**Lecture notes**

* Please revise H plc - the question on ‘Investment Decisions’. Answers are provided below.
* Additional areas on investment decisions that were dealt with in the lecture are also included.

**H plc. [Question from the last lecture]**

Two mutually exclusive investments in machines A or B are being considered by H plc to expand its capacity.

Their expected cash flows, in £000s, are as follows:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Year | 1 | 2 | 3 | 4 | 5 |
| Machine A | 100 | 300 | 300 | 100 | 100 |
| Machine B | 250 | 300 | 100 | 90 | 80 |

Both machines require similar initial investment of £600,000 and similar scrap value at the end of year 5 of £40,000.

H plc’s cost of capital is 10% and require a payback period of 3 years.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Year | 1 | 2 | 3 | 4 | 5 |
| Discount factors @ 10 % | 0.909 | 0.826 | 0.751 | 0.683 | 0.621 |

**Required:**

(a) Payback for both machines. Which machine is preferred? [6 marks]

(b) Net present value (NPV) for both machines. Which machine is

preferred? [8 marks]

(c) Advise Y plc on the investment decision. Explain why? [4 marks]

(d) Comment on the Internal Rate of Return (IRR) of the machine recommended in (c). Calculation of the IRR is **not** required.

(e) Explain the technique Internal Rate of Return (IRR). State one advantage and one disadvantage of this technique. [4 marks]

**H plc. [INDICATIVE CONTENT / SUGGESTED ANSWER]**

**(a) Payback for both machines. Which machine is preferred? [6 marks]**

Payback period for machine A

|  |  |  |
| --- | --- | --- |
| Year | NCF (£000) | Cumulative NCF (£000) |
| 1 | 100 | 100 |
| 2 | 300 | 400 |
| 3 | 300 | 700 |

Payback is between years 2 and 3

Payback = 2 + £[600,000 – 400,000] / £300,000 = 2 + £200,000/ £300,000 = 2.67 years

***Another* way to present the above answer**

Payback period for machine A

Cumulative cash flow for year 2 is £400,000

Cumulative cash flow for year 3 is £700,000

Payback is between years 2 and 3

Payback for A = 2 + [£200,000 / £300,000] = 2.67 years

Machine B

Payback period for machine B

Cumulative cash flow for year 2 is £550,000

Cumulative cash flow for year 3 is £650,000

Payback for B = 2 + [£50,000 / £100,000] = 2.5 years

***Machine B is preferred since it has the shortest/quickest payback.***

**(b) Net present value (NPV) for both machines. Which machine is**

**preferred? [8 marks]**

NPV @10% [£000s] for machine A

= 100 x 0.909 + 300 (0.826 + 0.751) + 100 x 0.683 + (100 + 40) x 0.621 - 600

= 90.9 + 473.1 + 68.3 + 86.94 – 600 = 119.24

**NPV @10% = £119,240**

NPV @10% [£000s] for machine B

= 250 x 0.909 + 300 x 0.826 + 100 x 0.751 + 90 x 0.683 + [80 + 40] x 0.621 – 600

= 227.25 + 247.8 + 75.1 + 61.47 + 74.52 – 600

= 86.14

**NPV @ 10% for machine B is £86,140**

***Machine A is preferred since it has the higher/larger NPV****.*

**(c) Advise H plc on the investment decision. Explain why? [5 marks]**

***Please note: This is a longer answer for the above marks***

All investment decisions should be made using any DCF method. This may be either NPV or IRR. In this case, NPVs for both investments are available.

Both investments show a positive NPV, i.e. an **economic profit** @ 10 % cost of capital. Hence both are viable.

However, in a **mutually exclusive** scenario, **machine A is recommended** for selection since it has the **highest NPV.** This selection will lead to an increase in the present value of the company and consequently will result in an increase in the company’s share price and shareholders’ wealth.

Payback may be used as an additional criteria but **not** as the primary/main method for investment decisions since it ignores time value of money and the post payback cashflows.

**(d) Comment on the Internal Rate of Return (IRR) of the machine recommended in (c). Calculation of the IRR is not required. [5 marks]**

IRR is the discount rate/cost of capital at which the NPV = 0

The relationship between NPV and cost of capital: As cost of capital increases, NPV decreases and tends towards zero and then becomes negative.

This relationship is an inverse relationship.

Hence based on this and the fact that machine A has a positive NPV, the IRR must be more than 10%

An increase in the discount rate/cost of capital will lead to a decrease in discount factors. So as the discount rate increases will result in the positive NPV of an investment to decrease and tend towards zero before the NPV becomes negative.

Since the NPV of the recommended machine A is positive at the 10% discount rate, this discount rate has to increase above 10% for the NPV to be equal to zero.

Hence it can be concluded that the IRR for machine A must be higher than 10%.

**(e) Explain the technique Internal Rate of Return (IRR). State one advantage and one disadvantage of this technique. [5 marks]**

IRR is the discount rate or cost of capital at which the NPV will be zero. It is the investment’s rate of return in DCF terms.

Advantages of IRR are: (any ***one*** of these advantages will be good enough)

* It accounts for time value of money
* It is cash flowbased.
* It evaluates on the basis of a “user-friendly” percentage rate of return.

Disadvantage of IRR are:

* IRR provides **unreliable advice** when evaluating alternative projects involving different costs/sizes. [see explanation below]

***The following explain the above – this is not required to answer the above question.***

The IRR of a larger investment may be lower but may have a higher positive NPV. An investment with a higher NPV may be preferable even though its IRR is lower. The investment with the higher NPV will increase the value of the company and the shareholders’ wealth by a larger amount.

This is referred to as the **“big factory / little factory” problem** of the IRR method.

So, in mutually exclusive situations, where a conflict arises in the ranking between the two DCF methods, NPV and IRR, the NPV ranking should be relied on.

**Big Factory or Little Factory**

**Cost: £20m £8m**

**IRR: 25% 30%**

**Minimum acceptable IRR: 20%...**

**IRR says the *Little Factory* is best – but is this correct?**

**An IRR of 25% on £20m [big factory] will have a higher NPV compared to the IRR of 30% from a smaller investment of £8m [little factory] which may have a lower NPV.**

**An investment with a higher NPV will increase shareholders’ wealth/equity as well as the value of the company/business if the big factory is chosen instead of the little factory investment.**

**Example to illustrate the financial effect of investing in a project with a positive NPV.**

A plc has 10 million shares and its current market price of its shares is £5 per share.

Market value of A plc’s equity is: 10 million shares x £5 per share = £50m

The Board of Directors of A plc has decided to invest in a new project which has a positive NPV of £10m.

What is the financial consequence of this investment decision on the value of the company?

Total market value of A plc will rise from £50m to £60m [market value of £50m + NPV of new project of £10m].

This announcement to undertake this investment is expected to affect the share price as follows:

The share price will rise to £6 per share. [i.e. £60m/10m shares = £6]

**Calculation of IRR** **using the method of interpolation**

**Example:**

An investment has an NPV @ 15% cost of capital of £3,000 and at 20% cost of capital the NPV is negative at £ (7000).

This shows the investment’s IRR will lie between 15% and 20% and it will be more than 15% and less than 20%. In addition the IRR will be closer to 15% than 20% since the NPV @15% of £3000 will be closer to zero than the NPV@20% of £ (7000).

Using the method of interpolation:

The IRR = 15% + [£3,000 / (3,000 + 7000)] x (20% - 15%)

= 15% + [£3000 / £10,000] x 5%

= 15% + 0.3 x 5%

= 15% + 1.5%

= **16.5%**

-----------------------------------------------------------------------------------------------

**Cost-volume-profit analysis [NEXT TOPIC]**

**CVP Analysis Question – J Ltd**

J Ltd manufactures and sells kitchen electric products for domestic use. A new product, an electric kettle, is planned for in 2022. Details of this planned launch is as follows.

Selling price per kettle is £25 and expect to sell 35,000 kettles.

Variable costs of production and sales are £15 per kettle.

Total fixed costs specific to the new kettle product line is expected to be £220,000 and the maximum production capacity is 50,000 kettles.

Required:

a) Breakeven sales volume and sales revenue.

b) Budgeted profit.

c) Margin of safety.

d) The sales volume and sales revenue required to make a profit of £100,000.

e) If the selling price reduces by £2 per kettle, calculate the budgeted profit for the

35,000 kettles and the breakeven point. Comment briefly on the results.

f) Discuss the limitations of the above analysis.

**END OF LECTURE 8 NOTES**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |  |  |  |