Example

• Consider a firm with two projects, A and B, each with the following cash flows and a 10 percent cost of capital:

<table>
<thead>
<tr>
<th>Year</th>
<th>Project A Cash Flows</th>
<th>Project B Cash Flows</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>-$100</td>
<td>-$150</td>
</tr>
<tr>
<td>1</td>
<td>$70</td>
<td>$100</td>
</tr>
<tr>
<td>2</td>
<td>$70</td>
<td>$100</td>
</tr>
</tbody>
</table>

Net Present Value (NPV)

• What is it?
  – Measure of value creation from project

• How do I do it?
  – PV of future CFs – Initial Cost

• The Investment Rule:
  – Accept projects with positive NPV and accept highest NPV first
Net Present Value (NPV)

- **Pros:**
  - Uses all cash flows
  - Incorporates time value of money
  - Directly related to EVA

- **Cons:**
  - Need appropriate discount rate
  - Relatively more difficult to explain

Internal Rate of Return (IRR)

- **What is it?**
  - Discount rate that makes the NPV = 0

- **How do I do it?**
  - Set NPV = 0 and solve for discount rate

- **The Investment Rule:**
  - Accept if IRR is greater than required rate of return and accept highest IRR first

Internal Rate of Return (IRR)

- **Pros:**
  - Closely related to NPV, leads to same decision MOST of the time
  - Relatively more easy to explain

- **Cons:**
  - May result in multiple answers
  - May result in incorrect decisions
NPV Profiles

- What is an NPV profile?
- Nonnormal Cash Flows
<table>
<thead>
<tr>
<th>Year</th>
<th>Cash Flow</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>-$252</td>
</tr>
<tr>
<td>1</td>
<td>$1,431</td>
</tr>
<tr>
<td>2</td>
<td>-$3,035</td>
</tr>
<tr>
<td>3</td>
<td>$2,850</td>
</tr>
<tr>
<td>4</td>
<td>-$1,000</td>
</tr>
</tbody>
</table>
- Mutually Exclusive Projects

Modified Internal Rate of Return (MIRR)

- What is it?
  - Discount rate that makes present value of outflows equal to future value of inflows
- How do I do it?
  - Take present value of outflows and future value of inflows and solve for breakeven rate
- The Investment Rule:
  - Accept if the MIRR is greater than the required rate of return and accept highest MIRR first.

Modified Internal Rate of Return (MIRR)

- Pros:
  - Assumes all cash flows are reinvested at the required rate of return
  - Closely related to NPV, leading to the same decision more than the IRR
  - No longer possible to get multiple answers
- Cons:
  - Can still lead to incorrect decisions when size/difference and mutually exclusive projects
Profitability Index

- **What is it?**
  - Benefit-cost ratio

- **How do I do it?**
  - Present value of future cash inflows divided by initial cost

- **The Investment Rule:**
  - Accept if PI greater than 1 and accept highest PI first.

Profitability Index

- **Pros:**
  - Closely related to NPV, leading to same decision MOST of the time
  - May be useful when available funds are limited

- **Cons:**
  - May result in incorrect decisions

Payback Period

- **What is it?**
  - Time to recover initial investment

- **How do I do it?**
  - Add up cash flows to determine time

- **The Investment Rule:**
  - Accept if payback period is less than cutoff and accept shortest payback first
Payback Period

• **Pros:**
  – Simple, no need for discount rate
  – Biased toward projects with higher liquidity

• **Cons:**
  – Ignores time value of money
  – Can accept negative NPV projects
  – Ignores cash flows beyond cutoff
  – Can reject positive NPV projects
  – Arbitrary cutoff
  – Biased against long-term projects (e.g., R&D)

Discounted Payback Period

• **What is it?**
  – Time for present value of cash flows to recover initial investment

• **How do I do it?**
  – Add up present value of cash flows to determine time

• **The Investment Rule:**
  – Accept if discounted payback period is less than cutoff and accept shortest discounted payback first

Discounted Payback Period

• **Pros:**
  – Incorporates the time value of money
  – Does not accept negative NPV projects
  – Biased toward liquidity

• **Cons:**
  – Ignores cash flows beyond the cutoff
  – Can reject positive NPV projects
  – Arbitrary cutoff
  – Biased against long-term projects (e.g., R&D)
Projects with Unequal Lives

• Replacement Chain or Common Life Approach

• Equivalent Annual Annuity (EAA) or Equivalent Annual Cost
  – Calculate the annuity payment based on the NPV

Projects with Unequal Lives: An Example

Your firm is considering which pollution reduction system to purchase and implement to meet required EPA standards. Option 1 involves an initial $30,000 investment and subsequent annual costs of $10,000, and must be replaced again after 3 years. Option 2 requires an initial investment of $55,000 and has a 6 year life, requiring subsequent annual costs of $4,000, $6,000, $8,000, $12,000, $14,000, and $16,000, respectively. The appropriate discount rate for this project is 12 percent. Which option do you recommend?

Chapter 12
Suggested Problems

• Questions:
  – 12-3 through 12-6

• Problems:
  – 12-1 through 12-9, 12-13, 12-16, 12-18, 12-20, and 12-22