Business Finance : course n°6

NPV and Stand-Alone Projects
Appliying actualisation to make decisions
IRR : Internal Rate of Return

BA 2nd Year - 01/11/2019

NPV and Stand-Alone Projects

The net present value (NPV) of a project is the difference between the **present value of its benefits** and the **present value of its costs**. Since a project's NPV represents its value in terms of cash today, the NPV investment rule, which states that all positive NPV projects should be accepted, is consistent with maximizing the value of the firm.

Stand-alone means taking project does not constrain ability to undertake others, in contrast with **Mutually exclusive**, wich means we can accept only one

Applying the NPV Rule

1. NPV (review): present value of all cash flows (positive and negative)
2. Criteria:
Key => NPV measures value of project
=> if undertake project, value of firm changes by NPV of project.
Stand-alone => accept project if NPV > 0
Mutually Exclusive => accept project with highest NPV > 0
3. Advantages of NPV
(1) Based on cash flow
(2) Considers all cash flows
(3) Incorporates the time value of money
(4) Incorporates risk of cash flows (through cost of capital)

Applying the NPV Rule

Practical work 1 : Is that project profitable ?

0	1	2	3	4
-100	10	20	35	45

Applying the NPV Rule

Practical work 1 : It is, but not that much. The natural thinking would be just to sum the cash flows. That means using no discount rate or that r = 0 %. It does take into account time value of money and more important : RISK !

0	1	2	3	4	Total
-100	10	20	35	45	10

Applying the NPV Rule

Practical work 2 : What would be the value of the project if the correct discount rate is 5 % ?

Applying the NPV Rule

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0	1	2	3	4	Total
-100	10	20	35	45	10
R =	5,00 %				
-100	9,52	18,14	30,23	37,02	-5,08

Applying the NPV Rule

Note that the NPV will be very sensible to the discount rate.

For example for the above serie of cash flows

0	1	2	3	4	5
-10 000	2 000	2 500	1 000	4 000	5 000

Applying the NPV Rule

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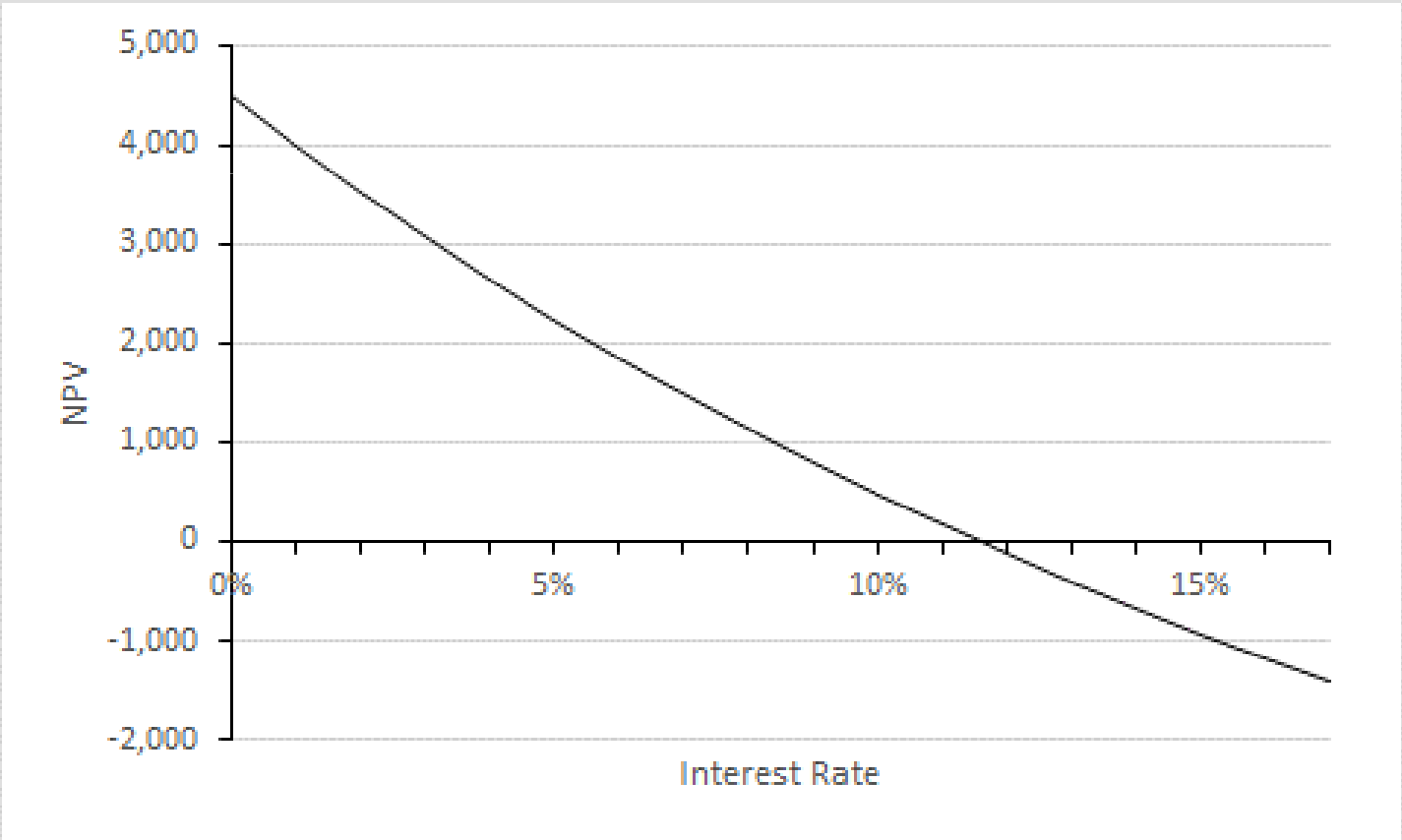
For example for the above serie of cash flows



Applying the NPV Rule

Practical work 3 : Microsoft is considering moving 1,000 employees from a help-desk call center in Seattle to Bombay. The total after-tax cost of a Seattle worker is $50,000 per year and the total aftertax cost of a Bombay worker is $30,000 per year. The move would require paying an upfront severance package worth $40,000 after taxes per former Seattle employee. Assume for this analysis that the cost savings would last forever and that Microsoft's cost of capital is 20%.

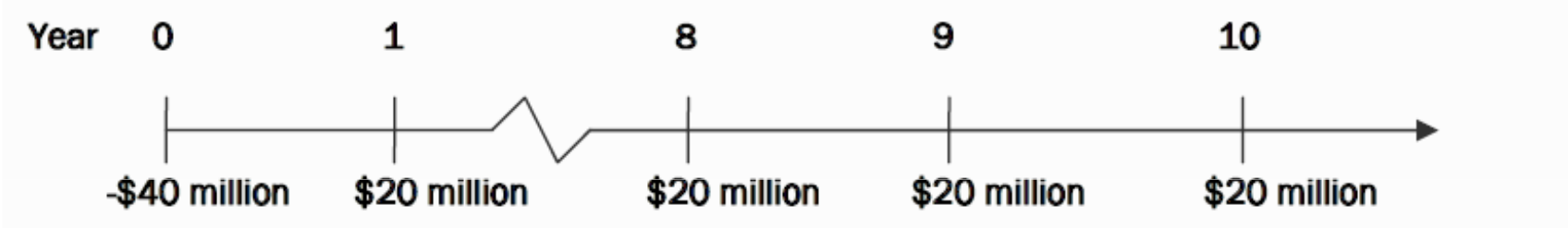
Should the project be accepted based on the NPV rule ?

Source : Pearson Education 2011

Applying the NPV Rule

Step 1. Put the cash flows on a time line.

The time 0 cost is \$40,000(1,000) = \$40 million. The annual savings is \$50,000(1,000) = \$50 million, and the new annual cost is\$30,000(1,000) = \$30 million, so the annual net incremental cash flow is \$20 million.



Applying the NPV Rule

Step 2. Determine the NPV. Since the cash flows after time 0 are a perpetuity:

$$\text{NPV} = \sum_{n=0}^{N} \frac{C_n}{(1+r)^n} = \sum_{n=0}^{\infty} \frac{C_n}{(1.2)^n} = C_0 + \frac{C}{r} = -40{,}000{,}000 + \frac{20{,}000{,}000}{.2} = \$60 \text{ million}$$

Since the NPV > 0, the project should be accepted.

Applying the NPV Rule

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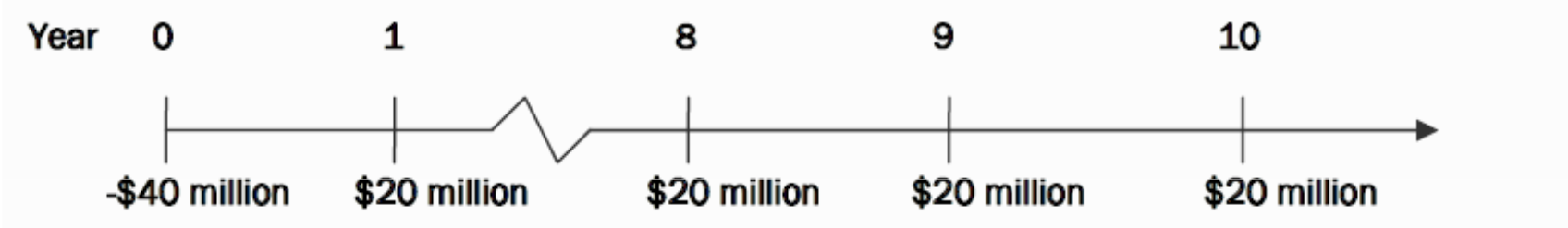

Applying the NPV Rule

Practical work 4 : You own a gold mining company and are considering opening a new mine. The mine is expected to generate $10 million for the next 21 years. After 21 years, the gold is expected to be depleted, but the site can be sold for an expected $20 million.

If the cost of capital is 8%, what is the most you should invest to open the mining operation at time 0?

Source : Pearson Education 2011

Applying the NPV Rule

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Using X as the initial investment:

$$\text{NPV} = X + \frac{10}{.08}\left(1 - \frac{1}{(1.08)^{21}}\right) + \frac{20}{(1.08)^{21}} = X + 100 + 4 = 0 \Rightarrow X = -\$104 \text{ million.}$$

Thus, the most you should invest is $104 million.

Internal rate of return

The **internal rate of return (IRR)** is the rate of return that makes the net present value of a stream of cash flows equal to zero.

Thus, accepting projects with an IRR above the required return, or cost of capital, is generally equivalent to accepting projects with a positive NPV.

The difference between the cost of capital (= discount rate) and the IRR can be thought of as the maximum amount of estimation error in the cost of capital estimate that can exist without altering the original decision.

Internal rate of return

Solving for IRR :
a. Use Excel or financial calculator
b. Trial and Error by Hand (Not recommended)
Steps
1) try a rate
2) if NPV = 0, done
3) if NPV ≠ 0, try again
Note: NPV profile will help if using trial and error
2. Criteria:
Stand-alone: accept project if IRR > cost of capital
Mutually Exclusive: accept project with highest IRR > cost of capital

Internal rate of return : example

Year	Cash Flows	PV of Cash Flows
0	-$500,000	-$500,000
1	$160,000	$141,247
2	$160,000	$124,692
3	$160,000	$110,077
4	$160,000	$97,176
5	$50,000	$26,808

NPV	**0**
IRR	**13%**

Internal rate of return : limitations

1) IRR is unaffected by scale of project
Ex. Would you rather invest $1 and get back $1.50 in one year (50% IRR) or invest $1,000,000 and get back $1,200,000 in one year (20% IRR) ?

2) Short term predominancy
NPV of projects dominated by long-term cash flows fall faster as increase discount rate than projects dominated by short-term cash flows. Long-term projects may have lower IRR other things equal.
3) Risk !
Difficult to compare projects if different cost of capital (because of different risk)

Applying the NPV Rule

Practical work 5 : Appliying NPV to bond trading. Let's have a look to lebanese international bond issues.

Quotations for USD bonds can be found here :

https://www.bankaudi.com.lb/private-banking/capital-markets/fixed-income

We choose to focus on the nearest 10 year.

Applying the NPV Rule

Practical work 5 : Appliying NPV to bond trading. Let's have a look to lebanese international bond issues.

Keep in mind that a bond is just a serie of futur cash flows.
The price of a bond is the present value of this serie of cash flow, discounted at a rate that is the market rate for the bond.
If the rate is known we can compute the price. If the price is known we can compute the rate.

With Excel we can find the rate for wich the PV of this bond is equal to the market price.

ISIN Code	XS1196419854																					
Today =	12/11/19																					
R =	14,80 %																					
Previous Coupon	26/08/19																					
nb days	78																					
Accrued coupon	1,421																					
Flow n°	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	
Date	26/02/20	26/08/20	25/02/21	26/08/21	25/02/22	27/08/22	25/02/23	27/08/23	26/02/24	26/08/24	25/02/25	26/08/25	25/02/26	27/08/26	25/02/27	27/08/27	26/02/28	26/08/28	25/02/29	26/08/29	25/02/30	
Year fraction	0,29	0,79	1,29	1,79	2,29	2,79	3,29	3,79	4,29	4,79	5,29	5,79	6,29	6,79	7,29	7,79	8,29	8,79	9,29	9,79	10,29	
Coupon	3,325	3,325	3,325	3,325	3,325	3,325	3,325	3,325	3,325	3,325	3,325	3,325	3,325	3,325	3,325	3,325	3,325	3,325	3,325	3,325	103,325	
Discounted Coupon	3,19	2,98	2,78	2,60	2,42	2,26	2,11	1,97	1,84	1,72	1,60	1,50	1,40	1,30	1,22	1,13	1,06	0,99	0,92	0,86	24,97	