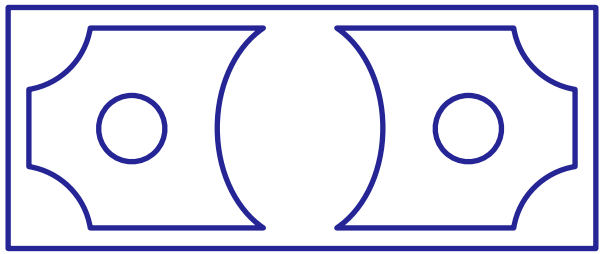
Chapter 10: Cash Flow Estimation



Learning Objectives

- Explain the General Rule of Project Cash Flows
- Estimate project initial cost
- Estimate project terminal cash flow
- Estimate project free cash flows
- Account for sunk costs, opportunity costs, externalities, and inflation

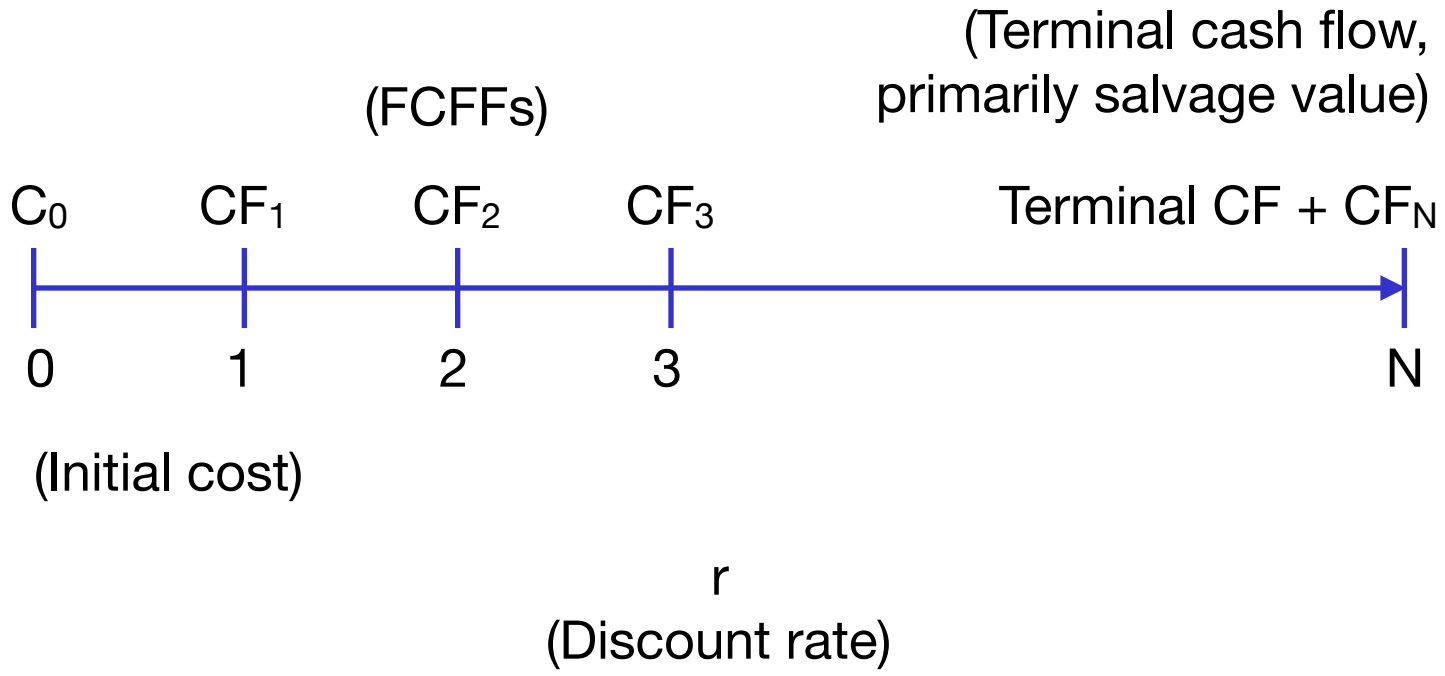
The General Rule

- The General Rule is:

  Project CF_t = (CF_t **with** the Project) - (CF_t **without** the Project)

- Is the cash flow incremental? Is it due to the project?
- That is, does it occur **only** if we accept the project?
  - If YES, include it.
  - If NO, ignore it.
- If the cash flow occurs whether or not you take on the project

Typical Project Cash Flows



Step 1: Initial Cost and Terminal Cash Flow

- Initial cost is the money spent by the firm to start the project.
  - Includes shipping costs and installation costs.
  - Includes investment tax credits.
- Terminal cash flow is comprised of one-time cash flows that close down the project.
  - Includes after-tax salvage value.
  - Includes severance and tear-down costs.
- After-Tax Salvage Value = Sale Price - (Tax on Gain)
- Gain = Sale Price - Book Value at End

Step 2: Estimating FCFF

1. Calculate operating cash flows.
2. Subtract additional capital expenditures.
3. Subtract change in non-cash working capital.

Step 2: Estimating FCFF

Revenues
(Costs)
(Depreciation)
EBIT
(Tax)
$EBIT_{after\text{-}tax}$
Depreciation
(Capital expenditures)
(Working capital)
FCFF

FCFF = (Rev - Costs - Dep)(1 - t) + Dep - Capex - ΔNWC

Step 2a: Operating Cash Flow

- Revenues = Units x (Price per Unit)
- (Variable) Costs = Units x (Cost per Unit)
- (Fixed) Costs = Costs
- Total Costs = Variable Costs + Fixed Costs
- EBIT = Revenues - Costs - Depreciation

Step 2a: Operating Cash Flow

- We often assume **straight-line depreciation**.
- Major assets are depreciated towards a book value at the end of their useful lives.
- Depreciation Expense Calculation:

$$\text{Depreciation} = (\text{Purchase Price} - BV_{end}) / \text{Depreciation Lifetime}$$

Step 2a: Operating Cash Flow

- $EBIT_{after\text{-}tax}$ = EBIT - Taxes
- Finally,

$$\text{Operating Cash Flow} = EBIT_{after\text{-}tax} + \text{Depreciation}$$

Step 2b: Capex

- Capital expenditures associated with the project.
- Often, companies assume Capex will equal depreciation.

Step 2c: Working Capital

- ΔNWC = ΔInv + ΔAR - ΔAP ➟ -ΔNWC = -ΔInv - ΔAR + ΔAP
  - Increasing inventory is a use of cash ➟ negative.
  - Increasing accounts receivable is a use of cash ➟ negative.
  - Increasing accounts payable is a source of cash ➟ positive.
- Working capital often increases at the start of a project's life…
  - Buy materials on credit ➟ increase AP
  - Sell product on credit ➟ increase AR
  - Build of inventories ➟ increase Inv
- … then returns to original levels at the end of the project.

Example

- As CFO of Hidden Valley you are considering building a new salad dressing factory. The initial cost to build the factory is $1 billion. The factory will last 5 years and have a salvage value of $250 million. You plan to use straight line depreciation and depreciate the factory to a book value of 0. You plan to sell 250 million bottles of the dressing each year, at a price of $5 per bottle. Your variable cost per unit produced is $2.75 and your fixed costs are $62.5 million. Additional capital expenditures of $50 million will be required at the end of each of the next 5- years (i.e., at t=1,2,3,4 and 5). Inventories and A/P will immediately rise by $20 million and $5 million respectively and remain at these levels until returning to original levels at the end of the project (t=5). A/R will rise by $100 million after the 1st year (i.e., at t=1) and remain at that level until falling back to original levels at the end of the project's life (t=5). If the WACC for the project is 15% and the marginal tax rate is 40%, what are the project's NPV, IRR, and MIRR?

Step 1

- “The initial cost to build the factory is $1 billion, the factory will last 5 years and have a salvage value of $250 million. You plan to use straight-line depreciation to depreciate the factory to a book value of zero.”
- Initial costs = $1000 million
- Salvage Value = $250 million
- Book Value = $0 million
- Therefore,

$$\mathbf{SV_{after\text{-}tax} = SV - (SV - BV) \times t = \$250 \times 0.60 = \$150 \text{ million}}$$

Step 2a-2b: Operating Cash Flow and Capital Expenditures

Revenues	250 million x $5	$1500 billion
(Variable Costs)	250 million x $2.75	$687.5 million
(Fixed Costs)		$62.5 million
(Depreciation)	$1 billion / 5	$200 million
EBIT		$300 million
(Tax)		$120 million
$EBIT_{after\text{-}tax}$		$180 million
Depreciation	$1 billion / 5	$200 million
Capex		$50 million
		$330 million

Step 2c: Working Capital

	0	1	2	3	4	5
ΔAR		$100				-$100
ΔInv	$20					-$20
(ΔAP)	$5					-$5
ΔNWC	$15	$100				-$115

(values in millions)

Step 2: FCFF

	0	1	2	3	4	5
…		$330	$330	$330	$330	$330
ΔAR		$100				-$100
ΔInv	$20					-$20
(ΔAP)	$5					-$5
ΔNWC	$15	$100				-$115
FCFF	-$15	$230	$330	$330	$330	$445

(values in millions)

Step 3: Combined Cash Flows

	0	1	2	3	4	5
Initial	-$1000					
FCFF	-$15	$230	$330	$330	$330	$445
Terminal						$150
Final	-$1015	$230	$330	$330	$330	$595

(values in millions)

Step 4: Net Present Value

	0	1	2	3	4	5
Initial	-$1000					
FCFF	-$15	$230	$330	$330	$330	$445
Terminal						$150
Final	-$1015	$230	$330	$330	$330	$595
Discount	1.00	1.15	1.32	1.52	1.75	2.01
PV	-$1015	$200	$250	$217	$189	$296
					NPV	$136

(values in millions)

Additional Considerations: Sunk Costs

- Hidden Valley plans to use a building that it owns for its new factory. The building was built at a cost of $250 million which we did not include in the initial cost of the project. Should we include it?
- **No**. This cost is **sunk (**i.e., the cost of the building has been incurred and does not depend on whether we accept or reject the project). It is not an incremental cash flow.

Additional Considerations: Opportunity Costs

- Hidden Valley plans to use a building it owns for its new factory. It could rent the building instead for $15 million per year. Does this affect our project decision?
- Yes. If the project is taken then we lost the opportunity to rent the building, so

0	1	2	3	4	5
	-$15	-$15	-$15	-$15	-$15

Additional Considerations: Externalities

- The new bottled salad dressing will have sales of $1.25 billion, but some of those sales (representing $10 million in FCFF) will come from consumers who switch from buying Hidden Valley's existing dry packet salad dressing. Does this affect our decision to produce bottled dressing?
- Yes. This cost is only incurred if we accept the project (this is known as **product cannibalization**).

0	1	2	3	4	5
	-$10	-$10	-$10	-$10	-$10

Step 4: Net Present Value (Update)

	0	1	2	3	4	5
Initial	-$1000					
FCFF	-$15	$230	$330	$330	$330	$445
Terminal						$150
Opp.		-$15	-$15	-$15	-$15	-$15
Ext.		-$10	-$10	-$10	-$10	-$10
Final	-$1015	$205	$305	$305	$305	$570
Discount	1.00	1.15	1.32	1.52	1.75	2.01
PV	-$1015	$178	$231	$201	$174	$283
					NPV	$52

(values in millions)

Additional Considerations: Inflation

- Does WACC incorporate inflation?
- YES—inflation is part the the risk-free rate.
- We need to make sure cash flows also reflect inflation.
- What assumptions does inflation affect?
    1. Prices
    2. Costs
    3. Cannibalization
    4. Opportunity Costs

Step 5a: FCFF with Inflation

	0	1	2	3	4	5
Revenue		$1250	$1288	$1326	$1366	$1407
(Costs)		$750	$773	$796	$820	$844
(Dep)		$200	$200	$200	$200	$200
EBIT		$300	$315	$330	$346	$363
(Tax)		$120	$126	$132	$139	$145
$EBIT_{after\text{-}tax}$		$180	$189	$198	$208	$218
Dep		$200	$200	$200	$200	$200
(Capex)		$50	$50	$50	$50	$50
(NWC)	$15	$100				-$115
FCFF	-$15	$230	$339	$348	$358	$483

(values in millions)

Step 5b: Final Time Line with Inflation

	0	1	2	3	4	5
Initial	-$1000					
FCFF	-$15	$230	$339	$348	$358	$483
Terminal						$150
Opp.		-$15	-$15	-$16	-$16	-$17
Ext.		-$10	-$10	-$11	-$11	-$11
Final	-$1015	$205	$313	$322	$330	$605
Discount	1.00	1.15	1.32	1.52	1.75	2.01
PV	-$1015	$178	$237	$212	$189	$301
					NPV	$101

(values in millions)

Summary

- Project cash flows are incremental.
- What cash flows are caused by the project?
- Use FCFF and WACC in NPV calculations.
- Both have firm-wide perspective.
- **Careful**:
    1. Gain on sale of equipment.
    2. Sunk costs.
    3. Externalities.
    4. Inflation.