Chapter 9
Making Capital Investment Decisions

Key Concepts and Skills
- Understand how to determine the relevant cash flows for a proposed investment
- Understand how to analyze a project’s projected cash flows
- Understand how to evaluate an estimated NPV

Chapter Outline
- Project Cash Flows: A First Look
- Incremental Cash Flows
- Pro Forma Financial Statements and Project Cash Flows
- More on Project Cash Flows
- Evaluating NPV Estimates
- Scenario and Other What-If Analyses
- Additional Considerations in Capital Budgeting

Relevant Cash Flows
- The cash flows that should be included in a capital budgeting analysis are those that will only occur if the project is accepted
- These cash flows are called incremental cash flows
- The stand-alone principle allows us to analyze each project in isolation from the firm simply by focusing on incremental cash flows

Asking the Right Question
- You should always ask yourself “Will this cash flow change ONLY if we accept the project?”
  - If the answer is “yes,” it should be included in the analysis because it is incremental
  - If the answer is “no”, it should not be included in the analysis because it is not affected by the project
  - If the answer is “part of it,” then we should include the part that occurs because of the project

Common Types of Cash Flows
- Sunk costs – costs that have accrued in the past
- Opportunity costs – costs of lost options
- Side effects
  - Positive side effects – benefits to other projects
  - Negative side effects – costs to other projects
- Changes in net working capital
- Financing costs
- Taxes
Pro Forma Statements and Cash Flow

- Capital budgeting relies heavily on pro forma accounting statements, particularly income statements
- Computing cash flows – refresher
  - Operating Cash Flow (OCF) = EBIT + depreciation – taxes
  - OCF = Net income + depreciation when there is no interest expense
  - Cash Flow From Assets (CFFA) = OCF – net capital spending (NCS) – changes in NWC

Table 9.1 Pro Forma Income Statement

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Sales (50,000 units at $4.00/unit)</td>
<td>$200,000</td>
</tr>
<tr>
<td>Variable Costs ($2.50/unit)</td>
<td>125,000</td>
</tr>
<tr>
<td>Gross profit</td>
<td>75,000</td>
</tr>
<tr>
<td>Fixed costs</td>
<td>12,000</td>
</tr>
<tr>
<td>Depreciation ($90,000 / 3)</td>
<td>30,000</td>
</tr>
<tr>
<td>EBIT</td>
<td>$33,000</td>
</tr>
<tr>
<td>Taxes (34%)</td>
<td>11,220</td>
</tr>
<tr>
<td>Net Income</td>
<td>$21,780</td>
</tr>
</tbody>
</table>

Table 9.2 Projected Capital Requirements

<table>
<thead>
<tr>
<th>Year</th>
<th>NWC</th>
<th>Net Fixed Assets</th>
<th>Total Investment</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>$20,000</td>
<td>90,000</td>
<td>$110,000</td>
</tr>
<tr>
<td>1</td>
<td>$20,000</td>
<td>60,000</td>
<td>$80,000</td>
</tr>
<tr>
<td>2</td>
<td>$20,000</td>
<td>30,000</td>
<td>$50,000</td>
</tr>
<tr>
<td>3</td>
<td>$20,000</td>
<td>0</td>
<td>$20,000</td>
</tr>
</tbody>
</table>

Table 9.5 Projected Total Cash Flows

<table>
<thead>
<tr>
<th>Year</th>
<th>OCF</th>
<th>Change in NWC</th>
<th>Capital Spending</th>
<th>CFFA</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>$51,780</td>
<td>-$20,000</td>
<td>-$90,000</td>
<td>-$110,000</td>
</tr>
<tr>
<td>1</td>
<td>$51,780</td>
<td></td>
<td></td>
<td>$51,780</td>
</tr>
<tr>
<td>2</td>
<td>$51,780</td>
<td></td>
<td></td>
<td>$51,780</td>
</tr>
<tr>
<td>3</td>
<td>$71,780</td>
<td></td>
<td></td>
<td>$71,780</td>
</tr>
</tbody>
</table>

Making The Decision

- Now that we have the cash flows, we can apply the techniques that we learned in chapter 8
- Enter the cash flows into the calculator and compute NPV and IRR
  - \( \text{NPV} = -$110,000 + 51,780/1.2 + 51,780/(1.2)^2 + 71,780/(1.2)^3 \)
  - \( \text{NPV} = $10,648 \)
  - \( \text{IRR} = 25.8\% \)
- Should we accept or reject the project?

The Tax Shield Approach

- You can also find operating cash flows, using the tax shield approach
  - \( \text{OCF} = (\text{Sales} – \text{costs})(1 – \text{T}) + \text{Depreciation}^*\text{T} \)
- This form may be particularly useful when the major incremental cash flows are the purchase of equipment and the associated depreciation tax shield – such as when you are choosing between two different machines
More on NWC

• Why do we have to consider changes in NWC separately?
  – GAAP requires that sales be recorded on the income statement when made, not when cash is received
  – GAAP also requires that we record cost of goods sold when the corresponding sales are made, regardless of when we actually pay our suppliers
  – So, cash flow timing differences exist between the purchase of inventory, revenue and costs from its sale on the income statement, and the actual cash collection from its sale

Depreciation

• The depreciation expense used for capital budgeting should be the depreciation schedule required by the IRS for tax purposes
• Depreciation itself is a non-cash expense; consequently, it is only relevant because it affects taxes
• Depreciation tax shield = D x T
  – D = depreciation expense
  – T = marginal tax rate

Computing Depreciation

• Straight-line depreciation
  – D = (Initial cost – salvage) / number of years
  – Very few assets are depreciated straight-line for tax purposes
• MACRS
  – Need to know which asset class is appropriate for tax purposes
  – Multiply percentage given in table by the initial cost
  – Depreciate to zero
  – Mid-year convention

After tax Salvage

• If the salvage value is different from the book value of the asset, then there is a tax effect
• Book value = initial cost – accumulated depreciation
• After tax salvage = salvage – T(salvage – book value)

Example: Depreciation and After-tax Salvage

• You purchase equipment for $100,000 and it costs $10,000 to have it delivered and installed. Based on past information, you believe that you can sell the equipment for $17,000 when you are done with it in 6 years. The company’s marginal tax rate is 40%. What is the depreciation expense each year, and the after tax salvage in year 6, for each of the following situations?

Example: Straight-line Depreciation

• Suppose the appropriate depreciation schedule is straight-line
  – D = ($110,000 – 17,000) / 6 = $15,500 every year for 6 years
  – BV in year 6 = $110,000 – 6($15,500) = $17,000
  – After tax salvage = $17,000 – .4(17,000 – 17,000) = $17,000
Example: Three-year MACRS

<table>
<thead>
<tr>
<th>Year</th>
<th>MACRS Percent</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>.3333</td>
<td>.3333(110,000) = 36,663</td>
</tr>
<tr>
<td>2</td>
<td>.4444</td>
<td>.4444(110,000) = 48,884</td>
</tr>
<tr>
<td>3</td>
<td>.1482</td>
<td>.1482(110,000) = 16,302</td>
</tr>
<tr>
<td>4</td>
<td>.0741</td>
<td>.0741(110,000) = 8,151</td>
</tr>
</tbody>
</table>

BV in year 6 = 110,000 – 36,663 – 48,884 – 16,302 – 8,151 = 0

After-tax salvage = 17,000 – .4(17,000 – 0) = $10,200

Example: Seven-Year MACRS

<table>
<thead>
<tr>
<th>Year</th>
<th>MACRS Percent</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>.1429</td>
<td>.1429(110,000) = 15,719</td>
</tr>
<tr>
<td>2</td>
<td>.2449</td>
<td>.2449(110,000) = 26,939</td>
</tr>
<tr>
<td>3</td>
<td>.1749</td>
<td>.1749(110,000) = 19,239</td>
</tr>
<tr>
<td>4</td>
<td>.1249</td>
<td>.1249(110,000) = 13,739</td>
</tr>
<tr>
<td>5</td>
<td>.0893</td>
<td>.0893(110,000) = 9,823</td>
</tr>
<tr>
<td>6</td>
<td>.0893</td>
<td>.0893(110,000) = 9,823</td>
</tr>
</tbody>
</table>

BV in year 6 = 110,000 – 15,719 – 26,939 – 19,239 – 13,739 – 9,823 = 14,718

After-tax salvage = 17,000 – .4(17,000 – 14,718) = 16,087.20

Example: Replacement Problem

- **Original Machine**
  - Initial cost = 100,000
  - Annual depreciation = 9,000
  - Purchased 5 years ago
  - Book Value = 55,000
  - Salvage today = 65,000
  - Salvage in 5 years = 10,000

- **New Machine**
  - Initial cost = 150,000
  - 5-year life
  - Salvage in 5 years = 0
  - Cost savings = 50,000 per year
  - 3-year MACRS depreciation

- **Required return = 10%**
- **Tax rate = 40%**

Replacement Problem – Pro Forma Income Statements

<table>
<thead>
<tr>
<th>Year</th>
<th>Cost Savings</th>
<th>Depr. New</th>
<th>Dep. Old</th>
<th>Incr. Dep.</th>
<th>EBIT</th>
<th>Taxes</th>
<th>NI</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>50,000</td>
<td>49,995</td>
<td>9,000</td>
<td>40,995</td>
<td>50,000</td>
<td>9,005</td>
<td>40,995</td>
</tr>
<tr>
<td>2</td>
<td>50,000</td>
<td>66,660</td>
<td>9,000</td>
<td>57,660</td>
<td>47,770</td>
<td>14,078</td>
<td>33,692</td>
</tr>
<tr>
<td>3</td>
<td>50,000</td>
<td>22,230</td>
<td>9,000</td>
<td>13,230</td>
<td>36,770</td>
<td>19,154</td>
<td>17,616</td>
</tr>
<tr>
<td>4</td>
<td>50,000</td>
<td>11,115</td>
<td>9,000</td>
<td>2,115</td>
<td>47,885</td>
<td>23,600</td>
<td>24,285</td>
</tr>
<tr>
<td>5</td>
<td>50,000</td>
<td>0</td>
<td>9,000</td>
<td>9,000</td>
<td>59,000</td>
<td>29,731</td>
<td>29,269</td>
</tr>
</tbody>
</table>

Replacement Problem – Computing Cash Flows

- Remember that we are interested in incremental cash flows
- If we buy the new machine, then we will sell the old machine
- What are the cash flow consequences of selling the old machine today instead of in 5 years?

Replacement Problem – Incremental Net Capital Spending

- **Year 0**
  - Cost of new machine = $150,000 (outflow)
  - After-tax salvage on old machine = $65,000 - .4(65,000 – 55,000) = $51,000 (inflow)
  - Incremental net capital spending = $150,000 – 61,000 = $89,000 (outflow)
- **Year 5**
  - After tax salvage on old machine = $10,000 - .4(10,000 – 10,000) = $10,000 (outflow because we no longer receive this)
Replacement Problem – Cash Flow From Assets

<table>
<thead>
<tr>
<th>Year</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>OCF</td>
<td>46,398</td>
<td>53,064</td>
<td>35,292</td>
<td>30,846</td>
<td>26,400</td>
<td>16,400</td>
</tr>
<tr>
<td>NCS</td>
<td>-89,000</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Δ In</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NWC</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CFFA</td>
<td>-89,000</td>
<td>46,398</td>
<td>53,064</td>
<td>35,292</td>
<td>30,846</td>
<td>16,400</td>
</tr>
</tbody>
</table>

Replacement Problem – Analyzing the Cash Flows

- Now that we have the cash flows, we can compute the NPV and IRR
  - Discount the cash flows at 10%
  - NPV = 54,801.29
  - IRR = 36% by trial-and-error (36.27%, more precisely, using a financial calculator or spreadsheet)
  - Note that the positive NPV indicates IRR > 10%

- Should the company replace the equipment?

Evaluating NPV Estimates

- The NPV estimates are just that – estimates
- A positive NPV is a good start – now we need to take a closer look
  - Forecasting risk – how sensitive is our NPV to changes in the cash flow estimates, the more sensitive, the greater the forecasting risk
  - Sources of value – why does this project create value?

Scenario Analysis

- What happens to the NPV under different cash flows scenarios?
- At the very least look at:
  - Best case – revenues are high and costs are low
  - Worst case – revenues are low and costs are high
  - Measure of the range of possible outcomes
- Best case and worst case are not necessarily probable; they can still be possible

Sensitivity Analysis

- What happens to NPV when we vary one variable at a time
- This is a subset of scenario analysis where we are looking at the effect of specific variables on NPV
- The greater the volatility in NPV in relation to a specific variable, the larger the forecasting risk associated with that variable and the more attention we want to pay to its estimation

New Project Example

- Consider the project discussed in the text
- The initial cost is $200,000 and the project has a 5-year life. There is no salvage. Depreciation is straight-line, the required return is 12% and the tax rate is 34%
- The base case NPV is $15,567
Summary of Scenario Analysis

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Net Income</th>
<th>Cash Flow</th>
<th>NPV</th>
<th>IRR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Base case</td>
<td>$19,800</td>
<td>$59,800</td>
<td>$15,567</td>
<td>15.1%</td>
</tr>
<tr>
<td>Worst Case</td>
<td>-15,510</td>
<td>24,490</td>
<td>-111,719</td>
<td>-14.4%</td>
</tr>
<tr>
<td>Best Case</td>
<td>59,730</td>
<td>99,730</td>
<td>159,504</td>
<td>40.9%</td>
</tr>
</tbody>
</table>

Summary of Sensitivity Analysis

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Unit Sales</th>
<th>Cash Flow</th>
<th>NPV</th>
<th>IRR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Base case</td>
<td>6,000</td>
<td>59,800</td>
<td>15,567</td>
<td>15.1%</td>
</tr>
<tr>
<td>Worst case</td>
<td>5,500</td>
<td>53,200</td>
<td>-8,226</td>
<td>10.3%</td>
</tr>
<tr>
<td>Best case</td>
<td>6,500</td>
<td>66,400</td>
<td>39,357</td>
<td>19.7%</td>
</tr>
</tbody>
</table>

Making A Decision

- Beware “Paralysis of Analysis”
- At some point, you have to make a decision
- If the majority of your scenarios have positive NPVs, then you can feel reasonably comfortable about accepting the project
- If you have a crucial variable that leads to a negative NPV with a small change in the estimates, then you may want to forgo the project

Managerial Options

- Capital budgeting projects often provide other options that we have not yet considered
  - Contingency planning
  - Option to expand
  - Option to abandon
  - Option to wait
  - Strategic options

Capital Rationing

- Capital rationing occurs when a firm or division has limited resources
  - Soft rationing – the limited resources are temporary, often self-imposed
  - Hard rationing – capital will never be available for this project
- The profitability index is a useful tool when faced with soft rationing