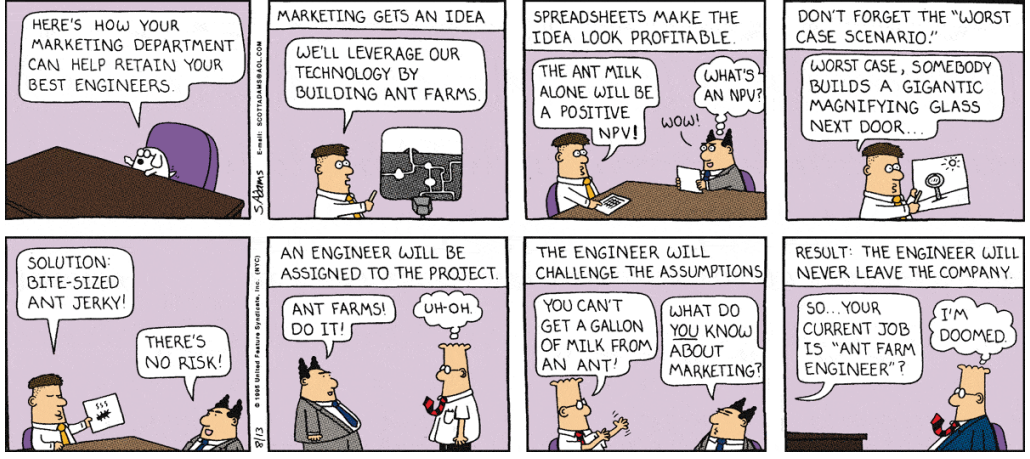


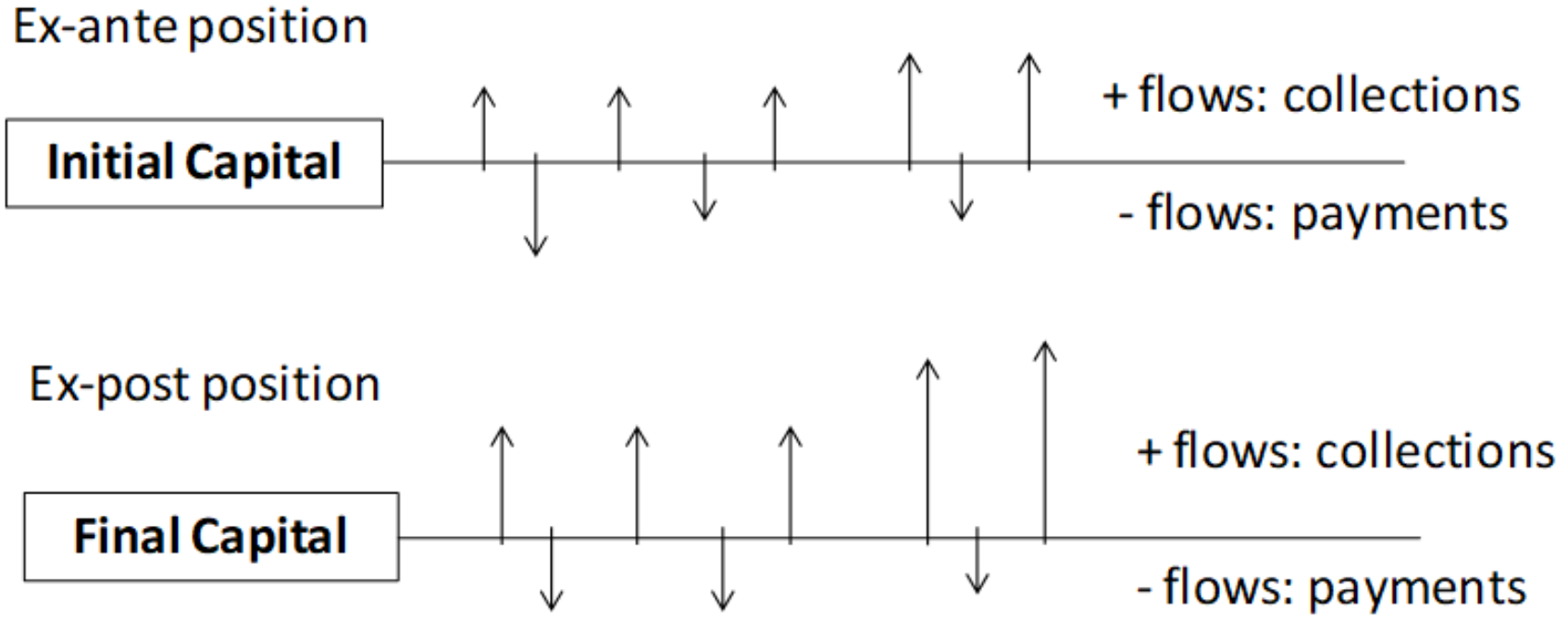
Lesson 7

Investment Analysis

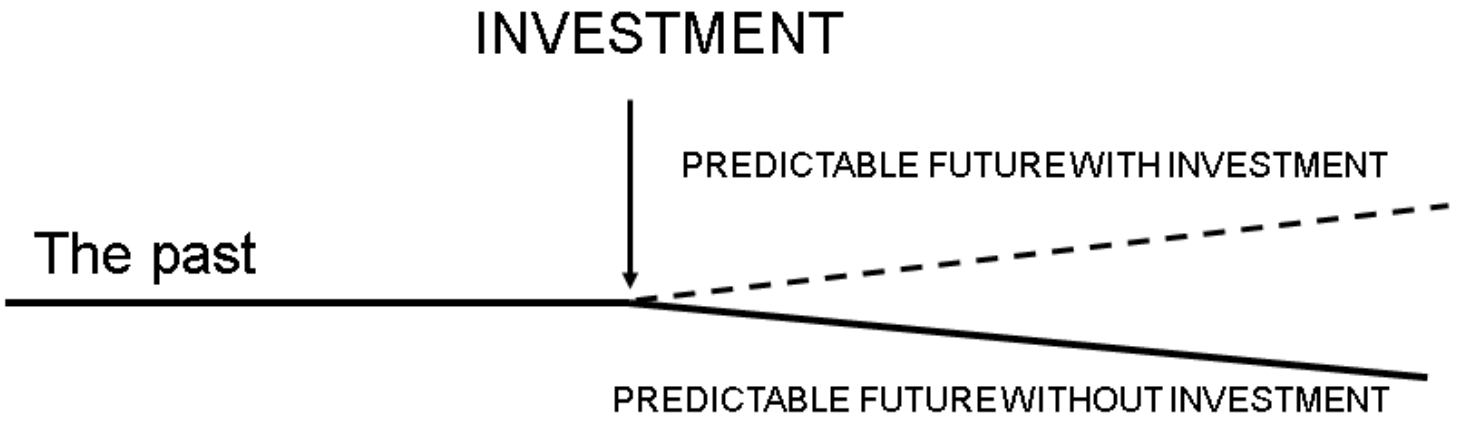
1. Concept of investment

- Present commitment of money for the purpose of receiving money later
- In most situations the amount of money to be obtained later is uncertain
- To renounce to a certain and current wealth hopefully to obtain future and uncertain profits
- Company point of view definition: purchasing of durable assets with the aim of improving the future skills to generate positive returns
- Usually durable assets dedicated to produce but financial assets also meet the definition
- Business investments: a company invest when acquires fixed assets with the aim of improving its future results
- The assets of any kind not related to productive functions cannot be considered investment or capital formation
- Every investment involves risk because everything to be produced in the future involves uncertainty
- If an asset of any kind, movable, real estate, material or intangible is not related to production then it cannot be considered as investment or capital formation

2. Effect of investments in companies



Effect of investments in companies II



An investment means a change in the foreseeable future of the company. To make a decision whether or not to carry out the investment a comparison should be made: predictable future with investment vs. predictable future without investment

The decision involves:

- Technical viability
- Commercial viability
- Financial viability

3. Types of investments

Investment can be classified…

According to the support:

- Material investments: machinery, equipment, transport vehicles, furniture, IT equipment,…
- Intangible investments: there is no material support, they are immaterial goods such as patents, software,
- Financial investments: assets from the financial markets: shares, bonds, bank deposits,..

According to chronology:

- Investment in a new company (start-up)
- Investment in an existing company

Types of investments

According to the goal of the investment in working companies:

- Replacement investments: in order to replace and old equipment (machine,..) by a new one keeping the production level while lowering production costs. The main objective is to reduce costs
- Expanding investments: to improve the production capacity in order to sell to a higher demand or to improve the company operations (stock management, quality,…)
- Product line investments: with the aim of improving the features of the current products or with the aim of introducing new products
- New technology investments: incorporating new technologies in order to increase competitiveness

4. Investment parameters

An investment can be characterized by means of 3 parameters:

- Initial outlay
- Time horizon or lifespan or economic life or life of the investment or planning horizon
- Cash-flows (Collections – Payments)

Initial outlay of capital: amount to pay in order to carry out the investment and make it work. This amount is used to purchase fixed assets (main investment) and to purchase any current asset needed to make the main investment functional.

E.g. if the investment is to buy machinery the initial outlay is not only the price of the machines but also the set-up, to form the employees in using the machines,… and everything need to make the machine work

Investment parameters II

Time horizon: period of time of generation of economic flows due to the investment project. It is usually measured in years although it could be expressed in bimesters, quarters or even months

There are 3 types of life:

- Physical life
- Market life
- Technological life

Sometimes is hard to distinguish among them (e.g. market vs technological)

The lifespan is fixed taking the lowest of them

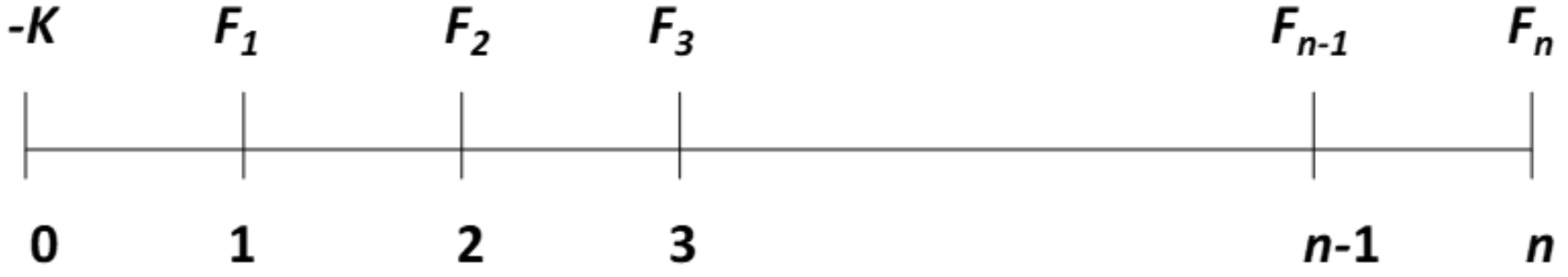
In the case of an investment made up by different types of elements with different lifespan the lifespan of the most expensive asset will fix the lifespan of the whole investment

Investment parameters III

Cash flows

1. Collections: incomes of cash or inflows of each year (or semester…)
2. Payments: outcomes of cash or outflows of each year (or semester…)

Plot of the flows:



Once the investment parameters are defined the investment return can be analyzed and then the investment decision can be made (to invest or not to invest)

5. Investment criteria

- Need of indicators to decide whether to carry out an investment
- Static criteria
- Dynamic criteria

6. Static criteria

- Do not take into account the influence of time in the value of money
- In invesment project assessment using simple criteria, proxy criteria, the moment of time of generating the net cash flows is not taken into account
- Simple criteria consider that a current net cash flow is financially equivalent to a future net cash flow. i.e. the moment when the cashflows are obtained does not matter
- Total net cashflow per investment unit
- Average net cashflow per investment unit
- Payback

Project	Initial outlay (K)	CF1	CF2	CF3	CF4	CF5
A	-100	15	20	30	25	20
B	-100	25	25	25	25	25

7. Dynamic criteria

Show preference for the present money because :

- That money can be invested
- That money is a certain amount with no risk
- NPV
- IRR

8. NPV

- Net Present Value
- NPV measures the increase of the company value if the investment is carried out
- The company seeks to maximize its value because of that the investment will be accepted when NPV ≥ 0
- When ranking projects they will be ordered from highest to lowest

$$NPV = -K + \frac{CF_1}{(1+k)^1} + \frac{CF_2}{(1+k)^2} + \frac{CF_3}{(1+k)^3} + \cdots + \frac{CF_n}{(1+k)^n}$$

- r = company cost of capital or discount rate. Also called hurdle rate
- Decision rule:
  - NPV > 0
  - If NPVa > NPVb then NPVa is preferable

NPV

If the cash flows are constant through the life of the project:

$CF_1 = CF_2 = CF_3 = \cdots = CF_n = CF$ Then the NPV formula can be simplified.
Two cases can be considered:

- Case 1: Limited life (n years)

$$NPV = -K + \frac{CF}{(1+k)^1} + \frac{CF}{(1+k)^2} + \frac{CF}{(1+k)^3} + \cdots + \frac{CF}{(1+k)^n}$$

$$NPV = -K + CF \cdot \sum_{j=1}^{n} \frac{1}{(1+k)^j} = -K + CF \cdot \left[\frac{(1+k)^n - 1}{k \cdot (1+k)^n} \right]$$

- Case 2: Constant and Perpetual Flows

$$NPV = -K + CF \cdot \sum_{j=1}^{\infty} \frac{1}{(1+k)^j} = -K + \frac{CF}{k}$$

NPV

NPV	Meaning	Decision rule
NPV > 0	Positive returns	The project is accepted
NPV = 0	Expected returns	The project is accepted
NPV < 0	Negative returns	The project is rejected

9. IRR

- Internal Rate of Return
- It is the discount rate that solve the equation

$$0 = -K + \frac{CF_1}{(1+\lambda)^1} + \frac{CF_2}{(1+\lambda)^3} + \frac{CF_2}{(1+\lambda)^3} + \cdots + \frac{CF_n}{(1+\lambda)^n}$$

- It is the interest rate that makes the NPV equal to zero
- With constant cashflows

$$0 = -K + CF \cdot \sum_{j=1}^{n} \frac{1}{(1+\lambda)^j} = -K + CF \cdot \left[\frac{(1+\lambda)^n - 1}{\lambda \cdot (1+\lambda)^n} \right]$$

- With constant and perpetual cashflows

$$NPV = -K + CF \cdot \sum_{j=1}^{\infty} \frac{1}{(1+\lambda)^j} = -K + \frac{CF}{\lambda}$$

IRR

- IRR provides a measure of the gross relative annual return per Euro invested in the project. It is a relative measure since it is expressed as a percentage or as parts per unit. It is a gross measure since the cost of finance of the capital invested (k) has not been taken into account. To transform it into a net return the weighted average cost of capital (k) should be subtracted from the IRR:

$$Rn = r-k$$

Value	Decision rule
r>k (Rn=r-k>0)	The project is accepted
r=k (Rn=r-k=0)	The project is accepted
r<k (Rn=r-k<0)	The project is rejected

- If the relative net return is positive it is worthwhile to carry out the investment
- In the same way as in the NPV when choosing between a set of projects the one with the highest IRR is preferable
- IRR could also be defined as the maximum cost of finance for which it is advisable to carry out the investment

10. Discussion on NPV and IRR

Using NPV and IRR has got some advantages and disadvantages:

- Being dynamic criteria the time when the flows occur is taken into account
- They transform amounts of money obtained in different times to a common unit
- Calculating the NPV is easy, however the IRR is harder to calculate and some inconsistencies can appear sometimes
- Solving the IRR is to solve an ‘n’ grade equation. There are ‘n’ feasible solutions. According to Descartes’ rule there are so many real solutions as sign changes can happen in the equation
- This is rational from a math point of view but it is inconsistent from a economic point of view because it will mean the existence of more than one IRR for the very same project

📝 Exercise 7.1

The expected cash flow structure of an investment is as follows:

Year	Concept	Value
0	Capital investment	-20000
1	Cash flow	5000
2	Cash flow	7000
3	Cash flow	8000
4	Cash flow	6000
5	Cash flow	5000
6	Cash flow	3000

Report about the adequacy of this investment using the criteria studied in lesson 7.

Consider a discount rate of 10%

📝 Exercise 7.2

A bolts manufacturing company is considering to replace its equipment. The expected outlay for the new equipment is 1,142 € with an expected increase of the cash flow of 400 € during 4 years (expected lifespan). The residual value of the new equipment is expected to be zero. The discount rate is 10%.

The company wants to know whether replacing the equipment is advisable. If non-limited life of the investment is considered, how much would the NPV be?

📝 Exercise 7.3

A company has decided to carry out a 5,000 €investment expecting to generate a series of constant net cash flows of 800 € for the next 10 years. Assuming a 6% cost of capital, determine:

a) Absolute return

b) Relative return

Considering the forgoing determinations, would it be advisable to carry out this project?

📝 Exercise 7.4

Let us consider investments A, B, C and D which net cash flows for the next 4 years are gathered in the following table:

	0	1	2	3	4
A	-10	4	9	-2	6
B	-20	7	7	7	7
C	-4,5	0	6		
D	-7	3	7	2	

Determine:

- The parameters of each investment assuming that the investment is fully paid in the year 0
- Pay-back, NPV and IRR of each investment
- Which investments are advisable according to the NPV criterion
- Order the investments using pay-back and NPV

The cost of capital is 8%

📝 Exercise 7.5

Estimate the acceptable variability intervals for the initial outlay, CF1, CF2, CF3 and the cost of capital. Data of the investment:

K = -9,500

F1 = 3,000

F2= 2,000

F3 = 2,200

F4 = 3,400

F5 = 4,000

k = 5%

📝 Exercise 7.6

A airport concession company is planning to invest 20 million Euros in a new terminal, when finished, they will have 7,500 sq. m to lease. Besides they will have make an upfront payment of 52 million Euros in order to operate the concession for 20 years.

If they wish to obtain an annual return of 15% how much should they charge for the annual lease of one square meter? No inflation is considered.