Capital Budgeting Decisions

LEARNING OBJECTIVES

After studying this chapter, you should be able to:

1. Determine the acceptability of an investment project using the net present value method.
2. Determine the acceptability of an investment project using the internal rate of return method (with interpolation, if needed).
3. Explain how the cost of capital is used as a screening tool.
4. Prepare a net present value analysis of two competing investment projects using either the incremental-cost approach or the total-cost approach.

LEARNING OBJECTIVES

After studying this chapter, you should be able to:

5. Make a capital budgeting analysis involving automated equipment.
6. Rank investment projects in order of preference using (1) the internal rate of return method and (2) the net present value method with the profitability index.
7. Determine the payback period for an investment.
8. Compute the simple rate of return for an investment.

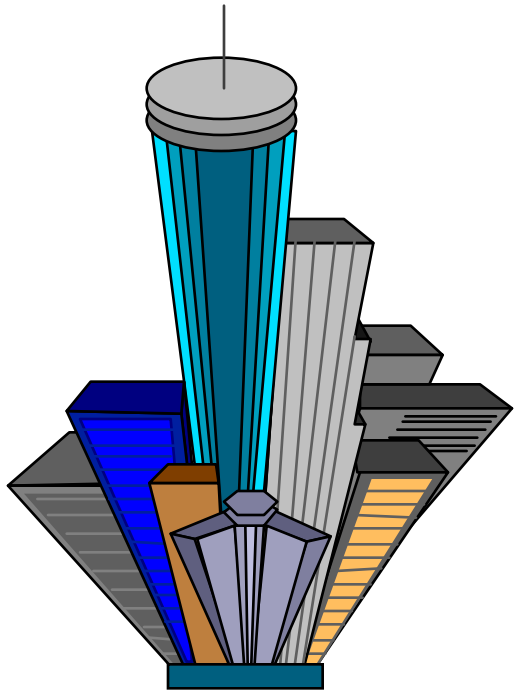
LEARNING OBJECTIVES

After studying this chapter, you should be able to:

9. (Appendix 14A) Explain the concept of present value and make present value computations with and without the present value tables.
10. (Appendix 14B) Explain the effect of inflation on capital budgeting decisions.

Capital Budgeting

Describes how managers plan significant outlays on projects that have long-term implications such as the purchase of new equipment and introduction of new products.



Typical Capital Budgeting Decisions

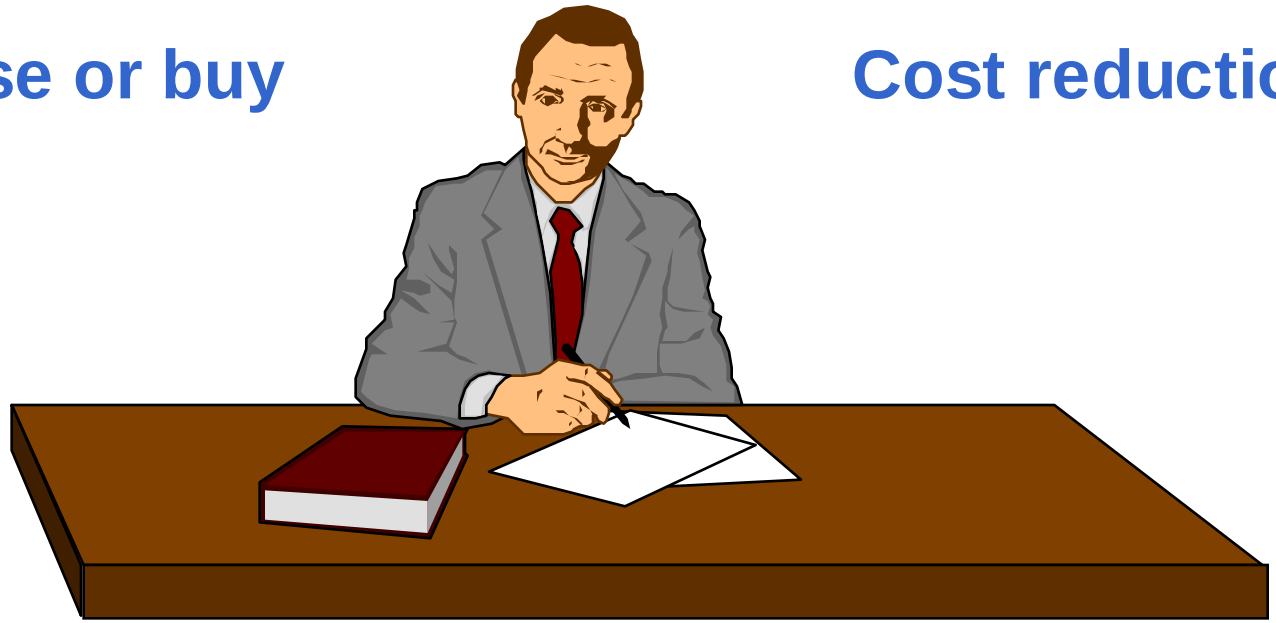
Plant expansion

Equipment selection

Equipment replacement

Lease or buy

Cost reduction

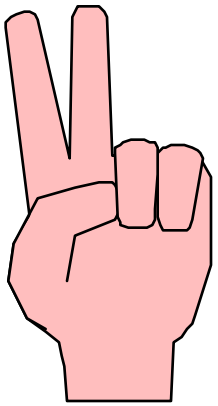


Typical Capital Budgeting Decisions

Capital budgeting tends to fall into two broad categories . . .

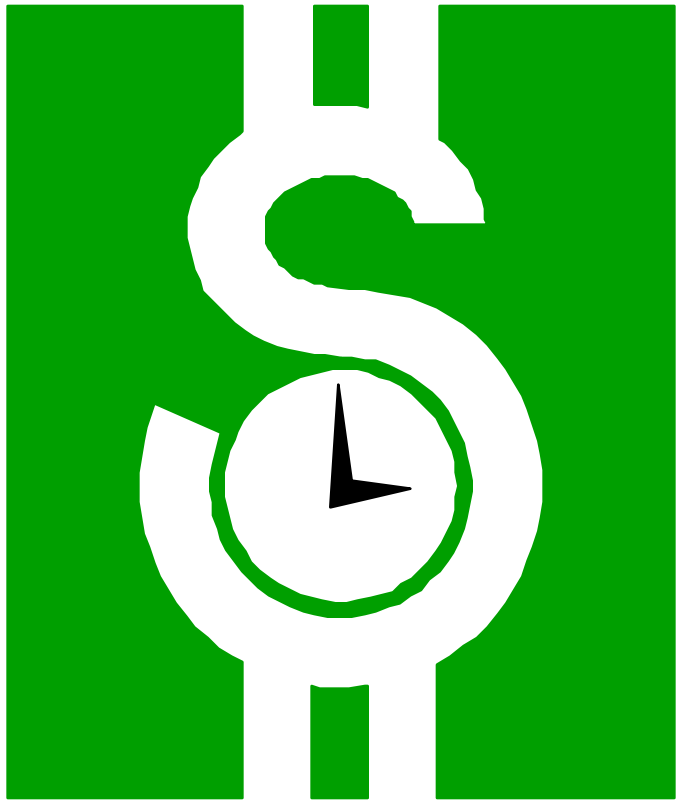
❶**Screening decisions**. Does a proposed project meet some present standard of acceptance?

❷**Preference decisions**. Selecting from among several competing courses of action.



Time Value of Money

- Business investments extend over long periods of time, so we must recognize the time value of money.
- Investments that promise returns earlier in time are preferable to those that promise returns later in time.



Time Value of Money

A bond will pay $100 in two years. What is the present value of the $100 if an investor can earn a return of 12% on the investment?

We can determine the present value factor using the formula or using present value tables.

Time Value of Money

Excerpt from **Present Value of $1** Table in Appendix C of Chapter 14

	Rate		
Periods	**10%**	**12%**	**14%**
1	0.909	0.893	0.877
2	0.826	0.797	0.769
3	0.751	0.712	0.675
4	0.683	0.636	0.592
5	0.621	0.567	0.519

Time Value of Money

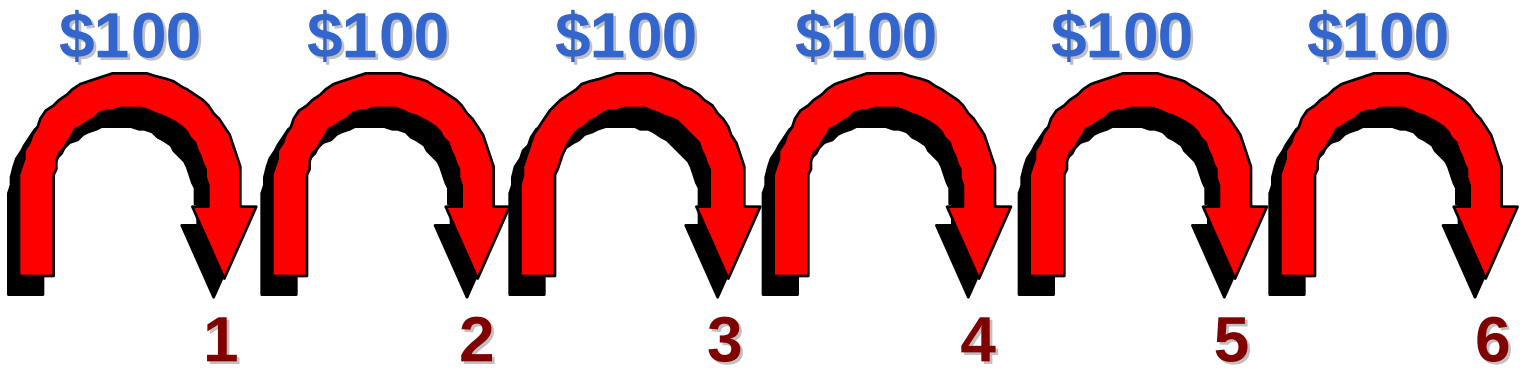
$100 × 0.797 = $79.70 present value

Periods	Rate		
	10%	12%	14%
1	0.909	0.893	0.877
2	0.826	0.797	0.769
3	0.751	0.712	0.675
4	0.683	0.636	0.592
5	0.621	0.567	0.519

Present value factor of $1 for 2 periods at 12%.

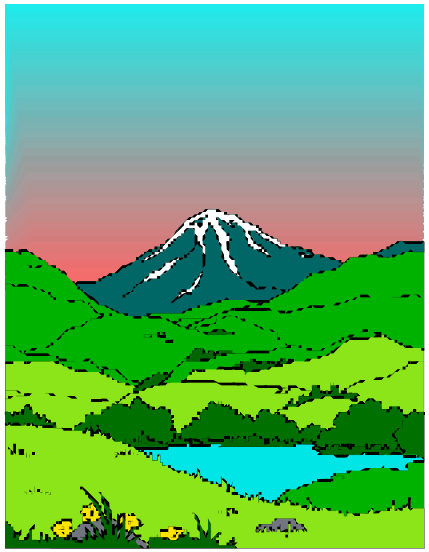
Time Value of Money

An investment that involves a series of identical cash flows at the end of each year is called an annuity.



Time Value of Money

Lacey Company purchased a tract of land on which a $60,000 payment will be due each year for the next five years. What is the present value of this stream of cash payments when the discount rate is 12%?



Time Value of Money

We could solve the problem like this . . .

Look in Appendix C of this Chapter for the Present Value of an Annuity of $1 Table

Periods	10%	12%	14%
1	0.909	0.893	0.877
2	1.736	1.690	1.647
3	2.487	2.402	2.322
4	3.170	3.037	2.914
5	3.791	3.605	3.433

Time Value of Money

We could solve the problem like this . . .

$$\$60{,}000 \times 3.605 = \$216{,}300$$

Periods	10%	12%	14%
1	0.909	0.893	0.877
2	1.736	1.690	1.647
3	2.487	2.402	2.322
4	3.170	3.037	2.914
5	3.791	3.605	3.433

Typical Cash Outflows

Repairs and maintenance

Working capital

Initial investment

Incremental operating costs

Typical Cash Inflows

Salvage value

Release of working capital

Reduction of costs

Incremental revenues

Recovery of the Original Investment

St. Joseph Hospital is considering the purchase of an attachment for its X-ray machine.

Cost	**$3,170**
Life	**4 years**
Salvage value	**zero**
Increase in annual cash flows	**1,000**

No investments are to be made unless they have an annual return of at least 10%.

Should the hospital invest in the attachment?

Recovery of the Original Investment

Item	Year(s)	Amount of Cash Flow	10% Factor	Present Value of Cash Flows
Annual cash inflows	1-4	$ 1,000	3.170	$ 3,170
Initial investment(outflow)	Now	(3,170)	1.000	(3,170)
Net present value				$ -0-

Periods	10%	12%	14%
1	0.909	0.893	0.877
2	1.736	1.690	1.647
3	2.487	2.402	2.322
4	3.170	3.037	2.914
5	3.791	3.605	3.433

Present value of an annuity of $1 table

Recovery of the Original Investment

Item	Year(s)	Amount of Cash Flow	10% Factor	Present Value of Cash Flows
Annual cash inflows	1-4	$ 1,000	3.170	$ 3,170
Initial investment(outflow)	Now	(3,170)	1.000	(3,170)
Net present value				$ -0-

Because the net present value is equal to zero, the attachment investment provides exactly a 10% return.

Recovery of the Original Investment

Amortization is not deducted in computing the present value of a project because . . .

1. It is not a current cash outflow.
2. Discounted cash flow methods **automatically** provide for return of the original investment.

Choosing a Discount Rate

- The firm's **cost of capital** is usually regarded as the most appropriate choice for the discount rate.
- The cost of capital is the average rate of return the company must pay to its long-term creditors and shareholders for the use of their funds.

The Net Present Value Method

To determine net present value we . . .

1. Calculate the present value of cash inflows,
2. Calculate the present value of cash outflows,
3. Subtract the present value of the outflows from the present value of the inflows.

The Net Present Value Method

General decision rule . . .

If the Net Present Value is . . .	Then the Project is . . .
Positive . . .	Acceptable, since it promises a return greater than the required rate of return.
Zero . . .	Acceptable, since it promises a return equal to the required rate of return.
Negative . . .	Not acceptable, since it promises a return less than the required rate of return.

The Net Present Value Method

The Net Present Value Method

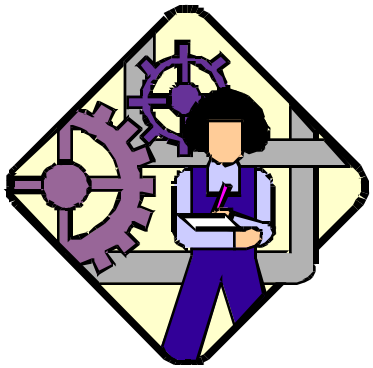
Lester Company has been offered a five-year contract to provide component parts for a large manufacturer.

Cost and revenue information	
Cost of special equipment	$160,000
Working capital required	100,000
Relining equipment in 3 years	30,000
Salvage value of equipment in 5 years	5,000
Annual cash revenue and costs:	
Sales revenue from parts	750,000
Cost of parts sold	400,000
Salaries, shipping, etc.	270,000

The Net Present Value Method

- At the end of five years the working capital will be released and may be used elsewhere by Lester.
- Lester Company uses a discount rate of 10%.

Should the contract be accepted?



The Net Present Value Method

Annual net cash inflows from operations

Sales revenue	$ 750,000
Cost of parts sold	(400,000)
Salaries, shipping, etc.	(270,000)
Annual net cash inflows	$ 80,000

The Net Present Value Method

	Years	Cash Flows	10% Factor	Present Value
Investment in equipment	Now	$ (160,000)	1.000	$ (160,000)
Working capital needed	Now	(100,000)	1.000	(100,000)
Net present value				

The Net Present Value Method

	Years	Cash Flows	10% Factor	Present Value
Investment in equipment	Now	$ (160,000)	1.000	$ (160,000)
Working capital needed	Now	(100,000)	1.000	(100,000)
Annual net cash inflows	1-5	80,000	3.791	303,280
Net present value				

Present value of an annuity of $1 factor for 5 years at 10%.

The Net Present Value Method

	Years	Cash Flows	10% Factor	Present Value
Investment in equipment	Now	$ (160,000)	1.000	$ (160,000)
Working capital needed	Now	(100,000)	1.000	(100,000)
Annual net cash inflows	1-5	80,000	3.791	303,280
Relining of equipment	3	(30,000)	0.751	(22,530)
Net present value				

Present value of $1 factor for 3 years at 10%.

The Net Present Value Method

	Years	Cash Flows	10% Factor	Present Value
Investment in equipment	Now	$ (160,000)	1.000	$ (160,000)
Working capital needed	Now	(100,000)	1.000	(100,000)
Annual net cash inflows	1-5	80,000	3.791	303,280
Relining of equipment	3	(30,000)	0.751	(22,530)
Salvage value of equip.	5	5,000	0.621	3,105
Net present value				

Present value of $1 factor for 5 years at 10%.

The Net Present Value Method

	Years	Cash Flows	10% Factor	Present Value
Investment in equipment	Now	$ (160,000)	1.000	$ (160,000)
Working capital needed	Now	(100,000)	1.000	(100,000)
Annual net cash inflows	1-5	80,000	3.791	303,280
Relining of equipment	3	(30,000)	0.751	(22,530)
Salvage value of equip.	5	5,000	0.621	3,105
Working capital released	5	100,000	0.621	62,100
Net present value				$ 85,955

Accept the contract because the project has a **positive** net present value.

The Internal Rate of Return Method

- The internal rate of return is the **interest yield** promised by an investment project over its useful life.
- The internal rate of return is computed by finding the discount rate that will cause the **net present value** of a project to be **zero**.

The Internal Rate of Return Method

- Decker Company can purchase a new machine at a cost of $104,320 that will save $20,000 per year in cash operating costs.
- The machine has a 10-year life.

The Internal Rate of Return Method

Future cash flows are the same every year in this example, so we can calculate the internal rate of return as follows:

$$\text{PV factor for the internal rate of return} = \frac{\text{Investment required}}{\text{Net annual cash flows}}$$

$$= \frac{\$104,320}{\$20,000}$$

$$= 5.216$$

The Internal Rate of Return Method

Using the present value of an annuity of $1 table . . .

Find the 10-period row, move across until you find the factor 5.216. Look at the top of the column and you find a rate of 14%.

Periods	10%	12%	14%
1	0.909	0.893	0.877
2	1.736	1.690	1.647
. . .	. . .	. . .	. . .
9	5.759	5.328	4.946
10	6.145	5.650	5.216

The Internal Rate of Return Method

- Decker Company can purchase a new machine at a cost of $104,320 that will save $20,000 per year in cash operating costs.
- The machine has a 10-year life.

The internal rate of return on this project is 14%.

If the internal rate of return is equal to or greater than the company's required rate of return, the project is acceptable.

Net Present Value vs. Internal Rate of Return

Net Present Value

- Easier to use.
- Assumes cash inflows will be reinvested at the discount rate. This is a realistic assumption.

Expanding the Net Present Value Method

To compare competing investment projects we can use the following net present value approaches:

- Total-cost
- Incremental cost

The Total-Cost Approach

- White Co. has two alternatives: (1) remodel an old car wash or, (2) remove it and install a new one.
- The company uses a discount rate of 10%.

	New Car Wash	Old Car Wash
Annual revenues	$90,000	$70,000
Annual cash operating costs	30,000	25,000
Net annual cash inflows	$60,000	$45,000

The Total-Cost Approach

If White installs a new washer . . .

Cost	$300,000
Productive life	10 years
Salvage value	7,000
Replace brushes at the end of 6 years	50,000
Salvage of old equip.	40,000

Let's look at the present value of this alternative.

The Total-Cost Approach

Install the New Washer				
	Year	Cash Flows	10% Factor	Present Value
Initial investment	Now	$(300,000)	1.000	$(300,000)
Replace brushes	6	(50,000)	0.564	(28,200)
Net annual cash inflows	1-10	60,000	6.145	368,700
Salvage of old equipment	Now	40,000	1.000	40,000
Salvage of new equipment	10	7,000	0.386	2,702
Net present value				$ 83,202

If we install the new washer, the investment will yield a positive net present value of $83,202.

The Total-Cost Approach

If White remodels the existing washer . . .

Remodel costs	$175,000
Replace brushes at the end of 6 years	80,000

Let's look at the present value of this second alternative.

The Total-Cost Approach

Remodel the Old Washer

	Year	Cash Flows	10% Factor	Present Value
Initial investment	Now	$(175,000)	1.000	$(175,000)
Replace brushes	6	(80,000)	0.564	(45,120)
Net annual cash inflows	1-10	45,000	6.145	276,525
Net present value				$ 56,405

If we remodel the existing washer, we will produce a positive net present value of $56,405.

The Total-Cost Approach

Both projects yield a positive net present value.

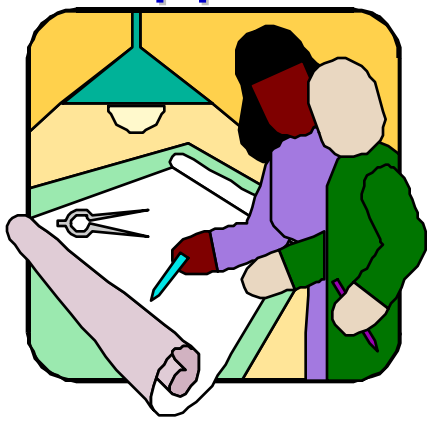
	Net Present Value
Invest in new washer	$ 83,202
Remodel existing washer	56,405
In favor of new washer	$ 26,797

However, investing in the new washer will produce a higher net present value than remodeling the old washer.

The Incremental-Cost Approach

Under the incremental-cost approach, only those cash flows that differ between the two alternatives are considered.

Let's look at an analysis of the White Co. decision using the incremental-cost approach.



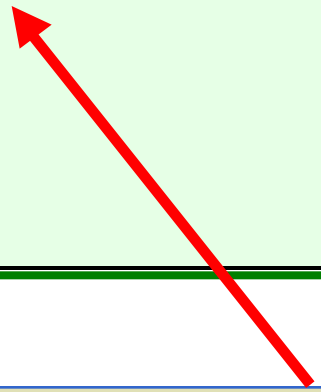
The Incremental-Cost Approach

	Year	Cash Flows	10% Factor	Present Value
Incremental investment	Now	$(125,000)	1.000	$(125,000)
Net present value				

$300,000 new - $175,000 remodel = $125,000

The Incremental-Cost Approach

	Year	Cash Flows	10% Factor	Present Value
Incremental investment	Now	$(125,000)	1.000	$(125,000)
Incremental cost of brushes	6	$ 30,000	0.564	16,920
Net present value				



$80,000 remodel - $50,000 new = $30,000

The Incremental-Cost Approach

	Year	Cash Flows	10% Factor	Present Value
Incremental investment	Now	$(125,000)	1.000	$(125,000)
Incremental cost of brushes	6	$ 30,000	0.564	16,920
Increased net cash inflows	1-10	15,000	6.145	92,175
Net present value				

$60,000 new - $45,000 remodel = $15,000

The Incremental-Cost Approach

	Year	Cash Flows	10% Factor	Present Value
Incremental investment	Now	$(125,000)	1.000	$(125,000)
Incremental cost of brushes	6	$ 30,000	0.564	16,920
Increased net cash inflows	1-10	15,000	6.145	92,175
Salvage of old equipment	Now	40,000	1.000	40,000
Salvage of new equipment	10	7,000	0.386	2,702
Net present value				$ 26,797

We get the same answer under either the total-cost or incremental-cost approach.

Least Cost Decisions

In decisions where revenues are not directly involved, managers should choose the alternative that has the least total cost from a present value perspective.

Let's look at the Home Furniture Company.

Least Cost Decisions

- Home Furniture Company is trying to decide whether to overhaul an old delivery truck now or purchase a new one.
- The company uses a discount rate of 10%.

Least Cost Decisions

Here is information about the trucks . . .

Old Truck	
Overhaul cost now	$ 4,500
Annual operating costs	10,000
Salvage value in 5 years	250
Salvage value now	9,000

New Truck	
Purchase price	$21,000
Annual operating costs	6,000
Salvage value in 5 years	3,000

Least Cost Decisions

Buy the New Truck

	Year	Cash Flows	10% Factor	Present Value
Purchase price	Now	$(21,000)	1.000	$ (21,000)
Annual operating costs	1-5	(6,000)	3.791	(22,746)
Salvage value of old truck	Now	9,000	1.000	9,000
Salvage value of new truck	5	3,000	0.621	1,863
Net present value				(32,883)

Keep the Old Truck

	Year	Cash Flows	10% Factor	Present Value
Overhaul cost	Now	$ (4,500)	1.000	$ (4,500)
Annual operating costs	1-5	(10,000)	3.791	(37,910)
Salvage value of old truck	5	250	0.621	155
Net present value				(42,255)

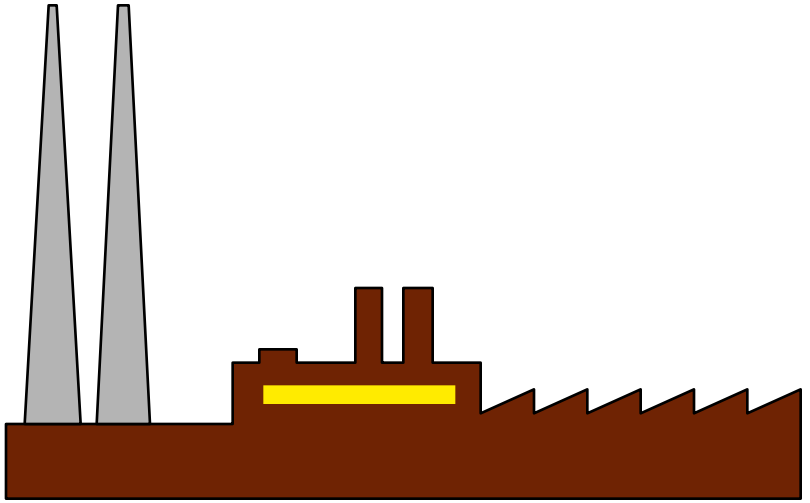
Least Cost Decisions

Home Furniture should purchase the new truck.

Net present value of costs associated with purchase of new truck	**$(32,883)**
Net present value of costs associated with remodeling existing truck	**(42,255)**
Net present value in favour of purchasing the new truck	**$ 9,372**

Investments in Automated Equipment

- Investments in automated equipment tend to be very large in dollar amount.
- The benefits received are often indirect and intangible.



Ranking Investment Projects

$$\text{Profitability index} = \frac{\text{Present value of cash inflows}}{\text{Investment required}}$$

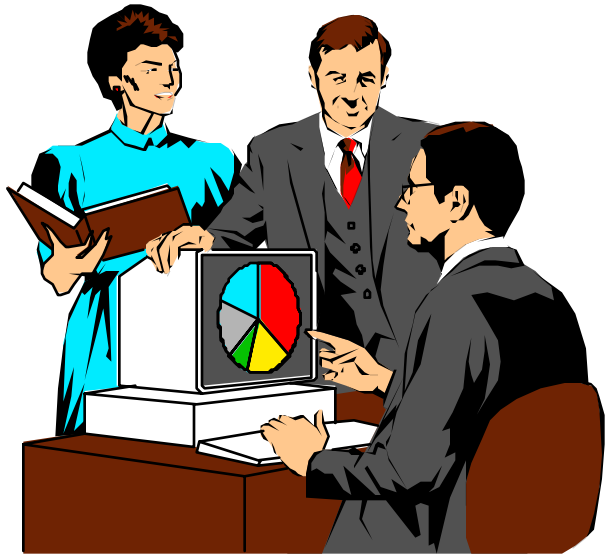
	Investment	
	A	B
Present value of cash inflows	$81,000	$6,000
Investment required	80,000	5,000
Profitability index	1.01	1.20

The higher the profitability index, the more desirable the project.

Other Approaches to Capital Budgeting Decisions

Other methods of making capital budgeting decisions include . . .

1. The Payback Method.
2. Simple Rate of Return.



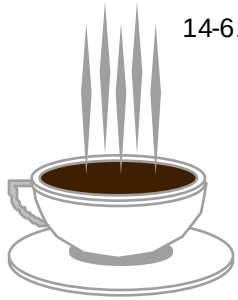
The Payback Method

The **payback period** is the length of time that it takes for a project to recover its initial cost out of the cash receipts that it generates.

- When the net annual cash inflow is the same each year, this formula can be used to compute the payback period:

$$\text{Payback period} = \frac{\text{Investment required}}{\text{Net annual cash inflow}}$$

The Payback Method



- Management at The Daily Grind wants to install an espresso bar in its restaurant.
- The espresso bar:
  - Costs $140,000 and has a 10-year life.
  - Will generate net annual cash inflows of $35,000.
- Management requires a payback period of 5 years or less on all investments.

What is the payback period for the espresso bar?

The Payback Method

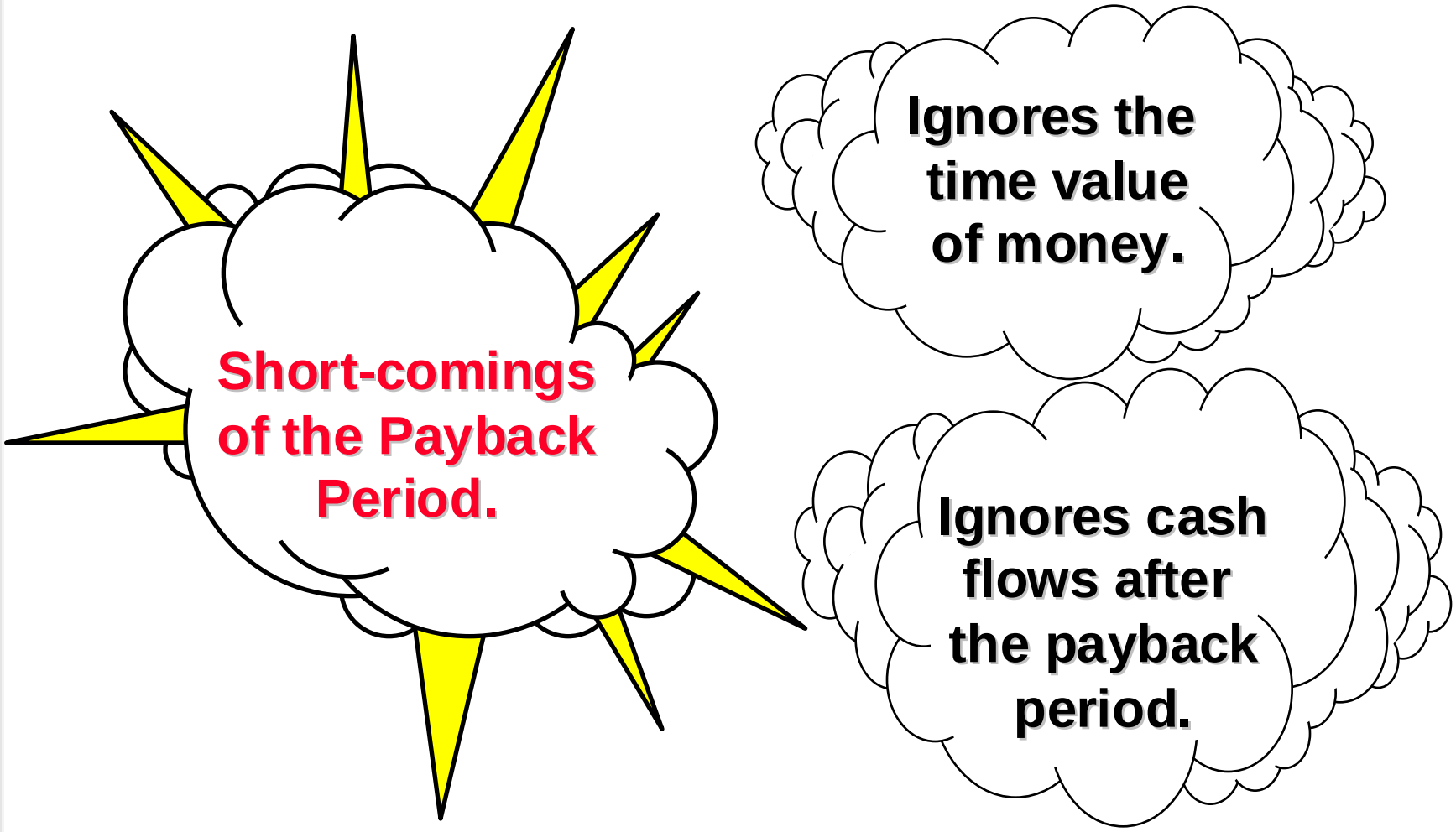
$$\text{Payback period} = \frac{\text{Investment required}}{\text{Net annual cash inflow}}$$

$$\text{Payback period} = \frac{\$140{,}000}{\$35{,}000}$$

$$\text{Payback period} = 4.0 \text{ years}$$

According to the company's criterion, management would invest in the espresso bar because its payback period is less than 5 years.

Evaluation of the Payback Method



The Simple Rate of Return Method

- Does not focus on cash flows -- rather it focuses on accounting income.
- The following formula is used to calculate the simple rate of return:

$$\text{Simple rate of return} = \frac{\text{Incremental revenues} - \text{Incremental expenses, including amortization}}{\text{Initial investment}}$$

The Simple Rate of Return Method

- Management of The Daily Grind wants to install an espresso bar in its restaurant.
- The espresso bar:
  - Cost $140,000 and has a 10-year life.
  - Will generate incremental revenues of $100,000 and incremental expenses of $65,000 including amortization.

What is the simple rate of return on the investment project?

The Simple Rate of Return Method

$$\text{Simple rate of return} = \frac{\$100{,}000 - \$65{,}000}{\$140{,}000} = 25\%$$

The simple rate of return method is not recommended for a variety of reasons, the most important one being that it ignores the time value of money.

Appendix

14A

The Concept of Present Value

The Theory of Interest

The amount to be received in one year is equal to:

$$F_1 = P(1=r)$$

where

F_1 =the amount to be received in one year

P = the present outlay to be made, and

R = the rate of interest involved

The Theory of Interest

Assume P = $100 and r = 8%. The future value, F_1 , = 100 x (1+.08) = $108

The value P, of $100, is called the *present value* or the *discounted value* of the future $108 receipt.

Compound Interest

Continuing our previous example, after 2 years, the value would be $116.64 as follows:

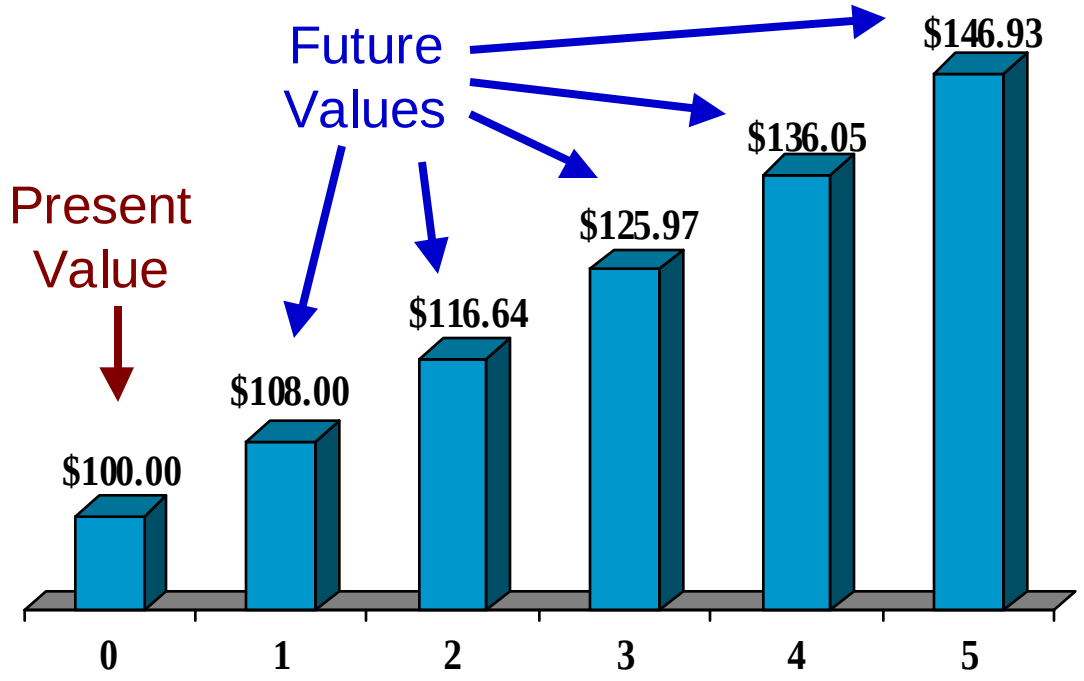
Original deposit	$100.00
Interest for year one	8.00
Amount, end of year one	$108.00
Interest for year two	8.64
Amount, end of year two	$116.64

Compound Interest

The formula can be revised as follows:

$$F_n = P(1+r)^n \quad \text{where } n = \text{years.}$$

Over 5 years, the present value will grow to $146.93 as shown below:



Compound Interest

The formula can be revised to compute present value as follows:

$$P = F_n (1+r)^{-n}$$

Present value tables can also be used to calculate present value but the answer will not be as accurate as that calculated by using the above formula.

Annuities

The present value of an annuity is the value of a series of equal payments or receipts discounted at compound interest and made at regular intervals.

The present value of an annuity of $1 is calculated as follows:

$$P_n = \frac{1-(1+r)^{-n}}{r}$$

Annuity Due

The present value of an annuity due is the value of a series of equal payments or receipts discounted at compound interest and made at the *beginning* of each period.

The present value of an annuity due of $1 is calculated as follows:

$$P_n = \frac{F_n}{(1+r)^n}$$

Deferred Annuity

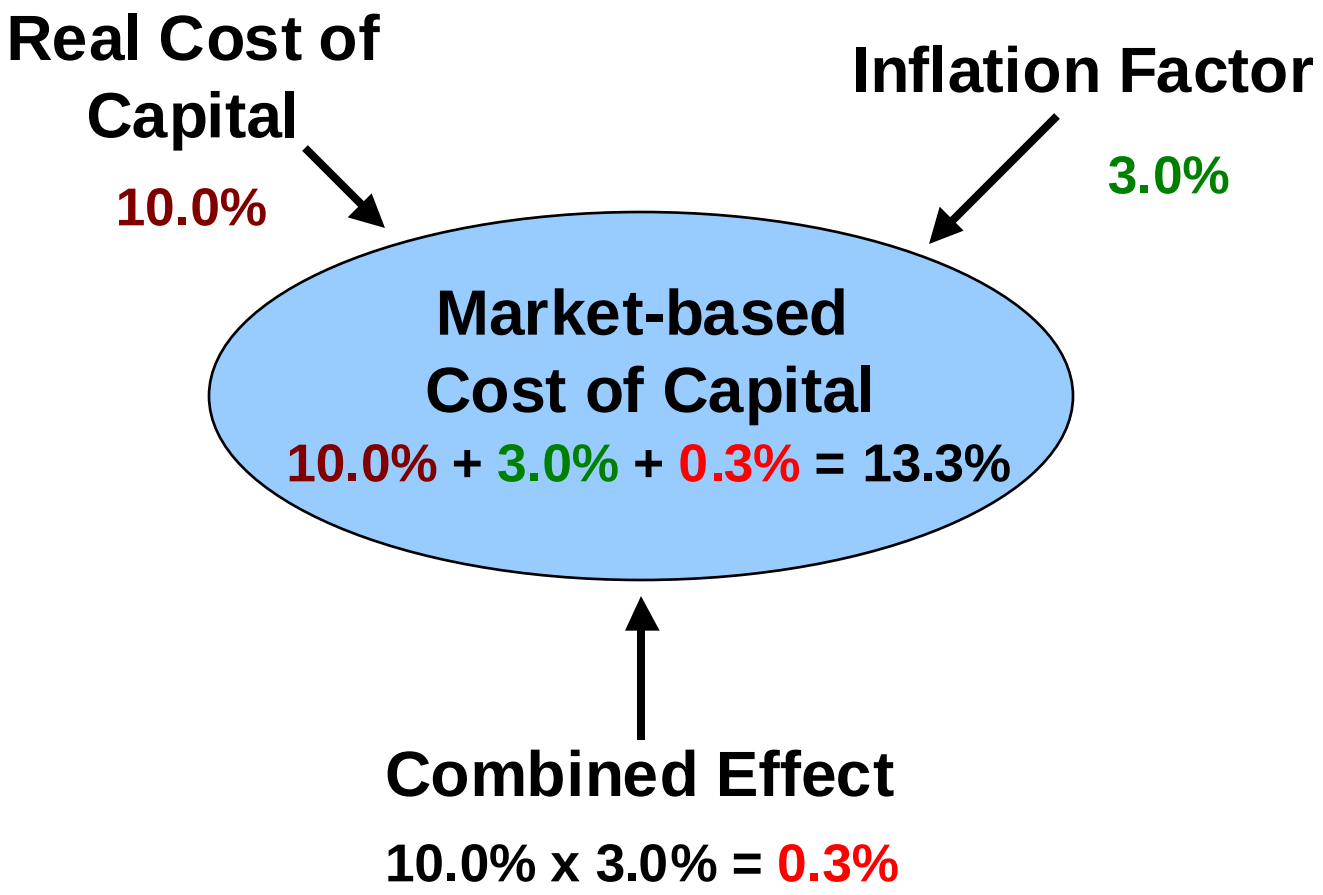
A deferred annuity is one in which the first payment or receipt does not begin until more than one interest period has expired.

Appendix

14B

Inflation and Capital Budgeting

Cost of Capital



Inflation and Capital Budgeting

- When there is no inflation, market-based and real costs of capital are the same.
- When there is inflation, the unadjusted cash flows can be used if the cash flows are affected identically by inflation and the real cost of capital is used as the discount rate.
- Otherwise, the cash flows should be adjusted for inflation and the market-based cost of capital should be used in the analysis.

End of Chapter 14