FIN104 Week 8

Note: Some of the problems in this Tutorial require the use of Excel. However, you will use a university-approved calculator to answer all of the questions on your Final Exam. All of the exercises in this Tutorial are designed to assist you in comprehending the Lecture Note's main topics.

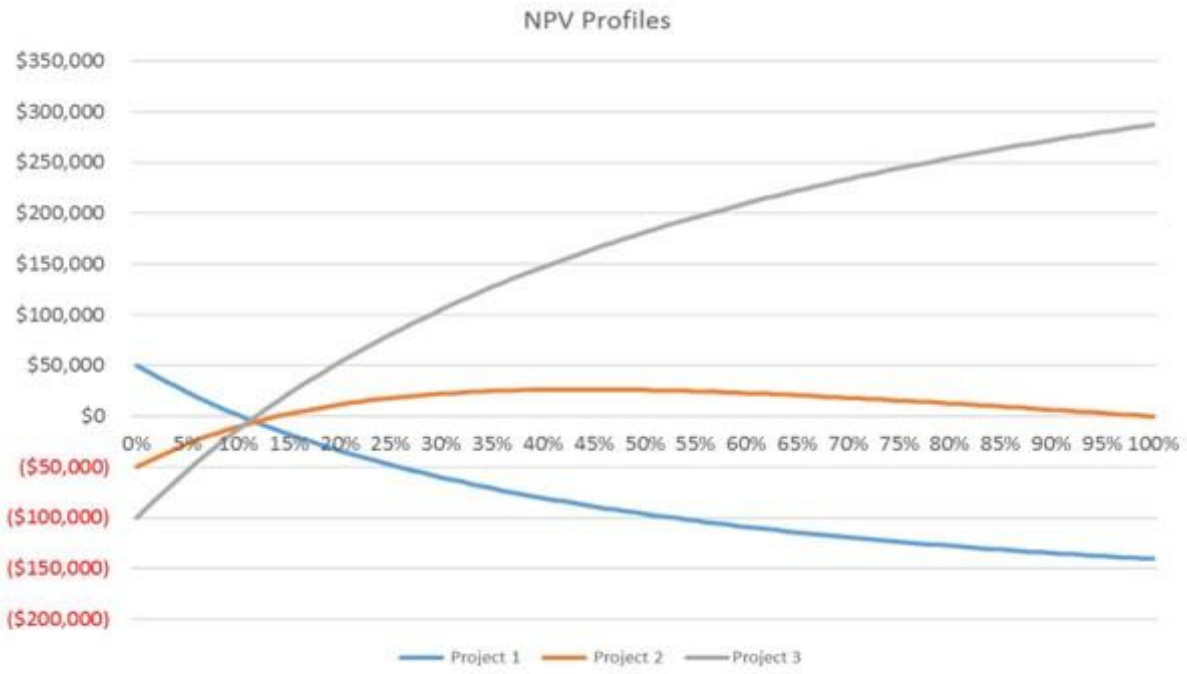
1. (Alternative Example 1 in Lecture Note – Investment Appraisal)

   Consider the following projects:

Project	**0**	**1**	**2**	**3**
1	**($200,000)**	$50,000	$75,000	$125,000
2	**($250,000)**	$675,000	**($225,000)**	**($250,000)**
3	$500,000	**($300,000)**	**($200,000)**	**($100,000)**

   Estimate each project's IRR by graphing the NPV profile for each.

Solution:



The y-axis ranges from negative 200,000 dollars through 350,000 dollars. A curve for project 1 starts at (0, 50,000) and passes through the following points: (10, 0), (55, 100,000), and (100, 145,000). A curve for project 2 starts at (0, negative 50,000) and passes through the following points: (14, 0), (45, 30,000), and (100, 0). A curve for project 3 starts at (0, negative 100,000) and passes through the following points: (12, 0), (55, 200,000), and (100, 280,000).

Solution (continued)
The N P V profile for Project 1 crosses the horizontal axis at about 10%.
The N P V profile for Project 2 crosses the horizontal axis at about 14% and 100%.
The N P V profile for Project 3 crosses the horizontal axis at about 12%.

2. (Alternative Example 2 in Lecture Note – Investment Appraisal)

   Projects A, B, and C each have an expected life of five years. Given the initial cost and annual cash flow information below, what is the payback period for each project?

	A	B	C
Cost	$80	$120	$150
Cash Flow	$25	$30	$35

Solution

- Project A

$$\frac{\$80}{\$25} = 3.2\ years$$

- Project B

$$\frac{\$120}{\$30} = 4.0\ years$$

- Project C

$$\frac{\$150}{\$35} = 4.29\ years$$

3. (Alternative Example 3 in Lecture Note – Investment Appraisal)

   A venture capitalist is considering investing in several projects. You have researched several possibilities for her and come up with the following cash flow estimates. Which investment should you recommend for the venture capitalist to choose?

Project	Initial Investment	First-Year Cash Flow	Growth Rate	Cost of Capital
Dating App	$250,000	$55,000	4%	7%
Green Energy	$350,000	$75,000	4%	8%
Water Purification	$400,000	$120,000	5%	8%
"Smart" Clothes	$500,000	$125,000	8%	12%

Solution

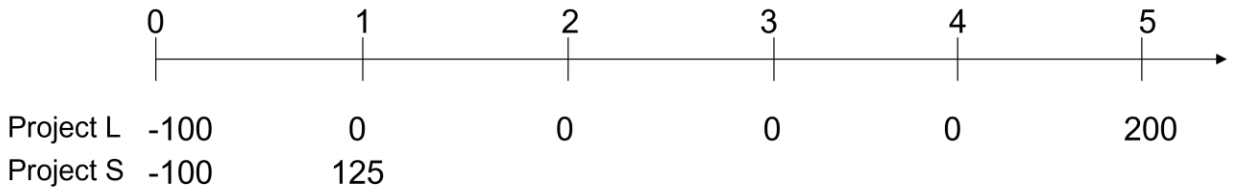
Assuming each business lasts indefinitely, we can compute the present value of the cash flows from each as a constant growth perpetuity. The NPV of each project is

$$NPV(Dating\ App) = -\$250{,}000 + \frac{\$55{,}000}{7\% - 4\%} = \$1{,}583{,}333$$
$$NPV(Green\ Energy) = -\$350{,}000 + \frac{\$75{,}000}{8\% - 4\%} = \$1{,}525{,}000$$
$$NPV(Water\ Purification) = -\$400{,}000 + \frac{\$120{,}000}{8\% - 5\%} = \$3{,}600{,}000$$
$$NPV(\text{"Smart"}\ Clothes) = -\$500{,}000 + \frac{\$125{,}000}{12\% - 8\%} = \$2{,}625{,}000$$

Thus, all of the alternatives have a positive NPV. But, because we can only choose one, the clothing store is the best alternative.

4. (Alternative Example 4 in Lecture Note – Investment Appraisal)

Suppose your firm is considering two different projects, one that lasts one year and another that lasts five years. The cash flows for the two projects look like this:



Project L	-100	0	0	0	0	200
Project S	-100	125				

What is the IRR of each proposal? What is the incremental IRR? If your firm's cost of capital is 10%, what should you do?

Solution

We can compute the IRR of Project L using the annuity calculator:

Blank	**NPER**	**RATE**	**PV**	**PMT**	**FV**	**Excel formula**
Given	5		-100	0	200	
Solve for rate		14.87%				= RATE(5, 0, -100, 200)

We can compute the IRR of Project S using the annuity calculator:

Blank	**NPER**	**RATE**	**PV**	**PMT**	**FV**	**Excel formula**
Given	1		-100	0	125	
Solve for rate		25%				= RATE(1, 0, -100, 125)

We can calculate the incremental IRR this way:

Project	**0**	**1**	**2**	**3**	**4**	**5**
L	-100					200
S	-100	125				
Difference	0	-125				200

	NPER	RATE	PV	PMT	FV	Excel formula
Given	4		-125	0	200	
Solve for rate		12.47%				= RATE(4, 0, -125, 200)

Since the upfront negative cashflow precedes the positive cashflow afterwards, you can apply the IRR rule to make the investment decision.

5. (Alternative Example 5 in Lecture Note – Investment Appraisal)

   Suppose your firm has the following five positive NPV projects to choose from. However, there is not enough manufacturing space in your plant to select all of the projects. Use profitability index to choose among the projects, given that you only have 100,000 square feet of unused space.

Project	**N P V**	**Square feet needed**
Project1	100,000	40,000
Project2	88,000	30,000
Project3	80,000	38,000
Project4	50,000	24,000
Project5	12,000	1,000
Total	330,000	133,000

Solution

Compute the PI for each project.

Project	N P V	Square feet needed	Profitability Index (NPV/ Sq.Ft)
Project1	100,000	40,000	2.5
Project2	88,000	30,000	2.93
Project3	80,000	38,000	2.10
Project4	50,000	24,000	2.08
Project5	12,000	1,000	12.0
Total	330,000	133,000	

Rank order them by PI and see how many projects you can have before you run out of space.

Project	N P V	Square feet needed	Profitability Index (N P V/Sq.Ft)	Cumulative total space used
Project 5	12,000	1,000	12.0	1,000
Project 2	88,000	30,000	2.93	31,000
Project 1	100,000	40,000	2.5	71,000
Project 3	80,000	38,000	2.11	
Project 4	50,000	24,000	2.08	

6. Your firm is considering the launch of a new product, the XJ5. The upfront development cost is $10 million, and you expect to earn a cash flow of $3 million per year for the next five years. Plot the NPV profile for this project for discount rates ranging from 0% to 30%. For what range of discount rates is the project attractive?

Solution

r	NPV	IRR
0%	5.000	15.24%
5%	2.988	
10%	1.372	
15%	0.056	
20%	-1.028	
25%	-1.932	
30%	-2.693	

The project should be accepted as long as the discount rate is below 15.24%.

7. You are considering an investment in a clothes distributor. The company needs $100,000 today and expects to repay you $120,000 in a year from now. What is the IRR of this investment opportunity? Given the riskiness of the investment opportunity, your cost of capital is 20%. What does the IRR rule say about whether you should invest?

Solution

IRR = 120000/100000 – 1 = 20%. You are indifferent.

8. You are deciding between two mutually exclusive investment opportunities. Both require the same initial investment of $10 million. Investment A will generate $2 million per year (starting at the end of the first year) in perpetuity. Investment B will generate $1.5 million at the end of the first year and its revenues will grow at 2% per year for every year after that.

   a. investment has the higher IRR?
   b. Which investment has the higher NPV when the cost of capital is 7%?
   c. In this case, for what values of the cost of capital does picking the higher IRR give the correct answer as to which investment is the best opportunity?

Solution

a. Timeline:

	0	1	2	3
A	–10	2	2	2
B	–10	1.5	1.5(1.02)	$1.5(1.02)^2$

$$NPV_A = \frac{2}{r} - 10$$

Setting $NPV_A = 0$ and solving for r

$IRR_A = 20\%$

$$NPV_B = \frac{1.5}{r - 0.02} - 10$$

Setting $NPV_B = 0$ and solving for r

$$\frac{1.5}{r - 0.02} = 10 \Rightarrow r - 0.02 = 0.15 \Rightarrow r = 17\%. \ \ So, \ IRR_B = 17\%$$

Based on the IRR, you always pick project A.

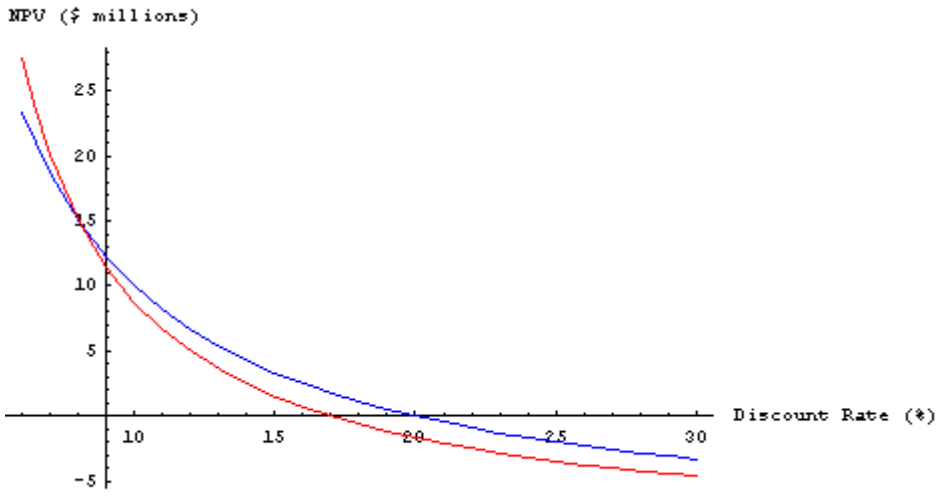
b. Substituting $r = 0.07$ into the NPV formulas derived in part (a) gives

$NPV_A = \$18.5714$ million,

$NPV_B = \$20$ million.

So the NPV says take B.

c. Here is a plot of the NPV of both projects as a function of the discount rate. The NPV rule selects A (and so agrees with the IRR rule) for all discount rates to the right of the point where the curves cross.



$$
\begin{aligned}
NPV_A &= NPV_B \\
\frac{2}{r} &= \frac{1.5}{r-0.02} \\
\frac{r}{2} &= \frac{r-0.02}{1.5} \\
1.5r &= 2r - 0.04 \\
0.5r &= 0.04 \\
r &= 0.08
\end{aligned}
$$

So the IRR rule will give the correct answer for discount rates greater than 8%