Survey of Accounting, 9e

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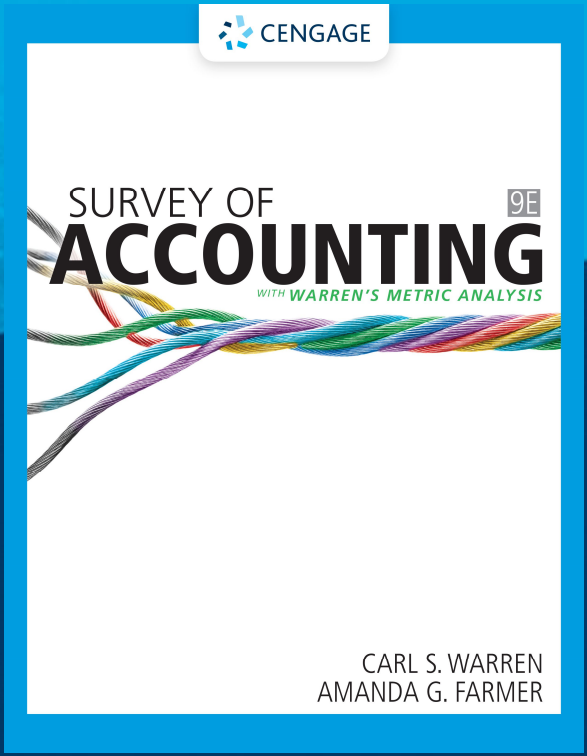

Chapter 15

Capital Investment Analysis

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Learning Objectives

- Describe the nature and importance of capital investment analysis
- Evaluate capital investment proposals using the average rate of return and cash payback methods
- Evaluate capital investment proposals using the net present value and internal rate of return methods
- Describe factors that complicate capital investment analysis
- Describe and diagram the capital rationing process
- Describe and illustrate the impact of financial leverage (debt) on the return on stockholders' equity

Learning Objective 1

Describe the nature and importance of capital investment analysis

Capital Investment Analysis

- Process by which management plans, evaluates, and controls investments in fixed assets
  - Known as capital budgeting
- Capital investments use funds and affect operations for many years
  - Must earn a reasonable rate of return

Capital Investment Evaluation Methods

- Methods that do not use present values
  - Average rate of return method
  - Cash payback method
- Methods that use present values
  - Net present value method
  - Internal rate of return method

Learning Objective 2

Evaluate capital investment proposals using the average rate of return and cash payback methods

Methods Not Using Present Values

- Useful in evaluating capital investment proposals with relatively short useful lives
- Often used to screen proposals as they are easy to apply
  - If a proposal meets minimum standards, it may be subject to further analysis using the present value methods
  - Proposal that does not meet minimum standards is dropped

Average Rate of Return

- Also known as the accounting rate of return
- Measures the average income as a percent of the average investment as follows:

$$\text{Average Rate of Return} = \frac{\text{Estimated Average Annual Income}}{\text{Average Investment}}$$

- Assuming straight-line depreciation, the average investment is computed as follows:

$$\text{Average Investment} = \frac{\text{Initial Cost} + \text{Residual Value}}{2}$$

Average Rate of Return of a Machine: Illustration

Cost of new machine	$500,000
Residual value	0
Estimated total income from machine	200,000
Expected useful life	4 years

- Estimated average annual income from the machine is $50,000

$$\text{Average Investment} = \frac{\text{Initial Cost} + \text{Residual Value}}{2}$$

$$= \frac{\$500{,}000 + \$0}{2} = \$250{,}000$$

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Average Rate of Return of a Machine: Illustration
(continued)

- Computation of average rate of return

$$\text{Average Rate of Return} = \frac{\text{Estimated Average Annual Income}}{\text{Average Investment}}$$

$$= \frac{\$50{,}000}{\$250{,}000} = 20\%$$

Advantages and Disadvantages of Average Rate of Return

- Advantages
  - Easy computation
  - Includes the entire amount of income earned over the life of the proposal
  - Emphasizes accounting income
- Disadvantages
  - Does not directly consider the expected cash flows from the proposal or the timing of the cash flows

Cash Payback Method

- Expected period of time between the date of an investment and the recovery in cash of the amount invested
- When annual net cash inflows are equal, the cash payback period is computed as follows:

$$\text{Cash Payback Period} = \frac{\text{Initial Cost}}{\text{Annual Net Cash Inflow}}$$

- In the illustration, management is evaluating the purchase of the following new machine:

Cost of new machine	$200,000
Cash revenues from machine per year	50,000
Expenses of machine per year	30,000
Depreciation per year	20,000

Cash Payback Method (continued)

- Net cash inflow per year from use of the machine is as follows:

Net cash inflow per year:		
Cash revenues from machine		$ 50,000
Less cash expenses of machine:		
Expenses of machine	$ 30,000	
Less depreciation	(20,000)	(10,000)
Net cash inflow per year		$ 40,000

- Computation of the estimated cash payback period

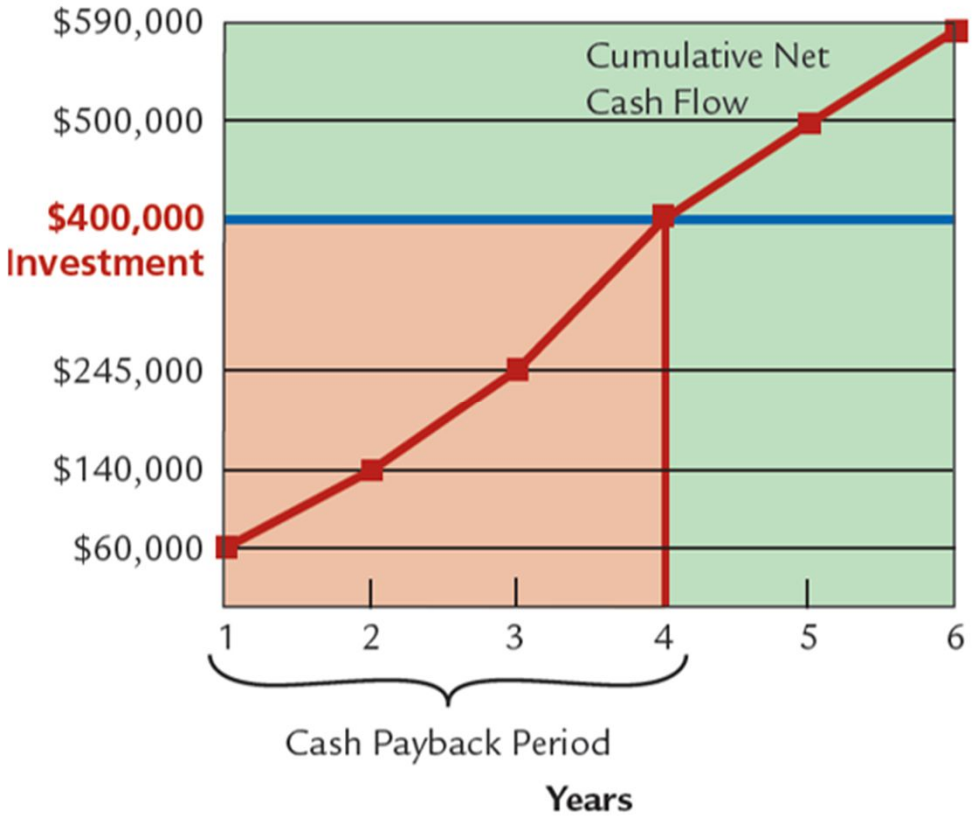
$$\text{Cash Payback Period} = \frac{\text{Initial Cost}}{\text{Annual Net Cash Inflow}} = \frac{\$200{,}000}{\$40{,}000} = 5 \text{ years}$$

Cash Payback Period for a Machine: Illustration

- Assume that a proposed investment has an initial cost of $400,000
  - Annual and cumulative net cash inflows over the proposal's six-year life are as follows:

Year	Net Cash Flow	Cumulative Net Cash Flow
1	$ 60,000	$ 60,000
2	80,000	140,000
3	105,000	245,000
4	155,000	400,000
5	100,000	500,000
6	90,000	590,000

Cash Payback Period for a Machine: Illustration
(continued)



Advantages and Disadvantages of the Cash Payback Method

- Advantages
  - Simple to use and understand
  - Analyzes cash flows
- Disadvantages
  - Ignores cash flows that occur after the payback period
  - Does not use present value concepts in valuing cash flows occurring in different periods

Learning Objective 3

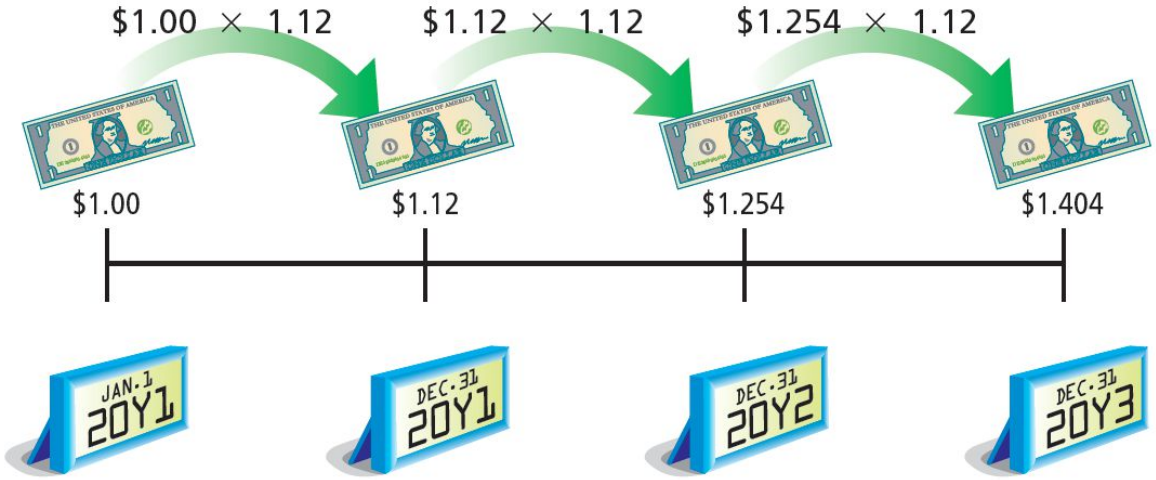
Evaluate capital investment proposals using the net present value and internal rate of return methods

Methods Using Present Values

- Present value methods use the amount and timing of the net cash flows in evaluating an investment
- Methods of evaluating capital investments using present values
  - Net present value method
  - Internal rate of return method

Present Value Concepts

- Present value of an amount
  - Value of $1 today is worth more than $1 receivable in the future as $1 can be invested and interest can be earned



Present Value of an Amount

- Net cash inflow per year from use of the machine is as follows:

Present Value		Amount to Be Received in 3 Years		Present Value of $1 to Be Received in 3 Years (from Exhibit 2)
$1	=	$1.404	×	0.712

- Partial present value of $1 table

Present Value of $1 at Compound Interest					
Year	6%	10%	12%	15%	20%
1	0.943	0.909	0.893	0.870	0.833
2	0.890	0.826	0.797	0.756	0.694
3	0.840	0.751	0.712	0.658	0.579
4	0.792	0.683	0.636	0.572	0.482
5	0.747	0.621	0.567	0.497	0.402
6	0.705	0.564	0.507	0.432	0.335
7	0.665	0.513	0.452	0.376	0.279
8	0.627	0.467	0.404	0.327	0.233
9	0.592	0.424	0.361	0.284	0.194
10	0.558	0.386	0.322	0.247	0.162

Present Value of an Annuity

- Amount of cash needed today to yield a series of equal net cash flows at fixed time intervals in the future
- **Annuity**: Series of equal net cash flows at fixed time intervals

Exhibit 4: Present Value of $100 for Five Periods with Compound Interest of 12%

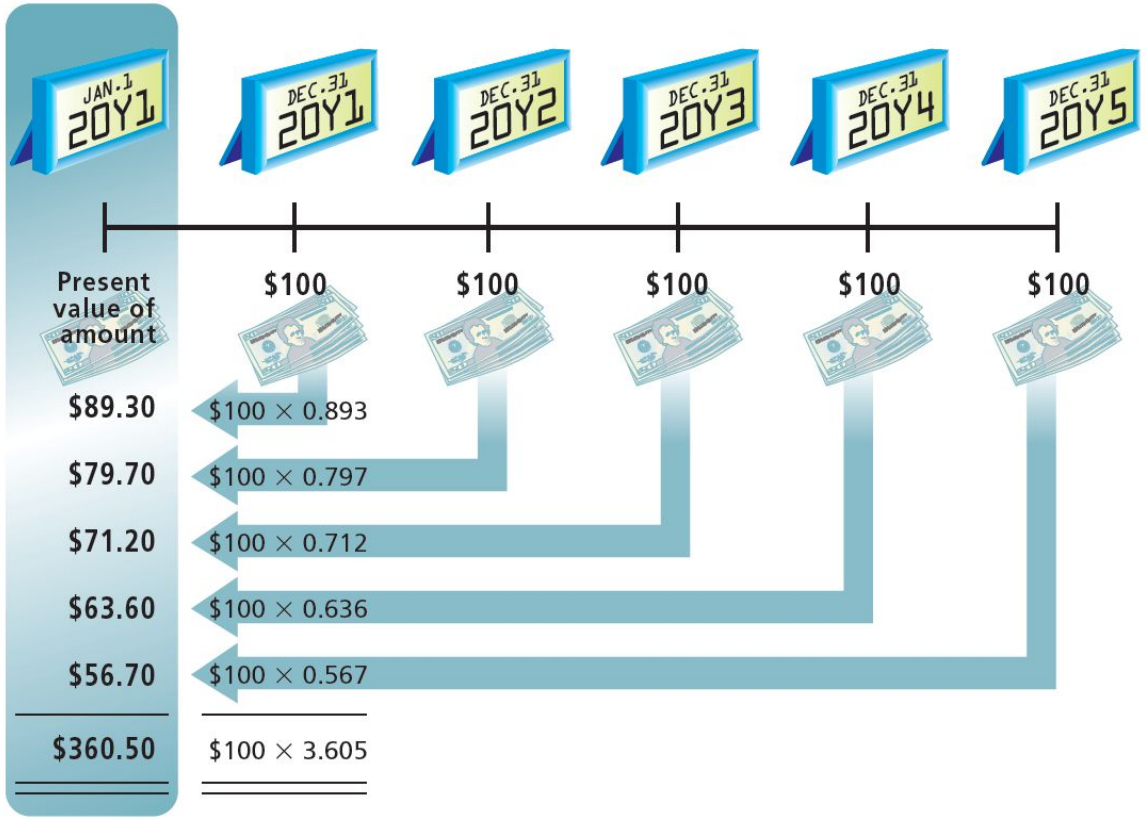


Exhibit 5: Partial Present Value of an Annuity Table

Present Value of an Annuity of $1 at Compound Interest					
Year	6%	10%	12%	15%	20%
1	0.943	0.909	0.893	0.870	0.833
2	1.833	1.736	1.690	1.626	1.528
3	2.673	2.487	2.402	2.283	2.106
4	3.465	3.170	3.037	2.855	2.589
5	4.212	3.791	3.605	3.353	2.991
6	4.917	4.355	4.111	3.785	3.326
7	5.582	4.868	4.564	4.160	3.605
8	6.210	5.335	4.968	4.487	3.837
9	6.802	5.759	5.328	4.772	4.031
10	7.360	6.145	5.650	5.019	4.192

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Net Present Value Method

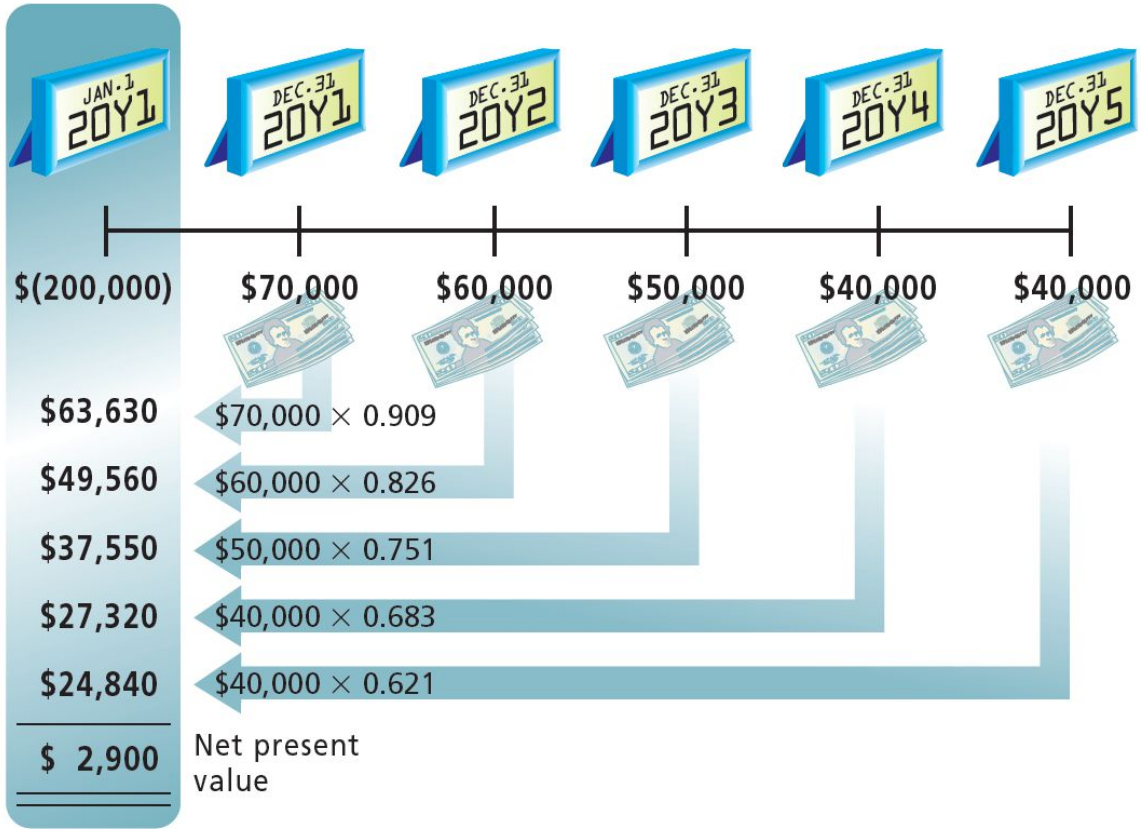
- Compares the amount to be invested with the present value of the net cash inflows
  - Known as discounted cash flow method
- Interest rate (return) or the hurdle rate
  - Based on factors such as the purpose of the investment and the cost of obtaining funds for the investment
    - If the present value of the cash inflows equals or exceeds the amount to be invested, the proposal is desirable

Net Present Value Method: Illustration

- Assume the following data for a proposed investment in new equipment:

Cost of new equipment	$200,000
Expected useful life	5 years
Minimum desired rate of return	10%
Expected cash flows to be received each year:	
Year 1	$ 70,000
Year 2	60,000
Year 3	50,000
Year 4	40,000
Year 5	40,000
Total expected cash flows	$260,000

Exhibit 6: Present Value of Cash Flows from New Equipment



Advantages and Disadvantages of the Net Present Value Method

- Advantages
  - Considers the cash flows of the investment
  - Considers the time value of money
  - Ranks projects with equal lives, using the present value index
- Disadvantages
  - Has more complex computations than methods that don't use present value
  - Assumes the cash flows can be reinvested at the minimum desired rate of return, which may not be valid

Net Present Value Index

- Prepares a ranking of proposals when capital investment funds are limited and the proposals involve different investments

$$\text{Present Value Index} = \frac{\text{Total Present Value of Net Cash Flow}}{\text{Amount to Be Invested}}$$

- To illustrate, net present value and the present value index for three proposals are as follows:

	Proposal A	Proposal B	Proposal C
Total present value of net cash flow	$ 107,000	$ 86,400	$ 86,400
Amount to be invested	(100,000)	(80,000)	(90,000)
Net present value	$ 7,000	$ 6,400	$ (3,600)
Present value index:			
Proposal A ($107,000/$100,000)	1.07		
Proposal B ($86,400/$80,000)		1.08	
Proposal C ($86,400/$90,000)			0.96

Internal Rate of Return (IRR) Method

- Uses present value concepts to compute the rate of return from a capital investment proposal based on its expected net cash flows
- Known as the time-adjusted rate of return method
  - Begins with net cash flows and works backward to determine the rate of return expected from a project

Internal Rate of Return (IRR) Method (continued)

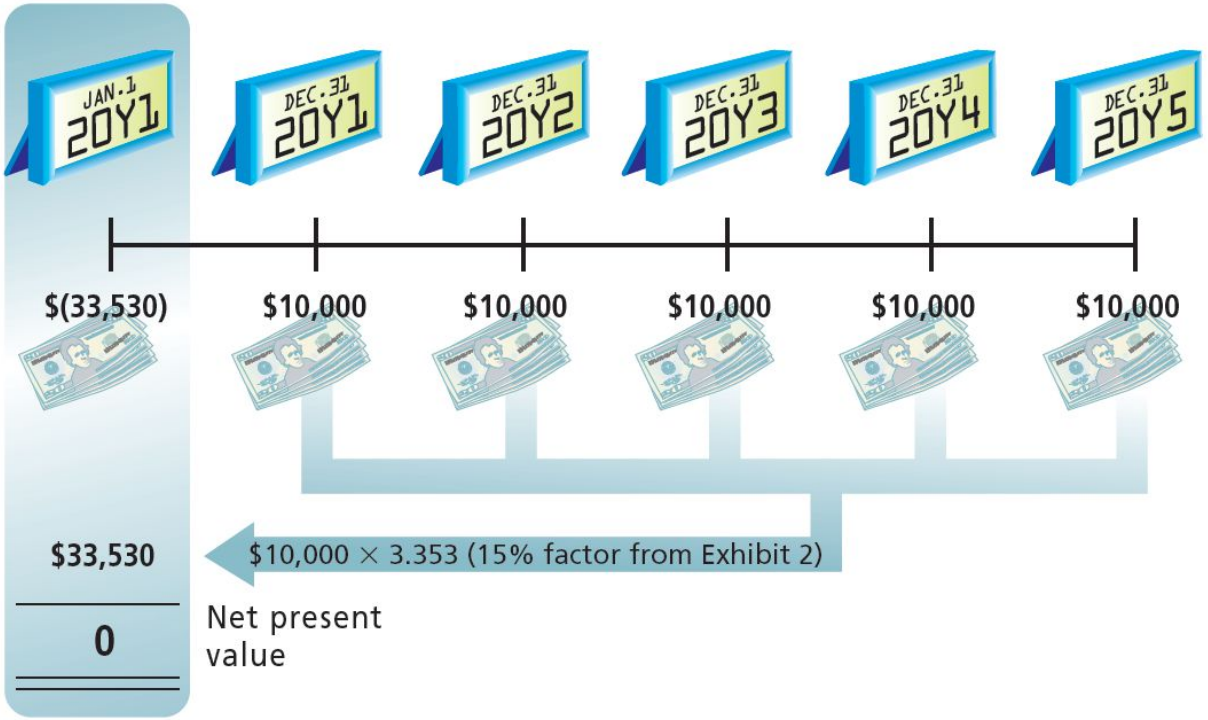
- Illustration: Proposal to purchase new equipment

Cost of new equipment	$33,530
Yearly expected cash flows to be received	10,000
Expected life	5 years
Minimum desired rate of return	12%

- Present value of the net cash flows

Annual net cash flow (at the end of each of five years)	$10,000
Present value of an annuity of $1 at 12% for five years (Exhibit 2)	× 3.605
Present value of annual net cash flows	$36,050
Less amount to be invested	(33,530)
Net present value	$ 2,520

Exhibit 8: Present Value of an Annuity with an Internal Rate of Return of 15%



Determining IRR When Equal Annual Net Cash Flows Are Expected

Step 1. Determine a present value factor for an annuity of $1 as follows:

$$\text{Present Value Factor for an Annuity of \$1} = \frac{\text{Amount to Be Invested}}{\text{Equal Annual Net Cash Flows}}$$

Step 2. Locate the present value factor determined in Step 1 in the present value of an annuity of $1 table (Exhibit 2) as follows:

a. Locate the number of years of expected useful life of the investment in the Year column.
b. Proceed horizontally across the table until you find the present value factor computed in Step 1.

Step 3. Identify the internal rate of return by the heading of the column in which the present value factor in Step 2 is located.

Internal Rate of Return (IRR): Illustration

- Management's proposal to purchase new equipment is as follows:

Cost of new equipment	$97,360
Yearly expected cash flows to be received	20,000
Expected useful life	7 years

- Computation of the present value factor for an annuity of $1

$$\text{Present Value Factor for an Annuity of \$1} = \frac{\text{Amount to Be Invested}}{\text{Equal Annual Net Cash Flows}}$$

$$\text{Present Value Factor for an Annuity \$1} = \frac{\$97{,}360}{\$20{,}000} = 4.868$$

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Exhibit 9: Determining Internal Rate of Return of 10%

Present Value of an Annuity of $1 at Compound Interest

	Year	6%		10% (Step 3)	12%
	1	0.943		0.909	0.893
	2	1.833		1.736	1.690
	3	2.673		2.487	2.402
	4	3.465		3.170	3.037
	5	4.212		3.791	3.605
	6	4.917	Step 2(b)	4.355	4.111
Step 2(a)	7	5.582	→	**4.868**	4.564
	8	6.210		5.335	4.968
	9	6.802		5.759	5.328
	10	7.360		6.145	5.650

Step 1: Determine present value factor for an annuity of $1 $= \frac{\$97,360}{\$20,000} = 4.868$

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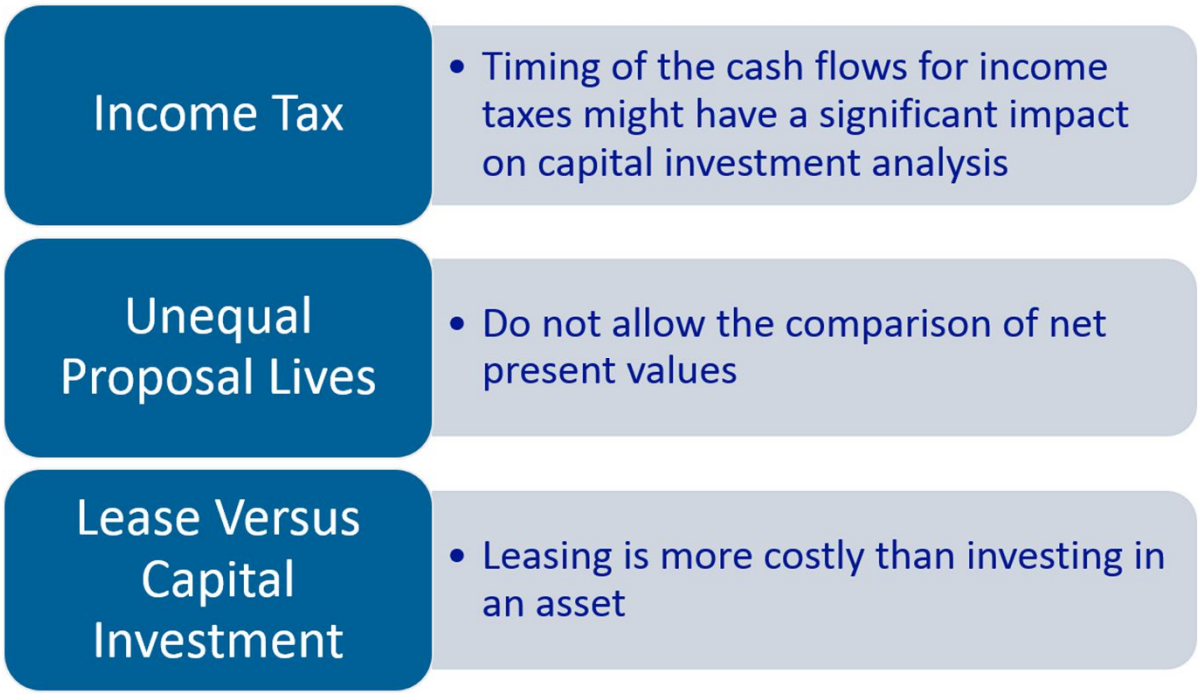
Advantages and Disadvantages of IRR

- Advantages
  - Considers the cash flows of the investment and the time value of money
  - Ranks proposals based upon the cash flows over their complete useful life, even if the project lives are not similar
- Disadvantages
  - Has complex computations
  - Assumes the cash received from a proposal can be reinvested at the internal rate of return, which may not be valid

Learning Objective 4

Describe factors that complicate capital investment analysis

Factors That Complicate Capital Investment Analysis



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Factors That Complicate Capital Investment Analysis
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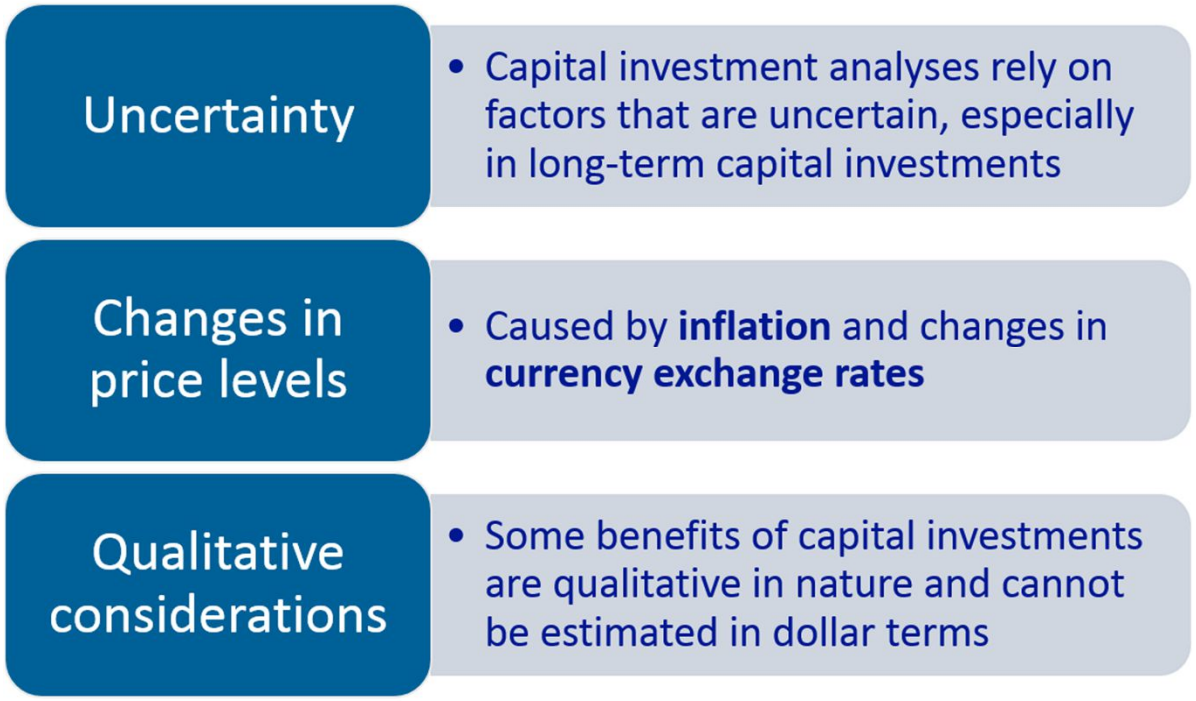

Net Present Value Analysis: Unequal Lives and Equalized Lives of Proposals

	A	B	C	D
1	Truck			
2		Present	Net	Present
3		Value of	Cash	Value of
4	Year	$1 at 10%	Flow	Net Cash Flow
5	1	0.909	$ 30,000	$ 27,270
6	2	0.826	30,000	24,780
7	3	0.751	25,000	18,775
8	4	0.683	20,000	13,660
9	5	0.621	15,000	9,315
10	6	0.564	15,000	8,460
11	7	0.513	10,000	5,130
12	8	0.467	10,000	4,670
13	Total		$155,000	$112,060
14				
15	Amount to be invested			(100,000)
16	Net present value			$ 12,060
17				

	A	B	C	D
1	Computer Network			
2		Present	Net	Present
3		Value of	Cash	Value of
4	Year	$1 at 10%	Flow	Net Cash Flow
5	1	0.909	$ 30,000	$ 27,270
6	2	0.826	30,000	24,780
7	3	0.751	30,000	22,530
8	4	0.683	30,000	20,490
9	5	0.621	35,000	21,735
10	Total		$155,000	$116,805
11				
12	Amount to be invested			(100,000)
13	Net present value			$ 16,805
14				

	A	B	C	D
1	Truck—Revised to 5-Year Life			
2		Present	Net	Present
3		Value of	Cash	Value of
4	Year	$1 at 10%	Flow	Net Cash Flow
5	1	0.909	$ 30,000	$ 27,270
6	2	0.826	30,000	24,780
7	3	0.751	25,000	18,775
8	4	0.683	20,000	13,660
9	5	0.621	15,000	9,315
10	5 (Residual			
11	value)	0.621	40,000	24,840
12	Total		$160,000	$118,640
13				
14	Amount to be invested			(100,000)
15	Net present value			$ 18,640

Truck Net Present Value Greater than Computer Network Net Present Value by $1,835

Learning Objective 5

Describe and diagram the capital rationing process

Capital Rationing

- Process by which management allocates funds among competing capital investment proposals
  - Alternative proposals are initially screened by establishing minimum standards using the cash payback and the average rate of return methods
    - Proposals that survive are further analyzed using the net present value and internal rate of return methods
    - Qualitative factors related to each proposal are also considered
    - Accepted proposals are ranked and compared with the funds available

Learning Objective 6

Describe and illustrate the impact of financial leverage (debt) on the return on stockholders' equity

Metric-Based Analysis: Financial Leverage

- Formulas to compute return on stockholders' equity

$$\text{Return on Stockholders' Equity} = \frac{\text{Operating Income}}{\text{Average Stockholders' Equity}}$$

$$\text{Return on Stockholders' Equity} = \frac{\text{Operating Income}}{\text{Sales}} \times \frac{\text{Sales}}{\text{Average Total Assets}} \times \frac{\text{Average Total Assets}}{\text{Average Stockholders' Equity}}$$

$$\text{Return on Stockholders' Equity} = \text{Profit Margin} \times \text{Asset Turnover} \times \text{Financial Leverage}$$

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Financial Leverage: Illustration

- For a recent year, Apple Inc. reported the following data (in millions):

Sales	$265,595
Operating income	70,898
Average total assets	370,522
Average stockholders' equity	120,597

- Computation of the present value factor for an annuity of $1

	Profit Margin	×	Asset Turnover	×	Financial Leverage	=	Return on Stockholders' Equity
	26.7%		0.72		3.07		59.0%*
Computations:	$\frac{\$70,898}{\$265,595}$	×	$\frac{\$265,595}{\$370,522}$	×	$\frac{\$370,522}{\$120,597}$	=	58.8%*

*Differences due to rounding.

End of Chapter 15