Analyzing Project Cash Flows

Chapter 12

Principles Applied in This Chapter

- Principle 3: Cash Flows Are the Source of Value.

- Principle 5: Individuals Respond to Incentives.

Identifying Incremental Cash Flows

- **Incremental cash flow** refers to the additional cash flow a firm receives by taking on a new project.

$$\begin{pmatrix}\text{Incremental Project}\\ \text{Cash Flows}\end{pmatrix} = \begin{pmatrix}\text{Firm Cash Flows}\\ \text{with the Project}\end{pmatrix} - \begin{pmatrix}\text{Firm Cash Flows}\\ \text{without the Project}\end{pmatrix}$$

Guidelines for Forecasting Incremental Cash Flows

- **Sunk Costs** (such as market research) and **overhead costs** (such as utilities expenses) are not incremental cash flows.

- Account for positive and negative **synergistic effects** and **opportunity costs.**

Guidelines for Forecasting Incremental Cash Flows

- Work in **Working Capital Requirement**
  - Need for additional working capital arises as cash inflows and outflows are often mismatched.

- Ignore **Financing Costs**
  - They are accounted for in the discount rate used to discount cash flows.

Forecasting Project Cash Flows

- **Pro forma financial statements** are forecasts of future financial statements.
- We can calculate free cash flow using the following equation:

$$\text{Free Cash Flow} = \overbrace{\underbrace{\text{Net Operating Income (Profit)}}_{\text{Net Operating Profit after Taxes or NOPAT}} - \text{Taxes} + \text{Depreciation Expense}}^{\text{Operating Cash Flow}} - \text{Increase in Capital Expenditures } (\textit{CAPEX}) - \text{Increase in Net Operating Working Capital } (\textit{NOWC})$$

Forecasting Project Cash Flows

- Four Step Procedure for calculating cash flows

1. Depreciation expense
2. Change in working capital required
3. Change in capital expenditures
4. Calculate Free Cash Flows for project

Depreciation Expense, Taxes and Cash Flow

Depreciation expenses is subtracted while calculating the firm's taxable income.

However, depreciation is a not a cash expense.

Therefore, depreciation must be added back into net operating income when calculating cash flows.

Depreciation Expense, Taxes and Cash Flow

Annual Depreciation expense (using straight line method)

= (Cost of equipment

+ Shipping & Installation Expense

– Expected salvage value) ÷ (Life of the equipment)

Depreciation Expense, Taxes and Cash Flow

Example Consider a firm that purchased an equipment for $500,000 and incurred an additional $50,000 for shipping and installation.

The equipment is expected to last 10 years and have a salvage value of $25,000?

What is the annual depreciation expense?

Depreciation Expense, Taxes and Cash Flow

Annual Depreciation expense

= (Cost of equipment + Shipping & Installation Expense – Expected salvage value) ÷ (Life of the equipment)

= ($500,000 + $50,000 - $25,000) ÷ (10)

= **$52,500**

Working Capital

Step 2: Calculating a Project's Working Capital Requirements

When sales increase, firm's account receivable balance will tend to grow.

In addition, new projects may lead to an increase in the firm's investment in inventories.

Both lead to cash outflow.

Working Capital

If the firm is able to finance some or all of its inventories using trade credits, this will offset the cash outflow. Thus the net increase is given by:

$$\begin{aligned}\text{Investment in Net Operating Working Capital} &= \begin{pmatrix}\text{Increase in}\\ \text{Accounts Receivable}\end{pmatrix} + \begin{pmatrix}\text{Increase in}\\ \text{Inventories}\end{pmatrix} - \begin{pmatrix}\text{Increase in}\\ \text{Accounts Payable}\end{pmatrix} \\ &= \$60{,}000 + 36{,}000 - 18{,}000 = \$78{,}000\end{aligned}$$

Working Capital

- Increase working capital is a cash outflow
- Will working capital requirements drop when the project ends?
  - If "Yes," we have a cash inflow at the end of the project

Capital Expenditures

Step 3: Calculating a Project's Capital Expenditure Requirement

When the project is over, we add the salvage value of asset to the final year's free cash flow along with recovery of any operating working capital.

Free Cash Flow

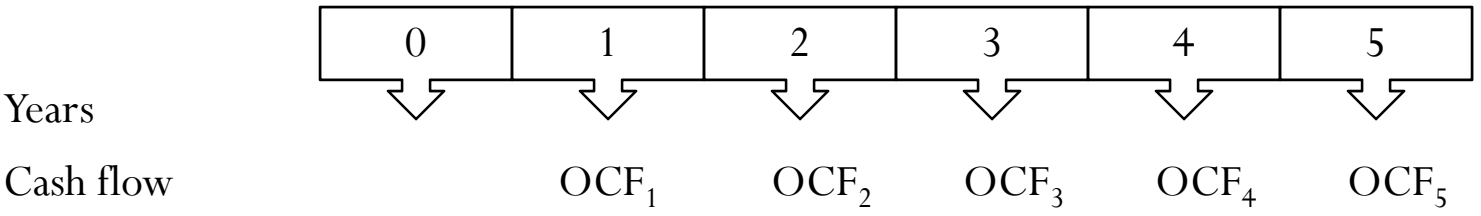
Step 4: Calculating a Project's Free Cash Flow

$$\text{Free Cash Flow} = \overbrace{\underbrace{\text{Net Operating Income (Profit)} - \text{Taxes}}_{\textbf{Net Operating Profit after Taxes or NOPAT}} + \text{Depreciation Expense}}^{\textbf{Operating Cash Flow}} - \text{Increase in Capital Expenditures } (\textit{CAPEX}) - \text{Increase in Net Operating Working Capital } (\textit{NOWC})$$

The Problem

- Crockett Clothing Company has analyzed investing in a new sewing machine assuming $360,000 annual revenue.
  - Checkpoint 12.1
- The firm's management wants to know the impact of a decrease in expected revenues from $360,000 to $240,000 per year.
- What would be the project's operating cash flow under the revised revenue estimate?

Step 1: Picture the Problem



- $OCF_{1\text{-}5}$ = Sum of additional revenues less operating expenses (cash and depreciation) less taxes plus depreciation expense

Step 1: Picture the Problem

This is the information given to us:

Equipment	**$2,00,000**
Project life	**5 years**
Salvage Value	**-**
Depreciation expense	**$40,000 per year**
Cash Operating Expenses	**-$5,000 per year**
Revenues	**$240,000 per year**
Growth rate for revenues	**0%**
Cost of goods sold/Revenues	**60%**
Investment in Net operating working capital	**-$78,000**
Required rate of return	**20%**
Tax rate	**30%**

Step 2: Decide on a Solution Strategy

- We need to calculate the operating cash flows

$$\text{Operating Cash Flow}_t = \underbrace{\text{Net Operating Income (or Profit)}_t - \text{Taxes}_t}_{\text{NOPAT}_t} + \text{Depreciation Expense}_t$$

Step 3: Solve

Since there is no change in revenues or other sources of cash flows from year to year, the total operating cash flows will be the same every year.

Step 3: Solve (cont.)

	Year 1-5
Project Revenues (growth rate =0%)	$240,000
- Cost of goods sold (60% of revenues)	-144,000
= Gross Profit	$96,000
- Cash operating expense	-$5,000
- Depreciation	-$40,000
= Net operating income	$51,000
- Taxes (30%)	-$15,300
=Net Operating Profit after Taxes (NOPAT)	$35,700
+ Depreciation	$40,000
= Operating Cash Flows	$75,700

Step 4: Analyze

- This project contributes $35,700 to the firm's net operating income (after taxes) based on annual revenues of $240,000.
  - This represents a significant drop from $69,300 when the revenues were $360,000.
- Since depreciation is a non-cash expense, it is added back to determine the annual operating cash flows.

Step 4: Analyze

	Year 1-5
Project Revenues (growth rate =0%)	$240,000
- Cost of goods sold (60% of revenues)	-144,000
= Gross Profit	$96,000
- Cash operating expense	-$5,000
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= Net operating income	$51,000
- Taxes (30%)	-$15,300
=Net Operating Profit after Taxes (NOPAT)	$35,700
+ Depreciation	$40,000
= Operating Cash Flows	$75,700

Step 4: Analyze

- The project contributes $75,700 to the firm's net operating income (before taxes). It shows that if the revenues drop from $360,000 to $240,000, the operating cash flows will also drop.

Computing Project NPV

Once we have estimated the operating cash flow, we can compute the NPV

$$\text{Net Present Value or } NPV = \underbrace{\text{Cash Flow for Year 0 } (CF_0)}_{\text{Cost of making the investment}} + \underbrace{\frac{\text{Cash Flow for Year 1 } (CF_1)}{\left(1 + \text{Discount Rate } (k)\right)^1} + \frac{\text{Cash Flow for Year 2 } (CF_2)}{\left(1 + \text{Discount Rate } (k)\right)^2} + \cdots + \frac{\text{Cash Flow for Year } n \ (CF_n)}{\left(1 + \text{Discount Rate } (k)\right)^n}}_{\text{Present value of the investment's cash inflows}}$$

Cost of making the investment = Initial cash flow, this is typically a cash outflow taking on a negative value.

Present value of the investment's cash inflows = Present value of the project's future cash inflows.

Computing Project NPV

- Compute the NPV for Checkpoint 12.1: *CheckYourself* based on the following additional assumptions:
  - Increase in net working capital = -$70,000 in Year 0
  - Decrease in net working capital = $70,000 in Year 5
  - Discount Rate = 15%

Computing Project NPV (cont.)

	Year 0	Year 1-4	Year 5
Operating Cash flow	**-**	**$75,700**	**$75,700**
Less: Capital expenditure	**-$200,000**	**-**	**-**
Less: additional net working capital	**-$70,000**	**-**	**$70,000**
Free Cash Flow	**-$270,000**	**$75,700**	**$145,700**

Computing Project NPV

Using a Mathematical Equation

$$\text{Net Present Value or } NPV = \underbrace{\text{Cash Flow for Year 0 } (CF_0)}_{\text{Cost of making the investment = Initial cash flow, this is typically a cash outflow taking on a negative value.}} + \underbrace{\frac{\text{Cash Flow for Year 1 } (CF_1)}{\left(1 + \text{Discount Rate } (k)\right)^1} + \frac{\text{Cash Flow for Year 2 } (CF_2)}{\left(1 + \text{Discount Rate } (k)\right)^2} + \cdots + \frac{\text{Cash Flow for Year } n \ (CF_n)}{\left(1 + \text{Discount Rate } (k)\right)^n}}_{\text{Present value of the investment's cash inflows = Present value of the project's future cash inflows.}}$$

- NPV = -$270,000 + {$75,700/(1.15)} + {$75,700/$(1.15)^2$} + {$75,700/$(1.15)^3$} + {$75,700/$(1.15)^4$} + {$145,700/$(1.15)^5$}

= **$18,560**

12.3 INFLATION AND CAPITAL BUDGETING

Inflation and Capital Budgeting

- Cash flows that account for future inflation are referred to as **nominal cash flows. Real cash flows** are cash flows that would occur in the absence of inflation.

- Nominal cash flows must be discounted at nominal rate and real cash flows must be discounted at real rate of interest.

Replacement Project Cash Flows

An **expansion project** increases the scope of firm's operations, but does not replace any existing assets or operations.

A **replacement investment,** an acquisition of a new productive asset, replaces an older, less productive asset.

Replacement Project Cash Flows

A distinctive feature of many replacement investment is that principal source of cash flows comes from ***cost savings***, not new revenues.

Replacement Project Cash Flows

To facilitate the capital budgeting analysis for replacement projects, we categorize the investment cash flows into two categories:

- Initial Outlay (CF_0), and
- Annual Cash Flows ($CF_{1\text{-end}}$).

Category 1: Initial Outlay, CF_0

Initial outlay typically includes:

- Cost of fixed assets
- Shipping and installation expense
- Investment in net working capital
- Sale of old equipment
- Tax implications from sale of old equipment

Category 1: Initial Outlay

- There are three possible scenarios when an old asset is sold:

Selling Price of old asset	Tax Implications
At depreciated value	No taxes
Higher than depreciated value (or book value)	Difference between the selling price and depreciated book value is a taxable gain and is taxed at the marginal corporate tax rate.
Lower than depreciated value (or book value)	Difference between the depreciated book value and selling price is a taxable loss and may be used to offset capital gains.

Category 2: Annual Cash Flows

Annual cash flows for a replacement decision differ from a simple asset acquisition because we must now consider the differential operating cash flow of the new versus the old (replaced) asset.

Category 2: Annual Cash Flows

Change in Depreciation and Taxes:

The depreciation expenses will increase by the amount of depreciation on the new asset

but will decrease by the amount of the depreciation of the replaced asset.

Category 2: Annual Cash Flows

Changes in Working Capital: Increase in working capital is necessitated by the increase in accounts receivable and increased investment in inventories. The increase is partially offset if inventory is financed by accounts payable.

Category 2: Annual Cash Flows

Changes in Capital Spending: The replacement asset will require an outlay at the time of acquisition but may also require additional capital over its life.

Finally, at the end of the project's life, there will be a cash inflow equal to the after-tax salvage value of the new asset.

The Problem

- Forecast the project cash flows for the replacement press for Leggett where the new press results in net operating income per year of $600,000 compared to $580,000 for the old machine.
- This increase in revenues also means that the firm will also have to increase it's investment in net working capital by $20,000.
- Estimate the initial cash outlay required to replace the old machine with the new one
- Estimate the annual cash flow for years 1 through 5.

The Problem

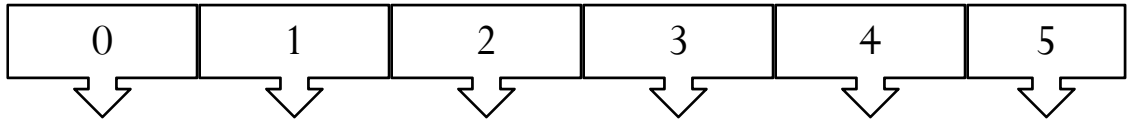
	Machine	
	New	Old
Annual cost of defects	$ 20,000	$ 70,000
Net operating income	$600,000	$580,000
Book value of equipment	350,000	100,000
Salvage value (today)	NA	150,000
Salvage value (Year 5)	50,000	—
Shipping cost	$ 20,000	NA
Installation cost	30,000	NA
Remaining project life (years)	5	5
Net operating working capital	$ 80,000	$ 60,000
Salaries	100,000	200,000
Fringe benefits	10,000	20,000
Maintenance	60,000	20,000

Step 1: Picture the Problem

- The new machine will require an initial outlay, which will be partially offset by the after-tax cash flows from the old machine.

- The new machine will help improve efficiency and reduce repairs, but it will also increase the annual maintenance expense.

Step 1: Picture the Problem



Cash flows(New)	$CF(N)_0$	$CF(N)_1$	$CF(N)_2$	$CF(N)_3$	$CF(N)_4$	$CF(N)_5$
MINUS						
Cash Flows (Old)	$CF(O)_0$	$CF(O)_1$	$CF(O)_2$	$CF(O)_3$	$CF(O)_4$	$CF(O)_5$
EQUALS						
Difference (New – Old)	ΔCF_0	ΔCF_1	ΔCF_2	ΔCF_3	ΔCF_4	ΔCF_5

Step 1: Picture the Problem

- The decision to replace will be based on the replacement cash flows.

$$\text{Replacement Cash Flows } (\Delta CF)_{\text{Year } t} = \begin{pmatrix} \text{Cash Flow for} \\ \text{the New Asset} \\ CF\,(\text{New})_{\text{Year } t} \end{pmatrix} - \begin{pmatrix} \text{Cash Flow for} \\ \text{the Old Asset} \\ CF\,(\text{Old})_{\text{Year } t} \end{pmatrix}$$

Step 2: Decide on a Solution Strategy

The cash flows will be calculated using

$$\text{Operating Cash Flow}_t = \underbrace{\text{Net Operating Income (or Profit)}_t - \text{Taxes}_t}_{\text{NOPAT}_t} + \text{Depreciation Expense}_t$$

Step 2: Decide on a Solution Strategy

- However, for replacement projects, the emphasis is on the difference in costs and benefits of the new machine versus the old.

- Accordingly, we compute the initial cash outflow and the annual cash flows (from Year 1 through Year 5).

Step 3: Solve

Initial cash outflow (CF_0)

= Cost of new equipment

+ Shipping cost

+ Installation cost

– Sale of old equipment

± tax effects from sale of old equipment.

Step 3: Solve

Year 0		New Machine	Old Machine
Purchase price		-$350,000	
Shipping cost		-$20,000	
Installation cost		-$30,000	
Working Capital		-$20,000	
Total cost of New		-$420,000	
Sale Price			$150,000
Less: Tax on gain	$50,000*.30		-$15,000
Net cash flow			$135,000
Replacement Net Cash Flow		-$285,000	

Step 3: Solve

- Thus, the total cost of new machine of $400,000 is partially offset by the old machine resulting in a net cost of $285,000.

- Next we compute the annual cash from years 1-5. Cash Flows for years 1-4 will be the same.

Step 3: Solve

Analysis of Annual Cash Inflows	Years 1-4	Year 5
Increase in operating income	$20,000	$20,000
Reduced salaries	$100,000	$100,000
Reduced defects	$50,000	$50,000
Reduced fringe benefits	$10,000	$10,000
Total cash inflows	$180,000	$180,000

Step 3: Solve

Analysis of Annual Cash Out Flows	Years 1-4	Years 5
Increased maintenance	-$40,000	-$40,000
Increased depreciation	-$50,000	-$50,000
Net operating income	$90,000	$90,000
Less: Taxes	-$27,000	-$27,000
Net operating profit after taxes	$63,000	$63,000
Plus: depreciation	$50,000	$50,000
Operating cash flow	$113,000	$113,000
Less: Change in operating working capital		$20,000
Less: CAPEX		50,0000
Free Cash Flows	$113,000	$183,000

Step 4: Analyze

- In this case, we observe that the new machine generated cost savings and also increased the revenues by $20,000.

- Based on the estimates of initial cash outflow and subsequent annual free cash flows for years 1-5, we can compute the NPV.

Computing NPV

- Compute the NPV for this replacement project based on discount rate of 15%.

$$NPV = -\$285{,}000 + \$113{,}000/(1.15)^1 + \$113{,}000/(1.15)^2 + \$113{,}000/(1.15)^3 + \$113{,}000/(1.15)^4 + \$183{,}000/(1.15)^5$$

$$= \mathbf{\$128{,}595.90}$$