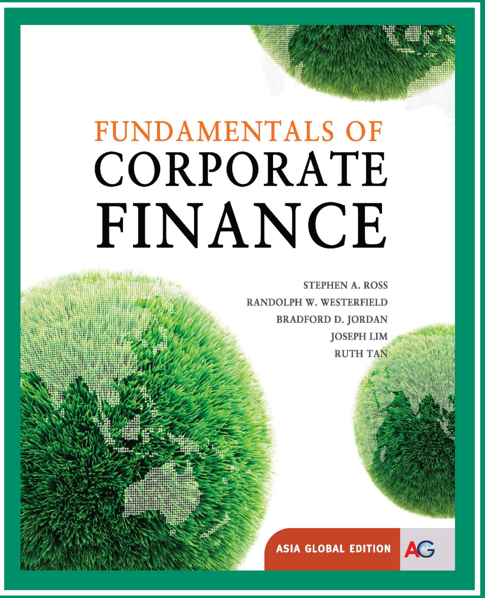

Chapter 10♪

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Making Capital Investment Decisions♪

McGraw-Hill/Irwin

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

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

Pro Forma or Projected Statements and Cash Flow

- Capital budgeting relies heavily on pro forma accounting statements, particularly income statements
- Computing cash flows
  – Operating Cash Flow (OCF) = EBIT – taxes + depreciation
  – Total Cash Flow = – net capital spending (NCS) + OCF – changes in NWC

Table 10.1 Projected 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 10.2 Projected Capital Requirements

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

Table 10.5 Projected Total Cash Flows

	Year			
	0	1	2	3
Capital Spending	-$90,000			
Operating Cash Flow		$51,780	$51,780	$51,780
Changes in NWC	-$20,000			20,000
Total Project CF	-$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 9
- Enter the cash flows into the calculator and compute NPV and IRR
  - Using financial calculator: -110,000 CF_0; 51,780 CF_1; 51,780 CF_2; 71,780 CF_3; 20 I/Y; CPT NPV = 10,648
  - CPT IRR = 25.8%
- ***Should we accept or reject the project?***

More on NWC

- Why do we have to consider changes in NWC separately?
  - General accounting principle requires that sales be recorded on the income statement when made, not when cash is received
  - It 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 = Depreciation x Tax Rate

Computing Depreciation

- Straight-line depreciation
  - Depreciation = Initial cost / number of years
  - We do not deduct salvage value to get the depreciation
- 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 – Tax (salvage – book value)
  - Aftertax salvage = Salvage (1 - Tax) only if the book value =0

Example: Straight-Line Depreciation and After-tax Salvage

- You purchase equipment for $90,000, 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 5 years. The company's marginal tax rate is 40%. Under straight line depreciation, what is the depreciation expense each year and the after-tax salvage in year 5?
  - Depreciation = 100,000 / 5 = 20,000 every year for 5 years
  - Book Value in year 5 = 100,000 – 5(20,000) = 0
  - After-tax salvage = salvage – Tax (salvage – book value) =17,000 - .4(17,000 – 0) = 10,200

Example: Replacement Problem

Original Machine

Initial cost = 100,000

Annual depreciation = 9000

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

Straight-line dep = 30,000

Salvage in 5 years = 17,000

Cost savings = 50,000/year

Required return = 10%
Tax rate = 40%
The old machine will be sold when the new machine is purchased.
The incremental CF are the changes from the old to the new situation.

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 – Incremental Net Capital Spending

Buy new machine = 150,000 (outflow)

Sell old machine = 65,000 - 0.4(65,000 – 55,000)
= 61,000 (inflow)

SV BV

Net capital spending
=150,000–61,000
=89,000(outflow)

Replacement Problem – Incremental OCF

Year	1 - 5
Cost Savings	50,000
Depreciation	
New	30,000
Old	9,000
Incremental	21,000
EBIT	29,000
Taxes	11,600
	17,400
NI Depreciation	21,000
OCF	38,400

relevant

Replacement Problem – Incremental Terminal CF

Net Salvage Value on new machine

= 17,000 - 0.4(17,000 - 0)

=10,200

SV BV

Net Salvage Value on old machine

= 10,000 - 0.4(10,000 – 10,000)

= 10,000

This is an opportunity cost because we no longer receive this at Year 5

Terminal CF = 200

Replacement Problem – Incremental CF on a Timeline

Year	0	1	2	3	4	5
NCS	-89,000					
OCF		38,400	38,400	38,400	38,400	38,400
SV (New)						+10,200
SV (Old)						-10,000
ΔNWC	0					0
NCF	-89,000	38,400	38,400	38,400	38,400	38,600

Replacement Problem – Analyzing the Cash Flows

- Now that we have the cash flows, we can compute the NPV and IRR
  - Enter the cash flows
  - Compute NPV = 56,690
  - Compute IRR = 32.66%
- Should the company replace the equipment?
- *In the next slide, we show that the new and old machines can be analyzed separately. In fact the NPV of the replacement decision = NPV (new machine) – NPV of (keeping the old machine)*

	New Machine	**Old Machine**	**New - Old**
Year 0	-150,000	-[65,000 - 0.4(65,000 – 55,000)] = -61000	-89000
Year 1	(50000-30000)(0.6)+30000=42000	(0-9000)(0.6)+9000=3600	38400
Year 2	42000	3600	38400
Year 3	42000	3600	38400
Year 4	42000	3600	38400
Year 5	42000	3600	38400
Year 5	17000- (17000-0)(0.4) =10200	3600+10000-(10000 –10000)(0.4)=10000	200
NPV@10%	15546.44	-41143.95	56690.39

Other Methods of Computing OCF

- Bottom-Up Approach
  - OCF = EBIT(1 - Tax) + depreciation
- Top-Down Approach
  - OCF = Sales – Costs – Taxes
  - Don’t subtract non-cash deductions
- Tax Shield Approach
  - OCF = (Sales – Costs)(1 – Tax) + Depreciation*Tax

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 4-year straight line basis. 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

Example: Setting the Bid Price

The lowest acceptable bid price is the one that makes the NPV = 0. At that price, you expect to just earn your required return.

- Consider the following information:
  - Army has requested bid for multiple use digitizing devices (MUDDs)
  - Deliver 4 units each year for the next 3 years
  - Labor and materials estimated to be $10,000 per unit
  - Production space leased for $12,000 per year
  - Requires $50,000 in fixed assets with expected salvage of $10,000 at the end of the project (depreciate straight-line)
  - Require initial $10,000 increase in NWC
  - Tax rate = 34%
  - Required return = 15%

Projects with Unequal Lives

- Suppose a firm is planning to expand and it has to select 1 of 2 machines. These machines have different economic lives. In addition, replacement of the machines is necessary at the end of their economic lives.
- How to choose between mutually exclusive machines with different lives when replacement is necessary?

Example: Projects with Unequal Lives

Projects S and L are mutually exclusive and will be replaced at the end of their economic lives. Which is better? Use r = 10%

	0	1	2	3	4
Project S	(100)	60	60		
Project L	(100)	33.5	33.5	33.5	33.5

	S	L
NPV	4.132	6.190

$NPV_L > NPV_S$

But is L better?

Note that if there is no replacement, L is indeed better.

Projects with Unequal Lives: Replacement Chain Approach

Project S with replication

	S	L
NPV	7.547	6.190

$NPV_S > NPV_L$

S is better

	0	1	2	3	4
Project S	(100)	60	60		
			(100)	60	60
	(100)	60	(40)	60	60

$NPV_S = \$7.547$

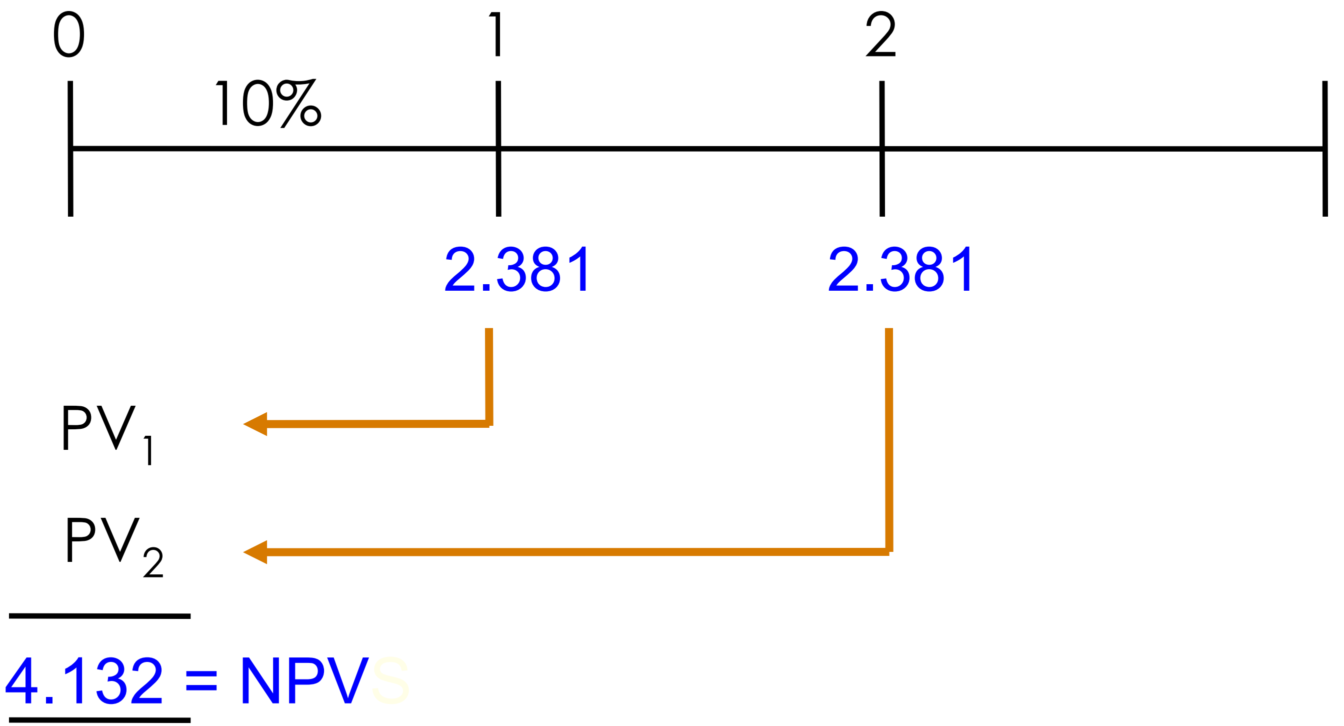
Projects with Unequal Lives: Equivalent Annual Annuity Approach

- Compute project's NPV over its initial life
  - For project S (over 2 years), it is $4.132
  - For project L (over 4 years), it is $6.190

- There is some constant annual CF (EAA) that has the same PV as the project's NPV

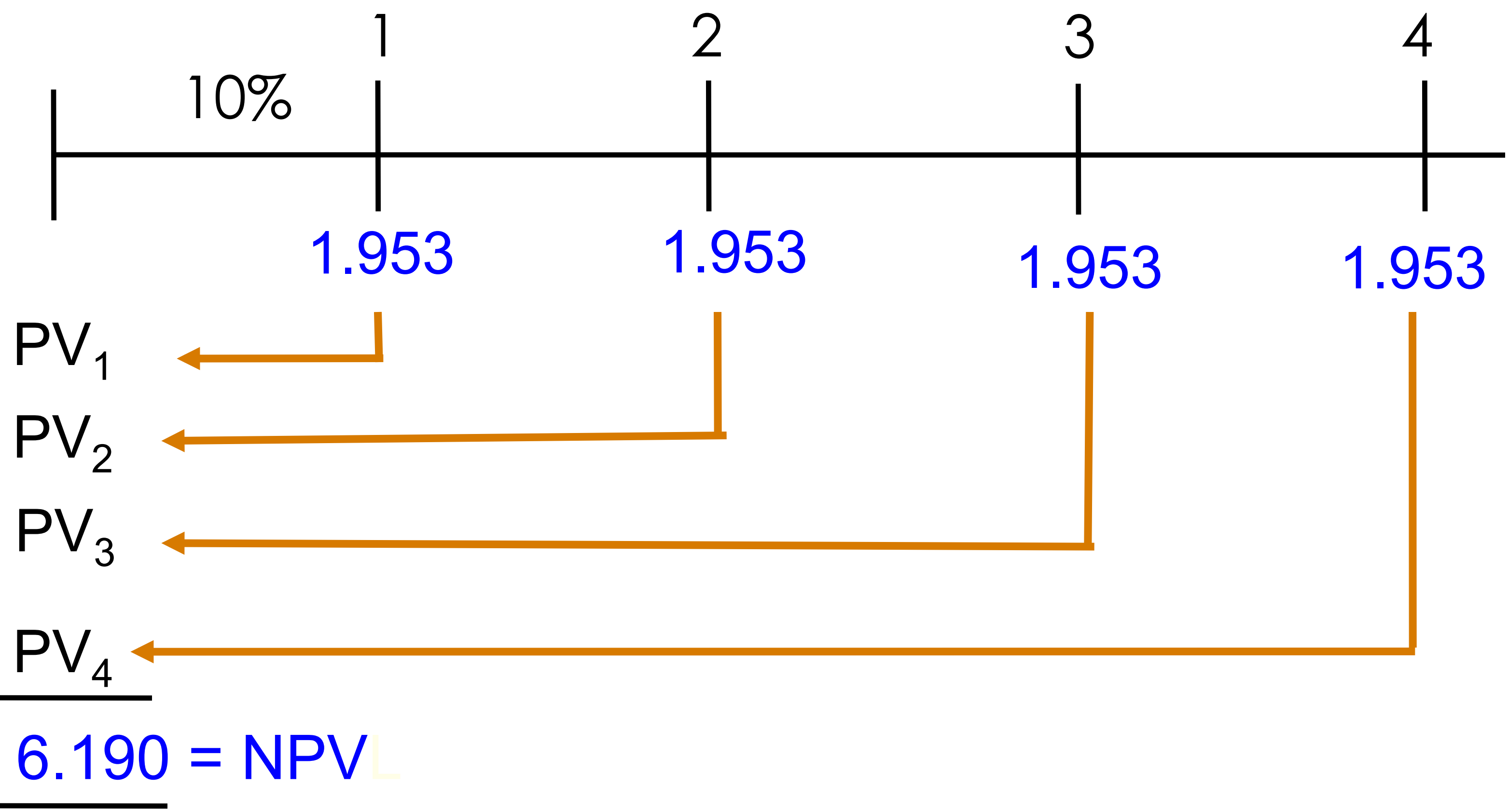
EAA Timeline for Project S

Project S:



EAA Timeline for Project L

Project L:



EAA Analysis of Projects S & L

- $EAA_S > EAA_L$ so select S

	S	L
EAA	2.381	1.953

- Replacement chains (NPV using common life) and EAA always lead to the same decision

Another Example: EAA 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 the basic process for finding the bid price?
- What is equivalent annual cost and when should it be used?

Example: MACRS 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 under 3-year MACRS and 7-year MACRS?

Example: Three-year MACRS

Year	MACRS percent	Depreciation
1	.3333	.3333(110,000) = 36,663
2	.4445	.4445(110,000) = 48,895
3	.1481	.1481(110,000) = 16,291
4	.0741	.0741(110,000) = 8,151

BV in year 6 = 110,000 – 36,663 – 48,895 – 16,291 – 8,151 = 0

After-tax salvage = 17,000 - .4(17,000 – 0) = $10,200

Example: Seven-Year MACRS

Year	MACRS Percent	Depreciation
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	.0892	.0892(110,000) = 9,812

BV in year 6 = 110,000 – 15,719 – 26,939 – 19,239 – 13,739 – 9,823 – 9,812 = 14,729

After-tax salvage = 17,000 – .4(17,000 – 14,729) = 16,091.60

End of Chapter