

INVESTMENT APPRAISAL/Dr Andrew Fowkes 2011

Individuals, businesses and organisations are always interested in new projects. A 'project' could be a new member of staff, a new piece of equipment, a new way of doing things, creating a new product or building infrastructure.

The aim of investment in projects is to make returns, which could be in the form of profits, a surplus or benefits.

Investment refers to spending money now on a project which is expected to last for some time period, often a number of years, over which time period that project will generate returns.

There are a number of ways of estimating, measuring or assessing investment decisions.

- Consider an initial investment of £95,000
- The gross return on the investment is expected to be £120,000
- The time period is eight years

Average return

This is the average return per annum: $\text{Gross return} / \text{time period}$

$$£120,000 / 8 = £15,000$$

Average rate of return

This looks at the average return as a percentage of the initial investment:

$$(£15,000 / £95,000) \times 100 = 15.79 \text{ per cent.}$$

Average net return

As for the average return, but this time the net value:
 $(\text{Gross return} - \text{initial investment}) / \text{time period}$

$$\text{The net return is } £120,000 - £95,000 = £25,000$$

$$\text{The average net return per annum: } £25,000 / 8 = £3,125$$

Average net rate of return

This looks at the average net return as a percentage of the initial investment:

$$(\text{£}3,125 / \text{£}95,000) \times 100 = 3.29 \text{ per cent.}$$

These and other accounting methods will give rates which, if used consistently will allow planners and managers etc to rank in order different projects and replacement schemes etc. Note that it is usual for more than one project to be considered at the same time.

Problems with the above methods

- No account is taken of when in time the returns occur. For example, returns may be different each year.
- It is difficult to compare projects and schemes with different time periods.

Payback period

The payback year (time period) is that time when the initial investment is recouped by the sum of annual returns. If there is a range of schemes, it is possible to see which scheme pays back the investment first. In most instances people and organisations have a preference for early payback.

Consider an initial investment of £100,000 and the following returns for two schemes. (Values are in £000s.)

Year	Scheme 1	Scheme 2
1	45	40
2	35	30
3	20	15
4	20	15
5	15	40
Total	135	140

Scheme 1 pays back the initial investment of £100,000 by year three, whereas scheme 2 pays back in year four. On this basis scheme 1 may be preferred but this method does not take into account any returns after the payback period. Scheme 2 realises £5,000 more returns overall.

Exercises

For the following projects calculate the:

- average return
- average rate of return
- average net return
- average net rate of return

All monies are in £000.

	Investment	Gross return	Time period (yrs)
Project 1	131,000	163,000	6

	Investment	Gross return	Time period (yrs)
Project 2	15,000	19,500	3

	Investment	Gross return	Time period (yrs)
Project 3	650,000	780,000	9

	Investment	Gross return	Time period (yrs)
Project 4	5,000	7,700	4

	Investment	Gross return	Time period (yrs)
Project 5	2,400,000	3,300,000	7

	Investment	Gross return	Time period (yrs)
Project 6	52,000	73,000	5

- Which of the six projects gives the best return on the initial investment?
- Which of the six projects gives the worst return on the initial investment?

For the following projects calculate the **payback period** and the **net percentage return** $[(\text{Gross return} - \text{initial investment}) / \text{initial investment} \times 100]$. In each case, which of the two projects would you chose and why?

All monies are in £000.

	Project 1 invest £90		Project 2 invest £120	
Year	Return	Cumulative return	Return	Cumulative return
1	20		25	
2	24		29	
3	27		31	
4	19		20	
5	16		15	
Gross Return				

Project 1 invest £90			Project 2 invest £120	
Year	Return	Cumulative return	Return	Cumulative return
1	20	20	25	25
2	24	44	29	54
3	27	71	31	85
4	19	90	20	105
5	16	106	15	120
Gross Return	106		120	

	Payback	Net % Return
Project 1 invest £90	Year 4	17.78
Project 2 invest £120	Year 5	0.00

Now do the rest

	Project 1 invest £12		Project 2 invest £8	
Year	Return	Cumulative return	Return	Cumulative return
1	3		4	
2	4		4	
3	6		2	
4	4		1	
Gross Return				

	Project 1 invest £200		Project 2 invest £260	
Year	Return	Cumulative return	Return	Cumulative return
1	40		46	
2	45		64	
3	60		56	
4	55		50	
5	24		50	
6	16		46	
Gross Return				

	Project 1 invest £300		Project 2 invest £450	
Year	Return	Cumulative return	Return	Cumulative return
1	56		68	
2	64		78	
3	90		85	
4	55		95	
5	34		45	
6	45		92	
Gross Return				

INVESTMENT APPRAISAL USING NET PRESENT VALUE

Timing and time preference

People generally prefer present consumption to future consumption.

- Do you want £100 now or £121 in two year's time?
- Do you want to pay £100 now or £121 in two year's time?

This issue is covered by what is known as **marginal time preference rate (MTPR)**, where marginal is used to indicate that the rate may change. In order to answer this we need to know the earning power of a currency. For example if interest rates are 10 per cent then the two examples can be seen as the same:

(£100 @ 10% = £100+£10 = £110(Year 1); £110 @ 10% = £110+£11 = £121 (Year 2))

The prime use of this technique is to value future costs and benefits in terms of today's values.

The technique of **discounted cash flow** will be looked to calculate **net present value**.

Using the net present value of projects/investments allows us to consider and compare alternative projects which may have different time periods and varying amounts of costs and revenue streams.

Net present value (NPV); brings all future monies to the present time, which is referred to as year 0.

$$\text{Benefits} = B_1 / (1+r)^1 + B_2 / (1+r)^2 + B_3 / (1+r)^3 + B_4 / (1+r)^4 + B_n / (1+r)^n$$

the same formula is used for costs;

$$\text{Costs} = C_1 / (1+r)^1 + C_2 / (1+r)^2 + C_3 / (1+r)^3 + C_4 / (1+r)^4 + C_n / (1+r)^n$$

The subscript, e.g. C_4 and B_4 means the costs and benefits for year four.
The superscript, e.g. $(1+r)^4$ means to the power of four.

The discount rate, r , is expressed as follows:

- Discount rate of 6% becomes 0.06, so $1 + r = 1.06$
- Discount rate of 16% becomes 0.16, so $1 + r = 1.16$

Using the NPV formula

What is today's value (NPV) of £4,000 in year 5 at a discount rate of 6%?

$$4,000 / (1.06)^5$$

Note: $(1.06)^5$ is known as 1.06 to the power 5 which means you multiply 1.06 by itself 5 times ie $(1.06 \times 1.06 \times 1.06 \times 1.06 \times 1.06)$ which, if you do it, comes out as 1.338 rounded down to three decimal places.

$$4,000 / 1.338$$

$$= £2,990$$

What is today's value (NPV) of £47,000 in year 4 at a discount rate of 8%?

$$47,000 / (1.08)^4$$

$$47,000 / 1.360$$

$$= £34,559$$

The lower the discount rate the closer the value of future monies is to today's value, so with a discount rate of 1.5% the NPV of £47,000 in year 4 is:

$$47,000 / (1.015)^4$$

$$47,000 / 1.061$$

$$= £44,298$$

NPV exercises

A project has costs of £10,000 now and £15,000 in year two. The expected benefits are £40,000 in year four. The discount rate is 12%. Is the project worthwhile?

Repeat the above with the discount rate set at 18%.

What does this tell you about the value of the discount rate?

A bridge over a river is in need of major repairs. To rebuild the bridge now will cost £300,000 and plans to widen it eight years will cost £240,000. Alternatively a wide bridge could be built now for £420,000. The discount rate is 12%. Which project would you choose?

