Chapter 9

- **Net Present Value and Other Investment Criteria**

Key Concepts and Skills

Be able to compute

- *Net Present Value (NPV)*
- *Payback Period*
- *Discounted Payback*
- *Accounting Rates of Return*
- *Internal Rate of Return*
- Profitability Index

- Understand **Best Decision Criterion**

Chapter Outline

- **Net Present Value**
- **The Payback Rule**
- **The Discounted Payback**
- **The Average Accounting Return**
- **The Internal Rate of Return**
- **The Profitability Index**

Good Decision Criteria

- ***"When evaluating capital budgeting decision rules"***, we need to ask ourselves the following questions
  - Does the decision rule
    - ***Adjust for the time value of money***?
    - ***Adjust for risk***?
    - Provide information on whether we are ***creating value for the firm***?

Example 9.1: Project Information

- You are looking at a new project and you have estimated the following cash flows:
  - Year 0: CF = -165,000
  - Year 1: CF = 63,120; NI = 13,620
  - Year 2: CF = 70,800; NI = 3,300
  - Year 3: CF = 91,080; NI = 29,100
  - Average Book Value = 72,000
- Your required return for assets of this risk is 12%.

Payback Period

- How long does it take to get the initial cost back in a nominal sense?
- Computation
  - Estimate the cash flows
  - Subtract the future cash flows from the initial cost until the initial investment has been recovered
- Decision Rule – ***Accept if the payback period is less than some preset limit***

Computing Payback For The Project

Decision Criteria Test - Payback

- Does the payback rule account for the time value of money?
- Does the payback rule account for the risk of the cash flows?
- Does the payback rule provide an indication about the increase in value?
- Should we consider the payback rule for our primary decision rule?

Advantages and Disadvantages of Payback

- Advantages
  - Easy to understand
  - Adjusts for uncertainty of later cash flows
- Disadvantages
  - Ignores the time value of money
  - Requires an arbitrary cutoff point
  - Ignores cash flows beyond the cutoff date
  - Biased against long-term projects, such as research and development, and new projects

Discounted Payback Period

- Compute the present value of each cash flow and then determine how long it takes to payback on a discounted basis
- Compare to a specified required period
- Decision Rule - ***Accept the project if it pays back on a discounted basis within the specified time***

Computing Discounted Payback for the Project

Advantages and Disadvantages of Discounted Payback

- Advantages
  - Includes time value of money
  - Easy to understand
- Disadvantages
  - May reject positive NPV investments
  - Requires an arbitrary cutoff point
  - Ignores cash flows beyond the cutoff point
  - Biased against long-term projects, such as R&D and new products

Average Accounting Return

- There are many different definitions for average accounting return
- The one used in the book is:
  - AAR = $\frac{\text{Average net income}}{\text{Average book value}}$
  - Note that the average book value depends on how the asset is depreciated.
- Need to have a target cutoff rate
- Decision Rule: ***Accept the project if the AAR is greater than a preset rate.***

Computing AAR For The Project

Advantages and Disadvantages of AAR

- Advantages
  - Easy to calculate
  - Needed information will usually be available
- Disadvantages
  - Not a true rate of return; time value of money is ignored
  - Uses an arbitrary target cutoff rate
  - Based on accounting net income and book values, not cash flows and market values

Profitability Index

- Measures the benefit per unit cost, based on the time value of money
- The PI = $\frac{\text{PV of the cash inflows}}{\text{PV of cash outflow}}$
- A profitability index of 1.1 implies that for every $1 of investment, we create an additional $0.10 in value
- This measure can be very useful in situations in which we have limited capital

Advantages and Disadvantages of Profitability Index

- Advantages
  - Closely related to NPV, generally leading to identical decisions
  - Easy to understand and communicate
  - May be useful when available investment funds are limited
- Disadvantages
  - May lead to incorrect decisions in comparisons of mutually exclusive investments

Net Present Value

- The difference between the market value of a project and its cost
- How much value is created from undertaking an investment?
  - The first step is to estimate the expected future cash flows.
  - The second step is to estimate the required return for projects of this risk level.
  - The third step is to find the present value of the cash flows and subtract the initial investment.

NPV – Decision Rule

- ***If the NPV is positive, accept the project***
  - A positive NPV means that the project is expected to add value to the firm and will therefore increase the wealth of the owners.
- Since our goal is to increase owner wealth, NPV is a direct measure of how well this project will meet our goal.

Year	Cash Flow
0	-165,000
1	63,120
2	70,800
3	91,080

Computing NPV for the Project

Internal Rate of Return

- This is the most important alternative to NPV
- It is often used in practice
- It is based entirely on the estimated cash flows and is independent of interest rates found elsewhere

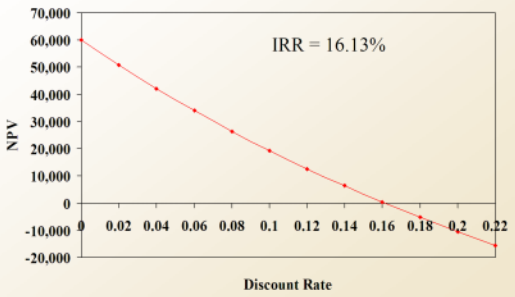
IRR – Definition and Decision Rule

- Definition: IRR is the return that makes the NPV = 0
- Decision Rule: ***Accept the project if the IRR is greater than the required return***

Computing IRR For The Project

- If you do not have a financial calculator, then this becomes a ***trial and error process***

NPV Profile For The Project



The NPV Profile

- The NPV Profile shows what the NPV would be at various discount rates.
- For normal projects, the NPV profile is slightly convex(slightly curvature toward the origin), but over small intervals, the assumption that it is a straight line is not too bad.
- Since the IRR is the rate that results in an NPV of zero, the IRR is the point on the NPV profile where it crosses the horizontal axis.

Congruent Triangles

- One property of congruent triangles is that the ratios of their sides is always equal.
- This is the fundamental relationship that allows us to use trigonometry.
- The triangle will help us to find IRR, where the profile crosses the horizontal axis.
- This axis creates a second congruent triangle.

Example 9.2: Interpolation Method – Calculating IRR

- Initial investment: 165,000

  CF1: $63,120, CF2: $70,800, CF3: $91,080.
  Find IRR?

Answer 9.2

Example 9.3: Interpolation Method

- Initial investment: 10,000
  CF1: $1,000, CF2: $3,000, CF3: $6,000,
  CF4: $7,000 . Find IRR?

Answer 9.3

Example 9.4: Interpolation Method Find IRR?

- Initial investment: 210,000
  CF1: $15,000, CF2: $30,000,
  CF3: $30,000, CF4: $370,000 . Find IRR?

Answer 9.4

Summary of Decisions For The Project

Summary	
Net Present Value	***Accept***
Payback Period	***Reject***
Discounted Payback Period	***Reject***
Average Accounting Return	***Reject***
Internal Rate of Return	***Accept***

Conflicts Between NPV and IRR

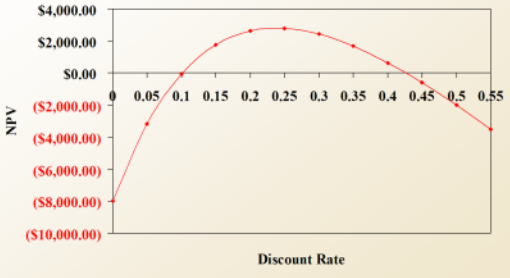
- NPV directly measures the increase in value to the firm
- Whenever there is a conflict between NPV and another decision rule, you should ***always*** use NPV

You would use the following decision rules:
NPV- choose the project with the higher NPV
IRR- choose the project with the higher IRR

Another Example – Non-conventional Cash Flows

- Suppose an investment will cost $90,000 initially and will generate the following cash flows:
  - Year 1: 132,000
  - Year 2: 100,000
  - Year 3: -150,000
- The required return is 15%.
- Should we accept or reject the project?

NPV Profile



Summary of Decision Rules

- The NPV is positive at a required return of 15%, so you should ***Accept***
- If you use the financial calculator, you would get an IRR of 10.11% which would tell you to ***Reject***
- You need to recognize that there are non-conventional cash flows and look at the NPV profile

Sugested Problems

- 1-5, 7-12, 15-17.