Solved examples for use inside the class

Examples investment selection – USE OF EXCEL FUNCTIONS

NPV (NET PRESENT VALUE) AND IRR (INTERNAL RATE OF RETURN) FOR CALCULATIONS

PAYBACK CALCULATION

1. Given the following cash flows for projects A and B

CASH FLOWS (thousands of euros)				
PROJECTS	**C_0**	**C_1**	**C_2**	**C_3**
A	-50	25	25	80
B	-150	50	50	50

a) Calculate the payback period or payback for each project.

For A, the payback is 2 years
For B, the payback is 3 years

FULL EXERCISE

2. The directors of the "Y" company must decide between two possible investments; The cash flows are shown in the following table:

PROJECTS	**C_0**	**C_1**	**C_2**
A	-400	+241	+293
B	-200	+131	+172

If the cost of capital is 9%:
a) Which project has a higher NPV?
b) Which project has a higher IRR?
c) Which project should be taken by the company if we're dealing with mutually excluded projects? What if they aren't excluding? Explain your choice and justify your answer.
d) Can we use either the NPV or the IRR criteria in order to decide which project to undertake?
e) For which levels the opportunity cost (or intervals) is preferable to carry out the project A or B?

Solution

a) We calculate the NPV of each investment:

$$NPV(A) = -400 + \frac{241}{1{,}09} + \frac{293}{1{,}09^2} = 67{,}71€$$

$$NPV(B) = -200 + \frac{131}{1{,}09} + \frac{172}{1{,}09^2} = 64{,}95€$$

A has a higher NPV

b) The IRR is the interest rate (i = r = K) or discount rate for which the NPV = 0, in any case what we are measuring is the internal rate of return generated by the project.

Therefore, we define IRR = i / / NPV = 0

$$NPV(A) = -400 + \frac{241}{1 + IRR_A} + \frac{293}{(1 + IRR_A)^2} = 0€$$

IRR_A **=21%**

The way to solve it, we call x = 1 + IRR

$$-400 + \frac{241}{x} + \frac{293}{x^2} = 0$$

$$-400x^2 + 241x + 293 = 0$$

$$400x^2 - 241x - 293 = 0$$

$$x = \frac{241 \pm \sqrt{241^2 - 4*400*(-293)}}{2*400}$$

X = 1.2085; IRR = 1.2085-1 = 0.2085; IRR = 21%
the other solution is x =- 0.6060, then IRR <0, makes no economic sense.

$$NPV(B) = -200 + \frac{131}{1+IRR} + \frac{172}{(1+IRR_B)^2} = 0€$$

IRR_B **=31%**

The IRR for B is greater than the one for A, but this approach is not useful to compare both projects.

a) To compare projects we are guided by the criterion of NPV ever since the IRR can lead to inconsistencies.

- If both projects are mutually excluding, I can only choose one of the two, I will choose A because it has a higher NPV.

If they are not mutually excluding, I will choose those that create value for the company. This choice is based on the application of evaluation criteria for each project, individually, and for that we use two criteria, either NPV or IRR.

Project A
Has NPV (A)> 0 and IRR (A)> K (21%> 9%). Choosing this project creates value for the company.

Project B

Has NPV (B)> 0 and IRR (B)> k (31%> 9%), again creating value for the company.

We will choose projects A and B if we have sufficient resources to carry out the initial investment on each one.

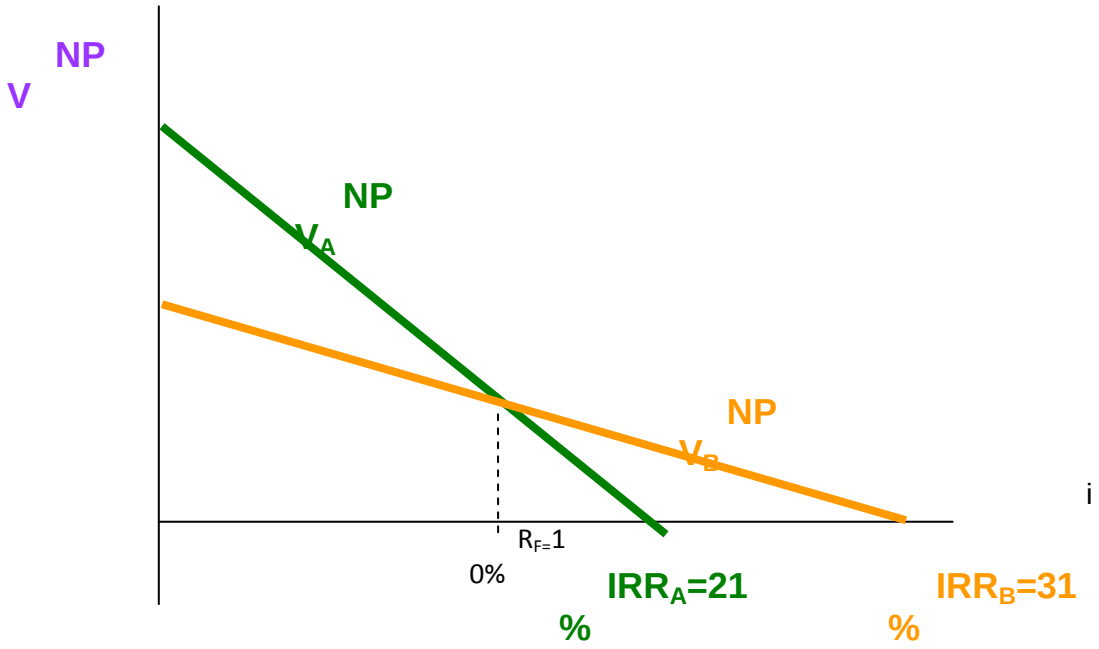
a) No, in this case the IRR criterion is not valid because if two investments do not have the same initial investment and the duration of its IRR is not comparable. This is the reason why, whenever we have to either select or compare projects, we'll always be guided by the NPV criterion.

d) We see that NPV (A)> NPV (B), but we can say more:
We calculate the rate of Fisher: rate = i = r / / NPV (A) = NPV (B)

$$NPV(A) - 400 + \frac{241}{1+i} + \frac{293}{(1+i)^2} = NPV(B) = -200 + \frac{131}{1+i} + \frac{172}{(1+i)^2}$$

Operating.... i = 0.1, 10%
- It has been proved that for this value of i NPV (A) = NPV (B)> 0

this tells us (you can see it graphically), that:



- For an opportunity cost between 0 and 10%, Project A is better (has higher NPV).
- For a higher opportunity costs, above 10%, project B is better (has higher NPV) up to a maximum opportunity cost of 31%, from which both projects are also not recommended to have NPV <0.