3.8 Investment appraisal

Net present value (NPV) (HL)

Which is worth more, $100 today or $100 in five years' time? The answer is $100 today.

A unit of money does not have the same value in the future as it does today. There are two factors that play a role here. The first is inflation. Inflation is an increase in the general price level in the economy. It is usually expressed as a percentage change. If prices are rising over time, as is normally the case, then $100 will not buy as much in the future. A 3% inflation rate means that after one year $100 will buy only $97 worth of goods. After another year, with the same inflation rate, that money will buy only $94.09 worth of goods.

There is another factor to consider relating to the future value of money. If you take your $100 and put it into a bank, it will earn interest from the bank. If the interest rate you get from the bank is 2%, then after one year you will have $102, and after two years you will have $104.40. It is usually the case that a bank will pay a lower interest rate on deposits than the inflation rate. Thus, over time, the value of money in terms of what can be purchased with it, will decline.

Figure 1. Money loses its value over time.

One significant limitation of the investment appraisal methods of payback period and average rate of return is that they assume that cash flows in future years have the same value as those today. However, this is not the case. Another investment appraisal method, net present value (NPV), shows the real value of estimated future net cash flows so that the investment appraisal is more accurate.

Discount factor

A discount rate is the rate a business could earn on another comparable investment. When that rate is applied to the expected future cash flows from an investment, these cash flows can be reduced, or 'discounted' to reflect today's value of that future cash flow. By doing this, a business can compare different investment options, even when they involve different lengths of time for execution.

Table 1 shows various discount rates. Looking at the table, you can see that if an 8% discount rate is used, a discount factor of 0.9259 must be applied to the net cash flow figure in the first year.

Table 1. Discount factors.

Years	Discount rate				
	4%	6%	8%	10%	20%
1	0.9615	0.9434	0.9259	0.9091	0.8333
2	0.9246	0.8900	0.8573	0.8264	0.6944
3	0.8890	0.8396	0.7938	0.7513	0.5787
4	0.8548	0.7921	0.7350	0.6830	0.4823
5	0.8219	0.7473	0.6806	0.6209	0.4019
6	0.7903	0.7050	0.6302	0.5645	0.3349
7	0.7599	0.6651	0.5835	0.5132	0.2791
8	0.7307	0.6271	0.5403	0.4665	0.2326
9	0.7026	0.5919	0.5002	0.4241	0.1938
10	0.6756	0.5584	0.4632	0.3855	0.1615

You can now use the discount values above to calculate the present value of a future cash inflow. The formula is:

Present value (single year) = net cash flow x discount factor

Concept

Ethics

It is very easy to make the present value of an investment appear larger than it is by using a lower discount rate. If an analyst creating a report wants to make her boss think the investment is worth more, she could lower the discount rate from 6% to 4%. This will give a larger present value and make the investment look more attractive. Be careful when looking at businesses' interest rate assumptions, as they can be easily manipulated.

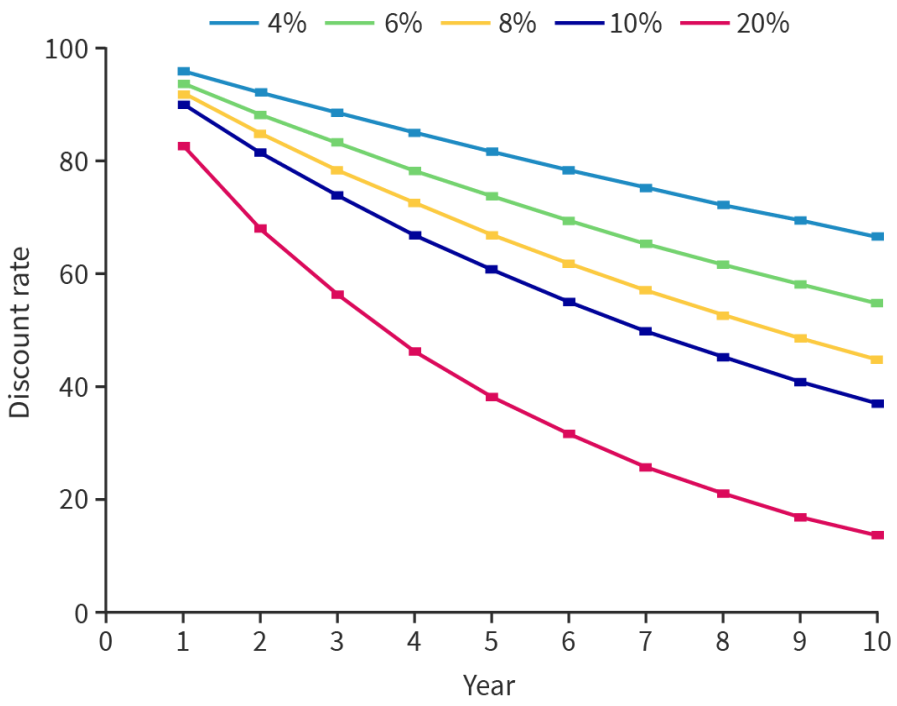

Figure 2. Discount rates affect the size of an investment.

Calculating net present value

Net present value expresses all future net cash flows from an investment in terms of their present value today. The formula is:

$$\textbf{Net present value (NVP)} = \sum \textbf{present values of return} - \textbf{original cost}$$

Exam tip

The formula sheet you are given in the exam includes the NPV formula and a discount table, so you do not need to memorise these. However, you do need to understand how to use them.

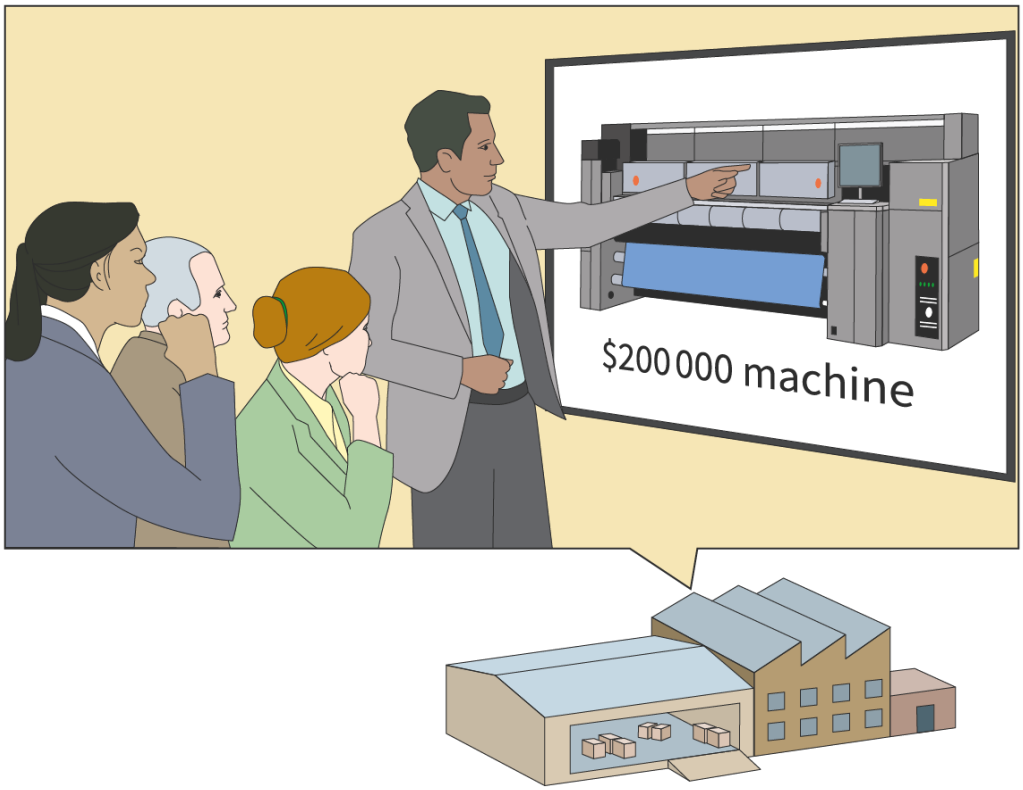

Figure 3. The average rate of return (ARR) investment appraisal method can help evaluate the investment.

The concept of net present value is explained below, using the same example of a company that is considering purchasing a new $200 000 machine and using the same cash flows as in the previous examples and a discount rate of 10%.

Step 1: Discount the net cash flows in each year

As a reminder, the formula for calculating the present value is below. The discount factor is found in the discount table according to the future year.

Present value (single year) = net cash flow × discount factor

In Year 1: $\$60\,000 \times 0.9091 = \$54\,546$

In Year 2: $\$80\,000 \times 0.8264 = \$66\,112$

In Year 3: $\$120\,000 \times 0.7513 = \$90\,156$

In Year 4: $\$160\,000 \times 0.6830 = \$109\,280$

Table 2. Adding a discount rate to net cash flows to determine the present value for each year.

Year	Cash inflow ($)	Cash outflow ($)	Net cash flow ($)	10% discount rate	Present value ($)
1	80000	20000	60000	0.9091	54546
2	140000	60000	80000	0.8264	66112
3	240000	120000	120000	0.7513	90156
4	360000	200000	160000	0.6830	109280

Step 2: Find the net present value

The next step is to add all the present values and subtract out the original cost of the investment. As a reminder, the formula for net present value is:

Net present value (NVP) = $\sum$ present values of return − original cost

$\text{NVP} = (\$54\,546 + \$66\,112 + \$90\,156 + \$109\,280) - \$200\,000$

$= \$120\,094$

If net present value is positive, then the investment would have a positive return.

As in previous examples, it may be helpful to lay out the information in a table.

Evaluation of net present value

Like the other investment appraisal methods, net present value has both benefits and limitations. The main benefit is that the method considers the change in value of money over time, which provides the business with a more accurate understanding of the future value of cash flows from an investment. It also allows the business to compare opportunities with different investment periods.

However, a limitation of net present value is that it is more complex to calculate than payback period and average rate of return. Another limitation is that assumptions have to be made about the future value of money, which may be inaccurate. The discount rate chosen to calculate present value could be quite inaccurate depending on future economic conditions. So, these discount rate assumptions need to be analysed critically to ensure that they are not overly optimistic.