I.R.R – INTERNAL RATE OF RETURN EXPLAINED

Finance & Property
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'Internal Rate of Return' – a term to strike fear in the hearts of many a tough (and successful) businessmen. It's built its own mystique while becoming a part of everyday language. It's used by many who don't really understand it while hoping like crazy no-one will ask them to explain it. (If you're one of these then take this article home so your colleagues can't see you reading it).

This article points out how simple the concept of 'Internal Rate of Return' or IRR is. The easiest way to do this is by example.

Suppose you invest a dollar today and get back $1.10 in a year's time. What's your rate of return or your 'Internal Rate of Return'? You're right, it's 10%.

Now what if you invest your dollar at 10% per year for three years? You get 10c dividend each year plus your original 100c returned at the end of the third year. Let's put that scenario into an income stream:

	Invest	**End year 1**	**End year 2**	**End year 3**	**Total**
Cash flow	-100c	10c	10c	110c	30c

To take this further, we now introduce the idea of* Discount Rate. *This is a measure of how much more you prefer money now rather than later – say in a year or two.

If you're prepared to accept a 10% return, that means you're equally happy with 100c now or 110c after one year. Or 100c now and 121c in two years. In other words, 110c after one year has a present value to you of 100c. Or, 121c at the end of two years has a present value of 100c.

It also means that you would be equally happy with 10c after one year and 9.09c now since 9.09c invested at 10% will yield 10c in one year (9.09 plus 10% equals 10c. Similarly, 8.265c in two years has a *present value* of 10c now.

Lets apply these figures to our cash flow and look at our scenario in terms of present values (bottom row of table below).

	Invest	End year 1	End year 2	End year 3	Total
Cash flow	-100c	10c	10c	110c	30c
Present value	-100c	9.090c	8.265c	82.645c	0c

You will notice that the present values add to zero. This means that your internal rate of return is 10%.

Internal Rate of Return is the discount rate at which the present value of all cash flows total to zero.

Yes, that's all it is! The IRR tells you how hard your money is working for you over the period of the investment.

Let's go over what we have just discussed. We took the first year's cash flow and divided it by 1.1 (i.e, 1 + 10%) to get its present value. We took the second year's cash flow and divided it by 1.1^2 to get its present value. And we divided the third year's cash flow by 1.1^3 to get its present value.

We then added all the present values together to get zero.

Note that we could have used dollars, thousands of dollars or percentages instead of cents in the cash flow and still got the same IRR.

Now for another scenario you wouldn't bother working out by hand i.e. without Microsoft EXCEL or equivalent.

End of Year								
Invest	1	2	3	4	5	6	7	8
-100c	5c	-4c	34c	6c	13c	-19c	7c	147c

What's the internal rate of return here? This one's much harder to work out because the income flow is variable and, at the end of years 2 and 6, the managers have asked you to tip in 4 and 19 cents per unit.

But the answer is that the IRR is again 10%. In other words the above scenario results in the same IRR as the one below, for which the IRR is (rather more obviously) 10%.

End of Year								
Invest	1	2	3	4	5	6	7	8
-100c	10c	10c	10c	10c	10c	10c	10c	110c

In Microsoft Excel:

For the example above with the varied cashflows, in a cell, type:

=IRR(C1:C9) <return>

where C1 = the initial investment (-100) and C9 = the final cash flow (147). Using the ":" notation in the middle means all the other cashflows between the first and the last will also be included.

If you're still with us you're way ahead of a lot of others. For a more in-depth understanding read on.

When we incur costs or make our initial investment our cash flow is negative. These negative figures are discounted in the same way as the positives. So we end up with present values for negative cash flow years and present values for positive cash flow years.

When the present value ('PV') for the positive cash flow years is the same as the PV from the negative cash flow years, the discount rate used is the Internal Rate of Return.

Example again (in a different form):

	End of year									
	Invest	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**Total PVs**
All cash flows	-100	5	-4	34	6	13	-19	7	147	
Positive cash flows		5		34	6	13		7	147	
PV of positive cash flows		4.55		25.54	4.10	8.07		3.59	68.58	114
Negative cash flows	-100		-4				-19			
PV of negative cash flows	-100		-3.31				-10.73			-114

In practice the computer works out the IRR by randomly selecting an IRR figure, say 8%, and calculating a PV which (in the above case) is positive. It then repeats this process with different discount rates until it finds the discount rate which gives a PV of zero. It can do this in a fraction of a second where it would take you or I hours to work out.

A present value that incorporates negative returns as well as positive returns, as in this example, is sometimes called *Net Present Value* or *NPV*.

Why is the IRR important?

The IRR is important because it tells you exactly how hard your money is working for you. It is not misleading like many other measures of rate of return.

Let's illustrate how an alternative such as the 'average rate of return' can be extremely misleading. In the first example below, the average rate of return p.a. over the investment period is 28.8% i.e. (0+0+20+20+40 +40+50+60)/8. But in the second example it is only 22.5%. Yet the Internal Rate of Return is higher in the second example than in the first (25% versus 20%). Funds invested are working harder in the second example. The reason is that the bulk of returns are received earlier.

Even more misleading is when prospectuses report an average rate of return for only part of an investment's life. In the first example some prospectuses might state the average rate of return p.a. after the second year is 38.3% (20+20+40+40+50+60)/6)!!! This is a way of excluding the zero cash flows from years 1 and 2 in an attempt to improve the appearance of returns.

	End of year								***IRR***	***Ave. rate of return p.a.***	***Ave. rate of return p.a. (after 2nd yr)***
Invest	***1***	***2***	***3***	***4***	***5***	***6***	***7***	***8***			
-100	*0*	*0*	*20*	*20*	*40*	*40*	*50*	*160*	***20%***	*28.8%*	*38.3%*
-100	*30*	*30*	*25*	*20*	*20*	*20*	*15*	*120*	***25%***	*22.5%*	*20.0%*

In the extreme example, the rate of return in some timber plantation investments is very high in year 25 when trees are harvested. But there is no income in the first 24 years! An IRR is essential to get a real perspective on rate of return.

What this shows is that returns in the early years are more important to IRRs than returns in later years.

So beware of investments which show high rates of return in later years and publish these figures (and not IRRs) in prospectuses. Always use the IRR for the most accurate indication of return.

IRRs will tell you exactly how hard your money is working for you* irrespective *of the pattern of income distributions over time. No other measure of return will do this.