

# Business Investment Rules 9

Corporate Financial Management 3e  
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## Learning Objectives

- Describe the process of capital budgeting.
- Calculate various investment criteria.
- Understand the strengths and weaknesses of NPV, IRR, and other investment criteria.
- Explain why an NPV profile is the most useful investment criterion.

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## Chapter Outline

- 9.1 The Capital Budgeting Process
- 9.2 Net Present Value
- 9.3 Internal Rate of Return
- 9.4 Using the NPV and IRR
- 9.5 Other Capital Budgeting Criteria
- 9.6 Business Investment in Practice

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## Focus on Principles

- Valuable Ideas
  - Look for new ideas to use as a basis for capital budgeting projects will create value
- Comparative Advantage
  - Look for capital budgeting projects that will use the firm's comparative advantage to create value.
- Incremental benefits
  - Identify and estimate the expected future cash flows for a capital budget project on an incremental basis.

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## Focus on Principles

- Risk-Return Trade-Off
  - Incorporate the risk of a capital budgeting project into its *cost of capital*—the project's required return.
- Time-Value-Of-Money
  - Measure the current value a capital budgeting project will create, its NPV.

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## Focus on Principles

- Options
  - Recognize the value of options, such as the option to delay, expand, or abandon a project.
- Two-Sided Transactions
  - Consider why the other party to a transaction is willing to participate.
- Signaling
  - Consider the products and actions of competitors.

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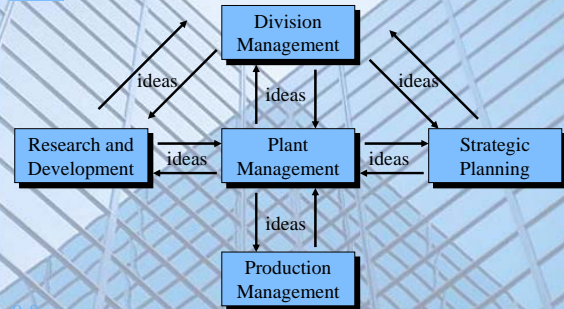
## 9.1 The Capital Budgeting Process

The process can be broken down into five steps as a project moves from idea to reality:

1. Generating ideas for capital budgeting projects.
2. Reviewing existing projects and facilities.
3. Preparing proposals.
4. Evaluating proposed projects and creating the **capital budget**.
5. Preparing appropriation requests.

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## Generating ideas for capital budgeting projects



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## The Capital Budget

- The capital budget is made up of the firm's planned capital expenditures.
- Capital budgeting projects can be classified into several categories:
  - Maintenance Projects
  - Cost Savings/Revenue Enhancement
  - Capacity Expansions in Current Business
  - New Products and New Businesses
  - Projects Required by Government Regulation or Firm Policy

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## Preparing Proposals

- Generally, the originator presents a written proposal.
- Most large firms use standard forms, and these are typically supplemented by written memoranda.
- There may be consulting studies prepared by outside experts.

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## 9.2 Net Present Value

- Recall that net present value (NPV) is the difference between what something is worth and what it costs.

Suppose you notice a run-down house for sale near your own house. The price is \$150,000. The house requires \$110,000 in repairs, which would take a year. You estimate that you could then sell the house for \$300,000. Having this house fixed up would increase the value of your house by \$15,000. If the cost of capital is 10%, what is the NPV of this project?

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## Calculating NPV

- You invest \$260,000 (= 150 + 110). If your cost of capital is 10%, the project's NPV is \$26,363.64:

$$NPV = -260,000 + \frac{\$315,000}{(1.10)} = \$26,363.64$$

- Notice that the project's NPV for someone who does not live in the neighborhood is only \$12,727.27:

$$NPV = -260,000 + \frac{300,000}{(1.10)} = \$12,727.27$$

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### 9.3 Internal Rate of Return

- The internal rate of return is the discount rate that sets NPV of the expected cash flows to zero.
- The internal rate of return is the project's expected return.
- Undertake a project if the IRR exceeds  $r$ , the project's cost of capital.

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### Calculating IRR

Recall that the **IRR** is the project's **expected return**. Usually—but not always—if the IRR exceeds the cost of capital, the NPV is positive. This is always true for independent, conventional projects.

**Example:** A project costs \$100,000 and is expected to generate a \$28,600 cash flow per year for six years. What is the project's IRR?

$$\text{IRR} = 18.0123\%$$

$$N=6 \quad PV=-100,000 \quad PMT=28,600 \quad FV=0 \quad i=18.0123$$

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### 9.4 Using NPV and IRR

- Most of the time NPV and IRR are both valuable guides to making decisions.
- There are occasions, however, where NPV and IRR disagree.
- When in doubt, go with NPV.

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### NPV Profile

- An **NPV profile** plots the project's NPV as a function of the discount rate.
- It shows both the NPV and the IRR of the project.
- It can be used to identify the range of cost of capital at which the project would add value to the firm.

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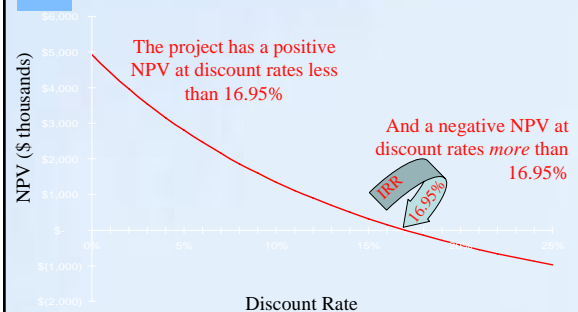
### NPV Profile: Example

Consider a 10-year project with these cash flows:

	Cash Flow
Initial Investment	-\$3,985,000
Cash Flow in years 1 to 5	\$806,000
Cash Flow in years 6 to 9	\$926,000
Cash Flow in year 10	\$1,151,000

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### NPV Profile



## Types of Projects

- A **conventional** project is one that has an initial cash outflow, followed by one or more expected future net cash inflows.
  - Buying a stock or bond.
- A **non-conventional** project may have several net cash outflows and inflows.
  - Some net cash outflows may occur in the future.
  - For example, an environmental clean up cost at the end of a project or a major overhaul during the project's life.

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## Types of Projects

- Two projects are **independent** if undertaking one does not affect the other.
  - IRR and NPV methods agree for conventional, independent projects.
- Two projects are **mutually exclusive** if undertaking one precludes taking the other.
  - IRR and NPV methods can yield conflicting decisions when choosing between mutually exclusive projects.

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## When IRR and NPV Can Disagree

- Mutually exclusive projects with:
  - Differences in size.
  - Differences in cash flow timing.
- Reverse conventional projects.

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## Projects Of Different Size

A firm is considering two mutually exclusive one-year projects, with the cash flows shown below. The cost of capital for both projects is 12%. Compute the NPV and IRR for each project and indicate which one should be undertaken.

Project	CF0	CF1	NPV	IRR
Small	-1,000	+1,200	71.43	20%
Big	-8,000	+9,200	214.29	15%

Take the higher-NPV project, Big.

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## Cash Flow Timing Differences

- The conflict between the NPV and the IRR arises because of differences in each method's assumption regarding the **reinvestment rate**.
- The NPV method assumes that future cash flows from the project will be reinvested at the project's cost of capital.
- The IRR method assumes that future cash flows from the project will be reinvested at the IRR.

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## Cash Flow Timing Differences

A firm is considering two mutually exclusive projects, L and H. Their cash flows are shown in the table.

- Plot each project's NPV profile.
- Find each project's IRR.
- If each project has a cost of capital of 10%, which project should be selected?
- If each project has a cost of capital of 17%, which project should be selected?

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## Cash Flows for Projects L and H

Year	Project L	Project H
0	-\$12,000	-\$12,000
1	\$2,000	\$6,000
2	\$3,000	\$5,000
3	\$4,000	\$4,000
4	\$5,000	\$2,000
5	\$8,000	\$2,000

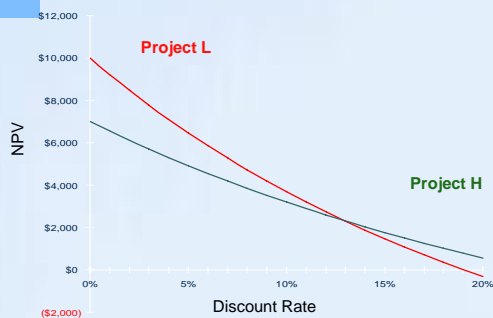
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## IRR and NPV for L and H

	Project L	Project H
IRR	19.06%	22.59%
NPV @ 10%	\$3,685	\$3,200
NPV @ 12.93%	\$2,330	\$2,330
NPV @ 17.00%	\$716	\$1,258

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## NPV Profiles for L and H



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## IRRs and Non-Conventional Projects

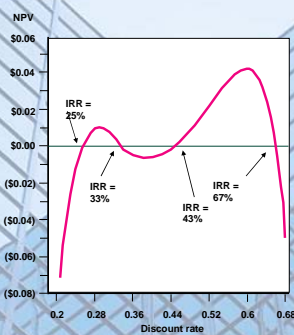
Consider this project:

Year	Cash flows
0	-\$252
1	1,431
2	-3,035
3	2,850
4	-1,000

What is the IRR?  
 NPV = 0 at 25.00%; at 33.33%; at 42.86%, and at 66.67%  
 The IRR rule breaks down.

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## IRRs and Non-Conventional Projects



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## 9.5 Other Capital Budgeting Criteria

- Profitability Index
- Modified Internal Rate of Return (MIRR)
- Payback
- Discounted Payback
- Urgency

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## Profitability Index

$$PI = \frac{\text{PV of Future Cash Flows}}{\text{Initial Investment}}$$

$$= 1 + \frac{\text{NPV}}{\text{Initial Investment}}$$

**Decision Rule:**  
Undertake the project if  $PI > 1.0$

## Profitability Index

Perma-Filter is considering two mutually exclusive one-year projects, whose cash flows are shown below. The cost of capital for either project is 12%. Compute the NPV and the PI for each project and indicate which one should be undertaken.

Project	CF <sub>0</sub>	CF <sub>1</sub>
Alpha	(\$1,000)	\$1,200
Beta	(\$8,000)	\$9,200

## Profitability Index

	Project Alpha	Project Beta
Year 0 Cash Flow	(\$1,000)	(\$8,000)
Year 1 Cash Flow	\$1,200	\$9,200
NPV @ 12%	\$71.43	\$214.29
PI	1.071	1.027

## Profitability Index

- PI measures the NPV **per dollar** invested.
- For independent projects, the PI method yields conclusions identical to the NPV method.
- For mutually exclusive projects, differences in project size can lead to conflicting conclusions.
  - Use the NPV method.
- PI is useful when there is capital rationing.

## Modified IRR: MIRR

The MIRR is the return that equates the future value of all the project's cash flows reinvested at the cost of capital to the present value of all those cash flows.

**Decision Rule:**  
Undertake the project if the MIRR exceeds the cost of capital.

## Modified IRR: MIRR

A project with a 12% cost of capital costs \$2,000, and is expected to return \$600 per year for five years plus a salvage value of \$700 at the end of five years. The MIRR = 17.6690% (IRR = 21.5226%):

$$N=5 \quad I=12 \quad PV=0 \quad PMT=600 \quad FV=-3,811.71$$

$$3,811.71 + 700 = 4,511.71$$

$$N=5 \quad PV=-2,000 \quad PMT=0 \quad FV=4,511.71 \quad I=17.6690$$

$$N=5 \quad PV=-2,000 \quad PMT=600 \quad FV=700 \quad I=21.5226$$

## Payback Method

The payback is the length of time it takes for the project's cash flows to equal its investment.

### Decision Rule:

Undertake the project if the payback is less than a preset amount of time.

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## Discounted Payback Method

The discounted payback is the length of time it takes for the project's discounted cash flows to equal its investment.

### Decision Rule:

Undertake the project if the discounted payback is less than a preset amount of time.

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## Payback and Discounted Payback

The cash flows for two mutually exclusive projects X and Y are shown below. The cost of capital for each project is 12%. Compute the NPV, the payback, and the discounted payback for each project. Which project should the firm choose?

Year	Project X	Project Y
0	(\$8,000)	(\$8,000)
1	\$4,000	\$2,000
2	\$4,000	\$2,000
3	\$2,000	\$4,000
4	\$2,000	\$6,000

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## Payback and Discounted Payback for Project X

Year	Cash Flow	Cumulative Cash Flow	Discounted	
			Cash Flow	Cumulative Cash Flow
0	(\$8,000)	(\$8,000)	(\$8,000)	(\$8,000)
1	\$4,000	(\$4,000)	\$3,571	(\$4,429)
2	\$4,000	\$0	\$3,189	(\$1,240)
3	\$2,000		\$1,424	\$184
4	\$2,000		\$1,271	

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## Payback and Discounted Payback for Projects X and Y

	Project X	Project Y
Payback	2 years	3 years
Discounted Payback*	2.87 years	3.46 years
NPV**	\$1,455	\$2,040

\*For Project X:  $2 + 1,240/1,424$

\*\*Discount rate = 12%

\*\*\*Choose Project Y

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## Payback and Discounted Payback

- Payback ignores the time value of money.
- Both require an arbitrary cutoff value.
- Payback ignores risk differences between projects.
- Both ignore cash flows after the payback period.

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## Urgency

- This method says "invest in the project when you absolutely have to."
  - Replacement decisions: replace the asset *only* after it has broken down!
- It ignores planning ahead.
  - "An ounce of prevention is worth a pound of cure."
  - If it's worth doing . . . it's worth doing right.
- It is the most widely used decision method.
  - If it's not important . . . do it at the last minute!

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## 9.6 Business Investment in Practice

- Most firms use more than one method for evaluating capital budgeting projects.
- The NPV profile is the most useful item.
  - It provides the most complete view of the project.
- Most firms also use a process for appropriating capital—even after the projects have been selected.
- Firms should review project performance periodically.

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## Summary

- The capital budgeting process and the investment criteria used to make capital budgeting decision are critical because firms are effectively defined by the products and services they provide using their capital assets.

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