Foundations of Accounting & Finance

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Week - 11

Lecture – 50

Numerical on Technique of Evaluating Capital Investment Decisions

Example 1: Net Present Value

You are considering two independent projects that have differing requirements. Project A has a required return of 12 percent compared to Project B's required return of 13.5 percent. Project A costs $75,000 and has cash flows of $21,000, $49,000, and $12,000 for Years 1 to 3, respectively. Project B has an initial cost of $70,000 and cash flows of $15,000, $18,000, and $41,000 for Years 1 to 3, respectively. Based on the NPV, you should:

Solution:

Firstly, we will compute the present value of each cash flows using the discount rate of 12 and 13.5 % for project A and B respectively. Please note each of the project might have a different discount rate as the risk profiles of the projects may be different. We can either directly compute the present value $\frac{Cash\ flow}{(1+Rate)^{Year}}$ or can multiply with the present value interest factor $\frac{One}{(1+Rate)^{Year}}$. Summation of the present value of cash flows minus the initial investment provide the value for NPV which is 3628.27 for Project A and -1688.86 for Project B. The calculation and the decision is depicted below:

	Cash flow					
Year	Project A	Project B	PVIF	PVIF	PV	PV
0	-54500	-69400	1	1	-54500	-69400
1	16400	0	0.88	0.89	14398.60	0.00
2	28900	48300	0.77	0.79	22276.68	38162.96
3	31700	42100	0.68	0.70	21453.00	29568.18
				NPV	3628.27	-1668.86
Accept Project A; because its NPV is positive while Project B's NPV is negative						

Using Excel function

Now, let us use excel to calculate the NPV for both Project A and Project B. I will demonstrate using Excel's NPV function.

For Project A:

- I will select the cell where I want the NPV result.
- Then, I will go to the Formulas tab and click on "Insert Function" or "More Functions" and choose NPV.
- I will input the rate, which is 12%, and select the cash flow values for Project A.
- Excel will then compute the NPV, which in this case is $3628.

Next, I will repeat the process for Project B:

- Again, I will select the cell for the NPV result.
- Input the rate, which is 13.5%, and select the cash flow values for Project B.
- Excel will calculate the NPV, and in this scenario, it is negative -1688.

Example 2: Payback period

Jack is considering adding toys to his general store. He estimates the cost of toy inventory will be $4,200. The remodeling and shelving costs are estimated at $1,500. Toy sales are expected to produce net annual cash inflows of $1,200, $1,500, $1,600, and $1,750 over the next four years, respectively. Should Jack add toys to his merchandise if he requires a three-year **payback period**? Why or why not?

Solution:

Let us start by calculating the cumulative cash flows over the four-year period.

Year 1: $1,200 Year 2: $1,500 + $1,200 = $2,700 Year 3: $1,600 + $2,700 = $4,300 Year 4: $1,750 + $4,300 = $6,050

Now, let us determine the payback period. Jack's total initial investment, including inventory and remodelling costs, amounts to $5,700 ($4,200 + $1,500).

Since Jack aims for a three-year payback period, we will check if the cumulative cash flow at the end of Year 3 covers his initial investment. In this case, at the end of Year 3, Jack has accumulated $4,300. Thus, he still needs $1,400 to recover his initial investment.

To calculate the payback period, we divide the remaining investment by the cash flow in Year 4. So, $1,400 / $1,750 = 0.8 years.

Therefore, Jack's project fails to meet his three-year payback requirement, as it takes approximately 3.8 years to recover his initial investment. Consequently, adding toys to his merchandise may not be advisable based on the payback period criterion.

Year	Cash flow	cummulative cash flows	
0	5700		
1	1200	1200	
2	1500	2700	
3	1600	4300	
4	1750	6050	
Payback period	3.8	**Years**	
the project does not meet his requirement of payback in three years as the project takes 3.8 yrs to pay back			

Example 3: Internal Rate of Return

A financing project has an initial cash inflow of $42,000 and cash flows of −$15,600, −$22,200, and −$18,000 for Years 1 to 3, respectively. The required rate of return is 13 percent. What is the internal rate of return? Should the project be accepted?

Solution:

- I will select the cell where I want the IRR result.
- Then, I will go to the Formulas tab and click on "Insert Function" or "More Functions" and choose IRR.
- we input the cash flows as follows: Values: -$15,600, -$22,200, -$18,000, $42,000
- Excel will then compute the IRR, which in this case is approximately 15.26%.

Upon calculation, we find that the IRR for the project is approximately 15.26 percent.

However, since this is a financing project where the initial cash inflow represents borrowed funds, an IRR higher than the required rate of return of 13 percent indicates that the project is not viable. In such cases, a higher IRR implies increased financing costs, making the project unsustainable. Therefore, the project should be rejected as it fails to meet the required rate of return criteria.

Year	Cash flow			
0	42000			
1	-15600			
2	-22200			
3	-18000			
Required rate	13.00%			
IRR	**15.26%**			
since it is a financing project a IRR which is higher than the required rate of return will be rejected				

Example 4: Profitability Index

Juan is considering two independent projects. Project A costs $74,600 and has projected cash flows of $18,700, $46,300, and $12,200 for Years 1 to 3, respectively. Project B costs $70,000 and has cash flows of $10,600, $15,800, and $67,900 for Years 1 to 3, respectively. Juan assigns a discount rate of 10 percent to Project A and 12 percent to Project B. Which project or projects, if either, should he accept based on the profitability index rule?

Solution:

For Project A:

- Initial Investment: $74,600
- Projected Cash Flows: $18,700, $46,300, and $12,200 for Years 1 to 3
- Discount Rate: 10%

Using Excel, the present value of each cash flow is calculated by dividing the cash flow by one plus the discount rate (1 + discount rate) raised to the power of the corresponding year. Then, the present values are summed up to find the total present value of future cash flows, which is $64,431. The profitability index (PI) is calculated by dividing the total present value of future cash flows by the initial investment (74,600), resulting in a PI of approximately 0.86 for Project A.

For Project B:

- Initial Investment: $70,000
- Projected Cash Flows: $10,600, $15,800, and $67,900 for Years 1 to 3
- Discount Rate: 12%

Similarly, the present value of each cash flow is calculated using the same method. The total present value of future cash flows for Project B is $70,390. Dividing this by the initial investment (70,000) gives a PI of approximately 1.01 for Project B.

Based on the profitability index rule, Project B is preferred as it has a PI greater than 1, indicating that the present value of its future cash flows exceeds the initial investment. Therefore, Juan should accept Project B.

	Project A	Project B		
Required return	10.00%	12.00%		
	Cash flow			
Year	Project A	Project B	PV	PV
0	-74600	-70000		
1	18700	10600	17000	9464
2	46300	15800	38264	12596
3	12200	67900	9166	48330
			64431	70390
		Profitability Index	**0.86**	**1.01**
Accept project B				

Example 5: All the capital budgeting techniques

A proposed new venture will cost $175,000 and should produce annual cash flows of $48,500, $85,000, $40,000, and $40,000 for Years 1 to 4, respectively. The required payback period is 3 years and the discounted payback period is 3.5 years. The required rate of return is 9 percent. Which methods indicate project acceptance and which indicate project rejection?

Solution:

NPV

For the proposed new venture:

- Initial Investment: $175,000
- Annual Cash Flows: $48,500, $85,000, $40,000, and $40,000 for Years 1 to 4
- Required Rate of Return: 9%

Using Excel, the NPV is calculated by using the NPV function, where the rate is set to 9% and the cash flows for each year are provided. Upon calculation, the NPV of the project is determined to be $240.88.

Since the NPV is positive, the project is accepted according to the NPV rule.

IRR

For the proposed new venture:

- Initial Investment: $175,000
- Annual Cash Flows: $48,500, $85,000, $40,000, and $40,000 for Years 1 to 4
- Required Rate of Return: 9%

Using Excel, the IRR function is applied to the cash flows of the project. Upon calculation, the IRR is determined to be approximately 9.07%.

Since the IRR (9.07%) exceeds the required rate of return (9%), the project is accepted according to the IRR rule

Payback period

For the proposed new venture:

- Initial Investment: $175,000
- Annual Cash Flows: $48,500, $85,000, $40,000, and $40,000 for Years 1 to 4

To calculate the payback period, cumulative cash flows are determined. The cumulative cash flows are as follows:

- Year 1: $48,500
- Year 2: $133,500 ($48,500 + $85,000)
- Year 3: $173,500 ($48,500 + $85,000 + $40,000)
- Year 4: $213,500 ($48,500 + $85,000 + $40,000 + $40,000)

Since the project becomes successful in the fourth year, the payback period is calculated as follows:

$$\text{Payback period} = \text{Year } 3 + \frac{\text{Investment remaining}}{\text{Cash flow in Year } 4}$$

$$\text{Payback period} = 3 + \frac{\$175{,}000 - \$173{,}500}{\$40{,}000}$$

$$\text{Payback period} = 3 + \frac{\$1{,}500}{\$40{,}000}$$

$$\text{Payback period} = 3.0375 \text{ years}$$

Since the required payback period is 3 years, and the calculated payback period of 3.0375 years exceeds this, the project is rejected according to the payback period rule.

Discounted payback period

For the proposed new venture:

- Initial Investment: $175,000
- Annual Cash Flows: $48,500, $85,000, $40,000, and $40,000 for Years 1 to 4
- Discount Rate: 9%

To calculate the discounted payback period, the present value of each cash flow is determined using the discount rate of 9%. The discounted cash flows are as follows:

- Year 1: $\frac{48{,}500}{(1+0.09)^1}$
- Year 2: $\frac{85{,}000}{(1+0.09)^2}$
- Year 3: $\frac{40{,}000}{(1+0.09)^3}$
- Year 4: $\frac{40{,}000}{(1+0.09)^4}$

The cumulative present value of cash flows is then calculated:

- Year 1: Present Value of $48,500
- Year 2: Present Value of $133,500 ($48,500 + $85,000)
- Year 3: Present Value of $167,137.60 ($48,500 + $85,000 + $33,637.60)
- Year 4: Present Value of $196,757.64 ($48,500 + $85,000 + $33,637.60 + $29,620.04)

Since the project becomes successful in the fourth year, the discounted payback period is calculated as follows:

$$\text{Discounted Payback Period} = \text{Year 3} + \frac{\text{Investment remaining}}{\text{Discounted cash flow in Year 4}}$$

$$\text{Discounted Payback Period} = 3 + \frac{\$175{,}000 - \$167{,}137.60}{\$196{,}757.64}$$

$$\text{Discounted Payback Period} = 3 + \frac{\$7{,}862.40}{\$196{,}757.64}$$

$$\text{Discounted Payback Period} = 3.99 \text{ years}$$

Since the required discounted payback period is 3.5 years, and the calculated discounted payback period of 3.99 years exceeds this, the project is rejected according to the discounted payback period rule.

Profitability index

For the proposed new venture:

- Initial Investment: $175,000
- Annual Cash Flows: $48,500, $85,000, $40,000, and $40,000 for Years 1 to 4
- Discount Rate: 9%

To calculate the profitability index, we first determine the present value of all cash flows using the discount rate of 9%. Then, the profitability index is calculated by dividing the total present value of cash flows by the initial investment.

The present value of cash flows is calculated as follows:

- Year 1: Present Value of $48,500
- Year 2: Present Value of $85000
- Year 3: Present Value of $40000
- Year 4: Present Value of $40000

The total present value of future cash flows for Project is $175,263. Dividing this by the initial investment (175,000) gives a PI of approximately 1.0015.

Based on the profitability index rule, Project is preferred as it has a PI greater than 1, indicating that the present value of its future cash flows exceeds the initial investment. Therefore, Juan should accept Project.

	Project A					
Required return	9.00%					
	Cash flow					
Year	Project A	Cummulative cash flows	PV	cummulative pv cash flows		
0	-175000					
1	48500	48500	44495.41	44495		
2	85000	133500	71542.8	116038		
3	40000	173500	30887.34	146926		
4	40000	213500	28337.01	175263		
			175262.6			
NPV	$240.88	ACCEPT THE PROJECT				
IRR	9.07%	ACCEPT THE PROJECT				
Pay back period	3.0375	Reject the project as it exceeds the required 3 yrs payback				
Dis pay back	3.99	Reject the project as it exceeds the required 3 yrs payback				
Profitability index	1.0015	ACCEPT THE PROJECT as PI is more than 1				