Chapter 10
Making Capital Investment Decisions

Key Concepts and Skills
• Understand how to determine the relevant cash flows for various types of proposed investments
• Understand the various methods for computing operating cash flow
• Understand how to set a bid price for a project
• Understand how to evaluate the equivalent annual cost of a project

Chapter Outline
• Project Cash Flows: A First Look
• Incremental Cash Flows
• Pro Forma Financial Statements and Project Cash Flows
• More about Project Cash Flow
• Alternative Definitions of Operating Cash Flow
• Some Special Cases of Discounted Cash Flow Analysis
Relevant Cash Flows

- The cash flows that should be included in a capital budgeting analysis are those that will only occur (or not 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.

Relevant Capital Budgeting Cash Flows are:

- Future, not past (i.e. Sunk)
- Operating, Not financial (dividends, interest, repayment of loans, issuing stock)
- Incremental, = Company with – Company without
- After-tax, Cash Flows, Not Profits
  - Add back non-cash expense (i.e. Depreciation)

Initial (Year 0) Cash Flows:

- 1. Cost of new equipment including shipping and installation (this is the number that will be depreciated (depreciable basis)), always a cash outflow (-).
- 2. Change in working capital (increases in assets are a use (-) of cash, increases in liabilities are a source (+) of cash).
- 3. Tax impact of new equipment (rarely tested, almost always exists in real life).
- Replacement only, 4. Salvage Value of Old Equipment, always a cash inflow (+).
- Replacement only, 5. Tax impact of Old Equipment (= ((Book Value – Salvage Value)\(\times \)tax rate)), may be inflow or outflow.
Operating Cash Flows, a modified income statement for each year of the Project

• + Sales
• - Variable Operating Expenses
• - Fixed Operating Expenses
• - Depreciation (depreciable basis * depreciation percentage)
• = EBIT
• - Taxes
• = NOPAT
• + Depreciation
• = Operating Cash Flows

More on Operating Cash Flows

• If a replacement problem, use net changes for Sales, Variable Operating Expenses, Fixed Operating Expenses and Depreciation.
• Example

Terminal Cash Flows (New Project)

• 1. Salvage Value of the now old New Equipment, always a cash inflow.
• 2. Tax impact of now old New Equipment = (Book Value – Salvage Value) * tax rate.
  – If you sell machine for more than book value, this is a profit that creates a tax liability or a cash outflow (-). If you sell the machine for less than book value, this is a loss/reduction in profits that creates a tax credit or a cash inflow (+).
• 3. Recovery of Working Capital (the exact same number as line 2 in Initial Cash Flows with the opposite sign).
Terminal Cash Flows (Replacement Project)

• Lines 1, 2, 3 of New Project and Replacement Problems Only. 4. Opportunity Cost of not receiving Salvage Value for Old equipment, which is always a cash outflow (-).
  - This is because if you sell the old machine at time 0 (a cash inflow) you cannot later sell it at the end of the project. Thus we record the selling price we do not receive as a negative number.
• Replacement Problems Only. 5. Opportunity Cost of tax impact of not receiving Salvage Value for Old Equipment = -(Book Value-Opportunity Salvage)/tax rate.
  - Note the negative sign prior to book value, since line 4 is always a cash outflow, we reverse the sign for the tax impact.

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Asking the Right Question

• You should always ask yourself “Will this cash flow occur 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 will occur anyway
  - 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

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  - Cash Flows
    - Not Profits
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5. Replacement only, Tax impact of Old Equipment (= ((Book Value – Salvage Value)*tax rate)), may be inflow or outflow.
Operating Cash Flows, a modified income statement for each year of the Project

- Sales
- Variable Operating Expenses
- Fixed Operating Expenses
- Depreciation (depreciable basis * depreciation percentage)
- = EBIT
- Taxes
- = NOPAT
+ Depreciation
= Operating Cash Flows

More on Operating Cash Flows

- If a replacement problem, use net changes for Sales, Variable Operating Expenses, Fixed Operating Expenses and Depreciation.
- Example

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  - Note the negative sign prior to book value, since line 4 is always a cash outflow, we reverse the sign for the tax impact.

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 10.1 Pro Forma Income Statement (pgs. 310-311)

<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 10.2 Projected Capital Requirements

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

Table 10.5 Projected Total Cash Flows

<table>
<thead>
<tr>
<th>Year</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
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<tbody>
<tr>
<td>OCF</td>
<td>$51,780</td>
<td>$51,780</td>
<td>$51,780</td>
<td></td>
</tr>
<tr>
<td>Change in NWC</td>
<td>-$20,000</td>
<td>20,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>NCS</td>
<td>-$90,000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CFFA</td>
<td>-$110,000</td>
<td>$51,780</td>
<td>$51,780</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 9
- Enter the cash flows into the calculator and compute NPV and IRR
  - $\text{CF}_0 = -110,000; \text{CF}_1 = 51,780; \text{F0} = 2; \text{CF}_2 = 71,780; \text{F0} = 1$
  - NPV; I = 20; CPT NPV = 10,648
  - CPT IRR = 25.8%
- Should we accept or reject the project?
<table>
<thead>
<tr>
<th></th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sales</td>
<td>$200,000</td>
<td>$200,000</td>
<td>$200,000</td>
</tr>
<tr>
<td>Variable Expense</td>
<td>$125,000</td>
<td>$125,000</td>
<td>$125,000</td>
</tr>
<tr>
<td>Fixed costs</td>
<td>$12,000</td>
<td>$12,000</td>
<td>$12,000</td>
</tr>
<tr>
<td>Depreciation (straightline)</td>
<td>$30,000</td>
<td>$30,000</td>
<td>$30,000</td>
</tr>
<tr>
<td>EBIT</td>
<td>$33,000</td>
<td>$33,000</td>
<td>$33,000</td>
</tr>
<tr>
<td>Taxes @ 34%</td>
<td>$11,220</td>
<td>$11,220</td>
<td>$11,220</td>
</tr>
<tr>
<td>NOPAT</td>
<td>$21,780</td>
<td>$21,780</td>
<td>$21,780</td>
</tr>
<tr>
<td>Depreciation</td>
<td>$30,000</td>
<td>$30,000</td>
<td>$30,000</td>
</tr>
<tr>
<td>Operating Cash Flow</td>
<td>$51,780</td>
<td>$51,780</td>
<td>$51,780</td>
</tr>
<tr>
<td>Salvage</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
</tr>
<tr>
<td>Tax Impact of Salvage</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
</tr>
<tr>
<td>Recovery of Working Capital</td>
<td>$20,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>-110,000</td>
<td>$51,780</td>
<td>$51,780</td>
</tr>
</tbody>
</table>

**Decision**

- **NPV@20% = 10,648** Accept
- **IRR = 25.80%** Accept
- **PI @20% = 1.097** Accept
- **Payback = 2 to 3 years** Don’t Know

**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, whether we have actually paid our suppliers yet
  - Finally, we have to buy inventory to support sales, although we haven’t collected cash yet

**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
  \[ D = \frac{\text{Initial cost} - \text{salvage}}{\text{number of years}} \]
  - Very few assets are depreciated straight-line for tax purposes; lots for external reporting purposes
- MACRS (generally required by tax law)
  - 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
- Impact
  - Same total Profits, Taxes, and Cash Flows
  - Higher early years Net Income for Straight-line as lower depreciation expense
  - Higher NPV for MACRS as higher early year cash flows

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 – \[ T(\text{salvage} - \text{book value}) \]

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

- 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>
<th>BV in year 6 = 110,000 – 36,663 – 48,895 – 16,291 – 8,151 = 0</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>.3333</td>
<td>.3333(110,000) = 36,663</td>
<td>After-tax salvage (1) 17,000</td>
</tr>
<tr>
<td>2</td>
<td>.4445</td>
<td>.4445(110,000) = 48,895</td>
<td>(2) (0-17,000),4-6800</td>
</tr>
<tr>
<td>3</td>
<td>.1481</td>
<td>.1481(110,000) = 16,291</td>
<td>Total = $10,200</td>
</tr>
<tr>
<td>4</td>
<td>.0741</td>
<td>.0741(110,000) = 8,151</td>
<td></td>
</tr>
</tbody>
</table>

Example: Seven-Year MACRS

<table>
<thead>
<tr>
<th>Year</th>
<th>MACRS Percent</th>
<th>D</th>
<th>BV in year 6 = 110,000 – 15,719 – 26,939 – 19,239 – 13,739 – 9,812 = 14,729</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>.1429</td>
<td>.1429(110,000) = 15,719</td>
<td>After-tax salvage (1) 17,000</td>
</tr>
<tr>
<td>2</td>
<td>.2449</td>
<td>.2449(110,000) = 26,939</td>
<td>(2) (17,000–14,729),4–908.40</td>
</tr>
<tr>
<td>3</td>
<td>.1749</td>
<td>.1749(110,000) = 19,239</td>
<td>= 16,091.60</td>
</tr>
<tr>
<td>4</td>
<td>.1249</td>
<td>.1249(110,000) = 13,739</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>.0893</td>
<td>.0893(110,000) = 9,823</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>.0892</td>
<td>.0892(110,000) = 9,812</td>
<td></td>
</tr>
</tbody>
</table>
Contact Charles Hodges

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Example: Replacement Problem

- Original Machine
  - Initial cost = 100,000
  - Annual depreciation = 20,000
  - 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 – 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 – Analyzing the Cash Flows

- Now that we have the cash flows, we can compute
- Should the company replace the equipment?
- NPV@10% = 54,801 Accept
- IRR = 36.26% Accept
- PI @10% = 1.365 Accept
- Payback = 3 to 4 years Don’t Know

Other Methods for Computing OCF

- Bottom-Up Approach
  - Works only when there is no interest expense
  - OCF = NI + depreciation
- Top-Down Approach
  - OCF = Sales – Costs – Taxes
  - Don’t subtract non-cash deductions
- Tax Shield Approach
  - OCF = (Sales – Costs)(1 – T) + Depreciation*T
Example: Cost Cutting

- Your company is considering a new computer system that will initially cost $1 million. It will save $300,000 per year in inventory and receivables management costs. The system is expected to last for five years and will be depreciated using 3-year MACRS. The system is expected to have a salvage value of $50,000 at the end of year 5. There is no impact on net working capital. The marginal tax rate is 40%. The required return is 8%.

- Click on the Excel icon to work through the example.

<table>
<thead>
<tr>
<th>Year</th>
<th>Cost</th>
<th>NWC</th>
<th>Revenues</th>
<th>Variable Expense</th>
<th>Fixed costs</th>
<th>Depreciation (pg. 316)</th>
<th>EBIT</th>
<th>Taxes @ 40%</th>
<th>NOPAT</th>
<th>Depreciation</th>
<th>Operating Cash Flow</th>
<th>Salvage</th>
<th>Tax Impact of Salvage</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>-$1,000,000</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
<td>-$300,000</td>
<td>$333,300</td>
<td>-$33,300</td>
<td>-$13,320</td>
<td>-$19,980</td>
<td>$333,300</td>
<td>$313,320</td>
<td>$50,000</td>
<td>-$20,000</td>
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<td>$444,500</td>
<td>-$144,500</td>
<td>-$57,800</td>
<td>-$86,700</td>
<td>$444,500</td>
<td>$357,800</td>
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<td></td>
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<td>2</td>
<td></td>
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<td></td>
<td>$148,100</td>
<td>$151,900</td>
<td>$60,760</td>
<td>$91,140</td>
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<td>$74,100</td>
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<td></td>
<td></td>
<td></td>
<td>$210,000</td>
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|        |        |        |        |        |        |        |        |        |        |        |        |        |        |
|        |        |        |        |        |        |        |        |        |        |        |        |        |        |

- Decision:
  - NPV @ 8% = $83,798; Accept
  - IRR = 11.45%; Accept
  - PI = 1.084; Accept
  - Payback = 3 to 4 years; Don’t Know

Example: Equivalent Annual Cost Analysis

- Burnout Batteries
  - Initial Cost = $36 each
  - 3-year life
  - $100 per year to keep charged
  - Expected salvage = $5
  - Straight-line depreciation
- Long-lasting Batteries
  - Initial Cost = $60 each
  - 5-year life
  - $88 per year to keep charged
  - Expected salvage = $5
  - Straight-line depreciation

The machine chosen will be replaced indefinitely and neither machine will have a differential impact on revenue. No change in NWC is required.

The required return is 15%, and the tax rate is 34%.
Quick Quiz

• How do we determine if cash flows are relevant to the capital budgeting decision?
• What are the different methods for computing operating cash flow and when are they important?
• What is equivalent annual cost and when should it be used?

Ethics Issues

• In an L.A. Law episode, an automobile manufacturer knowingly built cars that had a significant safety flaw. Rather than redesigning the cars (at substantial additional cost), the manufacturer calculated the expected costs of future lawsuits and determined that it would be cheaper to sell an unsafe car and defend itself against lawsuits than to redesign the car. What issues does the financial analysis overlook?

Comprehensive Problem

• A $1,000,000 investment is depreciated using a seven-year MACRS class life. The project will last for 8 years and the salvage value is 0. It requires $150,000 in additional inventory and will increase accounts payable by $50,000. It will generate $400,000 in revenue and $150,000 in cash expenses annually, and the tax rate is 40%. What is the incremental cash flow in years 0, 1, 7, and 8?
## Financial Summary

<table>
<thead>
<tr>
<th>Year</th>
<th>Cost</th>
<th>NWC</th>
<th>Revenues</th>
<th>Variable Expense</th>
<th>Fixed Costs</th>
<th>Depreciation</th>
<th>EBIT</th>
<th>Taxes @ 40%</th>
<th>NOPAT</th>
<th>Depreciation</th>
<th>Operating Cash Flow</th>
<th>Salvage</th>
<th>Tax Impact of Salvage</th>
<th>Recovery of Working Capital</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>$1,000,000</td>
<td>$100,000</td>
<td>$400,000</td>
<td>$150,000</td>
<td>$0</td>
<td>$142,900</td>
<td>$107,100</td>
<td>$42,840</td>
<td>$64,260</td>
<td>$142,900</td>
<td>$207,160</td>
<td>$0</td>
<td>$100,000</td>
<td>$1,100,000</td>
<td>$207,160</td>
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<tr>
<td>2</td>
<td>$1,000,000</td>
<td>$100,000</td>
<td>$400,000</td>
<td>$150,000</td>
<td>$0</td>
<td>$244,900</td>
<td>$5,100</td>
<td>$2,040</td>
<td>$3,060</td>
<td>$244,900</td>
<td>$247,960</td>
<td>$0</td>
<td>$100,000</td>
<td>$1,100,000</td>
<td>$247,960</td>
</tr>
<tr>
<td>3</td>
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</table>

**Contact Charles Hodges**

- Email D2L Email or chodges@westga.edu
- Chat Sessions
- Skype (bufordshighway), LinkedIn and Facebook (Charles Hodges).
- Office Phone (678)839-4816 and Cell Phone (770)301-8648, target is under 24 hours