

Module 8

IDENTIFYING AND ESTIMATING A PROJECT'S CASH FLOWS

Background

- Fundamental principles guiding the determination of a project's cash flows and how they should be applied
 - Actual cash-flow principle
 - Cash flows must be measured at the time they actually occur
 - With/without principle
 - Cash flows relevant to an investment decision are only those that change the firm's overall cash position
 - Sunlight Manufacturing Company's (SMC) designer desk lamp project used to illustrate approach

Background

- After reading this Module, students should understand
 - The actual cash-flow principle and the with/without principle and how to apply them when making capital expenditure decisions
 - How to identify a project's relevant and irrelevant cash flows
 - Sunk costs and opportunity costs
 - How to estimate a project's relevant cash flows

The Actual Cash-flow Principle

- Cash flows must be measured at the time they actually occur
- If inflation is expected to affect future prices and costs, **nominal cash flows** should be estimated
 - Cost of capital must also incorporate the anticipated rate of inflation
- If the impact of inflation is difficult to determine, **real cash flows** can be employed
 - Inflation should also be excluded from the cost of capital
- A project's expected cash flows must be measured in the same currency

The With/Without Principle

- The **relevant cash flows** are only those that change the firm's overall future cash position, as a result of the decision to invest
 - AKA: **incremental**, or **differential**, cash flows
 - Equal to difference between firm's expected cash flows if the investment is made (the firm 'with' the project) and its expected cash flows if the investment is not made (the firm 'without' the project)

The With/Without Principle

- To illustrate the definitions of **incremental, differential cash flows** and those of **relevant/irrelevant costs, unavoidable costs, sunk costs and opportunity costs** consider the following example
 - Example: A person must decide whether to drive to work or take public transportation
 - If he drives his monthly costs are:

• Insurance costs	\$120
• Rent on garage near apartment	\$150
• Parking fees	\$90
• Gas and car service	\$110

The With/Without Principle

- If he takes the train his monthly ticket costs are \$140
 - The cash flows **with** the project are (assuming he doesn't sell his car)
 - $CF(\text{train}) = -120 - 150 - 140 = -\410
 - The cash flows **without** the project are
 - $CF(\text{car}) = -120 - 150 - 90 - 110 = -470$
 - The **incremental cash flows** are
 - $CF(\text{train}) - CF(\text{car}) = -\$410 - -\$470 = +\60

The Designer Desk Lamp Project

- Sunlight Manufacturing Company (SMC) is considering a possible entrance in the designer desk lamp market
 - The project's characteristics are reported in [Exhibit 8.1](#)
- SMC's financial manager must
 - Estimate the project's expected cash flows
 - Determine whether the investment is a value-creating proposal

EXHIBIT 8.1a:

Data Summary of the Designer Desk Lamp Project.

ITEM	CORRESPONDING UNITS OR VALUE	TYPE	TIMING
1. Expected annual unit sales	45,000; 40,000; 30,000; 20,000; 10,000	Revenue	End of year 1 to 5
2. Price per unit	\$40 first year, then rising annually at 3%	Revenue	End of year 1 to 5
3. Consulting company's fee	\$30,000	Expense	Already incurred
4. Losses on standard lamps	\$100,000	Net cash loss	End of year 1 to 5
5. Rental of building to outsiders	\$10,000	Revenue	End of year 1 to 5
6. Cost of the equipment	\$2,000,000	Asset	Now
7. Straight-line depreciation expenses	\$400,000 (\$2,000,000 divided by 5 years)	Expense	End of year 1 to 5
8. Resale value of equipment	\$100,000	Revenue	End of year 5
9. Raw material cost/unit	\$10 the first year, then rising annually at 3%	Expense	End of year 1 to 5
10. Raw material inventory	7 days of sales	Asset	Now

EXHIBIT 8.1b:

Data Summary of the Designer Desk Lamp Project.

ITEM	CORRESPONDING UNIT OR VALUE	TYPE	TIMING
11. Accounts payable	4 weeks (or 28 days) of purchases	Liability	Now
12. Accounts receivable	8 weeks (or 56 days) of sales	Asset	Now
13. Work in process and finished goods inv	16 days of sales	Asset	Now
14. Direct labor cost per unit	\$5 the first year, then rising annually at 3%	Expense	End of year 1 to 5
15. Energy cost per unit	\$1 the first year, then rising annually at 3%	Expense	End of year 1 to 5
16. Overhead charge	1% of sales	Expense	End of year 1 to 5
17. Financing charge	12% of the net book value of assets	Expense	End of year 1 to 5
18. Tax expenses on income	40% of pretax profits	Expense	End of year 1 to 5
19. Tax expenses on capital gains	40% of pretax capital gains	Expense	End of year 5
20. Aftertax cost of capital	9% (see Module 10)	Not in the cash flow	

Identifying A Project's Relevant Cash Flows

- Sunk cost
 - Cost that has already been paid and for which there is no alternative use at the time when the accept/reject decision is being made
 - With/without principle excludes sunk costs from the analysis of an investment
- Opportunity costs
 - Associated with resources that the firm could use to generate cash, if it does not undertake the project
 - Costs do not involve any movement of cash in or out of the firm

Identifying A Project's Relevant Cash Flows

- Costs implied by potential sales erosion
 - Another example of an opportunity cost
 - Sales erosion can be caused by the project, or by a competing firm
 - Relevant only if they are directly related to the project
 - If sales erosion is expected to occur anyway, then it should be ignored
- Allocated costs
 - Irrelevant as long as the firm will have to pay them anyway
 - Only consider increases in overhead cash expenses resulting from the project

Identifying A Project's Relevant Cash Flows

- Depreciation expenses
 - Do not involve any cash outflows
 - Irrelevant to an investment decision
 - However provides for tax savings by reducing the firm's taxable profit
 - These tax savings are added to the project's relevant cash flows
- Tax expenses
 - If an investment is profitable, the *additional* tax the firm will have to pay is a relevant cash outflow
 - Computed using the firm's marginal corporate tax rate
 - Tax savings from the deductibility of interest expenses are taken into account in a project's estimated after-tax cost of capital
 - The tax reduction that results from the deduction of interest expenses must be ignored when calculating cash flows

Identifying A Project's Relevant Cash Flows

- Financing costs
 - Cash flows *to* the investors, not cash flows *from* the project
 - Are captured in the project's cost of capital
 - Should not be deducted from the project's cash flow stream
 - Investment- and financing-related cash flows from the designer desk lamp project are shown in [Exhibit 8.2](#)
- Inflation
 - If inflation is incorporated in the cost of capital, then it should also be incorporated in the calculation of cash flows
 - Need not incorporate the anticipated inflation rate in the cash flow items that the management *can* decide not to raise

EXHIBIT 8.2: Investment- and Financing-Related Cash-Flow Streams.

TYPE OF CASH-FLOW STREAM	INITIAL CASH FLOW	TERMINAL CASH FLOW	NPV at 10%
Investment-related cash flows	-\$1,000	+\$1,200	+\$91
Financing-related cash flows	+\$1,000	-\$1,100	Zero
Total Cash Flows	Zero	+\$100	+\$91

Estimating A Project's Relevant Cash Flows

- The expected cash flows must be estimated over the **economic life** of the project
 - Not necessarily the same as its **accounting life**—the period over which the project's fixed assets are depreciated for reporting purposes

Measuring The Cash Flows Generated By A Project

- Classic formula relating the project's expected cash flows in period t to its expected contribution to the firm's operating margin in period t :
 - $CF_t = EBIT_t(1-Tax_t) + Dep_t - \Delta WCR_t - Capex_t$
 - Where:
 - CF_t = relevant cash flow
 - $EBIT_t$ = contribution of the project to the Firm's Earnings Before Interest and Tax
 - Tax_t = marginal corporate tax rate applicable to the incremental $EBIT_t$
 - Dep_t = contribution of the project to the firm's depreciation expenses
 - ΔWCR_t = contribution of the project to the firm's working capital requirement
 - $Capex_t$ = capital expenditures related to the project

Estimating The Project's Initial Cash Outflow

- Project's initial cash outflow includes the following items:
 - Cost of the assets acquired to launch the project
 - Set up costs, including shipping and installation costs
 - Additional working capital required over the first year
 - Tax credits provided by the government to induce firms to invest
 - Cash inflows resulting from the sale of existing assets, when the project involves a decision to replace assets, including any taxes related to that sale

Estimating The Project's Intermediate Cash Flows

- The project's intermediate cash flows are calculated using the cash flow formula

Estimating The Project's Terminal Cash Flow

- The incremental cash flow for the last year of any project should include the following items:
 - The last incremental net cash flow the project is expected to generate
 - Recovery of the project's incremental working capital requirement, if any
 - After-tax resale value of any physical assets acquired in relation to the project
 - Capital expenditure and other costs associated with the termination of the project

EXHIBIT 8.3a:

Estimation of the Cash Flows Generated by the Designer Desk Lamp Project.

Figures in thousands of dollars; data from Exhibit 8.1

		End of Year				
	Now	1	2	3	4	5
I. Revenues						
1. Expected unit sales in thousands		45	40	30	20	10
2. Price per unit, rising at 3% per year		40.00	41.20	42.44	43.71	45.02
3. Total sales revenues (line 1 x line 2)	\$0	\$1,800	\$1,648	\$1,273	\$874	\$450
II. Operating Expenses						
4. Material cost per unit, rising at 3% per year		10.00	10.30	10.61	10.93	11.26
5. Total material cost (line 1 x line 4)		450	412	318	219	113
6. Labor cost per unit, rising at 3% per year		5.00	5.15	5.30	5.46	5.63
7. Total labor cost (line 1 x line 6)		225	206	159	109	56
8. Energy cost per unit, rising at 3% per year		1.00	1.03	1.06	1.09	1.13
9. Total energy cost (line 1 x line 8)		45	41	32	22	11

EXHIBIT 8.3b:

Estimation of the Cash Flows Generated by the Designer Desk Lamp Project.

Figures in thousands of dollars; data from Exhibit 8.1

		End of Year				
	Now	1	2	3	4	5
10. Loss of rental income (opportunity cost)		10	10	10	10	10
11. Depreciation Expense (\$2,000/5)		400	400	400	400	400
12. Total operating expenses (line 5+7+9+10+11)	\$0	\$1,130	\$1,069	\$919	\$760	\$590
III. Operating profit						
13. Pretax operating profit (EBIT) (line 3 – 12)	\$0	670	579	354	116	(140)
14. Less tax at 40% (when positive, a tax credit)	0	(268)	(232)	(142)	(47)	56
15. Aftertax operating profit (line 13 + 14)	\$0	\$402	\$347	\$212	\$69	(\$84)

EXHIBIT 8.3c:

Estimation of the Cash Flows Generated by the Designer Desk Lamp Project.

Figures in thousands of dollars; data from Exhibit 8.1

		End of Year				
	Now	1	2	3	4	5
IV. Cash flow generated by the project						
16. Aftertax operating profit (line 15)	\$0	\$402	\$347	\$212	\$69	(\$84)
17. Depreciation expense (Line 11)		400	400	400	400	400
18. WCR ¹ at 20% of next year's sales	360	330	255	175	90	0
19. Change in WCR from previous year	360	(30)	(75)	(80)	(85)	(90)
20. Capital expenditure	2,000	0	0	0	0	0
21. Recovery of the aftertax resale value of equip.						60
22. Cash flow from the project (line 16+17-19-20+21)	(\$2,360)	\$832	\$822	\$692	\$554	\$466

¹WCR = working capital requirement

EXHIBIT 8.4:

Calculation of Net Present Value for SMC's Designer Desk Lamp Project.

Figures from Exhibit 8.3

Initial cash outlay $CF_0 =$ (\$2,360,000)

Present value of $CF_1 = \$832,000 \times \frac{1}{(1 + 0.09)^1} = \$832,000 \times 0.9174 = \$763,276$

Present value of $CF_2 = \$822,000 \times \frac{1}{(1 + 0.09)^2} = \$822,000 \times 0.8417 = \$691,878$

Present value of $CF_3 = \$692,000 \times \frac{1}{(1 + 0.09)^3} = \$692,000 \times 0.7722 = \$534,362$

Present value of $CF_4 = \$554,000 \times \frac{1}{(1 + 0.09)^4} = \$554,000 \times 0.7084 = \$392,454$

Present value of $CF_5 = \$466,000 \times \frac{1}{(1 + 0.09)^5} = \$466,000 \times 0.6799 = \$302,853$

Net present value at 10%

\$324,823

Should SMC Launch The New Product?

- The project has a positive NPV
 - Before making the final decision the firm should perform a sensitivity analysis on the project's NPV to account for two important elements:
 - SMC may not be able to raise the price of its new lamp in steps with the inflation
 - SMC may incur net cash losses as a result of a potential reduction in the sales of its standard desk lamps

Sensitivity Of The Project's NPV To Changes In The Lamp Price

- Even if SMC is unable to raise the price of its lamps by the three percent expected rate of inflation, the project is still worth undertaking
 - Because its NPV remains positive

Sensitivity Of NPV To Sales Erosion

- Before deciding whether to launch the designer desk lamp project, SMC's managers must determine
 - The size of the possible annual reduction in sales and net cash flows through sales erosion
 - With an estimated \$100,000 yearly sales erosion, the project is no longer a value-creating proposal
 - However, it can withstand some sales erosion and still have a positive NPV
- Sensitivity analysis is a useful tool when dealing with project uncertainty
 - Helps identify those variables that have the greatest effect on the value of the proposal
 - Shows where more information is needed before a decision can be made