is negative, the project's ROR is less than the discount rate. If:

Present value of incremental net cash inflows <
Incremental investment cash outflows

then:

Project's ROR < Minimum acceptable ROR.

If net present value is negative, the project should be rejected.

Exhibit 14.2: Net present value of capital investment cash flows

		Life of the Project				
Cash Flows:	***Today***	***Year 1***	***Year 2***	***Year 3***	***Year 4***	***Year 5***
Net cash flow	$ (95,000)	$ 40,000	$ 40,000	$ 40,000	$ 40,000	$ 53,000
Present value factors at 12%	× 1.000	× 0.893	× 0.797	× 0.712	× 0.636	× 0.567
Present values at 12%	$ (95,000)	$ 35,720	$ 31,720	$ 14,240	$ 25,440	$ 30,051
Sum of PVs for Years 1 to 5	137,331					
Net present value	$42,331					

The Interest Rate

What interest rate should be used for discounting the cash flows? This rate has many names that help explain its source and use. Among them are:

1. **cost of capital**—a weighted-average cost of long-term funds. Only projects that can earn at least what the firm pays for funds should be accepted. Later, we illustrate a calculation of cost of capital;
2. **minimum acceptable rate of return**—a particular rate that is considered to be the lowest ROR that management will accept. This rate of return is usually decided by the organization's board of directors or executive committee;
3. **desired rate of return**, **target rate of return**, or **required rate of return**—a rate that reflects management ROR expectations;
4. **hurdle rate**—a threshold that a project's ROR must "jump over" or exceed; and
5. **cutoff rate**—the rate at which projects with a higher ROR are accepted and those with a lower ROR are rejected; often the rate where all available capital investment funds are committed.

A firm will use one or more of these terms as its **discount rate**. While these terms sometimes produce different rates in the business world, we will use these terms interchangeably here. Generally, if a project's ROR is below the chosen discount rate, it is rejected; above this rate, the project is acceptable. Still, whether it is funded depends on the availability of capital funds.

In the Clairmont Hospital example, we assume that management has decided that 12% is the minimum acceptable rate of return. Calculations needed to obtain a net present value are shown in Exhibit 14.2. The net present value is a positive $42,331; therefore, the project earns more than a 12% ROR. The net present value method does not provide information about the project's exact ROR; it merely informs whether the project is earning more than, less than, or equal to the minimum acceptable ROR.

If other discount rates had been selected, we would find the following net present values:

Percentage	Present Value of Net Cash Inflows	− Investment =	Net Present Value
16%	$124,328	$95,000	$29,328
20	113,246	95,000	18,246
24	103,713	95,000	8,713
28	95,523	95,000	523
30	91,797	95,000	(3,203)

Notice that, as the interest rate increases, the present values of the future cash flows decrease. At 30% per year, the project's net present value is negative, and the project is unacceptable. The project's rate of return must be between 28% and 30%.

Project Ranking

Even though a project has a positive net present value, too many attractive projects may exist, given the investment dollars available. A ranking system is needed. We can rank projects by the amount of net present value each generates, but this ignores the relative size of the initial investments. An extension of the net present value method is the **profitability index**. It is found by dividing the present value of a project's net cash inflows by its net initial investment. The resulting ratio is cash in to cash out. The higher the ratio is, the more attractive the investment becomes. Notice that an acceptable project should have a profitability index of at least 1. The following projects are ranked by the profitability index.

Project	Present Value of Net Cash Inflows	Initial Investment	Net Present Value	Profitability Index	Ranking
A	$235,000	$200,000	$35,000	1.18	5
B	170,000	140,000	30,000	1.21	4
C	80,000	60,000	20,000	1.33	1
D	98,000	80,000	18,000	1.23	3
E	52,000	40,000	12,000	1.30	2

We would typically accept projects with the highest profitability index until we exhaust the capital budget or the list of acceptable projects.

Internal Rate of Return (IRR) Method

The **internal rate of return (IRR)** is the project's ROR and is the rate where the:

> Net initial investment cash outflow =
> Present value of the incremental net cash inflows.

Without calculator or computer assistance, the specific ROR is found by trial and error. We search for the rate that yields a zero net present value.

In the Clairmont Hospital example, the internal rate of return was found to be between 28% and 30%. The net present value at 28% is positive and at 30% is negative. By interpolation, we can approximate a "more accurate" rate as follows:

Rate of Return	Net Present Value	Calculations	
28%	$ 523	Base rate	= 28.00%
30	(3,202)	($523 ÷ $3,725) × 2%	= 0.28%
2% difference	$3,725 absolute difference	Internal rate of return	28.28%

In most cases, however, knowing that the rate is between 28% and 30% is adequate.

Estimating the Internal Rate of Return

By using Table 14.2 and knowing certain project variables, we can estimate other unknown variables, including a project's internal rate of return. This estimate requires that the annual net cash inflows be an annuity. The variables and a sample set of data are:

Variable	Example Data
A = Initial investment cash outflow	$37,910
B = Life of project	5 years
C = Annual net cash inflow	$10,000 per year
D = Internal rate of return	10%
E = Present value at 10% (Table 14.2)	3.791

If we know any three of A, B, C, or D, we can find E and the missing variable. A variety of questions can be answered:

1. What is the internal rate of return of the project? If A, B, and C are known, we can calculate E and find D as follows:

$$E = A \div C$$

$$\$37{,}910 \div \$10{,}000 = 3.791.$$

On Table 14.2, we go to the 5-period (year) row and move across until we find 3.791 (E) in the 10% column (D). At 10%, the cash outflow ($37,910) equals the present value of the net cash inflows (3.791 × $10,000). The internal rate of return is 10%.

2. What annual cash inflow will yield a 10% IRR from the project? If A, B, and D are known, we can find E and calculate C. E is found in Table 14.2 by using 5 years and 10% ROR. The annual cash inflow is found as follows:

$$C = A \div E$$

$$\$37{,}910 \div 3.791 = \$10{,}000 \text{ per year.}$$

We need $10,000 per year in cash inflow to earn a 10% IRR.

3. What can we afford to invest if the project earns $10,000 each year for 5 years and we want a 10% IRR? If we know B, C, and D, we can find E and then calculate A. The investment is found by using the annual net cash inflow and 3.791 as follows:

$$A = C \times E$$

$$\$10{,}000 \times 3.791 = \$37{,}910.$$

We can pay no more than $37,910 and still earn at least a 10% return.

4. How long must the project last to earn at least a 10% IRR? If we know A, C, and D, we calculate E and find B as follows:

$$E = A \div C$$

$$\$37{,}910 \div \$10{,}000 = 3.791.$$

For a 10% IRR, 3.791 is on the 5-period row. The project's life must be at least 5 years.

Most spreadsheet software and business calculators have built-in functions to find the internal rate of return. This simplifies the calculation burden that has limited its use in the past.

Project Ranking

Since each project has a specific rate of return, ranking projects under the IRR method is relatively simple. All projects are listed according to their rates of return from high to low. The cost of capital or a cutoff rate can establish a minimum acceptable rate of return. Then, projects are selected by moving down the list until the budget is exhausted or the cutoff rate is reached.

Reinvestment Assumption

The internal rate of return method assumes that cash flows are reinvested at the project's internal rate of return. While this assumption may be realistic for cost of capital rates, it may be wishful thinking for projects with high internal rates of return. This issue, however, is best left to finance texts and courses.

High Discount Rates

A concern exists about the use of high discount rates in present value methods. A project with significant long-term payoffs may not appear favorable because the long-term payoffs will be discounted so severely. Even huge cash inflows due 10 years or more into the future appear to be less valuable than minor cost savings earned in the first year of another project. High discount rates may encourage managers to think only short term; to ignore research, market innovations, and creative product development projects; and to ignore long-term environmental effects. Thus, positive or negative impacts can result from the wise or unwise use of accounting tools and policies.

The Payback Period Method

The **payback period method** is a "quick and dirty" evaluation of capital investment projects. It is likely that no major firm makes investment decisions based solely on the **payback period**, but many ask for the payback period as part of their analyses. The payback period method asks:

How fast do we get our initial cash investment back?

No ROR is given, only a time period. If annual cash flows are equal, the payback period is found as follows:

Net initial investment ÷ Annual net cash inflow = Payback period.

If the investment is $120,000 and annual net cash inflow is $48,000, the payback period is 2.5 years. We do not know how long the project will last nor what cash flows exist after the 2.5 years. It might last 20 years or 20 days beyond the payback point.

If annual cash flows are uneven, the payback period is found by recovering the investment cost year by year. In the Clairmont Hospital example:

Year	Cash Flows	Unrecovered Investment
0	**$(95,000)**	**$95,000**
1	40,000	55,000
2	40,000	15,000
3	20,000	0

In Year 3, the cost is totally recovered, using only $15,000 of Year 3's $20,000 (75%). The payback period is 2.75 years.

The payback method is viewed as a "bail-out" risk measure. How long do we need to stick with the project just to get our initial investment money back? It is used frequently in short-term projects where the impact of present values is not great. Such projects as efficiency improvements, cost reductions, and personnel savings are examples. Several major companies set an arbitrary payback period, such as 6 months, for certain types of cost-saving projects.

Using the Payback Reciprocal to Estimate the IRR

The payback period can be used to estimate a project's IRR, assuming a fairly high ROR (over 20%) and project life that is more than twice the payback period. For example, if a $40,000 investment earns $10,000 per year for an expected 12 years, the payback period is 4 years. The reciprocal of the payback period is 1 divided by 4 and gives an IRR estimate of 25%. From Table 14.2 for 12 years, the present value factor (payback period) of 4 indicates a rate of return of between 22% and 24%. The **payback reciprocal** will always overstate the IRR somewhat. If the project's life is very long, say 50 years, the payback reciprocal is an almost perfect estimator. (See the present value factor of 4.000 for 25% and 50 periods on Table 14.2.)

Ranking Projects

When the payback period is used to rank projects, the shortest payback period is best. Thus, all projects are listed from low to high. A firm's policy may say that no project with a payback period of over 4 years will be considered. This acts like a cutoff point. After that, projects would be selected until capital funds are exhausted. The major complaints about the payback period method are that it ignores:

1. the time value of money and
2. the cash flows beyond the payback point.

These are serious deficiencies, but the method is easily applied and can be a rough gauge of potential success.

Accounting Rate of Return Method

This method:

1. ignores the time value of money;
2. presumes uniform flows of income over the project's life; and
3. includes depreciation expense and other accounting accruals in the calculation of project income, losing the purity of cash flows.

In fact, we only discuss this approach because many internal corporate performance reporting systems use accrual accounting data. Many companies use discounted cash flows for investment decisions but report actual results using accrual income and expense measures.

The **accounting rate of return (ARR) method** attempts to measure the return from accrual net income from the project. The ARR subtracts depreciation expense on the incremental investment from the annual net cash inflows. Other accrual adjustments may also be made. The general formula is:

$$\frac{\text{Annual net operating cash inflow} - \text{Annual depreciation expense in incremental investment}}{\text{Average investment}} = \text{Accounting rate of return}$$

The average investment, the denominator, is the average of the net initial investment and the ending investment base ($0 if no salvage value exists). This is the average book value of the investment over its life. Some analysts prefer to use the original cost of the investment or replacement cost as the denominator. The numerator is the annual incremental accrual net income from the project. To illustrate, assume the following:

Initial investment	$110,000
Salvage value	$ 10,000
Annual cash inflow	$ 35,000
Project life	5 years
Depreciation expense	$ 20,000

ARR calculations are:

$$\frac{\$35{,}000 - \$20{,}000}{(\$110{,}000 + \$10{,}000)/2} = \frac{\$15{,}000}{\$60{,}000} = 25\%.$$

The 25% must be viewed relative to other projects' ARR and cannot be compared to present value rates of return. For ranking purposes, projects are ranked from high to low. An arbitrary percentage may be set as a minimum rate, similar to an accrual return on equity.

Another problem with the ARR is the impression it gives of an increasing ROR on an annual basis as an asset grows older. A manager would see this project's performance on annual investment center responsibility report as follows:

	Average Investment (Book Value)	**Project Net Income**	**Annual ARR**
Year 1	$100,000	$15,000	15.0%
Year 2	80,000	15,000	18.8
Year 3	60,000	15,000	25.0
Year 4	40,000	15,000	37.5
Year 5	20,000	15,000	75.0

The average annual book value declines each year, and net income is assumed to remain constant. As the asset gets older, the ARR increases. It is tempting for managers to reject any proposal that will make their performance reports look less favorable. This is particularly true when their bonuses are tied to accrual accounting performance numbers. Managers will be biased toward sticking with older assets with higher accounting rates of return. They forego new investments that offer new technology, lower operating costs, and greater productivity.

14.4 Ethical Issues and Pressures on Management

In many corporate situations, managers are under pressure to earn high rates of return in the short run. This pressure, driven by the desire for higher and higher current profits, tends to create a situation where managers look to short-term profitability rather than the long-term health of the organization. All capital investment analyses depend on the credibility of future cash flow estimates. Unlike past facts, which are measured very objectively, future values are based on predictions, opinions, judgments, and perhaps wishful thinking. The quality of decision making rests on a premise that future estimates are made objectively and in good faith. A manager trying to get a needed project approved may develop estimates that are too optimistic because of the manager's enthusiastic support of the idea.

Company policies compound the problem by setting very high hurdle or cutoff rates that encourage proposal developers to overestimate future revenues and underestimate investment costs. Managers have been heard to say, "Show me the hurdle, and I'll make the project jump over it." In fact, a vicious cycle may develop: higher hurdles, more bias in estimates; higher hurdles, and so on.

To control these problems, many firms have special analysts who evaluate proposals independent of the sponsoring managers. Others perform post-audits to compare actual results to the estimates. Tying responsibility for the project's promises to the manager's future evaluations may help solve some of these problems.

The second issue is the severe pressure on managers to show growth in immediate earnings. Capital investment proposals include a mix of short-term and long-term projects. Short-term projects often emphasize cost savings, which may be worthwhile but not strategically important. Long-term projects include research and development and new technology. Unfortunately, these projects often have long payback periods, but they offer significant future potential. If hurdle rates are high, long-term projects will rarely rank as high as short-term projects. The long-run competitiveness and success of a firm may be damaged severely if its managers are biased toward short-term rewards.

Japanese firms, for a number of reasons, are said to have a much longer-term investment horizon. They are less concerned about the immediate profitability of new products and markets. Market penetration and market share are more important. This allows managers to develop a strategic plan that emphasizes the long-run success of the firm.

14.5 Taxes and Depreciation

The illustrations have thus far ignored income taxes. Also, depreciation expense, being noncash, was used only in the accounting rate of return method. These factors impact capital budgeting significantly.

Income Taxes and Capital Investments

Except for nonprofit organizations, the real world is a tax-paying world, and capital investment analysis must consider taxes. Taxation rules are complex and impact many cash flows. Taxable income and gains include:

1. incremental revenues minus incremental expenses;
2. incremental operating expense savings; and
3. gains on sales of old assets now and of new assets at the project's end.

Incremental expenses and losses reduce taxes and include:

1. incremental operating expenses and
2. losses on sales of old assets now and of new assets at the end of a project's life.

The tax rate should be the expected **marginal tax rate** for the future year being analyzed. The marginal tax rate is the tax rate applied to any incremental taxable income. For simplicity, we assume that the marginal income tax rate is 40% for all income tax–related issues. Clearly, income taxes reduce the ROR on capital projects by reducing net cash inflows.

Depreciation Expense

The only role that depreciation expense plays in cash flow–based capital investment analysis is as a deduction in calculating income taxes. If taxes are ignored or are not applicable, as in nonprofit organizations, depreciation expense is also ignored.

The Internal Revenue Code uses the terms **Accelerated Cost Recovery System (ACRS)** and the **Modified Accelerated Cost Recovery System (MACRS)** to describe the methods used to depreciate tangible assets for tax purposes. To simplify our depreciation expense and taxation discussions, we assume that (1) straight-line depreciation is used, (2) depreciation expense calculations ignore salvage values, and (3) salvage values are net of tax consequences.

To understand the tax and depreciation expense impacts, let us look again at the Clairmont Hospital example in Exhibit 14.2 and now apply a tax rate of 40% to the incremental operating cash flows. For now, we ignore the effects of depreciation. This is shown in Exhibit 14.3.

Exhibit 14.3: Net present value analysis with taxes but without depreciation

		Life of the Project				
Cash Flows:	**Today**	**Year 1**	**Year 2**	**Year 3**	**Year 4**	**Year 5**
Net investment cash flows	$ (95,000)					$ 13,000
Annual cash inflows (taxable)		$ 40,000	$ 40,000	$ 20,000	$ 40,000	$ 40,000
Taxes on taxable income (40%)		(16,000)	(16,000)	(8,000)	(16,000)	(16,000)
Aftertax cash inflows		$ 24,000	$ 24,000	$ 12,000	$ 24,000	$ 24,000
Net annual cash flows	$ (95,000)	$ 24,000	$ 24,000	$ 12,000	$ 24,000	$ 37,000
Present value factors at 12%	× 1.000	× 0.893	× 0.797	× 0.712	× 0.636	× 0.567
Present values at 12%	$ (95,000)	$ 21,432	$ 19,128	$ 8,544	$ 15,264	$ 20,979
Sum of PVs for Years 1 to 5	85,347					
Net present value	$ (9,653)					

As Exhibit 14.3 shows, suddenly a very profitable project (just under 30% on a no-tax basis) now has a negative net present value using a 12% discount rate. We assume that the overhaul in Year 3 is a deductible expense, salvage value is net of taxes, and inventory recovery has no tax effects.

The Tax Shield

Depreciation expense is a noncash expense, provides a legitimate deduction for tax purposes, and creates a **tax shield**. By reducing taxable income, cash paid for taxes is reduced. Depreciation saves cash by reducing tax payments. Thus, if depreciation expense increases, tax payments decrease. Cash outflow is reduced. A reduced outflow has the same effect as an increased inflow.

The depreciation impact is seen in the Clairmont example. The increase in depreciable assets is $92,000 ($100,000 minus $8,000) and is spread over 5 years. Currently, salvage value is ignored in most IRS depreciation calculations. Assuming straight-line depreciation, the incremental depreciation expense is $18,400 per year. Aftertax cash flows are:

	Year 1
Incremental revenues	$ 55,000*
− Incremental cost of sales	−30,000*
+ Operating cost savings	15,000*
Incremental cash inflow	$ 40,000
− Depreciation expense	−18,400
Taxable income	$ 21,600
− Incremental taxes (40%)	−8,640*
Aftertax project net income	$ 12,960
+ Add back depreciation expense	18,400
Aftertax cash inflow	$31,360

* Cash flows

The project's Year 1 aftertax profit, $12,960, and the incremental depreciation expense, $18,400, are summed to find the Year 1 aftertax cash flow. Tax cash outflows for the entire project are included in the Exhibit 14.4 analysis. The increased tax deduction for depreciation moves the net present value of the project from a negative $9,653 to a positive $16,879, a $26,532 change. This is the present value of the depreciation expense tax savings, as follows (the one dollar difference is due to rounding of present value factors):

Depreciation expense	×	Tax rate	×	Present value factor (for 5 years at 12%)	=	Present value of tax shield
$18,400	×	0.40	×	3.605	=	$26,533

Exhibit 14.4: Net present value analysis with depreciation and taxes

		Life of the Project				
Cash Flows:	***Today***	***Year 1***	***Year 2***	***Year 3***	***Year 4***	***Year 5***
Net investment cash flows	$ (95,000)					$ 13,000
Annual cash inflows (taxable)		$ 40,000	$ 40,000	$ 20,000	$ 40,000	$ 40,000
Taxes on taxable income (40%)		(8,640)	(8,640)	(640)	(8,640)	(8,610)
Aftertax cash inflows		$ 31,360	$ 31,360	$ 19,360	$ 31,360	$ 31,360
Net annual cash flows	$ (95,000)	$ 31,360	$ 31,360	$ 19,260	$ 31,360	$ 44,360
Present value factors at 12%	× 1.000	× 0.893	× 0.797	× 0.712	× 0.636	× 0.567
Present values at 12%	$ (95,000)	$ 28,004	$ 28,994	$ 13,784	$ 19,945	$ 25,152
Sum of PVs for Years 1 to 5	111,879					
Net present value	$ 16,879					

Accelerated Depreciation Benefits

The cash-saving power of depreciation can be increased by using **accelerated depreciation** to deduct more depreciation earlier in a project's life. Deferring taxes has a time value of money. By merely changing depreciation methods, the net present value can increase or decrease. This is strictly from speeding up or slowing the depreciation expense deductions and the time value of the tax deferrals.

14.6 Cost of Capital

Throughout our discussions, cost of capital is mentioned frequently. Long-term money has a cost, either real as in interest paid on bonds payable or an opportunity cost as in the use of earnings retained in the business. A basic approach is explained here to show the source of this rate.

A **weighted-average cost of capital** pools a firm's long-term funds and is used because the relative amount of each fund's source affects the average cost. Debt generally is less costly than equity, since the creditor assumes less risk and interest is deductible for tax purposes. If a firm has a pretax debt cost of 10% and a 40% tax rate, the aftertax cost is 6%. Dividends, on the other hand, are not deductible for tax purposes and are profit distributions to owners, not a business expense.

Assume that a firm has the following long-term funds structure and cost of funds:

	Book Value	Mix Percentage	Pretax Cost	After Tax Cost	Weighted Average
Bonds payable	$10,000,000	25%	10%	6%	1.5%
Preferred stock	4,000,000	10	12	12	1.2
Common stock	14,000,000	35	18	18	6.3
Retained earnings	12,000,000	30	18	18	5.4
Total long-term funds	$40,000,000	100%			14.4%

The pretax cost percentages come from financial markets calculations. The weighted-average cost of capital is 14.4%. Often, financially strong companies have low cost of funds. High risk, financially unstable, or new firms often have high funds costs.

14.7 Calculation Issues

The variety of issues surrounding capital investment decisions are sufficient that entire textbooks have been written about them. Here, we introduce a few of the more significant complexities.

Inflation and Future Cash Flows

Inflation is a common economic problem. Over the past 40 years in the United States, annual inflation rates have ranged from a high of over 12% to a low of under 2%. These levels are moderate compared to rates in many other countries. Yet, capital investment decisions should consider inflationary impacts on future cash flows.

While several approaches could be used to incorporate inflation into the analysis, the approach we suggest is to build the impacts of inflation into the expected future cash flows. This allows the use of specific inflation rates for each cash-flow component. Also, rates can be changed for each future period. The discount rate will be the noninflated desired rate of return times one plus the expected general inflation rate.

To illustrate inflation impacts on estimates of future cash flows, assume that Kazen Medical Equipment Repairs plans to expand its equipment diagnostic business. Equipment will cost about $120,000 and should last about 3 years. After 3 years, it is thought that greater on-board computer use will require more powerful testing technology. Annual revenues are expected to be $150,000, personnel costs are $60,000, and other support costs would be about $30,000. Kazen uses a 10% desired rate of return.

Economic forecasts indicate that inflation will be 6% per year for the next few years. But Kazen feels that, at best, prices could be raised no more than 4% per year. Personnel costs will probably increase at a 10% rate, primarily because of benefits costs. Other costs will increase at an average of 6% annually. The equipment, which has no salvage value, will be depreciated on a straight-line basis. Assume a 40% tax rate. Cash flows related to the equipment are as follows:

	Investment		Life of the Project	
	Year 0	Year 1	Year 2	Year 3
Initial investment	$(120,000)			
Revenues	$ 150,000	$156,000	$162,240	
Personnel costs		(60,000)	(66,000)	(72,600)
Other costs		(30,000)	(31,800)	(33,708)
Incremental taxes*	—	(8,000)	(7,280)	(6,373)
Net cash flows	$(120,000)	$ 52,000	$ 50,920	$49,559

* Taxes in Year 1: ($150,000 – 60,000 – 30,000 – 40,000) × 0.4 = $8,000
Taxes in Year 2: ($156,000 – 66,000 – 31,800 – 40,000) × 0.4 = $7,280
Taxes in Year 3: ($162,240 – 72,600 – 33,708 – 40,000) × 0.4 = $6,373

Notice that depreciation, being based on the historical cost of the investment, is still $40,000 in each year. While all other revenues and costs have inflation built into them, the tax law requires that the depreciation expense is always expressed in historical-cost dollars from the year of acquisition. Using historical cost-based depreciation in tax calculations often leads to higher tax payments since profits grow from inflated revenues.

It is dangerous to ignore inflation. To do so assumes that all inflation effects sum to zero, which is rarely the case. Certain cost areas, such as healthcare, have had unusually high increases in recent years. Forecasting these costs should include estimated inflationary impacts to make cash-flow estimates credible.

Working Capital

When expansion occurs, inventories and receivables often grow. Financing working capital growth is an integral part of a project's total investment. Unlike depreciable equipment and fixed assets, working capital is committed and can probably be recovered at the end of the project. Often, working capital requirements grow slowly over time as sales increase. Incremental inventories and accounts receivable net of incremental accounts payable can easily be overlooked and omitted from a project's analysis. In contrast, JIT projects often release working capital by reducing inventories, which can help finance the project itself.

Assume that Champs Medical Supplies operates a chain of medical supplies stores in shopping malls. Opening a new store requires layout, equipment, and fixtures costing about $450,000. In addition, about $200,000 of inventory is needed to stock a new store. Experience shows that inventory and other working capital needs will grow at about $20,000 per year for the first 5 years. If Champs Medical Supplies uses an 8-year timeframe for evaluating a store location, assumptions will be needed about the equipment salvage value and the recovery of the working capital investment. The fixed assets' salvage values are estimated to be $50,000 net of taxes, and the entire working capital investment (now $300,000) is thought to be recovered. The cash flows would look like:

		Life of the Project			
Cash Flows:	**Today**	**Year 1**	**Year 2**	**Year 5**	**Year 8**
Initial construction	$(450,000)				$ 50,000
Working capital needs	$(200,000)	$(20,000)	$(20,000)	$(20,000)	$300,000

Working capital recovery is not automatic. Inventory may be obsolete, and receivables might not be collectible. A **going-concern assumption** can generally be made if the business is expected to continue past the timeframe cutoff.

Uneven Project Lives

When comparing projects, lives of each project may not match. How can a 3-year solution to a problem be compared to a 5-year or an 8-year solution? The decision must be viewed from the timeframe of the job to be done. Do we want a solution for 3, 5, or 8 years? How long can the physical asset last? Often, technology changes often make an asset's economic life shorter than its physical life. A 3-year solution may be sought, while an asset's physical life might well be twice that long.

If the time period is based on the needs of the problem, the task is to find salvage or market values for assets at the end of the defined time period. If the time period is based on the physical lives of the proposed assets, different useful lives of the proposed solutions must somehow be matched. One approach is to use a shorter-lived project as the comparison time period. This requires finding salvage or market values for assets at midpoints in their lives. While no specific rule exists, the investment's timeframe as defined by management seems to be the better choice. Management's intent and common sense, rather than the physical lives of assets, should govern the time period choice.

Evaluation of Projects With Different Initial Investments

Up to this point, most of the illustrations have assumed that a single investment alternative existed. The firm had to decide whether or not to invest in that project. Actually, a firm may have several alternatives but still have to select only one. In such a case, care must be exercised in using the internal rate of return method because the project with the highest internal rate of return may not be the most desirable. This can happen in those cases where the dollar investment is not the same. The dollar amount of the return from a larger investment, in many cases, will exceed the dollar return from a smaller investment having a better internal rate of return.

Assume that Behar Medical Clinic must choose between two x-ray machine alternatives. Each has an estimated life of 5 years with annual returns as follows:

	Machine I	Machine II
Net investment	$75,000	$100,000
Net cash inflow for each of 5 years	26,000	33,000

Investments are expected to earn a desired rate of return of at least 12%. Machine II requires an investment of an additional $25,000 versus Machine I. The approximate internal rate of return is computed for each alternative and for the incremental investment as follows:

	Machine I	Machine II	Incremental (II − I)
Net investment	$(75,000)	$(100,000)	$(25,000)
Annual return	$ 26,000	$ 33,000	$ 7,000
Payback period	2.885	3.030	3.571
Nearest PV factor on Table 14.2 for 5 periods	2.864	2.991	3.605
Nearest IRR given on Table 14.2	22%	20%	12%

It appears that Machine I should be selected because the internal rate of return is higher. The additional $25,000 investment needed by Machine II yields a much lower rate of return: 12%. But, if the rate of return on the incremental investment is greater than the hurdle rate of return, the larger investment could still be made. In this example, an additional $7,000 per year is returned on an additional investment of $25,000. The rate of return on the incremental investment barely meets the 12% desired rate of return.

In another situation, Machine I could be a Phase I of a pair of sequential jobs, and Machine II could be Phases I and II combined. Phase I may be executed without Phase II but not vice versa. Advocates of Phase II would clearly argue that both phases be approved at one time. However, as we have seen, Phase II has an IRR of about 12%. If the cutoff rate is 15%, Phase I and the combined phases are acceptable. But Phase II by itself is unacceptable. Breaking down projects into their subcomponents can give useful insight into the yields on incremental investments.

Gains and Losses on Asset Disposals

If assets are sold at more or less than their book values, gains or losses appear with tax implications. The book value is an asset's original cost minus its accumulated depreciation. In the business world, accounting book values and tax cost bases often differ. In our discussions here, unless specifically mentioned, these two amounts are assumed to be the same. If the sale is for more than the book value, a gain occurs; if for less, a loss occurs.

Gains and losses on disposals and their impacts on cash flows arise at two points in the capital investment decision:

1. Old assets may be sold as part of investing in a new asset, and
2. new assets may be sold at the end of the project's expected life.

14.8 The Time Value of Money

Dollars promised in the future are not equal to dollars received now. When given a choice, we all prefer getting \$100 today versus \$100 two years from now. Dollars due in different time periods should be valued on a uniform scale that recognizes the **time value of money**. Present value converts future dollars into current dollar equivalents. **Future value** converts all dollars into equivalent dollars as of some future date. To find these values, we need an interest rate and the number of time periods between today and the future cash flows.

Money has earning power. Dollars today grow to larger sums through earning interest on the principal plus earning interest on interest. The investment principal plus **compound interest** is the future value (FV). The future value of \$100 in 2 years, with interest compounded at the rate of 10% annually, is \$121. The formula for the future value of \$1 is:

$$\text{FV} = (1 + i)^n \text{ where } i = \text{interest rate}$$
$$n = \text{number of years.}$$

In the example, the future value is computed as follows:

$$\text{FV of \$1} = (1.10)^2 = \$1.21$$
$$\text{FV of \$100} = \$100 \times \$1.21, \text{ or } \$1.21.$$

An investor who is happy with a 10% ROR looks at the receipt of \$121 in 2 years as equivalent to \$100 today, assuming certainty. This investor is indifferent between the \$100 today or \$121 in 2 years.

The interest rate influences the values. If a decision maker has a choice of investments, the preferred choice is the investment with the highest ROR. The reason, of course, is that the investment with the highest ROR will yield the largest future amount or require the smallest current investment. For example, an alternative investment will earn a 15% ROR. Assuming certainty, the future value in 2 years of the \$100 at 15% is:

$$\$100 \times (1.15)^2 = \$100 \times 1.3225 = \$132.25.$$

Since \$132.25 is larger than \$121, the project earning 15% is preferred to the 10% project.

Present Value of Money

Because decisions are made today and because future cash flows come in many different patterns and time periods, present values of future dollars are more useful and easier to analyze. It is conventional to use present value analysis.

How much money must we invest today to earn a given dollar amount in the future? Or, given an investment, how much will be earned in the future? Or, given an investment and a set of future cash inflows, what is the ROR? Answers to these questions can be found by computing the present value of the future cash flows and comparing it with the amount invested.

The present value (PV) of a future value can be computed by multiplying the future value by the present value of $1. The present value of $1 is:

$$\text{PV of \$1} = 1 \div (1 + i)^n.$$

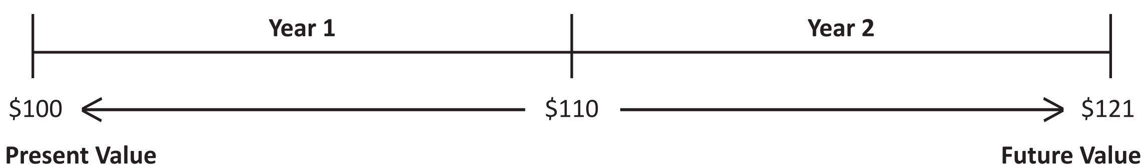
Assume, for example, that $121 is needed in 2 years, and the rate of interest is 10%. How much must be invested today to have $121 after 2 years? We first determine the present value of $1 due in 2 years with interest compounded annually at 10%:

$$\text{PV of \$1 for 2 years at 10\%} = 1 \div (1.10)^2 = 0.826.$$

Next, we multiply by the future value:

$$\text{PV of \$121 for 2 years at 10\%} = \$121 \times 0.826 = \$100 \text{ (rounded)}.$$

The computation can be viewed as:



$121 ÷ 1.10 = $110 is the value at the end of Year 1.

$110 ÷ 1.10 = $100 is the investment at the start of Year 1, or today.

This is summarized as follows:

$$\$121 \div (1.10)^2 \text{ or } [1 \div (1.10)^2] \times \$121 = \$100.$$

The process of reducing a future amount to a present value is called **discounting**. The present value is sometimes called the **discounted value**. The rate of interest is the discount rate. The 0.826 is called the present value factor or **discount factor**.

It is seldom necessary to calculate either future values or present values as done here. Calculators and spreadsheet software easily perform these functions. Tables 14.1 and 14.2, found at the end of this chapter, give present value factors for various discount (interest) rates for various time periods expressed in years. Table 14.1 gives the present value of $1 to be received at the end of the various time periods at interest or discount rates shown across the top row of the table. Thus, it is a tabulation of the factor $1 \div (1 + i)^n$, where n is the number of years and i is the discount rate. The factor for 2 years at 10% is 0.826, and the present value (PV) of $121 to be received in 2 years is calculated as follows:

$$PV = \$121 \times 0.826 = \$100 \text{ (rounded)}.$$

The discount factors appearing in Tables 14.1 and 14.2 are rounded to the third digit, which is sufficient precision for most capital investment problems.

Present Value of a Series of Future Cash Flows

Often, a series of future cash inflows are earned from an investment instead of one cash inflow. As an example, a machine costing $3,500 today is forecast to generate cash inflows of $1,000 each year for 5 years. The time interval for most decisions is annual, but any time interval (a day, week, month, quarter, etc.) can be used as long as the interest rate (i) is adjusted to correspond to the time period.

Calculating present values depends on whether the cash flows series are equal or unequal amounts. An **annuity** refers to a series of equal cash flows. In either case, however, the underlying concepts are the same. The present value of a series is the sum of the present values of the individual amounts. The present value of these five annual receipts of $1,000 using a 10% discount rate is computed as follows:

Year	Computation	Explanation
1	$\$1{,}000 \times (1 \div 1.10) =$	$909 PV of $1,000 received at the end of Year 1
2	$1{,}000 \times [1 \div (1.10)^2] =$	826 PV of $1,000 received at the end of Year 2
3	$1{,}000 \times [1 \div (1.10)^3] =$	751 PV of $1,000 received at the end of Year 3
4	$1{,}000 \times [1 \div (1.10)^4] =$	683 PV of $1,000 received at the end of Year 4
5	$1{,}000 \times [1 \div (1.10)^5] =$	621 PV of $1,000 received at the end of Year 5
		$3,790 PV of an annuity of $1,000 for years

The present value can also be computed as follows:

$$\$1{,}000 \times \left[\frac{1}{(1.10)^2} + \frac{1}{(1.10)^3} + \frac{1}{(1.10)^4} + \frac{1}{(1.10)^5}\right] = \$3{,}790.$$

The decimal equivalents of the fractions can be found in Table 14.1 and applied to the annual cash inflow:

$$0.909 + 0.826 + 0.751 + 0.683 + 0.621 = 3.790$$

$$\$1{,}000 \times 3.790 = \$3{,}790.$$

Note that the factor, 3.791, can be found on Table 14.2 using the 10% column and the 5-period row. The factors in Table 14.2 are the sums of the present value factors in Table 14.1. The difference between 3.790 and 3.791 is due to rounding. The following calculations using interest rates of 8%, 10%, and 12% for 5 years illustrate this point.

	8%		10%		12%	
Years	**Table 14.1**	**Table 14.2**	**Table 14.1**	**Table 14.2**	**Table 14.1**	**Table 14.2**
1	0.926		0.909		0.893	
2	0.857		0.826		0.797	
3	0.794		0.751		0.712	
4	0.735		0.683		0.636	
5	0.681		0.621		0.567	
Total	3.993	3.993	3.790*	3.791*	3.605	3.605

* Difference due to rounding.

When calculating, it is easier to add the annual factors and make one computation. Thus, Table 14.2 is more convenient for evaluating equal cash flows. If the annual cash-flow amounts are not equal, it is necessary to use Table 14.1.

Present Value Analysis Applied

Assume that we sell medical equipment and offer financing to our customers using long-term notes payable. When a contract is signed, the customer makes two promises:

1. to pay the principal amount (the **face value** of the note) at maturity and
2. to pay interest periodically at the rate stated in the contract.

We can either hold the note (earning interest and collecting the principal at the end of the contract) or sell the contract to an investor to get the cash for the sale now. The contract's market value depends on several factors, including the **market rate of interest** for similar contracts. The sum of the present values of the two promises is the contract's market price. As the market rate of interest rises, the contract's value declines, and vice versa.

To illustrate, assume that we sell a $100,000 machine. The buyer signs a 10-year $100,000 contract with an interest rate of 10%, paid annually. This contract specifies the following cash payments:

Year	Interest at 10%	Payment of Principal	Total Cash Outflow
1	$10,000		$ 10,000
2	10,000		10,000
. . . .	. . . .		. . . .
9	10,000		10,000
10	10,000	$100,000	110,000

Suppose that the current market rate of interest is 12%. In this case, investors are not willing to buy the contract at face value because they could earn 12% elsewhere. To sell the contract, we must price the contract below face value. Selling at a price below face allows the investor to increase the rate of return by paying less for the two promises.

Promise 1:	$100,000 × 0.322 (10 periods at 12% from Table 14.1)	$32,300
Promise 2:	$10,000 × 5.650 (10 payments at 12% from Table 14.2)	56,500
	Proceeds from sale of the contract	$88,700
	Discount	$11,300

The investor that purchases the contract from us at $88,700 (with a **discount** of $11,300) will earn 12% interest on the $88,700 invested. The 12% earned is usually called the yield or the effective rate of interest. An **effective interest rate** or **yield to maturity** is the rate of interest earned regardless of the compounding period or the stated interest rate.

Likewise, if the current market rate of interest is 8%, an investor will pay a **premium** for a contract with a 10% interest rate. The selling price and premium are determined as follows:

Promise 1:	$100,000 × 0.463 (10 periods at 8% from Table 14.1)	$ 46,300
Promise 2:	$10,000 × 6.710 (10 payments at 8% from Table 14.2)	67,100
	Proceeds from sale of the contract	$113,400
	Premium	$ 13,400

Case Study: Dolores Dialysis

Dolores Dialysis purchased a new machine 1 year ago at a cost of $68,000. The machine has been working very satisfactorily, but the clinic manager, Harold Eliot, has just received information on an advanced dialysis machine that is vastly superior to the machine that he now uses. While both machines can meet all required existing quality standards and tolerances, the new machine's quality potential can far exceed the old machine's capabilities. Comparative data on the two machines follow:

	Present Machine	Proposed New Machine
Purchase cost new (including installation costs)	$70,000	$90,000
Salvage value today	35,000	
Salvage value at end of life	5,000	10,000
Annual costs to operate	95,000	75,000
Estimated useful life when new	7 years	6 years

(continued)

Case Study: Dolores Dialysis *(continued)*

Harold makes a few quick computations and exclaims, "Wow! We need that machine and its capabilities. But, no way can I sell it upstairs. When the boss sees the loss on the old machine, he'll have kittens." He's looking at this:

Remaining book value of the old machine	$60,000
Salvage value now of the old machine	35,000
Net loss from disposal (before tax deduction of the loss)	$25,000

Dolores Dialysis uses straight-line depreciation and ignores salvage value in its depreciation calculations. Sales are expected to remain unchanged at $300,000 per year indefinitely. Other cash costs total $80,000 annually. The corporate tax rate is 40%.

Case Study Exercises

1. Prepare summary income statements covering the next 6 years for the dialysis operation, assuming that:
   a. the new machine is not purchased.
   b. the new machine is purchased.
2. What do you recommend? Show any needed additional analysis.
3. Comment on the reality of the $25,000 loss Harold has calculated. Can or should this be ignored?
4. Comment on why introducing new technology is difficult to justify to management.
5. Develop a policy that would encourage investment in new technology and yet would avoid wasting scarce capital investment money.

Table 14.1a: Present value table, 1%–15%

Present Value of $1				$P = 1 / (1 + i)^n$			Where:	P = Present Value Factor i = Interest Rate n = Number of Periods		
Periods (n)	**1%**	**2%**	**4%**	**5%**	**6%**	**8%**	**10%**	**12%**	**14%**	**15%**
0	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
1	0.990	0.980	0.962	0.952	0.943	0.926	0.909	0.893	0.877	0.870
2	0.980	0.961	0.925	0.907	0.890	0.857	0.826	0.797	0.769	0.756
3	0.971	0.942	0.889	0.864	0.840	0.794	0.751	0.712	0.675	0.658
4	0.961	0.924	0.855	0.823	0.792	0.735	0.683	0.636	0.592	0.572
5	0.951	0.906	0.822	0.784	0.747	0.681	0.621	0.567	0.519	0.497
6	0.942	0.888	0.790	0.746	0.705	0.630	0.564	0.507	0.456	0.432

(continued)

Table 14.1a: Present value table, 1%–15% *(continued)*

Present Value of $1				$P = 1 / (1 + i)^n$			Where:	P = Present Value Factor i = Interest Rate n = Number of Periods		
Periods (n)	1%	2%	4%	5%	6%	8%	10%	12%	14%	15%
7	0.933	0.871	0.760	0.711	0.665	0.583	0.513	0.452	0.400	0.376
8	0.923	0.853	0.731	0.677	0.627	0.540	0.467	0.404	0.351	0.327
9	0.914	0.837	0.703	0.645	0.592	0.500	0.424	0.361	0.308	0.284
10	0.905	0.820	0.676	0.614	0.558	0.463	0.386	0.322	0.270	0.247
11	0.896	0.804	0.650	0.585	0.527	0.429	0.350	0.287	0.237	0.215
12	0.887	0.788	0.625	0.557	0.497	0.397	0.319	0.257	0.208	0.187
13	0.879	0.773	0.601	0.530	0.469	0.368	0.290	0.229	0.182	0.163
14	0.870	0.758	0.577	0.505	0.442	0.340	0.263	0.205	0.160	0.141
15	0.861	0.743	0.555	0.481	0.417	0.315	0.239	0.183	0.140	0.123
16	0.853	0.728	0.534	0.458	0.394	0.292	0.218	0.163	0.123	0.107
17	0.844	0.714	0.513	0.436	0.371	0.270	0.198	0.146	0.108	0.093
18	0.836	0.700	0.494	0.416	0.350	0.250	0.180	0.130	0.095	0.081
19	0.828	0.686	0.475	0.396	0.331	0.232	0.164	0.116	0.083	0.070
20	0.820	0.673	0.456	0.377	0.312	0.215	0.149	0.104	0.073	0.061
21	0.811	0.660	0.439	0.359	0.294	0.199	0.135	0.093	0.064	0.053
22	0.803	0.647	0.422	0.342	0.278	0.184	0.123	0.083	0.056	0.046
23	0.795	0.634	0.406	0.326	0.262	0.170	0.112	0.074	0.049	0.040
24	0.788	0.622	0.390	0.310	0.247	0.158	0.102	0.066	0.043	0.035
25	0.780	0.610	0.375	0.295	0.233	0.146	0.092	0.059	0.038	0.030
30	0.742	0.552	0.308	0.231	0.174	0.099	0.057	0.033	0.020	0.015
35	0.706	0.500	0.253	0.181	0.130	0.068	0.036	0.019	0.010	0.008
40	0.672	0.453	0.208	0.142	0.097	0.046	0.022	0.011	0.005	0.004
45	0.639	0.410	0.171	0.111	0.073	0.031	0.014	0.006	0.003	0.002
50	0.608	0.372	0.141	0.087	0.054	0.021	0.009	0.003	0.001	0.001
	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Table 14.1b: Present value table, 16%–40%

Present Value of $1			$P = 1 / (1 + i)^n$			Where:	P = Present Value Factor i = Interest Rate n = Number of Periods	
Periods (n)	16%	18%	20%	22%	24%	25%	30%	40%
0	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
1	0.862	0.847	0.833	0.820	0.806	0.800	0.769	0.714
2	0.743	0.718	0.694	0.672	0.650	0.640	0.592	0.510
3	0.641	0.609	0.579	0.551	0.524	0.512	0.455	0.364
4	0.552	0.516	0.482	0.451	0.423	0.410	0.350	0.260
5	0.476	0.437	0.402	0.370	0.341	0.328	0.269	0.186
6	0.410	0.370	0.335	0.303	0.275	0.262	0.207	0.133
7	0.354	0.314	0.279	0.249	0.222	0.210	0.159	0.095
8	0.305	0.266	0.233	0.204	0.179	0.168	0.123	0.068
9	0.263	0.225	0.194	0.167	0.144	0.134	0.094	0.048
10	0.227	0.191	0.162	0.137	0.116	0.107	0.073	0.035
11	0.195	0.162	0.135	0.112	0.094	0.086	0.056	0.025
12	0.168	0.137	0.112	0.092	0.076	0.069	0.043	0.018
13	0.145	0.116	0.093	0.075	0.061	0.055	0.033	0.013
14	0.125	0.099	0.078	0.062	0.049	0.044	0.025	0.009
15	0.108	0.084	0.065	0.051	0.040	0.035	0.020	0.006
16	0.093	0.071	0.054	0.042	0.032	0.028	0.015	0.005
17	0.080	0.060	0.045	0.034	0.026	0.023	0.012	0.003
18	0.069	0.051	0.038	0.028	0.021	0.018	0.009	0.002
19	0.060	0.043	0.031	0.023	0.017	0.014	0.007	0.002
20	0.051	0.037	0.026	0.019	0.014	0.012	0.005	0.001
21	0.044	0.031	0.022	0.015	0.011	0.009	0.004	0.001
22	0.038	0.026	0.018	0.013	0.009	0.007	0.003	0.001
23	0.033	0.022	0.015	0.010	0.007	0.006	0.002	0.000
24	0.028	0.019	0.013	0.008	0.006	0.005	0.002	0.000
25	0.024	0.016	0.010	0.007	0.005	0.004	0.001	0.000
30	0.012	0.007	0.004	0.003	0.002	0.001	0.000	0.000
35	0.006	0.003	0.002	0.001	0.001	0.000	0.000	0.000
40	0.003	0.001	0.001	0.000	0.000	0.000	0.000	0.000
45	0.001	0.001	0.000	0.000	0.000	0.000	0.000	0.000
50	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Table 14.2a: Present value table, 1%–14%

Present Value of $1 Received Periodically for *n* Periods			$P = [1 - (1 / (1 + i)^n] / i$			Where:	P = Present Value Factor i = Interest Rate n = Number of Periods		
Periods (n)	1%	2%	4%	5%	6%	8%	10%	12%	14%
0	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
1	0.990	0.980	0.962	0.952	0.943	0.926	0.909	0.893	0.877
2	1.970	1.942	1.886	1.859	1.833	1.783	1.736	1.690	1.647
3	2.941	2.884	2.775	2.723	2.673	2.577	2.487	2.402	2.322
4	3.902	3.808	3.630	3.546	3.465	3.312	3.170	3.037	2.914
5	4.853	4.713	4.452	4.329	4.212	3.993	3.791	3.605	3.433
6	5.795	5.601	5.242	5.076	4.917	4.623	4.355	4.111	3.889
7	6.728	6.472	6.002	5.786	5.582	5.206	4.868	4.564	4.288
8	7.652	7.325	6.733	6.463	6.210	5.747	5.335	4.968	4.639
9	8.566	8.162	7.435	7.108	6.802	6.247	5.759	5.328	4.946
10	9.471	8.983	8.111	7.722	7.360	6.710	6.145	5.650	5.216
11	10.368	9.787	8.760	8.306	7.887	7.139	6.495	5.938	5.453
12	11.255	10.575	9.385	8.863	8.384	7.536	6.814	6.194	5.660
13	12.134	11.348	9.986	9.394	8.853	7.904	7.103	6.424	5.842
14	13.004	12.106	10.563	9.899	9.295	8.244	7.367	6.628	6.002
15	13.865	12.849	11.118	10.380	9.712	8.559	7.606	6.811	6.142
16	14.718	13.578	11.652	10.838	10.106	8.851	7.824	6.974	6.265
17	15.562	14.292	12.166	11.274	10.477	9.122	8.022	7.120	6.373
18	16.398	14.992	12.659	11.690	10.828	9.372	8.201	7.250	6.467
19	17.226	15.678	13.134	12.085	11.158	9.604	8.365	7.366	6.550
20	18.046	16.351	13.590	12.462	11.470	9.818	8.514	7.469	6.623
21	18.857	17.011	14.029	12.821	11.764	10.017	8.649	7.562	6.687
22	19.660	17.658	14.451	13.163	12.042	10.201	8.772	7.645	6.743
23	20.456	18.292	14.857	13.489	12.303	10.371	8.883	7.718	6.792
24	21.243	18.914	15.247	13.799	12.550	10.529	8.985	7.784	6.835
25	22.023	19.523	15.622	14.094	12.783	10.675	9.077	7.843	6.873
30	25.808	22.396	17.292	15.372	13.765	11.258	9.427	8.055	7.003
35	29.409	24.999	18.665	16.374	14.498	11.655	9.644	8.176	7.070
40	32.835	27.355	19.793	17.159	15.046	11.925	9.779	8.244	7.105
45	36.095	29.490	20.720	17.774	15.456	12.108	9.863	8.283	7.123
50	39.196	31.424	21.482	18.256	15.762	12.233	9.915	8.304	7.133
	100.000	50.000	25.000	20.000	16.667	12.500	10.000	8.333	7.143

Table 14.2b: Present value table, 15%–40%

Present Value of $1 Received Periodically for *n* Periods			$P = [1 - (1 / (1 + i)^n] / i$			Where:	P = Present Value Factor i = Interest Rate n = Number of Periods		
Periods (*n*)	15%	16%	18%	20%	22%	24%	25%	30%	40%
0	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
1	0.870	0.862	0.847	0.833	0.820	0.806	0.800	0.769	0.714
2	1.626	1.605	1.566	1.528	1.492	1.457	1.440	1.361	1.224
3	2.283	2.246	2.714	2.106	2.042	1.981	1.952	1.816	1.589
4	2.855	2.798	2.690	2.589	2.494	2.404	2.362	2.166	1.849
5	3.352	3.274	3.127	2.991	2.864	2.745	2.689	2.436	2.035
6	3.784	3.685	3.498	3.326	3.167	3.020	2.951	2.643	2.168
7	4.160	4.039	3.812	3.605	3.416	3.242	3.161	2.802	2.263
8	4.487	4.344	4.078	3.837	3.619	3.421	3.329	2.925	2.331
9	4.772	4.607	4.303	4.031	3.786	3.566	3.463	3.019	2.379
10	5.019	4.833	4.494	4.192	3.923	3.682	3.571	3.092	2.414
11	5.234	5.029	4.656	4.327	4.035	3.776	3.656	3.147	2.438
12	5.421	5.197	4.793	4.439	4.127	3.851	3.725	3.190	2.456
13	5.583	5.342	4.910	4.533	4.203	3.912	3.780	3.223	2.469
14	5.724	5.468	5.008	4.611	4.265	3.962	3.824	3.249	2.478
15	5.847	5.575	5.092	4.675	4.315	4.001	3.859	3.268	2.484
16	5.954	5.668	5.162	4.730	4.357	4.033	3.887	3.283	2.489
17	6.047	5.749	5.222	4.775	4.391	4.059	3.910	3.295	2.492
18	6.128	5.818	5.273	4.812	4.419	4.080	3.928	3.304	2.494
19	6.198	5.877	5.316	4.843	4.442	4.097	3.942	3.311	2.496
20	6.259	5.929	5.353	4.870	4.460	4.110	3.954	3.316	2.497
21	6.312	5.973	5.384	4.891	4.476	4.121	3.963	3.320	2.498
22	6.359	6.011	5.410	4.909	4.488	4.130	3.970	3.323	2.498
23	6.399	6.044	5.432	4.925	4.499	4.137	3.976	3.325	2.499
24	6.434	6.073	5.451	4.937	4.507	4.143	3.981	3.327	2.499
25	6.464	6.097	5.467	4.948	4.514	4.147	3.985	3.329	2.499
30	6.566	6.177	5.517	4.979	4.534	4.160	3.995	3.332	2.500
35	6.617	6.215	5.539	4.992	4.541	4.164	3.998	3.333	2.500
40	6.642	6.233	5.548	4.997	4.544	4.166	3.999	3.333	2.500
45	6.654	6.242	5.552	4.999	4.545	4.166	4.000	3.333	2.500
50	6.661	6.246	5.554	4.999	4.545	4.167	4.000	3.333	2.500
	6.667	6.250	5.556	5.000	4.545	4.167	4.000	3.333	2.500

Key Terms

Accelerated Cost Recovery System (ACRS) A procedure established under tax laws for computing depreciation. The method assigns all depreciable assets to one of eight classes of property life and specifies the rate of cost recovery each year for each designated class life.

accelerated depreciation Depreciation methods that charge larger amounts of depreciation in the early years of an asset's life and relatively smaller amounts to the later years.

accounting rate of return (ARR) method A method of calculating a rate of return on a capital investment project in which the average annual net income from the project is divided by the average book value of the investment.

annuity A series of equal cash flows received or paid over equal time intervals.

capital budgeting The process of evaluating, selecting, controlling, and financing capital investments.

capital investment The cash outflow needed to acquire long-term assets or to obtain access to cash inflows in future periods.

capital investment decisions A decision of whether to acquire assets with an expected life in excess of 1 year.

compound interest Interest on the principal plus the previously earned interest.

cost of capital The weighted average cost, expressed as a percentage, of obtaining long-term financial resources for an organization.

cutoff rate The minimum acceptable rate of return set by management that a capital investment project can earn and still be approved.

desired rate of return A target rate of return on capital investments as selected by top management for determining the minimum rate of return acceptable.

discount The difference between the principal or face amount of a financial instrument and what an investor will pay for a fixed-rate instrument because the coupon rate is below the current market rate.

discounted value The value now for an amount to be received in the future; the amount to be paid now to settle a debt that becomes due in the future.

discount factor The multiplier used to determine the present value.

discounting The process of reducing a future amount to a present value using a specific interest rate.

discount rate The interest rate used in reducing a future amount to a present value.effective interest rate The actual rate of interest earned in 1 year, regardless of the compounding period associated with the stated interest rate.

face value The principal amount due at maturity.

future value The compound amount of any principal plus interest at the end of a specific time period, using a specific interest rate.

going-concern assumption Can generally be made if the business is expected to continue past the timeframe cutoff.

hurdle rate The minimum acceptable rate of return set by management that a capital investment project can earn and still be approved.

inflation General increases in the prices of goods and services.

internal rate of return (IRR) The rate of return that equates the present value of the future cash inflows with amount of the capital investment outlay.

marginal tax rate The tax rate that would be applied to the next dollar of taxable income.

market rate of interest The effective yield that is currently earned on similar types of financial instruments.

minimum acceptable rate of return The lowest rate of return that a capital investment project can earn and still be approved.

Modified Accelerated Cost Recovery System (MACRS) A version of the ACRS method that was created by federal income tax law in 1986 for property put into service in 1987 and thereafter.

net initial investment The net outflow of cash, a commitment of cash, or the sacrifice of an inflow of cash that occurs at the beginning of a project.

net present value (NPV) The difference between the investment and the present value of future returns discounted at a specific interest rate.

payback period The amount of time required to recover the net initial investment.

payback period method A quick way to evaluate potential capital investments by asking only how long it will take to recover the net initial investment.

payback reciprocal The percentage obtained by dividing the payback period into 1.

premium Amount in excess of the principal or face amount that an investor will pay for a fixed-rate instrument because the coupon rate is higher than the current market rate.

present value The value now for an amount to be received in the future; the amount to be paid now to settle a debt that becomes due in the future.

profitability index The ratio of the present value of cash inflows divided by the net initial investment.

required rate of return The minimum acceptable rate of return set by management that a capital investment project can earn and still be approved.

target rate of return The minimum acceptable rate of return set by management that a capital investment project can earn and still be approved.

tax shield The amount of taxes saved because of the tax deductibility of an expenditure.

time value of money The concept that a future sum of money is of less value than the same dollar amount today.

weighted-average cost of capital The cost of debt capital and equity capital weighted by their respective proportions in the total long-term capital structure.

yield to maturity The actual rate of interest earned in 1 year regardless of the compounding period associated with the stated interest rate.

Review Questions

The following questions relate to several issues raised in the chapter. Test your knowledge of these issues by selecting the best answer. (The odd-numbered answers appear in the answer appendix.)

1. Why is timing important in a capital investment decision? What is meant by the time value of money?

2. Could the net present value method and the internal rate of return use the same interest rate? Explain.

3. Are the returns from an investment the same as the accounting profit? Explain.

4. What are the advantages and disadvantages of the accounting rate of return method?

5. Explain the difference between the internal rate of return method and the net present value method.

6. How can project rankings using the internal rate of return and the profitability index differ?

7. Explain the tax shield. Tie this explanation to the comment: "Depreciation is a source of cash."

8. What is the advantage of accelerated depreciation over straight-line depreciation in a capital investment decision?

9. Knowing the cost of capital is a necessary part of present value analysis. What does it represent? Explain one way to measure it.

10. How can inflation be incorporated into capital investment analysis?

11. By incorporating inflation into the discount rate, what assumptions are made?

Exercises

1. **Capital investment decision.** Sarah Keren has won second prize in the BIG lottery. Friends she never knew about have offered her several "opportunities of a lifetime." She would like a 14% annual return. The lottery prize was a check for $300,000. Among the "opportunities" are:

   (1) $50,000 per year for 10 years;
   (2) $400,000 to be paid on this same date in the next U.S. presidential election year;
   (3) $20,000 per year for the rest of her life (about 50 years);
   (4) A penniless friend tells Sarah that he wrote her a check for $1,000,000 and put it "in the mail" several years ago, and he asks whether she has received it yet; and
   (5) $500,000 to be paid on this same date 5 years from now.

   a. After judging uncertainty, which should she select? Explain.

2. **Evaluation methods**. Avondale Clinic updated its exams rooms with new equipment totaling $100,000. The cash inflow from using the rooms is expected to be $30,000 per year for 8 years. Avondale uses a 15% cutoff rate.
   a. Use straight-line depreciation where needed, and ignore taxes. What are the payback period, the estimated IRR, the NPV, and the ARR?
3. **Payback period**. Elbein Clinic purchased new medical equipment for $125,000 and will depreciate it on a straight-line basis over a 5-year period with an aftertax salvage value of $15,000. The related cash operating savings, before income taxes, is expected to be $50,000 a year.
   a. Find the payback period, ignoring taxes.
   b. Assume that Elbein's effective income tax rate is 40% and that salvage value is ignored when calculating depreciation. What is the payback period?
4. **Net cash flow and net present value**. Miramar Hospital Corporation wants to expand its current operations. Additional medical equipment will cost $100,000, last 10 years, have no salvage value, and be depreciated using the straight-line method. Net patient fees will increase by $80,000 per year. Variable contribution margin is 40%, and additional cash fixed costs incurred will be $6,000. The tax rate is 40%. The short-term bank-borrowing rate is 10%, the firm's outstanding long-term debt pays 12%, the firm's weighted average cost of capital is 14%, and stockholders want a return on common equity of 16%.
   a. What is the annual net cash flow from this project for each year?
   b. What is the net present value from this project?
5. **Rate of return**. Glenmont Medical Group has data on two $100,000 investment opportunities. With only $100,000 in cash available, the owners must decide which is the better opportunity. The controller has gathered the following data:

   Investment 1: $30,000 of cash inflow for each of the first 3 years and $90,000 for each of the last 3 years.

   Investment 2: $80,000 of cash inflow in the first year, $60,000 in the next 4 years, and $40,000 in the 6th year.

   a. If 14% ROR is needed, which investment will be preferred? Why?
6. **Cash flows**. By replacing an old refrigeration unit in their pharmacy, Sheila Marshall of Victoria Hospital Group in Liverpool, United Kingdom, thinks that sales from the greater capacity will increase by £100,000 per year and that cash operating costs will decline by £60,000 per year. The new refrigerator will cost £350,000. Her variable contribution margin is 40%. The old equipment is fully depreciated but can be sold for £8,000. The new refrigerator will use straight-line depreciation, has a 5-year life, and is expected to have a salvage value of £40,000. Ignore taxes.
   a. Format the cash flows for the refrigeration unit proposal.
7. **Cash flow, rate of return, and net present value**. The Eastway Hospital Company is considering new equipment that can reduce personnel costs by an estimated $60,000 a year. The new equipment is also expected to generate annual intangible customer service benefits of $70,000. The new equipment will cost $400,000 and will be depreciated on a straight-line basis for tax purposes. The

asset will have no residual value at the end of 10 years, the estimated life of the equipment. Income tax is estimated at 40%.

a. Determine the annual net cash inflow from the proposed investment.
b. Will the investment earn an 18% aftertax rate of return?
c. Comment on the NPV.

8. **Payback period, accounting rate of return, and net present value**. The following projects of Regenbaum Clinics each require an $80,000 investment.

Cash Inflows:	98-A4	98-G3	98-K1	98-P6	98-S4
	Project				
Year 1	$20,000	$10,000	$40,000		$ 60,000
Year 2	$20,000	$10,000			$ 30,000
Year 3	$20,000	$15,000	$40,000		$ 10,000
Year 4	$20,000	$15,000		$160,000	$(60,000)
Year 5	$20,000	$25,000	$40,000		
Year 6	$20,000	$25,000			$ 40,000
Year 7	$20,000	$30,000	$40,000		
Year 8	$20,000	$30,000			$ 80,000

a. For each project, find the payback period.
b. For each project, find the ARR.
c. For each project, find the NPV (using a 15% discount rate).

9. **Aftertax cash flow**. By replacing present equipment with more efficient equipment, Belvoir Clinic estimates that cash operating costs can be reduced by $65,000 a year. In addition, increased patient volume can result in a larger contribution margin of $25,000 a year without considering the efficiency savings. Depreciation of $50,000 per year will be taken on new equipment. Depreciation on present equipment is $10,000 per year. The income tax rate is 40%.

a. What is the estimated incremental annual aftertax cash inflow on this investment?

10. **Complete the internal rate of return**. The table below compares six projects, but it is incomplete.

	Initial Investment	Life of the Project	Annual Net Cash Inflow	Percentage	Present Value Factor (Table 14.2)
	Internal Rate of Return				
Project 1	$118,932	6 years	$34,000	?%	?
Project 2	?	5 years	12,000	?%	3.605
Project 3	68,000	15 years	?	16%	?
Project 4	84,750	? years	15,000	12%	?
Project 5	?	? years	20,000	20%	2.991
Project 6	111,925	20 years	?	8%	?

a. Provide the missing values for these projects.

11. **Net present value method**. Sittin'-in-the-Sun Health Spas is evaluating an expansion of its existing facilities this fall. The proposal calls for a 6-year building rental contract at $10,000 a year. Equipment purchases and facility improvements are expected to cost $60,000. Straight-line depreciation is used. Other cash operating expenses are estimated at $25,000 annually. Based on past experience, the company thinks new revenues should be $50,000 annually. Sittin'-in-the-Sun will not expand unless the project covers its 14% cost of capital. The company's effective tax rate is 40%.

    Inflation is a concern. The controller thinks that revenues and cash expenses will inflate by 5% per year. Round the discount rate to the next highest rate available in Table 14.2.

    a. Using NPV, suggest whether the expansion project should be adopted.

Problems

1. **Internal rate of return method.** For many years Pedro Ramos has been successful in the retail garment industry in Nogales, Mexico. Recently he has learned of an opportunity to purchase a two-story modern building for M$750,000. He believes that he can operate successfully by using only one of the two floors. At the present time, his business is operating in an older building where he uses three floors. This has sales and production constraints, he admits.

    With uncertainties about inflation and interest rates, he would hesitate to invest unless he could obtain a discounted rate of return of at least 15%. Yet he estimates that the annual returns from his business after income tax would probably increase by M$150,000 for each of the next 10 years if he moved. This investment opportunity does not appear that good to him, and he is inclined to continue the current arrangements.

    His daughter, who has recently graduated from medical school, disagrees with his position: "You forget that this area is growing. We have no professional building, and I know of several doctors and dentists who would be happy to have offices on the second floor if you did some remodeling. I already have estimates and find that you can have the second floor remodeled for M$100,000. The offices should yield annual aftertax rental income of M$40,000."

Instructions

a. From the data given, what is the approximate IRR on the building itself?
b. What is the approximate IRR on the building and the remodeling investment together?
c. Comment on the worthiness of the incremental investment.

2. **Maximizing a capital investment decision**. The Edo Hospital Company owns a facility in the business center of Tokyo. The building has a large unused lobby area. The facilities manager for the firm, Koji Seguchi, is planning to get a greater financial return from the unused space and believes that a convenience shop should be placed in the lobby. He talked to managers of several other office buildings and projected the following annual operating results if the company establishes the shop:

Sales	¥8,500,000
Cost of sales	4,000,000
Salaries and benefits of clerks	2,400,000
Licenses and permits	100,000
Share of utilities on the building	200,000
Share of building depreciation	100,000
Advertising for the shop	100,000
Allocation of Edo administrative expense	150,000

The investment required would be ¥5,000,000, all for equipment that would be worthless in 10 years. Before presenting the plan to the executive manager, Koji learned that the space could be leased to an outside firm that would operate a convenience shop. The lease firm would pay a commission of ¥500,000 per year for 10 years. Because the lobby is heated and lighted anyway, Edo would supply utilities at a minimal added cost. Edo's cost of capital is 12%. Ignore taxes.

Instructions

a. Determine the best course of action for Edo Hospital Company.
b. Determine how much annual rent Edo would have to receive to equalize the attractiveness of the options.

3. **Net present value, payback period, and internal rate of return**. Sutherland Clinics is trying to decide whether to expand its clinic to serve patients with rehabilitation needs. The average fee for service will be $300 and has a variable cost of $140 per patient. Volume is expected to be 4,000 patients per year for 5 years. To add the service, the firm will have to buy additional medical equipment that will cost $900,000, has a 5-year life, and has a $100,000 salvage value net of taxes. Straight-line depreciation is used, and salvage value is ignored in depreciation calculations. Additional fixed cash operating costs will be $200,000 per year. Sutherland has a 40% tax rate, and its cost of capital is 16%.

Instructions

a. Using NPV, determine whether the computer console line should be expanded.
b. Compute the payback period.
c. Determine the approximate IRR that the firm expects to earn on the investment. Ignore salvage value.

4. **Limit on funds and available and net present value**. Grosvenor Hospital Systems has designated $1.2 million for capital investment expenditures during the upcoming year. Its cost of capital is 14%. Any unused funds will earn the cost of capital rate. The following investment opportunities, along with their required investment and estimated net present values, have been identified:

Project	Net Investment	NPV	Project	Net Investment	NPV
A	$200,000	$22,000	F	$250,000	$30,000
B	275,000	21,000	G	100,000	7,000
C	150,000	6,000	H	200,000	18,000
D	190,000	(19,000)	I	210,000	4,000
E	500,000	40,000	J	250,000	35,000

Instructions

a. Rank the projects using the profitability index. Considering the limit on funds available, which projects should be accepted?
b. Using the NPV, which projects should be accepted, considering the limit on funds available?
c. If the available investment funds are reduced to only $1,000,000:

(1) Does the list of accepted projects change from Part (b)?
(2) What is the opportunity cost of the eliminated $200,000?

5. **Evaluation methods, unequal lives, and unequal investment**. Data relating to three possible investments are as follows:

	X	Y	Z
Cost	$34,000	$25,000	$75,000
Annual cash savings	$ 8,111	$ 7,458	$14,011
Useful life—years	10	5	20

Instructions

a. Ignoring taxes, rank the investments according to their desirability using the payback period, IRR, NPV with a discount rate of 12%, and the profitability index.
b. Comment on the impact that the unequal lives have on the rankings.
c. Comment on the impact that the unequal investments have on the rankings.

6. **Cash flows and a capital investment decision**. Pam Williams, owner of a medical clinic, has just received an offer that is worth $600,000 after taxes for the clinic buildings. She is interested in another investment opportunity that can probably yield an annual discounted return of 15% after taxes. The clinic business is expected to continue to yield an annual cash inflow, before taxes, of $170,000 for a period of 15 years. The book value of the clinic buildings is $660,000, and straight-line depreciation is used for tax purposes. Zero salvage value is predicted. A 40% tax rate applies.

Instructions

a. Should the offer to sell the clinic business be accepted? Explain.