Week 12

EVALUATING INVESTMENT PROFITABILITY

Economic and management principles

Review of the Last Lecture

- In the last lecture, we talked about cost of capital and its different components
- We explained what types of capital firms can use to finance investment projects.
- We showed how the cost of capital components is derived.
- We defined the weighted average cost of capital.
- This concept is essential for evaluating investment decisions – a topic of today.

Evaluating Investment Profitability

- A firm needs to make an investment when
  - it needs to replace capital to continue current operations.
  - it wants to reduce costs
  - it wants to expand existing products or markets
  - it wants to expand into new products and markets.
- In all these cases, it has to be determined whether such investment is profitable (whether it will bring revenues that offset the costs).
- There are some criteria that help us to determine the profitability of an investment.

Net Present Value

- The net present value (NPV) method is the primary capital budgeting decision criterion.
- The NPV is a direct measure of the projects' contribution to shareholder wealth.
- The method consists of

  1. finding the present value of each cash flow, including the cost, discounted at the project's cost of capital (WACC),

  2. defining the project's NPV as the sum of these discounted cash flows:

$$NPV = \sum_{t=0}^{T} \frac{CF_t}{(1 + WACC)^t}$$

Net Present Value

- NPV criterion tells us by how much the project should increase shareholder wealth
- NPV should be greater than 0 for the project to be profitable.
- The higher the NPV, the more profitable the project is.
- For most common investment cases, for which the cash flow in time t = 0 is negative and all remaining cash flows are positive, NPV is a decreasing function of the cost of capital.
- There exists a maximal value of the cost of capital for which NPV is non-negative - this maximal value is called Internal Rate of Return (IRR).

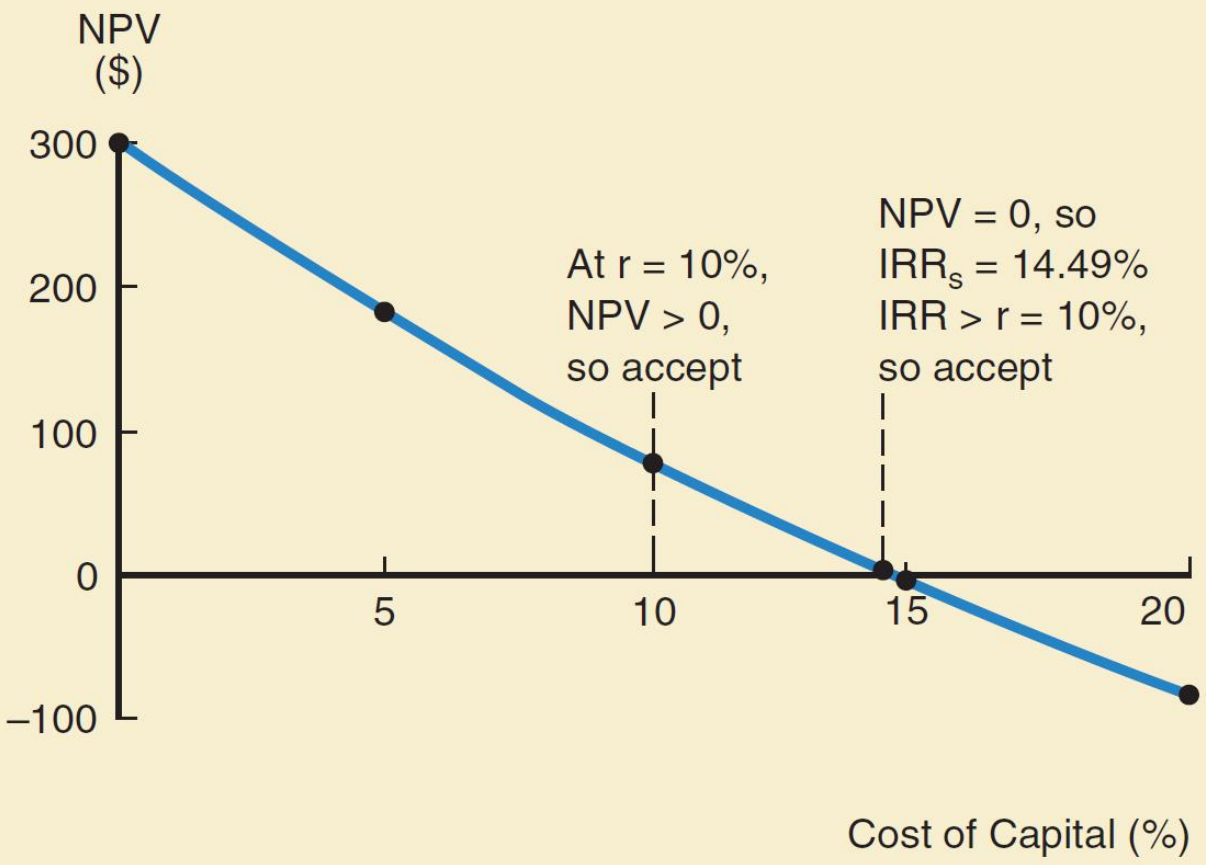
Internal Rate of Return

- IRR criterion tells us how much a project yields over the cost of capital
- The IRR is defined as the discount rate that forces the project's NPV to equal zero:

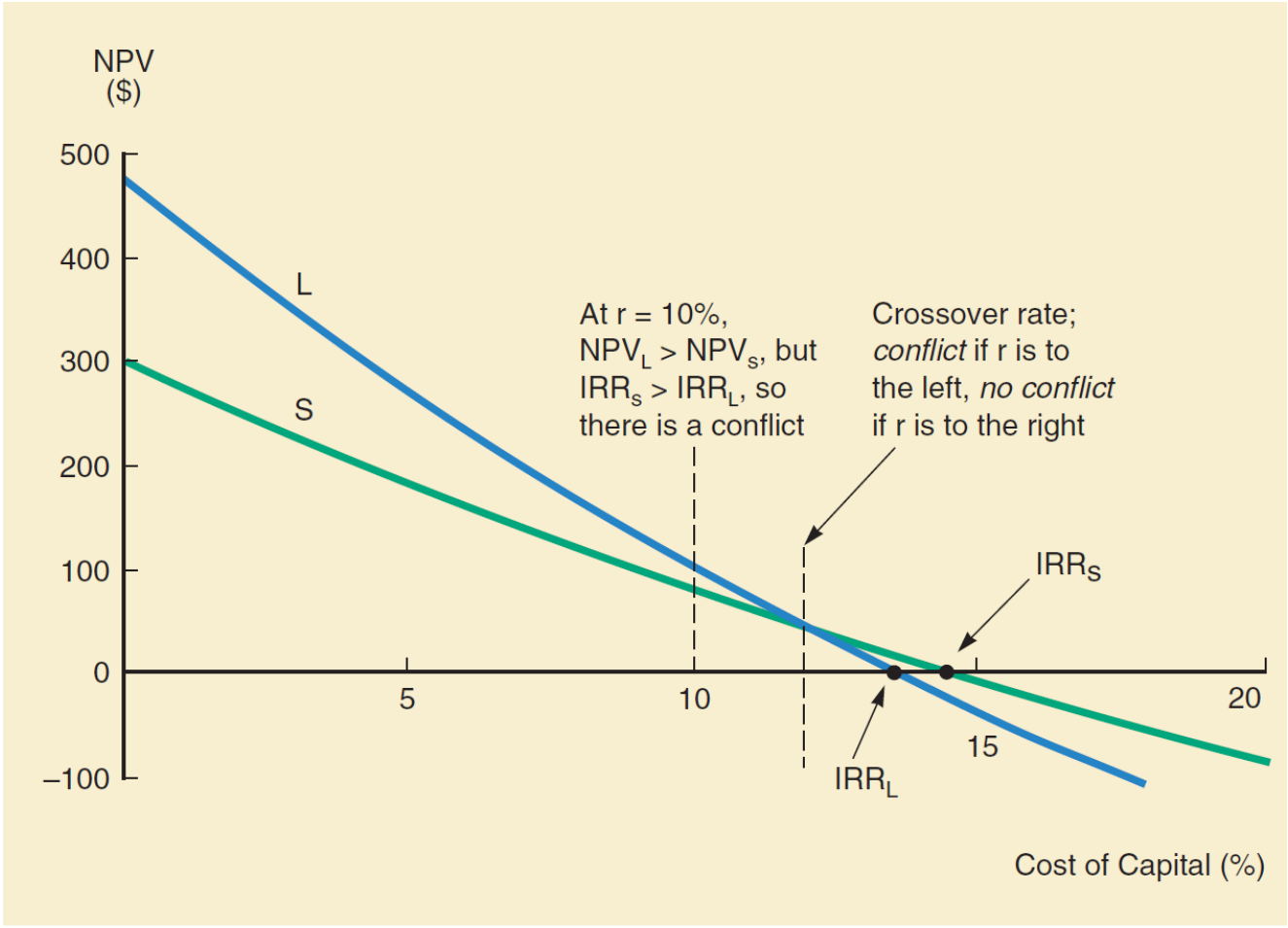
$$0 = \sum_{t=0}^{T} \frac{CF_t}{(1 + IRR)^t}$$

- The project should be accepted only if *IRR > WACC*.
- The higher the IRR, the more profitable the project is.
- NPV is usually a decreasing function of the cost of capital.
- NPV and IRR criteria often give the same result, but they also can be in conflict.

NPV and IRR Criteria



Conflict Between NPV and IRR Criteria



Payback Period

- Payback criterion tells us when we get our investment back.
- The NPV and IRR are the most used methods today, but the earliest selection criterion was the payback period, defined as the number of years required to recover a project's cost from operating cash flows.
- The payback year is the year prior to full recovery plus a fraction equal to the shortfall at the end of that year divided by the cash flow during the full recovery year.
- The shorter the payback, the better.
- The payback has a flaw: cash flows received in different years are all given the same weight.

Payback Period

- To counter the first criticism, analysts developed the discounted payback, where cash flows are first discounted at the WACC and then used to find the payback year.
- Thus, the discounted payback period is defined as the number of years required to recover the investment's cost from discounted cash flows.
- Even here we have one additional problem: Cash flows beyond the payback year are given no consideration whatever, regardless of how large they might be.
- Unlike the NPV, which tells us by how much the project should increase shareholder wealth, and the IRR, which tells us how much a project yields over the cost of capital, the payback merely tells us when we get our investment back.

Scenario Analysis

- Analyses of investment projects consist of several parts:

1. Collection and estimation of input data (will be given for our purposes).
2. Specification of depreciation schedule (will be given by law).
3. Salvage value calculations - cash flows the firm will realize when it disposes of the building and equipment.

   Do not forget that gains and losses are treated as ordinary income and are subject to taxation.

4. Cash flows projection.

   We will use here all the information that we have acquired in the course.

5. Appraisal of the proposed project.

Scenario Analysis

- Scenario analysis is a technique that brings in the probabilities of changes in the key variables, and it allows us to change more than one variable at a time. This mitigates the risk.
- In a scenario analysis, the financial analyst begins with the base case, which uses the most likely set of input values.
- Then he or she asks marketing, engineering, and other operating managers to specify a worst-case scenario (low unit sales, low sales price, high variable costs, and so on) and a best-case scenario.
- Often, the best and worst cases are defined as where there is a 25 percent probability of conditions being that good or bad, with a 50 percent probability of the base-case conditions.

Scenario Analysis

- We will be mostly interested in the expected NPV and its standard deviation
- Suppose that the NPV can take three values (with corresponding probabilities:

$$NPV = \begin{cases} NPV_1 & \dots & p_1 = Prob(NPV = NPV_1) \\ NPV_2 & \dots & p_2 = Prob(NPV = NPV_2) \\ NPV_3 & \dots & p_3 = Prob(NPV = NPV_3) \end{cases}$$

- Expected value can be computed as

$$E[NPV] = p_1 \cdot NPV_1 + p_2 \cdot NPV_2 + p_3 \cdot NPV_3$$

and standard deviation as

$$\sigma_{NPV} = \sqrt{p_1 \cdot NPV_1^2 + p_2 \cdot NPV_2^2 + p_3 \cdot NPV_3^2 - (E[NPV])^2}$$

Scenario Analysis

- The expected value tells us what is the value of NPV that we will most likely get from the project.
- The standard deviation tells us how big the risk is that the value of NPV will be fare from expectations.
- To relate the risk to the size of profit, we define the coefficient of variation defined as

$$CV_{NPV} = \frac{\sigma_{NPV}}{E[NPV]}$$

- We should prefer projects with high NPV and low risk.

Summary

- In this lecture, we explained how to evaluate investment opportunities.

- We should understand the concept of Net Present Value and its difference to Internal Rate of Return and Payback Period.
- We should be able to apply methods of the Scenario Analysis.