

# Industrial and investments analysis as a tool for the regulation of local public services

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# Outline of the lecture

The nature of business investments

The balance sheet

Income and cash flows

Cash flows for Capital Budgeting

Present Value concept

Valuation techniques

Taxation and investment evaluation

The Cost of Capital

The cost of Equity

WACC

# Capital budgeting

- Free cash –flows can be retained as liquid assets or distributed as dividends or can be used to buy plants and equipments to increase or improve the production structure and allow the firm to generate future income.
- By deciding to invest the entrepreneur will exchange capitals available today with the expectation of higher financial flows in the future.

- Business investments in plants and equipments have different characteristics compared to a financial investment:
  - Initial expenditure mostly uncertain
  - Cash inflow and outflow irregular over time
  - Resources difficult to quantify (human know-how, job training, research, working capital, experience)
  - Uncertain residual value
  - Uncertain time horizon
  - Qualitative components
  - Interaction with other operating variables

# Flow chart of an investment project

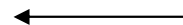
Strategic analysis of the project



Alternative proposals



Operating and investing activities



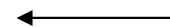
Income budget over time. Output and input. Sales and operating expenditures. Inflation, interest rates, taxes. Changes in working capital and fixed assets.



Cash- flows budgeting for to each proposal



Capital budgeting evaluations



Choosing criteria and valuation techniques

# The Balance sheet

- Double- sided listing of the assets and the financing of these assets
- Assets: the left-hand side
- Financing: the right-hand side
- (Liabilities and Owners' Equity)

# The Balance Sheet

- ASSETS
- **Current assets**
- Cash
- Bank (money in the bank)
- Accounts receivable (customers unpaid bills)
- Inventories (raw material, Work In Progress, products)
- **Fixed assets**
- Leased property and equipment
- Plant property, Equipment (at cost of acquisition) less Depreciation (loss of value due to aging)
- Land
- Goodwill (if assets were paid more than their market value)

# The Balance Sheet

- LIABILITIES AND OWNERS' EQUITY
- **Current liabilities**
- Accounts payable (unpaid bills to suppliers)
- Current portion of long-term debts
- Short-term borrowings
- **Long-term liabilities**
- Obligations under leases
- Long-term debts
- **Equity**
- Stock value (original amount paid for the capital stock of the firm)
- Retained earnings



# Income Statement

- Sales
- Cost of goods sold (raw materials, external services, salaries)
- Selling, general and administrative expenses
- Depreciation
- **Earnings before interest and taxes (EBIT)**
- Interests (bonds, loans, lease contracts)
- **Earnings before taxes (EBT)**
- Taxes
- **Earnings after taxes (EAT)**
- Dividends (cash paid during the year to the shareholders)
- Retained earnings (added to the accumulated earnings)

# Net cash flows

Sales

Cost of goods sold

General expenses

Delta NWC

Interests

Taxes

-----

**Net cash Flows**

# Income

Sales

Cost of goods sold

General expenses

Depreciation

Interests

Taxes

-----

**Income**

# Net working capital

- Increase in account payables (A/P)
- Increase in account receivables (A/R)
- Increase in inventories

## Why Cash Flows and not accounting earnings to evaluate business investments?

- Capital budgeting needs the measure outflows and inflows of every period and concerns all suppliers of capital
- The measurement of accounting earnings (EAT) is based on revenues and costs, that are useful to assess the economic use of production factors and the profitability in the short term
- The income is not a complete measure of cash flows

# A simple example of NCF

## Firm A

	<b>Income Statement</b>	<b>Net cash flows</b>
Sales	100	100
Costs of goods sold	40	40
General expenses	10	10
Depreciation	20	--
Interests	10	10
Taxes (40%)	8	8
-----	----	
<b>Profit</b>	<b>12</b>	
Changes NWC (↓6)		6
-----		----
<b>NCF</b>		<b>38</b>

## Why cash flows from operation (NCFO) for Capital Budgeting. ?

- We want to neutralize the effects of the debt on the project
- We want to see if the investment improve or not the operating activity without caring about the sources of funds

# A simple example of NCFO

	<b>Firm A</b>	<b>Firm B</b>
Sales	100	100
Costs of goods sold	40	40
General expenses	10	10
Depreciation	20	20
Interests	10	--
<b>EBT</b>	<b>20</b>	<b>30</b>
Taxes (40%)	8	12
-----	----	----
<b>EAT (Profit)</b>	<b>12</b>	<b>18</b>
Changes NWC (↑8)		
<b>NCF ?</b>		
<b>NCFO?</b>		

# NCF-NCFO

	Firm A		Firm B	
	NCF	NCFO	NCF	NCFO
Sales	100	100	100	100
Costs of goods sold	40	40	40	40
General expenses	10	10	10	10
Depreciation	--	--	--	--
Interests	10	---	--	--
<b>EBT</b>	<b>20</b>	<b>30</b>	<b>30</b>	<b>30</b>
Taxes (40%)	8	12	12	12
-----	----	----	-----	-----
Changes NWC (↑8)	-8	-8	-8	-8
<b>Total</b>	<b>24</b>	<b>30</b>	<b>30</b>	<b>30</b>



# Cash flows for capital budgeting

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- Cash inflows from sales
- Cash outflows for operating expenditures
- 

- THEORETICAL CASH FLOWS FROM OPERATIONS (TCFO)
- Changes in net working capital (NWC)
  - Taxes on operating income (TCFO)
- 

- NET CASH FLOWS FROM THE OPERATIONS (NCFO)
- Investments (payments for plant, equipment and software (ICF)
  - + residual value ( just for the final period) (E)
- 

NET CASH FLOWS FOR CAPITAL BUDGETING (NCFCB)

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# Net Cash flows for capital budgeting in absence of taxation: an example

## SOLAR

### Income budget for the period $t_0 - t_3$

Sales	2000
Costs of goods sold	800
general expenses	100
Depreciation	700
Interests	200

Changes in the **initial** net working capital 200

Investments of the firm for the ongoing business (promotion and marketing) 1800

Lets assume absence of taxation and **at the end** of the third year the recover of the entire working capital

The stream of net cash flows will be displayed as follow:

Net cash flow	t0	t1	t2	t3
Theoretical CFO	-	1100	1100	1100
Investment in Net Working Capital	(200)	-	-	-
Disinvestment in Net Working Capital	-	-	-	200
<b>NCFO</b>	(200)	1100	1100	1300
Investment (Promotion Marketing)	(1800)			
<b>Total (NCFCB)</b>	(2000)	1100	1100	1300

# (Case 1) Bell electricity

- Bell electricity is a distributor of electricity. The firm is valuating a project concerning the maintenance of the distribution network characterized by two alternatives of investment:
  - a) to built a new line in substitution of the old structure;
  - b) to improve the maintenance of the old lines, introducing new cheaper selling contracts concerning the possibility of temporary interruption of the electric service.

The costs of the projects are reported in the next page.

# Bell electricity

• <b>Projects</b>	<b>A</b>	<b>B</b>
Expenditures for plant	1400	--
Residual value of the investment t 10	400	--
Changes in NWC to	-100	100

## **Changes of costs (every years)**

Depreciation	40	--
Raw materials	-30	--
Salaries	-55	22
Interests	70	10
Revenues from interruption of the service	--	-30

Time horizon 10 years

**What is the NCFCB for the two projects in every years?**

# Bell electricity resolution

<b>Project A</b>	<b>t0</b>	<b>t1-t9</b>	<b>t10</b>
<b>Cash flows CB</b>			
Raw materials (saving)	--	30	30
Salaries (saving)	--	55	55
<b>TCFO</b>	<b>--</b>	<b>85</b>	<b>85</b>
Changes NWC	100	--	--
<b>NCFO</b>	<b>100</b>	<b>85</b>	<b>85</b>
Investment	-1400	--	--
Residual value	--	--	400
<b>NCFCB</b>	<b>-1300</b>	<b>85</b>	<b>485</b>

# Bell electricity resolution

<b>Project B</b>	<b>t0</b>	<b>t1-t9</b>	<b>t10</b>
<b>Cash flows CB</b>			
Raw materials (saving)	--	--	--
Salaries (increasing)	--	-22	-22
Revenues from interruption s. (reduction)	--	-30	-30
<b>TCFO</b>	--	<b>-52</b>	<b>-52</b>
Changes NWC	-100	--	--
<b>NCFO</b>	<b>-100</b>	<b>-52</b>	<b>-52</b>
Investment	--	--	--
Residual value	--	--	--
<b>NCFCB</b>	<b>-100</b>	<b>-52</b>	<b>-52</b>

# The time value of money and CF Present Value concept (PV)

- Let:

$C_0$  = value of an amount at time 0

$C_n$  = value of an amount at time n

$i$  = unitary interest rate

$C_1 = C_0 + C_0 * i = C_0 * (1 + i)$

$C_2 = C_1 * (1 + i) = C_0 * (1 + i) * (1 + i) = C_0 * (1 + i)^2$

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$C_n = C_0 * (1 + i)^n$

$C_0 = C_n / (1 + i)^n$

Time-t discount factor:  **$DF = 1 / (1 + i)^n$**

**$PV(CF_t) = CF_t * DF_t = CF_t * (1 / (1 + i)^n)$**

# The time value of money and CF Present Value concept with constant postponed annual Cash flows

- PV at a rate  $i$ , in case of constant postponed annual installment ( $A$ )

$$PV = A * ((1+i)^n - 1) / i(1+i)^n$$

$$A = PV / ((1+i)^n - 1) / i(1+i)^n$$



# Valuation Techniques

$NPV_0$  = Value at  $t_0$  of the Discounted Cash Flows

$CF_S$  = Cash Flows of the period (**NCFCB**)

$E$  = Residual Value

$k$  = Cost of Capital

$$NPV_0 = \sum_{t=0}^n \frac{CF_t}{(1+k)^t} + \frac{E}{(1+k)^n}$$

1. Net Present Value:  $NPV_0 = f(CF_S, n, E, k)$
2. Internal Rate of Return (IRR):  $\det i = f(CF_S, n, E, NPV_0 = 0)$
3. Pay-back period (PBP):  $\det n = f(CF_S, E, NPV_0 = 0)$

# Calculation of NPV and IRR

- | <b>Time</b> | <b>t0</b> | <b>t1</b> | <b>t2</b> | <b>t3</b> |
|-------------|-----------|-----------|-----------|-----------|
| NCFCB       | -6000     | 1240      | 3500      | 4000      |

Cost of capital 15%

NPV ?

IRR ?

# Solution of calculation NPV and IRR

- **NPV**=  $-6000 + 1240/1.15 + 3500/1.15^2 + 4000/1.15^3 = 355$

**What means a NPV of 355?**

- i) We recovered the initial capital of 6000
- ii) We recovered 15% over the capital per three years
- iii) We produced a value of 355 for the shareholders

- **IRR ?**

$$-6000 + 1240/(1+i) + 3500/(1+i)^2 + 4000/(1+i)^3 = 0$$

$$\text{IRR} = 18\%$$

# Profitability Index

How to choose between different projects characterized by positive NPV under financial budget constraint?

If we are driven by the NPV method and if we want to make a ranking of the projects it is possible to use the profitability index (PI)

$I_0$  = Sum of the initial outflows

$CF_s$  = future cash flows from the investment (**NCFO**)

$K$  = selected cost of capital

$$PI = \frac{\sum_{s=1}^n \left( \frac{CF_s}{(1+K)^s} \right)}{I_0}$$

# Calculating Profitability Index

Considering project A and B, the profitability index will be:

	PROJECT A	PROJECT B
PV inflow	10,000	6,500
Initial investment expenditure	8,000	5,000
NPV	2,000	1,500
Profitability Index	1.25	1.30

- Project B has a PI greater than A
- The method is useful to make a rating of financial resources but it is clear that in case of two alternative projects the one that *ceteris paribus* presents the greater NPV will be selected

# Pay-back period

Two cases

	INVESTMENT A		INVESTMENT B	
	Initial period outflow	End of period cash-in	Initial period outflow	End of period cash-in
1	500		1500	
2	1500		500	
3		1400		1200
4		600		800
5		1200		1300
6		800		700
<b>Total</b>	<b>2000</b>	<b>4000</b>	<b>2000</b>	<b>4000</b>

Not considering the cost of capital, the pay-back period in both cases, would be 4 years.

If the cost of capital was set to 15%, how this would change the result?

## Calculation of Pay-back period: an example

	<b>Initial period (a) Outflow</b>	<b>Interests (b)</b>	<b>(a+b)</b>	<b>Final period inflow</b>
1	500	75	575	-
2	2075	311	2386	-
3	2386	358	2744	1400
4	1344	202	1546	600
5	946	142	1088	1200

	<b>Invested capital initial period (a)</b>	<b>Interests (b)</b>	<b>(a+b)</b>	<b>Final period cash flow</b>
1	1500	225	1725	-
2	2225	334	2559	-
3	2559	384	2943	1200
4	1743	261	2004	800
5	1204	181	1385	1300
6	85	13	98	700

# Net present value

## Case 2: Dora recycling

- Consider the following statements:

### Income statement ('000 Euros 1/1/t1- 31/12/t1)

Sales	600	
Raw materials	300	
C&B (50% fixed costs)	180	(compensation and Benefits)
Depreciation	30	

### Year-End Balance Sheet ('000 Euros 31/12/t1)

Account receivables	340	Account payables	160
Fixed assets at cost	330	Equity	310
Accumulated depreciation	(200)		
<b>Total Assets</b>	<b>470</b>	<b>Total Liabilities+Equity</b>	<b>470</b>

Fiscal rate 40%

Cost of capital 12%



# Net present value

## Case 2: Dora recycling

- The firm is thinking to invest in a new software to manage the customers. The expenses will be 50,000 euro and managers hope to increase the sales by 10% per year for a period of 10 years. The net working capital will decrease by 15,000 euro at the end of the year 1 and it will stay constant for the next years.

The time horizon is 10 years and the final value of the investment and WC is zero.

Should Dora invest or not?

# Net present value

## Case 2: Dora recycling resolution

<b>NCFCB ?</b>	<b>t0</b>	<b>t1</b>	<b>t2-t10</b>
Sales		60	60
Raw material		30	30
Salaries		9	9
Depreciation		5	5
<b>EBIT</b>		<b>16</b>	<b>16</b>
Taxes 40%		6.4	6.4
Ch. NWK		15	--
<b>NCFO</b>		<b>29.6</b>	<b>14.6</b>
Inv. Software	-50	--	--
<b>NCFCB</b>	<b>-50</b>	<b>29.6</b>	<b>14.6</b>

**NPV= -50+20.6/1.15 +14.6(((1.15)^9-1)/0.15(1.15)^9)/1.15=45.88**

# NPV or IRR ?

<b>Projects</b>	<b>NCFCB a</b>	<b>NCFCB b</b>
t0	-15522	-15522
t1	10000	--
t2	--	--
t3	10000	22100
NPV (k=9%)	1374.1	1543.3
IRR	14%	12.5%

What is the best project?

# NPV or IRR?

The two methods often return the same results but:

- In the NPV, the cash flows are reinvested at a rate reflecting to the cost of capital of the company
- In the IRR, the cash flows are reinvested at the rate of return of the project itself. Usually this doesn't coincide with the cost of capital of the company
- With the IRR, the implicit re-investment rate differs for each investment: a high return presumes a high rate of re-investment and low returns presume a low rate of reinvestment
- The IRR does not take into account the dimension of total expenses and this can lead to erroneous decisions in case of alternative investments
- In presence of investment with a mixed sequence of inflows and outflows, the IRR presents multiple positive solutions

To summarize, NPV is the best measure

# Business and Financing considerations of an investment

Operating cash-flows (gross of the the cost of capital) are used in the valuation of the investments. The process of industrial investment involves both the “financial management” of capitals both the “industrial management” of investments financed by those capitals.

Assume:

$FCF_0$  = inflows related to the investment financing

$CFR_s$  = outflows related to the reimbursement

The convenience will be given by the total value of the two NPVs:

$$\text{NPV.business side} = \sum_{s=0}^n \frac{NCFB_s}{(1+k)^s} + \frac{E}{(1+k)^n}$$

$$\text{NPV. financial side} = FCF_0 - \sum_{s=0}^n \frac{CFR_s}{(1+k)^s}$$

Usually the financing side is forgotten because most of the financial resources come straight from the operations and their cost equals the rate  $k$ .

This will be the same as capitalizing and discounting the financial flows at the same rate, with a financial NPV equal to zero.

# Funds strictly bound to the industrial project

When the investment is financed with operating resources, the financing side of the capital budgeting is neglected

On the contrary, when the investment is financed with external funds strictly bound to the industrial project itself, it is important to consider also the financing process

E.g: Business side

<b>Time</b>	<b>0</b>	<b>1</b>	<b>2</b>	<b>3</b>
<b>NCFCB</b>	-1.000	250	350	750

The average cost of capital for business investments is 15%

$$\text{Business NPV} = -1.000 + 250 / 1.15 + 350 / (1.15)^2 + 750 / (1.15)^3$$

$$\text{Business NPV} = -25$$

The business side of the project is not satisfactory

# The financing side of the investment

Mortgage of 500 at a rate of 4%, postponed annual installments (A), refund in three years.

In this case the installment will be:

$$A = 500 / a_{\overline{3}|0.04} = 180$$

Hence the flows relative to the financing side will be:

<b>t0</b>	<b>t1</b>	<b>t2</b>	<b>t3</b>
500	-180	-180	-180

The Net Present Value of the transaction, with a discount rate reflecting the desired rate of the return (15%, we suppose that the cost of Debt and Equity is the same), will be:

$$\text{Financing NPV} = 500 - 180/1.15 - 180/1.15^2 - 180/1.15^3$$

$$\text{Financing NPV} = 89$$

$$\text{Total NPV: } -25 + 89 = 64$$

# The role of taxation in the investment evaluation

Assume:

- TCFO = Cash flows from operations before taxes
- NCFO = Net cash flows from operations after taxes
- $\Delta R$  = Variation of the revenues generated by the investment
- $\Delta VC$  = Variation of variable costs
- $\Delta FMC$  = Variation of fixed monetary cost (excluded the financial costs)
- TOC = Taxes on operating costs
- Tao = Fiscal rate
- $\Delta DEP$  = Variation of depreciation

The TCFO before taxes generated by the investment will be:

$$TCFO = \Delta R - \Delta VC - \Delta FMC$$

The relative taxation will be:

$$TOC = Tao (\Delta R - \Delta VC - \Delta FMC - \Delta DEP)$$

Therefore

$$NCFO = (\Delta R - \Delta VC - \Delta FMC) - Tao (\Delta R - \Delta VC - \Delta FMC - \Delta DEP)$$

$$NCFO = (\Delta R - \Delta VC - \Delta FMC) (1 - Tao) + Tao \Delta DEP$$



# Taxation: an example

Sales	2000
Costs of goods sold	500
C&B (variables)	600
Salaries (fixed)	400
Depreciation	200
<b>EBIT</b>	<b>300</b>
Interests	200
<b>EBT</b>	<b>100</b>
Taxes 40/%	40
<b>Income after Taxes</b>	<b>60</b>
<b>NCFO ?</b>	

# Solution of the example on taxation

## TCFO

Income AT	60	
Taxes	40	
Interests	200	
Depreciation	200	
<b>TCFO</b>	<b>500</b>	
Depreciation	-200	
<b>OP income BT</b>	<b>300</b>	<b>EBIT</b>
Taxes 40%	-120	
<b>NCFO</b>	<b>380</b>	

Formula

$$\text{NCFO} = (2000 - 500 - 600 - 400)(1 - 0.4) + 0.4(200) = 380$$

# The cost of capital

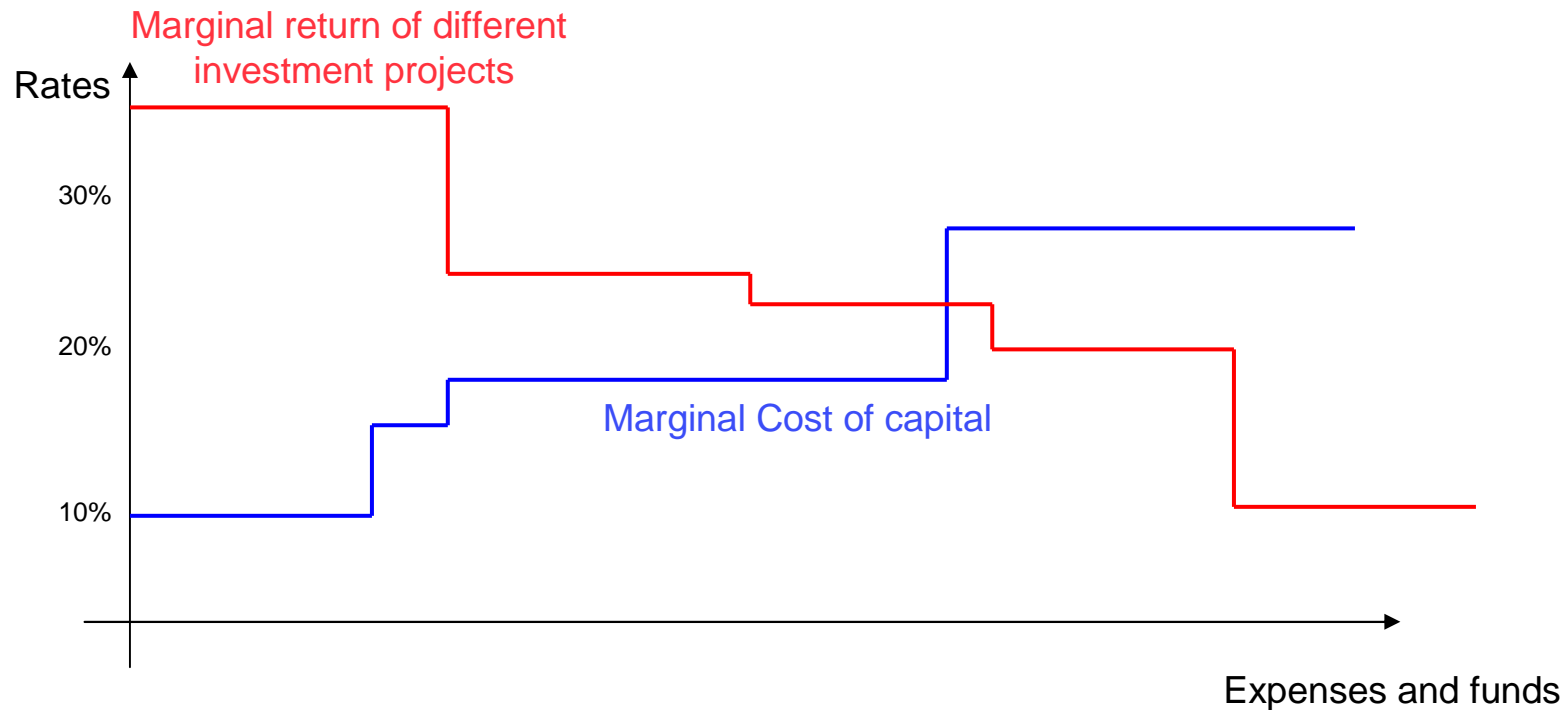
Problems:

- Marginal cost or average cost
- Evaluation of the cost of the Equity (E)
- Evaluation of the cost of the debt (D)
- Optimal financial structure

# Marginal cost or average cost?

- Marginal Cost

After rating the available investments on the basis of their return, the company will make use of the financial sources starting with the less expensive one.



# Reason for choosing the average cost of capital

In general, the company doesn't define a specific relation between investing activities and funding activities

Fund raising is oriented to balance the different nature of the resources

The investment needs to grant an average return that should remunerate the shareholders and rise new resources from the financial market

# Relation between the cost of Equity and risk

The “risk” can be understood as the possibility that the return of a defined operation can differ from what expected

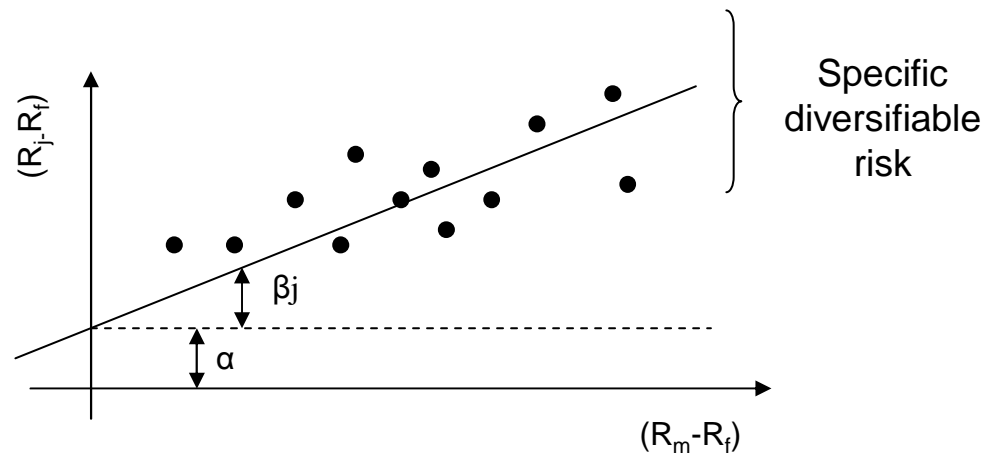
The risk reflects the difference between the actual and expected value. In other terms, it depends on the variability of the returns measured by their standard deviation ( $\sigma$ ) and the Variance ( $\sigma^2$ )

The cost of Equity includes a premium for the time (for renouncing to the present consumption) and a premium for the risk (return variability)

# CAPM

## Capital Asset Pricing Model

- $R_f$  = risk free rate
- $R_m$  = market average return
- $R_j$  = return of the single share
- $\beta_j$  = Beta value. Coefficient that measures the systematic risk of a share



$$R_j = R_f + (R_m - R_f) \beta_j$$

# WACC

## Weighted Average Cost of Capital

Assume:

- $R_A$  = weighted average cost of capital
- $R_E$  = cost of Equity
- $R_D$  = cost of Debt
- $D$  = amount of Debt
- $E$  = amount of Equity

We have:

$$R_A = R_E \frac{E}{D+E} + R_D \frac{D}{D+E}$$

$$R_D = RD_G(1-\tau)$$



# Case 3

## WACC: ANVIA WINES

ANVIA WINES is a wine producer located in ASTI (famous in the world for the production of champagne). The firm wants to implement a project concerning the automation of a line of production and consisting of buying a new plant. The cost is 100,000 euro, the economic horizon is 5 years and the residual value is zero.

The annual variation of the income budget ('000 euro) is reported below.

<b>Time</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
Sales	50	80	100	100	80
Cost of goods sold	10	15	20	20	15
General expenses	5	10	10	10	10

Level of NWC = 20% sales and totally recovered at the end of time 5.

Taxes = 40%

The Assets are financed for 50% by Debt and 50% by Equity

Cost of debt 10%, cost of equity 20%

**Is the project profitable?**

# Solution ANVIA WINES

('000 euros)

Time	0	1	2	3	4	5
Sales		50	80	100	100	80
Cost of goods sold		10	15	20	20	15
General expenses		5	10	10	10	10
<b>TCFO</b>		<b>35</b>	<b>55</b>	<b>70</b>	<b>70</b>	<b>55</b>
Depreciation		20	20	20	20	20
<b>EBIT</b>		<b>15</b>	<b>35</b>	<b>50</b>	<b>50</b>	<b>35</b>
Taxes 40%		6	14	20	20	14
Var NWC		-10	-6	-4	--	20
<b>NCFO</b>		<b>19</b>	<b>35</b>	<b>46</b>	<b>50</b>	<b>61</b>
Investment	100					
<b>NCFCB</b>	<b>-100</b>	<b>19</b>	<b>35</b>	<b>46</b>	<b>50</b>	<b>61</b>
<b>WACC =</b>	<b><math>0.5(20\%)+0.5(10\%)(1-40\%) = 13\%</math></b>					
<b>NPV =</b>	<b><math>-100+19/1.13+35/1.13^2+46/1.13^3+50/1.13^4+61/1.13^5 =</math></b>					
	<b>39.88</b>					

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