

## Chapter 13

### Capital Budgeting

Besley & Brigham

# Chapter 13 – Learning Objectives

---

- ✓ Describe the relevant cash flows that must be forecast to make informed capital budgeting decisions.
- ✓ Describe the importance of capital budgeting decisions and the general process that is followed when making investment (capital budgeting) decisions.
- ✓ Describe how (a) the net present value (NPV) technique and (b) the internal rate of return (IRR) technique are used to make investment (capital budgeting) decisions.

# Chapter 13 – Learning Objectives

---

- ✓ Compare the NPV technique with the IRR technique and discuss why the two techniques might not always lead to the same investment decisions.
- ✓ Describe how the riskiness of a capital budgeting project is evaluated and how the results are incorporated in capital budgeting decisions.
- ✓ Describe how capital budgeting decisions differ for firms that have foreign operations compared to firms that only have domestic operations.

# Capital Budgeting

---

- ✓ The process of planning investments in assets whose cash flows are expected to extend beyond one year

# Importance of Capital Budgeting

---

- ✓ Long-term impact
- ✓ Timing
- ✓ Substantial expenditures for which funds must be raised (either internally, externally, or both)

# Project Classifications

---

- ✓ **Replacement decisions**—determine whether to purchase assets to **take the place of existing assets to maintain** existing operations
- ✓ **Expansion decisions**—determine whether to purchase assets/projects and **add** them to existing assets to increase existing operations

# Project Classifications

---

- ✓ **Independent projects**—projects whose cash flows are **not affected by the acceptance or rejection of other projects**; all good independent projects can be purchased
- ✓ **Mutually exclusive projects**—a set of projects where the acceptance of one project means the others cannot be accepted; **only one mutually exclusive project can be purchased**

# Steps in the Valuation Process

---

1. Determine **the cost**, or purchase price, of the asset
2. Estimate the **cash flows** expected from the asset
3. Evaluate **the riskiness** of the projected cash flows to determine the appropriate rate of return to use for computing the PV of the estimated cash flows
4. Compute the **PV of the expected cash flows**
5. Compare the PV of the expected future cash flows **with the initial investment**, or cost, required to acquire the asset



# Cash Flow Estimation

---

- ✓ Cash is different from accounting profits
- ✓ Evaluate cash flows *after taxes*
- ✓ Only **incremental cash flows** are relevant to the accept/reject decision
  - ✓ The change in a firm's net cash flow attributable to an investment project

# Problems in Cash Flow Estimation

---

## ✓ Sunk costs

- ✓ **Already incurred** and cannot be recovered; not a relevant cash flow

## ✓ Opportunity costs

- ✓ Return on the **best alternative** use of an asset; a relevant cash flow

## ✓ Externalities

- ✓ **The effect accepting a project will have on the existing cash flows in other areas of the firm; must be considered when estimating new cash flows**

# Problems in Cash Flow Estimation

---

## ✓ Shipping and Installation

- ✓ The depreciable basis for an asset includes the purchase price plus shipping and installation; a relevant cash flow

## ✓ Inflation

- ✓ Expected inflation should be built into the expected cash flows; inflation effects must be considered when estimating future cash flows

# Cash Flow Estimation and the Evaluation Process

---

## ✓ Expansion projects

- ✓ Initial investment outlays required
- ✓ Estimate the cash flows once production begins
- ✓ Terminal cash flow

## ✓ Replacement analysis

- ✓ Must consider cash flow from both the old asset and the new asset in the decision
- ✓ Cash flows from the new asset take the place of cash flows from the old asset
- ✓ Any cash flows that change as a result of replacing an asset must be included in the analysis

# Capital Budgeting Evaluation Techniques

---

- ✓ Net present value (NPV)
- ✓ Internal rate of return (IRR)
- ✓ Payback period (PB)

# Net Present Value

---

- ✓ **NPV** is a method of evaluating capital investment proposals **by finding the present value of future cash flows** and combining the result with the initial investment outlay (generally a negative value)
- ✓ **NPV** is a discounted cash flow (DCF) technique that uses time value of money concepts
- ✓ **A project is acceptable if its NPV is greater than 0**

# Net Present Value

---

$$NPV = CF_0 + \frac{\hat{CF}_1}{(1+r)^1} + \frac{\hat{CF}_2}{(1+r)^2} + \dots + \frac{\hat{CF}_n}{(1+r)^n}$$

$CF_0$  = initial investment outlay

$\hat{CF}_t$  = estimated cash flow received at the end of Year  $t$

$r$  = firm's required rate of return

# Internal Rate of Return

---

- ✓ IRR is the discount rate that forces the PV of a project's expected cash flows to equal its initial cost
- ✓ A project is acceptable if its IRR is greater than the firm's required rate of return (WACC)
- ✓ Similar to the YTM on a bond

$$\text{NPV} = \text{CF}_0 + \frac{\hat{\text{CF}}_1}{(1+\text{IRR})^1} + \frac{\hat{\text{CF}}_2}{(1+\text{IRR})^2} + \text{L} + \frac{\hat{\text{CF}}_n}{(1+\text{IRR})^n} = 0$$



# Payback

---

- ✓ The traditional payback period (PB) is the **length of time it takes to recover the original cost** of an investment from the expected cash flows the investment is expected to generate
- ✓ A project is acceptable if its **PB is less than some period** determined by the firm

$$\text{Payback period} = \left( \begin{array}{l} \text{Number of years just } \textit{prior} \\ \text{to the year of full recovery} \\ \text{of initial investment} \end{array} \right) + \left( \frac{\text{Amount of the initial investment that is } \textit{unrecovered} \text{ at start of recovery year}}{\text{Total cash flow generated during the recovery year}} \right)$$

# Discounted Payback

---

- ✓ Discounted payback (DPB) is the length of time it takes for a project's *discounted* (PV of) cash flows to repay the initial cost of the investment
- ✓ A project is acceptable if its DPB is less than its useful life

# Comparison of the NPV and IRR Methods

---

- ✓ NPV profile is a graph (curve) showing the relationship between a project's NPV and various discount rates (required rates of return)
- ✓ IRR is at the point where the NPV profile crosses the X-axis

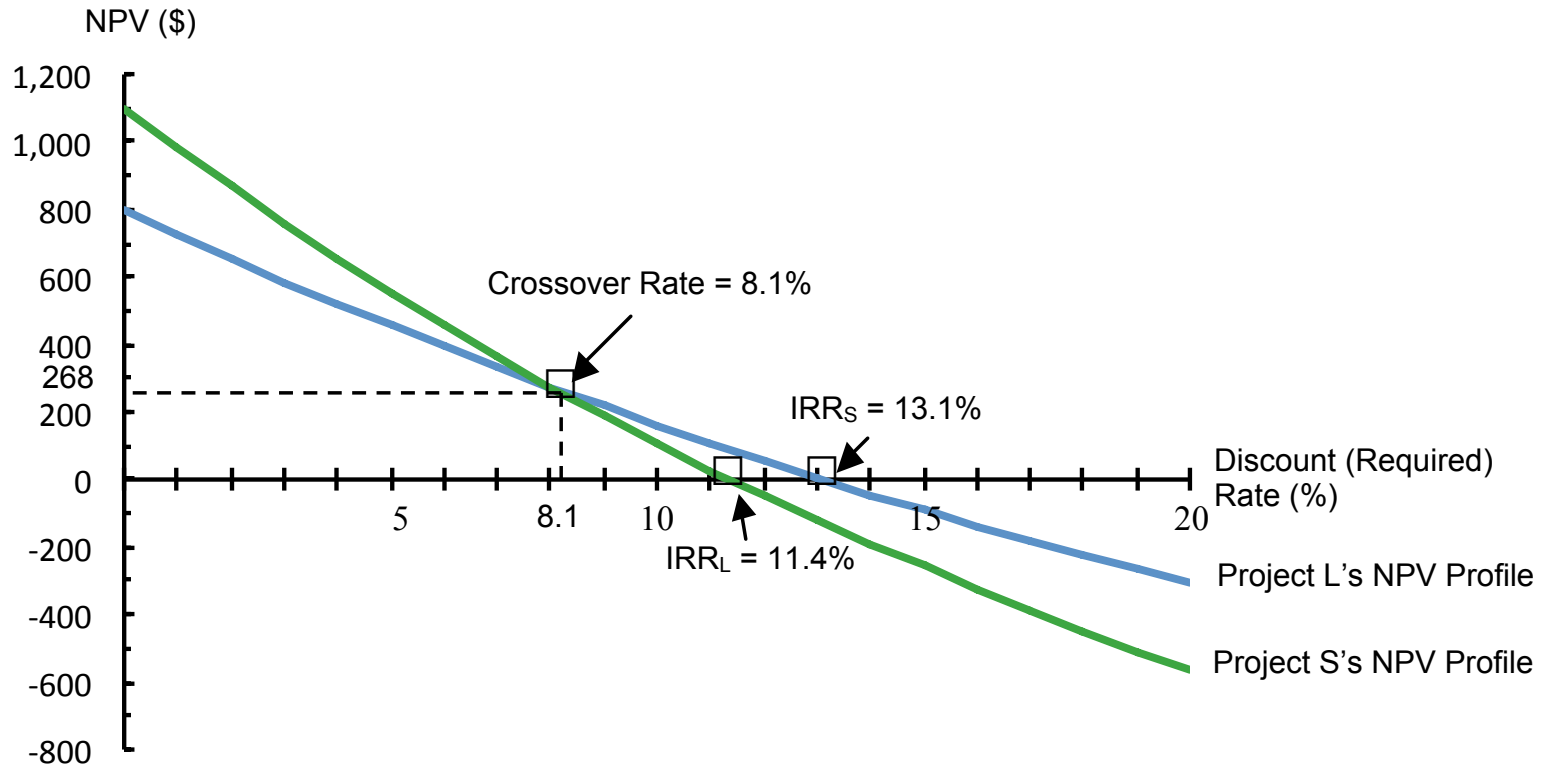
# NPVs and the Required Rate of Return

---

## ✓ Crossover rate

- ✓ The discount rate at which the NPV profiles of two projects cross and, thus, at which the projects' NPVs are equal

# NPVs and the Required Rate of Return



# Independent Projects

---

- ✓ NPV and IRR will both lead to the same decision
  - ✓ If a project's NPV is positive, its IRR will exceed  $r$ , whereas if NPV is negative,  $r$  will exceed the IRR

# Mutually Exclusive Projects

---

- ✓ If NPV profiles cross, NPV and IRR decisions may conflict depending on discount rate selected
  - ✓ Project size differences
  - ✓ Timing differences
    - ✓ Reinvestment rate may not match IRR
- ✓ NPV method is preferred

# Multiple IRRs

---

- ✓ A project can have two or more IRRs
  - ✓ Unconventional cash flow pattern
    - ✓ Large outflow during or at the end of its life
  - ✓ NPV profile is helpful



# Modified IRR (MIRR)

---

MIRR helps solve the multiple IRR problem

$$\text{PV of cash outflows} = \frac{\text{FV of cash inflows}}{(1 + \text{MIRR})^n} = \frac{\text{TV}}{(1 + \text{MIRR})^n}$$

$$\sum_{t=0}^n \frac{\text{COF}_t}{(1+r)^t} = \frac{\sum_{t=0}^n \text{CIF}_t (1+r)^{n-t}}{(1 + \text{MIRR})^n}$$

# Conclusions on the Capital Budgeting Decision Methods

---

- ✓ Payback and discounted payback indicate **risk and liquidity** of a project
- ✓ NPV gives **a direct measure of the dollar benefit** to the shareholders (increase in wealth)
- ✓ IRR provides information about a project's **“safety margin”**
- ✓ IRR reinvestment assumption may be unrealistic
- ✓ Watch out for **multiple IRRs**

# Incorporating Risk in Capital Budgeting Analysis

---

## ✓ Stand-alone risk

- ✓ The risk an asset would have if it were a firm's **only asset**
- ✓ Measured by the **variability of the asset's expected returns**
- ✓ Generally **standard deviation**,  $\sigma$ , is used to measure an asset's stand-alone risk

# Incorporating Risk in Capital Budgeting Analysis

---

## ✓ Scenario analysis

- ✓ A risk analysis technique in which “good” and “bad” sets of financial circumstances are compared with a most likely, or best-case situation
  - ✓ Base-case scenario—all of the input variables are set at their most likely values
  - ✓ Worst-case scenario—all of the input variables are set at their worst reasonably forecasted values
  - ✓ Best-case scenario—all of the input variables are set at their best reasonably forecasted values

# Incorporating Risk in Capital Budgeting Analysis

---

- ✓ Corporate (within-firm) risk
  - ✓ Risk not considering the effects of stockholders' diversification
  - ✓ Measured by a project's effect on the firm's earnings variability
  - ✓ Effect of adding an asset to the portfolio of existing assets

# Corporate (Within-Firm) Risk

---

- ✓ Diversification (risk reduction)
  - ✓ As long as assets are **not perfectly positively correlated** some diversification can be achieved
  - ✓ **Adding projects can help reduce corporate risk**

# Incorporating Risk in Capital Budgeting Analysis

---

- ✓ Beta (market) risk
  - ✓ That part of a project's risk that **cannot be eliminated by diversification**
  - ✓ Measured by the project's **beta coefficient**

# Beta (or Market) Risk

---

- ✓ Project required rate of return,  $r_{\text{proj}}$ 
  - ✓ The risk adjusted required rate of return for an individual project

$$r_{\text{proj}} = r_{\text{RF}} + (r_{\text{M}} - r_{\text{RF}})\beta_{\text{Proj}}$$

$r_{\text{RF}}$  = risk-free rate of return

$r_{\text{M}}$  = market (average investment) return

$\beta_{\text{Proj}}$  = beta coefficient of the project



# Beta (or Market) Risk

---

## ✓ Pure play method

- ✓ Estimating the beta of a project using beta coefficients of firms whose only business is the product in question

# How Project Risk is Considered in Capital Budgeting Decisions

---

## ✓ Risk-adjusted discount rate

- ✓ Required rate of return that applies to a risky stream of income
- ✓ Equal to **the risk-free rate of interest** plus a **risk premium** appropriate for the level of risk attached to a particular project's cash flow stream

# Multinational Capital Budgeting

---

- ✓ Similar to capital budgeting in domestic companies, but more complex

# Multinational Capital Budgeting

---

## ✓ Factors to consider

- ✓ **Repatriation** of earnings—process of sending cash flows from a foreign subsidiary to the parent company
- ✓ **Exchange rate risk**—uncertainty associated with the price at which the currency from one country can be converted into the currency of another country
- ✓ **Political risk**—risk of expropriation (takeover) of a foreign subsidiary's assets by the host country, or of unanticipated restrictions on sending cash flows to the parent company

# Chapter Principles

## Key Capital Budgeting Concepts

---

- ✓ What are the relevant cash flows that must be forecast to make informed capital budgeting decisions?
  - ✓ Initial investment outlay, supplemental operating cash flows, terminal cash flows
- ✓ Why are capital budgeting decisions important and what process is followed when making these decisions?
  - ✓ Capital budgeting decisions are important because they involve long-term assets.
  - ✓ The process of valuing a capital budgeting project to determine whether it should be purchased is the same as valuing financial assets, such as stocks and bonds.

# Chapter Principles

## Key Capital Budgeting Concepts

---

- ✓ How are the NPV technique and the IRR technique used to make investment decisions?
  - ✓ The NPV indicates by how much the firm's value will change if the capital budgeting project is purchased. A project should be purchased if its NPV is positive.
  - ✓ A project's internal rate of return (IRR) represents the average rate of return that a company will earn if the project is purchased and held until the end of its useful life. A project should be purchased if its IRR is greater than the firm's required rate of return.

# Chapter Principles

## Key Capital Budgeting Concepts

---

- ✓ Why do the NPV technique and the IRR technique not always lead to the same investment decisions?
  - ✓ A ranking conflict which results from the reinvestment assumptions associated with each technique might occur when evaluating two mutually exclusive projects using the NPV technique and the IRR technique.
  - ✓ This conflict generally can be resolved by using the modified internal rate of return (MIRR) technique rather than the traditional IRR technique.

# Chapter Principles

## Key Capital Budgeting Concepts

---

- ✓ How is risk incorporated in capital budgeting techniques?
  - ✓ Projects that are riskier are evaluated with a higher required rate of return
  - ✓ Failure to account for risk could lead to incorrect capital budgeting decisions
- ✓ How do capital budgeting analyses/decisions differ for multinational firms?
  - ✓ Exchange rate risk, political risk, and the ability to repatriate earnings make capital budgeting decisions more complicated when multinational firms evaluate foreign investments