CHAPTER 12

CAPITAL BUDGETING AND THE INVESTMENT DECISION

INTRODUCTION

This chapter begins by discussing some of the problems associated with capital asset decisions, such as the long life of the assets, the initial high cost, and the unknown future costs and benefits.

Two fairly simple methods of measuring proposed investments—the accounting rate of return and the payback period—are then illustrated and explained.

The concept of the time value of money is then discussed, and discounted cash flow is illustrated in conjunction with time value.

Discounted cash flow is then used in conjunction with two other investment measurement methods: net present value and internal rate of return. Net present value and internal rate of return are then contrasted, and capital investment control is discussed.

The chapter concludes by demonstrating how discounted cash flow can be used to help make leasing versus buying decisions.

CHAPTER OBJECTIVES

After studying this chapter, the reader should be able to

1. Discuss the ways in which long-term asset management differs from day-to-day budgeting.
2. Explain how the accounting rate of return is calculated, use the equation, and explain the major disadvantage of this method.

3. Give the equation for the payback period, use the equation, and state the pros and cons of this method.
4. Discuss the concept of the time value of money and explain the term discounted cash flows.
5. Use discounted cash flow tables in conjunction with the net present value method to make investment decisions.
6. Use discounted cash flow tables in conjunction with the internal rate of return method to make investment decisions.
7. Contrast the net present value and internal rate of return methods and explain how they can give conflicting rankings of investment proposals.
8. Solve problems relating to the purchase versus the leasing of fixed assets.

THE INVESTMENT DECISION

This chapter concerns methods of evaluating which long-term asset to select. This is frequently referred to as **capital budgeting.** We are not so much concerned with the budgeting process as we are with the decision about whether to make a specific investment, or which of two or more investments would be best. The largest investment that a hotel or food service business has to make is in its land and buildings, which is an infrequent investment decision for each separate property. This chapter is primarily about more frequent investment decisions, for items such as equipment, furniture purchases, and replacements. Investment decision making, or capital budgeting, differs from day-to-day decision making and ongoing budgeting for a number of reasons. Some of these will be discussed.

LONG LIFE OF ASSETS

Capital investment decisions concern assets that have a relatively long life. Day-to-day decisions concerning current assets are decisions about items (such as inventories) that are turning over frequently. A wrong decision about the purchase of a food item does not have a long-term effect. But a wrong decision about a piece of equipment (a long-term asset) can involve a time span stretching over many years. This long life of a capital asset creates another problem—that of estimating the life span of an asset to determine how far into the future the benefits of its purchase are going to be spread. Life span can be affected by both physical wear and tear on the equipment and by obsolescence—invention of a newer, better, and possibly more profitable piece of equipment.

COSTS OF ASSETS

Day-to-day purchasing decisions do not usually involve large amounts of money for any individual purchase. But the purchase of a capital asset or assets normally requires the outlay of large sums of money, and one has to be sure that the initial investment outlay can be recovered over time by the net income generated by the investment.

FUTURE COSTS AND BENEFITS

As will be demonstrated, analysis techniques to aid in investment decision making involve future costs and benefits. On one hand, the future is always uncertain; on the other hand, if we make a decision based solely on historic costs and net income, we may be no better off, since they might not be representative of future costs and net income. For example, one factor considered is the recovery (scrap) value of the asset at the end of its economic life. If two comparable items of equipment were being evaluated and the only difference from all points of view was that one was estimated to have a higher scrap value than the other at the end of their equal economic lives, the decision would probably be made in favor of the item with the highest future trade-in value. However, because of technological change, that decision could eventually be the wrong one in five or more years.

TOOLS TO GUIDE INVESTMENT DECISIONS

These, then, are some of the hazards of making decisions about capital investments. The hazards can seldom be eliminated, but there are techniques available that will allow the manager to reduce some of the guesswork. Although a variety of techniques are available, only four will be discussed in this chapter:

1. Accounting rate of return
2. Payback period
3. Net present value
4. Internal rate of return

To set the scene for the accounting rate of return and the payback period methods, consider a restaurant that is using an inefficient dishwasher. The part-time wages of the employee who runs the dishwasher are $4,000 a year. The restaurant is investigating the value of installing a new dishwasher that will eliminate the need for the part-time employee, since the servers can operate the machine. Two machines are being considered, and we have information about them, as shown in Exhibit 12.1.

	Machine A	*Machine B*
Cash cost, including		
Installation	$5,000	$4,700
Economic life	5 years	5 years
Trade in (residual) value	$1,000	$200
Depreciation	$\frac{\$5{,}000 - \$1{,}000}{5} = \$800$ per year	$\frac{\$4{,}700 - \$200}{5} = \$900$ per year
Saving, wages of cashier	$4,000	$4,000
Expenses		
Maintenance	$ 350	$ 300
Supplies	650	1,000
Depreciation	800	900
Total expenses	$1,800	$2,200
Net saving (before income tax)	$2,200	$1,800
Tax (30%)	(660)	(540)
Net Annual Saving	$1,540	$1,260

EXHIBIT 12.1

Data Concerning Two Alternative Machines

ACCOUNTING RATE OF RETURN

The **accounting rate of return (ARR)** is sometimes called the **average rate of return.** It compares the average annual net income (after taxes) resulting from the investment with the average investment. The formula for the ARR is

$$\frac{\textbf{Net annual saving}}{\textbf{Average investment}}$$

Using the information from Exhibit 12.1, the ARR for each machine is

$$\textbf{Machine A}\ \frac{\$1{,}540}{[(\$5{,}000 + \$1{,}000) / 2]} = \frac{\$1{,}540}{\$3{,}000} = \underline{51.3\%}$$

$$\textbf{Machine B}\ \frac{\$1{,}260}{[(\$4{,}700 + \$200) / 2]} = \frac{\$1{,}260}{\$2{,}450} = \underline{51.4\%}$$

Note that average investment is the initial investment plus the trade-in value divided by 2. The average investment is

$$\frac{\textbf{(Initial investment + Trade-in value)}}{\textbf{2}}$$

In the example given, the assumption was made that net annual saving is the same for each of the five years. In reality, this might not always be the case. For example, there might be expenses in year 0001 (or in any of the other years) that are nonrecurring—for example, training costs or a major overhaul. Alternatively, the amount of an expense might change over the period—for example, depreciation computed using double-declining balance. To take care of this, we project total savings and total costs for each year for the entire period under review. We add up the annual net savings to give us the net saving figure for the entire period. This net saving figure for the entire period can then be divided by the number of years of the project to give an average annual net savings figure to be used in the equation.

Let us illustrate this for Machine A only. Savings and expenses are as in Exhibit 12.1, except that in year 0003 there will be a special overhaul cost of $1,000, and the double-declining balance method of depreciation (rather than straight line) will be used. Since the asset has a five-year life, the depreciation rate is 40 percent. Exhibit 12.2 shows the results.

Total net saving over the five-year period will be the sum of the individual years' savings. This amounts to $7,000. The average annual net saving will be $7,000 divided by 5 equals $1,400.

$$\textbf{ARR} = \frac{\textbf{\$1,400}}{\textbf{\$3,000}} = \underline{\underline{\textbf{46.7\%}}}$$

The same approach should be carried out for Machine B, and then a comparison can be made. Note that in Exhibit 12.2 the change in the method of

	Machine A				
	Year 1	***Year 2***	***Year 3***	***Year 4***	***Year 5***
Wage saving	$4,000	$4,000	$4,000	$4,000	$4,000
Maintenance	350	350	350	350	350
Supplies	650	650	650	650	650
Depreciation	2,000	1,200	720	80	0
Overall			1,000		
Total expenses	$3,000	$2,200	$2,720	$1,080	$1,000
Net saving (before income tax)	$1,000	$1,800	$1,280	$2,920	$3,000
Income tax	(300)	(540)	(384)	(876)	(900)
Net Saving	$ 700	$1,260	$ 896	$2,044	$2,100

EXHIBIT 12.2

Net Savings for Machine A after Special Overhaul and Double-Declining Balance Depreciation

depreciation, by itself, did not affect the change in the ARR since average depreciation is still $800 per year, and average tax and average net saving are the same. In this particular case, the only factor that caused our ARR to decrease from 51.3 percent to 46.7 percent for Machine A was the $1,000 overhaul expense.

The advantage of the accounting rate of return method is its simplicity. It is used to compare the anticipated return from a proposal with a minimum desired return. If the proposal's return is less than desired, it is rejected. If the proposal's ARR is greater than the desired rate of return, a more in-depth analysis using other investment techniques might then be used. The major disadvantage of the accounting rate of return method is that it is based on net income or net savings rather than on cash flow.

PAYBACK PERIOD

The **payback period** method overcomes the cash flow shortcoming of the accounting rate of return method. The payback method compares the initial investment with the annual cash inflows:

$$\textbf{Payback period (years)} = \frac{\textbf{Initial investment}}{\textbf{Net annual cash saving}}$$

Since Exhibit 12.1 only gives us net annual saving and not net annual cash saving, we must first convert the figures to a cash basis. This is accomplished by adding back the depreciation (an expense that does not require an outlay of cash).

	Machine A	***Machine B***
Net annual saving	$1,540	$1,260
Add depreciation	800	900
Net annual cash saving	$2,340	$2,160

Therefore, our payback period for each machine is

Machine A	***Machine B***
$\frac{\$5{,}000}{\$2{,}340} = 2.14$ years	$\frac{\$4{,}700}{\$2{,}160} = 2.18$ years

Despite its higher initial cost, Machine A recovers its initial investment in a slightly shorter period than does Machine B. This confirms the results of the accounting rate of return calculation made earlier. The payback method only

considers the cash flows until the cost of the asset has been recovered. Since the ARR calculation takes into account all of the benefit flows from an investment and not just those during the payback period, the ARR method could be considered more realistic. However, the payback method considers cash flows while the ARR method only considers net savings.

Note that in this illustration, straight-line depreciation was used and it was assumed the net annual cash saving figure was the same for each year. This might not be the case in reality. For example, the use of an accelerated method of depreciation (such as double declining balance) will increase the depreciation expense in the early years. This, in turn, will reduce income taxes and increase cash flow in those years, making the calculation of the payback period a little more difficult. To illustrate, consider an initial $6,000 investment and the following annual cash flows resulting from that investment:

Year 1	$2,500
Year 2	1,800
Year 3	1,400
Year 4	900
Year 5	700

By the end of year three, $5,700 ($2,500 + $1,800 + $1,400) will have been recovered, with the remaining $300 to be recovered in year four. This remaining amount will be recovered in one-third of a year 4 ($300 divided by $900). Total payback time will, therefore, be 3.33 years.

The payback period analysis method, although simple, does not really measure the merits of investments, but only the speed with which the investment might be recovered. It has a use in evaluating a number of proposals so that only those that fall within a predetermined payback period will be considered for further evaluation using other investment techniques.

However, both the payback period and the ARR methods still suffer from a common fault: They ignore the time value of cash flows, or the concept that money now is worth more than the same amount of money at some time in the future. This concept will be discussed in the next section, after which we will explore the use of the net present value and internal rate of return methods.

DISCOUNTED CASH FLOW

The concept of **discounted cash flow** can probably best be understood by looking first at an example of compound interest. Exhibit 12.3 shows, year by year, what happens to $200 invested at a 10 percent compound interest rate; at the end of four years, the investment would be worth $292.82.

	Jan. 1 0001	*Dec. 31 0001*	*Dec. 31 0002*	*Dec. 31 0003*	*Dec. 31 0004*
Balance forward	$200.00	$200.00	$220.00	$242.00	$266.20
Interest 10%		20.00	22.00	24.20	26.62
Investment value, end of year		$220.00	$242.00	$266.20	$292.82

EXHIBIT 12.3

Compound Interest, $200 @ 10%

Discounting is simply the reverse of compounding interest. In other words, at a 10 percent interest rate, what is $292.82 four years from now worth to me today? The solution could be worked out manually using the following equation:

$$P = F \times \frac{1}{(1 + i)^n}$$

where P = present value
F = future amount
I = interest rate used as a decimal
n = number of years ahead for the future amount

For example, using the already illustrated figures, we have

$$\begin{aligned} P &= \$292.82 \times \frac{1}{(1 + 0.10)^4} \\ &= \$292.82 \times \frac{1}{1.4641} \\ &= \$292.82 \times 0.683 \\ &= \underline{\underline{\$200}} \end{aligned}$$

Although a calculation can be made for any amount, any interest rate, and for any number of years into the future with this formula, it is much easier to use a table of discount factors.

Exhibit 12.4 illustrates such a table. If we go to the number (called a factor) that is opposite year 4 and under the 10 percent column, we will see that it is 0.6830. This factor tells us that $1.00 received at the end of Year 4 is worth only $1.00 × $0.683, or $0.683 right now. In fact, this factor tells us that any

Period	*5%*	*6%*	*7%*	*8%*	*9%*	*10%*	*11%*	*12%*	*13%*	*14%*	*15%*	*16%*	*17%*	*18%*	*19%*	*20%*	*25%*	*30%*
1	0.9524	0.9434	0.9546	0.9259	0.9174	0.9091	0.9009	0.8929	0.8850	0.8772	0.8696	0.8621	0.8547	0.8475	0.8403	0.8333	0.8000	0.7692
2	0.9070	0.8900	0.8734	0.8573	0.8417	0.8264	0.8116	0.7972	0.7831	0.7695	0.7561	0.7432	0.7305	0.7182	0.7062	0.6944	0.6400	0.5917
3	0.8638	0.8396	0.8163	0.7938	0.7722	0.7513	0.7312	0.7118	0.6951	0.6750	0.6575	0.6407	0.6244	0.6086	0.5934	0.5787	0.5120	0.4552
4	0.8227	0.7921	0.7629	0.7350	0.7084	0.6830	0.6587	0.6355	0.6133	0.5921	0.5718	0.5523	0.5337	0.5158	0.4987	0.4823	0.4096	0.3501
5	0.7835	0.7473	0.7130	0.6806	0.6499	0.6209	0.5935	0.5674	0.5428	0.5194	0.4972	0.4761	0.4561	0.4371	0.4191	0.4019	0.3277	0.2693
6	0.7462	0.7050	0.6663	0.6302	0.5963	0.5645	0.5346	0.5066	0.4803	0.4556	0.4323	0.4104	0.3898	0.3704	0.3521	0.3349	0.2621	0.2072
7	0.7107	0.6651	0.6228	0.5835	0.5470	0.5132	0.4817	0.4524	0.4251	0.3996	0.3759	0.3538	0.3332	0.3139	0.2959	0.2791	0.2097	0.1594
8	0.6768	0.6274	0.5820	0.5403	0.5019	0.4665	0.4339	0.4039	0.3762	0.3506	0.3269	0.3050	0.2848	0.2660	0.2487	0.2326	0.1678	0.1226
9	0.6446	0.5919	0.5439	0.5003	0.4604	0.4241	0.3909	0.3606	0.3329	0.3075	0.2843	0.2630	0.2434	0.2255	0.2090	0.1938	0.1342	0.0943
10	0.6139	0.5584	0.5084	0.4632	0.4224	0.3855	0.3522	0.3220	0.2946	0.2697	0.2472	0.2267	0.2080	0.1911	0.1756	0.1615	0.1074	0.0725
11	0.5847	0.5298	0.4751	0.4289	0.3875	0.3505	0.3173	0.2875	0.2607	0.2366	0.2149	0.1954	0.1778	0.1619	0.1476	0.1346	0.0859	0.0558
12	0.5568	0.4970	0.4440	0.3971	0.3555	0.3186	0.2858	0.2567	0.2307	0.2076	0.1869	0.1685	0.1520	0.1372	0.1240	0.1122	0.0687	0.0429
13	0.5303	0.4688	0.4150	0.3677	0.3262	0.2897	0.2575	0.2292	0.2042	0.1821	0.1625	0.1452	0.1299	0.1163	0.1042	0.0935	0.0550	0.0330
14	0.5051	0.4423	0.3878	0.3405	0.2993	0.2633	0.2320	0.2046	0.1807	0.1597	0.1413	0.1252	0.1110	0.0986	0.0876	0.0779	0.0440	0.0254
15	0.4810	0.4173	0.3625	0.3152	0.2745	0.2394	0.2090	0.1827	0.1599	0.1401	0.1229	0.1079	0.0949	0.0835	0.0736	0.0649	0.0352	0.0195
16	0.4581	0.3937	0.3387	0.2919	0.2519	0.2176	0.1883	0.1631	0.1415	0.1229	0.1069	0.0930	0.0811	0.0708	0.0618	0.0541	0.0281	0.0150
17	0.4363	0.3714	0.3166	0.2703	0.2311	0.1978	0.1696	0.1456	0.1252	0.1078	0.0929	0.0802	0.0693	0.0600	0.0520	0.0451	0.0225	0.0116
18	0.4155	0.3503	0.2959	0.2503	0.2120	0.1799	0.1528	0.1300	0.1108	0.0946	0.0808	0.0691	0.0592	0.0508	0.0437	0.0376	0.0180	0.0089
19	0.3957	0.3305	0.2765	0.2317	0.1945	0.1635	0.1377	0.1161	0.0981	0.0829	0.0703	0.0596	0.0506	0.0431	0.0367	0.0313	0.0144	0.0068
20	0.3769	0.3118	0.2584	0.2146	0.1784	0.1486	0.1240	0.1037	0.0868	0.0728	0.0611	0.0514	0.0433	0.0365	0.0308	0.0261	0.0115	0.0053

EXHIBIT 12.4

Table of Discontinued Cash Flows

amount of money at the end of four years from now at a 10 percent interest (discount) rate is worth only 68.3 percent of that amount right now. Let us prove this by taking our $292.84 amount at the end of year 0004 from Exhibit 12.3 and discounting it back to the present:

$292.82 × 0.683 = $200.00

We know $200 is the right answer because it is the amount we started with in our illustration of compounding interest in Exhibit 12.3. To illustrate with another example, assume we have a piece of equipment that a supplier suggests will probably have a trade-in value of $1,200 five years from now. At a 12 percent interest rate, what is the present value of $1,200?

$1,200 × 0.5674 = $680.88

The factor (multiplier) of 0.5674 was obtained from Exhibit 12.4 on the year-5 line under the 12 percent column. The factors in Exhibit 12.4 are based on the assumption that the money is all received in a lump sum on the last day of the year. This is not normally the case in reality, since outflows of cash for expenses (e.g., wages, supplies, and maintenance) occur continuously or periodically throughout its life and not just at the end of each year. Although continuous discounting is feasible, for most practical purposes the year-end assumption, using the factors from Exhibit 12.4, will give us solutions that are acceptable for decision making.

For a series of annual cash flows, one simply applies the related annual discount factor for that year to the cash inflow for that year. For example, a cash inflow of $1,000 a year for each of three years using a 10 percent factor will give us the following total discounted cash flow:

Year	*Factor*	*Amount*	*Total*
1	0.9091	$1,000	$ 909.10
2	0.8264	1,000	826.40
3	0.7513	1,000	751.30
			$2,486.80

In this illustration, the cash flows are the same each year. Alternatively, in the case of equal annual cash flows, one can total the individual discount factors (in our case, this would be 0.9091 + 0.8264 + 0.7513 = 2.4868) and multiply this total by the annual cash flow:

2.4868 × $1,000 = $2,486.80

Special tables have been developed from which one can directly read the combined discount factor to be used in the case of equal annual cash flows, but

they are not included in this chapter because Exhibit 12.4 will be sufficient for our needs.

NET PRESENT VALUE

The equation for calculating the **net present value (NPV)** of an investment is

$$\text{NPV} = A_0 + \frac{A_1}{1+i} + \frac{A_2}{(1+i)^2} + \cdots + \frac{A_n}{(1+i)^n}$$

where A_1 through A_n are the individual annual cash flows for the life of the investment, and i is the interest or discount rate being used. A_0 is the initial investment. Although it is possible with this formula to arrive at an NPV investment decision, it is much easier to use the table of discount factors illustrated in Exhibit 12.4. For example, Exhibit 12.5 gives projections of savings and costs for two machines. Machine A has an investment cost of $10,000; Machine B an investment cost of $9,400. Estimating the future savings and costs is the most difficult part of the exercise. In our case, we are forecasting for five years. We have to assume the figures are as accurate as they can be. Obviously, the longer the period, the less accurate the estimates are likely to be.

Note that depreciation for each machine is calculated as follows:

	Machine A	*Machine B*
Initial cost	$10,000	$9,400
Residual (trade-in, scrap) value	(1,000)	(200)
	$ 9,000	$9,200
Depreciation, straight line	$\frac{\$9{,}000}{5} = \underline{\$1{,}800}$ per yr.	$\frac{\$9{,}200}{5} = \underline{\$1{,}840}$ per yr.

The **trade-in,** or **scrap, value** is a partial recovery of our initial investment and is, therefore, added in as a positive cash flow at the end of year 5 in Exhibit 12.5. Note that depreciation is deductible as an expense for the calculation of income tax, but this expense does not require an outlay of cash year by year. Therefore, to convert our annual additional net income (saving) from the investment to a cash situation, the depreciation is added back each year.

The data we are interested in from Exhibit 12.5 are the initial investment figures and the annual net cash flow figures for each machine. These figures have been transferred to Exhibit 12.6 and, using the relevant 10 percent discount factors from Exhibit 12.4, have been converted to a net present value basis.

Exhibit 12.6 shows that from a purely cash point of view, Machine A is a better investment than Machine B: $5,437 net present value against $5,107. In this example, both net present value figures were positive. It is possible for a

Machine A (Investment Cost $10,000)					
	Year 1	***Year 2***	***Year 3***	***Year 4***	***Year 5***
Saving (wages)	$8,000	$8,000	$8,000	$8,000	$8,000
Expenses					
Initial training cost	$3,500				
Maintenance contract	900	$ 900	$ 900	$ 900	$ 900
Special overhaul			750		
Supplies	1,300	1,300	1,300	1,300	1,300
Depreciation	1,800	1,800	1,800	1,800	1,800
Total expenses	$7,500	$4,000	$4,750	$4,000	$4,000
Saving less expenses	$ 500	$4,000	$3,250	$4,000	$4,000
Income tax 30%	(150)	(1,200)	(975)	(1,200)	(1,200)
Net Income	$ 350	$2,800	$2,275	$2,800	$2,800
Add back depreciation	1,800	1,800	1,800	1,800	1,800
					$4,600
Add scrap value					1,000
Net Cash Flow	$2,150	$4,600	$4,075	$4,600	$5,600

Machine B (Investment Cost $9,400)					
	Year 1	***Year 2***	***Year 3***	***Year 4***	***Year 5***
Saving (wages)	$8,000	$8,000	$8,000	$8,000	$8,000
Expenses					
Initial training cost	$3,000				
Maintenance contract	850	$ 850	$ 850	$ 850	$ 850
Special overhaul			500		
Supplies	1,700	1,700	1,700	1,700	1,700
Depreciation	1,840	1,840	1,840	1,840	1,840
Total expenses	$7,390	$4,390	$4,890	$4,390	$4,390
Saving less expenses	$ 610	$3,610	$3,110	$3,610	$3,610
Income tax	(183)	(1,083)	(933)	(1,083)	(1,083)
Net Income	$ 427	$2,527	$2,177	$2,527	$2,527
Add back depreciation	1,840	1,840	1,840	1,840	1,840
					$4,367
Add scrap value					200
Net Cash Flow	$2,267	$4,367	$4,017	$4,367	$4,567

EXHIBIT 12.5

Calculation of Annual Net Cash Flows for Each Machine

	Machine A					Machine B				
Year	Net Cash Flow	×	Discount Factor	=	Present Value	Net Cash Flow	×	Discount Factor	=	Present Value
1	$2,150	×	0.9091	=	$ 1,955	$2,267	×	0.9091	=	$ 2,061
2	4,600	×	0.8264	=	3,801	4,367	×	0.8264	=	3,609
3	4,075	×	0.7513	=	3,062	4,017	×	0.7513	=	3,018
4	4,600	×	0.6830	=	3,142	4,367	×	0.6830	=	2,983
5	5,600	×	0.6209	=	3,477	4,567	×	0.6209	=	2,836
Total present value					$15,437					$14,507
Less: Initial investment					(10,000)					(9,400)
Net present value					$ 5,437					$ 5,107

EXHIBIT 12.6

Conversion of Annual Cash Flows to Net Present Values

net present value figure to be negative if the initial investment exceeds the sum of the individual years' present values. If the NPV is negative, the investment should not be undertaken since, assuming the figures are accurate, the investment will not produce the rate of return desired.

Finally, the discount rate actually used should be realistic. It is frequently the rate that owners and/or investors expect the company to earn, after taxes, on investments.

INTERNAL RATE OF RETURN

As we have seen, the NPV method uses a specific discount rate to determine if proposals result in a net present value greater than zero. Those that do not exceed zero are rejected.

The **internal rate of return (IRR)** method also uses the discounted cash flow concept. However, this method's approach determines the interest (discount) rate that will equate total discounted cash inflows with the initial investment:

$$IC = \frac{A_1}{1+i} + \frac{A_2}{(1+i)^2} + \cdots + \frac{A_n}{(1+i)^n}$$

where A_1 through A_n are the individual annual cash flows for the life of the investment, i is the interest or discount rate being used, and IC is the investment cost. Although it is possible with this formula to arrive at an IRR investment decision, it is usually easier to use the table of discount factors illustrated in Exhibit 12.4.

For example, suppose a motel owner decided to investigate renting a building adjacent to her motel in order to run it as a coffee shop. It will cost $100,000 to redecorate, furnish, and equip the building with a guaranteed five-year lease. The projected cash flow (net income after tax, with depreciation added back) for each of the five years is

Projected Annual Cash Flow	
Year 1	$ 18,000
Year 2	20,000
Year 3	22,000
Year 4	25,000
Year 5	30,000
	$115,000

In addition to the total of $115,000 cash recovery over the five years, it is estimated the equipment and furnishings could be sold for $10,000 at the end of the lease period. The total cash recovery is therefore $125,000, which is $25,000 more than the initial investment required of $100,000. On the face of it, the motel owner seems to be ahead of the game. If the annual cash flows are discounted back to their net present value, a different picture emerges, as illustrated in Exhibit 12.7.

Exhibit 12.7 shows that the future stream of cash flows discounted back to today's values using a 12 percent rate is less than the initial investment by almost $14,000. Thus, we know that if the projections about the motel restaurant

Year	*Annual Flow*	×	*Discount Factor 12%*	=	*Present Value*
1	$18,000	×	0.8929	=	$ 16,072
2	20,000	×	0.7972	=	15,944
3	22,000	×	0.7118	=	15,660
4	25,000	×	0.6355	=	15,888
5	30,000	×	0.5674	=	17,022
Sale of equipment and furniture	10,000	×	0.5674	=	5,674
Total present value					$ 86,260
Less: Initial investment					(100,000)
Net present value (negative)					$(13,740)

EXHIBIT 12.7

Annual Cash Flows Converted to Net Present Value

are correct, there will not be a 12 percent cash return on the investment. The IRR method determines the rate to be earned if the investment is made. From Exhibit 12.7, we know that 12 percent is too high. By moving to a lower rate of interest, we will eventually, by trial and error, arrive at one where the net present value (the difference between total present value and initial investment) is virtually zero. This is illustrated in Exhibit 12.8 with a 7 percent interest (discount) rate.

Exhibit 12.8 tells us that the initial $100,000 investment will return the initial cash outlay except for $157 ($100,000 − $99,843) and earn 7 percent on the investment. Or, stated slightly differently, the motel operator would recover the full $100,000, but earn slightly less than 7 percent interest. If the motel owner is satisfied with a 7 percent cash return on the investment (*note,* this is 7 percent after income tax), then she could go ahead with the project.

A mathematical technique known as interpolation could be used for determining a more exact rate of interest, but since our cash flow figures are estimates to begin with, the value of knowing the exact interest rate is questionable. In most practical situations, knowing the expected interest rate to the nearest whole number is probably good enough for decision-making purposes.

NET PRESENT VALUE VERSUS INTERNAL RATE OF RETURN

Despite the difference in approach used by the NPV and IRR methods, they will usually give the same accept or reject decision for any single project. However, if a number of proposals that were mutually exclusive were being evaluated and were being ranked, the rankings from NPV might differ from the rankings from IRR. A mutually exclusive alternative means that, if only one of a number is accepted, the others will be rejected. For example, if a restaurant were assessing

Year	*Annual Cash Flow*	×	*Discount Factor 7%*	=	*Present Value*
1	$18,000	×	0.9346	=	$16,823
2	20,000	×	0.8734	=	17,468
3	22,000	×	0.8163	=	17,959
4	25,000	×	0.7629	=	19,073
5	30,000	×	0.7130	=	21,390
Sale of equipment and furniture	10,000	×	0.7130	=	7,130
Total present value					$99,843

EXHIBIT 12.8

Discount Factor Arrived at by Trial and Error

a number of different electronic registers and only one was to be selected, it would want to select the most profitable one and reject all others, even if the others were profitable. In this sense, *profitable* could mean reduction in costs from current levels.

Another situation where profitable proposals are rejected is when the company is faced with capital rationing. **Capital rationing** means that there is only sufficient capital to accept a limited number of investments for the budget period. Once the money available for the capital budget has been exhausted, all other proposals, even if profitable, are postponed for reconsideration during some future budget period.

Therefore, at times, the ranking of projects in order of potential profitability is important if a company wishes to maximize the profitability from its investment. Unfortunately, the NPV and IRR results can indicate a conflict in their ranking of profitability because of differences in the cost of, and/or differences in the timing of, cash flows from alternative investments.

To illustrate this, refer to Exhibit 12.9, which shows two alternative investments, each with the same initial cost, but different amounts of cash flow, differences in the timing of cash flow amounts, and differences in total cash flow

	Alternative A			*Alternative B*		
Net Present Value	***Annual Cash Flow***	***Discount Factor 10%***	***Present Value***	***Annual Cash Flow***	***Discount Factor 10%***	***Present Value***
Year 1	$ 3,000	0.9091	$ 2,727	$7,000	0.9091	$ 6,364
Year 2	3,000	0.8264	2,479	4,000	0.8264	3,306
Year 3	3,000	0.7513	2,254	3,000	0.7513	2,254
Year 4	10,000	0.6830	6,830	3,000	0.6830	2,049
Total present value			$14,290			$13,973
Less: Initial cost			(10,000)			(10,000)
Net present value			$ 4,290			$ 3,973
Internal Rate of Return	***Annual Cash Flow***	***Discount Factor 25%***	***Present Value***	***Annual Cash Flow***	***Discount Factor 31%***	***Present Value***
Year 1	$ 3,000	0.8000	$ 2,400	$7,000	0.7634	$ 5,344
Year 2	3,000	0.6400	1,920	4,000	0.5827	2,331
Year 3	3,000	0.5120	1,536	3,000	0.4448	1,334
Year 4	10,000	0.4096	4,096	3,000	0.3396	1,019
Total present value			$ 9,952			$10,028
Initial cost			$10,000			$10,000

EXHIBIT 12.9

Two Investment Alternatives and Their Respective NPV and IRR Ranking Results

amounts. Using the NPV method at 10 percent and the IRR method, the ranking decision is contradictory. Alternative A is preferable from an NPV point of view ($4,290 to $3,973), whereas Alternative B is preferable using IRR (31 percent to 25 percent).

The reason for this is that the NPV method assumes annual cash inflows are reinvested at the rate used, in our case 10 percent, for the balance of the life of the project. The IRR method assumes that the cash inflows are reinvested at the rate resulting from IRR analysis (in our case 25 percent and 31 percent for Alternatives A and B, respectively) for the balance of the life of the project, an assumption that may not be realistic.

Theoretically, the NPV method is considered the better method because it uses the same discount rate for alternative proposals, and that rate would normally represent the minimum rate acceptable for investments to be made by the company. However, proponents of the IRR method contend that it is easier to interpret, does not require the predetermination of a discount rate, and allows a more meaningful comparison of alternatives.

CAPITAL INVESTMENT CONTROL

One of the major difficulties in capital investment decision making is that it is only possible to approximate the investment rate to be achieved. Investment proposals are based on estimated cash flows, and the decisions based on those cash flows can only be judged as good or otherwise after actual cash flows are known. A review of all investment proposals is, thus, recommended at the end of each project's life. In this way, among other benefits, the process of forecasting cash flows can be reviewed and refined so that future investment decisions can be based on potentially more accurate figures.

INVESTMENT AND UNCERTAINTY

In this chapter, we ignored the risk factor in investments, or we assumed that the risk of alternative investments was equal and was built into the discount or investment rates used. **Risk** is defined as the possible deviation of actual cash flows from those forecast. Also, in the illustrations, only short periods were used: five years or less. As the time grows longer for more major investments (e.g., hotel or restaurant buildings that may have an economic life of 25 years or more), the risk factor must play a more important role. Forecasting cash flows for periods of five years or less is difficult enough. Forecasting for periods in excess of that is increasingly more difficult, and the risks, thus, become much greater.

Although there are techniques, such as the use of probabilities, that can be used to deal with risk, they are quite theoretical and might be difficult to use in practice. Thus, we will not discuss them in this text. However, this does not imply that the business manager should ignore risk, since it does exist. The interested reader wishing to gain more insight into techniques available to encompass risks, or uncertainty, is referred to any of the excellent textbooks available on general managerial finance.

NONQUANTIFIABLE BENEFITS

The results obtained using investment decision techniques may not be the only information needed to make decisions. Some information is not easily quantifiable but is still relevant to decision making. One should not ignore such factors as prestige, goodwill, reputation, employee acceptability, and the social or environmental implications. For example, if a hotel redecorates its lobby, what are the cash benefits? They may be difficult to quantify, but to retain customer goodwill, the lobby may need to be redecorated. Similarly, how are the relative benefits to be assessed in spending $50,000 on improvements to the staff cafeteria or using the $50,000 for Christmas bonuses? Personal judgment must then come into play in such investment decisions.

CHOOSING WHETHER TO OWN OR LEASE

Until this point, the discussion concerning long-term, or fixed, assets has been based on purchasing, and owning them. However, there may be situations where renting or leasing is favorable from a cost point of view. For example, income tax is a consideration. On one hand, lease payments are generally tax deductible, so there can be an advantage in leasing. On the other hand, ownership permits deduction for tax purposes of both depreciation and the interest expense on any debt financing of the purchase. What may be advantageous in one situation may be disadvantageous in another. Each case must be investigated on its own merits. Let us look at a method by which a comparison between the two alternatives can be made. Assume that we are considering whether to buy or rent new furnishings for a motel.

Purchase of the furniture will require a $125,000 loan from the bank. Cost of the furniture is $125,000. The bank loan has an 8 percent interest rate and the principal will be repayable in four equal annual installments of principal ($31,250 per year). The furniture will be depreciated over five years at $25,000 per year. It is assumed to have no trade-in value at the end of that period. The

Year	*Interest at 8%*	*Principal Amount*	*Balance*
1	$10,000	$31,250	$93,750
2	7,500	31,250	62,500
3	5,000	31,250	31,250
4	2,500	31,250	-0-

EXHIBIT 12.10

Bank Repayment Schedule for $125,000

income tax rate is 50 percent. Alternatively, the furniture can be leased for five years at a rental of $30,000 per year.

First, with the purchase plan, we must prepare a bank repayment schedule showing principal and interest payments for each of the four years (see Exhibit 12.10). Next, under the purchase plan we must calculate the net cash outflow for each of the five years. This is shown in Exhibit 12.11. In Exhibit 12.11, note that since depreciation and interest expense are tax deductible and since the motel is in a 50 percent tax bracket, there is an income tax saving equal to 50 percent of these expenses. Thus, in year 1, the expenses of $35,000 are offset by the $17,500 tax saving. The net cost, after tax, is therefore only $17,500. This $17,500 has to be increased by the principal repayment of $31,250 on the bank loan and reduced by the depreciation expense of $25,000, since depreciation does not require an outlay of cash. In year 1, the net cash outflow is thus $23,750. Figures for the other years are calculated similarly. Note that in year 5, since there is no interest expense and bank loan payment to be made, the cash flow is positive rather than negative.

	Year 1	*Year 2*	*Year 3*	*Year 4*	*Year 5*
Interest expense (from Exhibit 12.10)	$10,000	$ 7,500	$ 5,000	$ 2,500	-0-
Depreciation expense	25,000	25,000	25,000	25,000	25,000
Total tax deductible expense	$35,000	$32,500	$30,000	$27,500	$25,500
Income tax saving (50%)	(17,500)	(16,250)	(15,000)	(13,750)	(12,750)
After-tax cost	$17,500	$16,250	$15,000	$13,750	$12,750
Add: principal payments	31,250	31,250	31,250	31,250	-0-
Deduct: depreciation expense	(25,000)	(25,000)	(25,000)	(25,000)	(25,000)
Net annual cash outflow (inflow)	$23,750	$22,500	$21,250	$20,000	($12,250)

EXHIBIT 12.11

Annual Net Cash Outflows with a Purchase

	Year 1	*Year 2*	*Year 3*	*Year 4*	*Year 5*
Rental expense	$30,000	$30,000	$30,000	$30,000	$30,000
Income tax saving 50%	(15,000)	(15,000)	(15,000)	(15,000)	(15,000)
Net cash outflow	$15,000	$15,000	$15,000	$15,000	$15,000

EXHIBIT 12.12

Annual Cash Outflows with a Rental

Exhibit 12.12 shows the calculation of annual net cash outflows under the rental plan. Note that under the rental option there is no depreciation expense (since the motel does not own the furnishings) and no interest or principal payments (since no money is borrowed).

Finally, the net cash flow figures from Exhibits 12.11 and 12.12 have been transferred to Exhibit 12.13 and discounted, using the appropriate discount factor from Exhibit 12.4. The discount rate used is 8 percent. This rate was selected because it is the current cost of borrowing money from the bank. Exhibit 12.13 shows that from a present value point of view it would be better to rent in this particular case, since total present value of cash outflows is lower by $4,450 ($64,339 − $59,889).

In any buy-or-lease situation, other factors could be taken into the calculations. For example, in the purchase option, a firm might use some of its own cash as a down payment and borrow less than the full purchase amount required. In such a case, the down payment is an additional cash outflow at the beginning of the first year. Under a purchase plan, there might also be a trade-in value at the end of the period. This trade-in amount would be handled in the calculations as

	Purchase					*Rental*				
Year	*Annual Cash Outflow (Inflow)*		*Discount Factor 8%*		*Present Value*	*Annual Cash Outflow*		*Discount Factor 8%*		*Present Value*
1	$23,750	×	0.9259	=	$21,990	$15,000	×	0.9259	=	$13,888
2	22,500	×	0.8573	=	19,289	15,000	×	0.8573	=	12,860
3	21,250	×	0.7938	=	16,868	15,000	×	0.7938	=	11,907
4	20,000	×	0.7350	=	14,700	15,000	×	0.7350	=	11,025
5	(12,500)	×	0.6806	=	(8,508)	15,000	×	0.6806	=	10,209
Total present value					$64,339	*Total present value*				$59,889

EXHIBIT 12.13

Total Present Values Converted from Exhibits 12.11 and 12.12

a cash inflow at the end of the period. In a rental plan, the annual payment might be required at the beginning of each year, rather than at the end, as was assumed in our illustration. This means that the first rental payment is at time zero, and each of the remaining annual payments is advanced by one year. Under a rental plan, there might also be a purchase option to the lessee at the end of the period. If the purchase is exercised, it will create an additional cash outflow.

Furthermore, terms on borrowed money can change from one situation to another, and different depreciation rates and methods can be used. For example, the use of an accelerated depreciation method will give higher depreciation expense in the earlier years, thus reducing income tax and increasing the cash flow in those years.

Because of all these and other possibilities, each buy-or-lease situation must be investigated on its own merits, taking all the known variables into consideration before a decision is made.

COMPUTER APPLICATIONS

Computers can readily handle the calculations necessary for investment decisions. For example, spreadsheet programs can be used to handle all of the calculations required for the ARR, NPV, and IRR investment methods, and can indicate the preferable investment option. Once the spreadsheet has been programmed with the correct formulas, it can be used repeatedly to eliminate the time it takes to perform the calculations manually. Spreadsheets have built in functions to calculate NPV and IRR.

A spreadsheet program can also be used to perform all the calculations necessary in a buy or lease situation.

SUMMARY

Capital asset management concerns decision making about whether to make a specific investment or which alternative investments would be best. Capital assets are assets with a long life that have a relatively high cost and about which future costs and benefits are uncertain.

Four methods of analyzing capital asset investments were illustrated: accounting rate of return (ARR), payback period, net present value (NPV), and internal rate of return (IRR). The equation for the ARR is

$$\frac{\textbf{Net annual saving}}{\textbf{0.5} \times \textbf{(Initial investment + Salvage)}}$$

The disadvantage of this method is that it is based on accounting income rather than on cash flow.

The payback period method is based on cash flow:

$$\frac{\textbf{Initial investment}}{\textbf{Net annual cash saving}}$$

The disadvantage of the payback period method is that it ignores what happens beyond the payback period. Both the ARR and the payback period methods also share a common fault. They do not take into consideration the time value of money. Discounted cash flow tables (the reverse of compound interest tables) have been developed so that flows of future cash can be readily discounted back to today's values. The NPV and IRR methods make use of these tables.

With NPV, the initial investment is deducted from the total present value of future cash flows to obtain NPV. If the NPV is positive, the investment is favorable; if negative, the investment should not be made.

With IRR, one simply uses the tables to determine the rate of interest (rate of return) that will equate the total future discounted cash inflows with the initial investment. If the rate of return is higher than the company has established as a minimum desired return, then the investment should proceed; otherwise, it should not.

Both the NPV and IRR methods will usually give the same accept or reject decision for any specific investment. However, if a number of alternative projects were being evaluated, the rankings might differ.

Regardless of the investment method used, subsequent to each investment, the results should be reviewed so that the investment process can be refined and improved.

Finally, one should not ignore the potential nonquantifiable benefits of each particular investment. There may be situations where it is preferable to rent or lease rather than purchase long-term assets. Cash flows under both alternatives can be discounted back to their present values to make a comparison. In each situation, all the known variables must be taken into consideration so that the final decision can be made on its own merits.

DISCUSSION QUESTIONS

1. Discuss the ways in which long-term asset management differs from day-to-day budgeting.
2. How is the accounting rate of return calculated? What is the major disadvantage of using this method?
3. What is the equation for calculating the payback period? What are the pros and cons of this method?

4. Under what conditions might a hotel consider buying an item of equipment with a rapid payback rather than one with a high accounting rate of return?
5. Discuss the concept that money is worth more now than that same amount of money a year from now.
6. How would you explain discounted cash flow to someone who had not heard the term before?
7. In Exhibit 12.4, in the 11 percent column opposite year 5, is the number 0.5935. Explain in your own words what this number or factor means.
8. If an investment requires an outlay today of $10,000 cash and, over the five-year life of the investment, total cash returns were $12,000, and the $12,000 had a present value of $9,500, would you make the investment? Explain.
9. Contrast the NPV and the IRR methods of evaluating investment proposals.
10. Under what circumstances might NPV and IRR give conflicting decisions in the ranking of proposed investments?
11. Landscaping for a resort hotel is an investment for which the benefits might be difficult to quantify. In what ways might you be able to quantify them? Even if investment analysis (for example, NPV) proved negative, what other considerations might dictate that the investment be made?
12. What factors, other than purely monetary factors, might one want to consider in a buy-versus-rent decision?

ETHICS SITUATION

The manager of a hotel has the permission of the owner to have a new swimming pool built. The manager contacts three companies for bids to do this construction work. The highest bidder has told the manager that if his bid is accepted he will also install a swimming pool at the manager's house at a 25 percent discount. The manager agrees to accept this offer and justifies the decision by believing that the higher swimming pool cost to the hotel will provide a larger depreciation expense amount. This, in turn, will reduce the income tax that the hotel has to pay and therefore provide the hotel with more working capital. Discuss the ethics of this situation.

EXERCISES

E12.1 Assume you are given the following information regarding a point-of-sale computer terminal: The net annual saving was calculated to be $2,000 on an average investment cost of $4,500. What is the accounting rate of return (ARR) on the terminal?

E12.2 Information is provided on two machines, which had an original cost of $25,800 for Machine X and $24,200 for Machine Y.

	Machine X	*Machine Y*
Net annual saving	$1,440	$3,600
Add: Depreciation	4,500	4,200
Net annual cash saving	$5,940	$7,800

a. Which is the best investment using the payback period method?

b. Will either of the machines provide the cash investment back in less than four years?

E12.3 Investment in an item of equipment is $18,000. It has a five-year life and no salvage value and straight-line depreciation is used. The equipment is expected to provide an annual saving of $2,000, which does not include depreciation. What is the payback period?

E12.4 What is the net present value of $2,125 for each year of two years with a discount factor of 0.8929 in year 1 and 0.7972 in year 2?

E12.5 Assume an item of equipment is purchased at a cost of $22,500 to be paid for over five years, requiring a payment on principal of 20 percent per year at an annual interest rate of 10 percent. Complete a repayment schedule for each of the five years.

PROBLEMS

P12.1 You have the following information about three electronic sales registers that are in the market. The owner of a restaurant asks for your help in deciding which of the three machines to buy.

	Register A	*Register B*	*Register C*
Cash investment required	$6,300	$6,000	$6,700
Estimated machine life	5 Years	5 Years	5 Years
Estimated residual trade-in value (at the end of 5 years)	$ 500	-0-	$ 300
Annual operating costs (excluding depreciation)	$ 400	$ 300	$ 300
Annual savings before deduction of costs	$2,000	$2,000	$2,000

Income tax rate is 30 percent. Assume straight-line depreciation.

a. Use the ARR method to decide which of the three machines would be the best investment.

b. If the restaurant owner wanted a return on investment of at least 10 percent, what would you advise?

P12.2 Using the information provided in Problem 12.1, which would be the best investment using the payback period method? If the owner wanted her cash back in less than four years, should she invest in any of the machines?

P12.3 An investor is planning to open a new fast-food restaurant. He has a five-year lease on a property that would require an investment estimated at $205,000 for redecorating and furnishing. He would use his own cash. The present cost of capital (borrowed money) is 13 percent. Use this figure as the discount rate.

Calculation of net cash flow from the restaurant for the five years of operation shows

Year	*Cash Flow*
1	$37,500
2	43,800
3	46,300
4	50,000
5	60,000

At the end of the lease, the furniture and equipment would have a cash value of $18,500. Should he make the investment? What IRR comes closest to giving him a complete return on his $205,000 investment?

P12.4 Dinah, the operator of Dinah's Diner, wishes to choose between two alternative investments providing the following annual net cash inflows over the five-year investment period:

Year	*Alternative 1*	*Alternative 2*
1	$8,000	$ 4,200
2	8,600	5,800
3	8,800	8,500
4	8,200	11,500
5	4,100	12,100

a. Calculate the payback time for each alternative, assuming an initial investment of $33,000 under each alternative.

b. Using NPV at 12 percent, would either of them be a good investment for Dinah?

P12.5 A hotel manager wishes to choose between two alternative investments giving the following annual net cash inflows over a five-year period:

Year	*Alternative 1*	*Alternative 2*
1	$ 8,400	$24,200
2	11,600	19,800
3	17,000	17,200
4	23,000	10,800
5	24,000	8,000

The amount of the investment under either alternative will be $70,000.

a. Using the payback period method, in which year, under both alternatives, will she have recovered the initial investment?

b. Using NPV at 10 percent, would either alternative be a good investment?

P12.6 A restaurant operator wishes to choose between two alternative roll-in storage units. Machine A will cost $9,000 and have a trade-in value at the end of its five-year life of $1,500. Machine B will cost $8,500 and at the end of its five-year life will have a trade-in value of $700. Assume straight-line depreciation.

Investment in the machine will mean that a part-time kitchen worker will not be required, and there will be an annual wage saving of $9,600. The following will be the operating costs, excluding depreciation, for each machine, for each of the five years.

	Machine A					*Machine B*				
Year	*1*	*2*	*3*	*4*	*5*	*1*	*2*	*3*	*4*	*5*
Training	$800					$700				
Maintenance	750	$750	$750	$750	$750	650	$650	$650	$650	$650
Overhaul			$550					400		
Supplies	300	300	300	300	300	500	500	500	500	500
Electricity	100	100	100	100	100	100	100	100	100	100

Income tax rate is 30 percent. For each machine, calculate the NPV by using a 12 percent rate. Ignoring any other considerations, which machine would be the preferable investment?

P12.7 Pete's Pizza is planning to purchase a new type of oven that cooks pizza much faster than the conventional oven now used. The new oven is estimated to cost $20,000 (use straight-line depreciation) and will have a five-year life, after which it will be traded in for $4,000. Pete has calculated that the new oven will allow him to increase his sales by $30,000 a year. His food cost is 30 percent, labor cost is 40 percent, and other costs are 10 percent of sales revenue. Tax rate is 40 percent. For any new investment, Pete wants a minimum 12 percent return. Use IRR to help him decide if he should purchase the new oven.

P12.8 You have to make a decision either to buy or to rent the equipment for your restaurant. Purchase cost would be $30,000. Of this amount, $7,500 would be paid cash now, and the balance would be owed to the equipment supplier. The owner agrees to accept $4,500 a year for five years as payment toward the principal, plus interest at 10 percent. The equipment will have a five-year life, at the end of which it can be sold for $5,000. Calculate depreciation on a straight-line basis over the five years. Alternatively, the equipment can be rented for the five years at a rental cost of $7,000 a year. Income tax rate is 30 percent. Discount rate is 8 percent.

a. Using discounted cash flow, which would be the better investment?

b. What other factors might you want to consider that would change your decision?

P12.9 Pizza Restaurant provides a delivery service and is considering purchasing a new compact vehicle or leasing it. Purchase price would be $13,500 (cash), which the restaurant has. Estimated life is five years. Residual (trade-in) value is $2,500.

Under the purchase plan, the additional net cash income (increased revenue less additional costs such as vehicle maintenance and driver's wages) before deducting depreciation and income tax would be as follows:

Year	*Cash Revenue Less Cash Costs*
1	$38,000
2	47,000
3	55,000
4	60,000
5	65,000

Depreciation will be straight-line. Income tax rate is 30 percent. Under the rental plan the cash income will be the same as under the purchase plan, except that vehicle maintenance will not be required (the leasor pays for this). Therefore, the given net cash income figures will have to be increased by the following maintenance amount savings:

Year	*Amount*
1	$1,000
2	2,500
3	2,500
4	4,000
5	5,000

However, under the rental plan, there is a rental cost based on mileage. Estimated mileage figures follow:

Year	*Mileage*
1	30,000
2	45,000
3	50,000
4	55,000
5	60,000

Rental cost is $0.30 per mile. Income tax rate will be 30 percent.

a. On a net present value basis using a 10 percent rate, would it be better to rent or buy?

b. Would your answer change if the rental cost were $1,000 a year plus $0.30 a mile? Explain your decision.

P12.10 For many years, a motor hotel has been providing its room guests with room service of soft drinks and ice, using the services of a part-time bellhop to deliver to the rooms. Typically, the service has been losing money. The average figures for each of the past few years are as follows:

Sales revenue:	Soft drinks	$25,550	
	Ice	2,400	$27,950
Expenses:	Cost of sales	$12,200	
	Labor	17,900	(30,100)
Loss:			($ 2,150)

The motor hotel has an offer from a soft drink vending company to install vending machines at no cost to the motor hotel. The vending company would collect the sales revenue (forecast to be as above for the next several years) from the soft drink machines, paying the motor hotel a commission of 10 percent on that revenue. Customers would help themselves to both soft drinks (by inserting cash in the machine) and ice (which would be free), thus eliminating the labor cost.

An ice machine would have to be purchased by the motor hotel at a cost of $7,000. It would have a five-year life and a trade-in value at the end of that time of $1,000. Use straight-line depreciation. Annual maintenance and operating costs of the ice machine are estimated to be $100 per year. The motor hotel is in a 30 percent tax bracket.

a. Calculate the payback period.

b. Calculate the ARR.

c. Calculate the NPV of the investment using a 12 percent discount factor and state whether the investment should be made.

P12.11 A motel leases out its 1,000-square-foot coffee shop, although it continues to own the equipment. The lease is due for renewal. The motel could continue to rent the space for $2 a square foot per month for the next three years, and then $2.50 a square foot for the following two years.

Alternatively, the motel could cancel this lease and take over the operation of the restaurant. If this occurs, the motel's management estimates that sales revenue in the first year would be $700,000 and that it would increase by $50,000 per year for each of the following four years. Variable operating costs of running the restaurant (food cost, wages, supplies) would be 90 percent of sales revenue. The motel would also have to assume certain other costs currently paid by the lessee for such items as supervision, advertising, and utilities. These are estimated to be $32,000 in year 1, increasing by $2,000 per year for each of the following four years, so that by year 5 the costs will be $40,000.

If the motel resumes operation of the restaurant, it will trade in some of the old equipment, for which it will get $5,000, and buy $40,000 of new equipment (this will not happen if the lease is renewed). The new equipment will have a five-year life and would be depreciated on a straight-line basis with no scrap value.

The motel is in a 25 percent tax bracket. Use NPV to decide whether the motel should operate the coffee shop itself or continue to lease it out. Use a 10 percent discount rate.

CASE 12

a. Early in year 2005, the owner of the building made Charlie an offer. The lease contract has four more years to run and, as you will recall from Case 2, the rent is to be increased by 10 percent a year each year over the preceding year. The rent is payable in equal monthly installments but, for the sake of simplicity, assume it is all paid at year-end. The building owner's offer is that a lump sum payment now (early in January 2005 before the January rent check had been prepared) of $80,000 would be considered as prepaid rent for the remaining four years of the contract. If the offer is accepted, Charlie would borrow $80,000 from the bank. The arrangement with the bank is that $20,000 of the principal will be repaid on December 31 of years 2005 through 2008, with interest at 12 percent on the amount owed at the beginning of each year. Use the interest rate as the discount rate. Should the offer be accepted?

b. You will note in part a that year-end discount tables were used, even though the annual rent was paid each month. If monthly discount tables were available to you and you recalculated the present value with those monthly tables, do you think your decision would change?