Lesson 3.
Some alternative investment rules

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May 2006
3. Some alternative investment rules

**Introduction**

*Capital budgeting*: the decision-making process for accepting or rejecting project.

Alternative budgeting methods:

1. Net present value (review)
2. The payback period model
3. The internal rate of return model.
1. Net present value

Basic investment rule:
\[
\begin{align*}
\text{accept a project if } & NPV > 0 \\
\text{reject a project if } & NPV < 0
\end{align*}
\]

Accepting positive NPV projects benefits the shareholders.

The value of the firm rises by the NPV of the project (value-additivity property).

BUT: cash flows are risky → which discount rate to choose?

Main properties of NPV:
\[
\begin{align*}
\text{NPV uses cash flows} \\
\text{NPV uses all the cash flows of the project} \\
\text{NPV discounts the cash flows properly}
\end{align*}
\]
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2. The payback period model

Consider the following project ($-50,000, $30,000, $20,000, $10,000)$

Choose a particular cutoff date: payback period. For example, $t = 2$. Then,

payback period rule: \[ \begin{cases} \text{accept a project if payback period} & \leq 2 \\ \text{reject a project if payback period} & > 2 \end{cases} \]

Problems:

1. Arbitrary standard for payback period.

2. Payments after the payback period.

3. Timing of cash flows within the payback period.
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3. The internal rate of return (IRR)

It provides a single number (independent of the market interest rate) summarizing the merits of the project.

IRR: what must the discount rate be to make $NPV = 0$?

IRR rule:

\[
\begin{align*}
\text{accept a project if } & IRR > \text{ discount rate} \\
\text{reject a project if } & IRR < \text{ discount rate}
\end{align*}
\]

But: the IRR rule does not always coincide with the NPV rule.
The Internal Rate of Return: Example

Consider the following project:

\[
\begin{align*}
0 & \quad 1 & \quad 2 & \quad 3 \\
-200 & & & \\
\end{align*}
\]

The internal rate of return for this project is 19.44%

\[
NPV = 0 = \frac{50}{(1 + IRR)} + \frac{100}{(1 + IRR)^2} + \frac{150}{(1 + IRR)^3}
\]
If we graph NPV versus discount rate, we can see the IRR as the x-axis intercept.

**Discount Rate** | **NPV**
--- | ---
0% | $100.00
4% | $71.04
8% | $47.32
12% | $27.79
16% | $11.65
20% | ($1.74)
24% | ($12.88)
28% | ($22.17)
32% | ($29.93)
36% | ($36.43)
40% | ($41.86)

IRR = 19.44%
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**Problems with the IRR approach**

- Investing or Financing?, that is, are we borrowing or lending?

- Multiple rates of return

- Scale problem

- Timing problem
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4. The practice of capital budgeting

Which methods are companies using?

Table 6.4 (book) % Always or almost always
Percent of CFOs who always or almost always use a given technique

<table>
<thead>
<tr>
<th>Technique</th>
<th>% Always or almost always</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internal rate of return</td>
<td>75.6%</td>
</tr>
<tr>
<td>Net present value</td>
<td>74.9%</td>
</tr>
<tr>
<td>Payback method</td>
<td>56.7%</td>
</tr>
<tr>
<td>Discounted payback</td>
<td>29.5%</td>
</tr>
<tr>
<td>Accounting rate of return</td>
<td>30.3%</td>
</tr>
<tr>
<td>Profitability index</td>
<td>11.9%</td>
</tr>
</tbody>
</table>
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<table>
<thead>
<tr>
<th>Table 6.5 (book)</th>
<th>Large firms</th>
<th>Small firms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency of use of various capital</td>
<td>Internal rate of return</td>
<td>3.41</td>
</tr>
<tr>
<td>budgeting methods</td>
<td>Net present value</td>
<td>3.42</td>
</tr>
<tr>
<td></td>
<td>Payback method</td>
<td>2.25</td>
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<tr>
<td></td>
<td>Discounted payback</td>
<td>1.55</td>
</tr>
<tr>
<td></td>
<td>Accounting rate of return</td>
<td>1.25</td>
</tr>
<tr>
<td></td>
<td>Profitability index</td>
<td>0.75</td>
</tr>
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