

Discounted Cash Flow

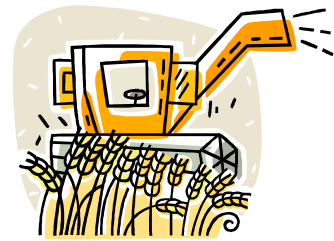
Everyone must be aware of borrowing money. It's useful for buying those things we can't yet afford.



But borrowing too much money can lead to big problems. If we can't afford the repayments we could lose everything. If we spread the cost of that new car over too long a period, we could finish up still paying for it long after we have scrapped it.

So it's the same in business. A manufacturing company may buy a new machine to make a certain product. The repayments will be in the form of cash inflows from sales. But if it takes too long to repay it, the product may have gone out of fashion or become obsolete before we get our money back.

Let us suppose we want a combine harvester. It's going to cost us £160,000 and we expect it to last 4 years before it needs replacing. Should we invest in this? Well firstly we will need to know what cash inflows we can expect over the next few years. Let us suppose that management has decided we can expect £50,000 per year plus an allowance in year 4 for selling the machine second hand. You can probably see that it will take just over 3 years to get our money back. We can show it like this:-



Year	Cash Flow	Cumulative Cash Flow
	£	£
0	(160,000)	(160,000)
1	50,000	(110,000)
2	50,000	(60,000)
3	50,000	(10,000)
4	70,000	60,000

So the **payback period** is just over 3 years. In exams and skills tests you will be asked to calculate part years. This is done by taking the outstanding £10,000 and dividing by the next year's inflow.

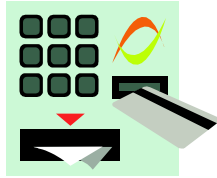
$$£10,000/£70,000 = 0.143.$$

Now we can multiply this by the number of months in the year.

$$0.143 \times 12 \text{ months} = 2 \text{ months (to the nearest month).}$$

So we can say that the payback period is 3 years and 2 months.

There is a problem with this though. Suppose you were fortunate enough to be able to lend a friend £100. Would you want paying back next week or next year? Well obviously you would choose next week, because in a year's time you could have made the £100 more by putting it in a bank where it would earn interest. Or you may have wanted to buy something with it, but in a year's time it will cost more than £100.



Let's suppose that we invested our £100 at an interest rate of 10%. In a year's time our £100 would become

Original investment	£100
Interest at 10%	<u>£10</u>
Value at end of 1 st year	£110

Then, after two years:

Interest at 10%	<u>£11</u>
Value at end of 2 nd year	£121

And so on until we withdraw the money.

So our friend would have to pay us back £121 in two years time just so that we can keep up with the value of our original £100.

Now let's work it backwards. At an interest rate of 10%, what would £121 in two years time be worth at today's value? Well we use a **present value factor** or **discount factor**. Don't worry about the terminology; it's simply a number we multiply by to bring it back to today's value. **AAT students won't have to work out this figure; it will be given to you in exams and skills tests.** However, those of you who are mathematically minded may like to know how it's done.

First year:-

$$\text{At an interest rate of 10\%} \quad \frac{100}{100 \text{ plus the interest rate}} = \frac{100}{110} = 0.909$$

Second year:-

$$\frac{100}{110} \times \frac{100}{110} = 0.826$$

So using our example above £121 x 0.826 = £100 (rounded to whole pounds). (It's not totally correct because we have left out a whole lot of decimal places, but it's near enough for what we want.). £121 in two year's time at an interest rate of 10% is worth £100 in today's money.

Now lets go back to our example with the combine harvester:

With an interest rate of 10% we can work out what our projected cash inflows in terms of today's values:

The discount factors are

Year 1	0.909
Year 2	0.826
Year 3	0.751
Year 4	0.683

Year	Cash Flow £	Discount Factor	Discounted Cash Flow £
0	(160,000)	1.000	(160,000)
1	50,000	0.909	45,450
2	50,000	0.826	41,300
3	50,000	0.751	37,550
4	70,000	0.683	47,810

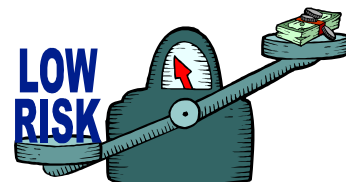
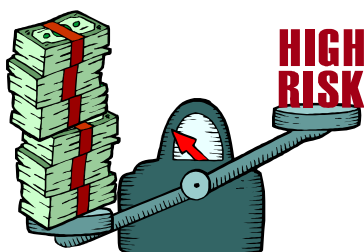
Remember that we invest in the machinery in year 0 and the discount factor will be 1.000. The cash flow will be negative because it is a cash outflow and not an inflow.

Now let's add up the discounted cash flows and see what we get:

£
(160,000)
45,450
41,300
37,550
47,810
12,110

So £12,110 is what our investment is worth to us at today's value. It's known as the **Net Present Value (NPV)**.

At AAT level you won't be asked to work out discount rates, but you may come across some higher rates than in the example and you may think they are unrealistic. However, the reason for the high rates is that companies add a percentage to account for risk. After all, if we put our money in the bank it's very unlikely we will lose our money, but if we invest in machinery our product may not take off as we had predicted. So why bother putting money into a project with risk when we can get the same money almost risk-free in the bank? If we can get a better return on our capital it may be worth it. Some companies add up to 15% on top of the expected basic interest rate.



In exams and skills tests you may be asked to compare two projects. You should use your own judgement, but as a general rule a short payback period and a higher NPV should be the project to choose. Forward forecasting becomes more difficult with time. It's more difficult to predict what your salary will be in 10 years time than it would be for next year. So the sooner you can pay off your project the more accurate

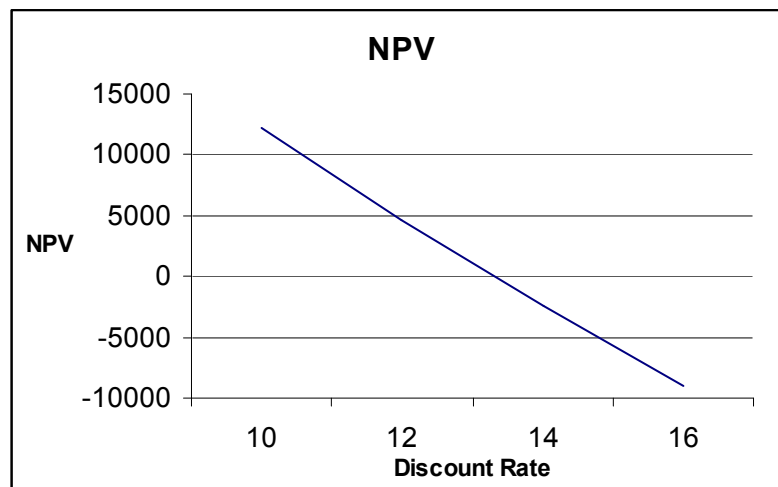
your predictions will be. A higher NPV will cover any errors in your forecasting better than a project which is only just above break-even.

There is one more means of determining whether a project is worthwhile or not. It's called the Internal Rate of Return (IRR). Don't worry about the jargon – it simply means the Discount Rate which will make the project break-even, or the Discount Rate where the Discounted Cash Flow shows a Net Present Value of zero. **You won't have to work this out** but you will have to know what it means.

Here I've worked it out by trial and error. You can see that the NPV is zero somewhere between 12% and 14%

Discount Rate %	10	12	14	16
YEAR 0	-160000	-160000	-160000	-160000
YEAR 1	45450	44643	43860	43103
YEAR 2	41300	39860	38473	37158
YEAR 3	37550	35589	33749	32033
YEAR 4	47810	44486	41446	38660
NPV	12110	4578	-2473	-9045

Here I've taken the highest and lowest NPV and plotted them on a graph. Again it shows NPV at zero when the Discount Rate is about 13%



So we can see that the IRR is about 13%. This means that if our interest rate gets above 13% then we will lose money on the project. If we can get a rate of return on our money by investing it somewhere else for more than 13% then the project is not worthwhile.

If we are asked to compare two projects then a higher IRR will be the better project.

Of course you will have to use your own judgement in exams, skills tests and real life as to whether a project is to go ahead or which of two projects is more worthwhile, but using **payback period**, **NPV** and **IRR** will give you figures on which to base your opinion.