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

Sales (50,000 units at $4.00/unit)	$200,000
Variable Costs ($2.50/unit)	125,000
Gross profit	$ 75,000
Fixed costs	12,000
Depreciation ($90,000 / 3)	30,000
EBIT	$ 33,000
Taxes (34%)	11,220
Net Income	$ 21,780

Table 9.2 Projected Capital Requirements

	Year			
	0	1	2	3
NWC	$20,000	$20,000	$20,000	$20,000
Net Fixed Assets	90,000	60,000	30,000	0
Total Investment	$110,000	$80,000	$50,000	$20,000

Table 9.5 Projected Total Cash Flows

	Year			
	0	1	2	3
OCF		$51,780	$51,780	$51,780
Change in NWC	-$20,000			$20,000
Capital Spending	-$90,000			
CFFA	-$110,00	$51,780	$51,780	$71,780

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
  - NPV = -$110,000 + 51,780/1.2 + 51,780/$(1.2)^2$ + 71,780/$(1.2)^3$
  - NPV = $10,648
  - 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
- OCF = (Sales – costs)(1 – T) + Depreciation*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 = DxT
  - 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

Year	MACRS percent	D
1	.3333	.3333(110,000) = 36,663
2	.4444	.4444(110,000) = 48,884
3	.1482	.1482(110,000) = 16,302
4	.0741	.0741(110,000) = 8,151

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

Year	MACRS Percent	D
1	.1429	.1429(110,000) = 15,719
2	.2449	.2449(110,000) = 26,939
3	.1749	.1749(110,000) = 19,239
4	.1249	.1249(110,000) = 13,739
5	.0893	.0893(110,000) = 9,823
6	.0893	.0893(110,000) = 9,823

BV in year 6 = 110,000 – 15,719 – 26,939 – 19,239 – 13,739 – 9,823 – 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 – 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 – Pro Forma Income Statements

Year	1	2	3	4	5
Cost Savings	50,000	50,000	50,000	50,000	50,000
Depr.					
New	49,995	66,660	22,230	11,115	0
Old	9,000	9,000	9,000	9,000	9,000
Increm.	40,995	57,660	13,230	2,115	(9,000)
EBIT	9,005	(7,660)	36,770	47,885	59,000
Taxes	3,602	(3,064)	14,708	19,154	23,600
NI	5,403	(4,596)	22,062	28,731	35,400

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) = $61,000 (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

Year	0	1	2	3	4	5
OCF		46,398	53,064	35,292	30,846	26,400
NCS	-89,000					-10,000
Δ In NWC	0					0
CFFA	-89,000	46,398	53,064	35,292	30,846	16,400

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

Scenario	Net Income	Cash Flow	NPV	IRR
Base case	$19,800	$59,800	$15,567	15.1%
Worst Case	-15,510	24,490	-111,719	-14.4%
Best Case	59,730	99,730	159,504	40.9%

Summary of Sensitivity Analysis

Scenario	Unit Sales	Cash Flow	NPV	IRR
Base case	6,000	59,800	15,567	15.1%
Worst case	5,500	53,200	-8,226	10.3%
Best case	6,500	66,400	39,357	19.7%

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